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Session } { No. 740

INDEX

TO THE

ports of The Chief of Engineers, U. S. Army (Including the Reports of the Isthmian Canal Commissions, 1899-1914)

1866–1912

VOLUME I—RIVERS AND HARBORS
VOLUME II—FORTIFICATIONS, BRIDGES
PANAMA CANAL, ETC.

Completed under the direction of
BRIG. GEN. DAN C. KINGMAN, Chief of Engineers, U. S. Army
By COLONEL GEORGE A. ZINN, Corps of Engineers
John McClure, Compiler

VOLUME I
RIVERS AND HARBORS

BRUARY 16, 1914.—Referred to the Committee on Rivers and Harbors
and ordered to be printed, with illustrations

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

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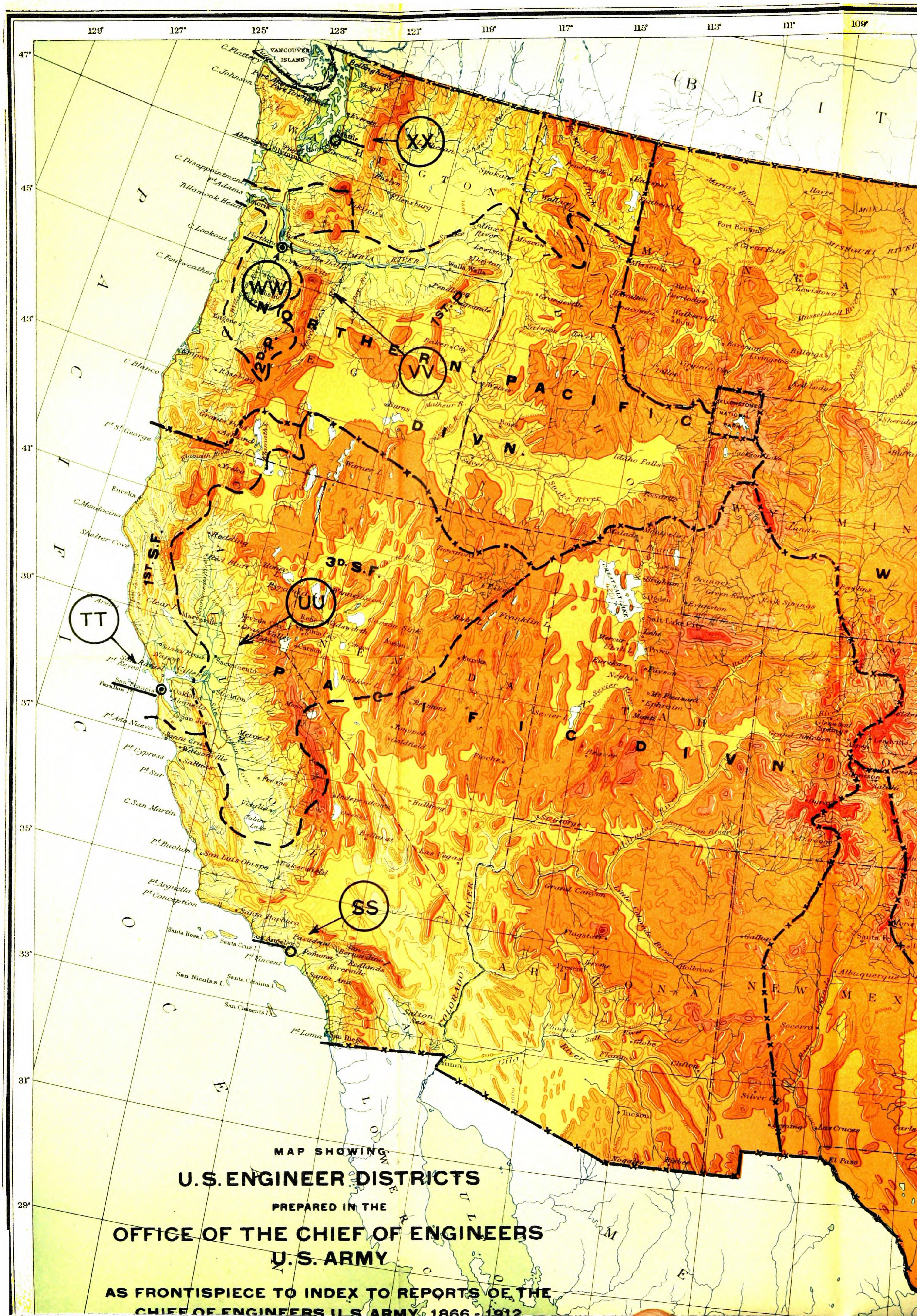
U.S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR



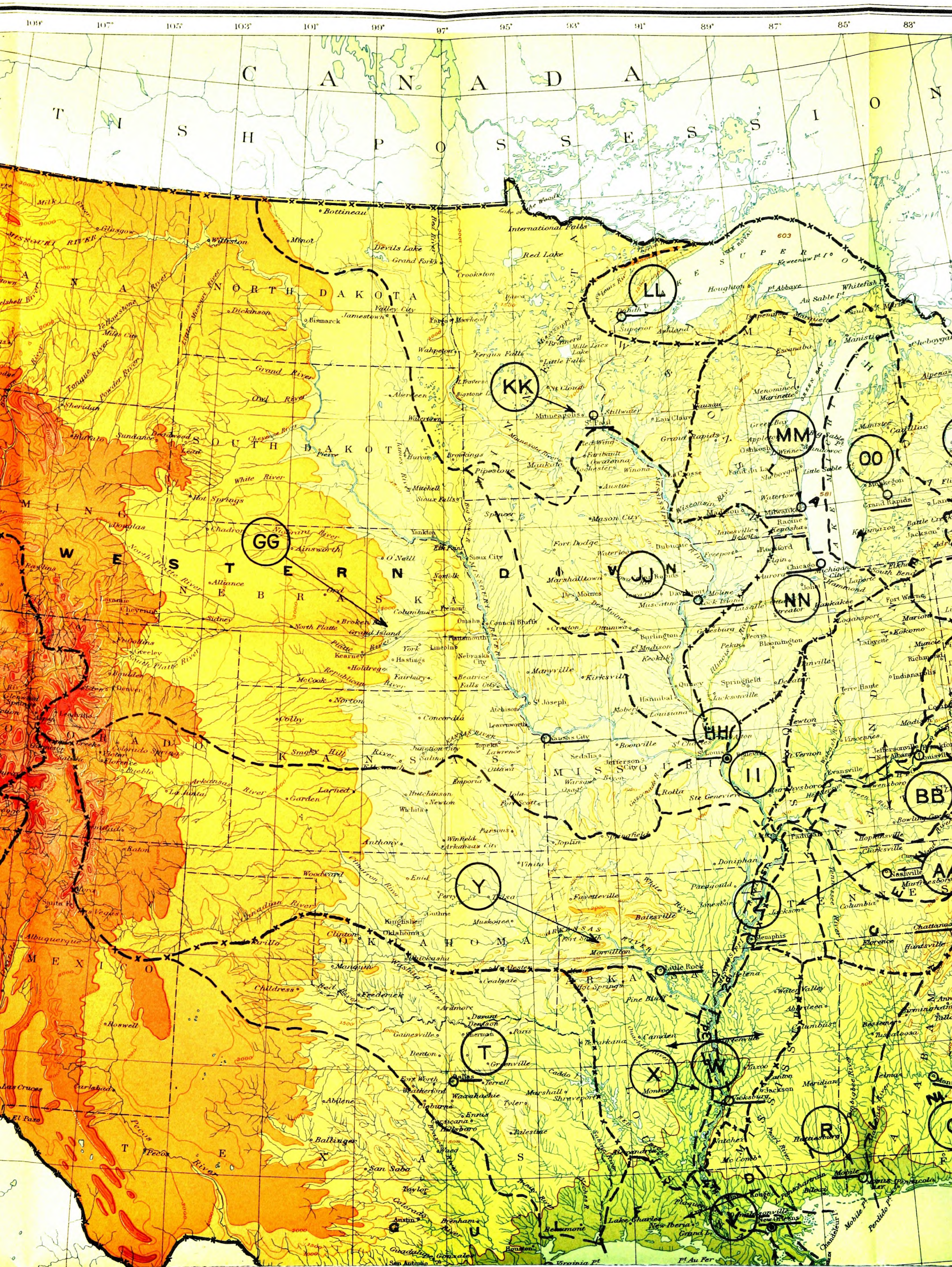
MAP SHOWING

U.S. ENGINEER DISTRICTS

PREPARED IN THE

OFFICE OF THE CHIEF OF ENGINEERS
U.S. ARMY

AS FRONTISPIECE TO INDEX TO REPORTS OF THE
CHIEF OF ENGINEERS U.S. ARMY, 1866-1912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BRITISH POSSESSIONS
NORTH DAKOTA
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MONTANA
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NEBRASKA
COLORADO
KANSAS
OKLAHOMA
TEXAS
NEW MEXICO
MISSOURI
ARKANSAS
LOUISIANA
MISSISSIPPI
ALABAMA
TENNESSEE
KENTUCKY
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INDIANA
OHIO
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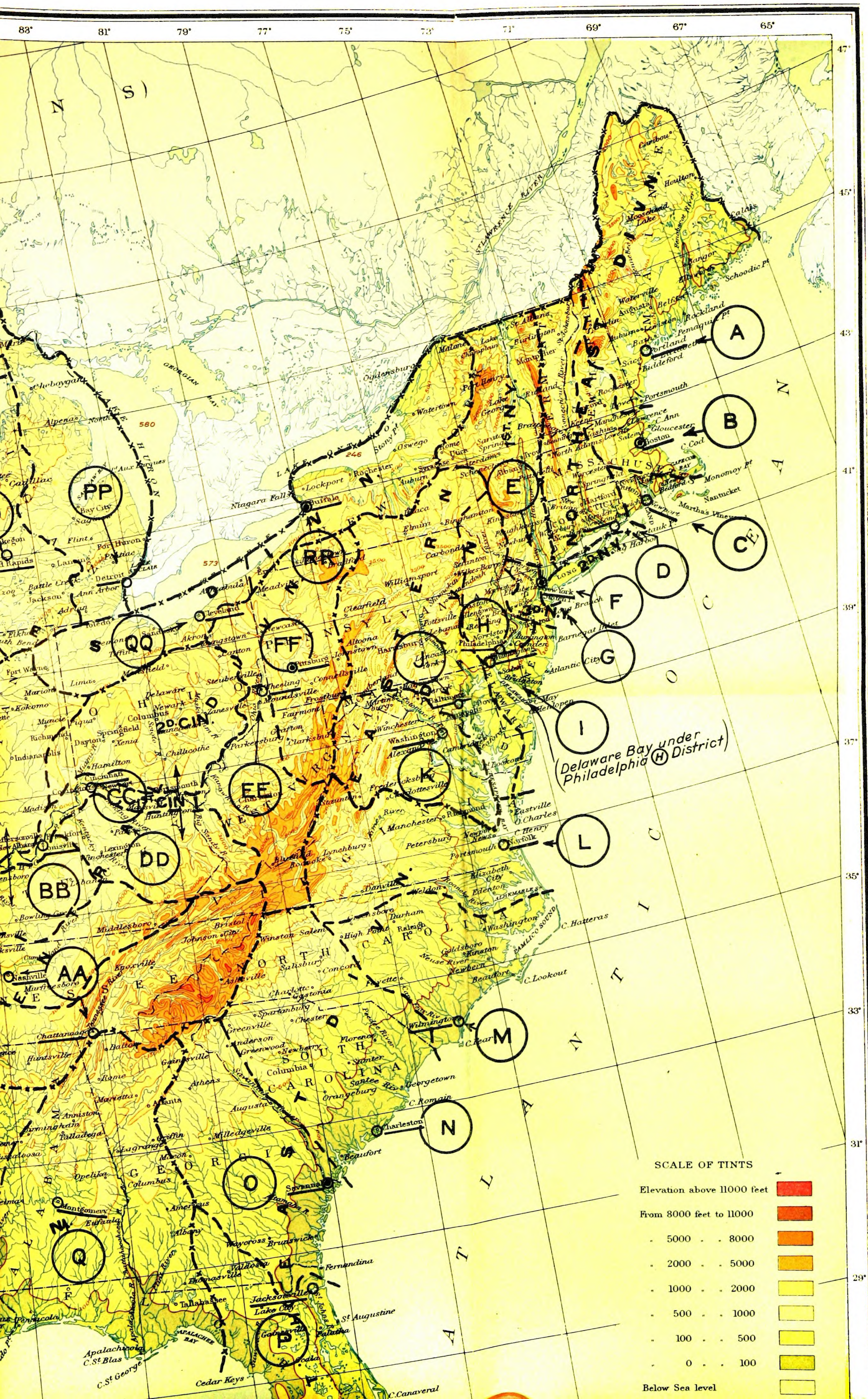
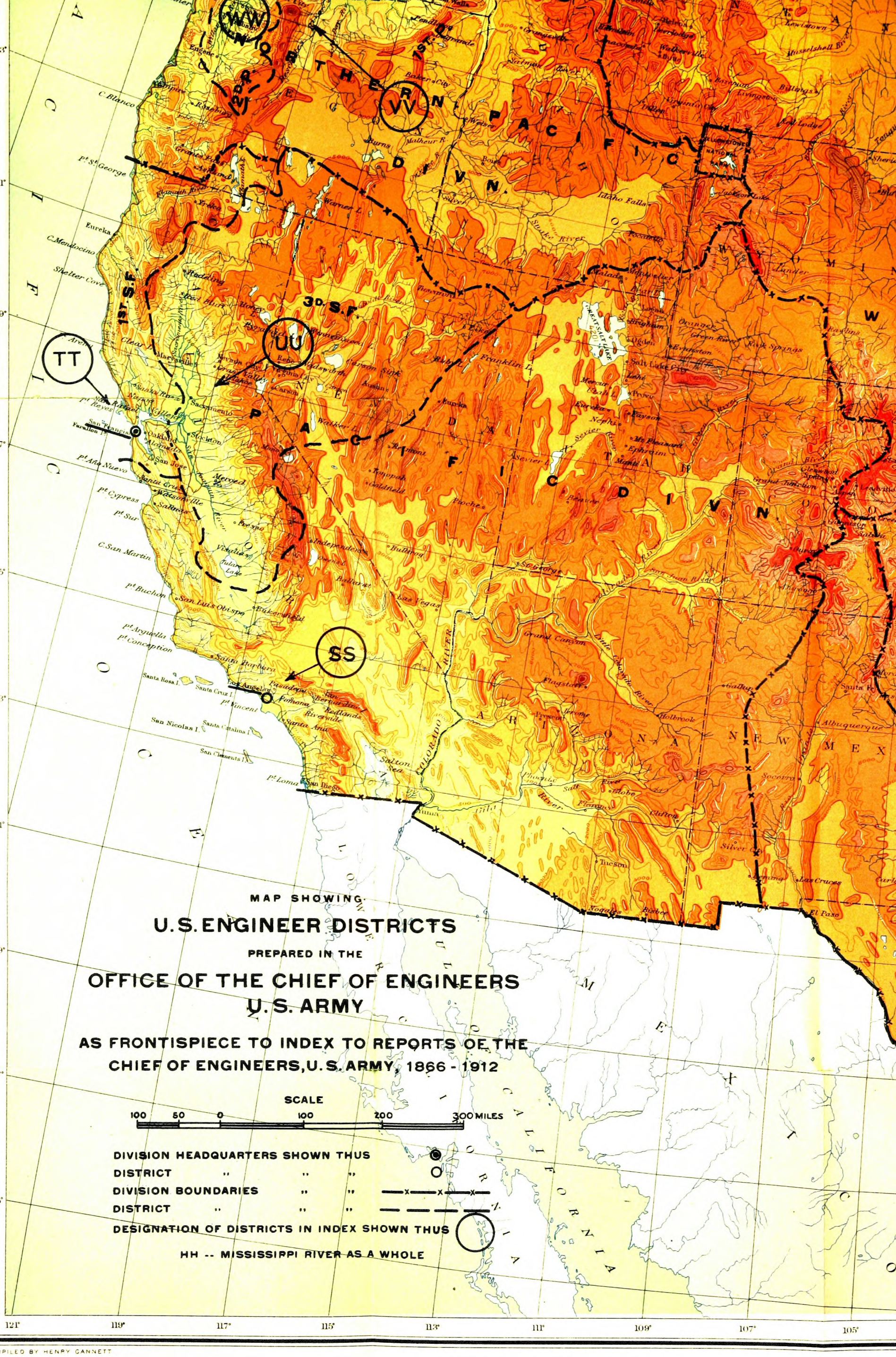
UNITED STATES
RELIEF MAP





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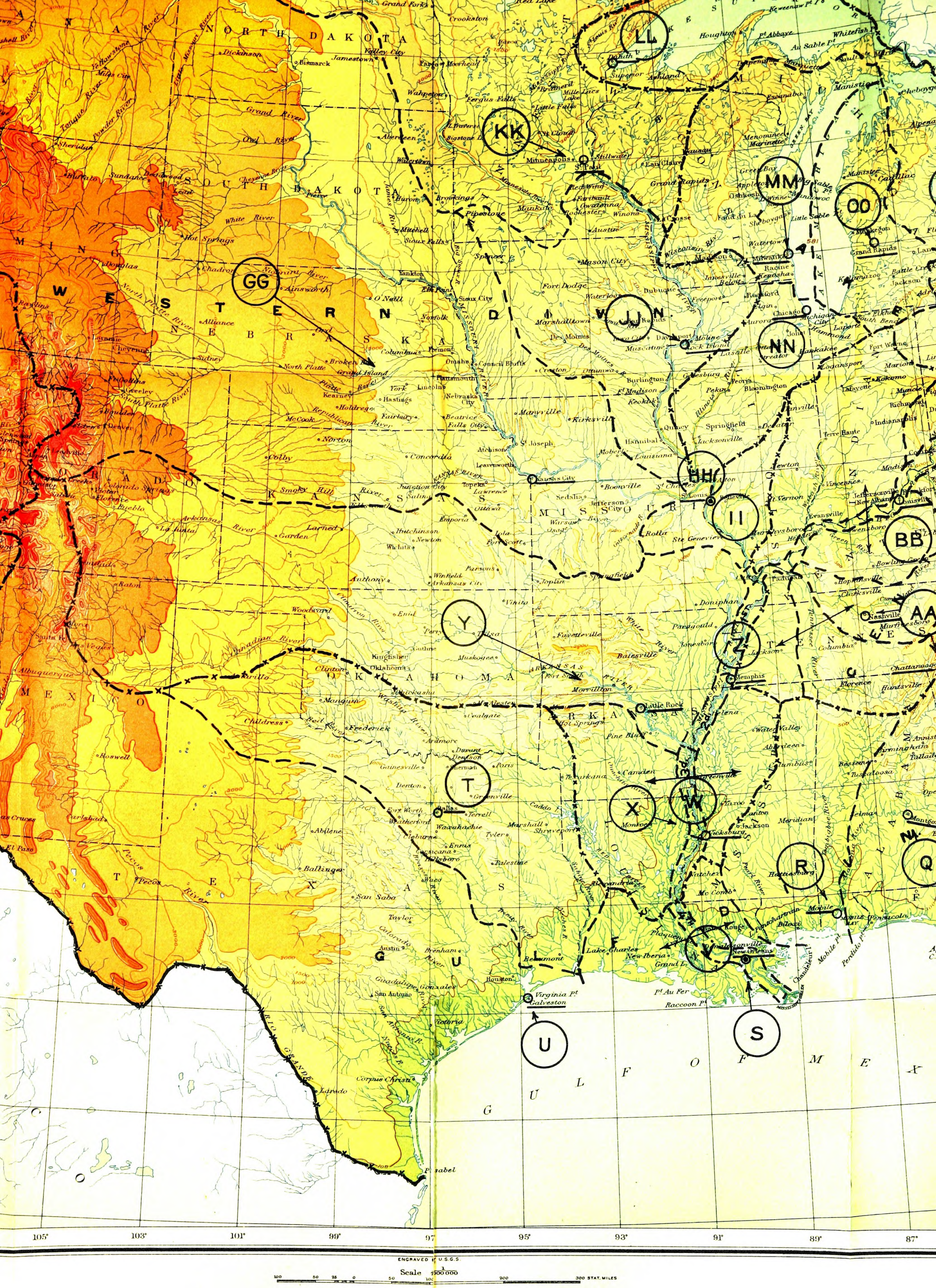
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INDIANA
OHIO
KENTUCKY
TENNESSEE
ARKANSAS
OKLAHOMA
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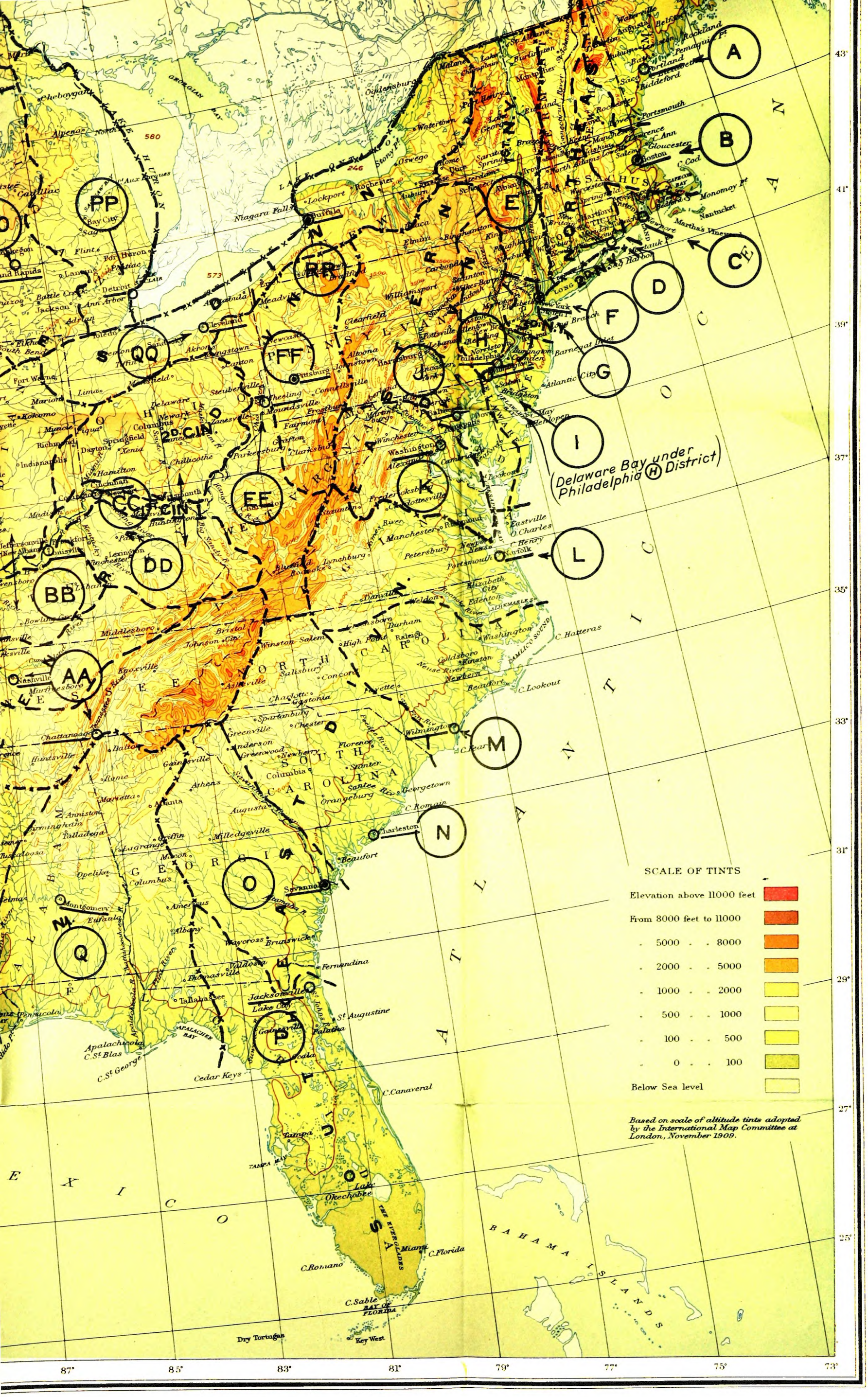

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63D CONGRESS 2d Session } HOUSE OF REPRESENTATIVES { DOCUMENT No. 740

INDEX

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VOLUME II—FORTIFICATIONS, BRIDGES PANAMA CANAL, ETC.

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Completed under the direction of
BRIG. GEN. DAN C. KINGMAN, Chief of Engineers, U. S. Army
By COLONEL GEORGE A. ZINN, Corps of Engineers
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VOLUME I
RIVERS AND HARBORS

FEBRUARY 16, 1914.—Referred to the Committee on Rivers and Harbors and ordered to be printed, with illustrations

WASHINGTON
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PART I. RIVERS AND HARBORS.

NORTH ATLANTIC COAST.

District:

A. Portland, Me	23
B. Boston, Mass	67
C. Newport, R. I	105
D. New London, Conn	139
E. New York, N. Y., No. 1	175
F. New York, N. Y., No. 2	213
G. New York, N. Y., No. 3	245
H. Philadelphia, Pa	269
I. Wilmington, Del	295

SOUTH ATLANTIC COAST.

J. Baltimore, Md	329
K. Washington, D. C	371
L. Norfolk, Va	409
M. Wilmington, N. C	451
N. Charleston, S. C	497
O. Savannah, Ga	531

GULF OF MEXICO COAST.

P. Jacksonville, Fla	567
Q. Montgomery, Ala	609
R. Mobile, Ala	643
S. New Orleans, La	679
T. Dallas, Tex	715
U. Galveston, Tex	731

LOWER MISSISSIPPI SYSTEM.

V. New Orleans, La. (4th M. R. C.)	779
W. Vicksburg, Miss. (3d M. R. C.)	781
X. Vicksburg, Miss	783
Y. Little Rock, Ark	815
Z. Memphis, Tenn. (1st and 2d M. R. C.)	841

OHIO RIVER SYSTEM.

District. Page.

AA. Chattanooga and Nashville, Tenn 843
BB. Louisville, Ky 889
CC. Cincinnati, Ohio (Ohio River) 905
DD. Cincinnati, Ohio, No. 2 957
EE. Wheeling, W. Va 981
FF. Pittsburgh, Pa 1001

MISSOURI RIVER SYSTEM.

GG. Kansas City, Mo 1023

MISSISSIPPI RIVER.

HH. 1067

UPPER MISSISSIPPI SYSTEM.

II. St. Louis, Mo 1227
JJ. Rock Island, Ill 1231
KK. St. Paul, Minn 1245

GREAT LAKES SYSTEM.

LL. Duluth, Minn 1263
MM. Milwaukee, Wis 1295
NN. Chicago, Ill 1347
OO. Grand Rapids, Mich 1375
PP. Detroit, Mich 1417
QQ. Cleveland, Ohio 1459
RR. Buffalo, N. Y 1491

PACIFIC COAST.

SS. Los Angeles, Cal 1541
TT. San Francisco, Cal., No. 1 1553
UU. San Francisco, Cal., No. 3 1575
VV. Portland, Oreg., No. 1 1591
WW. Portland, Oreg., No. 2 1613
XX. Seattle, Wash 1653

INSULAR POSSESSIONS.

YY. Porto Rico, Hawaii, etc 1683

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VOLUME II.

Fortifications ..... Part II
Miscellaneous (District of Columbia; Great Lakes Surveys; National Parks; Corps of Engineers, United States Army; Explorations, etc.) ..... Part III
Special subjects (Bridges, Dams, Harbor lines, Wrecks, Contractors, Engineers, Abstract of laws, Floating plant, Summary of appropriations .... Part IV
Reports of the Isthmian Canal (Panama Canal) Commissions ..... Part V
Topical index to engineering and physical data ..... Part VI

Consolidated finding list to Volumes I and II ..... Part VII

LETTER OF TRANSMITTAL.

War Department,
Washington, February 14, 1914.

Sir: I have the honor to transmit herewith a letter from the Acting Chief of Engineers, United States Army, dated February 12, instant, together with an index to reports of the Chief of Engineers from 1866 to 1912, inclusive, called for by paragraph 2, section 6, of the river and harbor act approved July 25, 1912.

Very respectfully,

Lindley M. Garrison,
Secretary of War.

The Speaker of the House of Representatives.

LETTER OF SUBMITTAL.

War Department,
Office of the Chief of Engineers,
Washington, February 12, 1914.

From: The Chief of Engineers, United States Army.
To: The Secretary of War.
Subject: Index to Reports of the Chief of Engineers from 1866 to 1912, inclusive.

There is submitted herewith for transmission to Congress an index to the reports of the Chief of Engineers, United States Army, called for by the second paragraph of section 6 of the river and harbor act approved July 25, 1912, as follows:

> There shall also be printed one thousand five hundred copies of the index to the Report of the Chief of Engineers, United States Army, from eighteen hundred and sixty-six to nineteen hundred and twelve, inclusive, to include the reprinting of House Document Numbered Four hundred and thirty-nine, Fifty-seventh Congress, second session, covering the period from eighteen hundred and sixty-six to nineteen hundred, inclusive, authorized by section thirteen of the act of June thirteenth, nineteen hundred and two; the additional information covering nineteen hundred and one to nineteen hundred and twelve, inclusive, to be furnished by the Secretary of War.

Edw. Burr,
Colonel, Corps of Engineers,
Acting Chief of Engineers.

PREFACE.

The necessity for a systematically arranged key or index to the printed annual reports of the Chief of Engineers, United States Army, was felt as early as 1878, when only 17 volumes of such reports existed. Under date of January 10, 1878, Maj. H. M. Robert, Corps of Engineers, stationed at Milwaukee, proposed to prepare such a work. Brig. Gen. A. A. Humphreys, Chief of Engineers, approved the project, and expressed the opinion that the work should begin with the report dated March 1, 1866. The index was prepared under Maj. Robert's direction by his chief clerk, Dr. Samuel O. L. Potter, and Asst. Engineer Louis Y. Schermerhorn. It embraces the reports from 1866 to 1879, inclusive, and was printed in 1881. Maj. Robert, in his letter of transmittal, printed in the index, describes the difficulties encountered in its preparation by reason of the incompleteness and inaccuracies found in the early reports and in securing harmony between the work done by the various indexers.

A second volume, covering the reports from 1880 to 1887, inclusive, was compiled under the same direction by Mr. L. Y. Schermerhorn and Mr. Holden B. Schermerhorn, and was published in 1889.

A third volume, covering the reports from 1888 to 1892, inclusive, was compiled under the direction of Maj. C. W. Raymond, Corps of Engineers, by Mr. L. Y. Schermerhorn and Mr. Holden B. Schermerhorn, and was published in 1895.

The preparation of a fourth volume under the same direction, covering the reports from 1893 to 1900, inclusive, was well advanced when it was decided to consolidate all the volumes into an entirely new edition in order to save space and cost, to facilitate convenient reference, and to avoid the necessity for reprinting the first two volumes, the editions of the latter having been nearly exhausted.

The second or "Raymond" index, issued in the form of three volumes in the year 1902 (H. Doc. No. 439, 57th Cong., 2d sess.), was prepared under direction of Lieut. Col. Raymond, the actual work of compiling all the different parts being done by Mr. John McClure, to whom Lieut. Col. Raymond gives great credit for the faithfulness and ability with which he conducted the work.

The plan adopted by Maj. Robert in the preparation of the "Robert" index was essentially the one followed in the later volumes and the "Raymond" index, with such changes and additions as experience had shown to be desirable. In the "Raymond" index all the important matter contained in the annual reports of the Chief of Engineers was indexed, while the previous volumes omitted fortifications and some miscellaneous subjects. The "Abstract of Laws" was first introduced in the third volume of the first index. The plan of the abstract of fortification data was prepared by Lieut. Spencer Cosby, Corps of Engineers, then on duty under the orders of Lieut. Col. Raymond, and the index of fortifications would have been compiled by him had his services continued to be available.

The plan adopted for the "Raymond" index was essentially as follows: The subjects covered in the reports of the Chief of Engineers were classified as, (1) river and harbor works, (2) fortifications, (3) bridges, (4) laws, (5) miscellaneous. Each of these divisions or parts was indexed (or abstracted) separately, the various subjects in each part (names of places, centers of coast defense, streams or harbors crossed by bridges, suggestive headings of laws, miscellaneous titles, etc.) being arranged alphabetically. The information abstracted or compiled under each sub-subject was set forth, in order of time generally, under a few important titles, arranged alphabetically, named and defined at the beginning of each part, the proper references to year, volume, and page being added to each statement or brief. A summary of river and harbor appropriations followed the index of river and harbor works; and a topical index of engineering, physical and miscellaneous data, the topics or subject names being arranged in alphabetical sequence, closed the work. Experience with this division of subjects and alphabetical arrangement of data showed that it afforded a convenient and rapid means for finding any desired information contained in the annual reports, with some exceptions to be noted later.

THE PRESENT INDEX.

Under date of August 9, 1910, the Chief of Engineers instructed Maj. Herbert Deakyne, Corps of Engineers, then in charge of the Philadelphia river and harbor district office, to prepare an index to the reports of the Chief of Engineers for the years 1901 to 1910, inclusive. On May 22, 1912, further instructions were issued to prepare a new consolidated index to replace the existing "Raymond" index of three separate volumes and to include therein the reports for 1911 and 1912.

Under date of August 9, 1912, the Chief of Engineers invited the attention of Lieut. Col. Joseph E. Kuhn, Corps of Engineers, who had succeeded Maj. Deakyne in charge of the Philadelphia office, to the following provision in the river and harbor act approved July 25, 1912:

> SEC. 6. * * *
> There shall also be printed one thousand five hundred copies of the index to the report of the Chief of Engineers, United States Army, from eighteen hundred and sixty-six to nineteen hundred and twelve, inclusive, to include the reprinting of House Document Numbered Four hundred and thirty-nine, Fifty-seventh Congress, second session, covering the period from eighteen hundred and sixty-six to nineteen hundred, inclusive, authorized by section thirteen of the act of June thirteenth, nineteen hundred and two; the additional information covering nineteen hundred and one to nineteen hundred and twelve, inclusive, to be furnished by the Secretary of War.

Steps were at once taken by Col. Kuhn to hasten forward the work contemplated, which had been progressing slowly, and the services of Mr. John McClure, who had prepared the second index, were secured for the purpose.

Under date of January 12, 1914, instructions were issued, with the approval of Col. Goethals, chairman of the Isthmian Canal Commission, by the Chief of Engineers, to treat the reports of the various Isthmian Canal Commissions from 1899 to 1914 in the new index in the same manner as other projects executed under the Corps of Engineers.

The magnitude of the work of preparing the new index as compared to that covering the previous indexes is shown in the following table:

Index.	Period.	Years.	Volumes.	Pages.
Robert	1866–1879	14	23	19,143
Do	1880–1887	8	27	21,959
Raymond	1888–1892	5	23	17,031
Do	1893–1900	8	51	34,109
Raymond combined	1866–1900	35	124	92,242
1901–1912	1901–1912	12	45	40,643
New index	1866–1912	47	169	132,885
House documents, various periods, say			30	15,000
Panama reports, including maps, etc., say			18	7,000
Total in this index			217	154,885

In the preparation of the new index not only was it desired to consolidate into compact form an adequate and complete index to all subjects covered by the reports of the Chief of Engineers so that a minimum of time would be required in finding everything that had been stated therein in connection with any given subject, but it was also desired to enhance its value by incorporating certain additional information not to be found directly in those reports.

The alphabetical arrangement of waterway data, used in previous indexes, is valuable when it is desired to secure information about a waterway of which the name is known, and which has been improved, examined, or surveyed. The relation of this waterway to adjacent waterways is nowhere shown; and although the given waterway may have been improved and at the same time be a portion or section of a larger waterway improvement, the index in no way indicated this fact. In other ways also the alphabetical arrangement has been found defective and misleading. The arrangement of waterway data in geographical order obviates all of these difficulties by bringing related abstracts together, and furnishes the opportunity to include much other information which will be of both present and future value, without adding anything to the cost of this work.

The United States is now divided into 51 river and harbor districts embracing over 10,000 waterways; the work included within the limits of each district is in charge of an officer of the Corps of Engineers stationed at a central point, which gives its name to the district, and which is designated in this index by a single or double letter. The letter A designates the first district (Portland) on the northeastern coast on the Atlantic Ocean, the letter B the adjoining district (Boston), and so on southward along the Atlantic coast, thence around the Gulf coast, up the Mississippi system to Cairo, thence up the Ohio system, thence up the Missouri system, thence up the Mississippi system to the Lakes, thence around these, thence up the Pacific coast to Alaska. (For full list of letters and names of districts see list, Part I, page 19, and see frontispiece map in colors.)

Each waterway in a district, whether improved or not, has been given a numerical designation according to its position in an order determined by beginning the list of the waterways of the district at the place where the preceding district group terminates, continuing thence to the next waterway until the end of

the district is reached. Where the waterway is a river, the list proceeds up the left bank of the stream to the first tributary, thence up that tributary, and even up the tributaries of the latter, in the same manner, the return to the mouth of the main stream being made by crossing to the opposite or right bank, and going down that side after the same manner.

The abstracts are printed in the order referred to in the preceding paragraphs.

Each group of abstracts is preceded by the title of the district, a map of the district, the location of the office of the district, and a list of the waterways of the district arranged in numerical order, as already explained.

Each waterway name in the lists of waterways is followed by a number in parentheses. This is the number of the stream to which the waterway is tributary. Hence, given the name of a waterway, river, or harbor, its related waterways can be found immediately.

In many cases the matter abstracted has had to be divided into separate parts, especially where the reports concern a large waterway or harbor, as the Mississippi or New York Harbor, or where the changes in the scope or character of an improvement make more than a single abstract necessary. Each part in these instances takes the name of the waterway it refers to principally, and the number of the main or summary title. For example, in the case of "Part (a), SS–20 Wilmington Harbor, Cal.," and "Part (b), SS–20 San Pedro Harbor, Cal.," the title of the summary of the two parts is "SS–20 Los Angeles Harbor, Cal."

An abstract concerning a waterway is given the title generally given to the matter in the reports of the Chief of Engineers. In some cases, however, this title may differ from the name given to the same waterway in the district list of waterways. Such variations are indicated by attaching a final letter to the number of the waterway, as "49(a)."

There are some abstracts of unfavorable reports on waterways not named in the list of waterways of the district concerned. Each one of these abstracts is given the number of the waterway geographically preceding the locality to which the abstract relates, the number being accompanied by a letter to indicate the interpolation, as "37(a)."

The geographical arrangement of data, however, does not furnish a means of readily finding any given desired information in the index, and to obviate this difficulty a consolidated finding list alphabetically arranged is necessary. Such a list is found at the back of Volume II and includes not only waterway and fortification data but also all other matter covered by the index, with the exception of that included in the topical index. In the latter the topics are arranged alphabetically, requiring no additional index.

A special finding list for waterways is printed at the back of Volume I. A special finding-list for each of the following waterways, namely, the Ohio, Missouri, Mississippi, and the Columbia, precedes the abstract to which it relates.

The geographical arrangement of fortification data has the same advantages as those mentioned for waterways and has therefore been adopted.

The alphabetical arrangement of titles is believed to be the best for an index of the special subjects, such as bridges, wrecks, etc., and similar matter contained in the reports, and has therefore been retained.

A new feature of this index is a series of views showing types or classes of construction work used in river and harbor works. These views were furnished by the district officers and are inserted in the topical index under the title "Construction."

The arrangement of parts used in the "Raymond" index has been retained with the addition of several new ones. The parts now are: I. River and harbor works; II. Fortifications; III. Miscellaneous reports; IV. Special subjects; V. Panama Canal; VI. Topical index; VII. Alphabetical finding list. Each of these parts has its own subdivisions, the headings of which are self-explanatory, but they are listed and described at the beginning of the respective parts as in the second or "Raymond" index.

All reasonable means have been employed to secure compactness in the work; thus, grammatical elision, abbreviations, and smaller type are used to a much larger extent than in the previous indexes, and the condensation thus secured has reduced the number of pages which would be required under the old plan by eight or nine hundred.

Succinctly stated, the present index differs from previous indexes in the following particulars: Geographical arrangement of waterway and fortification data, numbering of waterways, district maps, more comprehensive abstracts and summaries, views of constructions, Panama Canal data, convenient finding lists, and greater compactness.

While the matter indexed herein is that contained in the reports of the Chief of Engineers, or officers of the Corps of Engineers, it has been checked or verified by means of other publications, such as Treasury Document No. 373, 1882; House Document 421, Fifty-seventh Congress, second session; United States Coast Pilots; List of Merchant Vessels of the United States; and Coast and Geodetic Survey maps. Each district has reviewed the proof of the matter concerning its territory.

Brig. Gen. W. H. Bixby, Chief of Engineers, issued the instructions for the compilation, and outlined the general scheme of arranging the works by groups and numbering.

The district officers furnished the sketch maps, views of characteristic types of construction, and detailed lists of district rivers and harbors.

The work of indexing was inaugurated by Maj. Deakyne, continued by Col. Kuhn, and completed under the immediate supervision of the undersigned, who succeeded Col. Kuhn on August 16, 1913, since which date the final arrangement and editing has been performed.

The abstracting was done by Mr. John McClure, Mr. C. L. Kendler, and nine other persons whose connection with the work was of comparatively short duration.

The whole work was in direct charge of Mr. McClure, who also arranged the abstracts, edited the vast mass of matter incorporated in the index, prepared it for the printer, and revised the proof.

GEORGE A. ZINN,
Colonel, Corps of Engineers, U. S. Army.

U. S. ENGINEER OFFICE,
Philadelphia, Pa., September 27, 1915.

GUIDE TO USE OF INDEX.

Order of subjects.—The subjects considered are classified and appear in the following order:

Rivers and harbors.
Fortifications.
Miscellaneous.
Bridges.
Dams, dolphins, and weirs.
Harbor lines.
Wrecks.
Engineers.
Contractors.
Floating plant.
Appropriations.
Panama Canal.

Arrangement of data.—Rivers and harbors, and fortifications, are arranged in *geographical* order, other data in *special* or *alphabetical* order. Each subject is treated independently of the others.

Subdivisions of subjects.—Lists of titles of such subdivisions appear at the beginning of each subject. Page figures attached to data almost always refer to reports of Chief of Engineers; where they refer to other matter, this is made clear.

Explanatory notes appear at the beginning of each subject, the topical index, and the alphabetical finding lists.

Topical index.—This part of the index covers engineering, physical and miscellaneous information, the *subject names* arranged in alphabetical sequence, and is not otherwise indexed.

Alphabetical finding lists.—Several alphabetical finding lists are provided, as follows:

(a) A general or consolidated finding list for both volumes, at the back of Volume II, forming Part VII of the work, containing the names of important waterways, fortifications, bridges, etc., referred to in both volumes.

(b) A finding list at the back of Volume I, containing the names of waterways listed in Volume I, Part I of this work.

(c) A finding list for each of the following rivers—Ohio, Missouri, Mississippi, and Columbia—immediately preceding the abstracts of those rivers, containing references to each point and section mentioned in the abstracts.

Maps.—A map of the United States divided into districts appears at the beginning of the volume and district maps at the beginning of each river and harbor district.

Illustrations.—Views of typical classes of construction appear in the topical part under the subject "Construction."

References.—References in all parts of the main index are to year and page of *reports* of the Chief of Engineers, etc., *except* in the alphabetical finding lists, where the paging refers to *this book*. Deviations from this rule are usually embraced in footnotes, or are inclosed in parenthesis.

ABBREVIATIONS.[1]

The following is a list of the more important abbreviations employed:

au.	authority
*	allotment
an.	annual, annually
approx.	approximate
B.	Bay, Board
BE.	Board of Engineers
BERH.	Board of Engineers for Rivers and Harbors
break'r	breakwater
br.	bridge
C.	commerce, commercial
constr.	construction
chan.	channel
¢	cents
cy.	cubic yard
DO.	District Officer or Engineer
dw.	deep water
dr.	dredging
DE.	Division Engineer
e.	east
est.	estimate
estab.	establishment
ex.	examination
expend.	expenditures, expending
Engrs.	Engineers (Chief of Engineers in full)
fav.	favorable
h.	high
H.	Harbor
imp.	improvement
j.	jetty
l.	long, length, lengthening
l. & d.	lock and dam
m.	miles
max.	maximum
misc.	miscellaneous
min.	minimum
mainten.	maintenance, maintaining
mlw.	mean low water
n.	north
obstr.	obstruction
orig.	original
proj.	project
pre.	preliminary
pt.	point
p.	pier
P.	Panama
%	per cent
RR.	railroad
revet.	revetment
R.	(in blackface type) for Report
R.	river
recom.	recommended, recommendations
Sec. War	Secretary of War
SS.	steamboats
s.	south, or supplement
st.	stone
sur.	survey
sq.	square
St.	street
superstr.	superstructure
t.	ton, tonnage
Treas.	Treasury, Treasurer
U.S.	United States, government
unfav.	unfavorable
vol.	volume
w.	west

There are other abbreviations, such as Capt. for Captain, and the like, but all these should require no explanation.

Waterway dimensions are in numerals, in the order of depth and width and length, as 18′ x 100′ x 12 m.

02, S49, means the annual report for 1902, supplement, page 49. **P12**, 403, means the report of the Panama or I. C. Commission for 1912, page 403. (See below.)

PAGE AND VOLUME REFERENCE.

The volume references are in black figures and the page references in ordinary roman. **88**, 786 means the annual reports for 1888, page 786. 1900 is indicated by **00**. The years from 1901 to 1912 are indicated by **01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12.** Some

[1] Not a few instances may be found where words are not abbreviated according to this list. These may be instances where a group of abbreviations might obscure the meaning. In most cases, however, the abbreviations in the list are employed.

of the earlier references have lower-case i's after them, in which case "i" means the first volume, "ii" the second volume, and so on. **R** always means Report.

PAGING OF THE ANNUAL REPORTS.

Table showing what page ends each part of the annual reports of the Chief of Engineers, U. S. Army, from 1866 to 1912.

Year.	Part 1.	Part 2.	Part 3.	Part 4.	Part 5.	Part 6.	Part 7.	Part 8.
1866	*a* 1–58	*a* 1–238	*a* 1–40	*a* 1–336				
1867	867							
1868	1200							
1869	650							
1870	631							
1871	1030							
1872	1174							
1873	1249							
1874	897	*b* 1–633						
1875	982	*b* 1–1245						
1876	767	*b* 1–700	*b* 1–755					
1877	836	1455						
1878	840	1354	1883					
1879	950	1890	2399					
1880	1047	1873	2556					
1881	1042	1898	2877					
1882	1068	1908	2856					
1883	1045	1960	2413					
1884	886	1530	2406	2903				
1885	916	1660	2533	3032				
1886	800	1392	2170					
1887	962	1735	2525	3152				
1888	753	1417	2190	2941				
1889	845	1533	2208	2880				
1890	1035	1818	2884	3718				
1891	975	1489	1943	2666	3395	3948		
1892	1003	1958	2885	3545	Atlas.			
1893	1140	1793	2649	3544	3919	4404		
1894	826	1332	2008	2696	3074	3591		
1895	1020	1724	2525	3070	3615	3956	4301	
1896	680	1338	2060	2672	3401	4196		
1897	1190	1876	2648	3503	3835	4225		
1898	1074	1686	2414	3135	3458	3855		
1899	1206	2045	2724	3290	3653	4002		
1900	1072	1792	2306	2906	3946	4524	5006	5535
1901	986	1750	2596	3462	3938	*c d* 1–428		
1902	991	1876	2565	3265	*c d* 1–215			
1903	1026	1885	2370	3012	*c* 1–318			
1904*	1362	2403	3580	4315	*c* 1–298			
1905	1234	2239	3036	*c* 1–300				
1906	1432	2609						
1907	982	1866	2768					
1908	1253	2168	2833					
1909	1271	2161	2845					
1910	1374	2338	3110					
1911	1314	2508	3365					
1912	1404	2882	3988					

a Bound with the three other parts into one volume.
b Each part begins with page No. 1.
c Mississippi River Commission.
d Includes Missouri River Commission Reports.
* After this date there is a noticeable compression of volumes, due to less work on fortifications and to issue of reports on examination and surveys as congressional documents.

PART I.

RIVER AND HARBOR WORKS.

GUIDE TO THE USE OF PART I.

1. Alphabetical finding list at back of this index (and see also Abbreviations, p. 15).
2. Order of arrangement of waterway groups.
3. Numbering of the waterways.
4. Explanation of subheads used in Part I.

1. ALPHABETICAL FINDING LIST AT BACK OF THIS INDEX.

[And see also Abbreviations, p. 15.]

There is a finding-list at the back of this volume, composed of names of rivers, harbors, canals, etc., arranged alphabetically, and under each name are arranged properly all the references to that locality in this index. The first page of the finding-list presents details which may be useful to the user of the finding-list.

See also the consolidated finding-list, Part VII, at the back of Volume II of this index.

There are four special finding-lists, one for each of the following rivers, the Ohio, the Missouri, the Mississippi, and the Columbia, preceding the data for each of these waterways.

2. ORDER OF ARRANGEMENT OF WATERWAY GROUPS.

The matter in this index about rivers and harbors is arranged according to the order of connected geographical groups. The following is a list of these connected groups or districts, each taking its name from the town or city in which the office of the district is situated. It should be noted that were a district office to be closed or shifted that would not affect the order of listing followed—the listing is mainly geographical. The exceptions to this rule are explained clearly wherever they occur.

NORTH ATLANTIC.

A—Portland, Me.
B—Boston, Mass.
C—Newport, R. I.
D—New London, Conn.
E—1st New York, N. Y.
F—2nd New York, N. Y.
G—3rd New York, N. Y.
H—Philadelphia, Pa.
I—Wilmington, Del.

SOUTH ATLANTIC.

J—Baltimore, Md.
K—Washington, D. C.
L—Norfolk, Va.
M—Wilmington, N. C.
N—Charleston, S. C.
O—Savannah, Ga.

GULF COAST.

P—Jacksonville, Fla.
Q—Montgomery, Ala.
R—Mobile, Ala.
S—New Orleans, La.
T—Dallas, Tex.
U—Galveston, Tex.

MISSISSIPPI SYSTEM—LOWER.

V—4th District, Mississippi River Commission, New Orleans, La.
W—3rd District, Mississippi River Commission, Vicksburg, Miss.
X—Vicksburg, Miss.
Y—Little Rock, Ark.
Z—1st and 2nd districts, Mississippi River Commission, Memphis, Tenn.

MISSISSIPPI SYSTEM—OHIO RIVER BRANCH.

AA—Chattanooga and Nashville, Tenn.
BB—Louisville, Ky.
CC—1st Cincinnati, Ohio (Ohio River).
DD—2nd Cincinnati, Ohio.
EE—Wheeling, W. Va.
FF—Pittsburgh, Pa.

MISSISSIPPI SYSTEM—MISSOURI RIVER BRANCH.

GG—Kansas City, Mo. (Missouri River, etc.).

MISSISSIPPI SYSTEM—UPPER.

HH—Mississippi River.[1]
II—St. Louis, Mo.
JJ—Rock Island, Ill.
KK—St. Paul, Minn.

THE LAKES.

LL—Duluth, Minn.
MM—Milwaukee, Wis.
NN—Chicago, Ill.
OO—Grand Rapids, Mich.
PP—Detroit, Mich.
QQ—Cleveland, Ohio.
RR—Buffalo, N. Y.

PACIFIC COAST.

SS—Los Angeles, Cal.
TT—1st San Francisco, Cal.
UU—3rd San Francisco, Cal.[2]
VV—1st Portland, Oreg.
WW—2nd Portland, Oreg.
XX—Seattle, Wash.

INSULAR.

YY—Includes works in Porto Rico, Hawaii, and the Philippines.

3. NUMBERING OF THE WATERWAYS.

The waterways in each group are listed in a sequence determined by beginning the list where the list of the preceding group ends. The first waterway or harbor in each group is called No. 1 of that group—of Group A, or B, or C, etc.

The listing is done on the line of travel which follows the coast of a harbor, bay, or river. The list proceeds up each river to the first tributary on the left bank, then up this tributary in like manner, down the right bank to the mouth again, then up the main river to the next tributary, and so on, returning by the right bank of the main stream to the mouth of the river. Each waterway or harbor takes its number accordingly as it is placed in this listing.

A number is placed also after each waterway name. This is the number of the stream to which that waterway is tributary. For example, in the following,

H 1 Atlantic Ocean.
H 2 Delaware River (1).
H 3 Delaware and Chesapeake Canal (2).

H represents the group or district; the figures after the letter the number of the waterway named in that group. The final number after H 3 in the list shows that the Delaware and Chesapeake Canal connects with Delaware River. In some cases the title of an improvement differs from the title given a waterway in the district list. If the "list" number is "49," the abstract in a case like that mentioned would receive the number "49(a)," or 49(b)," and the same lettering plan is followed to indicate *parts*, and to indicate an *insertion*.

[1] Under this name all the data concerning the Mississippi River is placed, from mouth to headwaters.
[2] The 2d district embraces defensive matters.

4. EXPLANATION OF SUBHEADS USED IN PART I.

The data relating to each work are set forth, in the order of time, generally, under titles, the most important of which are as follows:

Appropriations.—The various amounts applied to the work as far as known.

Attention is drawn to the fact that each annual report made by an engineer in charge of a waterway improvement project provides a list of the appropriations made for the work. This list refers usually only to United States appropriations.

Commerce.—Under this heading reference is made to important commercial data. In later years tonnage is shown, and usually the value of it. An effort is made to do this so as to enable a comparison to be made of periods. Reports on examinations and surveys also refer to such statistics. Where there is a predominance of one special commodity it is named, as in the case of coal, grain, ore, etc. The commerce referred to in the reports is almost always water-borne commerce, but little reference being made to other than water traffic.

It should be pointed out that even where no commerce is reported as existing it may be that the improvement of the waterway is being made for future commerce very close at hand or for the purpose of helping to govern traffic rates on adjacent traffic routes.

Contracts.—The more important contracts are listed, the contractor, class of work, cost, and magnitude usually being shown.

Engineers.—The engineers in charge of a work are listed, with their terms of service, and a reference to their reports on the waterway. The ordinary reports of the fiscal year on waterways are of two kinds—(*a*) the summary of the report on a waterway known as the Chief of Engineers' report, and (*b*) the report of operations rendered by the engineer in direct charge. The former in late years gives an outline of the history of the improvement work.

Estimates.—This is a heading employed in the early issues of the index. It was for data which in later years are merged under the heading *Projects.*

Legal proceedings.—This refers to action taken through the customary legal channels for the acquirement of land, rights, etc.

Legislation.—Under this heading are grouped all references to legislation other than the direct authority of Congress for the work of improvement.

Maps.—The earlier reports contain many valuable maps of waterways. In later years most of these maps are printed in the bound volumes of the congressional documents relating to examinations, surveys, etc. They are all referred to under "Surveys."

Obstructions.—These references relate principally to bridges or to other things which are considered noteworthy physical obstructions to the waterway or its improvement.

Operations.—The matter under this head may be considered as supplementary to that under the head of "Projects," as it tells of the carrying forward from year to year of the details of the projects authorized. In other words, the matter under this heading is a condensed statement of the work carried on in each fiscal year ending June 30.

Physical characteristics.—Under this title are collected references to the physical characteristics of a waterway—its conformation, situation, connections, rainfall, etc.

The depths given are usually given from a level which Congress terms mean low water. The beginning or zero point of the depths given in the earlier reports may be found to vary, so that a close examination of the reports themselves will be needful for precise information on this point. For example, in the earlier reports "16 feet" may mean that depth at high water, or low water, or mean low or high water for a restricted period; in later years, "16 feet" would mean 16 feet below mean low water; and there may be occasions where "16 feet" would mean a channel permitting the passage of a craft drawing 16 feet—that is, a depth of 16 feet plus 1 or more feet allowance between the bottom of the craft and the bed of the waterway.

Details as to physical data are customarily found profusely in reports on examinations and surveys.

Plans.—It was the aim in previous indexes to collect under this head plans proposed by engineers for improving waterways, pending their selection and adoption by a higher authority. In later years such matter was included under "Projects," in view of the general difficulty in making the distinction between proposed and adopted plans.

Private work.—This refers to data pertaining to work on the waterway, or work closely connected thereto, not done by the United States.

Projects.—Under this title the various plans of improvement authorized or proposed are arranged sequentially by time. The attempt is to provide a clear and intelligible outline, so far as this can be done in a summary, of what has been proposed, or of what has been directed by Congress. Included in the matter are estimates of funds and time required.

Changes in conditions, with a consequent modification of plans, are recorded.

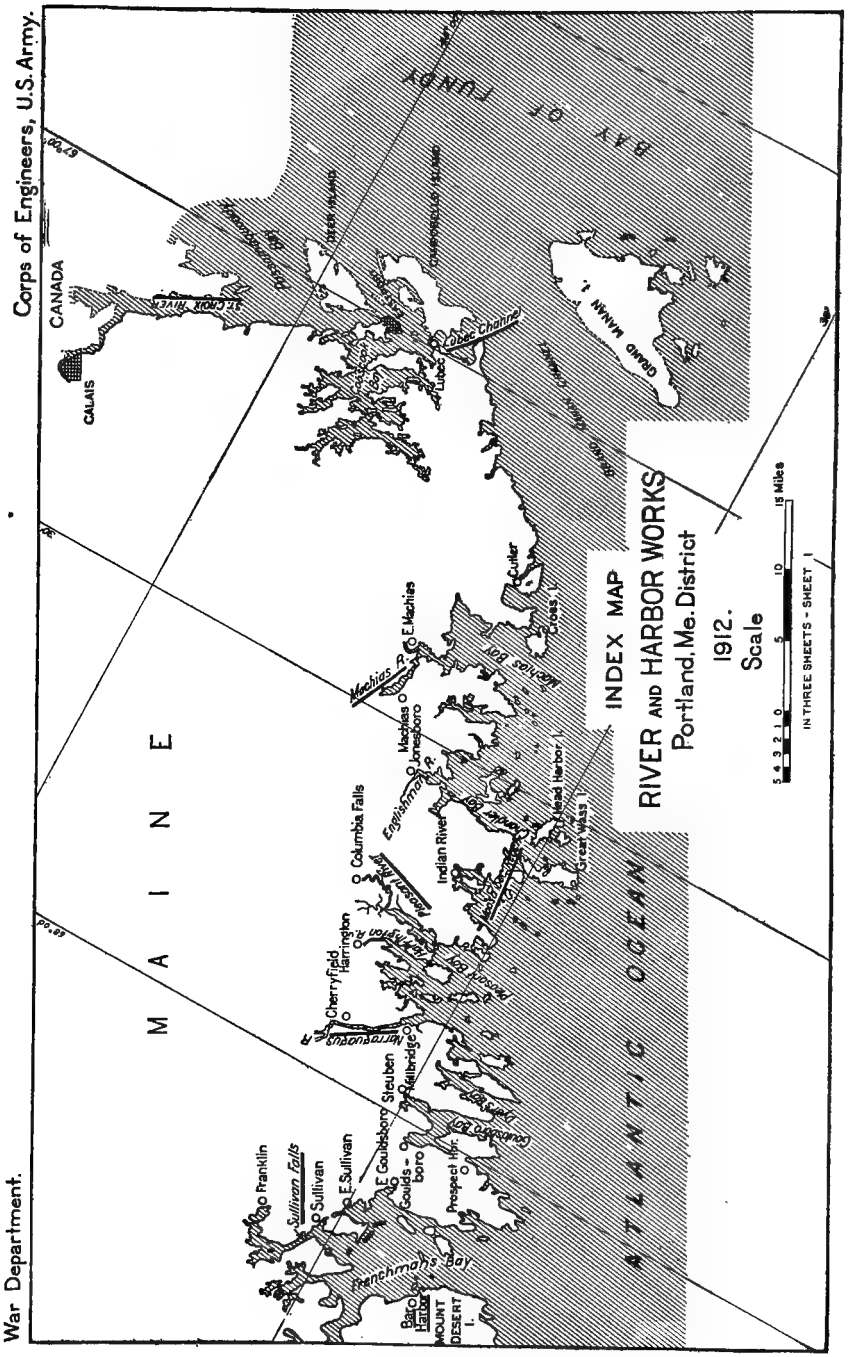
It should be borne in mind, in considering the data under this heading, that the adoption of an engineer's plan by Congress may mean a considerable modification of the method proposed or the results aimed at according to whether Congress makes provision for the carrying out of the plan, as proposed precisely by the engineer, or in any other way. This has reference to the frequent changes in estimates.

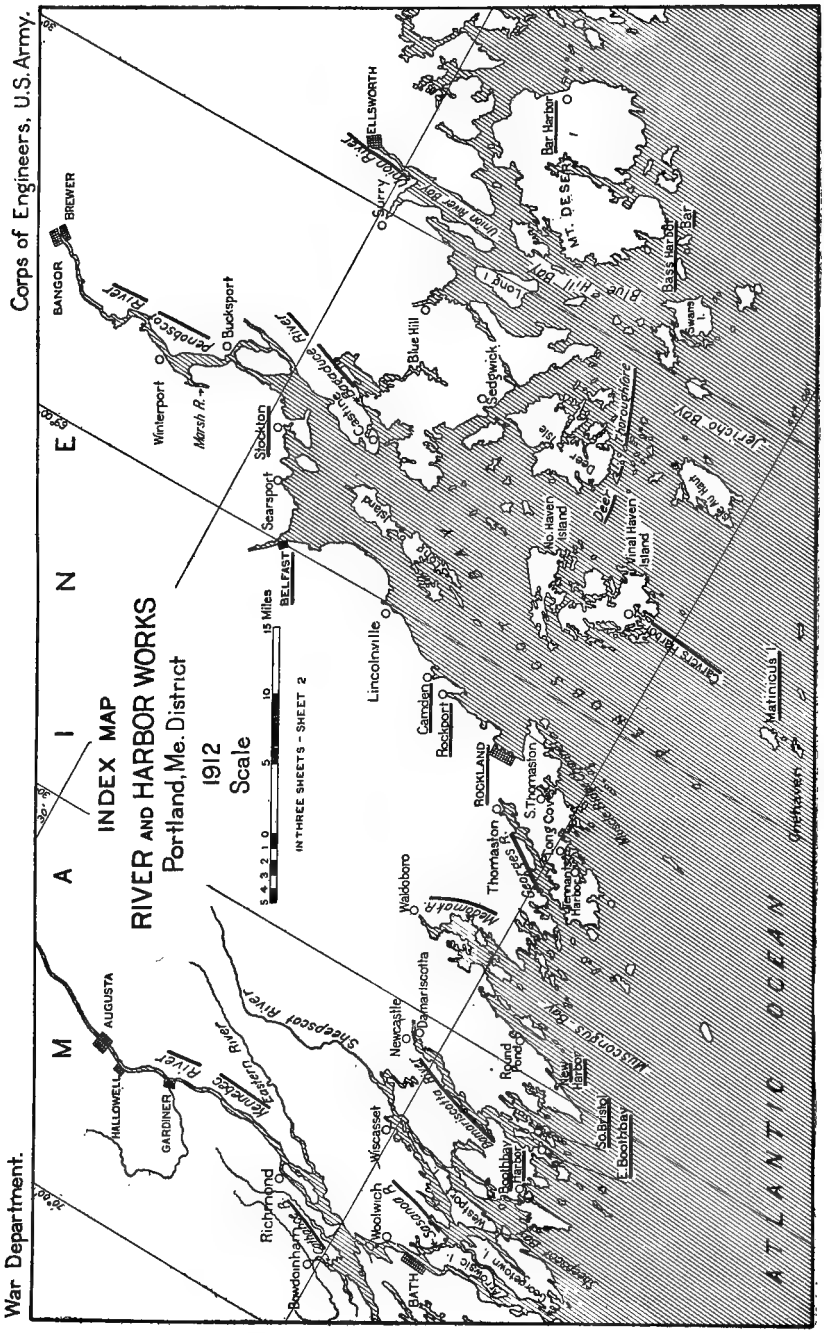
Surveys.—The matter under this title is meant to be a complete outline of all examinations and surveys made pertaining to the waterway.

RIVER AND HARBOR WORKS.

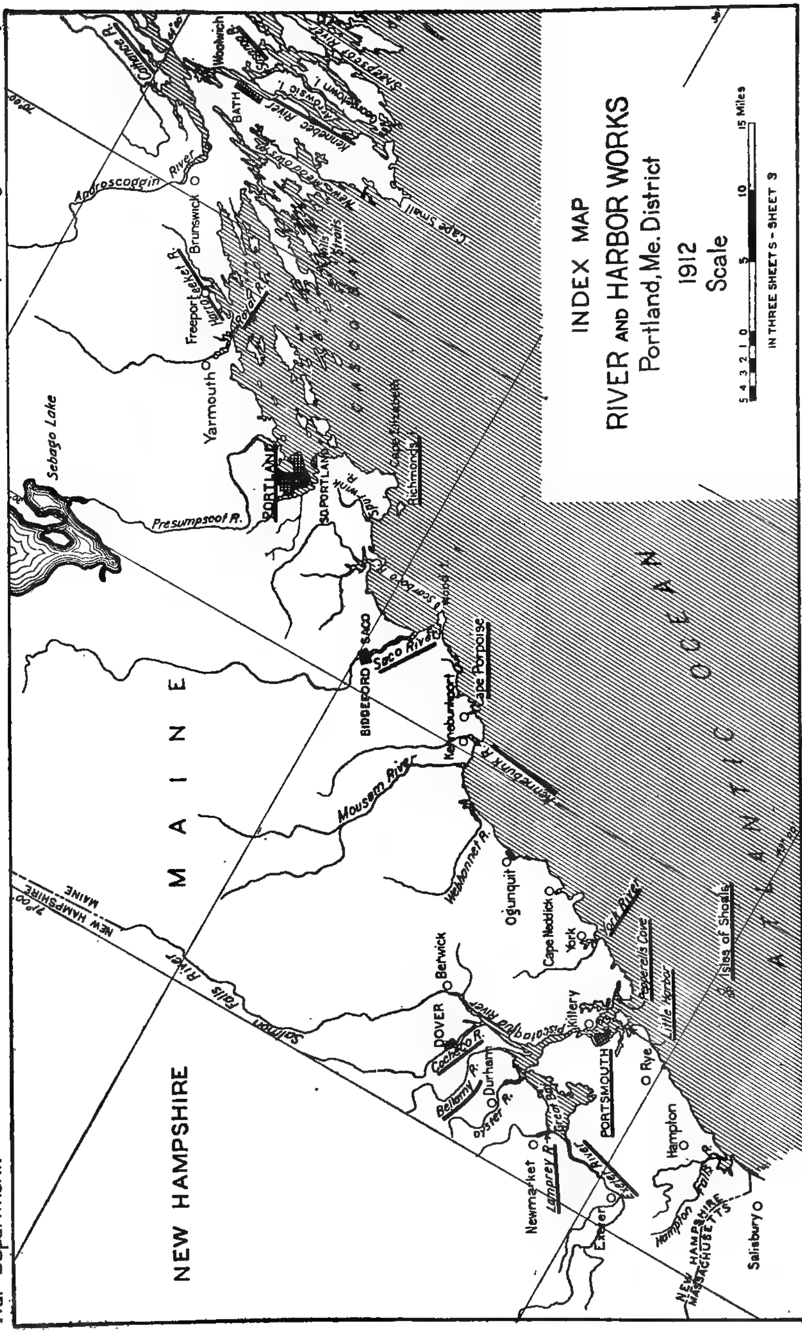
NORTH ATLANTIC.

A.—PORTLAND, ME., DISTRICT.


War Department.
Corps of Engineers, U.S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Portland, Me. District
1912.
Scale
IN THREE SHEETS - SHEET 1
15 Miles
BAY OF FUNDY
ATLANTIC OCEAN
MAINE
CANADA
CALAIS
ST. CROIX RIVER
DEER ISLAND
CAMPOBELLO ISLAND
GRAND MANAN I.
Lubec Channel
Lubec
Cutler
Cross I.
Machias R.
E. Machias
Machias
Jonesboro
Englishman R.
Columbia Falls
Indian River
Head Harbor I.
Great Wass I.
Cherryfield
Harrington
Narraguagus R.
Steuben
Millbridge
Goulds-boro
E. Goulds-boro
Prospect Hbr.
Franklin
Sullivan Falls
Sullivan
E. Sullivan
Frenchmans Bay
Bar Harbor
MOUNT DESERT I.


War Department.
Corps of Engineers, U.S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Portland, Me. District
1912
Scale
5 4 3 2 1 0 5 10 15 Miles
IN THREE SHEETS - SHEET 2
M A I N E
ATLANTIC OCEAN
BANGOR
BREWER
ELLSWORTH
AUGUSTA
HALLOWELL
GARDINER
BELFAST
Winterport
Bucksport
Stockton
Searsport
Lincolnville
Camden
Rockport
ROCKLAND
Thomaston
Waldoboro
Damariscotta
Newcastle
Wiscasset
Woolwich
Richmond
Bowdoinham
BATH
Boothbay
Harbor
New Harbor
Round Pond
Sedgwick
Blue Hill
Surry
Bar Harbor
MT. DESERT
Bass Harbor
Swans I.
Jericho Bay
Blue Hill Bay
Long I.
Union River
Penobscot River
Marsh R.
Castine
Bagaduce River
Deer Isle
Thoroughfare
No. Haven Island
Vinal Haven Island
Carvers Harbor
Matinicus I.
Grehaven
Muscongus Bay
Medomak R.
Georges R.
Sheepscot River
Kennebec River
Eastern River
Sheepscot Bay
Arrowsic I.
Georgetown I.
Westport
Sasanoa R.
Damariscotta River
Mussels Ridge
Long Island
Deer Isle

Corps of Engineers, U.S. Army.



War Department.

A.—PORTLAND, ME., DISTRICT.

In charge of U. S. Engineer Office,
Portland, Me.

A 1 St. John R., Me. (*)
A 2 Aroostook R., Me. (1)
A 3 St. Croix R., Me. (*)
A 4 Eastport H. (Friar Roads), Me. (*)
A 5 Cobscook B., Me. (*)
A 6 Pennamaquam R. (Pembroke H.), Me. (5)
A 7 Dennys R. (Dennysville), Me. (5)
A 8 Cobscook R., Me. (5)
A 9 Lubec Chan., Me. (*)
A 10 Little R. (Cutler), Me. (*)
A 11 Little Machias B., Me. (*)
A 12 Machias B., Me. (*)
A 13 Holmes B., Me. (12)
A 14 Machias R., Me. (12)
A 15 East Machias R., Me. (12)
A 16 Englishman B., Me. (*)
A 17 Little Kennebec B., Me. (16)
A 18 Pond Cove, Me. (16)
A 19 Roque Island H., Me. (16)
A 20 Chandler R., Me. (16)
A 21 Chandler B., Me. (*)
A 22 Mooseabec Reach, Me. (*)
A 23 Indian R., Me. (*)
A 24 Cape Split H., Me. (*)
A 25 Pleasant B., Me. (*)
A 26 Pleasant R., Me. (25)
A 27 Harrington B., Me. (25)
A 28 Harrington R., Me. (27)
A 29 Narraguagus B., Me. (*)
A 30 Narraguagus R., Me. (29)
A 31 Pigeon Hill B., Me. (*)
A 32 Dyers B., Me. (*)
A 33 Pinkham B., Me. (32)
A 34 Dyers H., Me. (32)
A 35 Gouldsborough B., Me. (*)
A 36 Joys B., Me. (35)
A 37 Steuben H., Me. (35)
A 38 Gouldsborough H., Me. (35)
A 39 Indian H., Me. (*)
A 40 Prospect H., Me. (*)
A 41 Birch H., Me. (*)
A 42 Schoodic H., Me. (*)
A 43 Frenchmans B., Me.(*)
A 44 Winter H., Me. (43)
A 45 Stave Island H., Me. (43)
A 46 Flanders B., Me. (43)
A 47 West Gouldsborough H., Me. (46)
A 48 Sullivan R., Me. (43)
A 49 Skillings R., Me. (43)
A 50 Jordans R., Me. (43)
A 51 Mount Desert Narrows, Me. (43)
A 52 Bar H., Me. (43)
A 53 North East H., Me. (*)
A 54 Somes Sound, Me. (*)
A 55 South West H., Me. (*)
A 56 Bluehill B., Me. (*)
A 57 Bass H., Me. (56)
A 58 Seal Cove, Me. (56)
A 59 Pretty Marsh H., Me. (56)
A 60 Bartletts Narrows, Me. (56)
A 61 Clarkes Cove, Me. (56)
A 62 Union River B., Me. (56)
A 63 Union R., Me. (62)
A 64 Pattens B., Me.(62)
A 65 Morgans B., Me. (56)
A 66 Bluehill H., Me. (56)
A 67 Salt Pond, Me. (56)
A 68 Allens Cove, Me. (56)
A 69 Casco Passage, Me. (56)
A 70 York Narrows, Me. (56)
A 71 Mackerel Cove., Me. (56)
A 72 Jericho B., Me. (*)
A 73 Burnt Coat H., Me. (72)
A 74 Seal Cove, Me. (72)
A 75 Herricks B., Me. (72)
A 76 Eggemoggin Reach, Me. (72)
A 77 Naskeag H., Me. (76)
A 78 Center H., Me. (76)
A 79 Benjamin R., Me. (76)
A 80 Bucks H., Me. (76)
A 81 Orcutts H., Me. (76)
A 82 Horseshoe Cove, Me. (76)
A 83 Greenlaws Cove, Me. (76)
A 84 South East H., Me. (72)
A 85 Deer Island Thoroughfare, Me. (72)
A 86 Webbs Cove, Me. (85)
A 87 Stonington H., Me. (85)
A 88 Merchants Row, Me. (72)
A 89 Head H., Me. (*)
A 90 East Penobscot B., Me. (*)
A 91 Moores H., Me. (90)
A 92 Isle Au Haut Thoroughfare, Me. (90)
A 93 South West H., Me. (90)
A 94 North West H., Me. (90)
A 95 Castine H., Me. (90)
A 96 Smiths Cove, Me. (95)
A 97 Bagaduce R., Me. (95)
A 98 South B., Me. (97)
A 99 Northern B., Me. (97)

*Atlantic Ocean.

A 100 Hatchs Cove, Me. (97)
A 101 Penobscot R., Me. (90)
A 102 Eastern Chan., Me. (101)
A 103 Bucksport H., Me. (101)
A 104 Bangor H., Me. (101)
A 105 Kenduskeag Stream, Me. (101)
A 106 Marsh R. (West Branch), Me. (101)
A 107 Fort Point Cove, Me. (101)
A 108 Stockton H., Me. (90)
A 109 Parkers Cove, Me. (90)
A 110 Sabbath Day H., Me. (90)
A 111 Islesboro H., Me. (90)
A 112 Dark H., Me. (90)
A 113 Winter H., Me. (90)
A 114 Seal B., Me. (90)
A 115 Roberts H., Me. (90)
A 116 Carvers H. (Vinalhaven), Me. (*)
A 117 Matinicus H., Me. (*)
A 118 Criehaven H., Me. (*)
A 119 West Penobscot B., Me. (*)
A 120 Hurricane Sound, Me. (119)
A 121 Crocketts Cove, Me. (119)
A 122 Fox Island Thoroughfare, Me. (119)
A 123 Seal Cove, Me. (122)
A 124 Carvers Cove, Me. (122)
A 125 Little Thoroughfare, Me. (122)
A 126 Kents Cove, Me. (122)
A 127 Watermans Cove, Me. (122)
A 128 North Haven H., Me. (122)
A 129 Southern H., Me. (122)
A 130 Bartletts H., Me. (119)
A 131 Pulpit H., Me. (119)
A 132 Gilkey H., Me. (119)
A 133 Seal H., Me. (119)
A 134 Turtle Head Cove, Me. (119)
A 135 Long Cove, Me. (119)
A 136 Searsport H., Me. (119)
A 137 Belfast B., Me. (119)
A 138 Belfast H., Me. (137)
A 139 Passagasawakeag R., Me. (137)
A 140 Frenchs Beach H. (Duck Trap H.), Me. (119)
A 141 Linconville H., Me. (119)
A 142 Camden H., Me. (119)
A 143 Rockport H., Me. (119)
A 144 Glen Cove H. (Clam Cove), Me. (119)
A 145 Rockland H., Me. (119)
A 146 Owls Head B., Me. (119)
A 147 Muscle Ridge Chan., Me. (*)
A 148 Weskeag R. (South Thomaston), Me. (147)
A 149 Seal H., Me. (147)
A 150 Clarks Cove, Me. (*)
A 151 Long Cove, Me. (*)
A 152 Tenants H., Me. (*)
A 153 Mosquito H., Me. (*)
A 154 Herring Gut (Port Clyde H.), Me. (*)
A 155 St. Georges R. (Thomaston H.), Me. (*)
A 156 Monhegan Island H., Me. (*)
A 157 Muscongus B., Me. (*)
A 158 Meduncook R., Me. (157)
A 159 Davis Cove, Me. (158)
A 160 Hornbarn Cove, Me. (158)
A 161 Friendship H., Me. (157)
A 162 Delano Cove, Me. (157)
A 163 Back R., Me. (157)
A 164 Back R. Cove, Me. (157)
A 165 Flying Passage, Me. (157)
A 166 Medomak R., Me. (157)
A 167 Broad Cove, Me. (157)
A 168 Eastern Branch, Me. (167)
A 169 Western Branch, Me. (167)
A 170 Hockomock Chan., Me. (157)
A 171 Keene Narrows, Me. (157)
A 172 Lower Narrows, Me. (157)
A 173 Muscongus Sound, Me. (157)
A 174 Muscongus H., Me. (173)
A 175 Round Pond H., Me. (173)
A 176 Long Cove, Me. (157)
A 177 New H., Me. (157)
A 178 Johns B., Me. (*)
A 179 Pemaquid H., Me. (178)
A 180 Pemaquid R., Me. (178)
A 181 Johns R., Me. (178)
A 182 Fosters Cove, Me. (181)
A 183 Western Branch, Me. (181)
A 184 Robinsons Cove, Me. (181)
A 185 McFarlings Cove, Me. (178)
A 186 Damariscotta R., Me. (*)
A 187 Christmas Cove, Me. (186)
A 188 The Gut (South Bristol H.), Me. (186)
A 189 Jones Cove, Me. (186)
A 190 Seal Cove, Me. (186)
A 191 Clarks Cove, Me. (186)
A 192 Damariscotta H., Me. (186)
A 193 Pleasant Cove, Me. (186)
A 194 East Boothbay H., Me. (186)
A 195 Booth B., Me. (*)
A 196 Linekins B., Me. (195)
A 197 Boothbay H., Me. (195)
A 198 Townsend Gut, Me. (195)
A 199 Sheepscot R., Me. (*)
A 200 Hendricks H., Me. (199)
A 201 Ebenecook H., Me. (199)
A 202 Back R., Me. (199)
A 203 Cross R., Me. (199)
A 204 Wiscasset H., Me. (199)
A 205 Cowsegan Narrows, Me. (199)
A 206 Back R., Me. (199)
A 207 Montsweag B., Me. (199)
A 208 Montsweag Creek, Me. (207)
A 209 Hockomock B., Me. (199)
A 210 Brookings B., Me. (209)
A 211 Great Hell Gate, Me. (199)
A 212 Knubble B., Me. (199)
A 213 Robin Hood Cove, Me. (199)
A 214 Goose Rock Passage, Me. (199)
A 215 Little Sheepscot R., Me. (199)
A 216 Herman H., Me. (199)
A 217 Stage Island B., Me. (*)
A 218 Sagadahoc B., Me. (*)
A 219 Kennebec R., Me. (*)
A 220 Back R., Me. (219)
A 221 Sasanoa R., Me. (219)
A 222 Upper Hell Gate, Me. (221)
A 223 Pleasant Cove, Me. (221)
A 224 Eastern R., Me. (219)
A 225 Lovejoys Narrows, Me. (219)

* Atlantic Ocean.

A 226 Cobosseecontee Stream, Me. (219)
A 227 Channel West of Swan Island, Me. (219)
A 228 Merrymeeting B., Me. (219)
A 229 Abagadassett R., Me. (228)
A 230 Cathance R., Me. (228)
A 231 West Branch, Me. (230)
A 232 Muddy R., Me. (228)
A 233 Androscoggin R., Me. (228)
A 234 Umbagog Lake, Me. (233)
A 234 (a) Ammonoosook Canal, N. H. (233, and D21)
A 235 Whiskeag Creek, Me. (219)
A 236 Winnegance Creek, Me. (219)
A 237 Drummore, Me. (219)
A 238 Parkers Head H., Me. (219)
A 239 Atkins B., Me. (219)
A 240 Morse R., Me. (*)
A 241 Seal Cove, Me. (*)
A 242 Bald Head Cove, Me. (*)
A 243 Casco B., Me. (*)
A 244 Small Point H., Me. (243)
A 245 New Meadows R., Me. (243)
A 246 Winnegance B., Me. (245)
A 247 Mill Cove, Me. (245)
A 248 Cundys H., Me. (245)
A 249 Quohog B., Me. (243)
A 250 Harpswell Sound, Me. (243)
A 251 Wills Straits, Me. (250)
A 252 Long Reach, Me. (250)
A 253 Harpswell H., Me. (250)
A 254 Potts H., Me. (243)
A 255 Broad Sound, Me. (243)
A 256 Middle B., Me. (243)
A 257 Mare Point B., Me. (243)
A 258 Maquoit B., Me. (243)
A 259 Freeport or Harraseeket R., Me. (243)
A 260 Yarmouth R. (Royal R.), Me. (243)
A 261 Broad Cove, Me. (243)
A 262 Portland H., Me. (243)
A 263 Back Cove, Me. (262)
A 264 Fore R., Me. (262)
A 265 Richmonds Island H., Me. (*)
A 266 Spurwink R., Me. (*)
A 267 Saco B., Me. (*)
A 268 Scarborough R., Me. (267)
A 269 Saco R., Me. (267)
A 270 Biddeford Pool, Me. (267)
A 271 Wood Island H., Me. (267)
A 272 Goose-Fair B., Me. (*)
A 273 Goose-fair Creek, Me. (272)
A 274 Cape Porpoise H., Me. (*)
A 275 Kennebunk R., Me. (*)
A 276 Mousam R., Me. (*)
A 277 Webhannet R. (Wells H.), Me. (*)
A 277 (b) Ogunquit H., Me. (*)
A 278 Cape Neddick H., Me. (*)
A 279 York R. (York H.), Me. (*)
A 280 Piscataqua R. (Portsmouth H.), Me. and N. H. (*)
A 281 Pepperells Cove, Me. (280)
A 282 Salmon Falls R., Me. and N. H. (280)
A 283 Great Works R., Me. (282)
A 284 Cocheco R., N. H. (280)
A 285 Great B., N. H. (280)
A 286 Bellamy R., N. H. (285)
A 287 Oyster R., N. H. (285)
A 288 Lamprey R., N. H. (285)
A 289 Exeter R., N. H. (285)
A 290 Little H., N. H. (280)
A 291 Isles of Shoals H. (Gosport H.), Me. and N. H. (*)
A 292 Rye H., N. H. (*)
A 293 Hampton H., N. H. (*)
A 294 Hampton R., N. H. (293)

A–1 ST. JOHNS RIVER, AT BIG RAPIDS, ME.

COMMERCE.

Flatboat navigation, **87,** 472.

ENGINEERS.

Chief of Engineers. **R., 87,** 21.
In charge. Maj. J. A. Smith, 1886. **R., 87,** 471.

SURVEY.

Ex. au. act Aug. 5, 1886, made, 1886, by Maj. Smith (**R.** unfav.), **87,** 471.

A–2 AROOSTOOK RIVER, ME.

COMMERCE.

Local, **74,** ii, 327.

ENGINEERS.

Chief of Engineers. **R., 73,** 106; **74,** 116; **79,** 52; **80,** 72.[1]
In charge. Lt. Col. George Thom, 1872–79, **73,** 106; **74,** 116; **79,** 52. **R., 74,** ii, 327.
Assistant. S. Haagensen, **74,** ii, 327. **R., 74,** ii, 328.

PHYSICAL CHARACTERISTICS.

Description of, **74,** ii, 327, 329.
Water stages, **74,** ii, 328.
Navigation limited to a short period of the year by obstr. at l. w., **74,** ii, 328.

OBSTRUCTION.

Obstructions, list of, **74,** ii, 330, 331.

PLANS.

By Lt. Col. Thom, chan. 50′2′ l. w., the international boundary to Masardis, 69 m., $50.000, **74,** ii, 327, 328, 329, 330.

SURVEYS.

By S. Haagensen, 1872, **73,** 106; **74,** 116, ii, 327, 328.
Ordered from international boundary to Masardis, 1878, **79,** 52.

* Atlantic Ocean.

[1] H. Ex. D. 84, 43d, 1st.

A–3 ST. CROIX RIVER, ME.

APPROPRIATIONS.

1867,	[1]$15,000,	**67,** 503; **68,** 72, 855.
1873,	10,000,	**73,** 94.
1874,	10,000,	**74,** 104.
1881,	[2]4,000,	**81,** 458.
1890,	35,000,	**91,** 570.
	74,000	
Transferred—		
1879,	[3]34,000	
1894,	[3]35,000	
	69,000	
	5,000	
1910,	75,000,	**10,** 1084.
Total,	80,000	

CANADIAN GOVERNMENT. (See *Surveys.*)

Appro. $25,000 for this imp., **74,** 104. Refused to expend any part of appro. without guarantee that no further deposit of slabs, edgings, and sawdust would be made in the **R.,** **74,** 104, ii, 294.

COMMERCE.

Benefit of imp. to C., **67,** 504; **68,** 856; **73,** 1053.

Nine-tenths of the C. American and one-tenth Canadian. About 65,000,000′ lumber, 55,000 t. coal, 40,000 bushels grain, etc., carried ann. **97,** 806. 1909, 200,000 t., **10,** 1084; 1911, 122,535 t., **12,** 35, 1354.

Destruction by fire of certain mills responsible for decrease in amount of C., **12,** 35, 1354.

CONTRACTS.

1881. A. Towers, rebuilding break'r cribs, **81,** 457.

1912. Bay State Dredging Co. (Ltd.), dr. about 210,000 c. y., 32.25 ¢ c. y., s. m., and $10 c. y. for bowlders exceeding 2 c. y. each, **12,** 1354.

ENCROACHMENTS.

Injury to R. from mill refuse, **87,** 479, 480.

ENGINEERS.

Chief of Engineers. **R.,** **67,** 50; **68,** 72; **69,** 62; **70,** 82; **71,** 87; **72,** 86; **73,** 94; **74,** 104; **75,** 111; **76,** 37; **77,** 32; **78,** 36; **79,** 43; **81,** 63; **82,** 63; **87,** 22; **89,** 31; **90,** 26; **91,** 19; **92,** 23; **93,** 21; **94,** 20; **95,** 22; **97,** 43; **01,** 120; **10,** 36, 59; **11,** 35; **12,** 34.

In charge:

Lt. Col. G. Thom., 1867–82. **R.,** **67,** 503; **68,** 855; **69,** 458; **70,** 503; **71,** 830; **72,** 924; **73,** 1051; **74,** ii, 290; **75,** ii, 382; **76,** 151; **77,** 153; **78,** 189; **79,** 245; (Col.) **81,** 457.

Maj. J. A. Smith, 1888–92. **R.,** **87,** 477; (Lt. Col.) **90,** 463; **91,** 570.

Lt. Col. P. C. Hains, 1892–94. **R.,** **92,** 494; **93,** 670; **94,** 489.

Lt. Col. D. P. Heap, 1895. **R.,** **95,** 537.

Maj. R. L. Hoxie, 1897. **R.,** **97,** 805.

Maj. S. W. Roessler, **01,** 120.

Lt. Col. G. A. Zinn, 1910. **R.,** **10,** 1084.

Lt. Col. W. E. Craighill, 1911–. **R.,** **11,** 1143; **12,** 1353.

Assistants:

S. Haagensen, **76,** 152.

F. S. Burrowes. **R.,** **90,** 465.

W. F. Robinson. **R.,** **97,** 807.

Lt. T. H. Jackson, **01,** 120.

Lt. C. W. Kutz, **01,** 120.

ESTIMATE. (See Plans *and* Projects.)

By Lt. Col. Thom, removal of slabs, edgings, and sawdust from the chan., $88,000, one-half to be paid by New Brunswick, **67,** 505. Revised, $99,000, **68,** 856; **69,** 458. Increased to $150,000, **73,** 1051; **77,** 154.

MISCELLANEOUS.

Piers are under control of Lighthouse Establishment; badly in need of repairs, but can not be repaired without au. from Congress, **01,** 120.

OPERATIONS.[4]

Break'r built in 1856, **81,** 457.

1881–82. Break'r c'g of 3 cribs rebuilt, **82,** 486.

1911–12. 29,057 c. y. dr. (dr. sunk by collision on June 26, 1912), **12,** 1353.

PHYSICAL CHARACTERISTICS.

Rise and fall of tides, **67,** 503.

Description of, **90,** 463; **97,** 806.

R. forms part of international boundary between U. S. and Canada. Head of navigation is Calais, where the d. is little more than 3′, **10,** 36.

R. rises in a series of lakes in Maine, on or near the boundary, and flows soherly. for about 100 m. into Passamaquoddy B., **12,** 34.

PLANS. (See Estimates *and* Projects.)

By Lt. Col. Thom, removal of slabs, edgings, and sawdust from the chan., **67,** 503. To increase w. of chan., **76,** 152.

By Col. Thom, 1875, dr. chan. 9′ x 200′ m. l. w. to Todds Ledge, and from thence to the toll bridge 100′ w.; est., $200,000, **75,** ii, 382; **87,** 480. Imp. not recom. until provision should be made for the proper disposal of mill waste, **87,** 481.

PROJECTS. (See Estimates *and* Plans.)

In 1856, 3 crib piers filled with st. built upon the ledge; object to prevent vessels from drifting upon the ledge. Work nearly destroyed by freshets and ice in 1881; rebuilt; cost about $4,000, **82,** 63, 486.

By Lt. Col. Smith, 1889, chan. 12′ x 200′ m. l. w. narrowed to 150′ and 100′ in the upper part of the harbor, to be secured by dr. and 600 l. f. of jetty constr.; est., $280,000, **90,** 466, 467; **92,** 494.

Maj. Hoxie est., 1897, $200,000 to imp. R., **97,** 806

Act June 25, 1910, au. chan. 9′ x 100′ m. l. w., upper ss. wharf at Calais, to the public landing at St. Stephen, thence 150′ w. to lower ss. wharf at Calais, thence 12′ x 200′ to Hills Pt.; est., $234,000,[1] **10,** 36.

SURVEYS.

Ex. by Lt. Col. Thom, 1867, from the ledge to head of navigation at Calais, **67,** 503.

By Lt. Col. Thom, 1873, **74,** ii, 290.

From Calais to break'r ledge au. act August 5, 1886, made by Maj. Smith, **87,** 477.

Au. act Aug. 11, 1888, made, 1889, by Lt. Col. Smith, **90,** 464.

Sur. au. act June 3, 1896. Ex. made, 1896, by Lt. Col. Damrell showed that sur. was unnecessary (**R.** fav. if the throwing of mill waste into the R. be suppressed), **97,** 805.

Pre. ex. and sur. au. act Mar. 3, 1909, of St. Croix R., at and near Calais, Me. **R.** by Lt. Col. Zinn, 1909 and 1910; est., $234,000: providing dumping of sawdust and other waste be permanently stopped, and that Canadian Govt. cooperate to extent of 20% of total cost,[1] **10,** 59.

Maps.[5]

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[1] The appro. of 1867 made with the proviso that the Province of New Brunswick would contribute and pay a like sum for said purpose, **67,** 503.

[2] Calais break'r.

[3] Lubec Chan.

[4] Reasons for postponement, **68,** 855; **69,** 458; **70,** 503; **71,** 830; **72,** 924; **73,** 1051; **74,** 104, ii, 290: **75,** 111, ii, 382; **76,** 37, 151; **77,** 32, 153.

[5] H. D. 748, 61st, 2d.

A-5 COBSCOOK BAY, ME. (Near Fall Island).[1]

APPROPRIATIONS.

1836, $300, act July 4 (sur.).
1852, 5,000, act Aug. 30.

Total, 5,300.

ENGINEERS.

Chief of Engineers. R., 66, 7, 36.
In charge. Col. J. D. Graham, **66,** 36.

PROJECT.

For removing obstr. to navigation, **66,** 7, 36.

A-6(a) PEMBROKE HARBOR, ME.

COMMERCE.

In 1892, unimportant, **93,** 723.

ENGINEERS.

Chief of Engineers. R., 89, 31; **93,** 37.
In charge:
Lt. Col. J. A. Smith, 1889. **R., 89,** 546.
Lt. Col. P. C. Hains, 1892-93. **R., 93,** 722.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 546; **93,** 723.
Chan. is a part of the headwaters of Pennamaquan R., a tidal estuary of Cobscook B., **93,** 723.

SURVEYS.

Ex. au. act Aug. 11, 1888, made 1889, by Lt. Col. Smith (**R.** unfav.), **89,** 546.
Ex. au. act July 13, 1892, made by Lt. Col. Hains in 1892 (**R.** unf.), **93,** 722.

A-9 LUBEC CHANNEL, ME.

APPROPRIATIONS.

1879, [2]$44,000, **79,** 44.
1880, 20,000, **80,** 327.
1881, 45,000, **81,** 460.
1882, 20,000, **82,** 488.
1884, 10,000, **84,** 461.
1886, 10,000, **86,** 530.
1888, 20,000, **88,** 375.
1894, { [2] 35,000, **95,** 540.
5,000, **95,** 540
1896, 32,000, **96,** 541.
1899, 25,000, **99,** 1018.
1902, 53,000, **02,** 827.

Total, 319,000

COMMERCE.

Benefits to, from imp., **88,** 374.
In 1911, 60,000 t., **12,** 36.
Imp. of international effect (See Phy. Data); rail traffic competes with water traffic, **12,** 36.

CONTRACTS.

1880. Atlantic Dredging Co., dr., **80,** 328.
1881. Moore & Wright, dr., **81,** 460.
1882. Moore & Wright, dr., 37¢ c. y., **82,** 488.
1884. W. S. White, j. constr., **84,** 461. Moore & Wright, dr., 42¢ c. y., **85,** 464. G. W. Townsend, r. removal, $24.90 per c. y., **85,** 462.
1887. Moore & Wright, dr., 35¢ c. y., **87,** 437.
1889. A. R. Wright, dr., 35¢ c. y., **89,** 505.
1895. Moore & Wright, dr., 31¢ c. y., p. m. (62,000), **95,** 541.
1897. Moore & Wright, dr., $1, and 27¢ c. y., s. m. ($52,180), **97,** 771.
1899. A. R. Wright, dr., 25¢ c. y., s. m. ($31,250); bowlders exceeding 5 t., $5 per t., **99,** 1018.
1902. Eastern Dredging Co., dr., 24⅝¢ c. y., and removing bowlders $5 per t., **03,** 712.
1905. William Whittelsey Co., constr. motor launch, $12,500, **06,** 850.

ENGINEERS.

Chief of Engineers. R., 78, 46; **79,** 44, 52; **80,** 63; **81,** 64; **82,** 63; **83,** 59; **84,** 67; **85,** 55; **86,** 54; **87,** 14; **88,** 11; **89,** 19; **90,** 15; **91,** 19, 33, 424; **92,** 24; **93,** 22; **94,** 21; **95,** 23; **96,** 24; **97,** 26; **98,** 36; **99,** 44; **00,** 45; **01,** 120; **02,** 62; **03,** 37; **04,** 19; **05,** 21; **06,** 18; **07,** 21; **08,** 26; **09,** 30; **10,** 37; **11,** 37; **12,** 36.

In charge:
Lt. Col. G. Thom, 1879–83. **R., 79,** 246, 279; (Col.), **80,** 325; **81,** 459; **82,** 486.
Col. C. E. Blunt, 1883–86. **R., 83,** 407; **84,** 460; **85,** 462.
Maj. J. A. Smith, 1886–92. **R., 86,** 527; **87,** 436; (Lt. Col.), **88,** 374; **89,** 504; **90,** 428; **91,** 571.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 495; **93,** 671; **94,** 491.
Lt. Col. D. P. Heap, 1895. **R., 95,** 539.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 540.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 770; **98,** 813.
Maj. S. W. Roessler, 1899–1904. **R., 99,** 1018; **00,** 1074; **01,** 988; **02,** 827; **03,** 712; **04,** 778;
Lt. Col. W. M. Black, 1904–06. **R., 05,** 780; **06,** 850.
Capt. C. W. Otwell, **07,** 21.
1st Lt. H. C. Jewett, 1906–07. **07,** 21.
Maj. Edw. Burr, **07,** 21.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 877; (Lt. Col.), **08,** 921; **09,** 965; **10,** 1084.
Lt. Col. W. E. Craighill, 1910–. **R., 11,** 1144; **12,** 1354.

Assistants:
A. C. Both. **R., 79,** 280.
Lt. T. H. Jackson, **01,** 120.
Lt. Chas. W. Kutz, 1901–02. **01,** 120; ¢**02,** 62.
1st Lt. C. W. Otwell, 1905–07. **05,** 21; **06.** 18; **07,** 21.

OPERATIONS.

1879-80. 3,720 c. y. dr., **80,** 326; **81,** 459.
1880-81. 13,327 c. y. dr., **81,** 459; **82,** 487.
1881-82. 41,330 c. y. dr., **82,** 64, 487.
1882-83. 45,831 c. y. dr., from chan., **83,** 408.
1884-85. 134 l. f. st. jy. built; r. removal commenced; 23,272 c. y. dr., **85,** 462.
1885-86. 5,792 c. y. dr., **86,** 528.
1886-87. 966 c. y. dr. from chan., **87,** 436.
1887-88. 24,172 c. y. dr., **88,** 374.
1889-90. 20,286 c. y. dr., **90,** 428.
1890-91. 29,172 c. y. dr., **91,** 571.
1895-96. About 100,000 c. y. dr., **96,** 541.
1896-97. About 20,000 c. y. dr., **97,** 770.
1897-98. About 56,000 c. y. dr., **98,** 814.
1899-00. 9,150 c. y. dr., **00,** 1074.
1900-01. 86,959 c. y. dr., **01,** 988.
1903-04. 108,734 c. y. dr., **04,** 778.
1904-05. 21,532 c. y. dr., completing proj. of 1894, **05,** 780.
1905-06. Motor launch constr. for district inspection purposes, **06,** 19.
1906-07. Proj. completed. **07,** 877.
No further a. r. to be made, **12,** 36.

PHYSICAL CHARACTERISTICS.

Description, **79,** 279–281.
Tidal observations, **79,** 279, 281.
Relation of chan. to surrounding points, **88,** 374.
Chan. lies between e. extremity of Me. and Campobello Isld., Canada. Orig., about l. t. (5′) vessels unable to use chan. and were obliged to route 10 m. longer through Canadian waters to reach various U. S. ports; chan. 3 ± m. l. Dense fogs and strong tides; widening chan. saves stranding-collision, **12,** 36.

[1] Survey.—**R.,** Sept. 20, 1837; est., $26,000. (H. D. 482, 55th, 2d.) [2] See St. Croix River, Me.

PLANS.

By Lt. Col. Smith, 1891, w. existing chan. to 650′ at m l. w.; est., $231,000, **91,** 618.

PROJECTS.

By Lt. Col. Thom, 1879, imp. bars between the Narrows and Western Bar Beacon, 2½ m., by w. the chan. to 200′ and d. to 12′; est., $48,000, **79,** 44, 246, 280, 282.

Revised, 1880, $130,000, **80,** 326. Amended, 1881 and 1882, to $154,000, **81,** 460; **82,** 487.

In 1883 Col. Blunt proposed chan. 15′ x 275′; est., $113,000, **83,** 409; **85,** 463.

In 1884 the aggregate of app. was $139,000, when the est. to complete was amended to $167,500, **86,** 529.

Amount est. for completion in 1888, $2,500, **88,** 375.

Proj. completed in 1891; cost, $168,929, **92,** 496.

By Lt. Col. Smith, 1891 (adopted 1895), dr. chan. 12′ x 500′ m. l. w.; est., 1895, $150,000, **96,** 540.

SURVEYS.

By A. C. Both, 1878–79, **78,** 46; **79,** 44, 52, 279.

Ex. of the chan., made, 1890; by Lt. Col. Smith, **91,** 617.

Maps:

Sketch showing location of proposed chan., **79,** 280.

84, 460.

Sketch showing imp., **04,** 778.

A-14 MACHIAS RIVER, ME.

APPROPRIATIONS.

1873,	$12,000,	**73,** 1054.
1874,	10,000,	**74,** 105.
1875,	10,000,	**75,** 112,
Total,	32,000	

COMMERCE.

Value of lumber and st. shipped annually, **95,** 586; **97,** 810.

CONTRACTS.

1873. E. M. Lee Prohon, removing Middle Rock, $6.75 c. y., **73,** 1054.

1874. Curtis, Fobes & Co., dr., 60¢ c. y., **75,** ii, 384.

1875. A. R. Wright, dr., 45¢ c. y., **75,** ii, 384.

ENGINEERS.

Chief of Engineers. **R.,** **73,** 94; **74,** 104; **75,** 112; **76,** 38; **77,** 32; **95,** 38; **97,** 43.

In charge:

Lt. Col. G. Thom, 1872–77. **R.,** **73,** 1053, 1102; **74,** ii, 295; **75,** ii, 383; **76,** 152, **77,** 154.

Lt. Col. D. P. Heap, 1895. **R.,** **95,** 584.

Maj. R. L. Hoxie, 1897. **R.,** **97,** 809.

Assistants:

S. Haagensen, **73,** 1102. **R.,** **73,** 1104.

W. F. Robinson. **R.,** **97,** 810.

OPERATIONS.

1873–74. Removal of Middle Rock to average depth of ½′ below m. l. w., **74,** 104, ii, 296.

1874–75. Removal of 6,100 c. y. by dr., **75,** ii, 384.

1875–76. Chan. 100′ x 850′ dr. through shoal above Middle Ground, and 125′ x 800′ through upper part of Middle Ground; removal of shoal near drawbridge, **76,** 38.

1876–77. Completion of proj.; total amount of rock removed, 1,350 c. y.; material dr., 33,000 c. y., **77,** 33.

PHYSICAL CHARACTERISTICS.

Description, **73,** 1053, 1103, 1104; **74,** ii, 296; **95,** 585.

List of obstr., **73,** 1053, 1103, 1104; **74,** ii, 296.

PROJECTS.

By Lt. Col. Thom, 1873, removal of obstr. to obtain a chan. 6′ x 150′ m. l. w. to the wharves at Machias, 3 m.; est., $48,000, **73,** 94, 1053, 1054, 1103, 1104; **74,** 104, ii, 296. Effect of imp. but temporary, unless the R. be protected, **74,** ii, 297; **75,** 112.

Orig. proj. modified, 1876, to chan. 100′ w., and removal of Middle Rock to ½′ below m. l. w.; est., $32,000, **76,** 153.

In 1895 Maj. Heap est. imp. would cost $50,244.25, **95,** 586.

SURVEYS.

Sur. S. Haagensen, 1872, **73,** 1053, 1104. Bench marks, **73,** 1105.

Sur. au. act Aug. 17, 1894, made, 1895, by Maj. Heap (**R.** fav.), **95,** 584.

Surv. au. act June 3, 1896, from Machias to Machiasport, made, 1897, by Lt. Col. Damrell (**R.** fav.), **97,** 809.

A-20 CHANDLERS RIVER, ME.

COMMERCE.

Description of, **97,** 799.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 42; **12,** 65.

In charge:

Maj. R. L. Hoxie, 1897. **R.,** **97,** 798.

Lt. Col. W. E. Craighill, **12,** 34.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 799.

SURVEY.

Ex. au. act June 3, 1896, made by Lt. Col. Damrell, 1897 (**R.** fav. to sur.), **97,** 798.

Pre. ex. au. act June 25, 1910; mouth to Jonesboro; **R.** by Lt. Col. Craighill, 1911 (unfav.),[1] **12,** 65.

A-22(a) MOOSABEC BAR, ME.

APPROPRIATIONS.

1881,	$10,000,	**81,** 462.
1882,	10,000,	**82,** 490.
1884,	10,000,	**84,** 463.
1886,	10,000,	**86,** 534.
1888,	15,000,	**88,** 376.
1890,	15,000,	**90,** 429.
1892,	15,000,	**92,** 497.
1894,	6,000,	**95,** 542.
1896,	12,000,	**96,** 543.
1899,	11,000,	**99,** 1019.
Total,	114,000	

COMMERCE.

Benefit to, **81,** 462.

CONTRACTS.

G. C. Fobes & Co., dr., 32½¢ c. y., **82,** 490.

Moore & Wright, dr., 42 ¢ c. y., **83,** 412.

1887. L. E. Lunt, r. removal, $16.20 c. y., **88,** 377.

1889. T. Symonds, dr., 30¢ c. y., **89,** 507.

1891. Hamilton & Webber, st. in break'r, 97¢ t., and for beacon, $2,670, **91,** 573.

1892. Johnston & Townsend, ledge removal, $13.35 c. y., p. m. ($13,363.35), **93,** 673.

[1] H. D. 265, 62d, 2d.

1894. Johnston & Townsend, ledge removal, $13.25 c. y., p. m. ($10,533.75), **94,** 494.
1895. Johnston & Townsend, ledge removal, $13.20 c. y., p. m. ($11,880), **95,** 542.
1897. Wm. D. Johnston, ledge removal, $13.75 c. y., p. m. ($13,750), **97,** 772.
1899. Harries & Letteney, ledge removal, $14.70 c. y., p. m. ($11,760), **99,** 1020.

ENGINEERS.

Chief of Engineers. **R., 80,** 72; **81,** 65; **82,** 64; **83,** 60; **84,** 68; **85,** 56; **86,** 55; **87,** 15; **88,** 11; **89,** 20; **90,** 15; **91,** 20; **92,** 24; **93,** 22; **94,** 21; **95,** 23; **96,** 25; **97,** 27; **98,** 37; **99,** 45; **00,** 46.

In charge.
Col. G. Thom, 1879–83. **R., 80,** 358; **81,** 461; **82,** 488.
Col. C. E. Blunt, 1883–86. **R., 83,** 410; **84,** 462; **85,** 465.
Maj. J. A. Smith, 1886–92. **R., 86,** 533; **87,** 438; (Lt. Col.) **88,** 376; **89,** 506; **90,** 428; **91,** 572; **92,** 497.
Lt. Col. P. C. Hains, 1892–94. **R., 93,** 673; **94,** 492.
Lt. Col. D. P. Heap, 1895. **R., 95,** 541.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 542.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 771; **98,** 815.
Maj. S. W. Roessler, 1899–. **R., 99,** 1019; **00,** 1075.

Assistant. A. C. Both. **R., 80,** 359.

OPERATIONS.

1881–82. 27,346 c. y., dr., **82,** 489.
1883–84. 20,983 c. y., dr., **84,** 462.
1885–86. 23,345 c. y., dr., completing the dr. chan. over the bar, **86,** 533.
1886–87. Preparation for removal of ss. ledge, **87,** 439.
1887–88. 50 c. y. r. removed, **88,** 376.
1889–90. 63,150 c. y., dr., **90,** 429.
1890–91. 1,652 t. st. placed in the break'r, **91,** 572.
1891–92. Break'r constr. in progress, **92,** 497.
1892–93. Excavation commenced, **93,** 673.
1893–94. About 1,100 c. y. r. excavated, **94,** 493.
1894–95. About 700 c. y. r. excavated, **95,** 542.
1895–96. About 213 c. y. r. excavated, **96,** 543.
1896–98. 1,240 c. y. removed, **97,** 772; **98,** 815.
1899–00. 748 c. y. ledge removed, completing proj., **00,** 1075.

PLANS. (See Projects.)

By Maj. Smith, 1886, w. chan., break'r, and beacon constr., and removal of r. ledges. Est., $45,000, **86,** 534. Chan., 16′ x 300′ m. l. w., by dr. and r. removal. Est., $110,000, **87,** 439.

PROJECTS. (See Plans.)

By Col. Thom, 1880, chan. through Moosabec Bar, 14′ x 200′ m. l. w., by dr. and r. removal; est., $28,000, **80,** 362. Increased, 1881, to $40,000, **82,** 489; **85,** 465.
Amended in 1888 to provide chan. 14′ x 300′, m. l. w., the removal of ledge r. near the w. end of the chan. to 16′, and small break'r and beacon to check cross currents; est., $110,000, making the total est., $150,000, **92,** 497.
Est. of cost of proj. of 1881 reduced to $114,000, **96,** 542.

SURVEYS.

Au. act Mar. 3, 1879; made, 1879, by Col. Thom, **80,** 359.
Maps:
80, 358; **85,** 466.
Moosabec Bar, **86,** 534.

A-26 PLEASANT RIVER, ME. (Columbia Falls to mouth).

APPROPRIATION.

1890, $3,500, **91,** 574.

ENGINEERS.

Chief of Engineers. **R., 89,** 32; **90,** 26; **91,** 20; **92,** 24.
In charge:
Lt. Col. J. A. Smith, 1888–92. **R., 90,** 467; **91,** 573.
Lt. Col. P. C. Hains, 1892. **R., 92,** 498.
Assistant. F. S. Burrowes, **R., 90,** 470.

OPERATIONS.

1891–92. Stone beacon built on "Channel Rocks" and an iron spindle established upon "Coffin Rocks;" 55 t. of r. removed from river above Addison Pt., **92,** 498.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 468.

PROJECTS.

By Lt. Col. Smith, 1890, removing r. ledges and erecting 3 beacons to mark position of dangerous r.; est., $3,500, **90,** 470; **91,** 574.

SURVEY.

Au. act Aug. 11, 1888, made, 1890, by Lt. Col. Smith, **90,** 469.

A-30 NARRAGUAGUS RIVER, ME.

APPROPRIATIONS.

1871,	$12,000,	**71,** 87.
1872,	10,000,	**72,** 86.
1886,	10,000,	**87,** 441.
1888,	10,000,	**88,** 379.
1890,	7,500,	**90,** 430.
1892,	7,500,	**92,** 499.
1894,	5,000,	**95,** 544.
1896,	5,000,	**96,** 545.
1899,	5,000,	**99,** 1021.
Total,	72,000	

COMMERCE.

Important, **71,** 87, 834; **72,** 926; **74,** 105.
In 1900, 35,825 t., **01,** 122; 1904, 42,000 t.±; 1906, 38,000 t. ±, **77,** 22.

CONTRACTS.

1887. Moore & Wright, dr., 16¢ c. y., **87,** 442.
1889. A. R. Wright, dr., 20¢ c. y., **89,** 509.
1890. Moore & Wright, dr., 8½¢ c. y., **91,** 576.
1895. Columbia Dredging Co., dr., 12.7¢ c. y. s. m., $12,700, **95,** 544.
1897. Moore & Wright, dr., 13¢ c. y., s. m., $5,200, **97,** 774.
1900. A. R. Wright, dr., 15¢ c. y. (30,000 c. y.), **1900,** 1078.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 83; **71,** 87; **72,** 86; **73,** 94; **74,** 105; **80,** 72; **81,** 77; **87,** 15; **88,** 12; **89,** 20; **90,** 16; **91,** 21; **92,** 25; **93,** 23; **94,** 22; **95,** 24; **96,** 26; **97,** 28; **98,** 38; **99,** 45; **00,** 47; **01,** 121; **02,** 63; **03,** 38; **04,** 20; **05,** 22; **06,** 19; **07,** 22.

In charge:
Lt. Col. G. Thom, 1870–81, **70,** 83. **R., 71,** 830; **72,** 925; **73,** 1055; **74,** ii, 297; (Col.), **81,** 535.
Maj. J. A. Smith, 1887–92. **R., 87,** 441; (Lt. Col.), **88,** 378; **89,** 508; **90,** 429; **91,** 574.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 498; **93,** 674; **94,** 494.
Lt. Col. D. P. Heap, 1895. **R., 95,** 543.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 544,

Maj. R. L. Hoxie, 1897–98. **R., 97,** 773; **98,** 816.
Maj. S. W. Roessler, 1899–1904. **R., 99,** 1021; **00,** 1077; **01,** 989; **02,** 829; **03,** 713; **04,** 779.
Lt. Col. W. M. Black, 1905–6. **R., 05,** 781; **06,** 851.
Maj. G. A. Zinn, 1907. **R., 07,** 878.

Assistants:
A. C. Both. **R., 81,** 536.
1st Lt. C. W. Otwell, **05,** 21; **06,** 18.

OPERATIONS.

1870–71. 550 t. r. excavated, **71,** 831; **72,** 86.
1871–72. 2,200 t. r. excavated, **72,** 86, 925, 926.
1872–73. 2,150 t. r. excavated, 2,000 c. y. dr., **73,** 94, 1056.
1873–74. 1,335 t. r. excavated, 5,000 c. y. dr., **74,** 105, ii, 297.
1886–87. Dr. commenced, **87,** 441.
1887–88. 55,450 c. y. dr., **88,** 378.
1889–90. 44,988 c. y. dr., **90,** 430.
1890–91. 61,740 c. y. dr., **91,** 575.
1895–96. About 88,000 c. y. dr., **96,** 544.
1896–97. About 34,000 c. y. dr., **97,** 773.
1899–00. 30,000 c. y., mostly sawdust and mud, dr., **00,** 1077. (Proj. completed.)

PHYSICAL CHARACTERISTICS.

General, **71,** 830, et seq.
Filling of chan. continuous, **1900,** 1077.
Bar at mouth obstructed navigation; shoaling from mixture of mud and sawdust, **01,** 121–22.
Depth does not maintain, **05,** 781.
Navigable section 7 m. l.; town of Millbridge 2 m. above its mouth, and lumber town of Cherryfield at head of navigation, **07,** 22.

PROJECTS.

By Lt. Col. Thom, dr. and r. excavation, est., $20,000, **71,** 833.
By Col. Thom, 1880. dr. chan. 11′ x 200′ l. w. from d. w. off Turners Pt. to d. w. off Ficketts Pt.; est., $50,000, **81,** 535.
The proj. for imp. adopted in 1886 consists in dr. chan. 11′ at l. w. to the ss. landing at Long Pt., and thence 9′ to the "Deep Hole," or anchorage; chan. w. to be 200′ throughout, except in the reach by the ss. wharf, where it is to be increased to 300′, **89,** 20. Amount required for completion in 1889, $30,000, **89,** 508; **92,** 499.
By Maj. Roessler, 1900, redr. chan. near ss. wharf. using available funds, **00,** 1077.
1907, ss. company had abandoned Long Wharf and erected wharf farther down, making unnecessary any further dr. above latter point, **07,** 22.

SURVEYS.

Sur. and ex. by Lt. Col. Thom, 1870. **R., 71,** 831.
Au. act June 14, 1880, made, 1880, by Col. Thom, **81,** 535.
By Maj. Roessler, 1899, **00,** 1077.
Maps. **91,** 575.

A-39(a) COREA HARBOR (Indian H.), GOULDSBORO, ME.

COMMERCE.

Tonnage, 1911, 700 t.[1]

ENGINEERS.

Chief of Engineers. **R., 12,** 65.
Boards. BERH. **R.,** unfav.[1]
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Ex. au. act June 25, 1910; **R.** by Lt. Col. Craighill, dated Aug. 14, 1911, (unfav.)[1], **12,** 65.

A-44 WINTER HARBOR (Hancock Co.), ME.

ENGINEERS.

Chief of Engineers. **R., 12,** 66.
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Pre. ex. au. act Feb. 27, 1911. **R.** by Lt. Col. Craighill, Aug. 14, 1911 [2] (unfav.), **12,** 66.

A-48 (a) SULLIVAN FALLS HARBOR, ME.

APPROPRIATIONS.

1871,	$10,000,	**71,** 88.
1872,	25,000,	**72,** 87.
1896,	5,000,	**96,** 547.
1899,	5,000,	**99,** 1023.
1902,	5,000,	**02,** 831.
1912,	5,000,	**12,** 1356.
Total,	55,000	

COMMERCE.

Important, **71,** 839 et seq.
In 1911, 74,150 t., **12,** 39.

CONTRACTS.

1871. G. W. Townsend, removal of Hatchers Rock and br. p., **71,** 835.
1872. G. W. Townsend, removal of br. p. and ledges, **73,** 1057.
1874. E. M. Le Prohon, r. excavation, **74,** ii, 299.
1897. W. D. Johnston, ledge removal, $16.48 c. y. in situ ($4,944), **97,** 776.
1899. H. H. Sturgis, ledge excavation, $25 c. y., p. m. ($8,750), **99,** 1023.
1902. H. H. Sturgis, removing ledge r., $22.50 c. y., **03,** 715.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 83; **71,** 88; **72,** 87; **73,** 95; **74,** 105; **75,** 112; **91,** 33; **96,** 27; **97,** 29; **98,** 39; **99,** 46; **00,** 48; **01,** 123; **02,** 65; **03,** 40; **04,** 22; **05,** 23; **06,** 21; **07,** 23; **08,** 28; **09,** 32; **10,** 39; **11,** 39; **12,** 38.

In charge:
Lt. Col. G. Thom, 1870–75; **70,** 83. **R., 71,** 834; **72,** 927; **73,** 1056; **74,** ii, 298; **75,** ii, 385.
Lt. Col. J. A. Smith, 1890. **R., 91,** 619.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 547.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 776; **98,** 818.
Maj. S. W. Roessler, 1899–04. **R., 99,** 1023; **00,** 1080; **01,** 992; **02,** 830; **03,** 714; **04,** 780.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 782; **06,** 852.
Maj. G. A. Zinn, 1907–10. **R., 07,** 880 (Lt. Col.); **08,** 924; **09,** 967; **10,** 1086.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1146; **12,** 1356.

OPERATIONS.

1870–71. 130 c. y. r. excavated at Hatchers Rock, **71,** 835.
1871–72. 140 c. y. r. excavated at Hatchers Rock, **72,** 926.
1872–73. 3 br. piers removed, **73,** 95, 1057.

[1] H. D. 425, 62d, 2d.
[2] H. D. 357, 62d, 2d.

1873-74. 147 c. y. r. excavated at Hatchers Rock and 85 c. y. at other ledges, **74,** ii, 298.
1874-75. 106 c. y. r. excavated at other ledges, **75,** ii, 386.
1897-98. 415 c. y. r. removed, **98,** 818.
1899-1900. 184 c. y. ledge removed; Hatchers Rock removed to 10′ m. l. w., and part of outer ledge "C" removed to same depth, **00,** 1080.
1902-03. About 222 c. y., p. m., ledge r. removed, **03,** 714.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 88, 834 et seq; **91,** 619.

PLAN.

By Lt. Col. Smith, 1890, removal of rock ledges near the Sullivan shore or Falls Point, to produce chan. 150′ x 10′ m. l. w.; est., $35,000, **91,** 33.

PROJECT.

By Lt. Col. Thom, removal of Hatchers Rock, ledges and br. piers; est., $44,000, **71,** 835, 838.
By Col. Smith, 1890, to give 10′ x 150′ m. l. w.; est. $35,000, **96,** 547.

SURVEYS.

By Lt. Col. Thom, 1870 and 1873, **74,** ii, 299 **R., 71,** 836.

A-52 BAR HARBOR, ME., BREAKWATER (from Mt. Desert to Porcupine Island).

APPROPRIATIONS.

1888,	$50,000.00,	**88,** 13.
1890,	50,000.00,	**90,** 431
1892,	50,000.00,	**92,** 501.
1894,	10,000.00,	**95,** 545.
1896,	10,000.00,	**96,** 546.
1894,	6,391.12,	act June 23 (claim of T. R. Smith).
1899,	20,000.00,	**99,** 1022.
1907,	30,000.00,	**07,** 880.
1910,	25,000.00,	**10,** 1085.
1911,	30,000.00,	**11,** 1145.
1912,	75,000.00,	**12,** 1355.
Total,	356,391.12	

COMMERCE.

Many large pleasure yachts; only convenient method of transportation is by water, **10,** 39; **12,** 37.
Details of, **11,** 38. Traffic, 1911; freight, 65, 950; passenger, 236, 436; **12,** 1356.

CONTRACTS.

1889. F. S. Andrews, furnishing and placing st. on break'r, $1.10 per t., **89,** 511.
1890. T. R. Smith, furnishing and placing st. on break'r, $1.23½ per t., **91,** 578. Contract annulled, **92,** 501.
1892. W. S. White, riprap break'r constr., $1.02 per t., **92,** 501. G. M. Neelon, riprap break'r constr., $1.23½ per t., **92,** 501.
1893. Wm. S. White, st., 97¢ t. ($48,500), **94,** 497.
1895. Hamilton & Cleaves, st., 74¢ t. ($7,400), **95,** 546.
1896. Hamilton & Cleaves, st., 84½¢ t. ($8,450), **97,** 775.
1900. W. S. White, st., 78¢ t., **00,** 1080.
1907. E. S. Belden & Sons, st., $1.13 t., **08,** 923.
1910. P. H. Doyen, st., 87¢ t., **11,** 1145.
1912. The Breakwater Co., 155,000 t. st., at 77½¢ t. in place, **12,** 1356.

ENGINEERS.

Chief of Engineers. R., 87, 22; **88,** 13; **89,** 21; **90,** 16; **91,** 21; **92,** 25; **93,** 23; **94,** 23; **95,** 25; **96,** 26; **97,** 28; **98,** 38; **99,** 46; **00,** 47; **01,** 122; **02,** 64; **03,** 39; **04,** 21; **05,** 23; **06,** 20; **07,** 23; **08,** 27; **09,** 31; **10,** 38; **11,** 38; **12,** 37.
In charge:
Maj. J. A. Smith, 1887–92. **R., 87,** 481; (Lt. Col.), **89,** 509; **90,** 430; **91,** 576.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 500; **93,** 676; **94,** 496.
Lt. Col. D. P. Heap, 1895. **R., 95,** 544.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 545.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 775; **98,** 817.
Maj. S. W. Roessler, 1899–1904. **R., 99,** 1022; **00,** 1079; **01,** 991; **02,** 830; **03,** 714; **04,** 780.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 782; **06,** 852.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 879; (Lt. Col.) **08,** 922; **09,** 966; **10,** 1085.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1145; **12,** 1355.

OPERATIONS.

1889-90. 11,393 t. st. delivered in break'r, **90,** 431.
1890-91. 6,127 t. st. delivered in break'r, **91,** 577.
1891-92. Constr. of break'r continued, **92,** 501.
1892-93. About 22,000 t. st. deposited, **93,** 677.
1893-94. About 64,000 t. st. deposited, **94,** 496.
1894-95. About 22,000 t. st. deposited, **95,** 545.
1895-96. About 15,000 t. st. deposited, **96,** 546.
1896-97. About 11,000 t. st. deposited, **97,** 775.
1899-00. 13,898 t. st. deposited, **00,** 1079.
1900-01. 9,393 t. st. placed on break'r, **01,** 991.
1907-08. 24,280 t. st. placed on break'r, **08,** 922.
1910-11. 21,568 t. st. placed in break'r, **11,** 1145.
1911-12. 3,591 t. st. placed in break'r, completing contract, **12,** 1355.

PHYSICAL CHARACTERISTICS.

Description, **87,** 481; **11,** 38.

PROJECTS.

By Lt. Col. Smith, constr. of riprap break'r, with concrete superstr., from Round Porcupine Island to Porcupine Dry Island, thence to within 400′ of the shore line, a total distance of 3,425′; est., $500,000, **87,** 484. Revised, 1889, to $800,000, **89,** 510. Increased, 1891, to $806,000, **91,** 577.
Proj. amended, 1893, to provide for constr. of the break'r for only 600′ from Mt. Desert Island, with slopes of 1 on 1, 20′ w. on top, reducing the est. to about $420,200, **93,** 677.
At 1912 about 62 % of proj. done; **12,** 37.

SURVEYS.

Ex. and sur. au. act Aug. 5, 1886, made, 1887, by Maj. Smith, **87,** 483.
Maps. **87,** 483; **91,** 576.

A-53 NORTH EAST HARBOR, ME.

ENGINEERS.

Chief of Engineers. R., 12, 65.
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** by Lt. Col. Craighill, Aug. 31, 1911,[1] (unf.), **12,** 65.

[1] H. D. 358, 62d, 2d.

A-57 BASS HARBOR BAR, ME.

ENGINEERS.

Chief of Engineers. R., 12, 66.
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Ex. and sur. au. act June 25, 1910 (**R.** to come) **12,** 66.

A-57(a) BASS HARBOR BAR AND DEER ISLAND THOROUGHFARE, ME.

ENGINEERS.

Chief of Engineers. R., 12, 66.
In charge. Lt. Col. W. E. Craighill, 1912. **12,** 34.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come) **12,** 66.

A-63 UNION RIVER, ME.

APPROPRIATIONS.

1870,	$15,000,	**70,** 82.
1871,	15,000,	**71,** 89.
1896,	15,000,	**96,** 548.
1899,	15,000,	**99,** 1025.
1900,	115,000,	**00,** 1083.
1909,	15,950,	**09,** 968.
Total,	190,950	

COMMERCE.

Benefit of the imp., **67,** 503.
Business by water decreasing; rail increasing, **07,** 25. 1911, 11,189 t., **12,** 41.

CONTRACTS.

1870. Morris & Cumings, dr., **70,** 506; **71,** 839. Contract extended, **71,** 839.
1897. Eastern Dredging Co., dr., 38¢ c. y., s. m. ($17,100), **98,** 820.
1899. A. R. Wright, dr., 18, 25, and 75¢ c. y., s. m.; removal of ledge, $6.40 c. y., p. m. ($119,890), **1900,** 1083.
1909. P. H. Doyen, dr., 17.5¢ and 24.5¢ c. y., **09,** 968.

ENGINEERS.

Chief of Engineers. R., 67, 50; **69,** 63; **70,** 82; **71,** 88; **72,** 87; **73,** 95; **89,** 31; **90,** 26; **96,** 27; **97,** 29, 42; **98,** 40, 52; **99,** 47; **00,** 49; **01,** 124; **02,** 66; **03,** 41; **04,** 23; **05,** 24; **06,** 22; **07,** 24; **08,** 29; **09,** 33; **10,** 40; **11,** 40; **12,** 39.
In charge.
Lt. Col. G. Thom, 1867–73. **R., 67,** 501; **70,** 506; **71,** 839; **72,** 927; **73,** 1057.
Lt. Col. J. A. Smith, 1890. **R., 90,** 458.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 548.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 777, 800; **98,** 819, 839.
Maj. S. W. Roessler, 1899–04. **R., 99,** 1024; **00,** 1081; **01,** 993; **02,** 831; **03,** 715; **04,** 781.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 783; **06,** 853.
Maj. G. A. Znn, 1907–10. **R., 07,** 881, (Lt. Col.); **08,** 924; **09,** 968; **10,** 1086.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1147; **12,** 1357.
Assistant. F. S. Burrowes. **R., 99,** 1028, 1030.

LEGISLATION.

Act of the legislature of Me. for protection of rivers from further injury by deposit of edgings and sawdust, **67,** 502.
Maj. Hoxie recom., 1897, further legislation to prevent the deposit of refuse in the rivers in his district, **98,** 840.

OPERATIONS.

1870–71. 40,000 c. y. dr., chan. 100′ w., 24 bowlders and 150 t. of ledge removed, **71,** 839.
1871–72. 30,000 c. y. dr., chan. 150′ w., 820 t. of ledge and bowlders removed, **72,** 928; **73,** 1058.
1872–73. Wrought-iron spindle erected, **73,** 96, 1058.
1897–99. About 36,000 c. y. dr., **98,** 819; **99,** 1024.
1899–1900. 10,938 c. y. dr., **00,** 1082.
1900–01. About 115,170 c. y. mud, sawdust, slabs, and rock dr., **01,** 993.
1901–02. 26,755 c. y., s. m., mud dr., 108,574 c. y., s. m., mill waste removed, 6,975 c. y., s. m., hardpan, 63 c. y., p. m., bowlders, 5,420 c. y., p. m., overlying bowlders and ledge rock removed, **02,** 831–32.
1902–03. 210,175 c. y. dr. near Ellsworth, 75,360 c. y. at mouth of R., and 7,563c. y. ledge rock and bowlders from narrows, **03,** 715.
1909–10. 18,575 c. y. removed from mouth of R. and 17,650 c. y. at Ellsworth, **10,** 1086.
1910–11. 4,910 c. y. dr. at Ellsworth and 9 bowlders removed from chan., **11,** 1147.
1911–12. 350 c. y. bowlders and 50 c. y. ledge rock removed, **12,** 1357.

PHYSICAL CHARACTERISTICS.

Presence of bowlders, **67,** 501.
De. of, **90,** 458.
Large quantities of sawdust, slabs and mill refuse are carried downstream an. by freshets and deposited in the chan., **01,** 994.

PLANS. (See Projects.)

By Lt. Col. Smith, 1890, excavation of chan. 6′ x 100′–150′, m. l. w., Lords Wharf to Ellsworth; also contraction of the R. at its mouth by rubble-st. j. and training wall with a combined l. of 6,700′, running from the we. shore across Hortons Rocks, thence parallel to and about 800′ from ea. shore; est., $225,000, **90,** 462, 463.

PROJECT. (See Plans.)

By Lt. Col. Thom, drg. and rock excavation, to give 4½′ m. l. w.; est., $40,000, **67,** 502; **69,** 63.
By Maj. Roessler, drg. and rock excavation, to obtain a 6′ chan., m. l. w., 100′–200′ wi. from R. mouth to wharves at Ellsworth; est., by continuous contract, $129,800, **99,** 1027. (See App.)
Lt. Col. Zinn est. that to restore the chan. to proj. d. and w. would require removal of 60,000 c. y. material; cost, $15,950, **08,** 925. Au. by act Mar. 3, 1909, **09,** 34.

SURVEYS.

By Lt. Col. Thom, 1867, an ex. from mouth to Ellsworth, head of navigation, **67,** 501.
Au. act Aug. 11, 1888, made, 1890, by Lt. Col. Smith, **90,** 461.
Sur. and ex. au. act June 3, 1896; ex. made, 1897, by Lt. Col. Damrell (no imp. to be recom. unless laws were made to prevent deposit of mill waste; app. made by Congress), **97,** 800.
Maj. Hoxie reported, 1898, that he agreed with Lt. Col. Damrell that a sur. was unnecessary, **98,** 841.
Sur. by Maj. Roessler, 1899 (see Projects), **99,** 1028.
To determine condition of dr. chan., **08,** 924.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 40.

A-66 BLUE HILL HARBOR, ME.

ENGINEERS.

Chief of Engineers. **R., 91,** 32; **12,** 66.
In charge. Lt. Col. J. A. Smith, 1891. **R., 91,** 611.
Lt. Col. W. E. Craighill, **12,** 34.

PHYSICAL CHARACTERISTICS.

Details of, **91,** 611.

SURVEYS.

Ex. au. act Sept. 19, 1890, made, 1890, by Lt. Col. Smith (**R.** unfav.), **91,** 611.
Pre. ex. of Blue Hill Inner Harbor au. act Feb. 27, 1911; **R.** by Col. Craighill unfav.,[1] **12,** 66.

A-78 CENTER HARBOR, BROOKLIN, ME.

ENGINEERS.

Chief of Engineers. **R., 06,** 41.
In charge. Lt. Col. W. M. Black, **06,** 18.

SURVEY.

Ex. au. act Mar. 3, 1905; **R.** by Lt. Col. Black 1905 (unfav.)[2] **06,** 41.

A-85 DEER ISLAND THOROUGHFARE, ME.

ENGINEERS.

Chief of Engineers. **R., 12,** 66.
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Pre. ex. au. act June 25, 1910, **12,** 66.

A-92 ISLE AU HAUTE THOROUGHFARE, ME.

COMMERCE.

Small, local in character, **04,** 803.

ENGINEERS.

Chief of Engineers. **R., 04,** 34, 802; **10,** 59.
Boards. BERH. **R., 04,** 804.
In charge. Maj. S. W. Roessler, 1904–. **R., 04,** 802.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 802.

SURVEYS.

Ex. between Isle au Haute and Kimballs Island, au. act June 13, 1902, for chan. 12′ x 30′, m. l. w.; made, 1902, by Maj. Roessler (unfav.),[3] **04,** 802.
Ex. between Isle au Haute and Kimballs Island, au. act Mar. 3, 1909, for d. and w. chan. and estab. H. of refuge; made, 1909, by Lt. Col. Zinn (unfav.),[4] **10,** 59.

A-97 BAGADUCE (Bayaduce) RIVER, ME.

APPROPRIATIONS.

1888,	$3,000,	**89,** 511.
1890,	4,000,	**90,** 432.
1892,	5,000,	**92,** 503.
1894,	5,000,	**95,** 547.
1896,	5,000,	**96,** 549.
1899,	3,000,	**99,** 1031.
1902,	3,000,	**02,** 833.
Total,	28,000	

COMMERCE.

Small, benefit of projected chan. doubtful, **10,** 43.
Traffic, 1911, 77,000 t., **12,** 1358.

CONTRACTS.

1893. E. P. Lovering, dr., 25¢ c. y. ($12,500); removal of bowlders weighing not less than 250 lbs., $3 per t., **93,** 682.
1895. Columbian Dredging Co., removal of bowlders, $4 per t. ($8,000), **95,** 547.
1897. Robert H. Rogers, removal of bowlders, $9.87 per t. ($987), **98,** 821.
1900. Townsend & Olsen, removing r. and bowlders, $1.59 per t. of 2,000 lbs., **00,** 1085.
1905. Eastern Dredging Co., dr., $2, and 30¢ c. y., **05,** 785.

ENGINEERS.

Chief of Engineers. **R., 88,** 13, 22; **89,** 21; **90,** 17; **91,** 22; **92,** 26; **93,** 24, 37; **94,** 24; **95,** 25; **96,** 28; **97,** 30; **98,** 40, 53; **99,** 48; **00,** 51; **01,** 125; **02,** 67; **03,** 42; **04,** 24; **05,** 25; **06,** 23; **07,** 25; **08,** 30; **09,** 34; **10,** 42; **11,** 42; **12,** 41.

In charge:

Lt. Col. J. A. Smith, 1888–92. **R., 88,** 398; **89,** 511; **90,** 432; **91,** 578.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 502; **93,** 681, 724; **94,** 498.
Lt. Col. D. P. Heap, 1895. **R., 95,** 546.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 548.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 778; **98,** 821, 842.
Maj. S. W. Roessler, 1899–1904. **R., 99,** 1031; **00,** 1084; **01,** 996; **02,** 833; **03,** 716; **04,** 782.
Lt. Col. W. M. Black, 1905–6. **R., 05,** 784; **06,** 853.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 882; (Lt. Col.) **08,** 926; **09,** 969; **10,** 1087.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1147; **12,** 1358.

Assistant. F. S. Burrowes. **R., 88,** 402.

OPERATIONS.

1893-94. About 30,000 c. y. dr., and 506½ t. of bowlders removed, **94,** 498.
1894-95. 1,150 t. of bowlders removed, **95,** 547.
1897-98. About 450 t. of bowlders removed, **98,** 821.
1899-00. 83 t. r. removed, **00,** 1084.
1900-01. 1,394 t. r. removed, **01,** 996.
1905-06. 1,034 c. y., p. m., rocks and bowlders removed; 2,166 c. y., p. m., dredged, **06,** 853.

PHYSICAL CHARACTERISTICS.

Character and dimensions of the natural chan. from the mouth to Penobscot, **88,** 399.
Chan. 40′ w. and 2′ deep, **03,** 42; 4′–6′ deep 1906; chan. about 4,000′ l.; **06,** 23.
De. of, **93,** 724; **05,** 26; **10,** 42; **11,** 42.

[1] H. D. 420, 62d, 2d. [2] H. D. 241, 59th, 1st. [3] H. D. 224, 58th, 2d. [4] H. D. 486, 61st, 2d.

PROJECTS.

By Lt. Col. Smith, 1888, to straighten and deepen the chan. by dr. and rock removal, giving a w. of 150′ from Bridges Pt. to Winslows Isld., and thence a w. of 100′ to the village of South Penobscot, with dep. of 6′ l. w. throughout; est. $45,000, **88,** 399, 402; **92,** 502.

Rock removal small quantity; est. $1,875, **01,** 126; **05,** 26.

Removal of bowlders at Winslow Islds. and dr., **02,** 68, 833.

About 25% of original proj. done up to 1905; **05,** 784. One-third of proj. done by 1906; **06,** 854.

Further imp. should depend on re-ex., **10,** 42.

SURVEYS.

Au. act Aug. 5, 1886, made, 1888, by Lt. Col. Smith, **88,** 401.

Ex. of the south fork of the R., au. act July 13, 1892, made, 1892, by Lt. Col. Hains (**R.** unfav.), **93,** 724.

Sur. up to Penobscot village, au. act June 3, 1896, made, 1897, by Maj. Hoxie (**R.** unfav.), **98,** 842.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 41.

A-101 PENOBSCOT RIVER, ME.[1]

APPROPRIATIONS.

1829,	$300 (sur.), act Mar. 2.
1870,	15,000, **70,** 82.
1871,	50,000, **71,** 89.
1872,	40,000, **72,** 88.
1873,	20,000, **73,** 96.
1874,	20,000, **74,** 106.
1875,	25,000, **75,** 114.
1876,	10,000, **76,** 40.
1878,	12,000, **78,** 37.
1879,	6,000, **79,** 45.
1884,	20,000, **85,** 465.
1886,	15,000, **87,** 442.
1888,	50,000, **88,** 380; **89,** 514.
1890,	25,000, **90,** 434.
1892,	40,000, **92,** 506.
1899,	28,000, **99,** 1033.
1907,	130,000, **07,** 883.
Total,	506,300, **12,** 1359.

COMMERCE.

Obstructions to, **68,** 72, 859, 861; **69,** 63; **74,** ii 333, 335, et. seq.; **75,** ii, 389; **78,** 193.

Benefit to, **68,** 870; **74,** ii, 332, 335.

Commercial advantages of Bangor, **70,** 503.

Commercial importance of Penobscot R., between Oldtown and Medway, **74,** ii, 333, 334.

Commercial necessity for increased harbor facilities, **84,** 477.

Statistics of ports of Bangor, Winterport, and Bucksport, **87,** 444, 445.

Railway connections with navigable portions of the river, **88,** 380.

Shipping of Bangor, **88,** 426.

De. of, Bucksport H., Me., **00,** 1108.

Diagram of freight and apprns., etc., **11,** 1149.

Tonnage, 1911, 655,204 t.; value, $11,000,000; imp. has made no notable reduction in rates, **12,** 43.

CONTRACTS.

1871. A. Boschke, dr. 33,000 c. y., **71,** 841.

1872. G. W. Townsend, rock excavation, **73,** 1060.

1873. Geo. A. Bailey, rock excavation; Curtis, Fobes & Co., dr. 25,150 c. y., 75¢ c. y., **73,** 1061; **74,** ii, 300.

1874. Curtis, Fobes & Co., dr. 20,690 c. y., 60 and 73¢ c. y., **75,** ii, 388.

1875. A. R. Wright, dr. 39,224 c. y., 50¢ c. y., **75,** ii, 388; Curtis, Fobes & Co., dr. 61,910 c. y., 12½¢ c. y., **76,** 156.

1877. Gardner Floyd, rock excavation, **77,** 158; A. R. Wright, dr. 11,024 c. y., 30¢ c. y., **77,** 34, 158.

1878. Atlantic Dredging Co., dr. 2,633 c. y., $1 c. y.; I. Hamilton, rock excavation, **79,** 248.

1885. Moore & Wright, dr., 36¢ c. y., **86,** 531.

1887. Moore & Wright, dr., 23¢ and rock removal, $10 c. y., **87,** 443.

1889. T. Symonds, dr., 30¢ c. y., **89,** 514.

1890. J. B. Johnston, dr., 17¢ c. y., **90,** 434.

1891. A. K. Stone, dr., 26½¢ c. y., **92,** 506.

1893. M. V. B. Mower, dr., 32¢ c. y., s. m. ($14,720), **93,** 686.

1894. Lynn Dredging Co., dr., 36¢ and 15½¢ c. y. ($17,025), **94,** 502.

1900. Harries & Letteney, dr., Kenduskeag R., $28.70 per c. y.; bowlder removal, $12, and ledge removal, $15 per c. y.; ledge removal, Bangor H., $7.65 per c. y. ($25,248.75), **00,** 1088.

1908. Eastern Dredging Co., dr. 9,000 c. y., p. m., of ledge r., and 15,000 c. y., p. m., other material, $124,900, **09,** 970.

DOCUMENT. (Not published in reports.)

H. Doc. 91, 39th Cong., 2d sess., on sur. and imp. of the Penobscot R., **67,** 17.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 28; **67,** 17, 50; **68,** 72; **69,** 63; **70,** 81; **71,** 89; **72,** 87; **73,** 96, 106; **74,** 106, 116; **75,** 113; **76,** 39; **77,** 33; **78,** 37; **79,** 44; **84,** 73; **85,** 55; **86,** 55; **87,** 16; **88,** 13, 22; **89,** 22; **90,** 17; **91,** 23, 33; **92,** 27, 39; **93,** 25; **94,** 24; **95,** 26; **96,** 28; **97,** 30, 43, 44; **98,** 41; **99,** 49; 62; **00,** 52, 63; **01,** 126; **02,** 68; **03,** 43; **04,** 25, **05,** 26; **06,** 24, 41; **07,** 26; **08,** 31; **09,** 35; **10,** 43; **11,** 42; **12,** 42.

Boards. Convened Jan., 1889, New York City, to ex. and report upon Lt. Col. Smith's proj. for the imp. of the Penobscot R. between Bucksport and Winterport, Me.; letter, **89,** 517. **R., 89,** 520. (Cols. Abbot and Comstock, and Lt. Cols. Houston and Gillespie.) **R., 89,** 517, 520.

In charge:

Maj. B. S. Alexander, 1866; **66,** ii, 41.

Lt. Col. G. Thom, 1867–79. **R., 68,** 858; **70,** 502 506; **71,** 840; **72,** 928; **73,** 1058; **74,** ii, 299, 331; **75,** ii, 387; **76,** 154; **77,** 156; **78,** 190; **79,** 247.

Col. C. E. Blunt, 1884–86. **R., 84,** 475, 476; **85,** 464.

Maj. J. A. Smith, 1886–92. **R., 86,** 530; **87,** 442; (Lt. Col.) **88,** 379, 425, 427; **89,** 512, 513, 516, 518, 519; **90,** 434; **91,** 579; **92,** 534.

Lt. Col. P. C. Hains, 1892–94. **R., 92,** 504; **93,** 682; **94,** 499.

Lt. Col. D. P. Heap, 1895. **R., 95,** 548.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 550.

Maj. R. L. Hoxie, 1897–98. **R., 97,** 779, 801, 811; **98,** 822.

Maj. S. W. Roessler, 1899–1904. **R., 99,** 1032; **00,** 1086, 1101, 1107, 1108; **01,** 997; **02,** 834; **03,** 717; **04,** 783.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 786; **06,** 855.

Maj. G. A. Zinn, 1907–10. **R., 07,** 883; (Lt. Col.) **08,** 927; **09,** 970; **10,** 1088.

Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1148; **12,** 1358.

Assistants:

J. A. Sullivan. **R., 68,** 858.

Capt. W. S. Stanton. **R., 74,** ii, 332.

A. C. Both, **76,** 155. **R., 88,** 428; **89,** 515; **92,** 539.

F. S. Burrowes. **R., 00,** 1103.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Thom, dr. and rock excavation to give chan. 18′ in d., $665,000, **68,** 860; **69,** 63; **70,** 82, 502.

By Capt. Stanton, blasting bowlders, $20,000, **74,** ii, 335. For general imp., $240,000, **74,** ii, 332, 342.

[1] Whitehead to Bangor: Sur.—**R.** Mar. 1, 1830; est. $410. (H. D. 482, 55th, 2d.)

OPERATIONS.

1870-71. About 20,000 c. y. dr. at Bangor; 400 t. rock excavated at Steamboat Wharf Ledge, and 80 t. at Independence Rock, **71,** 89, 842.

1871-72. 600 t. rock excavated at Steamboat Wharf Ledge; 800 t. at Independence Rock; 115 t. at Green's Pier Ledge, and 80 t. at Gulliver's Rock, **72,** 88, 929.

1873-74. 150 c. y. rock excavated at Steamboat Wharf Ledge, **74,** ii, 300.

1874-75. 25,150 c. y. dr. at Bangor; 106 c. y. rock excavated at Independence Rock, and 194 c. y. at ledge off Dole's Wharf, **75,** ii, 388.

1875-76. 8,222 c. y. dr. at Bangor and 61,910 c. y. at Bucksport; 342 c. y. rock excavated at Green's Pier Ledge, **76,** 39, 155, 156.

1876-77. 33,468 c. y. dr. at Bangor and 120 c. y. rock excavated at Green's Pier Ledge, **77,** 157.

1877-78. 18,224 c. y. dr. at Bangor and 11,024 c. y. at Bucksport; 70 c. y. rock excavated at other ledges, **78,** 191, 192, 193.

1878-79. 2,633 c. y. dr. at Bangor and 16,400 c. y. at Bucksport; 145.4 c. y. rock excavated at other ledges, **79,** 249.

1885-86. 40,000 c. y. dr. from chan. in Bangor H., **86,** 531.

1887-88. 14,102 c. y. dr. and 9½ c. y. st. removed from chan. at Bangor H., **88,** 380.

1888-89. 37,822 c. y. dr. and 22½ c. y. bowlders removed from Bangor H. chan., **89,** 512.

1889-90. Bangor H. chan. completed as projected; 137,343 c. y. dr. from Penobscot R. between Bangor and Bucksport narrows, **90,** 433.

1890-91. 65,460 c. y. dr. above Crosbys Narrows and at Frankfort Flats, **91,** 580.

1891-92. 12,000 c. y. dr. from river near Sterns Mills, **92,** 506.

1892-93. About 52,000 c. y. dr., **93,** 685.

1893-94. About 40,000 c. y. dr., **94,** 502.

1894-95. About 87,000 c. y. dr., **95,** 550.

1895-96. A rock obstr. navigation in Bangor H. removed at a cost of $150, **96,** 552.

1899-00. 1,986 c. y. dr. from Kenduskeag R.; a part of ledge in Bangor H. drilled and blasted, **00,** 1087.

1900-01. 27,428 c. y. mud dr., and 15 c. y. ledge rock removed, **01,** 998.

1901-02. Ledge rock in front of steamboat wharf removed, **02,** 834.

1908-09. About 6,000 c. y. material, s. m., removed, **09,** 970.

1909-10. About 4,000 c. y. material removed, **10,** 1088.

1910-11. Dr. for w. of chan. at Bangor continued; about 50% completed, **11,** 1148.

1911-12. W. chan. at Bangor about 82% completed, **12,** 1358.

PHYSICAL CHARACTERISTICS.

General, **74,** ii, 333.

Presence of sunken rocks, **68,** 72, 864, et seq.

Bars and formation, **68,** 866.

Soundings, and character of R. bed, **68,** 865; **74,** ii, 333.

Tides, **73,** 1059; **78,** 191.

Current observations and borings, **88,** 429, 430; **89,** 515, 516.

Shoal formation at High Head, **97,** 779.

De. of, Kenduskeag R., **97,** 812, 813; **00,** 1109.

De. of, Penobscot R., Me., at and near Bucksport Narrows, **00,** 1103.

De. of, Bucksport H., Me., **00.** 1105, 1106.

Ice gorge, 1902, caused water in Bangor H. to reach highest known level since 1856, flooding R. R. station and tracks of Maine Central R. R., wharves, business streets, and basements adjacent to basin of the Kenduskeag stream; height of flood, about 25′ above m. l. w., or 12′ above m. h. w., **02,** 69.

Large bowlders impair navigation of the Kenduskeag stream, **03,** 717.

R. drains large number of lakes and small streams; flows 100 m. s. through middle of Me. to Penobscot B., **12,** 42.

PLANS. (See Estimates and Projects.)

By Lt. Col. Thom, dr. and rock excavation to give a chan. 150′ w. and 18′ d., **68,** 860.

By Capt. Stanton, cutting a chan. through the obstr. in the R., **74,** ii, 341. For blasting of bowlders from the chan., **74,** ii, 335.

PRIVATE AND CORPORATE WORK.

Partial removal of rock by SS. company, **68,** 865.

PROJECTS. (See Estimates and Plans.)

By. Lt. Col. Thom, dr. and rock excavation to give chan.[1] 12′ x 150′; est., $125,000, subsequently increased to $155,000, **68,** 860; **70,** 82, 502; **71,** 841. For dr. through gravel bar to give 12′[1] x 200′; est., $70,000, **74,** ii, 301; modified to give a d.[1] of 11′[1] **76,** 155. For dr. through Middle Ground Shoal, near Bucksport, to give d.[1] of 12′; est., $10,000, **75,** ii, 389. Dr. and rock excavation in front of "High-head" wharves; est., $12,000, **78,** 194.

Proj. of 1884 proposed, by dr. to w. the chan. opposite Bangor to 300′, with a l.-w. d. of 11′; also to w., straighten, and d. the chan. near Crosbys Narrows; est., $75,000, **84,** 477; **86,** 531.

By Lt. Col. Smith, 1888, imp. between Bangor and Bucksport Narrows, contracting the cross-section of the R. at various points with st. jetties, to secure a chan. 22′ x 800′ m. l. w. through the shoals, the action of the jetties to be assisted by dr.; est., $365,000, **88,** 430, 431; **89,** 516. Total est. of proj. for the imp. of Bangor H. and Penobscot R., $440,000, **90,** 433; **92,** 504.

In 1891 Lt. Col. Smith proposed constr. of rubblest. j. to assist in maintaining the chan. at Frankford Flats; est., $46,200, **91,** 584.

By. Lt. Col. Smith, 1891, w. the chan. at Bangor and dr. at ferry landings; constr. of 2 st. j. at Crosbys Narrows, and 3 j. between Bucksport and Winterport; est., $202,000, **92,** 538.

By Lt. Col. Damrell, d. part of Bangor H. to [1] 11′; est., $17,940.45, **97,** 811.

By Lt. Col. Damrell, 1897, 90′ w. chan., 2′ d. at extreme l. t., in Kenduskeag, from its mouth up to Kendusgeag bridge; est., $10,680.45, **97,** 811.

Width of 90′ w. chan. lessened, 1899, by Maj. Roessler, to within 30′ only of the wharves, the d. reduced accordingly, **00,** 1110.

By Maj. Roessler, 1899, dr. sawdust bar, Bucksport H., Me., to 16′ d.; est., $20,000, **00,** 1107.

Adopted by act Mar. 2, 1907, for additional w. at Bangor, varying from 100′ to 300′ for l. of nearly 2,000′, and d. of 14′ m. l. w.; est., $130,000,[1] **07,** 27; **12,** 43.

SURVEYS.

By J. A. Sullivan, 1867. **R., 68,** 863.

Under direction of Lt. Col. Thom, by A. C. Both, 1872, **73,** 1060; **76,** 156.

By Capt. Stanton, 1873, from Oldtown to Medway. **R., 74,** ii, 332.

By A. C. Both, 1875, near Bucksport Narrows, **75,** ii, 388; **76,** 156.

Au. act Aug. 2, 1882, made by Col. Thom, 1883, **84,** 476.

Ex. Bangor to Bucksport Narrows; au. act Aug. 5, 1886, **87,** 22; made, 1888, by Lt. Col. Smith, **88,** 427.

Sur. Penobscot R., made, 1891, by Lt. Col. Smith, **92,** 535.

Sur. made, 1894, at Frankfort Flats, by Lt. Col. Hains, showed that no further work of imp. was needed there, and sur. made at High Head showed the chan. there to have d. of 22′, but not proper w., **94,** 501.

Sur. of Bangor H., au. act June 3, 1896, made by Lt. Col. Damrell, 1897 (**R.** fav.), **97,** 811.

Ex. of the s. chan. of a branch of the Penobscot R., au. act June 3, 1896, for removal of an old wreck. made, 1897, by Lt. Col. Damrell (**R.** fav.), **97,** 801.

Ex. of Penobscot R. at and near Bucksport Narrows, au. act Mar. 3, 1899, made, 1899, by Maj. Roessler, **00,** 1102. (Good d.; item in the R.

[1] Extreme l. water.

and H. act calling for this ex. thought to be a mistake.)

Ex. and sur. of Bucksport H., Me., au. act Mar. 3, 1899, made, 1899, by Maj. Roessler (**R.** fav.), **1900,** 1105, 1107.

Ex. of mouth of Kenduskeag R., with view to securing 2′ chan. at extreme l. t. for entire w. of R., au. act Mar. 3, 1899, made, 1899, by Maj. Roessler (**R.** unfav.), **1900,** 1109.

Pre. ex. and sur. au. act Mar. 3, 1905. **R.** by Lt. Col. Black, 1905 and 1906; est., $130,000, with $500 an. mainten.,[1] **06,** 41.

Of Bangor H., to determine amount and character of material to be removed, **08,** 927.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 43.

Maps.[1] **78,** 193; **80,** 328; **84,** 475; **89,** 516; **92,** 533; **97,** 811.

A-103 BUCKSPORT HARBOR, ME.[2]

APPROPRIATIONS.

1902, $20,000, **02,** 836.

COMMERCE.

Traffic, 15,572 t., **07,** 28.

CONTRACTS.

1902. Morris & Cumings Dredging Co., dr. 12.48¢ c. y., removing bowlders, $4 per t., **03,** 719.

ENGINEERS.

Chief of Engineers. **R., 02,** 70; **03,** 45; **04,** 27; **05,** 28; **06,** 26; **07,** 27.

In charge:

Maj. S. W. Roessler, 1902–04. **R., 02,** 836; **03,** 719; **04,** 784.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 787; **06,** 856.

Maj. Geo. A. Zinn, 1907–. **R., 07,** 884.

OPERATIONS.

1902-03. 124,970 c. y., s. m., dr., **03,** 719.

1903-04. Dr. completed; proj. completed, **04,** 784.

PHYSICAL CHARACTERISTICS.

Imp. not entirely permanent on account of mud and sawdust bars, **07,** 28.

PROJECTS.

Act of 1902, au. removing "Middle Ground" to 16′; est., $20,000.[3] (This harbor imp. 1875 to 1878 under app. for Penobscot R.—q. v.), **02,** 70.

A-106 MARSH RIVER, ME.

ENGINEERS.

Chief of Engineers. **R., 07,** 43.

In charge. Col. W. M. Black, **07,** 21.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, at or near Frankfort, Me. **R.** by Lt. Col. Black, Dec. 8, 1905, and Aug. 21, 1906,[4] (unfav.), **07,** 43.

A-108 STOCKTON HARBOR, ME.

APPROPRIATION.

1910, $38,000, **10,** 1089.

COMMERCE.

In 1909, 314,626 t., mostly coal, lumber and paper, **10,** 44.

In 1911, 392,604 t., **12,** 44.

CONTRACTS.

1910. J. S. Packard Dredging Co., dr. 285,000 c. y., s. m., 8.34¢ c. y., and $9 t. for removing bowlders, **11,** 1150.

ENGINEERS.

Chief of Engineers. **R., 09,** 48; **10,** 44; **11,** 44; **12,** 44.

In charge:

Lt. Col. G. A. Zinn, 1909–10. **R., 10,** 1088.

Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1150; **12,** 1359.

OPERATIONS.

1910-11. 270,330 c. y. dr., completing proj., **11,** 1150.

PRIVATE WORK.

80,000 c. y. dr. by R. R. company, **11,** 1150.

PROJECTS.

Act June 25, 1910, au. chan. on the e. side 25′ x 300′, beginning at the 25′ contour and extending about 3,600′ into harbor to a point off the new R. R. wharf; est., $38,000,[4] **10,** 44.

SURVEYS.

Pre. ex. and sur. au. act Mar. 2, 1907, from s. extremity of Macks Pt. to e. extremity of Cape Jellison (Stockton H.), Me., with view to establishing a harbor 25′ d., **08,** 44. **R.** by Lt. Col. Zinn, Oct. 25, 1907, and Nov. 5, 1908; est., $38,000,[5] **09,** 48.

Map.[5]

A-116 CARVERS HARBOR (Vinalhaven), ME.

APPROPRIATIONS.

1896,	$10,000,	**96,** 559.
1899,	15,000,	**99,** 1037.
1902,	20,000,	**02,** 839.
Total,	45,000,	**97,** 886.

COMMERCE.

Mostly stone; harbor of refuge, result of U. S. imp., **07,** 31. 1907, 73,000, **07,** 887.

CONTRACTS.

1897. Moore & Wright, dr., 15¢ c. y., s. m. ($11,250), **98,** 826.

1899. A. R. Wright, dr., 14.5¢ c. y., s. m.; bowlder removal, $5 per s. t. ($17,400), **00,** 1093.

1903. Hamilton & Sawyer, dr., 14¾¢ c. y., s. m.; rock excavation, $563; removing bowlders, $5 per t., **03,** 722.

ENGINEERS.

Chief of Engineers. **R., 93,** 37; **95,** 39; **96,** 32; **97,** 34; **98,** 44; **99,** 52; **1900,** 56; **01,** 129; **02,** 72; **03,** 48; **04,** 29; **05,** 31; **06,** 29; **07,** 30; **12,** 66.

In charge:

Lt. Col. P. C. Hains, 1892–93. **R., 93,** 725.

Lt. Col. D. P. Heap, 1895. **R., 95,** 587.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 558.

Maj. R. L. Hoxie, 1897–98. **R., 97,** 785; **98,** 826.

[1] H. D. 739, 59th, 1st.
[2] See Penobscot R. for sur. made under act Mar. 3, 1899.
[3] H. D. 275, 56th, 1st.
[4] H. D. 274, 59th, 2d.
[5] H. D. 1166, 60th, 2d.

Maj. S. W. Roessler, 1899–. **R., 99,** 1037; **1900,** 1092; **01,** 1003; **02,** 839; **03,** 722; **04,** 787.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 789; **06,** 857.
Maj. Geo. A. Zinn, 1907. **R., 07,** 886.
Lt. Col. W. E. Craighill, 1912–. **12,** 34.
Assistant. A. C. Both. **R., 95,** 589.

OPERATIONS.

1897-98. 60,000 c. y. dr., **98,** 826.
1899-00. 97,014 c. y. dr., **00,** 1092.
1903-04. 108,425 c. y. dr.; 24½ c. y. ledge r. removed; proj. completed, **04,** 787.

PHYSICAL CHARACTERISTICS.

De. of, **93,** 726; **96,** 558.

PROJECTS.

By Lt. Col. Heap, 1895, dr. inner H. to 16′; est., $64,000, **96,** 559.

SURVEYS.

Ex. au. act July 13, 1892, made by Lt. Col. Hains, 1892 (**R.** partly fav.), **93,** 725.
Sur. au. act Aug. 17, 1894, made by Maj. Heap, 1895 (see Projects), **95,** 587.
Ex. and sur. au. act Feb. 27. 1911. **R.** by Lt. Col. Craighill, 1911 and 1912; est., $16,000, for first constr.,[1] **12,** 66.
Maps.[1] **04,** 788.

A-117 MATINICUS HARBOR, ME.[2]

APPROPRIATIONS.

1852, [3] $1,000
1910, 13,000, **10,** 1092.

Total, 14,000

COMMERCE.

Imp. of Ten-Pound H. not warranted, **76,** 194.
Benefit to C. by the imp. of Matinicus H., **76,** 195.
Availability of place as a H. of refuge, **76,** 197, 198.
In 1911, 3,000 t.± fish, coal, and oil, **12,** 48.

CONTRACTS.

1911. P. H. Doyen Co., 9,000±t. s., $1.30 t., **11,** 1153.

ENGINEERS.

Chief of Engineers. **R., 76,** 48; **87,** 21; **08,** 44; **10,** 47; **11,** 48; **12,** 48.
In charge. Lt. Col. G. Thom, 1875. **R., 76,** 194.
Maj. J. A. Smith, 1887. **R., 87,** 475.
Lt. Col. G. A. Zinn, 1908–10. **R., 10,** 1092.
Lt. Col. W. E. Craighill, 1910–. **R., 11,** 1153; **12,** 1362.
Assistant. S. Haagensen. **R., 76,** i, 196.

OPERATIONS.

1911-12. 9,078 t. rough st. placed, completing break'r., **12,** 1362.

PHYSICAL CHARACTERISTICS.

General, **76,** 195, 196, 198.
Tides, **76,** 195, 197; **87,** 476.
General, tides, etc., **10,** 47; **11,** 48.
Has area of 20 ± acres, on e. side of Matinicus, which is largest of group of islands in Atlantic off mouth of Penobscot B., and 20 ± m. from Rockland H., Me., **12,** 48.

PLANS.

By S. Haagensen, 3 break'rs; (1) to inclose area between Matinicus Island, Indian and Dexter ledges, making a H. for small vessels only; est., $36,000; (2) to make a H. for vessels of all classes; est., $300,000; (3) from Curtis Pt. to Ten-Pound Island, and from Cato Ledge to Ragged Island, to make a H. of refuge; est., $1,114,000, **76,** 196, 197, 198

PROJECTS.

Act June 25, 1910, au. constr. of st. break'r from Youngs Pt. to Indian Ledge, 450′; affording protection for inner H.; est., $13,000,[4] **10,** 46.

SURVEY.[2]

By S. Haagensen, 1875. **R., 76,** i, 195.
Ex. au. act Aug. 5, 1886; made, 1887, by Maj. Smith (**R.** unfav.), **87,** 475.
Ex. au. act Mar. 2, 1907, for H. of refuge. **R.,** Lt. Col. Zinn, Oct. 10, and Nov. 27, 1907 (see Project); est., $13,000,[4] **08,** 44.
Map[4].

A-128 NORTH HAVEN HARBOR, ME.

ENGINEERS.

Chief of Engineers. **R., 06,** 41.
In charge. Lt. Col. W. M. Black, **06,** 18.
Assistant. 1st Lt. C. W. Otwell, **06,** 18.

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.,** by Lt. Col. W. M. Black, Oct. 5, 1905 [5] (unfav.), **06,** 41.

A-135 LONG COVE, ME.

ENGINEERS.

Chief of Engineers. **R., 06,** 41; **07,** 43.
In charge. Lt. Col. W. M. Black, **06,** 18; **07,** 21.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, for removal of 2 ledges. **R.,** by Lt. Col. Black, Sept. 25, 1905, and June 22, 1906 (unfav.),[6] **06,** 41; **07,** 43.

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[1] H. D. 624, 62d, 2d.
[2] Sur.—**R.** Dec. 17, 1852; est., $38,275. (H. D. 482, 55th, 2d.)
[3] For sur. in connection with building a break'r on the e. side of the island. (Treas. Doc. 373, 1882.)
[4] H. D. 653, 60th, 1st.
[5] H. D. 547, 59th, 1st.
[6] H. D. 213, 59th, 2d.

A-137(a) BELFAST BAY AND HARBOR, ME.

APPROPRIATIONS.

1826,	$1,200, act May 20.
1876,	5,000, **77,** 34.
1878,	12,000, **78,** 38.
1879,	5,000, **79,** 45.
1880,	3,000, **80,** 330.
1890,	10,000, **90,** 435.
1892,	10,000, **92,** 508.
1894,	8,000, **95,** 552.
1896,	8,000, **96,** 554.
Total,	62,200

COMMERCE.

Benefit of imp., **76,** 194; **77,** 161.
Commercial advantages of Belfast, **76,** 194.
Coal and freight traffic, **88,** 381.

CONTRACTS.

1877. J. M. Andrews, r. excavation, **77,** 161.
1878. Atlantic Dredging Co., dr., 38¢ c. y., **79,** 251.
1892. Hamilton & Sawyer, dr., 23¢ c. y. ($13,800), **93,** 688.
1895. Hamilton & Sawyer, dr., 14¾¢ c. y. s. m. ($7,375), **95,** 552.
1896. Hamilton & Sawyer, dr., 13⅞¢ c. y. s. m. ($7,215) **97,** 781.

ENGINEERS.

Chief of Engineers. **R., 76,** 48; **77,** 34; **78,** 37; **79,** 45; **80,** 64; **81,** 65; **82,** 65; **83,** 60; **84,** 69; **85,** 57; **86,** 56; **87,** 16; **88,** 14; **89,** 23, 31; **90,** 18, 26; **91,** 23; **92,** 28; **93,** 26; **94,** 26; **95,** 27; **96,** 30; **97,** 32.

In charge:
Lt. Col. G. Thom, 1876–85. **R., 76,** 190; **77,** 159; **78,** 194; **79,** 250; (Col.), **80,** 330; **81,** 463; **82,** 491; **83,** 412; **84,** 463.
Col. C. E. Blunt, 1885–86. **R., 85,** 467.
Maj. J. A. Smith, 1886–91. **R., 86,** 535; **87,** 445; (Lt. Col.), **88,** 381; **89,** 522; **90,** 435, 455; **91,** 586.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 507; **93,** 687; **94,** 503.
Lt. Col. D. P. Heap, 1895. **R., 95,** 551.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 553.
Maj. R. L. Hoxie, 1897. **R., 97,** 781.

Assistant. A. C. Both. **R., 76,** 191; **90,** 456.

ESTIMATES. (See also Projects.)

By A. C. Both, constr. of break'r, $310,000, **76,** 191, 193.

OPERATIONS.

1877-78. Portions of ledge off Lane's wharf removed, **78,** 194.
1878-79. Dr. of shoal to 10′ m. l. w., **79,** 251.
1879-80. Removal of shoal in front of wharves with hired dr. and plant, **80,** 330. Completion of proj. of 1877; cost, $22,000, **80,** 65, 331.
1885-86. Wreck of schooner Waldemar removed, **86,** 536.
1892-93. About 28,000 c. y. dr., **93,** 688.
1893-94. About 12,000 c. y. dr., **94,** 504.
1894-95. Chan. at entrance dr. to full w., and part of the H. dr., **95,** 552.
1895-96. In connection with work of previous year, about 50,000 c. y. dr., **96,** 554.
1896-97. Proj. completed, **97,** 781.

PHYSICAL CHARACTERISTICS.

General, **76,** 190. Tides, **76,** 190. Obstr.: Shoal and a sunken ledge, **76,** 190, 192.

PLANS.

By A. C. Both, break'r between McGilvery's shipyard and Pattersons Pt., in 2 sections, one running from each place, toward each other, 1,500′ and 900′ l., leaving an opening of 800′ between the outer ends; ps. to be 10′ w. on top and 14′ above m. l. w., **76,** 190, 192.
By Col. Thom, 1880, j. from n. shore of H., to direct tidal currents; est. $18,000, **80,** 331.

PROJECTS.

Orig. proj. was by Col. Thom, 1877, for dg., by dr. to 10′ and 12′, the area between the wharves and d. w. in the R., **76,** 190. Completed in 1880; cost, $22,000, **80,** 65, 531.
Lt. Col. Smith, 1888, proposed to increase the d. on the ne. side of the H. to 8′ by the removal of 52,000 c. y. of material, est. $12,850, **88,** 382. After an ex. and sur. in 1889, Lt. Col. Smith submitted a proj. for dr. a part of the main chan. to give 15′ and a least w. of 220′, and d. portions of the e. and w. sides to 8′ and 13′, respectively, m. l. w.; est., $52,000, **90,** 18, 435, 456; **91,** 586; **92,** 508.

SURVEYS.

By A. C. Both, 1875. **R., 76,** 191.
Au. act Aug. 11, 1888, made, 1889, by Lt. Col Smith (see Projects), **90,** 435, 455.
Maps. **80,** 330.

A-140 FRENCHS BEACH HARBOR (Duck Trap H.), ME.

COMMERCE.

De. of, **93,** 728.

ENGINEERS.

Chief of Engineers. **R., 93,** 37.
In charge. Lt. Col. P. C. Hains, 1892-93. **R., 93,** 728.

PHYSICAL CHARACTERISTICS.

De. of, **93,** 729.

SURVEYS.

Ex. au. act July 13, 1892, made by Lt. Col. Hains, 1892 (**R.** unfav.), **93,** 728.

A-141 LINCOLNVILLE HARBOR (Duck Trap H.), ME.

COMMERCE.

Benefit of imp. to C., **79,** 277, 278.
De. of, **93,** 728.

ENGINEERS.

Chief of Engineers. **R., 78,** 46; **79,** 52; **93,** 37.

In charge:
Lt. Col. Thom, **78,** 46; **79,** 52. **R., 79,** 275.
Lt. Col. P. C. Hains, 1892-93. **R., 93,** 727.

Assistant. A. C. Both, **79,** 275. **R., 79,** 276.

PHYSICAL CHARACTERISTICS.

De. of, **79,** 275, 276, 277; **93,** 727.
Table of tides, **79,** 276.

PLANS.

Of Lt. Col. Thom, 1879, chan. 3′ x 50-80′ x 1900,′ m. l. w., with a basin at its upper end 250′ x 110′; also a break'r to protect entrance; est., $10,000, **79,** 275, 276, 277.

SURVEYS.

Au. and in progress, 1878, **78,** 46; completed by A. C. Both, **79,** 52, 275.
Ex. au. act July 13, 1892; made by Lt. Col. Hains, 1892 (**R.** unfav.), **93,** 728.

A-142 CAMDEN HARBOR, ME.

APPROPRIATIONS.

1873,	$10,000,	**73,** 97.
1874,	10,000,	**74,** 107.
1875,	10,000,	**75,** 114.
1888,	5,000,	**89,** 523.
1890,	6,000,	**90,** 436.
1892,	12,000,	**92,** 510.
1894,	12,000,	**95,** 554.
1896,	10,000,	**96,** 556.
1902,	7,400,	**02,** 836.
1910,	20,000,	**10,** 1090.
Total,	102,400,	**12,** 1360.

COMMERCE.

Shipbuilding and manufacturing interests, **88,** 403, 404.
De. of, **00,** 1112.
Effect on rates unknown, **07,** 29.
Tonnage, 1911, 56,408 t., **12,** 45.

CONTRACTS.

1873. F. Mead, dr., 40¢ c. y., **73,** 1062.
1874. A. R. Wright, dr., 28¢ c. y., **74,** ii, 302.
1875. A. R. Wright, dr., 18¢ c. y., **75,** ii, 390.
1889. E. P. Lovering, dr., 25¢ c. y., **89,** 524.
1892. Hamilton & Sawyer, dr., 25¾¢ c. y., s. m. ($15,450), **93,** 690.
1895. Hamilton & Sawyer, dr., 19¼¢ c. y., s. m. ($11,550), **95,** 554.
1896. Hamilton & Sawyer, dr., 14¾¢ c. y., s. m. ($8,850), **97,** 782.
1903. Hamilton & Sawyer, dr., 26¼¢ c. y.; removing bowlders, $10 per t., **03,** 720.
1911. John H. Gerrish, dr. about 45,000 c. y., at 33.3¢ c. y., and $8.00 per c. y. for removing bowlders over 2 c. y. in volume, **11,** 1151.

ENGINEERS.

Chief of Engineers. R., 73, 97, 106; **74,** 107; **75,** 114; **76,** 40; **88,** 14, 22; **89,** 23; **90,** 19; **91,** 24; **92,** 28; **93,** 27; **94,** 26; **95,** 28; **96,** 30; **97,** 32; **99,** 62; **00,** 63; **02,** 70; **03,** 46; **04,** 27; **05,** 29; **06,** 26; **07,** 28; **08,** 44; **09,** 47; **10,** 45; **11,** 45; **12,** 44.
In charge:
Lt. Col. Thom, 1872–76; **73,** 93; **74,** 103; **75,** 111; **76,** 37. **R., 73,** 1062, 1106; **74,** ii, 302; **75,** ii, 390; **76,** 156.
Lt. Col. J. A. Smith, 1888–92. **R., 88,** 403; **89,** 523; **90,** 436; **91,** 587.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 509; **93,** 689; **94,** 505.
Lt. Col. D. P. Heap, 1895. **R., 95,** 553.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 554.
Maj. R. L. Hoxie, 1897. **R., 97,** 782.
Maj. S. W. Roessler, 1900–1904. **R., 00,** 1111, 1114; **02,** 836; **03,** 720; **04,** 785.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 787; **06,** 856.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 885; (Lt. Col.) **10,** 1090.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1151; **12,** 1360.
Assistants:
A. C. Both. **R., 73,** 1107; **00,** 1115.
F. S. Burrowes. **R., 88,** 406.

OPERATIONS.

1873-74. 22,753 c. y. dr., forming a chan. 7′ x 50′ x 2,000′, m. l. w., from d. w. to eastern wharves, **74,** 107, ii, 302.
1874-75. Dr. under contract, **75,** 114, ii, 390.
1875-76. 82,199 c. y. dr. from chan., completing proj., **76,** 40, 157. Total amount dr., 104,952 c. y., **76,** 40, 157.
1889-90. 18,045 c. y. dr., **90,** 436.
1891-92. 30,664 c. y. dr., **92,** 510.
1893-94. About 42,000 c. y. dr.; 11 bowlders obstr. entrance removed at a cost of $550, **94,** 506.
1895-96. About 56,000 c. y. dr., **96,** 555.
1896-97. About 62,000 c. y. dr.; proj. completed, **97,** 782.
1902-03. 5,781 c. y., s. m., dr., **03,** 720.
1903-04. 20,811 c. y., p. m., dr.; proj. completed, **04,** 785.
1910-11. 16,564 c. y. dr. under contract, being about 38% of quantity to be removed, **11,** 1151.
1911-12. 30,293 c. y. dr., completing proj. in Oct., 1911, **12,** 1360.

PHYSICAL CHARACTERISTICS.

Soundings, **73,** 1108.
De. of, **00,** 1114; **07,** 28.
Slight deterioration in d., **11,** 45.
On westerly side of Penobscot B., 8 m. n. of Rockland, Me. General d., 9′, **12,** 44.

PROJECTS.

By Lt. Col. Thom, 1872, chan. 7′ x 100′ m. l. w. to head of wharves on the e. side of h., 1,000′ l.; on w. side a chan. 3′ x 80′ x 1,400′, l. m. w., to wharves; further to regulate the entrances to these chan. by dr. between wharves, **73,** 97, 1062, 1108; **74,** 107, ii, 302; **75,** 114. Second chan. modified to 7′ d., m. l. w., **76,** 157.
By Lt. Col. Smith, 1888, imp. of chan. and h. areas by d. 2 areas to 10′ and 12′ m. l. w., respectively, and excavation of Channel C 100′ w. and Channel D 50′ w., both to be 10′ d.; m. l. w., est., $59,930, **88,** 405, 406; increased in 1890 to $60,000, **90,** 436; **91,** 588; **92,** 509.
By Maj. Roessler, 1900, dr. area in front of the Boston & Bangor SS. Co.'s wharf to 14′ d. m. l. w.; est., $7,400, **00,** 1114.
By Lt. Col. Zinn, 1908, dr. upper part of h. to 10′ m. l. w.; est., $20,000,[1] **09,** 47; au. act June 25, 1910, **10,** 45.

SURVEYS.

By A. C. Both, 1872, **73,** 97, 1062, 1106.
Au. act Aug. 5, 1886, made, 1888, by Lt. Col. Smith, **88,** 405.
Ex. and sur. au. act Mar. 3, 1899, made by Maj. Roessler, 1899 (no imp. of inner h. recom.; outer h. imp. recom.), **00,** 1111, 1114.
Au. act Mar. 2, 1907, made, 1907–08. **R.** by Lt. Col. Zinn,[1] **09,** 47.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 45; act June 25, 1910, au. ex. and sur. with view to constr. break'r (**R.** to come), **12,** 66.
Maps.[1] **04,** 786.

A-143 ROCKPORT HARBOR, ME.

APPROPRIATIONS.

1888,	$10,000,	**89,** 524.
1890,	5,000,	**90,** 437.
1910,	32,000,	**10,** 1091.
Total,	47,000	

COMMERCE.

Rockport shipments; probable increase from h. imp., **88,** 408.
In 1911, 164,800 t. lumber and cooperage, cement and lime, ice, coal, etc.; value, $531,000±, **12,** 46.

CONTRACTS.

1889. E. P. Lovering, dr., 20¢ c. y., **89,** 525.
1911. F. W. Carlton, rock excavation, $7 c. y., and dr. $1 c. y., **12,** 1361.

ENGINEERS.

Chief of Engineers. R., 88, 15, 22; **89,** 24; **90,** 19; **91,** 25; **92,** 29; **08,** 44; **10,** 45; **11,** 46; **12,** 46.
In charge:
Lt. Col. J. A. Smith, 1888–92. **R., 88,** 407, 409; **89,** 524; **90,** 437; **91,** 588.
Lt. Col. P. C. Hains, 1892. **R., 92,** 510.

[1] H. D. 1117, 60th, 2d.

Lt. Col. Geo. A. Zinn, 1908–10. **R., 10,** 1091.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1152; **12,** 1361.
Assistant. F. S. Burrowes. **R., 88,** 410

OPERATIONS.

1889–90. 45,000 c. y. dr., **90,** 437.
1891–92. 15,000 c. y. dr., **92,** 511.
1911–12. 80% of area drilled and blasted, and about 3,655 c. y. material removed, **12,** 1361.

PHYSICAL CHARACTERISTICS.

De. of, **88,** 407.
On w. side of Penobscot B., 6 m. n. of Rockland. Has area of 45±acres; **12,** 46.

PROJECT.

By Lt. Col. Smith, 1888, increasing the d. to 12′ at the upper end by dr.; est., $14,000, **88,** 410; **92,** 510.
Act June 25, 1910, au. removal of ledge about midway of entrance to h., to 15′ below l. of m. l. t.; est., $32,000,[2] **10,** 45, 46.

SURVEY.

Ex. au. act Aug. 5, 1886, **87,** 22; **88,** 407; made by Col. Smith (see above).
Pre. ex. au. act Mar. 2, 1907, with view to removing the beacon and ledge rock. **R.,** Maj. Zinn, 1907 and 1908; est., $32,000,[1] **08,** 44.

A-144 GLEN COVE HARBOR, ME.

COMMERCE.

Unimportant, **95,** 577.

ENGINEERS.

Chief of Engineers. **R., 95,** 38.
In charge. Lt. Col. D. P. Heap, 1895. **R., 95,** 577.

PHYSICAL CHARACTERISTICS.

De. of, **95,** 578.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Hains, 1894 (**R.** unfav.), **95,** 587.

A-145 ROCKLAND HARBOR, ME.

[See also A 146 (a)]

APPROPRIATIONS.

1880,	$20,000,	**80,** 332.
1882,	40,000,	**82,** 492.
1884,	40,000,	**84,** 465.
1886,	22,500,	**86,** 537.
1888,	30,000,	**88,** 385.
1890,	37,500,	**90,** 438.
1892,	30,000,	**92,** 512.
1894,	30,000,	**95,** 556.
1896,	25,500,	**96,** 556.
1897,	350,000,	**97,** 783.
1898,	300,000,	**98,** 824.
Total,	925,500	

COMMERCE.

Commerce of Rockland Port, **80,** 332.
About 8,000 vessels of all kinds used the h. during 1894, **96,** 583.
Benefits resulting from imp. are considerable, **03,** 48.
Break'r affords a safe and extensive anchorage and h. of refuge, **03,** 48.
In 1911, 605,150 t., valued at $14,151,750, **12,** 48.
Reduction in rates, through economies made possible by use of deeper draft vessels, **12,** 48.

CONTRACTS.

1881. Bodwell Granite Co., granite quarry grout, 74½¢ t., **81,** 465.
1882. J. F. Hamilton, granite quarry grout, $1.17 t., **83,** 414.
1884. T. A. Rowe, st., 88¢ t., **85,** 469.
1887. J. A. Hamilton and R. Soule, riprap granite, 67¢ t., **87,** 448.
1889. J. F. Hamilton, furnishing and placing st. upon break'r, 93½¢ s. t., **89,** 526.
1890. W. S. White, furnishing st. 78½¢ t., and taking up and relaying break'r st., 98½¢ t., **91,** 590.
1892. W. S. White, st., 73¢ t. ($25,550), **93,** 692.
1895. J. F. Curit, st., 56¢ t. ($19,600), **95,** 556.
1897. C. H. Souther, st., 59.3¢ t. ($207,550), **97,** 784.
1898. Dunbar & Sullivan, ledge excavation, $6.75 and $6.25 c. y., p. m. ($194,200). Moore & Wright, dr., 14¢ c. y., p. m., and $5 t. for bowlder removal, **98,** 825. Price of part of the dr. increased to 17¢ c. y. ($65,980.04), **1900,** 1089.
1899. C. W. Johnston, wreck removal, $565, **99,** 1036.
1900. R. V. Perini, st., $1.49 per t. ($52,150), **1900,** 1091.
1901. E. S. Belden, st. in place on outer slope of break'r, 87¢ t., **02,** 838.
1904. E. S. Belden & Sons, st., $1.07 t., **05,** 788.

ENGINEERS.

Chief of Engineers. **R., 80,** 65; **81,** 65; 475; **82,** 65; **83,** 60; **84,** 69; **85,** 57; **86,** 56; **87,** 17; **88,** 15; **89,** 24; **90,** 20; **91,** 25; **92,** 29; **93,** 27, 37; **94,** 27; **95,** 29; **96,** 31, 41; **97,** 33; **98,** 42; **99,** 51; **00,** 54; **01,** 128; **02,** 71; **03,** 47; **04,** 28; **05,** 29; **06,** 27; **07,** 29; **08,** 32; **09,** 36; **10,** 46; **11,** 46; **12,** 46.
Boards. Convened at New York Sept. 10, 1880, to report upon proj. of Col. Thom for imp. of Rockland H. **R., 81,** 468. (Cols. Tower and Newton.)
In charge:
Col. G. Thom, 1880–83. **R., 80,** 331; **81,** 464, 466, 467, 472; **82,** 492.
Col. C. E. Blunt, 1883–86. **R., 83,** 413; **84,** 464; **85,** 467.
Maj. J. A. Smith, 1886–91. **R., 86,** 536; **87,** 446; (Lt. Col.) **88,** 384; **89,** 525; **90,** 438, 439; **91,** 589.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 511; **93,** 691, 729; **94,** 506.
Lt. Col. D. P. Heap, 1895. **R., 95,** 555.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 556, 581.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 783; **98,** 823.
Maj. S. W. Roessler, 1899–04. **R., 99,** 1034; **00,** 1089; **01,** 1000; **02,** 837; **03,** 721; **04,** 786.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 788; **06,** 857.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 885; (Lt. Col.) **08,** 929; **09,** 971; **10,** 1091.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1153; **12,** 1362.
Assistant. A. C. Both. **R., 96,** 582.

OPERATIONS.

1880–81. 13,006 t. granite placed in Jameson Pt. break'r, extending same 560′, **81,** 464.
1881–82. 11,119 t. granite delivered on Jameson Pt. break'r, extending same 103′, **82,** 492.
1882–83. 30,232 t. granite quarry grout delivered in Jameson Pt. break'r, extending same 326′, **83,** 414.
1884–85. 25,813 t. st. placed in Jameson Pt. break'r, extending same 291′, **85,** 468.
1885–86. 39,959 t. st. placed in Jameson Pt. break'r, extending same 473′, **86,** 537.
1886–87. 10,869 t. st. placed in break'r, **87,** 447.
1887–88. 17,823 t. st. delivered upon break'r, **88,** 384.
1888–89. 13,599 t. st. delivered upon break'r, **89,** 525.
1889–90. 16,474 t. st. delivered upon break'r, **90,** 438.
1890–91. 2,762 t. st. delivered upon break'r, **91,** 589.
1891–92. 23,500 t. st. deposited in break'r, **92,** 512.

[1] H. D. 963, 60th, 1st.

1892-93. About 40,000 t. st. placed in break'r, **93,** 692.
1893-94. About 15,000 t. placed in break'r, **94,** 507.
1894-96. About 50,000 t. placed in break'r, **95,** 555; **96,** 557.
1896-97. 2,260 t. placed in break'r, **97,** 783.
1897-98. About 70,000 t. placed in break'r, **98,** 824.
1898-99. 240,682 t. placed in break'r; 188,271 c. y. dr., **99,** 1035.
1899-00. 100,455 t. placed on break'r, and 524 t. placed to raise it; 134,569 c. y. dr. and 14,602 c. y. rock removed, **00,** 1089, 1090.
1900-01. 26,131 t. st. placed in break'r, 5 st. beacons removed, 165,087 c. y., p. m., dr., and removal of Jameson Pt. ledge continued, **01,** 1000–01.
1901-02. 3,620 c. y., p. m., ledge rock removed, 842 c. y., s. m., hardpan dr., and 32,656 t. st. placed on outer slope of breakw'r, breakw'r completed, **02,** 837.
1904-05. 19,716 t. st. placed on sea slope of breakw'r, **05,** 788.

PHYSICAL CHARACTERISTICS.

De. of, **96,** 583.
Winter of 1903–04 extremely cold, heavy ice formed; breakw'r damaged by having st. displaced, **04,** 786.
H. on w. side of Penobscot B. near mouth; area, 1,180 acres; **12,** 46.

PROJECTS.

By Col. Thom, 1880, modified by B. E., 2 breakw'rs to a height of 5′ above m. l. w., with a w. on top of 10′, one extending from Jameson Pt. 1,900′ se. and the other extending from South Ledge 2,640′ toward Jameson Pt.; est., $550,000, **81,** 471, 473; **82,** 492; **86,** 536.
Revised in 1887 to bring top of breakw'rs to plane of h. w.; est., $650,000, **87,** 447.
Modified in 1890 to increase top w. of the Jameson Pt. Breakw'r to 20′, **90,** 20, 438.
In 1890 Lt. Col. Smith, modification, omitting the inner breakw'r at South Ledge and extending the breakw'r from Jameson Pt. 2,280′ on a continuation of its alignment involving the deposition of 480,000 t. of st.; est., $1,480,000, **90,** 440. Approved by B. E., **90,** 441. (Cols. Abbot and Comstock and Lt. Col. Gillespie.)
Proj. revised by Congress to include removal of South Ledge and Jameson Pt. ledge to 22 and 14′, m. l. w., resp., and for dr. at Crockets Pt. to from 4′ to 13′, m. l. w., est. $402,000; making the entire cost of the whole proj. $1,036,000, which also includes the cost of removing an old hulk, **96,** 557.
For raising breakw'r top 4′, 1881, with modifications, appr., 1900, **00,** 1089
By Maj. Roessler, 1899, for 4′, m. l. t., n. of Crocketts Pt., **00,** 1089.
By Maj. Roessler, to strengthen the breakw'r by placing about 23,000 t. on outer slope, **01,** 1000.

SURVEYS.

Ex. au. act July 13, 1892, made by Lt. Col. Hains, 1892 (**R.** fav.), **93,** 729.
Sur. au. act Aug. 17, 1894, made by Lt. Col. Damrell, 1895 (**R.** fav. to limited imp.), **96,** 581.
Pre. ex. au. act Feb. 27, 1911, at or near Atlantic Pt. **R.** by Lt. Col. Craighill, Sept. 30, 1911[1] (unfav.), **12,** 66.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 47.
Maps. **81,** 464; **90,** 440; **96,** 581.

A-146(a) OWLSHEAD HARBOR, ME.[2]

APPROPRIATIONS.

1836,	$400.00	(sur.), act July 4.
1852,	15,000.00	act Aug. 30.
1858,	2,502.11	(relief), act June 7.
Total,	17,902.11	

COMMERCE.

Restricted to local trade with vessels seeking the place as a H. of refuge, **93,** 732.

CONTRACT.

1855. A. & E. G. Colby, constr. of breakw'r, act June 7, 1858.

ENGINEERS.

Chief of Engineers. R., 66, 7; **85,** 60; **93,** 38.
In charge:
Lt. Col. J. D. Graham, 1865. **R., 66,** 36.
Col. C. E. Blunt. **R., 85,** 476.
Lt. Col. P. C. Hains, 1892–93. **R., 93,** 730.

PHYSICAL CHARACTERISTICS.

De. of, **93,** 731.

SURVEYS.

Ex. au. act July 5, 1884, made by Col. Blunt (**R.** unfav.), **85,** 476, 478.
Ex. au. act July 13, 1892, made, 1892, by Lt. Col. Hains (**R.** unfav.), **93,** 731.

A-152 TENANTS HARBOR, ME.

COMMERCE.

De. of, **93,** 733.

ENGINEERS.

Chief of Engineers. R., 93, 38; **08,** 44.
In charge:
Lt. Col. P. C. Hains, 1892–93. **R., 93,** 733.
Lt. Col. G. A. Zinn, **08,** 26.

PHYSICAL CHARACTERISTICS.

De. of, **93,** 733.

SURVEY.

Ex. au. act July 13, 1892, made by Lt. Col. Hains, 1892 (**R.** unfav.), **93,** 733.
Pre. ex. au. act Mar. 2, 1907, with view to obtaining 8′ d. **R.** by Lt. Col. Zinn, Oct. 14, 1907[3] (unfav.), **08,** 44.

A-155 ST. GEORGES RIVER, ME. (Warren to Thomaston).

[See A–155(a)]

COMMERCE.

Unimportant, **87,** 475.

ENGINEERS.

Chief of Engineers. R., 87, 21.
In charge. Maj. J. A. Smith. **R., 87,** 473.

OBSTRUCTIONS.

Bridges without draws, **87,** 474.

SURVEY.

Ex. au. act Aug. 5, 1886, made by Maj. Smith (**R.** unfav.), **87,** 473.

[1] H. D. 421, 62d, 2d.
[2] Sur.—**R.** Sept. 20, 1837; est., $253,000. (H. D. 482, 55th, 2d.)
[3] H. D. 351, 60th, 1st.

A-155(a) GEORGES RIVER, ME. (Thomaston H.)

[See A–155.]

APPROPRIATIONS.

1896, $10,000, **96,** 560.
1899, 10,000, **99,** 1038.
1902, 6,000, **02,** 840.

Total, 26,000

COMMERCE.

Small, **93,** 735.
In 1906, 18,950 t. coal, lime and wood, **07,** 31.

CONTRACTS.

1897. Hamilton & Sawyer, dr., 14.7¢ c y., s. m. ($7,350), **97,** 786.
1899. Hamilton & Sawyer, dr., 16½¢ c. y., s. m. ($11,550), **99,** 1038.
1902. Hamilton & Sawyer, dr., 20¢ c. y.; removing bowlders, $8 t., **03,** 723.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 38; **95,** 39; **96,** 32; **97,** 35; **98,** 45; **99,** 53; **1900,** 57; **01,** 130; **02,** 73; **03,** 49; **04,** 30; **05,** 31; **06,** 29; **07,** 31.
In charge:
Lt. Col. P. C. Hains, 1892. **R.,** **93,** 73.
Lt. Col. D. P. Heap, 1895. **R.,** **95,** 590.
Lt. Col. A. N. Damrell, 1896. **R.,** **96,** 559.
Maj. R. L. Hoxie, 1897–98. **R.,** **97,** 785; **98,** 827.
Maj. S. W. Roessler, 1899–1904. **R.,** **99,** 1038; **00,** 1093; **01,** 1004; **02,** 840; **03,** 723; **04,** 788.
Lt. Col. W. M. Black, 1905–06. **R.,** **05,** 789; **06,** 858.
Maj G. A. Zinn, 1907. **R.,** **07,** 887.
Assistant. A. C. Both. **R.,** **95,** 591.

OPERATIONS.

1897-98. 60,000±c. y. dr., **98,** 827.
1899-00. 56,997 c. y. dr., **00,** 1094.
1902-03. 20,824 c. y., s. m., dr., proj. done, **03,** 49, 723.

PHYSICAL CHARACTERISTICS.

De. of, **93,** 734.
Gradual shoaling to be expected, **07,** 31.

PROJECTS.

By Lt. Col. Heap, 1895, chan. 16′x 90′–220′, m. l. w.; est. to include repairs to a beacon at Browns Pt., $30,000, **95,** 590; est., 1907, $26,000, **07,** 31.

SURVEYS.

Ex. au. act July 13, 1892, made, 1892, by Lt. Col. Hains (**R.** fav. to imp. to Thomaston), **93,** 734.
Sur. au. act Aug. 17, 1894, made, 1895, by Lt. Col. Heap (see Projects), **95,** 591.

A-155(b) EAST THOMASTON HARBOR, ME.[1]

(See also A–145.)

A-156 MONHEGAN ISLAND HARBOR, ME.

COMMERCE.

Local, **89,** 548.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 31.
In charge. Lt. Col. J. A. Smith, 1888. **R.,** **89,** 547.

PHYSICAL CHARACTERISTICS.

De. of, **89,** 548.

SURVEY.

Ex. au. act Aug. 11, 1888, made, 1888, Lt. Col. Smith (**R.** unfav.), **89,** 547.

A-166 MEDOMAK (Medomac) RIVER, ME.

COMMERCE.

Unimportant, **89,** 549.
Incoming, 2,000±t. (coal), 600,000′ lumber, shingles, etc.; outgoing, 50,000±′ (lumber and wood), **04,** 806.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 31; **04,** 35; **12,** 66.
Boards. BERH. (see sur., 1900), **04,** 807, 808.
In charge:
Lt. Col. J. A. Smith, 1888. **R.,** **89,** 549.
Maj. S. W. Roessler, 1904. **R.,** **04,** 805, 809.
Lt. Col. W. E. Craighill, **12,** 34.
Assistant. A. C. Both, **R.,** **04,** 810.

PHYSICAL CHARACTERISTICS.

De. of, **89,** 549.
De., d., l., etc., **04,** 805.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Smith (**R.** unfav.), **89,** 549.
Pre. ex. and sur. au. act June 13, 1902, to head of navigation. **R.,** Maj. Roessler, 1902 and 1903; 3 plans submitted; ests., $18,500, $25,300, and $32,000; BERH. does not favor imp.[2] **04,** 35, 805, 808, 809.
R., Jan. 23, 1907, by BERH. requested by R. and H. Comm. to review former reports. (Unfav. recom.)[3]
Pre. ex. au. act June 25, 1910. **R.,** Lt. Col. Zinn, 1910, and Lt. Col. Craighill, 1912; est., $17,000, with $500 to $1,000 an. mainten.,[4] **12,** 66.
Maps.[4]

A-177 NEW HARBOR, ME.

APPROPRIATIONS.

1905, $10,500, **05,** 32, 790.

COMMERCE.

1904, 8,349 t., **05,** 32.

[1] Sur.—**R.** Nov. 30, 1835, est., $1,000,000. (H. D. 482, 55th, 2d.)
[2] H. D. 195, 58th, 2d.
[3] R. and H. Comm. D. 14, 59th, 2d.
[4] H. D. 674, 62d, 2d.

CONTRACTS.

1905. Eastern Dredging Co., dr. 31,500 c. y., p. m., 29.3¢ c. y., **05,** 790.

ENGINEERS.

Chief of Engineers. R., 04, 35; **05,** 32; **06,** 30.
In charge.
Maj. S. W. Roessler, 1904–05. **R., 04,** 35, 813, 816; **05,** 790.
Lt. Col. W. M. Black, 1906. **R., 06,** 859.

OPERATIONS.

1904–05. Contract was made for all work covered by proj., **05,** 790.
1905–06. 32,217 c. y. dr., completing contract and proj.; apprn. exhausted, **06,** 859.

PHYSICAL CHARACTERISTICS.

De. of, **06,** 30.

PROJECTS.

Act Mar. 3, 1905, au. dr. to 12′, m. l. t., over 4½ acres in lower part of H., and 6′, m. l. t., over 4½ acres in upper part; est., $10,500, **05,** 32.

SURVEY.

Pre. ex. and sur. au. act June 13, 1902. **R., Maj.** Roessler, 1902 and 1903; est., $10,500,[1] **04,** 35, 813, 816.

A-186 DAMARISCOTTA RIVER, ME.

APPROPRIATIONS.

1905, $5,000, **05,** 791.

COMMERCE.

Local in character; de. of; small; **04,** 797.
Place once large shipbuilding center.

CONTRACTS.

1905. Eastern Dredging Co., dr., 94¢ c. y., p. m., **05,** 791.

ENGINEERS.

Chief of Engineers. R., 04, 34, 795; **05,** 33; **06,** 30.
Boards. BERH. **R., 04,** 799.
In charge.
Maj. S. W. Roessler, 1904. **R., 04,** 796, 800.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 791; **06,** 859.
Assistant. A. C. Both. **R., 04,** 801.
Obstruction. Bridge without a draw 15 m. up; **04,** 796.

OPERATIONS.

1905–06. 4,444 c. y., p. m., dr.; proj. completed, **06,** 859.

PHYSICAL CHARACTERISTICS.

De. of: A tidal estuary, 15 m. long, to villages of Newcastle and Damariscotta, **04,** 796.

PROJECTS.

Maj. Roessler, 1903, recom. instead desired 12′ a 9′ chan.; est., $4,900,[2] **04,** 798, 800.

SURVEYS.

Au. act June 13, 1902; made, 1902–03, by **Maj.** Roessler,[2] **04,** 795.

A-188(a) SOUTH BRISTOL HARBOR, ME.

APPROPRIATIONS.

1912, $3,500, **12,** 1364.

ENGINEERS.

Chief of Engineers. R., 12, 49, 65.
In charge. Lt. Col. W. E. Craighill, 1912–. **R., 12,** 1364.

PHYSICAL CHARACTERISTICS.

Shoulder of ledge obstructs passage, **12,** 49.

PROJECT.

Act July 25, 1912, au. removing obstr. ledge to 2′ m. l. w.; est., $3,500,[3] **12,** 49.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, with view to securing chan. 12′ x 30′ through the drawb. **R.** by Lt. Col. Craighill, Nov. 26, 1910, and Oct. 5, 1911; est., $3,500,[3] **12,** 65.
Map.[3]

A-194 EAST BOOTHBAY HARBOR, ME.

APPROPRIATIONS.

1910, $6,500, **10,** 1092.

COMMERCE.

Imp't permits more regular and satisfactory service to localities dependent upon water transportation, **11,** 48.
Traffic, 1910, 7,855 t, **11,** 48.

CONTRACTS.

1910. John H. Gerrish, dr., 23.9¢ c. y., and $15 c. y. for removal of bowlders, **11,** 1154.

ENGINEERS.

Chief of Engineers. R., 08, 44; **10,** 47, 58; **11,** 48; **12,** 48.
In charge.
Lt. Col. Geo. A. Zinn, 1908–10. **08,** 26. **R., 10,** 1092.
Lt. Col. W. E. Craighill, 1911–12. **R., 11,** 1154; **12,** 1363.

OPERATIONS.

1910–11. 13,348 c. y. dr., completing proj., **11,** 1154.

PROJECT.

Act June 25, 1910, adopted proj. for dr. to increase d. to 8′, at m. l. w.; est., $6,500,[4 5] **10,** 47, 48.

SURVEYS.

Pre. and sur. au. act Mar. 2, 1907, for 8′ d.; **Rs.** Maj. Zinn, 1907, and Feb., 1908 (unfav.),[4] **08,** 44.
Pre. ex. and sur. au. act Mar. 3, 1909; **Rs.** Lt. Col. Zinn, Apr. 27 and Oct. 15, 1909; extension of proj. would require dr. area 8′ x 160′ x 180′, m. l.w.; est., $2,500,[5] **10,** 58.
Maps.[4 5]

[1] H. D. 167, 58th, 2d.
[2] H. D. 53, 58th, 2d.
[3] H. D. 564, 62d, 2d.
[4] H. D. 944, 60th, 1st. (fav.)
[5] H. D. 684, 61st, 2d.

A-197 BOOTHBAY HARBOR, ME.

APPROPRIATIONS.

1912, $18,000, **12,** 1364.

COMMERCE.

Important, **97,** 803; **1900,** 1119.
Traffic, 1910, 115,322 t. (ice, coal, fish, lumber, etc.); passengers, 103,000, **12,** 1364.
Deepening would give better access to wharves, **12,** 50.

ENGINEERS.

Chief of Engineers. R., 97, 43; **99,** 62; **00,** 63; **11,** 61; **12,** 50.
In charge:
Maj. R. L. Hoxie, 1897. **R., 97,** 802.
Maj. S. W. Roessler, 1900. **R., 00,** 1117, 1120.
Lt. Col. W. E. Craighill, 1911–. **11,** 35; **R., 12,** 1364.
Assistant. A. C. Both. **R.,** 1118.

PHYSICAL CHARACTERISTICS.

De. of, **97,** 803; **00,** 1119, 1120; **12,** 50.
H. so well favored naturally as to require no artificial works, 1899, **00,** 1121.

PROJECT.

Act July 25, 1912, au. dr. to 12′, m. l. t., along wharves and at upper end; est., $18,000; first work au.,[1] **12,** 50.

SURVEYS.

Ex. au. act June 3, 1896, made by Lt. Col. Damrell, 1897 (**R.** fav.) **97,** 803.
Ex. and sur. au. act Mar. 3, 1899, made by Maj. Roessler, 1899 (see Physical Characteristics), **00,** 1117, 1120.
Ex. and sur. au. act June 25, 1910; **Rs.** submitted 1910 and 1911 by Lt. Col. Craighill; est., $18,000,[1] **11,** 61.
Cong. docs., etc., relating to exs., surs., etc., **12,** 50.
Map.[1]

A-200 HENDRICKS HARBOR, ME.

ENGINEERS.

Chief of Engineers. R., 07, 43.
In charge. Lt. Col. W. M. Black, **07,** 21.

SURVEY.

Ex. and sur. au. act Mar. 3, 1905, for rock removal; **Rs.** Lt. Col. Black, 1905 and 1906 (unfav.),[2] **07,** 43.

A-219 KENNEBEC RIVER, ME.[3]

APPROPRIATIONS.

1827,	$4,000.00	**66,** iii, 28.
1828,	3,500.00	
1830,	5,000.00	
1832,	20.32, act July 3.	
1840,	1,075.39, act July 20.	
1852,	6,000.00, act Aug. 30.	
1866,	20,000.00, **67,** 490.	
1867,	30,000.00, **67,** 490.	
1869,	[4] 14,850.00, act Apr. 10.	
1870,	15,000.00, **70,** 81.	
1871,	15,000.00, **71,** 90.	
1872,	8,000.00, **72,** 89.	
1873,	12,000.00, **73,** 98, 1064.	
1874,	12,000.00, **74,** 108.	
1875,	15,000.00, **75,** 115.	
1888,	75,000.00, **89,** 528.	
1890,	50,000.00, **90,** 443.	
1892,	100,000.00, **92,** 514.	
1894,	50,000.00, **95,** 559.	
1896,	55,000.00, **96,** 564.	
1902,	40,000.00, **02,** 841.	
1906,	15,000.00, **06,** 860.	
1907,	75,000.00	**07,** 889.
	26,000.00	
1908,	86,500.00, **08,** 932.	
1909,	70,000.00, **09,** 973.	
1910,	43,500.00, **10,** 1094.	
Total,	847,445.71	(Incl. sales, and $20,000 app. for Richmond H., Kennebec R., $867,448.96, **12,** 1365.)

COMMERCE.

Important, **67,** 491, 495, 496; **69,** 456, 457.
Increase of, **68,** 858.
Importance of the R. as a water communication between the seaboard and the interior of the State; lumber, granite, and ice shipments, **88,** 415, 416.
Shipping and freight, **89,** 529.
De. of, **00,** 1124.
Est. that increase of d. from 17′ to 20′ would reduce freight on ice 20¢ t., **07,** 34; **12,** 54.
In 1911, 298,256 t., principally coal, ice, and pulp, **12,** 54.

CONTRACTS.

1867. A. R. Wright, dr., 40¢ c. y., **67,** 490, 492.
1868. A. R. Wright, dr., 40¢ c. y., **68,** 852, 854.
1871. A. R. Wright, dr., 40 and 50¢ c. y., **71,** 843, 844.
1872. G. W. Townsend, removing r., $30 c. y., **72,** 931. A. R. Wright, dr., 50¢ c. y., **72,** 931; **73,** 1063.
1873. E. M. Le Prohon, removal of r., **73,** 1064.
1874. E. M. Le Prohon & Co., removal of r., $33.50 c. y. I. Hamilton, removal of r., $15 c. y., **75,** ii, 392.
1889. M. J. Wheeler, st., 99½¢ t., and fascines, 85¢ each, **89,** 528.
1890. Jordan & Carleton, removal of old bridge prs., $2,423, **91,** 593.
1892. Moore & Wright, dr., 17½¢ c. y., **92,** 515; 28 and 40¢ c. y., s. m. ($42,600), **93,** 698.
1893. Townsend & Olsen, ledge removal, $12.47 c. y., p. m. ($23,518.42), **93,** 698.
1895. Moore & Wright, dr., 24 and 29¢ c. y., s. m. ($40,070), **95,** 560. Rogers & Fitzpatrick, ledge removal, $9.87 c. y., p. m. ($14,814.87), **95,** 560.
1898. Moore & Wright, dr., 40¢ c. y., s. m., and bowlder removal, $10 t. ($18,000), **98,** 829.
1905. Eastern Dredging Co., 35.5¢ c. y., s. m., **06,** 861.
1907. Eastern Dredging Co., dr., 35½, 41½, 90, and 44½¢ c. y., s. m. bowlders, $8 t. Rowe Brothers Co., st. in jes., 88¢ t. for st., and $6.50 c. y. for masonry beacons, **08,** 932.
1909. Eastern Dredging Co., r. excavation, $19.30 c. y., p. m., **09,** 974.
1910. Eastern Dredging Co. (suppl.), placing loose r. excavated from Lovejoys Narrows in j. at Upper Sands Bar, 35¢ c. y., s. m., **10,** 1094.

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[1] H. D. 82, 62d, 1st.
[2] H. D. 272, 59th, 2d.
[3] At Lovejoys Narrows: Ex.—**R.** (fav.) Jan. 11, 1827. Bath to Augusta, Augusta to Skowhegan, mouth to Bath: Sur.—**R.** Sept. 20, 1837; est. $22,000. (H. D. No. 482, 55th, 2d.)
[4] Allotted.

1911. Johnston & Virden, r. excavation at South Gardiner, Me., 245± c. y., p. m., at $20.50 c. y., **11,** 1156.

DEFENSE.

U. S. arsenal at Augusta, **67,** 496.

Importance of impt. to U. S. in case of war, **67,** 490, 496.

Fort Popham, at the mouth of the Kennebec, **67,** 490, 495.

DOCUMENTS. (Not published in reports.)

H. Doc. 91, 39th Cong., 2d sess. Sur., Kennebec and Penobscot Rs., **67,** 17.

ENGINEERS.

Chief of Engineers. R., 66, 7, ii, 40, iii, 28; **67,** 17, 49; **68,** 71; **69,** 62; **70,** 80; **71,** 89; **72,** 89; **73,** 97; **74,** 107; **75,** 115; **76,** 40; **77,** 34; **78,** 38; **88,** 16, 22; **89,** 25; **90,** 20; **91,** 26, 33, 424; **92,** 30, 39, **93,** 28; **94,** 28; **95,** 30; **96,** 33; **97,** 35; **98,** 45; **99;** 53; **1900,** 58, 64; **01,** 130; **02,** 74; **03,** 50; **04,** 31; **05,** 33; **06,** 31; **07,** 32, 43; **08,** 35; **09,** 39; **10,** 40, 58; **11,** 50; **12,** 52, 66.

In charge:

Col. S. H. Long, 1837; **67,** 494.

Col. J. D. Graham, 1864–66. **R., 66,** 36.

Maj. B. S. Alexander, 1866; **66,** ii, 40; **67,** 493.

Lt. Col. George Thom, 1866–78. **R., 67,** 488, 490, 492; **68,** 852, 856; **69,** 455; **70,** 500, 506; **71,** 842; **72,** 930; **73,** 1063; **74,** ii, 303; **75,** ii, 392; **76,** 158; **77,** 162; **78,** 195.

Lt. Col. J. A. Smith, 1888–92. **R., 88,** 412, 417; **89,** 527; **90,** 442; **91,** 590, 622.

Lt. Col. P. C. Hains, 1892–94. **R., 92,** 513, 544; **93,** 693; **94,** 508.

Lt. Col. D. P. Heap, 1895. **R., 95,** 557.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 560.

Maj. R. L. Hoxie, 1897–98. **R., 97,** 787; **98,** 828.

Maj. S. W. Roessler, 1899–1904. **R., 99,** 1039; **00,** 1095, 1121, 1127; **01,** 1005; **02,** 840; **03,** 724; **04,** 789.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 791; **06,** 860.

Maj. G. A. Zinn, 1907–10. **R., 07,** 888; (Lt. Col.) **08,** 931; **09,** 972; **10,** 1093.

Lt. Col. W. E. Craighill, 1910–. **R., 11,** 1155; **12,** 34, 1365.

Assistants:

F. S. Burrowes. **R., 88,** 421; **92,** 547; **00,** 1129.

A. C. Both. **R., 1900,** 1125.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Thom, dr. through Shepards Pt. Shoal, $10,214.32, **67,** 494. Increased d., $17,503.50, **67,** 494. Dr. chan. through all the shoals, $50,000, **67,** 490. To excavate a chan. through Hinkleys and Browns Isld. Shoals, $3,000, **67,** 489. Modified est. for completion of work from Gardiner to Augusta, $80,000, **68,** 852, 857.

By Lt. Col. Thom, Richmond to Gardiner, $12,976.30, **71,** 844. Removal of 2 ledges of r. below Richmond, $13,500, **72,** 932. Removal of Half-tide Rock and Ledge No. 2, etc., $30,603.60, **73,** 1064. Removal of ledges 3, 4, and 5, and Dry Rock, $40,500, **74,** ii, 303.

OPERATIONS.

1867. 63,526 c. y. dr., **68,** 852.

1869–70. 30 bowlders removed and 22,039 c. y. dr., **69,** 455; 50 bowlders removed and 39,633 c. y. dr., **70,** 500.

1870–71. 50 bowlders removed and 12,510 c. y. dr., **70,** 506; **71,** 842; **72,** 88, 931.

1871–72. 50 bowlders removed; Nehumkeg Rock removed and 28,466 c. y. dr., **72,** 931.

1872–73. 7,795 c. y. dr., **73,** 1064.

1873–74. Removal of Half-tide Rock, **74,** ii, 303.

1874–75. Removal of 3 ledges r., **75,** ii, 392.

1875–76. 325 c. y. r. removed; work unsatisfactory, **76,** 40, 158.

1876–77. 905 c. y. r. removed, **77,** 35, 162.

1877–78. 545 c. y. r. removed, **78,** 38.

1888–89. 4,542 t. st. and 359 fascines delivered, **89,** 528.

1889–90. 41,038 t. st. and 8,541 fascines placed in the work, **90,** 442.

1890–91. 39,484 t. st. and 4,351 fascines placed in the work; 64,696 c. y. dr.; removal of old br. prs. begun, **91,** 591, 592, 593.

1891–92. 30,000 c. y. sand dr., **92,** 513.

1892–93. About 12,000 t. st. placed in j. at Upper Sands Bar and about 9,000 t. st. placed in j. at Beef Rock Shoal; dr. in progress, **93,** 696.

1893–94. About 90,000 c. y. dr. and 6,044 t. placed in j. at Beef Rock Shoal; over 600 c. y. ledge r. removed at Lovejoy Narrows, **94,** 511.

1894–95. Ledge removal and dr. in progress, **95,** 559.

1895–96. About 128,000 c. y. dr. and about 3,000 c. y. r. excavated; j. at Beef Rock Shoal repaired with 2,660 t. st., **96,** 563.

1896–97. In connection with preceding years, 133,715 c. y. dr. About 1,383 c. y. r. excavated at Lovejoy Narrows, **97,** 787.

1897–98. Dr. in progress at Gages Shoal, **98,** 828.

1898–99. 37,409 c. y. dr.; 139 t. bowlders removed from Gages Shoal. Proj. practically completed, **99,** 1039.

1901–02. Dr. of shoals, caused by spring freshets, in progress, **02,** 841.

1902–03. Removal of shoals completed, **03,** 724.

1905–06. 3,000 c. y. s. m., dr., **06,** 860.

1906–07. 52,000 c. y. dr., **07,** 888.

1907–08. 104,329 c. y. dr., and 11,278 t. st. placed in j., **08,** 931.

1908–09. 212,129 c. y. s. m., dr., 21,722 t. st. placed in 2 js., masonry beacon built on end of each j., and drilling and blasting r. at Lovejoys Narrows, **09,** 972.

1909–10. 192,608 c. y. dr., one 7 t. bowlder and 982 c. y. r. removed, and 1,936 c. y. material placed in j. at Upper Sands Bar, **10,** 1093.

1910–11. Dr. completed, 49,895 c. y. removed at 41½¢ and 58 c. y. at 90¢; also 61 t. of bowlders at $8.00; 2,031.1 c. y. p. m., r. excavated at Lovejoys Narrows, completing contract; material placed on js. at Beef Rock and Upper Sands, **11,** 1156.

1911–12. 250 c. y. r. removed near South Gardiner, at $20.50 c. y., p. m., and a few bowlders taken out at other points, **12,** 1365.

PHYSICAL CHARACTERISTICS.

High and low water, **67,** 493.

Bed of R. composed of sand and gravel, **67,** 493.

Rapid rise of R., **70,** 501.

De. of, **00,** 1125, 1129; **10,** 49; **12,** 53.

Spring freshet of 1902 higher than usual; caused much shoaling, **02,** 75.

Range of tides, etc., **12,** 53.

R. drains many lakes and streams, and from Moosehead L., in w. central Me., flows 150 m. in a s. direction, discharging into Atlantic 25 m. e. of Portland. Augusta is head of navigation, 44 m. from mouth; Swan Isld. is 20 m. from mouth. Proj. portion between Augusta and Swan Isld., **12,** 52. Above Augusta stream devoted to water power and lumbering, **12,** 53.

PLANS. (See Projects.)

By Col. Long, 1837, dr. chan. through Shepards Pt. Shoal, **67,** 494.

By Lt. Col. Hains, 1892, 5′ navigation, SS. landing at Augusta to Waterville; cost $45,800; also for l. lock at Augusta; cost $25,000; total est., $70,800, **92,** 547.

PRIVATE (CITY) WORK.

Dr. by Augusta, 1847, **67,** 494.

PROJECTS. (See Plans.)

By Maj. Alexander, dr. new chan. through Shepards Pt. Shoal, **67,** 493.

By Lt. Col. Thom, new chan. 7-8′ x 75′ through all shoals; est., $50,000, **67,** 490. App. by Chief of Engineers, **68,** 855. To increase w. of chan. to 100′; est., $80,000, **68,** 852, 857.

By Lt. Col. Thom, 1871, for: 1st, removal of Nehumkeg Rock; 2d, removal of a ledge and bowlders below Gardiner; 3d, dr. Upper Sands Bar; 4th, dr.

through Swan Isld.; 5th, removing ledge from chan. near Richmond; est., $12,976, **71,** 843; **72,** 931.

By Lt. Col. Thom, removal of 2 ledges of r. below Richmond; est., $13,500, **72,** 932. Removal of Half-tide Rock, ledge No. 2, and sunken ledge; est., $30,603, **73,** 1064. Removal of ledges 3, 4, and 5 and Dry Rock; est., $40,500, **74,** ii, 303; **76,** 158.

By Lt. Col. Thom, 1870 and 1878, chan. not less than 90′ w., and from 11′ to 12′ d. m. l. w., by removal of r., **70,** 81; **78,** 197; **79,** 253; **82,** 67; completed in 1883; expend., $45,500, **83,** 62.

By Lt. Col. Smith, 1888, Kennebec R. at Bath, and Augusta to lower end of Perkins Isld., removal of shoals at Beef Rock, Hatchs Rock, and South Gardiner, and building of wing dams and training walls; removal of rs. in H. at Bath and at Lovejoys Narrows, and drg. the shoals, Augusta to Gardiner; est., $410,500, **88,** 417; **89,** 527. Increased in 1892 to $428,500, **92,** 514.

Proj. revised, 1892, to provide for chan. 13′ to Sands Isld., 12′ thence to Hinckleys Shoal, and 10′ thence to Augusta; a SS. chan., 9′, w. of Swan Isld., and the removal of old bridge prs. at Hallowell, by drg., contraction works, and excavation; est., $388,500, **93,** 695.

By Maj. Roessler, 1899, chan. 16′ x 125′ m. h. w. or 11′ at m. l. w. between Gardiner Bridge and Augusta dam; est., $81,000, **00,** 1128. Au. act June 13, 1902; **02,** 841.

Au. act Mar. 2, 1907, chans. through shoals between foot of Swan Isld. and Gardiner at least 150′ w. and of such d. that for a vessel passing up the R. at usual speed on flood tide and timed to reach Gardiner at h. w. the available d. would be no less than 20.5′, and 1′ deeper over ledge; 2 training walls to be repaired and 1 lengthened 700′; est., $275,000,[1] **07,** 33.

SURVEYS.

Ordered, **67,** 17.

By Lt. Col. Thom, Hallowell to Augusta, **67,** 488, 494. **R., 68,** 852.

Narrows below Richmond, **72,** 932; **73,** 1064.

Au. act Aug. 5, 1886; made, 1888, by Lt. Col. Smith, **88,** 412, 417.

Sur. au. act Sept. 19, 1890; made, 1892, by Lt. Col. Hains, **92,** 545.

Ex. and sur. au. act Mar. 3, 1899; made by Maj. Roessler, 1899 (**R.** fav.), **00,** 1122.

From mouth to Gardiner, au. act Mar. 3, 1905; made, 1905–06, by Lt. Col. Black,[1] **07,** 43.

Ex. from mouth, along Popham Beach, au. act Mar. 3, 1909; made, 1909, by Lt. Col. Zinn (**R.** unfav.),[2] **10,** 58.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 53.

Pre. ex. and sur. of chan. w. of Swan Isld. au. act Feb. 27, 1911. **Rs.,** Lt. Col. Craighill, 1911 and 1912, with maps; est., $30,500, with $2,500 ann. mainten.,[3] **12,** 66.

Maps.[1] **90,** 442; **12,** 66.

A-219(a) RICHMOND HARBOR, KENNEBEC RIVER, ME.

APPROPRIATIONS.

1881,	$10,000,	**81,** 478.
1882,	10,000,	**82,** 495.
Total,	20,000	

CONTRACTS.

1881. J. Ginn, rubblest., $1 t., **81,** 478. S. F, Purington, drg., 29¢ c. y., **81,** 478.

1882. Kennebec Drg. Co., drg., 40¢ c. y., **83,** 416.

ENGINEERS.

Chief of Engineers. Rs., 80, 72; **81,** 66, 77; **82,** 66; **83,** 61.

In charge:

Col. G. Thom, 1880–83. **Rs., 81,** 476, 479; **82,** 493.

Col. C. E. Blunt, 1883. **R., 83,** 415.

Assistant. Lt. W. T. Rossell. **R., 81,** 480.

OPERATIONS.

1881-82. 3,124 t. rubblest. delivered in Swan Isld. wing dam; 5,300 c. y. drg. at foot of Swan Isld., **82,** 494.

1882-83. 38,977 c. y. drg. at head and foot of Swan Isld. and at Hatches Rocks, completing projd. imp., **83,** 416.

PROJECTS.

By Col. Thom, 1880, increasing d. to 11′ m. l. w., by drg. at foot of Swan Isld., and to 10′ at head of isld. and at Hatches Rocks; est., $20,000, **81,** 477. Proj. completed in 1883, **83,** 416.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Thom, **81,** 479.

A-221 SASANOA RIVER, ME. (Bath, Me., Gut opposite).

(See A–219.)

APPROPRIATIONS.

1870,	$10,000,	**70,** 81.
1871,	6,500,	**71,** 90.
1878,	17,000,	**78,** 39.
1880,	7,000,	**80,** 335.
1881,	5,000,	**81,** 68.
1896,	19,000,	**96,** 565.
1907,	44,000,	**07,** 888.
Total,[4]	108,500	

COMMERCE.

Obstructions to, **67,** 49, 499; **69,** 62.

Benefit of imp. to C., **67,** 500; **78,** 199.

C. importance of the "Gut," **78,** 199; **79,** 254.

De. of, **95,** 593.

Imp. gives practically a straight chan. 140′ w., making it easily navigated, **09,** 38.

1911, 10,462 t., **12,** 51.

CONTRACTS.

1878. J. Andrews, r. excavation, **79,** 253.

1879. W. W. Wright, dr., 30¢ c. y., **79,** 253.

1880. J. Andrews, removing r., $35 c. y., **81,** 484.

1881. G. W. Townsend, removing r., $36 c. y., **81,** 485.

1897. R. H. Rogers, ledge excavation, $10.48 c. y. ($9,432), **97,** 789.

1898. Moore & Wright, dr., 25¢ c. y. ($500), **98,** 831.

1907. F. W. Carlton, r. removal, $9.50 c. y., p. m., **08,** 930.

ENGINEERS.

Chief of Engineers. R., 67, 49; **69,** 62; **70,** 81; **71,** 90; **72,** 89; **73,** 98; **78,** 38; **79,** 45; **80,** 65; **81,** 67; **82,** 67; **83,** 62; **95,** 39; **96,** 34; **97,** 37; **98,** 46; **99,** 55; **07,** 31; **08,** 34; **09,** 37; **10,** 48; **11,** 49; **12,** 50.

In charge:

Lt. Col. G. Thom, 1867–83. **R., 67,** 498; **70,** 506; **71,** 845; **72,** 932; **73,** 1064; **78,** 196; **79,** 252; (Col.) **80,** 333; **81,** 484; **82,** 496.

Col. C. E. Blunt, 1883. **R., 83,** 418.

Lt. Col. D. P. Heap, 1895. **R., 95,** 592.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 565.

[1] H. D. 321, 59th, 2d.
[2] H. D. 411, 61st, 2d.
[3] H. D. 746, 62d, 2d.
[4] Of this amount, $7,012.31 was covered into Treas.

Maj. R. L. Hoxie, 1896–98. **R., 97,** 789; **98,** 830.
Maj. S. W. Roessler, 1899. **R., 99,** 1040.
Maj. G. A. Zinn, 1907–10. **R., 07,** 888; (Lt. Col.) **08,** 929; **09,** 971; **10,** 1093.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1155; **12,** 1364.

OBSTRUCTIONS.

Draw of Arrowsic Bridge in unsatisfactory place, **95,** 593.

OPERATIONS.

1870–71. 5,550 c. y. dr.; 918 t. r. excavated; 2 wrecks removed, **71,** 845, 846.
1871–72. 250 c. y. r. excavated, **72,** 932.
1872–73. 750 c. y. r. excavated, **73,** 98, 1065.
1878–79. 111½ c. y. r. excavated, **79,** 46, 253.
1879–80. 185½ c. y. r. removed from ledge; 11,800 c. y. dr. at shoal above upper Hell Gate; 1,200 t. st. placed in j., **80,** 334.
1880–81. Removal of 120 c. y. r., at $36, **81,** 485.
1881–82. Removal of sunken ledges completed, **82,** 497.
1882–83. Removal of 57 c. y. r. Imp. completed as orig. proj. **83,** 419.
1896–97. 113 c. y. r. removed, **97,** 789.
1897–98. About 700 c. y. r. removed and 955 c. y. dr. Beacon built on j., proj. completed. **98,** 830.
1907–08. 740 c. y. r. removed, **08,** 929.
1908–09. 2,126 c. y., p. m., r. removed, completing proj., **09,** 971.

PHYSICAL CHARACTERISTICS.

Tides, **67,** 499.
Character of ledge, **71,** 845.
Velocity of current, **71,** 846.
The "Gut" described, **78,** 198.
De. of, **80,** 333; **95,** 593.

PROJECTS.

By Col. Thom, 1870 and 1878, chan. not less than 90′ wi. and from 11′ to 12′ d. m. l. w., by the removal of r., **70,** 81; **78,** 197; **79,** 253; **82,** 67. Proj. completed in 1883 by expend. of $45,500, **83,** 62.

By Maj. Heap, 1894, dr. 12′ at Carleton Ledges; for wi. the chan. at upper Hell Gate to 125′ with d. of 12′; est. cost, including a beacon on the j. at Camp Ground, $19,000, **95,** 594.

Act Mar. 2, 1907, proj. to increase wi. to not less than 140′, and to remove Flat R., to 12′., m. l. w.; est., $44,000,[1] **07,** 32.

SURVEYS.

By Lt. Col. Thom, 1867 and 1878, **67,** 499; **79,** 253.
Ex. at Bath, Augusta to Perkins Isld., au. act Aug. 5, 1886, **87,** 22. (See Kennebec R., Me.)
Sur. au. act Aug. 17, 1894; made, 1894, by Maj. Heap, **95,** 593.
Cong. docs., etc., relating to ex., surs., plans, etc. **12,** 51.
Maps. **80,** 334.

A-226(a) COBESSECONTE CANAL, ME.[2]

A-230 CATHANCE RIVER, ME.

APPROPRIATIONS.

1880,	$10,000,	**80,** 333.
1881,	6,000,	**81,** 483.
1882,	5,000,	**82,** 495.
Total,	21,000	

COMMERCE.

Benefit to C. from imp., **81,** 483.

CONTRACTS.

1880. W. W. Wright, dr., 27¢ c. y., **81,** 484; completed, **81,** 482. Eastern Dredging Co., dr., 21¢ c. y., **81,** 484; completed, **82,** 495.
1882. Kennebec Dredging Co., dr., 34¢ c. y., **83,** 418; completed, **84,** 465.

ENGINEERS.

Chief of Engineers. **R., 80,** 65, 71; **81,** 67; **82,** 66; **83,** 61; **84,** 70.
In charge:
Col. G. Thom, 1879–83. **R., 80,** 332, 354; **81,** 482; **82,** 495.
Col. C. E. Blunt, 1883–84. **R., 83,** 417; **84,** 465.
Assistant. E. C. Jordan. **R., 80,** 355.

OPERATIONS.

1880–81. 31,347 c. y., dr., **81,** 482.
1881–82. 27,922 c. y., dr., **82,** 495.
1882–83. 9,450 c. y., dr., **83,** 417.
1883–84. Contract with Kennebec Dredging Co., dr., completed, **84,** 465. Imp. completed, **84,** 465.

PROJECTS.

By Col. Thom, 1879, imp. R. at its junction with the Kennebec, by dr. chan. 10′ m. l. w. and a w. of not less than 200′ from the outlet of the R. into Merry Meeting B. to the chan. of the Kennebec R. near "The Chops," about 2½ m.; est., $25,000, **81,** 67.

SURVEY.

Au. act Mar. 3, 1879, **79,** 52; made, 1880, by Lt. Col. Thom, **80,** 354, 355.
Maps. **80,** 332.

A-233 ANDROSCOGGIN RIVER (at and below Brunswick), ME.

ENGINEERS.

Chief of Engineers. **R., 81,** 77; **82,** 77; **84,** 73.
In charge. Col. G. Thom, 1882–83. **R., 82,** 527; **84,** 473.
Col. C. E. Blunt, 1883–4.
Assistant. Lt. W. T. Rossell. **R., 82,** 528.

PLANS.

By Col. Thom, 1881, dr. chan. at Brunswick, 6½′ x 150′ d. l. w., through the shoals above Foster Isld., with bank protection and closure of chan. n. of Cow Isld.; no information as to necessity of imp. or its benefit to C.; est. cost, $34,000, **82,** 528, 530.

SURVEY.

Au. act Mar. 3, 1881, made by Col. Thom, 1881, **82,** 527.
Ex. below Brunswick (**R.** unfav.), **84,** 473.

[1] R. & H. C. 47, 61st, 2d.
[2] Sur.—**R.** Feb. 18, 1828. H. D. 482 55th, 2d.

A-233(a) BRUNSWICK CANAL AND HARBOR, ME.[1]

(See Androscoggin River.)

A-234(a) AMMONOSOOK CANAL, N. H.[2]

A-238(a) PARKERS HEAD HARBOR AND CHANNEL, ME.

COMMERCE.

De. of, **95,** 581; **1900,** 1137.
Limited, **95,** 581.

ENGINEERS.

Chief of Engineers. **R., 95,** 38; **99,** 62; **1900,** 64.
In charge:
Lt. Col. D. P. Heap, 1895. **R., 95,** 581.
Maj. S. W. Roessler, 1900. **R., 00,** 1131, 1136
Assistants:
A. C. Both. **R., 1900,** 1134.
F. S. Burrowes. **R., 1900,** 1137.

PHYSICAL CHARACTERISTICS.

De. of, **95,** 581; **00,** 1136.

SURVEYS.

Ex. au. act Aug. 17, 1894, made, 1894, by Lt. Col. Hains (**R.** unfav.), **95,** 581.
Ex. and sur. au. act Mar. 3, 1899, made, 1899, by Maj. Roessler (**R.** unfav.), **00,** 1132, 1136.

A-244(a) CAPE SMALL HARBOR, ME.

COMMERCE.

H. used to small extent by fishing boats and launches, **04,** 794.

ENGINEERS.

Chief of Engineers. **R., 04,** 34.
Board of Engineers (R. & H.) concurs in Maj. Roessler's opinion, 1902, that H. unworthy of imp., **04,** 795.
Engineer in charge. Maj. S. W. Roessler. **04,** 34; **R.,** 794.

PHYSICAL CHARACTERISTICS.

Detailed de., **04,** 793.

SURVEY.

Pre. ex. au. act June 13, 1902; **R.,** 1902, by Maj. Roessler (unfav.) [3] **04,** 793.

A-245 NEW MEADOWS RIVER, ME.

ENGINEERS.

Chief of Engineers. **R., 12,** 66.
In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910; **R.** to come, **12,** 66.

A-254(a) SOUTH HARPSWELL, ME. (Channel near.)

ENGINEERS.

Chief of Engineers. **R., 08,** 44.
In charge. Lt. Col. Geo. A. Zinn, **08,** 26.

SURVEY.

Ex. and sur. au. act Mar. 2, 1907, with view to removing ledge off Potts Pt.; **Rs.** by Lt. Col. Zinn, 1907 and 1908 (unfav.),[4] **08,** 44.
Maps.[4]

A-259(a) HARRASEEKET (HARRISECKET) RIVER, ME.

APPROPRIATIONS.

1890,	$10,000,	**91,** 595.
1892,	16,000,	**92,** 517.
1894,	5,000,	**95,** 562.
Total,	31,000	

COMMERCE.

Confined to a single, small steamer, which makes daily trips to Portland, Me. **97,** 816.

CONTRACTS.

1893. Moore & Wright, dr., 17½¢ c. y. s. m. ($26,250), **94,** 513.
1895. Moore & Wright, dr., 17¢ c. y. s. m. ($6,800), **95,** 562.

ENGINEERS.

Chief of Engineers. **R. 82,** 77; **89,** 31; **91,** 26; **92,** 31; **93,** 30; **94,** 29; **95,** 31; **96,** 35; **97,** 44.
In charge:
Col. G. Thom. **R., 82,** 530.
Lt. Col. J. A. Smith, 1889–92. **R., 89,** 550; **91,** 594.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 516; **93,** 699; **94,** 512.
Lt. Col. D. P. Heap, 1895. **R., 95,** 561.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 566.
Maj. R. L. Hoxie, 1897. **R., 97,** 815.
Assistants:
A. C. Both. **R., 82,** 531.
W. F. Robinson. **R., 97,** 816.

OPERATIONS.

1893-94. Dr. in progress, **94,** 513.
1894-95. 94,000±c. y. dr., **95,** 561.
1895-96. 69,000±c. y. dr., completing proj., **96,** 567.

PHYSICAL CHARACTERISTICS.

De. of, **89,** 551.

PLANS.

Col. Thom, 1881, dr. chan. Weston Pt. to Freeport Landing, 60′ x 12½′ h. w., with a basin at Freeport 180′ w.; est., $13,000, **82,** 531.

PROJECTS.

By Lt. Col. Smith, 1889, at H. entrance excavat. chan. 14′ x 60′ m. l. w., and constr. of wing dams; est., $36,000, **89,** 551; **92,** 516.

SURVEYS.

Au. act Mar. 3, 1881, made by Col. Thom, **82,** 530.
Ex. au. act Aug. 11, 1888, made, 1889, by Lt. Col. Smith, **89,** 550.
Sur. au. act June 3, 1896. Ex. by Lt. Col. A. N. Damrell in 1897 (**R.** unfav.), **97,** 815.

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[1] Sur.—**R.,** Feb. 18, 1828. (H. D. 482, 55th, 2d.)
[2] Sur.—**R.,** Feb. 18, 1828. No est.—H. D. 482, 55th, 2d.
[3] H. D. 244, 58th, 2d.
[4] H. D. 971, 60th, 1st.

A-260(a) ROYAL RIVER, ME.

APPROPRIATIONS.

1871,	$10,000,	**71,** 90.
1872,	10,000,	**72,** 89.
1882,	10,000,	**83,** 420.
Total,	30,000	

COMMERCE.

Not unimportant, **71,** 850; **73,** 1066.
De. of, **95,** 579.
Small, **97,** 817.

CONTRACTS.

1871. W. R. Stockbridge, dr., 2,945 c. y., 49½¢ c. y., **71,** 847. Contract abandoned, **72,** 89, 933.
1872. A. R. Wright, dr. 13,782 c. y., 49¢ c. y., **72,** 933; **73,** 1066.
1883. S. F. Hamilton, wing-dam constr., **83,** 420. A. R. Wright, dr., 26¢ c. y., **84,** 467.

ENGINEERS.

Chief of Engineers. R., 70, 31, 83; **71,** 90; **72,** 89; **73,** 98; **83,** 62; **84,** 70; **95,** 38; **97,** 44.
In charge:
Lt. Col. G. Thom, 1870–73. **R., 71,** 846; **72,** 933; **73,** 1065.
Col. C. E. Blunt, 1883–84. **R., 83,** 419; **84,** 466.
Lt. Col. D. P. Heap, 1895. **R., 95,** 579.
Maj. R. L. Hoxie, 1897. **R., 97,** 816.
Assistant. W. F. Robinson. **R., 97,** 817.

OPERATIONS.

1871-72. 8,963 c. y. dr., **72,** 933.
1872-73. 7,764 c. y. dr.; chan. 100′ x 4½′ m. l. w.; 3,640 t. r. removed, **73,** 1066.
1882-83. 2,227 t. rubblest. delivered, **83,** 420.
1883-84. 20,000 c. y. dr. from chan., terminating imp., **84,** 466.

PHYSICAL CHARACTERISTICS.

Rocks and bars in the chan.; character of currents, **71,** 90, 846 et seq.
De. of, **95,** 580.
A small stream with a narrow and crooked chan., **95,** 580.

PROJECT.

By Lt. Col. Thom, r. excavat. and dr.; est., $35,000, **71,** 846, 848.
By Col. Blunt, 1883, remedying obstr. caused by land-slide opposite Wolf's Pt. by constr. of a rubble-st. wing-dam just above the obstr., and dr. to direct the current into a new chan. est., $10,000, **83,** 419,; 420.

SURVEYS.

1870. By Lt. Col. Thom. **R., 71,** 847.
Ex., village of Yarmouth to Casco B., au. act Aug. 17, 1894, made by Lt. Col. Hains, 1894 (**R.,** fav.), **95,** 579.
Sur. au. act of June 3, 1896, by Lt. Col. Damrell 1897, (**R.** unfav.), **97,** 816.

A-262 PORTLAND HARBOR, ME.[1]

APPROPRIATIONS.

1836,	$10,000.00,	**66,** iii, 28; **78,** 199; **79,** 255.
1837,	25,000.00,	
1838,	26,366.00,	
1866,	105,111.05,	
1870,	10,000.00,	**70,** 80.
1871,	40,000.00,	**71,** 91.
1872,	[2] 45,000.00,	**72,** 90.
1873,	50,000.00,	**73,** 99.
1874,	20,000.00,	**74,** 109.
1875,	20,000.00,	**75,** 115.
1881,	20,000.00,	**81,** 488.
1882,	35,000.00,	**82,** 498.
1884,	30,000.00,	**84,** 468.
1886,	30,000.00,	**86,** 540.
1888,	40,000.00,	**88,** 386.
1890,	40,000.00,	**90,** 445.
1892,	30,000.00,	**92,** 519.
1896,	[3] 20,000.00,	**96,** 570.
1897,	[3] 350,000.00,	**97,** 790.
1898,	[3] 200,000.00,	**98,** 832.
1901,	21,000.00,	**01,** 1007.
1905,	100,000.00,	**05,** 791.
1906,	80,000.00,	**06,** 862.
1907,	59,000.00,	**07,** 891.
1912,	100,000.00,	**12,** 1366.
Total,	1,506,477.05	(Total, incl. miscl. and apprns. for Back Cove (q. v.), $1,622,736.49, **12,** 1366).

COMMERCE.

Benefit to, **67,** 486; **68,** 844; **69,** 448; **70,** 500.
Board of trade request extension to wharf line of dr. chan., **73,** 1071.
New R. R. and SS. lines, **74,** ii, 306; **86,** 542.
De. of, **93,** 736.
Portland the principal R. R. center and port of C. n. and e. of Boston, **01,** 1010.
Importance as a H. of refuge and naval base during time of war, **01,** 1011.
Large and well-sheltered d.-w. anchorage created under shelter of break'r, and trans-Atlantic vessels can arrive and depart from docks at lowest stages of tide; large ships reducing cost of trans., **08,** 38; **12,** 56.
In 1900, 2,261,008 t., **01,** 133; 1909, 2,956,011 t., **10,** 1095; 1911, 3,162,024 t. (one-half coal), 1,967,000 ± passengers, **12,** 1367.
Diagram, curves of C. and apprns., **12,** 1366.

CONTRACTS.

1867. Pierce & Rowe, st. G. P. Wescott, labor. Charles Staples & Son, bolts, **68,** 843; **69,** 447.
1868. A. B. Cooley & Co., dr., 34¢, 4,370 y.; abandoned. A. R. Wright, dr., 60¢, 4,120 y. (see Operations), **69,** 477, 460.
1869. Morris & Cummings, dr., 56¢, 118,415 y., **69,** 448.
1871. G. C. Fobes, dr., 45¢, 78,400 y., **71,** 851; **72,** 934.
1872. F. N. Lord and A. R. Wright, st. work. A. R. Soulé and Hugh Bowen, foundation, 3,766 t. Curtis & Fobes, dr., 25¢, 24,938 y., **73,** 1067; **74,** ii, 304.
1873. A. R. Wright, dr., 35¢ and 50¢, 136,849 y., **73,** 1068; **74,** ii, 304; **75,** ii, 394.
1880. G. C. Fobes, dr., 15¾¢ c. y., **81,** 488.
1881. G. C. Fobes, dr., 17¢ c. y., **81,** 488.
1882. Moore & Wright, dr., 13⅞¢ c. y., **83,** 422.
1884. Moore & Wright, dr., 14¢ c. y., **85,** 470.
1887. National Dredging Co., dr., 13¢ c. y., **87,** 450. A. D. Smith, boathouse constr., $400, **87,** 450.
1888. Moore & Wright, dr., 34¢ c. y. for hard and 17¢ c. y. for soft, **89,** 531.
1891. Moore & Wright, 19¢ c. y. for hard and 9½¢ for soft, **91,** 596.
1892. Moore & Wright, dr., 28¢ c. y., s. m. ($3,080), **93,** 704.
1894. Moore & Wright, dr., 15¾¢ c. y. ($23,625), **94,** 516.
1897. G. M. Valentine & Co., dr., 14.4¢ and 20¢ c. y., p. m. (quantity dependent on progress), **97,** 791.
1900. Morris & Cummings Dredging Co., dr., 13.85¢ and 16.5¢ c. y., p. m. ($349,477.58), **00,** 1099.
1905. Coastwise Dredging Co., dr., 87,500± c. y., s. m., 30¢ c. y., and about 1,325,000 c. y., s. m., 13⅞¢ c. y., with $10 t. for bowlders exceeding 5 t. in weight each, **06,** 862.

[1] Sur. R. Nov. 1, 1832, est. $94,852.28 (H. D. 482, 55th, 2d.).
[2] Included imp. of "Back Bay" (or "Cove"), **73,** 1066.
[3] Back Cove. See Projects.

ENGINEERS.

Chief of Engineers. Instructs officer in charge to make current and tidal observations, **67,** 486; to submit est. for dr., **68,** 847, 851; to advertise anew for bids for dr., **69,** 454; approves proj. for dr., **68,** 851; reports to Sec. of War that break'r is not being extended, and regarding grounding of SS. on bar, **68,** 850.

R., 66, 3, ii, 30, 40, iii, 18, 28; **67,** 48; **68,** 71; **69,** 61; **70,** 80; **71,** 90; **72,** 90; **73,** 99; **74,** 108; **75,** 115; **76,** 40; **77,** 35; **78,** 39; **79,** 46; **80,** 66; **81,** 68; **82,** 67; **83,** 62; **84,** 70; **85,** 58; **86,** 57; **87,** 17; **88,** 16; **89,** 25; **90,** 21; **91,** 27; **92,** 32; **93,** 30, 38; **94,** 30; **95,** 32; **96,** 36; **97,** 37; **98,** 47; **99,** 55; **00,** 60; **01,** 131, 133; **02,** 76; **03,** 51; **04,** 32; **05,** 35; **06,** 32, 41; **07,** 35; **08,** 37, 44; **09,** 41; **10,** 51; **11,** 52; **12,** 54, 65.

Boards. Convened June 12, 1867, Portland, Me.; recom. adoption of Col. Alexander's plan. (See Proj.) **R.** of the board, **67,** 487. (Col. Bache, Lt. Col. Thom, and Maj. Casey.)

In charge:

Col. J. D. Graham, 1865; **66,** 3. **R., 66,** 36, 39.

Maj. R. S. Alexander, 1865–66; **66,** ii, 40, iii, 18. **R., 66,** iv, 185.

Lt. Col. G. Thom, 1866–83; **66,** iii, 18. **R., 66,** iv, 187; **67,** 485, 487; **68,** 843, 847; **69,** 446, 460 (on merits of different dredges, **69,** 460, 465); **70,** 498, 505; **71,** 850; **72,** 934; **73,** 1066; **74,** ii, 304; **75,** ii, 393; **76,** 159; **77,** 164; **78,** 199; **79,** 255; (Col.) **80,** 335; **81,** 486; **82,** 498.

Col. C. E. Blunt, 1883–86. **R., 83,** 421; **84,** 467; **85,** 469.

Maj. J. A. Smith, 1886–92. **R., 86,** 538, 541; **87,** 448; (Lt. Col.) **88,** 385; **89,** 529; **90,** 444; **91,** 595; **92,** 517.

Lt. Col. P. C. Hains, 1892–94. **R., 93,** 701, 735; **94,** 514.

Lt. Col. D. P. Heap, 1895. **R., 95,** 563.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 568.

Maj. R. L. Hoxie, 1897–98. **R., 97,** 790; **98,** 832.

Maj. S. W. Roessler, 1899–1904. **R., 99,** 1041; **00,** 1097; **01,** 1006, 1015; **02,** 842; **03,** 725; **04,** 791.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 793; **06,** 861.

Maj. G. A. Zinn, 1907–10. **R., 07,** 890; **08,** 933; **09,** 974; (Lt. Col.) **10,** 1095.

Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1157; **12,** 1366.

Assistants:

A. G. Childs (current and tidal observations), **67,** 486; **68,** 843.

F. S. Burrowes. **R., 01,** 1016.

ESTIMATES. (See Plans and Projects.)

By Col. Graham, 6,000 c. f. of st., 600 l. f. of capping, and 400 l. f. extension of break'r, $105,111.05, **66,** 40. Detailed est. for same, **66,** 41, 42.

By Maj. Alexander, completion of break'r without extension, $60,286.41, **66,** iv, 187.

By Lt. Col. Thom, 1868, completing break'r, $59,984; for dr. to 20′, $28,600; **68,** 848, 849.

By Lt. Col. Thom, 1869, in detail, for dr. chan. to 20′ by day labor and purchase of dr., $24,000 to $40,000, **69,** 461. Est. compared with lowest bids received, **69,** 464. To increase w. of chan. 100′ $25,000, **70,** 499, 506. To increase w. of chan. to 500′, $40,000, **71,** 851. For dr. in "Back Bay," 40,000 c. y., $10,000, **72,** 934.

By Lt. Col. Thom, for dr. in Inner H., $60,000, **73,** 1068; $110,000, **73,** 1071.

LEGISLATION.

Joint resolution of Cong. appr. June 5, 1868, permitted unexpend. balance of app. to be used in dr. the "Middle Ground," and protecting and imp. the chan., **68,** 844, 847.

OBSTRUCTIONS.

Fore River, lower part of H., is crossed by 4 drawbridges, which limit navigation, but since their imp. greater facilities to coal trade and other deep-draft vessels than before, when they were greatly hampered and retarded by lack of room and sufficient water, **12,** 56.

OPERATIONS.

1838. 1,763 l. f. break'r extension; 1,030′ only completed, **78,** 199.

1866-67. Repairs to break'r, **67,** 49, 488.

1867-68. 538 l. f. break'r capping, **68,** 71, 844.

1868-69. 195 l. f. break'r capping; 4,120 c. y. spit (obtained by subtracting the sum of the other figures from the total number of yds. excavated), and 4,370 c. y. middle ground dr., **68,** 844; **69,** 61, 447.

1869-70. 90,815 c. y. middle ground dr., **70,** 80, 499.

1870-71. 28,100 c. y. middle ground dr., **70,** 505; **71,** 91, 850.

1871-72. 78,400 c. y. middle ground dr., **72,** 90, 934.

1872-73. P. extension commenced, **73,** 1068.

1873-74. 217 l. f. break'r capping; 242 l. f. break'r extension; 24,938 c. y. back bay dr.; 49,609 c. y. inner H. dr.; wreck removed; repairs, **74,** 108.

1874-75. 87,240 c. y. inner H. dr., **75,** ii, 394.

1875-76. 2,932 c. y. inner H. dr.; dr. at custom-house dock, **76,** 159.

1876-79. Operations suspended pending delay in removing private docks projecting into H., **79,** 256.

Total amount of dr., 370,024 c. y., **78,** 200; **79,** 256.

1880-81. 67,756 c. y. dr., **81,** 487.

1881-82. 249,468 c. y. dr., **82,** 498.

1882-83. 170,347 c. y. dr., **83,** 421.

1883-84. 69,063 c. y. dr., **84,** 467.

1884-85. 124,603 c. y. dr., **85,** 469.

1885-86. 19,890 c. y. dr., **86,** 539.

1886-87. 29,000 c. y. dr., **87,** 449.

1887-88. 169,872 c. y. dr., **88,** 386.

1888-89. 77,792 c. y. soft and 61,265 c. y. hard sand dr., **89,** 530.

1891-92. Dr. in continuation of the 29′ chan., **92,** 519.

1892-93. About 326,000 c. y. dr., **93,** 703.

1894-95. About 150,000 c. y. dr. Proj. completed. **95,** 565.

1897-98. Over 600,000 c. y. dr., **98,** 832.

1898-99. Over 800,000 c. y. dr., **99,** 1041.

1899-00. Over 429,000 c. y. dr., **00,** 1097.

1900-01. 821,900 c. y., p. m., excavated under contract, **01,** 1006.

1901-02. 1,355,208 c. y., p. m., dr. under contract, **02,** 842.

1902-03. 257,365 c. y., p. m., dr. under contract; completing it Oct. 22, 1902, **03,** 725.

1905-06. 321,550 c. y., s. m., dr., making chan. leading to Back Cove the full proj. d. for w. of 100′, with greater w. at bends and at upper end, and a chan. of similar dimensions in Fore R. from first br. to and through draw of second, **06,** 861.

1906-07. 872,000 c. y., s. m., dr., i. e.: 435,000 c. y. from Fore R., 378,000 c. y. from entrance to Back Cove, and 59,000 c. y. from area in front of old dry dock, **07,** 890.

1907-08. 487,539 c. y. dr., completing Back Cove entrance chan., area in front of old dry dock, and Fore R. chan., except about 30,000 c. y. to be removed from area above Vaughan br., **08,** 933.

1908-09. 52,052 c. y. dr. from upper part of Fore R., **09,** 974.

1909-10. Observation and supervision, **10,** 1095.

PHYSICAL CHARACTERISTICS.

Location described, **66,** 39; **12,** 54.

Currents and tides discussed, **66,** iv, 185.

Formation of bar, **68,** 848.

Wharves projecting beyond dock line, **73,** 1072.

Max. draft that can be carried to wharves in Back Cove about 11′, and to wharves in lower part of Portland H. about 29′, m. l. w., **01,** 1006.

Obstructions at entrance, **01,** 1012.

Entrance to main part of H. has always been good, but before imp. approach to inner H. was obstr. by shoal, the Middle Ground, with d. of from 8′ to 10′, m. l. w.; between it and Stamford Ledge greatest d. was 16′, **12,** 54.

Best part of wharf front was exposed to swell from main entrance; d. was as shallow as 4′, **12,** 54.

Imps. have afforded great relief to domestic and trans-Atlantic d.-draft vessels, **12,** 56.

H. in sw. Maine, **12,** 54.

PLANS. (See Estimates and Projects.)

By Col. Graham, repairs and extension of break'r, **66,** 40.

By Maj. Alexander, adverse to extension, **66,** iii, 18, iv, 185.

PRIVATE AND CORPORATE WORK.

Projecting wharves hindering dr. in inner H., **73,** 1072; **74,** ii, 305; **75,** ii, 394.

PROJECTS. (See Estimates and Plans.)

By Maj. Alexander, completion without extension of break'r, **66,** 40; appr. by BE., **67,** 485.

By Lt. Col. Thom, dr. a 300′ chan. to 20′ water, **68,** 848; appr. by the Chief of Engineers, **68,** 851.

By Lt. Col. Thom, extending break'r about 200′ and building a lighthouse p., **72,** 934; and dr. a chan. in Back Bay" 8′ x 100′, m. l. w., appr. by Chief of Engineers, **73,** 1067.

By Lt. Col. Thom, imp. inner H., **73,** 1068.

App. of 1836, 1837, and 1838, aggregating $61,336, applied toward the partial constr. of 1,763 l. f. of break'r on Stanfords Ledge, **78,** 199; **79,** 255.

From 1866 to 1884, incl., $375,111.05 was app. and applied to the completion of the break'r to 2,005′, the d. of the lower H. by dr. to 21′, m. l. w., and to 16′ as far up as Browns Wharf, and a small chan. in the Back Cove to 8′, m. l. w, **79,** 256; **86,** 57, 538; **87,** 451.

In 1886 Maj. Smith proposed increasing, by dr., the chan. approaching the lower wharves to w. of 500′ and a d. of 29′, m. l. w.; est., $135,000, **86,** 540; **87,** 449. Total expend. to 1888, $30,000. Amount required to complete proj., $105,000, **88,** 385, 386. Modified in 1889 to include d. the water front in the upper part of the H. to 16′, m. l. w.; est. additional cost, $5,000, **90,** 444; **92,** 518.

Proj. amended, 1894–95, to provide w. the upper end of the 29′ chan., and opening a 25′ chan. to connect the lower and upper ends of the H., **94,** 516.

Proj. adopted by Congress 1896 for dr. to 30′, m. l. w., a portion on the n. of the H. line of the southerly side of the H.; est., $770,000, under continuous contract; combining with this a proj. for the completion of the imp. of Back Cove, **96,** 568; proj. completed, 1902, for $253,000 less than est., **12,** 55.

Act Mar. 3, 1905, au. amendment to proj., by which 30′ chan. be continued up Fore R. as far as the Boston & Maine R. R. br., and a chan. of entrance to Back Cove dr. to same d.; w. in each case to be about 300′, **05,** 35.

Act July 25, 1912, au. enlarging dw. anchorage opposite e. end of city, excavating r. and other material, so as to give a chan. 14′, m. l. w., between Grand Trunk and Tukeys brs. at entrance to Back Cove; for restoring chan. in Back Cove to 12′, m. l. w., for redr. portion of chan. of approach to Back Cove; and restoring 30′ d. over the most important part of main H.; est., $460,000, with $2,000 an. mainten.,[1] **12,** 55.

SURVEYS.

Current and tidal observations, 1867, **67,** 486.

Minute hydrographic sur. by Col. Thom, 1867 with aid of the U. S. Coast Survey, **68,** 843, 848.

Triangulation and sur. of wharves and H. lines, 1875–76, **76,** 40.

Resur. of H., 1880, **80,** 336.

Ex., with a view to extending chan. along the front of the wharves on the s. side of the H. to give 8′, m. l. w., to Plush Mill wharf, au. act July 13, 1892, made by Lt. Col. Hains, 1892 (**R.** unfav.), **93,** 735.

Pre. ex. and sur. au. act June 6, 1900, with view to removing so much of Witch Rock as endangers navigation. **R.** by Maj. Roessler, Oct. 18, and Nov. 17, 1900; est., $500,000,[2] **01,** 133.

Pre. ex. au. act Mar. 3, 1905, with a view to incl. Fore R. above Portland br. and entrance to Back Cove. **R.** by Lt. Col. Black, Dec. 22, 1905[3] (unfav.), **06,** 41.

Pre. ex. and sur. au. act Mar. 2, 1907, of passage between Peaks Isld. and Great Diamond Isld., between main ship chan. of Portland H. and Husseys Sound, Me. **R.** by Maj. Zinn, 1907 and 1908,[4] **08,** 44.

Pre. ex. and sur. au. act June 25, 1910. **R.** by Lt. Col. Craighill, Feb. 17, 1911, and Nov. 24, 1911, with map; est., $460,000, with $2,000 an. mainten.,[1] **12,** 65.

Cong. docs., etc., relating to ex., surs., plans, etc. **12,** 55.

Maps. Of Portland H. and Break'r, **66,** i.

80, 336; **86,** 542; **87,** 450; **01,** 1008; H. D. 489, 62d, 2d.

A-262 (a) PEAKS ISLAND AND GREAT DIAMOND ISLAND, ME. (passage between).

ENGINEERS.

Chief of Engineers. **R.,** **08,** 44.
In charge. Lt. Col. Geo. A. Zinn, **08,** 26.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907, between main chan. of Portland H. and Husseys Sound, Me. **R.,** by Lt. Col. Zinn, 1907 and 1908[4] (unfav.), **08,** 44.

A-263 PORTLAND (Back Cove), ME.

APPROPRIATIONS.

1886,	$26,250,	**87,** 453.
1888,	25,000,	**88,** 388.
1890,	25,000,	**90,** 446.
1892,	20,000,	**92,** 521.
1894,	20,000,	**95,** 567.
Total,	116,250	

COMMERCE.

Development of business in consequence of the imp., **90,** 445.

CONTRACTS.

1887. J. E. Chapman, dr., 16¢ c. y., **87,** 453.
1889. E. Moore, dr., 22¢ c. y., **89,** 533.
1891. National Dredging Co., dr., 11¢ c. y., **91,** 598.
1894. C. W. Anthony, dr., 14.2¢ c. y., s. m. ($15,620), **94,** 518. Moore & Wright, dr., 16.5¢ c. y., s. m. ($19,800), **95,** 567.

ENGINEERS.

Chief of Engineers. **R.,** **87,** 18; **88,** 17; **89,** 26; **90,** 21; **91,** 27; **92,** 33; **93,** 31; **94,** 31; **95,** 33; **96,** 37.

In charge:

Maj. J. A. Smith, 1886–92. **R.,** **86,** 541; **87,** 451; (Lt. Col.) **88,** 387; **89,** 531; **90,** 445; **91,** 597.

Lt. Col. P. C. Hains, 1892–94. **R.,** **92,** 520; **93,** 705; **94,** 517.

Lt. Col. D. P. Heap, 1895. **R.,** **95,** 566.

Lt. Col. A. N. Damrell, 1896. **R.,** **96,** 570.

OBSTRUCTIONS.

Obstr. of Back Cove Chan. by Grand Trunk R. R. br., **90,** 445.

OPERATIONS.

1887-88. Sur. of chan. and preparations for dr., **87,** 452. 49,602 c. y. dr., **88,** 388.
1888-89. 114,130 c. y. dr., **89,** 531, 532.
1889-90. 74,542 c. y. dr., **90,** 445.

[1] H. D. 489, 62d, 2d. [2] H. D. 85, 56th, 2d. [3] H. D. 445, 59th, 1st. [4] H. D. 896, 60th, 1st.

1892-93. 208,000± c. y. dr., **93,** 706.
1894-95. 150,000± c. y. dr., **95,** 566.
1895-96. 96,000± c. y. dr., **96,** 571.

PROJECTS.

By Maj. Smith, 1886, w. and d. chan. in Back Cove to afford chan. 300′ x 12′ m. l. w. for 5,600′ along the H. commissioners' line; est., $181,000, **86,** 542; **87,** 452; reduced to $180,000, **88,** 387; **92,** 520.

Proj. of 1886 combined with proj. for imp. of Portland H., **96,** 571.

SURVEY.

Of chan. in Back Cove, **87,** 452.
Maps. **88,** 388.

A-265(a) RICHMOND ISLAND, ME. (Breakwater).

APPROPRIATIONS.

1852,	$10,000,	**67,** 484.
1872,	20,000,	**72,** 90.
1873,	60,000,	**73,** 99.
1875,	15,000,	**75,** 115.
1878,	6,000,	**78,** 39.
1879,	3,000,	**79,** 47.
1880,	3,000,	**80,** 337.
1881,	3,000,	**81,** 490.
Total,	120,000	

COMMERCE.

Benefit of imp., **67,** 485; **72,** 1072.
Importance of work as a H. of refuge, **81,** 490.

CONTRACTS.

1872. E. Moore, st., **73,** 1073.
1873. J. M. Andrews, st.; I. Hamilton, st., **73,** 1073.
1875. I. Hamilton, st.; D. N. Hill & S. F. Hamilton, st., **75,** ii, 396.
1878. J. F. Hamilton, st.; S. F. Hamilton & J. F. Currit, st., **79,** 257.
1879. H. Hamilton, granite grout, $1.05 t., **80,** 337.
1880. H. Hamilton & R. S. Smart, granite grout, $1.04 and $1.09 t., **81,** 491.
1881. C. H. Bragdon, granite quarry grout, $1.28 t., **81,** 491.

ENGINEERS.

Chief of Engineers. R., 67, 48; **69,** 62; **70,** 80; **72,** 90; **73,** 99; **74,** 109; **75,** 115; **76,** 41; **77,** 35; **78,** 39; **79,** 46; **80,** 67; **81,** 69; **82,** 68.

In charge:

Col. J. D. Graham, 1865; **66,** 36.
Lt. Col. G. Thom, 1867–82. **R., 67,** 484; **72,** 935; **73,** 1072; **74,** ii, 306; **75,** ii, 396; **76,** 160; **77,** 164; **78,** 201; **79,** 257; (Col.), **80,** 336; **81,** 489; **82,** 499.

OPERATIONS.

1853-54. Constr. of break'r, **67,** 484.
1872-73. Constr. of break'r, 9,858$\frac{2040}{2240}$ t. st. used, **73,** 1073.
1873-74. Constr. of break'r, 33,330$\frac{320}{2240}$ t. st. used, **74,** 109, ii, 307.
1874-75. Constr. of break'r, 10,861 t. st. used, **75,** 115.
1875-76. Constr. of break'r, 4,093 t. st. used, **76,** 41.
1878-79. Constr. of break'r, 5,980$\frac{60}{2240}$ t. st. used, **79,** 46, 258.
1879-80. 2,400 t. granite grout placed in break'r, **80,** 336.
1880-81. 1,827 t. granite grout placed in break'r, **81,** 489.
1881-82. 2,020 t. granite quarry grout placed in the break'r, completing proj. by a total of 68,176½ t., **82,** 499.

PHYSICAL CHARACTERISTICS.

Formation of bar, **67,** 484.

PROJECT.

By Lt. Col. Thom, 1867, rubblest. break'r, 2,000′ x 30′ x 13′; est. originally, $93,500; subsequently $80,000, **67,** 48, 484; **72,** 935; **76,** 160; **79,** 257; **80,** 336. Completed in 1882 at cost of $110,000, **82,** 499.

SURVEY.

By Lt. Col. Thom, **67,** 484.

A-269 SACO RIVER, ME.

APPROPRIATIONS.

1824,	[2] $5,000,	**66,** iii, 28.
1827,	[3] 7,000,	**66,** iii, 28.
1866,	[4] 40,000,	**66,** iii, 18, 28.
1867,	40,000,	**67,** 48.
1868,	*20,000,	**69,** 444.
1869,	*22,275,	**69,** 22.
1870,	10,000,	**70,** 79.
1871,	15,000,	**71,** 91.
1872,	15,000,	**72,** 91.
1884,	[5] 15,000,	**85,** 472.
1886,	[5] 12,500,	**86,** 545.
1886,	[5] 12,500,	**87,** 458.
1888,	[5] 12,500,	**88,** 389.
1888,	10,000,	**88,** 391.
1890,	[6] 65,000,	**90,** 448.
1892,	[7] 25,000,	**92,** 523.
1894,	10,000,	**95,** 570.
1896,	10,000,	**96,** 574.
1899,	5,000,	**99,** 1044.
1910,	30,000,	**10,** 1096.
1911,	25,000	**11,** 1158.
Total,	406,775	

COMMERCE.

Benefit of imp., **66,** iii, 18, iv, 195; **67,** 479; **68,** 840; **69,** 446; **70,** 497; **72,** 937.
Obstr. to navigation, **66,** iii, 18, iv, 191.
In 1911, about 66,641 t.; value $300,000; expected greater d. will bring lower rates, **12,** 58.

CONTRACTS.

1867. J. M. & J. W. Deering, st. for break'r. J. Andrews, removing sunken r., **67,** 479. J. M. Andrews, removing sunken r., **68,** 839.
1868. R. Wiley, removing sunken r., **69,** 444.
1869. I. Hamilton, st. for break'r, **70,** 496.
1870. H. Hamilton & I. Andrews, st. for break'r, **71,** 852.
1871. Gooch & Haines, st. for break'r, **71,** 852.
1872. C. H. Bragdon, st. for break'r, **73,** 1075, 1076.
1884. Hamilton & Soule, 11,000 t. of break'r st., **85,** 471.
1886. G. W. Andrews, break'r st., **87,** 454.
1887. T. Symonds, r. removal, $10.25 c. y., **87,** 459. R. Hamilton, dr., 23¢ c. y., **87,** 459.

*Allotment.
[2] Not mentioned in appro. act.
[3] Piers, buoys, and removing obstr. at and near entrance.
[4] Repairing prs.
[5] Break'r.
[6] River, break'r, and jetty.
[7] River and break'r.

1889. G. W. Andrews, furnishing and placing st. upon break'r, 87¢ s. t., **89,** 534; constr. of st. j., training wall, and bank protection, 93¢ t., **90,** 448.
1890. G. W. Andrews, st. j. constr., 84¢ t., **91,** 600.
1892. J. F. Curit, st., 90¢ t. ($10,800), **93,** 710. J. F. Hamilton, st., 93¢ t.; fascines, 75¢ each ($13,620), **93,** 711.
1894. Moore & Wright, dr., 20¢ c. y. ($10,000), **94,** 521.
1895. W. S. White, st., 90¢ t. ($9,000), **95,** 570.
1897. G. W. Andrews, st., $1.01 t. ($4,040), **98,** 835.
1900. G. W. Andrews, repairing j.; st., $1.37 s. t., **00,** 1145.
1910. P. H. Doyen Co., st. in s. j., $1.08 t.; in break'r, $1.18 t.; and in Cow Isld. j., $1.08 t., **11,** 1159.
1911. Eastern Dredging Co.; dr. (about 37,500 c. y.), 32.4¢ c. y., s. m., **12,** 1368.

ENGINEERS.

Chief of Engineers. Approves plan of officer in charge, **67,** 480. **R., 66,** ii, 40, iii, 18, 28; **67,** 48; **68,** 71; **69,** 61; **70,** 79; **71,** 91; **72,** 90; **73,** 99; **74,** 109; **84,** 73; **85,** 58; **86,** 58; **87,** 18, 19; **88,** 18; **89,** 27; **90,** 23; **91,** 28; **92,** 34; **93,** 32; **94,** 32; **95,** 34; **96,** 38; **97,** 39; **98,** 49; **99,** 58; **00,** 64; **01,** 133; **02,** 77; **03,** 54; **04,** 35; **05,** 36; **06,** 34; **07,** 37; **08,** 39; **09,** 43; **10,** 53, 59; **11,** 54; **12,** 56.
Boards:
Convened, Saco, Me., June 12, 1867; recom. adoption of Maj. Alexander's plan (see Projects), **67,** 48. **R., 67,** 483. (Col. Bache, Lt. Col. Thom, and Maj. Casey.)
Convened, New York, Apr., 1887, to consider proj. of Maj. Smith. **R., 87,** 459. (Cols. Casey and Abbot, Lt. Col. Houston, Maj. King.)
In charge:
Maj. Barnard, 1853; **66,** iii, 18.
Maj. B. S. Alexander, 1866; **66,** ii, 41. **R., 66,** iv, 188.
Lt. Col. G. Thom, 1866–83; **66,** iii, 18. **R., 66,** iv, 191; **67,** 478; **68,** 839; **69,** 443; **70,** 496, 505; **71,** 852; **72,** 936; **73,** 1074; **74,** ii, 307; **84,** 482, 483.
Col. C. E. Blunt, 1884–86. **R., 84,** 484; **85,** 471; **86,** 552, 553.
Maj. J. A. Smith, 1886–92. **R., 86,** 544, 546; **87,** 453; (Lt. Col.), **88,** 389, 390; **89,** 533, 534; **90,** 447; **91,** 598, 599.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 521; **93,** 708; **94,** 519.
Lt. Col. D. P. Heap, 1895. **R., 95,** 568.
Lt. Col. A. M. Damrell, 1896. **R., 96,** 572.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 792; **98,** 834.
Maj. S. W. Roessler, 1899. **R., 99,** 1043.
Maj. W. L. Fisk, 1900. **R., 00,** 1143.
Capt. H. Taylor, 1901–03. **R., 01,** 1036; **02,** 845; **03,** 732.
Lt. Col. W. S. Stanton, 1904. **R., 04,** 828.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 795; **06,** 863.
Maj. G. A. Zinn, 1907–10. **R., 07,** 892; (Lt. Col.) **08,** 935; **09,** 976; **10,** 1096.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1158; **12,** 1367.
Assistants:
F. F. Nes, U. S. C. S., **68,** 840.
G. Davidson, **66,** iv, 190.
C. Berrer. **R., 86,** 552, 554.

OPERATIONS.

1836. 12 ps. constr., **66,** iii, 18, iv, 191.
1867–68. 2,550 l. f. break'r extended, 1 sunken r. removed, **68,** 71, 839.
1868–69. 1,450 l. f. break'r extended, 1 sunken r. removed, **69,** 61, 444.
1869–70. 200 l. f. break'r extended, 1 sunken r. removed, **70,** 79, 496.
1870–71. Break'r enlarged, **71,** 852.
1871–72. 4,000 c. y. dr., break'r enlarged, **72,** 90, 936.
1872–73. Break'r enlarged, **73,** 1076.
1873–74. 3 R. ps. built and repaired, **74,** ii, 308.
1884–85. 3,494 t. st. placed in break'r, **85,** 471.
1885–86. 7,281 t. st. placed in break'r, **86,** 544.
1886–87. 4,475 t. st. placed in break'r, **87,** 454.
1887–88. 6,484 t. st. delivered upon break'r, **88,** 389; 16,987 c. y. dr. from chan. and 19,407 c. y. from shoals; 214 c. y. r. removed, **88,** 390.
1888–89. 104 t. st. placed upon break'r, **89,** 533; 4,641 t. st. delivered in training wall, **89,** 535.
1889–90. 10,030 t. st. placed in break'r, **90,** 446; 3,185 t. st. delivered in training wall, **90,** 448.
1890–91. 1,950 t. st. placed in break'r, **91,** 599; 8,626 t. st. delivered in j., **91,** 600.
1891–92. 26,374 t. st. delivered in s. j., **92,** 523.
1892–93. Over 23,000 t. st. placed in j., **93,** 709.
1893–94. 804 fascines laid and 17,065 t. st. placed in js. above and below Cow Isld., and 15,598 t. st. placed in j. on s. side of entrance, **94,** 521.
1894–95. 44,175 c. y. dr., repair of js. in progress, **95,** 570.
1895–96. About 13,000 t. st. placed in break'r and j. at mouth of R., **96,** 574.
1897–98. 5,200 t. st. placed in break'r, **98,** 834.
1899–00. 957 t. st. placed to repair s. j.; constr. of beacon at outer end of j. in progress, **00,** 1144.
1900–01. Repairs to s. j. and constr. beacon on outer end of j., **01,** 1036.
1909–10. Repairing beacons at mouth of R., **10,** 1096.
1910–11. Repairs to beacons, 421 t. st. placed in repairing Cow Isld. j., 2,965 t. in extending j. s. side of mouth of R., **11,** 1158.
1911–12. 195 t. st. placed in Cow Isld. j., completing work; 8,487 t. st. placed in j. s. side mouth of R., completing extension about 600′; 2,748 t. st. used in repair of n. j. or break'r; 12,000 c. y. dr. under contract, **12,** 1367.

PHYSICAL CHARACTERISTICS.

General, of R. and mouth, **66,** iv, 188, 191.
R. rises in White Mtn. region of N. H.; flows 105 m. to Atlantic about 16 m. sw. of Portland, Me. Imp. section, mouth to towns of Saco and Biddeford, at head of navigation, 5± m., **12,** 56.

PLANS.

By Col. Thom, 1883, repair and extension of existing break'r and formation of dr. chan. through adjacent shoals; est., $356,500, **84,** 484; **86,** 544.
By Lt. Col. Blunt, 1884, forming and maintaining chan. 5′ d. at m. l. w. below Saco, by dr., r. removal and use of submerged js.; est., $116,500, **84,** 484; **87,** 456.

PROJECTS.

For constr., 1836, of ps. in the R. and outside at its entrance, the 2 outside ps. evidently intended for break'rs, **66,** iv, 191.
By G. Davidson, constr. of 2 st. ps., conducting the R. to the sea in a ne. direction; est., $40,000. Utility of this plan discussed by Maj. Alexander. **66,** iv, 190, 191.
By Maj. Alexander, constr. of break'r between the 2 outside ps., 2,915′ l., 12′ above l. w., outer edge of cut granite, rear wall of rubblest.; est., $192,500, **66,** iii, 18, iv, 189, 191.
By Lt. Col. Thom, repairing and rebuilding the inside ps. in addition to Maj. Alexander's proj. for a break'r, increasing the est. cost to $211,701.05, **66,** iv, 194; app., **67,** 481; further increased to $270,000, **67,** 479; to $320,000, **68,** 840. For the imp. of the chan. below the wharves at Saco and Biddeford, Me., by means of machinery hired by the day, est., $2,500, **71,** 853; **72,** 936.
By Col. Thom, 1883, repairing and extending the old break'r, giving it a h. of 15′ above l. w. and a top w. of 12′; the orig. est. as amended was $70,000; amount app. to 1888, $27,500; amount required for completion of existing proj., $30,000, **84,** 484; **85,** 471; **87,** 453; **88,** 18, 389.
By Lt. Col. Smith, 1887, chan. 6′ d. at m. l. w. to the cities of Saco and Biddeford, by constr. of j. at the mouth of the R., pierhead, and revet. along coal wharf chan., wing dams, shoal revet., and dr.; est., $140,000, **88,** 391. Increased in 1889 to $155,000, **89,** 535.
In 1889 the imps. of Saco R. and that at the mouth were combined under one proj., and the

revised cost for completion for both R. and break'r placed at $185,000, **92,** 522.
By Maj. Roessler, 1899, repairing j. on s. side of R. mouth, **99,** 1043.
Act June 25, 1910, au. chan. d. of 7′, m. l. w., from head of navigation to sea, and extension of s. j. across bar at mouth[1]; est., $55,000, **10,** 53; **12,** 57.

SURVEYS.

By F. F. Nes, U. S. C. S., 1868, hydrographic sur., **68,** 840.
By Lt. Col. Thom, 1869, of the chan., **70,** 496; 1872, of the mouth and vicinity, **73,** 1075.
Au. act Aug. 2, 1882; made by Col. Thom, **84,** 483.
Au. act July 5, 1884; made by Col. Blunt, **86,** 552.
Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Col. Zinn, Apr. 30, 1909, and Feb. 12, 1910; est., $55,000,[1] **10,** 59.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 57.
Maps.[1] **66,** 188; **86,** 552; **87,** 458; H. D. 752, 61st, 2d.

A-271 WOOD ISLAND HARBOR, ME.

ENGINEERS.

Chief of Engineers. R., 85, 60.
In charge. Col. C. E. Blunt. **R., 85,** 489.

PHYSICAL CHARACTERISTICS.

De. of H., **85,** 489.

PLANS.

By Col. Blunt, 1885, forming H. of refuge with a break'r; est., $547,000, **85,** 490.

SURVEY.

Au. act July 5, 1884; made, 1885, by Col. Blunt (see Plans), **85,** 489.

A-274 CAPE PORPOISE HARBOR, ME.[2]

APPROPRIATIONS.

1899,	$70,000,	**99,** 1045.
1900,	10,000,	**00,** 1146.
1907,	46,000,	**07,** 894.
Total,	126,000,	**11,** 1159.

COMMERCE.

De. of, **95,** 583.
1910, 11,030 t., **11,** 56.

CONTRACTS.

1899. G. F. Taylor, dr., 9.2¢ c. y., s. m. ($65,964), **1900,** 1147.
1901. John J. Fitzpatrick, removing ledge, $4,218, **01,** 1038.
1907. Eastern Dredging Co., removing r., $9.60 c. y., p. m., **08,** 936.

ENGINEERS.

Chief of Engineers. R., 95, 38; **99,** 58, 62; **00,** 65; **01,** 135; **02,** 79; **06,** 40; **07,** 38; **08,** 40; **09,** 44; **10,** 54; **11,** 55.
In charge:
Lt. Col. D. P. Heap, 1895. **R., 95,** 583.
Maj. S. W. Roessler, 1899. **R., 99,** 1045, 1050.
Maj. W. L. Fisk, 1900. **R., 00,** 1146.
Capt. H. Taylor, 1901–02. **R., 01,** 1037; **02,** 846.
Maj. G. A. Zinn, 1907–10. **R., 07,** 893; (Lt. Col.) **08,** 936; **09,** 976; **10,** 1096.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1159.

OPERATIONS.

1899-00. 45,878 c. y. dr., **00,** 1146.
1900-01. 637,305 c. y. dr., **01,** 1038.
1901-02. 370 c. y. ledge r. removed, proj. completed, **02,** 847.
1907-08. 80% of area drilled and blasted, **08,** 936.
1908-09. Blasting completed; 3,999 c. y., p. m., r. removed, **09,** 976; proj. of 1907 completed, **10,** 1096.

PHYSICAL CHARACTERISTICS.

De. of, **95,** 583; **99,** 1051.
Completed proj. gives chan. of 190′ x 18′, m. l. w. **11,** 56.
Range of tide, 8.8′, **11,** 56.

PROJECTS.

By Maj. Roessler, 1899, entrance chan. 16′ x 200′ m. l. t., and chan. and anchorage within the H. about 15′ x 600′ x 3,000′ m. l. t.; est. (based on survey of civilian engineer), $125,000 (continuous contract), **99,** 1045.
By Lt. Col. Black, 1905, to give straight chan. 18′ x 200′ m. l. w., by removing r.; est., $46,000,[1] **06,** 40; adopted, 1907, **07,** 38.

SURVEYS.

Ex. au. act Aug. 17, 1894, made 1894 by Col. Hains (**R.** fav.). **95,** 583.
Congress, by concurrent resolution, 1898, asked for an est. of cost of imp. the H. **R.** (fav.), rendered 1899, by Maj. Roessler. (See Projects.) **99,** 1050.
Au. act Mar. 3, 1905; made, 1905, by Lt. Col. Black,[3] **06,** 40.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 56.
Map.[3]

A-275 KENNEBUNK RIVER, ME.

APPROPRIATIONS.

1829,	$5,000,	act Mar. 2.
1831,	1,175,	act Mar. 2.
1832,	1,700,	act July 3.
1834,	10,300,	act June 28.
1836,	7,500,	act July 2.
1837,	3,000,	act Mar. 3.
1838,	8,000,	act July 7.
1852,	7,500,	act Aug. 30.
1870,	5,000,	**70,** 82, 506.
1871,	5,000,	**71,** 91.
1876,	5,000,	**76,** 41.
1879,	2,000,	**79,** 47.
1880,	2,000,	**80,** 339.
1881,	2,000,	**81,** 492.
1890,	20,000,	**90,** 449.
1905,	3,500,	**05,** 796.
1911,	*3,000,	**11,** 1160.
Total,	[4] 91,675	

COMMERCE.

Important, **70,** 82, 506; **75,** ii, 433.
Obstr. to C., **75,** ii, 433.
Sufficient to justify mainten. of works, **03,** 55.
In 1911 did not exceed 3,000 t., chiefly coal, **12,** 1369.

CONTRACTS.

1870. A. Blaisdell & J. S. Bailey, extending e. p., **71,** 855.
1871. C. H. Bragdon, extending w. p., **71,** 855.
1877. G. C. Fobes & Co., dr. 6,450 c. y., 50¢ c. y., **77,** 166.
1892. J. F. Curit, st. and timbers, $1.05, $1.50, and $1.90 per t., and 5 pieces of timber at $20 for the lot ($2,158), **93,** 713.

ENGINEERS.

Chief of Engineers. R., 66, 7; **70,** 82; **71,** 91; **72,** 91; **73,** 100; **75,** 115, 121; **76,** 41; **77,** 35; **78,** 39;

*Allotment.
[1] H. D. 752, 61st, 2d.
[2] Sur.—**R.,** Oct. 2, 1845; est., $24,161.17. (H. D. 482, 55th, 2d.)
[3] H. D. 191, 59th, 1st.
[4] $1,590.99 carried to surplus fund, **11,** 1160.

79, 47; **80,** 67; **81,** 69; **82,** 68; **83,** 63; **84,** 71; **85** 58; **86,** 57; **87,** 19; **88,** 19; **89,** 28, 32; **90,** 23, 26; **91,** 29; **92,** 35; **93,** 33; **03,** 55; **04,** 36; **05,** 38; **06,** 36; **07,** 39; **11,** 56; **12,** 58, 65.

In charge:

Col. J. D. Graham, 1865. **R., 66,** 37.

Lt. Col. G. Thom, 1870–83. **R., 70,** 506; **71,** 854; **72,** 937; **73,** 1077; **75,** ii, 397; 432; **76,** 161; **77,** 165; **78,** 202; **79,** 259; (Col.) **80,** 337; **81,** 491; **82,** 499.

Col. C. E. Blunt, 1883–86. **R., 83,** 422; **84,** 468; **85,** 470.

Maj. J. A. Smith, 1886–92. **R., 86,** 543; **87,** 461; (Lt. Col.) **88,** 392; **89,** 537; **90,** 449, 471; **91,** 601.

Lt. Col. P. C. Hains, 1892–93. **R., 92,** 524; **93,** 712.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 796; **06,** 864.

Maj. G. A. Zinn, 1907–10. **R., 07,** 894.

Lt. Col. W. E. Craighill, 1910. **R., 11,** 1160; **12,** 1368.

Assistant. S. Haagensen. **R., 75,** ii, 433.

OPERATIONS.

1853. 600 l. f. e. p. extended; 290 l. f. w. p. extended; 160 l. f. e. sand catch built; 160 l. f. w. sand catch built; 300 l. f. crib wharf built, **76,** 161; **78,** 202.

1870–71. 168 l. f. e. p. extended; repairs, **71,** 855.

1871–72. 166⅔ l. f. w. p. extended; repairs, **72,** 91, 938.

1877–78. 6,450 c. y. dr.; repairs, **78,** 40.

1880–81. Ledges below Ward's wharf and at mouth of Gooch Creek removed to 4′ d.; chan. straightened and widened by dr. below Lord's and Ward's wharves and at upper part of Mitchell's Pt.; repairs to U. S. wharf, **81,** 492.

1881–82. Repairs to st. ps. and U. S. wharf, **82,** 500.

1883–84. Repairs to U. S. wharf, **84,** 468.

1887–88. Repairs to wooden p.; proj. completed and no further work contemplated, **88,** 392.

1890–91. Repairs to wharf and ps. in progress, **91,** 601.

1891–92. Repairs to wharf and protection of base of e. j.; constr. of j. at Wading Place, **92,** 525.

1892–93. Proj. completed, **93,** 713.

1905–6. Ps. repaired and partly rebuilt; proj. completed, **06,** 864.

1911–12. E. j. and wing wall repaired, and bank protected by riprap, **12,** 1369.

PHYSICAL CHARACTERISTICS.

Of chan., **75,** ii, 433.

De. of, **11,** 56.

Small stream, 15± m. l., flowing se. to Atlantic, 30± m. sw. of Portland H., Me. Proj. portion at mouth, head of navigation, Kennebunkport, 1½ m. up, **12,** 58.

PROJECTS.

By Lt. Col. Thom, 2 st. ps. as wings to those already built; est., $10,000, **70,** 506; **71,** 854. Dr. at Mitchell's Pt. and the Wading Place; est., $5,000, **75,** ii, 434. Dr., r. excavation, and repairs, to cost $6,000, **78,** 203; **79,** 260.

By Col. Thom, 1878, dr., r. excavation, and repairs to ps. and wharves; est., $6,000, **78,** 203; **79,** 260. Proj. completed in 1882, **82,** 500; **87,** 19.

After a sur. in 1889, Lt. Col. Smith est. $20,000 to repair the ps. and constr. 1 small j., **90,** 449, 474.

Capt. Taylor submits est. of $3,500 for repairs to ps. and wharf, **03,** 55.

SURVEYS.

By S. Haagensen, 1874. **R., 75,** ii, 433.

By Lt. Col. Thom, **78,** 203.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Smith, **90,** 449, 473.

Pre. ex. au. act June 25, 1910; **R.,** Lt. Col. Craighill, Mar. 22, 1911 (unfav.),[1] **12,** 65.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 59.

A-277(a) WELLS HARBOR (Webhannet), ME.

APPROPRIATIONS.

1872, $5,000, **72,** 91.

ENGINEERS.

Chief of Engineers. **R., 71,** 96; **72,** 91; **73,** 100; **74,** 109.

In charge. Lt. Col. G. Thom, 1871–74. **R., 72,** 938, 956; **73,** 1078; **74,** ii, 308.

OPERATIONS.

Constr. of a p. of cribwork 250 y. l. by the U. S. in early times, **72,** 91, 938.

1872–74. Repairs to p., **73,** 1078; **74,** 109.

PROJECT.

By Lt. Col. Thom, repairs; est., $5,000, **72,** 956.

SURVEY.

By Lt. Col. Thom, 1871. **R., 72,** 956.

A-277(b) OGUNQUIT HARBOR, ME.

ENGINEERS.

Chief of Engineers. **R., 12,** 65.

In charge. Lt. Col. W. E. Craighill, **12,** 34.

SURVEY.

Pre. ex. au. June 25, 1910. **R.,** Lt. Col. Craighill, Sept. 30, 1911[2] (unfav.), **12,** 65.

A-279(a) YORK HARBOR, ME.

APPROPRIATIONS.

1886,	$15,000,	**87,** 462.
1888,	10,000,	**88,** 394.
1890,	10,000,	**91,** 603.
1892,	9,000,	**92,** 527.
1905,	13,400,	**05,** 797.
Total,	57,400	

COMMERCE.

Large brickyards located on R., combined output, 22,000,000 bricks per an., **04,** 823.

CONTRACTS.

T. Symonds, for dr., 65¢ c. y., **87,** 463.

1889. T. Symonds, dr., 50¢ and r. removal, at $10 c. y., **89,** 539.

1891. T. Symonds, r. removal, $13 c. y., **91,** 603.

1892. A. B. Martin, dr., 68¢ and 36¢ c. y. ($11,280), **93,** 715.

1905. Hamilton & Sawyer, dr., 27.9¢ c. y., s. m., and removing bowlders, $4 t., **06,** 865.

ENGINEERS.

Chief of Engineers. **R., 85,** 60; **87,** 19; **88,** 19; **89,** 28; **90,** 23; **91,** 29; **92,** 35; **93,** 34; **94,** 33; **04,** 35; **05,** 38; **06,** 37; **07,** 40.

Boards. BERH., **R., 04,** 821, 822.

In charge:

Col. C. E. Blunt, 1884–85. **R., 85,** 485, 487.

Maj. J. A. Smith, 1885–92. **R., 87,** 462; (Lt. Col.) **88,** 393; **89,** 537; **90,** 450; **91,** 602.

Lt. Col. P. C. Hains, 1892–94. **R., 92,** 526; **93,** 714; **94,** 522.

[1] H. D. 423, 62d, 2d.

[2] H. D. 419, 62d, 2d.

Maj. S. W. Roessler, 1904. **R., 04,** 820, 823.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 796; **06,** 864.
Maj. Geo. A. Zinn, 1907. **R., 07,** 894.
Assistants:
C. Berrer. **R., 85,** 485, 488.
A. C. Both. **R., 04,** 824.

OPERATIONS.

1887-88. 19,342 c. y. gravel and r. removed, **88,** 393.
1889-90. 1,210 c. y. sand, gravel, and bowlders and 214 c. y. solid r. removed, **90,** 450.
1890-91. 760 c. y. r. removed, **91,** 602.
1892-94. About 18,000 c. y. dr. Proj. completed, **93,** 714; **94,** 523.
1905-06. 40,722 c. y., s. m., dr., completing proj., **06,** 865.

PROJECTS.

By Col. Blunt, 1885, imp. of York H. by dr. at obstr. pts. in the existing chan. to obtain uniform d. of 10′ l. w.; est., $25,000, **85,** 487. Increased $5,000 in 1887 by Lt. Col. Smith, **87,** 462. Revised in 1888, by Lt. Col. Smith, to cost $44,000, **88,** 393; **92,** 526.
Maj. Roessler submits a proj. for straightening chan. at bends to 10′ d.; est., $13,400, **04,** 824. Au. act Mar. 3, 1905, **05,** 38.

SURVEYS.

Ex. au. act July 5, 1884, made, 1884, by Col. Blunt, **85,** 485.
Sur. made, 1885, **85,** 487.
Pre. ex. and sur. au. act June 13, 1902. **R.,** by Maj. Roessler, Aug. 13 and Nov. 13, 1903; est., $13,400[1] (see Projects), **04,** 35, 819.

A-280 PISCATAQUA RIVER, ME. AND N. H.[3]

APPROPRIATIONS.

1826,	[3] $200, sur., act May. 20.
1828,	[4] 8,000
1832,	[4] 250
Total,	8,450

ENGINEERS.

Chief of Engineers. **R., 84,** 73.
In charge: Col. C. E. Blunt. **R., 84,** 485, 486.

PHYSICAL CHARACTERISTICS.

Locality described, **84,** 486.

PLANS.

By Col. Blunt, 1883, imp. Piscataqua R. with l. & d. just below the mouth of Great B.; est., $710,000, **84,** 487, 489, 490.

SURVEY.

Au. act Aug. 2, 1882, made by Col. Blunt, **84,** 485, 486.

A-280(a) PORTSMOUTH HARBOR, N. H.

APPROPRIATIONS.

1879,	$10,000, **79,** 48.
1880,	25,000, **80,** 341.
1881,	20,000, **81,** 500.
1882,	17,000, **82,** 508.
1882,	[5] 2,000, act Aug. 7.
1884,	20,000, **84,** 470.
1886,	15,000, **86,** 548.
1888,	15,000, **88,** 395.
1890,	13,000, **90,** 451.
Total,	137,000

COMMERCE.

Importance of Portsmouth H., **74,** ii, 343, 344; **79,** 283.
Existing facilities ample for C.; any imp. to be made would be to benefit naval vessels, **01,** 1058.

CONTRACTS.

1879. H. Hamilton, rubblest., 69¢ t., **80,** 342.
1880. J. F. Curritt, rubblest., 77¢ t., **81,** 501.
1882. J. Andrews, r. removing, $18 c. y., **82,** 508. S. S. Andrews, r. removing, $34.50 c. y., **83,** 432.
1884. G. W. Townsend, r. removing, $22 c. y., **85,** 474.
1886. G. W. Townsend, r. removing, $18.97 c. y., **87,** 465.
1889. O. J. Jennings, r. removing, $11 c. y., **89,** 540.
1891. T. Symonds, r. removing, $13 c. y., **91,** 605.

DEFENSE.

Forts Constitution and McClary and batteries on Gerrish's Isld. and Jerry's Pt., **74,** ii, 343; **79,** 263.
U. S. navy yard at Kittery, Me., **79,** 263, 283.

ENGINEERS.

Chief of Engineers. **R., 73,** 106; **74,** 116; **78,** 46; **79,** 48, 52; **80,** 68; **81,** 71; **82,** 71; **83,** 65; **84,** 17, 73; **85,** 58, 60; **86,** 58; **87,** 20; **88,** 20; **89,** 29; **90,** 24; **91,** 30; **92,** 36; **01,** 149; **10,** 59; **11,** 61.
In charge:
Lt. Col. G. Thom, 1873–83. **R., 74,** ii, 342; **79,** 262, 282; (Col.) **80,** 340; **81,** 498; **82,** 505; **84,** 474.
Col. C. E. Blunt, 1883–86. **R., 83,** 430; **84,** 469; **85,** 472, 478, 484.
Maj. J. A. Smith, 1886–92. **R., 86,** 546; **87,** 463; (Lt. Col.) **88,** 394; **89,** 539; **90,** 450; **91,** 604.
Lt. Col. P. C. Hains, 1892. **R., 92,** 527.
Capt. H. Taylor, 1901. **R., 01,** 1062.
Maj. W. L. Fisk, 1901. **R., 01,** 1057.
Lt. Col. G. A. Zinn, **10,** 36; **11,** 35.
Assistants:
S. Haagensen. **R., 74,** ii, 343.
W. F. Robinson. **R., 01,** 1064.

OPERATIONS.

1879-80. 12,200 t. st. placed, **80,** 341.
1880-81. 2,400 t. st. placed in j.; 100 c. y. r. removed from chan., **81,** 500.
1881-82. 310 c. y. r. removed from ledges, **82,** 506, 507.
1882-83. 690 c. y. solid r. removed from ledges, **83,** 431.
1883-84. 500 c. y. r. removed from Gangway Rock; 300 c. y. r. removed from Badgers Isld., **84,** 470.
1884-85. 400 c. y. r. removed, **85,** 473.
1885-86. 808 c. y. r. removed, **86,** 547.
1886-87. 100 c. y. r. removed, **87,** 464.
1887-88. 632 c. y. r. removed, **88,** 394.
1889-90. 168 c. y. r. removed, **90,** 451.
1890-91. 244 c. y. r. removed, **91,** 604.
1891-92. Proj. completed, **92,** 528.

PHYSICAL CHARACTERISTICS.

Bar between Gerrish's and Wood Islds., **74,** ii, 343, 344.
Tides, **74,** ii, 344.
Ledges and bowlders in the H., **79,** 283.

PLANS. (See Projects.)

By S. Haagensen, break'r between Gerrish's and Wood Islds., 1,376′ l., 556′ resting on solid ledge and 820′ on heavy bowlders, $150,000, **74,** ii, 344.

[1] H. D. 301, 58th, 2d.
[2] H. D. 423, 62d, 2d.
[3] Sur.—**R.,** 1826; est., $7,673.25 (H. D. 482, 55th, 2d.).
[4] Removing obstr., Berwick Branch.
[5] Relief act.

PROJECTS. (See Plans.)

By Lt. Col. Thom, 1879, break'r, 820′ l., 10′ in w. on top, and 2½′ above m. h. w. between Great and Goat Islds.; also for removing Gangway Rock to a d. of 20′ and part of the ledge off Badger's Rock to d. of 10′, m. l. w.; est., $150,000, **79,** 48, 262.

In 1882 Col. Thom did not consider completion of the break'r a public necessity, **84,** 474.

All contemplated imp. completed and no further app. needed, **92,** 528.

SURVEYS.

By Capt. Howard Stansbury, U. S. T. E., 1842–44, **74,** ii, 343; **79,** 283.

By S. Haagensen, 1873. **R., 74,** ii, 343.

By Lt. Col. Thom, 1878. **R., 79,** 282.

Of sunken ledges at point of Goat Isld., near Portsmouth P., and also in H. of refuge at Jerrys Pt., 1882, **82,** 507.

Ex. of H. at Portsmouth, sea to wharf, au. act July 5, 1884; made, 1885, by Col. Blunt (**R.** unfav.) **85,** 478.

Ex. of Little H., Portsmouth, for H. of refuge, au. act July 5, 1884; made, 1885, by Col. Blunt, **85,** 480.

Ex. for extension and completion of the break'r near third br. in Portsmouth H.; made, 1882, by Col. Thom, **84,** 474.

Pre. ex. and sur. au. act June 6, 1900, with view to removing portion of Henderson Pt. to imp. navigation to the navy yard. **R.** on pre. ex. by Maj. Fisk, Aug. 27, 1900, and on sur. by Capt. Taylor, Dec. 21, 1900; est., $1,180,000,[1] **01,** 149, 1057, 1062.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Lt. Col. Zinn, Dec. 10, 1909[2] (unfav. to constr. of l. and d. as contemplated), **10,** 59; **11,** 61.

Maps:

Showing the proposed imp., **79,** 282.

86, 546.

A-280(b) PULL-AND-BE-DAMNED POINT, PORTSMOUTH HARBOR, N. H.

ENGINEERS.

Chief of Engineers. **R., 99,** 62; **00,** 77.

In charge. Maj. S. W. Roessler, 1900. **R., 00,** 1170.

Assistant. Lt. C. Keller. **R., 00,** 1171.

PHYSICAL CHARACTERISTICS.

De. of, **00,** 1171–1172.

SURVEYS.

Ex. for removal of the pt., au. act Mar. 3, 1899; made, 1899, by Maj. Roessler (**R.** unfav.), **00,** 1170.

A-281 PEPPERELLS COVE, ME.

APPROPRIATIONS.

1910,	$60,000,	**10,** 1097.
1911,	35,000,	**11,** 1161.
Total,	95,000	

COMMERCE.

See Portsmouth H.

Has no C. except as adjunct to Portsmouth H. Imp. not expected to directly affect rates, but to provide anchorage and H. for small vessels, **10,** 56, 1098.

CONTRACTS.

1910. Eastern Dredging Co., dr. about 330,000 c. y., 16.2¢ c. y., and $8 c. y. for removing bowlders exceeding 2 c. y. each in vol., **11,** 1161.

1911. Eastern Dredging Co., dr. 100,000 c. y., 16.4¢ c. y., and $8 c. y. for bowlders, **12,** 1371.

ENGINEERS.

Chief of Engineers. **R., 91,** 32, 614; **08,** 44; **09,** 48; **10,** 56; **11,** 58; **12,** 61.

In charge:

Lt. Col. J. A. Smith, 1890. **R., 91,** 614.

Lt. Col. G. A. Zinn, 1908–10. **R., 10,** 1097.

Lt. Col. W. E. Craighill, 1910–. **R., 11,** 1161; **12,** 1370.

OPERATIONS.

1910–11. 57,084 c. y. dr. under contract, **11,** 1161.

1911–12. 269,523 c. y. dr., **12,** 1370.

PHYSICAL CHARACTERISTICS.

De. of, **91,** 615; **10,** 56; **12,** 61.

H. on e. or Maine side of Portsmouth H. and about 1 m. within entrance, **12,** 61.

PLANS.

Lt. Col. Smith did not consider locality worthy of imp., **91,** 616.

PROJECTS.

Act June 25, 1910, au. dr. area of about 41 acres to d. of 12′, m. l. t., and removal of the ledge to a d. of 12½′; est., $158,400,[3] **10,** 56.

SURVEYS.

91, 614.

Pre. ex. and sur. au. act Mar. 2, 1907, with a view to d. of cove and removal of ledge. **R.,** Lt. Col. Zinn, 1907 and 1908; est., $158,400,[1] **08,** 44; **09,** 48.

Map.[3]

A-284 COCHECO RIVER, N. H.[4]

APPROPRIATIONS.

1829,	$60,	act Mar. 2 (sur.).
1836,	5,000,	act July 4.
1837,	5,000,	act Mar. 3.
1871,	10,000,	**71,** 92.
1872,	10,000,	**72,** 91.
1873,	10,000,	**73,** 101.
1874,	10,000,	**74,** 110.
1875,	25,000,	**75,** 116.
1876,	14,000,	**76,** 42.
1878,	6,000,	**78,** 41.
1882,	28,000,	**83,** 428.
1884,	$28,000,	**84,** 473.
1886,	10,000,	**86,** 551.
1888,	9,000,	**88,** 397.
1890,	25,000,	**90,** 453.
1892,	15,000,	**92,** 530.
1894,	15,000,	**95,** 574.
1896,	15,000,	**96,** 578.
1899,	20,000,	**99,** 1046.
1902,	30,000,	**02,** 849.
1905,	21,711,	**05,** 798.
Total,	311,771,	**12,** 1371.

[1] H. D. 263, 56th, 2d.
[2] H. D. 1086, 61st, 3d.
[3] H. D. 1081, 60th, 2d.
[4] Sur.—**R.,** Feb. —, 1830; est., $4,199.36. (H. D. 482, 55th, 2d.)

COMMERCE.

Important, **71,** 856, 859; **77,** 168; **83,** 429; **86,** 550.
Decrease in rates from the imp., **90,** 453, 475.
A saving of 50¢ t. on coal alone a result of the imp., **93,** 718.
Rates on coal reduced 33%, **10,** 58.

CONTRACTS.

1871. Morris & Cumings, r. excavation, **71,** 857.
1872. E. Moore, r. excavation, **73,** 1079.
1873. E. Moore, r. excavation, **73,** 1079.
1874. E. Moore, r. excavation, **75,** ii, 398.
1875. J. Andrews, r. excavation. Aug. R. Wright, dr., 40 and 70¢. **75,** ii, 398.
1877. Atlantic Dredging Co., dr., 49 and 97¢, **77,** 168.
1883. Hamilton & Sawyer, excavation of cut-off chan. through Alleys Pt., **83,** 428.
1884. T. Symonds, r. removal and dr., **85,** 475, 476.
1886. T. Symonds, r. removal, $9.50 and $4.50 c. y., **87,** 466, 467.
1889. T. Symonds, dr., 45¢ c. y., **89,** 542.
1890. C. H. Souther, dr., 39½¢ c. y. for soft and $1.35 for hard material, **91,** 608.
1894. Rogers & Fitzpatrick, ledge removal, $6.44 c. y. ($12,880), **94,** 526.
1895. A. W. Bryne, ledge removal, $6.20 c. y. in place ($12,400), **95,** 574.
1897. S. J. Donovan, ledge removal, $7.50 c. y. in place ($9,750), **97,** 795.
1899. A. B. Martin, dr., 90¢ c. y. ($17,914.41), **00,** 1148.
1903. S. J. Donovan, dr., 65¢ c. y.; Bay State Dredging Co., dr., 95¢ c. y., **03,** 735.
1906. S. J. Donovan, dr., (A) 38¢, (B) $1.50, (C) 50¢ c. y., and $25 c. y. for r. removal, **06,** 866.

ENGINEERS.

Chief of Engineers. R., 70, 31, 83; **71,** 92; **72,** 91; **73,** 100; **74,** 109; **75,** 115; **76,** 41; **77,** 36; **78,** 40; **79,** 47; **83,** 65; **84,** 72; **85,** 59; **86,** 59; **87,** 20; **88,** 20; **89,** 30, 32; **90,** 25, 26; **91,** 31; **92,** 37; **93,** 35; **94,** 34; **95,** 36; **96,** 39; **97,** 40; **98,** 50; **99,** 59; **1900,** 66; **01,** 135; **02,** 80; **03,** 56; **04,** 38; **05,** 39; **06,** 38; **07,** 41; **08,** 42; **09,** 46; **10,** 57; **11,** 59, 61; **12,** 62.
In charge:
Lt. Col. G. Thom, 1870–79. **R., 71,** 856; **72,** 938; **73,** 1078; **74,** ii, 309; **75,** ii, 397; **76,** 162; **77,** 167; **78,** 203; **79,** 260.
Col. C. E. Blunt, 1883–86. **R., 83,** 426; **84,** 471; **85,** 474.
Maj. J. A. Smith, 1886–92. **R., 86,** 548; **87,** 466; (Lt. Col.) **88,** 396; **89,** 542; **90,** 453, 475; **91,** 607.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 529; **93,** 717; **94,** 524.
Lt. Col. D. P. Heap, 1895. **R., 95,** 573.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 576.
Maj. R. L. Hoxie, 1897–98. **R., 97,** 794; **98,** 835.
Maj. S. W. Roessler, 1899. **R., 99,** 1046.
Maj. W. L. Fisk, 1900. **R., 00,** 1147.
Capt. Harry Taylor, 1901–03. **R., 01,** 1039; **02,** 848; **03,** 734.
Lt. Col. W. S. Stanton, 1904. **R., 04,** 830.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 798; **06,** 866.
Maj. Geo. A. Zinn, 1907–10. **R., 07,** 896; (Lt. Col.) **08,** 937; **09,** 978; **10,** 1098.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1162; **12,** 1371.
Assistant. F. S. Burrowes. **R., 90,** 477.

OPERATIONS.

Mention of previous operations, **71,** 858.
1871-72. R. excavat. in progress, **72,** 939.
1872-73. R. excavat. in progress, **73,** 1079.
1873-74. 772 c. y. r. removed and cofferdam constr., **74,** ii, 309.
1874-75. 483 c. y. r. removed, **75,** ii, 398.
1875-76. 7,108 c. y. dr. and 1,108 c. y. r. removed, **76,** 41; **77,** 168.
1876-77. 600 c. y. r. removed, **77,** 168.
1877-78. 12,371 c. y. dr. and 300 c. y. r. removed, **78,** 40, 204.
1878-79. 3,000 c. y. dr., **79,** 262.
1882-83. 12,260 c. y. removed from cut-off through Alleys Pt., **83,** 428.
1883-84. 10,600 c. y. gravel and 135 t. bowlders removed from cut-off at Alleys Pt., completing the proposed work thereat, **84,** 471.
1884-85. 3,408 c. y. r. and hardpan removed from chan. above Clements's wharf, **85,** 475.
1885-86. 829 c. y. r. removed, **86,** 549.
1887-88. 738 c. y. solid r. and 350 c. y. bowlders removed, **88,** 396.
1888-89. 672 c. y. clay dr. and 4,780 c. y. clay removed, **89,** 542
1889-90. Proj. completed, **90,** 453.
1891-92. Chan. dr. to 7′ m. l. t. at Dover and at Clements's wharf, **92,** 530.
1893-95. About 2,100 c. y. r. removed, **94,** 526; **95,** 574.
1895-96. About 1,800 c. y. r. removed, **96,** 577.
1896-97. About 600 c. y. r. removed, **97,** 794.
1897-98. 535 c. y. r. removed, **98,** 836.
1898-99. 356 c. y. r. removed, **99,** 1046.
1899-00. 19,904 c. y. dr., **00,** 1148.
1902-03. 14,846 c. y. dr.; also 7,675 c. y. dr. from Lamprey R., **03,** 734.
1903-04. 23,436 c. y. dr., **04,** 830.
1906-07. 22,928 c. y. dr. and 104 c. y. r. removed, **07,** 896.

PHYSICAL CHARACTERISTICS.

Location of imp., **71,** 858.
Presence of rs. and shoals, **71,** 858.
Tides, **71,** 859.
De. of, **90,** 475; **04,** 38.
Shoaling, **11,** 60.
In se. N. H. Flows se. for 30 m. to Piscataqua R., about 9 m. above Portsmouth N. H. Section of proj., 3 m., **12,** 62.

PROJECTS.

In 1836–37 $10,000 was appro. for the imp. of the Cocheco Branch. Proj. of 1870 proposed the formation, by r. removal and dr. of a chan. 4′ x 40′ m. l. w. through Lower Narrows and up to the packet landing in Dover, **71,** 857; **72,** 939; **76,** 164. This work was accomplished in 1879 under aggregate appro. of $95,000, **79,** 261; **83,** 427; **86,** 549.
In 1882 the proj. amended to provide for a cut-off chan. through Alleys Pt. and w. to 60′ and d. to 5′ through Trickeys and Clements Pt. shoals; est., $28,000, **83,** 427.
This work having been accomplished in 1883, Col. Blunt proposed, 1884–85, to w. to 50′ and d. to 5′ m. l. w. all parts of the chan. with less dimensions, from Clements Pt. to the packet landing; est., $47,000, **84,** 471; **85,** 475; **87,** 466. Proj. completed in 1889, **89,** 542.
After ex. and sur. 1889, Lt. Col. Smith proposed to obtain a chan. d. of 7′, increased to 7½′ when passing over r., with a min. w. of 50′ in r. and 60′ where the material less expensive to remove; est., $175,000, **90,** 477; **91,** 607; **92,** 530; au. act Sept. 19, 1890, **04,** 38.
Act June 13, 1902, extended proj. of 1890 to include restoration of chan. in Lamprey R. and au. expend. $10,000 from main appro., **02,** 80; **04,** 38.
Est., 1909, $20,000, to restore proj. d., **10,** 58.
By Col. Zinn, for w. and d. chan., **10,** 58.

SURVEYS.

Under direction of Lt. Col. Thom, 1870–71. **R., 71,** 858; **72,** 939.
Sur., 1885, **85,** 474.
Au. act Aug. 11, 1888, made, 1889, by Lt. Col. Smith, **90,** 475.
Ex. and sur. au. act Mar. 3, 1909, made 1909 and 1910; **Rs.** by Lt. Col. Zinn, 1909 and 1910 (R. unworthy of immediate imp. further than by existing proj.),[1] **10,** 59; **11,** 61.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 62.
Maps. Of Cocheco R., vicinity of Dover, **85,** 474.

[1] H. D. 1106, 61st, 3d.

A-286 BELLAMY RIVER, N. H.

APPROPRIATIONS.

1888, $10,000, **88,** 20.
1890, 10,000, **90,** 453.
1892, 7,500, **92,** 529.
1894, 7,500, **95,** 572.

Total, 35,000

CONTRACTS.

1888. T. Symonds, dr., 19¾¢ c. y., **89,** 542.
1890. A. B. Martin, dr., 25¢ c. y., **91,** 607.
1895. Columbian Dredging Co., dr., 23¢ c. y., s. m. ($16,100), **95,** 572.

ENGINEERS.

Chief of Engineers. R., 87, 22; **88,** 20; **89,** 29; **90,** 25; **91,** 30; **92,** 36; **93,** 34; **94,** 34; **95,** 35; **96** 39; **97,** 40.
In charge:
Maj. J. A. Smith, 1886–92. **R., 87,** 484, 485; (Lt. Col.) **89,** 540; **90,** 452; **91,** 605.
Lt. Col. P. C. Hains, 1892–94. **R., 92,** 528; **93,** 716; **94,** 523.
Lt. Col. D. P. Heap, 1895. **R., 95,** 571.
Lt. Col. A. N. Damrell, 1896. **R., 96,** 575.
Maj. R. L. Hoxie, 1897. **R., 97,** 794.
Assistant F. S. Burrows. **R., 87,** 486.

OPERATIONS.

1888–89. 22,700 c. y. dr., **89,** 541.
1889–90. 21,650 c. y. dr., **90,** 452.
1890–91. Dr. continued, **91,** 606.
1892–93. 35,997 c. y. dr., **93,** 716.
1895–96. 46,409 c. y. dr., **96,** 576.
1896–97. About 12,000 c. y. dr. (proj. completed), **97,** 794.

PROJECTS.

By Maj. Smith, 1887, imp. for 2½ m. by dr. 50′ x 5′, m. l. w., mouth to head of navigation; est., $28,000, **87,** 486; **89,** 541. Increased, 1891, to $35,000, **91,** 606; **92,** 528.

SURVEYS.

Ex. and sur. au. act Aug. 5, 1886; made, 1887, by Maj. Smith, **87,** 484, 485.

A-287 OYSTER RIVER, N. H.

COMMERCE.

4,300 t. an.; would probably be doubled by imp. of R., **97,** 804.

ENGINEERS.

Chief of Engineers. R., 97, 43.
In charge. Maj. R. L. Hoxie, 1896–97. **R., 97,** 804.

PHYSICAL CHARACTERISTICS.

De. of, **97,** 804.

SURVEY.

Ex. au. act June 3, 1896; made by Lt. Col. Damrell, 1897 (**R.** fav. to sur.), **97,** 804.

A-288 LAMPREY RIVER, N. H.

APPROPRIATIONS.

1881, $10,000, **81,** 496.
1882, 10,000, **82,** 503.

Total, 20,000

COMMERCE.

Extent of prospective benefit to C., **75,** ii, 424; **81,** 495.

CONTRACT.

1882. T. Symonds, dr., 65¢ c. y., **83,** 426.

ENGINEERS.

Chief of Engineers. R., 75, 121; **81,** 70; **82,** 69; **83,** 64; **84,** 73; **10,** 59; **11,** 61.
In charge:
Lt. Col. G. Thom, 1881–83. **R., 75,** ii, 424; (Col.) **81,** 495; **82,** 502.
Col. C. E. Blunt, 1883–84. **R., 83,** 424; **84,** 472.
Lt. Col. Geo. A. Zinn, 1911. **11,** 35.
Assistant. S. Haagensen. **R., 75,** ii, 425.

OPERATIONS.

1881–82. 2,000 t. bowlders removed, **82,** 503.
1882–83. 12,956 c. y. dr. and 330 c. y. bowlders removed, **83,** 425.

PHYSICAL CHARACTERISTICS.

De., **75,** ii, 424, 425.

PLANS.

By Lt. Col. Thom, 1875, cut through neck at Shackfords Pt.; est., $30,000; not recom., **75,** ii 424–426.

PROJECTS.

By Col. Thom, 1874, imp. chan. 12′ at m. h. w. from mouth up to the Lower Narrows, 100′ w., thence up to the New Market wharves 11′ x 40′, m. h. w.; est., $24,000, **75,** ii, 424–426; **81,** 495.

SURVEY.

By S. Haagensen, 1874, below New Market, N. H., **75,** 121, ii, 424, 425.
Pre. ex. and sur. au. act Mar. 3, 1909. **Rs.,** Lt. Col. Zinn, 1909 and 1910 (unfav.), **10,** 59; **11,** 61.

A-289 EXETER RIVER, N. H.

APPROPRIATIONS.

1880, $20,000, **80,** 343.
1881, 15,000, **81,** 497.
1899, 12,000, **99,** 1049.
1902, 7,000, **02,** 850.
1911, 9,200, **11,** 1162.

Total, 63,200

COMMERCE.

Important, **75,** ii, 427, 428.
Est. amount of, **97,** 819.
Principally coal for local consumption, about 10,000 t. ann., **03,** 58.
1911, 7,474 t., all coal, **12,** 64.

CONTRACTS.

1881. T. Symonds, dr., at $1.06, 46¢ and 47¢ c. y., **81,** 498.
1900. A. B. Martin, dr., 54¢ c. y., s. m.; removal of bowlders greater than 3 t. in weight, $10 t., **00,** 1150.
1903. Bay State Dredging Co., dr., 81½¢ c. y., **03,** 736.
1911. Bay State Dredging Co., dr., 79¾¢ and $1.10 c. y., and $10 c. y. for bowlders exceeding 2 c. y. each in volume, **12,** 1372.

ENGINEERS.

Chief of Engineers. R., 75, 121; **80,** 68; **81,** 70; **82,** 70; **97,** 44; **99,** 61; **00,** 67; **01,** 136; **02,** 81;

03, 57; **04,** 39; **05,** 41; **06,** 39; **07,** 42; **10,** 59; **11,** 60 61; **12,** 63.

In charge:

Lt. Col. Thom, 1875–82. **R., 75,** 120; **75,** ii, 426; **80,** 342; **81,** 496; **82,** 504.

Maj. R. L. Hoxie, 1897. **R., 97,** 818.

Maj. S. W. Roessler, 1899. **R., 99,** 1048.

Maj. W. L. Fisk, 1900. **R., 00,** 1149.

Capt. Harry Taylor, 1901–03. **R., 01,** 1040; **02,** 849; **03,** 735.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 799; **06,** 867.

Maj. Geo. A. Zinn, 1907–11. **R., 07,** 897; (Lt. Col.) **10,** 36; **11,** 35.

Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1162; **12,** 1371.

Assistants:

S. Haagensen. **R., 75,** ii, 428.

J. W. Walker. **R., 97,** 819.

LEGISLATION.

Purchase of right of way for proj. cut-off at the Oxbow, **81,** 497.

OPERATIONS.

1880–81. 47,000 c. y. dr. and sunken rs. removed by hired labor, completing proj., **81,** 497.

1899–1900. 8,370 c. y. dr., **00,** 1149.

1900–01. 8,746 c. y. dr. and 115 t. bowlders removed, completing chan. to proj. dimensions, Gilman's wharf, Exeter, to Newfields, **01,** 1040.

1902–03. 6,594 c. y. dr. proj. completed, **03,** 736.

1911–12. 6792 c. y. dr., and 1 bowlder blasted, completing proj., **12,** 1371.

PHYSICAL CHARACTERISTICS.

De. of, **75,** ii, 427, 428; **04,** 39.

List of obstr., **75,** ii, 429, 430.

Small stream in sw. N. H., flows 20 m. e. and n. into Great B. Proj. portion, mouth to Exeter, 8 m., **12,** 63.

PROJECTS.

By Col. Thom, 1875, chan. 12′ x 40′ m. h. w. to Oxbow, thence (with 10′ d. at m. h. w. and the same w.), by a cut-off through Oxbow, to upper wharves at Exeter, by dr. and removal of bowlders; est., $34,000, **75,** ii, 427, 429, 430; **81,** 496.

By Maj. Hoxie, 1897, 12′ chan., mouth to Oxbow; 10′ chan., Oxbow to Exeter, 40′ w.; and removal of bowlders; total est., $12,000, **99,** 1049.

Act Feb. 27, 1911, au. restoring chan. d. made under proj. of 1899, with slight straightening of chan. at Stratham Bridge; est., $9,200 [2] (see Sur., 1910), **11,** 60.

SURVEYS.

Sur. below Exeter, by S. Haagensen, 1874. **75,** 121, ii, 427, 428.

Sur. au. act June 3, 1896, made, Lt. Col. Damrell, 1897 (restoration of old chan. of 1881 recom.), **97,** 818.

Ex. and sur. au. act Mar. 3, 1909; **R.,** Lt. Col. Zinn, 1909, and 1910; est., $9,200,[1] **10,** 59; **11,** 61.

Cong. docs., etc., relating to exs., surs., plans, etc. **11,** 60, 64.

Map.[2]

A-290 LITTLE HARBOR, AT PORTSMOUTH, N. H.

APPROPRIATIONS.

1886,	$10,000,	**86,** 60.
1888,	20,000,	**88,** 398.
1890,	40,000,	**90,** 454.
1892,	30,000,	**92,** 532.
1894,	10,000,	**95,** 577.
1896,	10,000,	**96,** 580.
1899,	12,000,	**99,** 1047.
1902,	13,000,	**02,** 851.
Total,	145,000	

COMMERCE.

None. Work intended as a H. of refuge, **85,** 483; **87,** 469; **93,** 720.

List of vessels wrecked near Little H., 1879 to 1889, **89,** 545.

None; 407 vessels anchored for refuge or pleasure during 1906, **07,** 898.

Inconsiderable; H. designed for H. of refuge, **09,** 47.

CONTRACTS.

1887. Moore & Wright, dr., 24¢ c. y., **87,** 468.

1888. New England Dredging Co., dr., 28¢ c. y. **89,** 545.

1890. T. A. Rowe, st. delivered in break'r, 69¢ t., and constr. of beacon, $450, **91,** 609.

1892. G. W. Andrews, break'r constr.; st., $1.11 t., **92,** 533.

1893. Moore & Wright, dr., 19¢ c. y., s. m. ($28,500), **93,** 721.

1894. Wm. S. White, break'r constr.; st. $1.96 t. ($12,212.76), **94,** 528.

1895. A. R. Wright, dr., 16¢ c. y., s. m. ($12,800) **95,** 577.

1897. C. H. Souther, dr., 14⅞¢ c. y., s. m. ($8,925), **97,** 797.

G. W. Andrews, repairs to break'r, replacing coping st., $200 for the job; $1.85 t. for st. ($2,050), **98,** 837.

1900. C. H. Souther, dr., 16⅞¢ c. y., s. m. (64,000 c. y.), **00,** 1152.

1903. Bay State Dredging Co., dr., 25¢ c. y. **03,** 737.

ENGINEERS.

Chief of Engineers. **R., 85,** 60, 480; **86,** 59; **87,** 21; **88,** 21; **89,** 30; **90,** 25; **91,** 31; **92,** 38; **93,** 36 **94,** 35; **95,** 37; **96,** 40; **97,** 41; **98,** 51; **99,** 60; **00,** 68; **01,** 137; **02,** 81; **03,** 58; **04,** 40; **05,** 41; **06,** 39; **07,** 42; **08,** 43; **09,** 47.

In charge:

Col. G. Thom. **R., 82,** 507.

Col. C. E. Blunt. **R., 85,** 480.

Lt. Col. J. A. Smith, 1886–92. **R., 87,** 468; **88,** 397; **89,** 543; **90,** 454; **91,** 608.

Lt. Col. P. C. Hains, 1892–94. **R., 92,** 531; **93,** 719; **94,** 527.

Lt. Col. D. P. Heap, 1895. **R., 95,** 575.

Lt. Col. A. N. Damrell, 1896. **R., 96,** 579.

Maj. R. L. Hoxie, 1897–98. **R., 97,** 796; **98,** 837.

Maj. S. W. Roessler, 1899. **R., 99,** 1047.

Maj. W. L. Fisk, 1900. **R., 00,** 1151.

Capt. H. Taylor, 1901–03. **R., 01,** 1041; **02,** 850; **03,** 736.

Lt. Col. W. S. Stanton, 1904. **R., 04,** 831.

Lt. Col. W. M. Black, 1905–06. **R., 05,** 799; **06,** 867.

Maj. G. A. Zinn, 1907–. **R., 07,** 898; (Lt. Col.) **08,** 938; **09,** 978.

OPERATIONS.

1886–88. 36,021 c. y. dr. from cut, **87,** 468; **88,** 398.

1888–89. 37,479 c. y. dr., **89,** 544.

1889–90. 27,000 c. y. dr., **90,** 454.

1890–91. Beacon built, and 4,543 t. st. placed in break'r, **91,** 609.

1891–92. 13,502 t. st. placed in break'r, **92,** 532.

1892–93. 6,096 t. st. placed in break'r and about 47,500 c. y. dr., **93,** 720.

1893–94. About 9,000 t. st. placed in break'r and about 98,000 c. y. dr., **94,** 528.

1894–96. 62,500 c. y. dr., **95,** 576; **96,** 580.

1896–97. 4,829 c. y. dr., **97,** 796.

1897–98. About 47,000 c. y. dr., **98,** 837.

1898–99. 1,058 t. st. placed to repair break'r, **99,** 1047.

1899–00. 25,735 c. y. dr., **00,** 1151.

[1] H. D. 1066, 61st, 3d.

[2] H. D. 1090, 61st, 3d.

1900-01. 38,064.4 c. y. dr., **01,** 1041.
1902-03. 10,787 c. y. dr.; proj. completed, **03,** 737.
1904-05. Repairs to break'r, 476 t. st. used, **05,** 799.

PLANS.

By Col. Blunt, conversion of Little H. into a larger H. of refuge by extending area and constr. of 2 break'rs; est., $154,000, **85,** 481.
By Maj. Smith, 1886, for an enlarged H.; est., $165,000, **87,** 470.

PROJECTS.

By Col. Thom, 1882, dr. a chan. of entrance to the inner H. 9′ x 100′, m. l. w., widening the anchorage basin to 300′ for 700′, and giving additional protection by a small break'r on the ledge at Jerry Pt.; est., $33,000, **82,** 507; **85,** 481; **86,** 60; **87,** 468.
Proj. enlarged by Lt. Col. Smith, 1888, to provide for 2 small break'rs at the mouth of the H., and for dr. the chan. and anchorage basin to 12′, l. w.; est., $235,000, **88,** 397; **89,** 30, 543, 544; **92,** 531.
Proj. amended so as to reduce the area to be dr. from 49 to 40 acres; est., $145,000, **95,** 576.

SURVEY.

Sur. for imp. for a H. of refuge, au. act July 5, 1884; made by Col. Blunt, **85,** 480.
Ex. of completed imp., **04,** 831.
Maps. **87,** 470.

A-291 ISLES OF SHOALS HARBOR, ME. AND N. H.

APPROPRIATIONS.

1821,	[1] $2,500 (sur.), act Mar. 3.
1822,	[1] 11,500, act May 7.
1902,	30,000, **02,** 848.
1910,	40,000, **10,** 1097.
Total,	84,000

COMMERCE.

De. of, **1900,** 1172.
Inconsiderable; H. valuable chiefly as a refuge, **10,** 56.

CONTRACTS.

1903. Massachusetts Contracting Co., break'r, $1.07 t., **03,** 733.
1912. Pigeon Hill Granite Co., 34,000 t. st., 83¢ t. in place in break'r, **12,** 1369.

ENGINEERS.

Chief of Engineers. **R., 99,** 62; **00,** 77; **02,** 79; **03,** 55; **04,** 37; **05,** 39; **06,** 37; **07,** 40; **08,** 41; **09,** 45, 48; **10,** 55; **11,** 57; **12,** 59.
In charge:
Maj. S. W. Roessler, 1900. **R., 00,** 1172.
Maj. W. L. Fisk, 1900. **R., 00,** 1175.
Capt. H. Taylor, 1902–03. **R., 02,** 847; **03,** 733.
Lt. Col. W. S. Stanton, 1904. **R., 04,** 829.
Lt. Col. W. M. Black, 1905–06. **R., 05,** 797; **06,** 865.
Maj. G. A. Zinn, 1907–10. **R., 07,** 895; (Lt. Col.) **08,** 937; **09,** 977; **10,** 1097.
Lt. Col. W. E. Craighill, 1911–. **R., 11,** 1160; **12,** 1369.
Assistant. Lt. C. Keller. **R., 00,** 1174.

OPERATIONS.

1902-03. 1,095 t. st. placed in break'r, **03,** 733.
1903-04. About 22,691 t. st. placed in break'r; proj. completed, **04,** 829.
1911-12. 7,791 t. st. placed in break'r, **12,** 1369.

PHYSICAL CHARACTERISTICS.

De. of, **1900,** 1175.
I. of S. lie in open sea 6± m. se. of Portsmouth H., N. H. Most protected anchorage, Grosport H.; lies between Star Isld. on s. and sw., Cedar Isld. on se., and Smuttynose Isld. on nne. At m. l. w., anchorage of 32 acres; has d. of 18–48′, and none of its entrances less than 24′, **12,** 59.

PROJECT.

Orig. proj. 1821, rebuilding small break'r on n. side of Haleys Cove, and to build break'r from Smuttynose Isld. to Cedar Isld., **12,** 59.
Maj. Fisk, 1899, est. it would cost $30,000 for new break'r, **1900,** 1176.
By Maj. Fisk, 1900, au. act June 13, 1902, break'r on site of old one; est., $30,000,[2] **02,** 79.
By Lt. Col. Zinn, break'r between Cedar and Star Islds.; est., $40,000,[3] **09,** 48; au. act June 25, 1910, **10,** 56.

SURVEYS.

1875, **75,** ii, 421.
Ex. between Smuttynose and Cedar Islds., au. act Mar. 3, 1899; made by Maj. Roessler, 1899 (**R.** fav.), **00,** 1172.
Sur. au. act of Mar. 3, 1899; made, 1899, by Maj. Fisk (see Projects), **00,** 1176.
Au. act Mar. 2, 1907; made, 1907–8, by Lt. Col. Zinn,[3] **09,** 48.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 60.
Map.[2]

A-291(a) SMUTTY NOSE ISLAND, ME.

(See A-291 Isles of Shoals, Me. and N. H.)

COMMERCE.

Natural H. of refuge at Smutty Nose Isld., **75,** ii, 421, 422.
Break'r connecting Smutty Nose with adjacent islds., **75,** ii, 421, 423.

ENGINEERS.

Chief of Engineers. **R., 75,** 121.
In charge. Lt. Col. G. Thom. **R., 75,** ii, 421.
Assistant. S. Haagensen. **R., 75,** ii, 422.

PHYSICAL CHARACTERISTICS.

Described, **75,** ii, 421–423.

PLAN.

By Lt. Col. Thom, 1875, rebuilding break'r between Smutty Nose and Cedar Islds., 18′ above m. l. w., of large blocks of granite and rubble st.; est., $85,000, **75,** ii, 422, 423.

SURVEY.

By S. Haagensen, 1874, **75,** 121, ii, 421, 422.

[1] Au.: H. R. D. 482, 55th, 2d. [2] H. D. 255, 56th, 1st. [3] H. D. 1122, 60th, 2d.

A-292 RYE HARBOR, N. H.

ENGINEERS.
Chief of Engineers. **R., 10,** 58.
In charge. Lt. Col. G. A. Zinn, **10,** 36.

SURVEY.
Pre. ex. au. act Mar. 3, 1909. **R.,** Lt. Col. Zinn, July 20, 1909 [1] (unfav.), **10,** 58.

A-293(a) HAMPTON RIVER AND HARBOR, N. H.

COMMERCE.
None, **04,** 871.

ENGINEERS.
Chief of Engineers. R., 89, 31; **04,** 69, 870.
Boards. BERH. **R., 04,** 872.
In charge:
Lt. Col. J. A. Smith, 1888. **R., 89,** 549.
Capt. H. Taylor, 1904–. **R., 04,** 870.

PHYSICAL CHARACTERISTICS.
De. of, **89,** 550; **04,** 870.

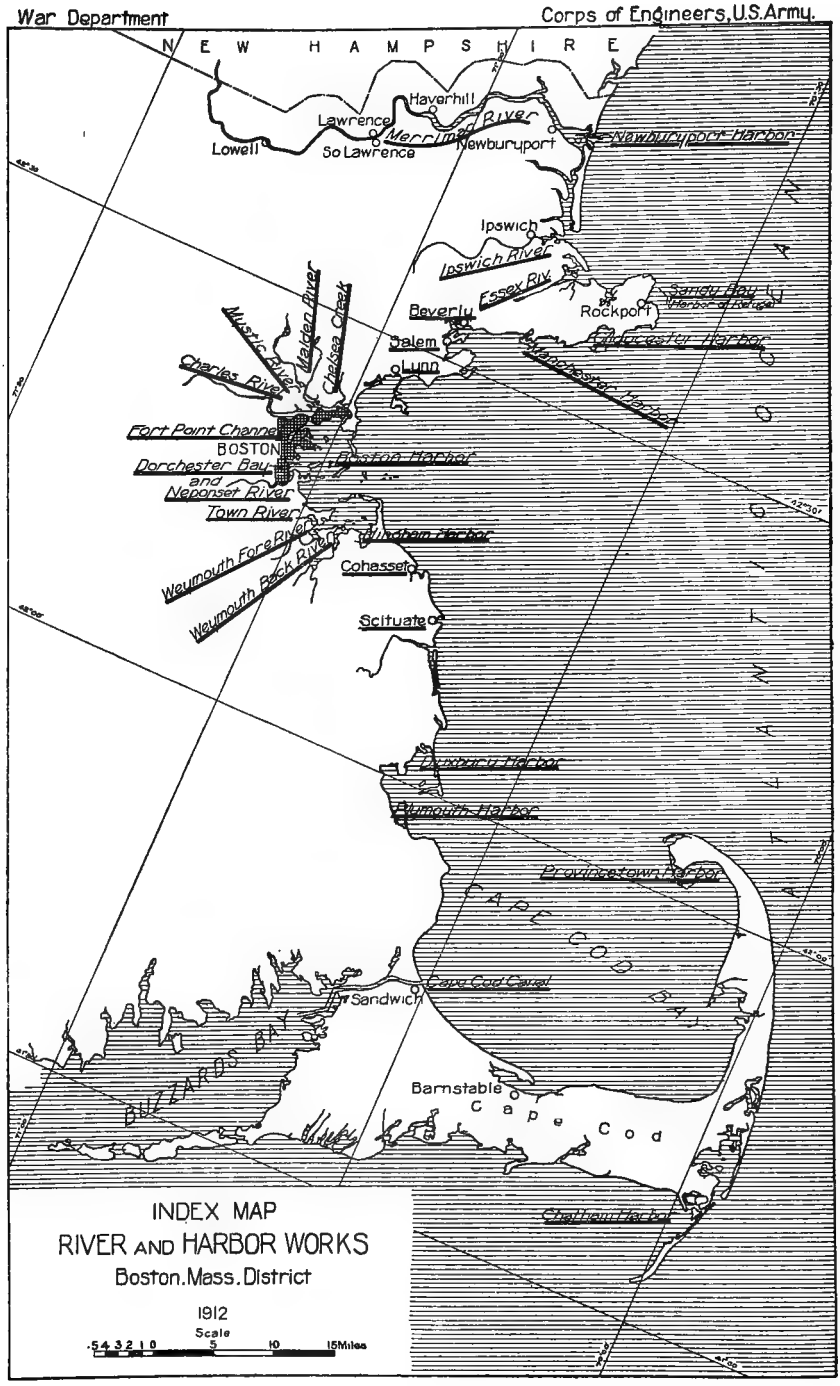
SURVEY.
Ex. au. act Aug. 11, 1888, made, 1888, by Lt. Col. Smith (**R.** unfav.), **89,** 549.
Ex. au. act June 13, 1902, made, 1903, by Capt. Taylor (unfav.),[2] **04,** 870.

[1] H. D. 301, 61st, 2d.

[2] H. D. 247, 58th, 2d.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

B.—BOSTON, MASS., DISTRICT.


War Department
Corps of Engineers, U.S. Army.
NEW HAMPSHIRE
Haverhill
Lawrence
Merrimac River
Lowell
So Lawrence
Newburyport
Newburyport Harbor
Ipswich
Ipswich River
Essex Riv.
Sandy Bay Harbor of Refuge
Rockport
Beverly
Salem
Gloucester Harbor
Lynn
Manchester Harbor
Mystic River
Malden River
Chelsea Creek
Charles River
Fort Point Channel
BOSTON
Boston Harbor
Dorchester Bay and Neponset River
Town River
Hingham Harbor
Weymouth Fore River
Weymouth Back River
Cohasset
Scituate
Duxbury Harbor
Plymouth Harbor
Provincetown Harbor
CAPE COD BAY
Cape Cod Canal
Sandwich
BUZZARDS BAY
Barnstable
Cape Cod
Chatham Harbor
INDEX MAP
RIVER AND HARBOR WORKS
Boston, Mass. District
1912
Scale
5 4 3 2 1 0 5 10 15 Miles

B.—BOSTON, MASS., DISTRICT.

In charge of U. S. Engineer Office,
Boston, Mass.

B 1 Atlantic Ocean.
B 2 Newburyport H., Mass. (1)
B 3 Merrimac R., Mass. and N. H. (2)
B 4 Black Rock Crk., Mass. (3)
B 5 Powow R., Mass. and N. H. (3)
B 6 Cobbler Brook, Mass. (3)
B 7 Cottells Crk., Mass. (3)
B 8 Creek Brook, Mass. (3)
B 9 Bear Meadow Brook, Mass. (3)
B 10 Spickett R., Mass. and N. H. (3)
B 11 Bartletts Brook, Mass. (3)
B 12 Richardson Brook, Mass. (3)
B 13 Beaver Brook, Mass. (3)
B 14 Flagg Meadow Brook, Mass. (3)
B 15 Clay Pit Brook, Mass. (3)
B 16 Scarlet Brook, Mass. (3)
B 17 Lawrence Brook, Mass. (3)
B 18 Little Nesenkeag Brook, N. H. (3)
B 19 Nesenkeag Brook, N. H. (3)
B 20 Sawmill Brook, N. H. (3)
B 21 Little Cohas Brook, N. H. (3)
B 22 Baker Brook, N. H. (3)
B 23 Suncook R., N. H. (3)
B 24 Winnepesaukee R., N. H. (3)
B 25 Lake Winnipiseogee (Winnepesaukee), N. H. (24)
B 26 Oliverian Canal, N. H. (25)
B 27 Pemigewasset R., N. H. (3)
B 28 Baker R., N. H. (27)
B 29 Squam R., N. H. (27)
B 30 Newfound R., N. H. (27)
B 31 Salmon R., N. H. (27)
B 32 Contoocook R., N. H. (3)
B 33 Turkey R., N. H. (3)
B 34 Piscataquog R., N. H. (3)
B 35 Bowman Brook, N. H. (3)
B 36 Sebbins Brook, N. H. (3)
B 37 Souhegan R., N. H. (3)
B 38 Baboosic Brook, N. H. (37)
B 39 Pennichuck Brook, N. H. (3)
B 40 Nashua R., N. H. and Mass. (3)
B 41 Bridge Meadow Brook, Mass. (3)
B 42 Deep Brook, Mass. (3)
B 43 Stony Brook, Mass. (3)
B 44 Concord R., Mass. (3)
B 45 Assabet R., Mass. (44)
B 46 Sudbury R., Mass. (44)
B 47 Trull Brook, Mass. (3)
B 48 Fish Brook, Mass. (3)
B 49 Shawsheen R., Mass. (3)
B 50 Indian R., Mass. (3)
B 51 Artichoke R., Mass. (3)
B 52 Plum Island R., Mass. (1) (3)
B 53 Parker R., Mass. (52)
B 54 Mill Crk., Mass. (53)
B 55 Mud Crk., Mass. (52)
B 56 Nelson Is. Crk., Mass. (52)
B 57 Rowley R., Mass. (52)
B 58 West Crk., Mass. (57)
B 59 Greens Crk., Mass. (1)
B 60 Ipswich R., Mass. (1)
B 61 Labor in Vain Crk., Mass. (60)
B 62 Treadwells Is. Crk., Mass. (60)
B 63 Fox Crk., Mass. (60)
B 64 Canal, Mass. (63) (65)
B 65 Castle Neck R., Mass. (66)
B 66 Essex R., Mass. (1)
B 67 Annisquam H., Mass. (1)
B 68 Squam R., Mass. (67) (Gloucester H. by canal).
B 69 Jones R., Mass. (68)
B 70 Little R., Mass. (68)
B 71 Mill R., Mass. (68)
B 72 Goose Cove, Mass. (68)
B 73 Lobster Cove, Mass. (68)
B 74 Hodgkins Cove, Mass. (1)
B 75 Folly Cove, Mass. (1)
B 76 Hoop Pole Cove, Mass. (1)
B 77 Sandy B. (H. of Refuge), Mass. (1)
B 78 Pigeon Cove, Mass. (1)
B 79 Rockport H., Mass. (1)
B 80 Whale Cove, Mass. (1)
B 81 Loblolly Cove, Mass. (1)
B 82 Brace Cove, Mass. (1)
B 83 Gloucester H., Mass. (1)
B 84 Vincent Cove, Mass. (83)
B 85 Harbor Cove, Mass. (83)
B 86 Canal into Squam R., Mass. (68) (83)
B 87 Magnolia H., Mass. (1)
B 88 Kettle Cove, Mass. (1)
B 89 Manchester H., Mass. (1)
B 90 Beverly Cove, Mass. (1)
B 91 Mackerel Cove, Mass. (1)
B 92 Beverly H., Mass. (1)
B 93 Essex Branch (Danvers R.), Mass. (92)
B 94 Bass R. (Beverly Crk.), Mass. (93)
B 95 Porter R., Mass. (93)
B 96 Crane R., Mass. (93)
B 97 Waters R., Mass. (93)
B 98 North R., Mass. (93)
B 99 Collins Cove, Mass. (92)
B 100 Salem H., Mass. (1)
B 101 Juniper Cove, Mass. (100)
B 102 Cat Cove, Mass. (100)

B 103 Palmers Cove, Mass. (100)
B 104 South R., Mass. (100)
B 105 Forest R., Mass. (100)
B 106 Dollibers Cove, Mass. (100)
B 107 Marblehead H., Mass. (1)
B 108 Lynn H., Mass. (1)
B 109 Saugus R., Mass. (108)
B 110 Little R., Mass. (109)
B 111 Pines (or Chelsea) R., Mass. (109)
B 112 Shirley Gut, Mass. (1) (113)
B 113 Boston H., Mass. (1)
B 114 Winthrop H., Mass. (113)
B 115 Crystal Cove, Mass. (113)
B 116 Belle Isle Inlet, Mass. (113) (118)
B 117 East Boston Chan., Mass. (113)
B 118 Chelsea R. (Crk.), Mass. (113)
B 119 Mystic R., Mass. (113)
B 120 Island End R., Mass. (119)
B 121 Malden R., Mass. (119)
B 122 South Chan., Mystic R., Mass. (113)
B 123 Charles R., Mass. (113)
B 124 Millers R., Mass. (123)
B 125 Lechmere Canal, Mass. (123)
B 126 Broad Canal, Mass. (123)
B 127 Fort Point Chan., Mass. (113)
B 128 South B., Mass. (127)
B 129 Reserved Chan., Mass. (113)
B 130 Pleasure B., Mass. (113)
B 131 Old H., Mass. (113)
B 132 Dorchester B., Mass. (113)
B 133 Tenean Crk., Mass. (132)
B 134 Neponset R., Mass. (132)
B 135 Sun Crk., Mass. (113)
B 136 Sachem Crk., Mass. (113)
B 137 Blacks Crk., Mass. (113)
B 138 Weymouth Fore R., Mass. (113)
B 139 Town R., Mass. (138)
B 140 Bents Crk., Mass. (138)
B 141 Ruggles Crk., Mass. (138)
B 142 Hayward Crk., Mass. (138)
B 143 Weymouth Back R., Mass. (138)
B 144 Broad Cove, Mass. (143)
B 145 Hingham H., Mass. (1)
B 146 Weir R., Mass. (113)
B 147 Hull Gut, Mass. (113)
B 148 Hull, Mass., Headland. (113)
B 149 Little H., Mass. (1)
B 150 Cohasset H., Mass. (1)
B 151 Scituate H., Mass. (1)
B 152 North R., Mass. (1)
B 153 First Herring R., Mass. (152)
B 154 Branch Crk., Mass. (152)
B 155 Broad Crk., Mass. (152)
B 156 Little Crk., Mass. (152)
B 157 South R., Mass. (152)
B 158 Green H., Mass. (1)
B 159 Green H. R., Mass. (158)
B 160 Duxbury Beach and H., Mass. (161)
B 161 Duxbury B., Mass. (1)
B 162 Cut R., Mass. (159) (161)
B 163 Back R., Mass. (161)
B 164 Blue Fish Brook, Mass. (161)
B 165 Kingston B. (and H.), Mass. (1)
B 166 Island Crk., Mass. (165)
B 167 Jones R., Mass. (165)
B 168 Plymouth (Long) Beach and H., Mass. (1)
B 169 Town Brook, Mass. (168)
B 170 Eel R., Mass. (168)
B 171 Warrens Cove, Mass. (1)
B 172 Indian Brook, Mass. (1)
B 173 Bass Crk., Mass. (1)
B 174 Scusset Mill Crk., Mass. (1)
B 175 Tuppers Crk., Mass. (1)
B 176 Cape Cod Ship Canal, Mass. (1)
B 177 Sandwich H., Mass. (1)
B 178 Mill Crk., Mass. (177)
B 179 Dock Crk., Mass. (177)
B 180 Menset Crk., Mass. (177)
B 181 Spring Hill Crk., Mass. (177)
B 182 Old H. Crk., Mass. (177)
B 183 Scorton H. Crk., Mass. (1)
B 184 Long Crk., Mass. (183)
B 185 Cow Crk., Mass. (183)
B 186 Barnstable H., Mass. (1)
B 187 Bass Crk., Mass. (186)
B 188 Wells Crk., Mass. (186)
B 189 Great Crk., Mass. (186)
B 190 Spring Crk., Mass. (186)
B 191 Lone Tree Crk., Mass. (186)
B 192 Chase Garden Crk., Mass. (186)
B 193 Sesuit H., Mass. (1)
B 194 East Dennis, Barnstable B., Mass. (1)
B 195 Quivett Crk., Mass. (1)
B 196 Namskaket Crk., Mass. (1)
B 197 Rock H., Mass. (1)
B 198 Rock Crk., Mass. (197)
B 199 Boat Meadow R., Mass. (1)
B 200 Herring R., Mass. (1)
B 201 Hatches Crk., Mass. (1)
B 202 Black Fish Crk., Mass. (1)
B 203 Wellfleet H., Mass. (1)
B 204 Duck Crk., Mass. (203)
B 205 Herring R., Mass. (203)
B 206 Duck H., Mass. (1)
B 207 Pamet R., Mass. (1)
B 208 Provincetown H., Mass. (1)
B 209 Nauset H., Mass. (1)
B 210 Town Cove, Mass. (209)
B 211 Quansett H., Mass. (1)
B 212 Pleasant B., Mass. (211)
B 213 Muddy Crk., Mass. (211)
B 214 Bassing H., Mass. (1)
B 215 Crows Pond, Mass. (214)
B 216 Ryder Cove, Mass. (214)
B 217 Chatham H. (Stage H.), Mass. (1)
B 218 Stage H., Mass. (1)
B 219 Chatham New H., Mass. (1)
B 220 Mitchel R., Mass. (218)
B 221 Oyster Crk., Mass. (218)

B-2 NEWBURYPORT HARBOR, MASS.[1]

APPROPRIATIONS.[2]

1880,	$50,000,	**80,** 346.
1881,	40,000,	**81,** 503.
1882,	40,000,	**82,** 509.
1884,	40,000,	**84,** 497.
1886,	37,500,	**86,** 560.
1888,	25,000,	**88,** 435.
1890,	25,000,	**90,** 483.
1892,	20,000,	**92,** 553.
1894,	20,000,	**95,** 599.
1896,	16,000,	**96,** 589.
1899,	25,000,	**99,** 1059.
1902,	30,000,	**02,** 852.
1905,	30,000,	**05,** 802.
1910,	50,000,	**10,** 1100.
Total,	448,500	(total, incl. $795.31 recd. from failing contractor, $449,295.31, **12,** 1376.)

COMMERCE.

In 1900, 128,440 t., **01,** 1044; 1906, 169,975 t., **07,** 901; 1911, 217,301 t.; value, $863,099.50, **12,** 1377.

Reduction in rates, **07,** 45; 17′ over bar might give further reduction of 15 to 25¢ t., **12,** 69.

CONTRACTS.

1881. E. P. Shaw, granite grout, $1.32 t., **81,** 504.

1883. I. Hamilton and S. Teague, dike constr., **83,** 435. T. A. Rowe and R. G. Sylvester, sheet piling, **83,** 436.

1886. T. C. Rowe, sand-catch fence constr., $2.67 per running f., **87,** 490. C. H. Edwards, st., $2.23 t., **87,** 490.

1888. Rockport & Pigeon Hill Granite Co., rubblest., $1.97 t., **89,** 556.

1890. J. H. White, rubblest., $1.47 t., **91,** 628;

1892. G. W. Andrews, rubblest., 15,094 t., $1.59 t., **93,** 742.

1894. Rockport Granite Co., 14,634 t. st., $1.23 t., **95,** 600.

1896. Rockport, Pigeon Hill, and Cape Ann Granite Cos., 15,533 t. st., $1.03 s. t., **97,** 826.

1899. Rockport, Pigeon Hill, and Cape Ann Granite Cos., 18,133 t. rubblest., $1.09 s. t., **99,** 1060.

1904. Joseph J. Callahan, rubblest. in js., $1.29 t., **05,** 802.

1906. Break'r Con. & Engr. Co., 28,000 t. rubblest. in n. j., 96¢ t., **06,** 870.

1907. P. H. Doyen, 21,600 t. rubblest. in n. j., $1.25 t., **07,** 900.

1908. Break'r Co., suppl., 4,499 t. rubblest. in n. j., in partial compensation for loss through failure of Break'r Con. & Engr. Co. to fulfill contract of May 1, 1906, **09,** 982.

1910. Rockport Granite Co. and Pigeon Hill Granite Co., rubblest. in n. j., $1.05 t., **11,** 1166.

ENGINEERS.

Chief of Engineers. **R., 80,** 69; **81,** 72, 504; **82,** 71; **83,** 66; **84,** 73; **85,** 60; **86,** 60; **87,** 22; **88,** 22; **89,** 32; **90,** 27; **91,** 33; **92,** 40; **93,** 38; **94,** 36; **95,** 39; **96,** 41; **97,** 45; **98,** 53; **99,** 63; **00,** 69; **01,** 138; **02,** 82; **03,** 59; **04,** 40; **05,** 42; **06,** 41; **07,** 44; **08,** 45; **09,** 48; **10,** 59; **11,** 62; **12,** 67.

Boards. Convened, New York, Oct. 4, 1880, to report upon proj. by Gen. Thom for imp. of Newburyport H. **R., 81,** 505. (Cols. Tower and Newton and Lt. Col. Abbot.)

In charge:

Col. G. Thom, 1871–83. **R., 80,** 345; **81,** 501, 507; **82,** 509.

Maj. C. W. Raymond, 1883–86. **R., 83,** 433, 436; **84,** 493, 497, 498, 499; **85,** 494.

Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 557; **87,** 489; **88,** 433.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 554; **90,** 482; **91,** 626; **92,** 551; **93,** 739; **94,** 529; **95,** 598; **96,** 587; **97,** 824; **98,** 847.

Col. C. R. Suter, 1899. **R., 99,** 1058.

Maj. W. L. Fisk, 1900. **R., 00,** 1153.

Capt. H. Taylor, 1901–03. **R., 01,** 1043; **02,** 851; **03,** 737.

Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 832. **05,** 802.

Maj. Edward Burr, 1906–09. **R., 06,** 869; **07,** 899; (Lt. Col.) **08,** 941; **09,** 981.

Col. F. V. Abbot, 1910. **R., 10,** 1099; **11,** 1165; **12,** 1375.

Assistants:

Lt. J. S. Sewell, **97,** 45; **98,** 53; **99,** 62.

Lt. C. S. Bromwell, **99,** 62.

Lt. R. R. Raymond, **99,** 62; **02,** 77.

Lt. C. Keller, **00,** 64.

1st Lt. G. R. Lukesh, **4,** 35; **05,** 42; (Capt.) **06,** 41; **07,** 44.

1st. Lt. H. C. Jewett, **06,** 41; **07,** 44; **08,** 44.

Lt. Richard Park, **08,** 44.

1st Lt. U. S. Grant (3d), **08,** 44; **09,** 48; **10,** 59.

OPERATIONS.[3]

1881-82. 30,366 t. rubblest. placed in j., extending the same a distance of 1,200′, **82,** 509.

1882-83. 17,800 t. rubblest. placed, extending dike 340′; 817 l. f. diking completed across "the basin"; 507 l. f. sheet piling constr. in s. j. shore extension at Plum Isld., **83,** 434.

1883-84. Dike across basin at Plum Isld. completed with exception of central portions; shore extension of s. j. at Plum Isld. completed and j. finished to 1,077′; 468 l. f. catch-sand fence built, **84,** 494.

1884-85. 16,820 t. rubble placed in work, extending n. j. core 2,640 l. f. and s. j. core 1,300 l. f., **85,** 494.

1885-86. N. j. core extended 35′; both js. leveled up throughout their lengths; 540 l. f. catch-sand fence built, **86,** 558.

1886-87. 860 l. f. of pile dike built; 7,937 t. st. delivered in extension of n. j., **87,** 490.

1887-88. 3,443 t. rubblest. deposited in n. j., **88,** 434.

1888-89. 5,185 t. rubblest. deposited in n. j., extending same 150′, **89,** 555.

1889-90. 4,814 t. rubblest. delivered in n. j., **90,** 483.

1890-91. 4,279 t. rubblest. placed in n. j., **91,** 627.

1891-92. 11,445 t. rubblest. placed in n. j., **92,** 552.

1892-93. 669 t. deposited in j., **93,** 741.

1893-94. About 13,775 t. st. deposited in j., **94,** 530.

1894-95. 973 t. st. placed in j., **95,** 599.

1895-96. 13,278 t. st. placed in j., **96,** 588.

1896-97. 476 t. st. placed in j., **97,** 825.

1897-98. 12,528 t. st. placed in j., **98,** 848.

1899-00. 16,997 t. st. placed in j., **00** 1154.

1901-02. North Rock removed July, 1901; beacon at end of n. j., displaced by storms, reset in June, 1902, and 100 t. st. placed around it for protection, **02,** 851.

1903-04. Bids opened for repairing both j., and for extending s. j.; contract au., **04,** 832.

1904-05. 11,328 t. st. deposited in s. j., of which 10,480 t. were used in bldg. 197 l. f. full cross section and 71′ of core and 848 t. in retopping 300 l. f. of j. previously completed; proj. 75% accomplished, **05,** 802.

1905-06. 2,500 t. st. deposited in n. j., retopping 550 l. f.; 6,378 t. st. placed in s. j., which, with 2,294 t. purchased informally from Rockport Granite Co., extended s. j. 94′; proj. 80% completed, **06,** 869–70.

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[1] Sur. **R.,** 1826; est., $32,080.27.—(H. Doc. 482, 55th, 2d.)

[2] Between 1828 and 1834, incl., $60,366.72 appro. for removal of a sand bar and the constr. of a break'r at the mouth of the Merrimac R.

[3] For operations previous to 1881, see Merrimac River.

1906-07. 2,026 t. rubblest. deposited, retopping 100 l. f. n. j.; contract with Break'r Con. & Engr. Co. annulled for failure to prosecute work as required, **07,** 900.

1907-08. 14,138 t. st. deposited, retopping 400 l. f. of n. j., and that j. extended seaward for 200 l. f., and st. deposited irregularly for 100′ farther, **08,** 941.

1908-09. 11,961 t. rubblest. deposited, of which 1,133 t. were for mainten., retopping outer end of n. j., and 10,828 t. for seaward extension of j.; work completed; n. j. extended 163′ seaward, **09,** 981–82.

1909-10. Clearing débris from breach made by action of elements in dike closing Plum Isld. Basin; sur. made of bar and entrance **10,** 1099.

1910-11. 13,470 t. rubblest. deposited in n. j., completing core to 12′ above m. l. w. for 200′, to 9′ above m. l. w. for 100′, and to m. l. w. level for distance of 325′, **11,** 1165.

1911-12. 23,158 t. rubblest. deposited in n. j., bringing core up to 12′ with w. of 5′ on top for 425′ and extending it for a further distance of 625′; proj. 85% completed, **12,** 1375–76.

PHYSICAL CHARACTERISTICS.

Decrease in w. of bar since commencement of js., **85,** 496.

Comparison of gorge and discharge sections from various surs., **85,** 496.

Discharge of R., **87,** 491.

Description of, **01,** 1043; **07,** 44; **10,** 59.

Chan. moved slightly n. of position in 1899, retaining same w., **01,** 139.

Max. draft over bar at m. l. w., in 1907, 12½′, **07,** 45; and in 1910, 11′, **10,** 60.

Action of elements made breach in dike closing Plum Isld. Basin, **10,** 1099.

On Merrimac R., 2½ m. above its mouth, and 58± m. by water n. of Boston. R. at Newburyport ¼ of m. wide, **12,** 67.

PROJECTS.

From 1828 to 1834, incl., $60,366 app. for the removal of a sand bar at the mouth of the Merrimac, and for break'r constr.

By Lt. Col. Thom, 1880, securing a constant d. of 17′ across the bar at m. l. w. by constr. of 2 converging rubblest. js., extending from Salisbury Pt. and Plum Isld.; est., $365,000, **81,** 502, 509, 511. Recom. by B. of E., **81,** 505. Concurred in by Chief of Engineers, **81,** 505.

In 1881 a dike closing Plum Isld. Basin was proposed, increasing cost of proj. to $375,000, **84,** 494.

In 1883 proj. was modified by changing the direction of s. j. and substituting for the apron beach protection a sand catch in rear and in prolongation of s. j., **83,** 437; **86,** 60; **87,** 490.

In 1892 it was proposed by Lt. Col. Mansfield to expend available funds in extending the n. j., **93,** 740.

In 1897 Lt. Col. Mansfield submitted revised est. $599,547.49, **97,** 825.

By Lt. Col. Mansfield, 1898, to place a spindle on the n. j. to aid navigation, **98,** 849.

Act June 25, 1910, au. dr. to be included as part of existing proj., **10,** 60.

SURVEYS.

Of area from gorge between Salisbury Pt. to Plum Isld., to js., and in front of js. to 15′ curve, **86,** 559.

Of outer bar and H. entrance, 1880, **81,** 501.

An. sur. made by Lt. Col. Mansfield, **93,** 741; **94,** 530; **95,** 599; **97,** 825.

Sur., 1900, made by Maj. Fisk, **00,** 1154.

Minor sur. in June, 1901, shows imp. in d. over bar; controlling d. in 1901 about 12.6′, as against 11′ m. l. w. in 1899, **01,** 139.

By Maj. Burr, 1906; for removing certain obstr. at mouth of R.; est., $62,000[1]; **07,** 46, 74.

Cong. Docs., etc., relating to surs. exs. etc., **12,** 63.

Maps:

81, 502; **83,** 438; **84,** 496; **85,** 494; **86,** 558; **87,** 492; **88,** 434; **89,** 556; **90,** 482; **91,** 627; **92,** Atlas, 2.

Plan showing condition of imp., **93,** 740; **94,** 530; **95,** 600; **97,** 826; **01,** 1043; sur. of bar and entrance, **05,** 802.

B-3 MERRIMAC RIVER, MASS. AND N. H.[2]

APPROPRIATIONS.

1828,	$32,100.00,	act May 23.
1830,	3,506.72,	act Apr. 23.
1831,	16,000.00,	act Mar. 2.
1833,	4,900.00,	act Mar. 2.
1834,	3,860.00,	act June 28.
1842,	8,000.00,	act (relief) June 4.
1870,	25,000.00,	**71,** 93.
1871,	25,000.00,	**71,** 93.
1872,	25,000.00,	**72,** 92.
1873,	25,000.00,	**73,** 101.
1874,	10,000.00,	**74,** 111.
1875,	12,000.00,	**75,** 116.
1878,	10,000.00,	**78,** 41.
1879,	5,000.00,	**79,** 49.
1880,	12,000.00,	**80,** 345.
1881,	9,000.00,	**81,** 514.
1882,	9,000.00,	**82,** 512.
1884,	3,500.00,	**84,** 501.
1890,	10,000.00,	**90,** 485.
1892,	1,500.00,	**92,** 555.
1896,	5,000.00,	**96,** 591.
1899,	40,000.00,	**99,** 1061.
1902,	40,000.00,	**02,** 853.
1905,	40,000.00,	**05,** 804.
1909,	*10,000.00,	**09,** 983.
1910,	10,000.00,	**10,** 1100.
Total,	395,366.72	(incl. misc., $395,368.80, **12,** 1377).

COMMERCE.

Important. **70,** 472; **73,** 1112, 1113; **79,** 267.

Newburyport a H. of refuge, **70,** 472.

Description of, **98,** 885.

Almost exclusively coal, carried in barges of about 7′ draft, **04,** 874.

Rates 35 to 50¢ per t. less by water than by rail on coal, **10,** 62.

In 1911, 108,686 t., mostly coal, **12,** 71.

CONTRACTS.

1870. G. W. Townsend, removal of obstr., **70,** 467. A. Boschké, removal of obstr., $25 per c. y., **70,** 467; **71,** 869.

1871. W. S. Fretch, dr., $10 per c. y., **71,** 868.

1873. A. R. Wright, dr., $4.95 per c. y., **73,** 1082. A. R. Wright, dr., $4.50 per c. y., **73,** 1082.

1875. Curtis, Fobes & Co., dr., 35¢ per c. y., **75,** ii, 401.

1878. I. A. Sylvester, removal of r., $28 per c. y., **79,** 264.

1879. Pentucket Navigation Co., removal of r., 95½ c. y., $30 c. y., **81,** 512.

1880. J. Andrews, removal of Gangway Rock, $30 per c. y., **81,** 515.

1881. G. W. Townsend, removal of Gangway Rock, $27.50 per c. y., **81,** 515. Trumbull & Cheney, removal of r., $44 per c. y., **81,** 515. Contract abandoned after partial completion, **83,** 440.

1882. Hamilton & Floyd, removal of South Badger Ledge, $110 per c. y., **83,** 441. G. W. Townsend, removal of North Rocks, $35 per c. y., **83,** 441.

1884. J. McDermott, dr., Rocks Br., $2.18 per c. y., **85,** 500.

1892. Sturgis & Andrews, ledge removal at $13.85 per c. y., p. m. ($4,847.50), **93,** 744.

1896. Eastern Dredging Co., dr. 1,250 c. y., $4; removal of bowlders over 6 t., $10, **97,** 829.

*Allotment. [1] H. D. 339, 59th, 2d [2] Sur.—R. 1826, est., $32,080.27. (H. D. 482, 55th, 2d.)

1899. A. E. Smith, dr. 72,727 c. y., 49½¢ s. m.; removal of bowlders over 3 t. in weight, $10 per c. y. (annulled), **00,** 1157.

1900. R. B. Rodermond, dr., 49.5¢ c. y., s. m.; removing bowlders, $10 per c. y., **01,** 1045.

1902. Harries & Letteney Co., dr., 55¢ and $1.75 per c. y., **03,** 739.

1906. W. E. Biddle and T. J. Gavin, dr., 55¢ and $1.40 per c. y., **06,** 871.

1909. N. E. Gordon, hire of plant for removing bowlders, $36.50 per day, **09,** 983.

1910. Commonwealth Dredging Co., dr. 24,000 c. y., $2.25 below Rocks Br. and 57¢ above, **11,** 1167.

ENGINEERS.

Chief of Engineers. **R., 69,** 60; **70,** 78; **71,** 92, **72,** 91; **73,** 101, 106; **74,** 110; **75,** 116; **76,** 42; **77;** 36; **78,** 41; **79,** 48; **80,** 68; **81,** 72, 77; **82,** 72, 77; **83,** 67; **84,** 74; **85,** 61; **86,** 61; **87,** 23; **88,** 23; **89,** 33; **90,** 27; **91,** 34; **92,** 40; **93,** 39; **94,** 37; **95,** 40; **96,** 42, 54; **97,** 46, 64; **98,** 54, 69; **99,** 63; **1900,** 70; **01,** 139; **02,** 84; **03,** 60; **04,** 42, 69, 872; **05,** 44; **06,** 43; **07,** 45, 74; **08,** 46; **09,** 50, 78; **10,** 61, 89; **11,** 64, 92; **12,** 69.

Boards. BERH., **R., 04,** 875.

In charge:

Lt. Col. J. G. Foster, 1869–71. **R., 69,** 421, 437; **70,** 467, 469, 471, 473; **71,** 867.

Lt. Col. G. Thom, 1871–83. **R., 71,** 866; **72,** 940, 961; **73,** 1081, 1112, 1114; **74,** ii, 310; **75,** ii, 399; **76,** 165; **77,** 169; **78,** 205; **79,** 264; (Col.) **80,** 343; **81,** 511; **82,** 510, 532.

Maj. C. W. Raymond, 1883–86. **R., 83,** 439; **84,** 500; **85,** 499.

Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 560; **87,** 493; **88,** 436.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 556; **90,** 484; **91,** 628; **92,** 554; **93,** 742; **94,** 430, 532; **95,** 600; **96,** 590, 616; **97,** 827, 865; **98,** 850, 884.

Col. C. R. Suter, 1899. **R., 99,** 1058–1060.

Maj. W. L. Fisk, 1900. **R., 00,** 1155.

Capt. H. Taylor, 1901–03. **R., 01,** 1044; **02,** 852; **03,** 738.

Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 833, 873; (Col.) **05,** 803.

Maj. Edw. Burr, 1906–09. **R., 06,** 870; **07,** 901; (Lt. Col.) **08,** 943; **09,** 983.

Col. F. V. Abbot, 1910–. **R., 10,** 1100; **11,** 1166; **12,** 1377.

Assistants:

Capt. G. L. Gillespie. **R., 69,** 438.
H. Mitchell. **R., 70,** 474.
D. Koppman, **70,** 473.
Lt. J. B. Quinn. **R., 73,** 1112.
G. P. Low. **R., 72,** 962.
S. Haagensen. **R., 82,** 535–544; **83,** 441.
T. T. H. Harwood. **R., 96,** 618; **98,** 885.
W. F. Robinson. **R., 04,** 876.

OBSTRUCTIONS.

Br. between Haverhill and Bradford, **94,** 430.

OPERATIONS.

1870–71. Removal of schooner "Globe," **71,** 867. Removal of main (s.) Gangway Rock, 600 t. r. **71,** 867. Removal of part of North Gangway Rock to 9.5′ d., **72,** 91, 940. Chan. at Lower Falls, 475 c. y. dr., **72,** 92, 940; **74,** 110; ii, 310.

1871–72. Chan. at Lower Falls, 2,731 c. y. dr., **72,** 92, 940; **74,** 110, ii, 310.

1872–73. Chan. at Upper Falls, 3,755 c. y. dr., **74,** 111; ii, 310.

1874–75. Completion of work above Haverhill, **75,** 116. Chan. at Upper Falls, 3,146.2 c. y. dr., **75,** ii, 400, 401. Chan. at Lower Falls, 3,570.2 c. y. dr., **75,** ii, 400, 401. Ledge and Little Currier Rock, 60 c. y. r. removed, **75,** ii, 400, 401.

1875–76. Rs. removed from Currier Shoal and below Rocks Br., including Petty Rock, **76,** 166.

1876–77. Chan. 100′ x 12′ through shoals, **77,** 170. Chan. 75′ x 12′ to Silsby's Isld., **77,** 170.

1877–78. Removal of bowlders from Silsby's Isld., 80 t. r., **78,** 206.

1878–79. Removal from North Gangway Rock, 305 c. y. r., **79,** 48, 264.

1879–80. Imp. of chan. at and below the upper and lower falls, **80,** 344.

1880–81. 124½ c. y. r. removed from Gangway Rock, North Rocks, and from chan. at Lower Falls; also removal of sunken prs. and wrecks from Newburyport H. and d. chan. by dr. at the Lower Falls and Rocks Br., **81,** 512.

1881–82. Completion of the removal of South Gangway Rock to 9′ and of South Badger Ledge and North Spur Rocks in part to 10′, **82,** 511.

1882–83. Breaking up and removal of South Badger Ledge and partial removal of North Rock, **83,** 440.

1883–84. Removal of North Rock to 9′, **84,** 500.

1884–85. 1,056 c. y. bowlders, gravel, and clay dr. from chan. at Rocks Br., **85,** 500.

1892–93. 201 c. y. r. removed, **93,** 743.

1893–94. 149 c. y. r. removed; proj. completed, **94,** 532.

1896–97. 855 c. y. r. removed, **97,** 828.

1897–98. 205 t. bowlders removed, **98,** 850.

1900–01. 4,792 c. y. dr., **01,** 1044.

1901–02. 64,356 c. y. mud and 2.5 c. y. bowlders removed, **02,** 853.

1902–03. 29,740 c. y. dr. and 5.35 c. y. bowlders removed, **03,** 738.

1903–04. 17,429 c. y. dr., **04,** 833.

1905–06. 4,554 c. y. dr., **06,** 870.

1906–07. 15,612 c. y. dr., **07,** 901.

1907–08. 4,102 c. y. dr., completing proj. chan., **08,** 943.

1908–09. Removal of bowlders below Rocks Br. begun, **09,** 983.

1909–10. 255 c. y. bowlders removed, **10,** 1100.

1910–11. 181 c. y. removed above and 229 c. y. below Rocks Br., **11,** 1166.

1911–12. 18,795 c. y. sand, gravel, and st., and 27 c. y. bowlders removed, **12,** 1377.

PHYSICAL CHARACTERISTICS.

Description of obstr., **69,** 438; **70,** 473, 474; **73,** 1113.

Of river, **70,** 474; **72,** 961, 962; **73,** 1113; **88,** 436; **96,** 616; **97,** 865; **98,** 885.

Description of, Lawrence to Manchester, **82,** 532.

Formed by confluence of Pemigewasset and Winnepesaukee Rs. at Franklin, N. H. Flows s. through N. H. to Mass., whence it flows e. to discharge into Atlantic at Newburyport, about 55 m. n. of Boston; l., 110± m. Proj. section in 1912 is between Newburyport (2½± m. above mouth) and Haverhill, Mass., and covers 16½ m. Head of navigation, 20 m. above Newburyport, **12,** 69.

PLANS. (See Projects.)

By H. Mitchell, 1870, moving barges over the rapids, **70,** 476.

By Lt. Col. Thom, 1871, slack-water navigation, Upper Falls, dam 900′ x 9′; est., $130,000, **71,** 869; **72,** 962.

By Col. Thom, 1881, imp. chan., head of Mitchells Falls at Lawrence, 21½ m. above the mouth of the R., to Manchester, N. H., 70 m. above the mouth, by r. removal and dr., with locks and canal walls on the section of R. between Nashua and Manchester, N. H. Est., $548,000, exclusive of the cost of new canals and locks at Lawrence and Lowell or the cost of adapting the present ones to the purpose of navigation. **82,** 533, 534, 539, 541.

PRIVATE AND CORPORATE WORK.

Sur., by H. Mitchell, for the Pentucket Navigation Co., **70,** 474.

PROJECTS. (See Plans.)

Between 1828 and 1834, inclusive, $60,366.72 was app. for removal of a sand bar and constr. of a break'r at the river's mouth.

Original proj., 1869, proposed the removal of obstr. from the upper and lower falls, of Gangway Rock, the Boilers, and a wreck near the mouth; est., $69,025, **69,** 421; **70,** 469, 473; **76,** 165; **86,** 61.

In 1874 proj. extended to include the removal of rs. at Deer Isld. and at Rocks Br. and Little Currier Shoal, to give chan. d. at ordinary h. w. as follows: From mouth to Deer Isld. Br., 16½′; thence to

Haverhill Br., 12′; thence to foot of Mitchells Falls, 10′; thence to head of Upper Falls, 4½′; est., including proj. of 1869, $147,000, **76,** 165; **86,** 61; **87,** 494. Proj. completed in 1884, with the exception of the removal of the "Boilers," under an aggregate app. of $167,000, when it was est. that $26,000 additional would be required for the further imp. of the R. between Plum Isld. Light and Lawrence, **82,** 534, 541; **84,** 501; **86,** 561; **87,** 494.

From 1883–86 additional imp. by Maj. Raymond for the R. below Mitchells Falls, including removal of the "Boilers" and sunken rs. at the Falls, est., $11,500, **90,** 485.

In 1882 $11,000 est. as required for the extension of the imp. to Lawrence, 5 m. above the Falls, **92,** 555.

Congress, 1896, app. $5,000 for removing some rs. below Rocks Br., **96,** 590.

Lt. Col. Mansfield, 1896, est. $1,496,851.07 to obtain 12′ chan. mouth to Haverhill, **96,** 590, 617; and in 1897, $171,442.70 for a 7′ chan. (au. proj.), **97,** 865.

By Lt. Col. Stanton, 1903, increasing d. from 7′ to 9′ from Newburyport to highway br. at Haverhill; est., $213,126.98,[1] **04,** 873.

By Maj. Burr, 1906, removing certain obstr. at the mouth; est., $62,000,[2] **07,** 46, 74.

SURVEYS.

Sur. by Capt. Gillespie, **69,** 60, 421, 437, 438.
Sur. by Gen. Foster, **70,** 471–476.
Sur. by G. P. Low, 1871, Hazeltine Rapids to Lawrence, **72,** 940, 961, 962.
Sur. by Lt. Quinn, 1872, bet. Haverhill and Newburyport, **93,** 106, 1112.
From Lawrence to Manchester, au. act Mar. 3, 1881, **81,** 77; made by Col. Thom, 1881, **82,** 532. At Rocks Br., made, 1883, **83,** 441.
Sur. for d. up to Haverhill equal to d. over bar at mouth, au. act Aug. 17, 1894; made in 1896, by Lt. Col. Mansfield (see Projects), **96,** 616.
Sur. of the same course au. act June 3, 1896; made, 1897, by Lt. Col. Mansfield (see Projects), **97,** 865.
Sur. from Lowell to old N. H. State line, au. act June 3, 1896; made, 1898, by Lt. Col. Mansfield (**R.** unfav.), **98,** 885.
Ex. au. act June 13, 1902; made, 1903, by Lt. Col. Stanton,[1] **04,** 872.
Ex. and sur. au. act Mar. 3, 1905, for chan. 12′ d., mouth to falls above Haverhill; made, 1905, by Col. Stanton (unfav.),[2] **07,** 74.
With view to removing certain obstrs. at mouth, made, 1906, by Maj. Burr,[2] **07,** 46, 74.
Au. act Mar. 2, 1907, for locks and dams for chan. 14′ d. from mouth to Haverhill; made, 1907–08, by Lt. Col. Burr (unfav.),[3] **09,** 78.
Pre. ex. au. act Mar. 3, 1909, from Haverhill to Lowell. **R.,** Lt. Col. Burr[4] (unfav.), **11,** 92.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 70.
Maps,[2, 3, 4]. **89,** 556.

B-5 POWOW RIVER, MASS. AND N. H.

APPROPRIATIONS.

1888,	$3,000,	**88,** 24.
1890,	5,000,	**90,** 486.
1892,	4,000,	**92,** 556.
1894,	15,000,	**95,** 603.
1896,	12,000,	**96,** 592.
1899,	12,000,	**99,** 1062.
Total,	51,000	

COMMERCE.

Important, **85,** 550.
In 1900, 5,000 t. coal for local consumption, **01,** 1046; 5,000 t. reported an., **02,** 85; 1904, 14,000 t. coal, **04,** 835.

CONTRACTS.

1894. A. R. Wright, dr. 64,102 c. y., 39¢, **95,** 603.
1896. Eastern Dredging Co., dr. 30,769 c. y., 39¢; removal of bowlders over 3 t., $5 c. y, **97,** 829.
1899. A. E. Smith, dr. 31,304 c. y., 34½¢; bowlder removal, over 3 t., $10 c, y, **99,** 1062; (annulled) **1900,** 1158.

ENGINEERS.

Chief of Engineers. R., 85, 67; **88,** 24; **89,** 33; **90,** 28; **91,** 35; **92,** 41; **93,** 40; **94,** 37; **95,** 41; **96,** 43; **97,** 47; **98,** 55; **99,** 64; **00,** 71; **01,** 140; **02,** 85; **03,** 61; **04,** 43; **05,** 45.

In charge:
Maj. C. W. Raymond. **R., 85,** 549.
Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 558; **90,** 485; **91,** 630; **92,** 556; **93,** 745; **94,** 533; **95,** 602; **96,** 591; **97,** 829; **98,** 851.
Col. C. R. Suter, 1899. **R., 99,** 1061.
Maj. W. L. Fisk, 1900. **R., 00,** 1157.
Capt. Harry Taylor, 1901–03. **R., 01,** 1046; **02,** 854; **03,** 740.
Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 834; **05,** 804.

Assistant. S. Haagensen. **R., 85,** 551.

OPERATIONS.

1887-90. Operations deferred pending the insertion of a draw in br. at Salisbury, **88,** 24; **89,** 558; **90,** 486; **91,** 630; **92,** 556.
1895-96. 23,209 c. y. dr., **96,** 592.
1896-97. About 67,000 c. y. dr., **97,** 829.
1899-00. 18,099 c. y. dr., **00,** 1158.
1900-01. Under open market agreement with R. B. Rodermond, 10,479 c. y. dr., w. chan. to 45′ for 2,900′ down R., **01,** 1046.

PHYSICAL CHARACTERISTICS.

Description of R., **85,** 549, 552; **05,** 45.
Max. draft to wharves at Amesbury 4.5′; mean rise of tide is 6.7′, **02,** 85.
A chan. 45′ wi. from Amesbury to mouth of R. has been dr., except for 650′ at lower end, where it is 30′ w., **04,** 43.
Head of navigation is at dam at Amesbury, to which pt. the stream is navigable, **04,** 43.
Flows into Merrimac R.; Amesbury (5 m. above Newburyport H.), 9,600′ above junct., **05,** 45.

PROJECTS.

By Maj. Raymond, 1885, dr. chan. 60′ x 12′ m. h. w. between Amesbury and the mouth, 9,600′, est. $77,000, **85,** 551; **89,** 558; **91,** 630.
By Lt. Col. Mansfield, 1894, cut the whole length of the proposed chan. 25′ w. and of full proj. d., **95,** 602.
A revised est. of the cost of the imp. submitted, 1897, by Lt. Col. Mansfield, increasing it to $100,000 **97,** 829.
Act Mar. 3, 1905, repealed proj., **05,** 45.

SURVEY.

Au. act July 5, 1884, made by Maj. Raymond, **85,** 549.

[1] H. D. 311, 58th, 2d.
[2] H. D. 339, 59th, 2d.
[3] H. D. 2, 61st, 1st.
[4] H. D. 9, 62d, 1st.

B-25 LAKE (WINNEPESAUKEE) WINNIPISEOGEE, N. H.[1]

APPROPRIATIONS.

1880, $5,000, **80,** 340.
1881, 2,500, **81,** 494.

Total, 7,500

CONTRACTS.

1880-81. Winnipiseogee Lake Cotton & Woolen Manuf. Co., dr., $1 per c. y., **81,** 495.

ENGINEERS.

Chief of Engineers. R., 75, 121; **79,** 52; **80,** 72; **81,** 70; **82,** 69; **83,** 64; **85,** 60.

In charge:
Lt. Col. G. Thom, 1879–83. **R., 75,** ii, 431; (Col.) **80,** 339, 362; **81,** 492; **82,** 501.
Col. C. E. Blunt, 1883–85. **R., 83,** 423; **85,** 479.

OPERATIONS.

1880-81. 400 c. y. dr., **81,** 494.
1881-82. 1,540 c. y. dr., **82,** 501.
1882-83. 1,285 c. y. dr., **83,** 424.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 431; **81,** 493.

PLANS.

Of Lt. Col. Thom, 1875, buoying chan.; est., $500, **75,** ii, 431, 432.

PROJECTS.

By Col. Thom, 1879, chan. 50′ x 5′ at extreme l. w., through the outlet from Lake Winnipiseogee to Long B. Est., $7,500. **80,** 363.

SURVEYS.

Ex. for placing buoys, by Lt. Col. Thom, 1875, **75,** 121, ii, 431.
Of outlet of Lake Winnipiseogee, au. act Mar. 3, 1879; made, 1879, by Col. Thom, **79,** 52; **80,** 362.
Ex. of Winnipiseogee Lake at "the Weirs," au. act July 5, 1884; made, 1884, by Col. Blunt. **R.** unfav. **85,** 479.
Maps. **80,** 362.

B-26 OLIVERIAN CANAL, N. H.

SURVEY.

Sur.—**Rs.**, Feb. 18, 1828, and Nov. 2, 1835 (H. D. 482, 55th, 2d.). Note: For canal from Connecticut R., near Haverhill, N. H., to Lake Winnipiseogee (Winnepesaukee), N. H., via Bakers R., Pemigewasset R., Squam R. and Lakes. (**R.**, H. D. 113, 28th, 2d.)

B-60 IPSWICH RIVER, MASS.

APPROPRIATIONS.

1886, $2,500, **87,** 497.
1888, 2,500, **88,** 439.
1892, 2,500, **92,** 558.

Total, 7,500

COMMERCE.

Important, **74,** ii, 345, 346.
Coal and fresh fish, 3,800 t., 1905.[2]

CONTRACTS.

1886. T. Symonds, dr., 31½¢ c. y., **87,** 497.
1892. E. B. Lovering, dr., 35¢ c. y., removal of bowlders over 3 t. in weight, $7 (12,285 c. y.), **93,** 747.

ENGINEERS.

Chief of Engineers. R., 73, 106; **74,** 116; **76,** 48; **84,** 79; **87,** 24; **88,** 24; **89,** 34; **90,** 29; **91,** 35; **92,** 42; **93,** 40; **94,** 38; **95,** 41; **06,** 72.

In charge:
Lt. Col. Thom, 1872–76, and 1884. **R., 74,** ii, 345; **76,** 198; (Col.) **84,** 557, 560.
Maj. C. W. Raymond. **R., 84,** 558.
Lt. Col. G. L. Gillespie, 1887–89. **R., 87,** 495; **88,** 438.
Lt. Col. S. M. Mansfield, 1889–95. **R., 89,** 559; **90,** 487; **91,** 631; **92,** 557; **93,** 746; **94,** 534; **95,** 603.
Col. W. S. Stanton, **06,** 41.

Assistant. S. Haagensen, **74,** ii, 345; **76,** 198. **R., 74,** ii, 346; **76,** 200; **84,** 562.

OPERATIONS.

1886-87. 4,665 c. y. dr. from chan. through shoals, **87,** 496.
1892-93. About 1,500 c. y. dr., **94,** 535.
1894-95. About 5,700 c. y. dr., **95,** 604.

ESTIMATES. (See Plans and Projects.)

By S. Haagensen, 1872, break'r at Lower Plum Cove, $640,000; at Upper Plum Cove, $1,130,000, **74,** ii, 345.

PHYSICAL CHARACTERISTICS.

Description, **74,** ii, 346; **76,** 199–201; **84,** 560, 563.
Character of coast, **74,** ii, 346.
Tidal observations, **74,** ii, 346; **76,** 200.
List of obstr., **76,** 202.

PLANS. (See Estimates.)

By S. Haagensen, 1873, break'r at Lower Plum Cove, affording 23 acres of good anchorage ground of 18′, and 32 acres of 12′ m. l. w., and 40 acres for small craft. L. of break'r 1,841′, to be constr. of riprap, st. masonry, and concrete. Fav. considered by Lt. Col. Thom; est., $640,000, **74,** ii, 345, 347. Or a break'r at Upper Plum Cove, affording 30 acres more than the above. L., 3,070′; est., $1,130,000; not recom., **74,** ii, 345, 347. For imp. r. by a 9′ chan. m. l. w., 60′ w.; not recom.—too costly and not permanent, **76,** 199, 201.
By Lt. Col. Thom, for imp. at and above Barras Turns by a 4′ chan. m. l. w., 60′ w.; est., $25,000, **76,** 199, 201, 202.

PROJECTS. (See Estimates.)

Orig. proj. for imp. submitted Dec. 6, 1875. It proposed chan. 60′ x 4′ d., m. l. w., "Barras Turns" to the town wharves; est., $25,000. On Nov. 5, 1883, orig. proj. divided into 3 partial proj.: (1) Removal of the ledges at Heards Pt. and opposite Nabbys Pt. to 2′, m. l. w., to open a navigable chan. of that d., at cost of $15,900; (2) to dr. shoals at "Labor in Vain" and "The Shoals" so as to open chan. 4′ x 60′, at a cost of $2,200; (3) to straighten the chan. by making a cut across "Barras Turns" and to build a j. to close the old chan.; cost, $6,900. In the an. **R.** of 1887 it was recom. that the general proj. be modified by limit-

[1] Sur. of canal—**R.**, Feb. 18, 1828. (H. D. 482, 55th, 2d.)

[2] H. D. 42, 59th, 1st.

ing the present imp. to opening a chan. 60′ x 4′ through "The Shoals" and "Labor in Vain" and extending it to the "Deep Hole," opposite the town wharves, **88,** 438.

By Lt. Col. Mansfield, 1892, for the use of available funds to complete the partial proj. of 1887, **93,** 746; Lt. Col. Mansfield est., 1895, that $17,500 would be required to complete the proj., but that the amount of imp. already completed was sufficient for any reasonable demands of C., **95,** 604.

SURVEYS.

Sur. by S. Haagensen, 1872, at Hodgkins Cove, to determine the practicability of a H. of refuge, **73,** 106; **74,** 116, ii, 345, 346.

Sur. completed by S. Haagensen, 1875, **76,** 48, 198, 200. Bench marks, **76,** 200.

Au. act Aug. 2, 1882, made by Col. Thom, **84,** 557.

Pre. ex. au. act Mar. 3, 1905; **R.,** Col. Stanton, May 22, 1905 (unfav.),[1] **06,** 72.

Maps. **87,** 496.

B-66 ESSEX RIVER, MASS.

APPROPRIATIONS.

1892,	$5,000,	**93,** 748.
1894,	5,000,	**95,** 606.
1896,	5,000,	**96,** 593.
1899,	10,000,	**99,** 1063.
1907,	5,000,	**07,** 902.

Total, 30,000 (total, incl. $5,000 contrib. by Mass., 1908, $35,000, **12,** 1379)

COMMERCE.

Description of, **91,** 677.

No freight, but small amount shipbuilding (fishing boats) carried on, **10,** 63.

Shipbuilding industry rapidly diminishing; cessation of U. S. imp. recom., **12,** 72.

CONTRACTS.

1894. Columbian Dredging Co., dr. 47,367 c. y., 19¢ c. y., s. m., **95,** 606.

1897. Eastern Dredging Co., dr. 14,516 c. y., 31¢ c. y.; removal of bowlders, over 6 tons, $10, **97,** 831.

1900. A. B. Martin, dr., 40¢ c. y., s. m.; bowlder removal, over 3 tons, $4 ($6,000), **1900,** 1160.

1908. Bay State Dredging Co., dr., 38¾¢ c. y., **09,** 984.

ENGINEERS.

Chief of Engineers. R., 91, 47; **93,** 41; **94,** 39; **95,** 42; **96,** 43; **97,** 48; **98,** 56; **99,** 65; **1900,** 72; **01,** 141; **05,** 45; **06,** 44, 72; **07,** 46; **08,** 47; **09,** 51; **10,** 62; **11,** 65; **12,** 71.

In charge:

Lt. Col. S. M. Mansfield, 1890–98. **R., 91,** 676, 677; **93,** 747; **94,** 536; **95,** 605; **96,** 592; **97,** 830; **98,** 852.

Col. C. R. Suter, 1899. **R., 99,** 1063.

Maj. W. L. Fisk, 1900. **R., 1900,** 1159.

Capt. Harry Taylor, 1901. **R., 01,** 1047.

Col. W. S. Stanton, 1905. **R., 05,** 805.

Maj. Edw. Burr, 1907–09. **R., 07,** 902; (Lt. Col.) **08,** 944; **09,** 984.

Col. Frederic V. Abbot, 1910–. **R., 10,** 1101; **11,** 1168; **12,** 1379.

Assistant. T. T. H. Harwood. **R., 91,** 678.

OPERATIONS.

1894–95. 13,000± c. y. dr., **95,** 605.

1895–96. 35,000± c. y. dr., **96,** 593.

1896–97. 13,500± c. y. dr., **98,** 852.

1900–01. 14,094 c. y. dr., proj. completed, **01,** 1047.

1904–05. Bowlders removed from chan., **05,** 805.

1908–09. 10,355 c. y. dr. and 5.69 c. y. bowlders removed, **09,** 984.

1909–10. 15,904 c. y. sand, mud, and peat, and 30,187 c. y. bowlders dr., **10,** 1101.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 678.

Rises Essex Co., Mass.; flows ne. for 6 m. into Ipswich B. Proj. length, 2¼ m., beginning 2½ m. from mouth, **12,** 71.

PRIVATE (STATE) WORK.

$5,000 app., 1908, by Mass. toward imp., **07,** 47; **08,** 48.

PROJECTS.

By Lt. Col. Mansfield, 1891, chan. 4′ x 60′ m. l. w, river's mouth to the head of navigation at Essex. 3½ m., by dr. and r. removal; est., $25,000, **91,** 677.

In 1893 Lt. Col. Mansfield recom. available funds be held awaiting further app., **93,** 748.

In 1894, by Lt. Col. Mansfield, use of available funds to obtain a chan. 25′ x 4′, **95,** 605.

In 1897, by Lt. Col. Mansfield, chan. the full w. and d. from the drawbr. in Essex down the R. as far as available funds would permit, **97,** 831.

In 1899 Col. Suter recom. imp. be limited to chan. below the drawbr., **99,** 1063.

Act Mar. 2, 1907, app. $5,000 for restoration of chan., provided State or other agency contrib. like amount, **07,** 47.

R. unworthy of further mainten., **12,** 72.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Mansfield, **91,** 677.

Pre. ex. au. act Mar. 3, 1905; made by Col. Stanton (**R.** unfav.),[2] **06,** 72.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 72.

Maps. **91,** 678.

B-77 SANDY BAY (CAPE ANN), MASS. (H. of refuge at).

(See B79.)

APPROPRIATIONS.

1884,	100,000.00,	**85,** 521.
1886,	100,000.00,	**86,** 583.
1888,	100,000.00,	**88,** 441.
1890,	150,000.00,	**90,** 490.
1892,	150,000.00,	**92,** 560.
1894,	150,000.00,	**95,** 608.
1896,	150,000.00,	**96,** 595.
1899,	250,000.00,	**99,** 1066.
1902,	200,000.00,	**02,** 855.
1905,	100,000.00,	**05,** 806.
1906,	100,000.00,	**06,** 872.
1907,	100,000.00,	**07,** 903.
1908,	25,000.00,	**08,** 945.
1909,	75,000.00,	**09,** 985.
1910,	100,000.00,	**10,** 1103.
1911,	100,000.00,	**11,** 1168.

Total, 1,950,000 (incl. misc., $1,950,001, **12,** 1379).

COMMERCE.

Necessity for H. of refuge, **84,** 571, 578; **85,** 525.

Advantages of Sandy B. as a H. of refuge, **85,** 529.

Anchorage capacity of H., **84,** 579; **85,** 531.

Requirements of a H. of refuge, **85,** 523.

Statistics relating to wrecks, **85,** 529.

Entire C. of New England directly interested, **1900,** 1162.

"The depth of water is ample for the largest vessels; the mean range of tide is 8.6 feet.

"The improvement is chiefly of value in providing refuge for coastwise vessels, especially towed barges, which are frequently and suddenly in urgent need of shelter in fog and snowstorms.

"The work already done has resulted in the creation of a serious menace to navigation until the submerged substructure is protected and made visible by a suitable superstructure." **12,** 74.

[1] H. D. 142, 59th, 1st.

[2] H. D. 68, 59th, 1st.

CONTRACTS.

1885. Rockpor 1and Pigeon Hill Granite Cos., rubblest. for break'r constr., 58$\frac{4}{5}$¢ per t., **86,** 582.

1886. Bridgewater Iron & Steel Co., wrought-iron spindle to mark Averys Ledge, 5¼¢ lb. G. W. Townsend, drilling hole in r. to receive iron spindle, $900. G. W. & F. Smith, cast-iron ring to hold spindle, **86,** 582. Rockport and Pigeon Hill Granite Cos., break'r st., 71¢ t., **87,** 498.

1888. Boynton Bros., removing remains of iron spindle, $650, **88,** 442.

1889. Rockport and Pigeon Hill Granite Cos., rubblest., 71¢ t., **89,** 563.

1890. Rockport and Pigeon Hill Granite Cos., rubblest., 73½¢ t., **91,** 634.

1892. Rockport and Pigeon Hill Granite Cos., 16,000 t. large st., $2.33 per s. t.; 120,000 t. small st., 89¢ s. t., **93,** 751.

1894. Cape Ann Granite Co., 251,256 t. small st., 59.7¢ t., **95,** 609.

1896. Rockport and Pigeon Hill and Cape Ann Granite Cos., 224,215 t. small st., 66.9¢ s. t., **97,** 834.

1899. Rockport and Pigeon Hill and Cape Ann Granite Cos., 157,079 t. small st., 63¢ s. t., **1900,** 1163.

1901. Rockport, Pigeon Hill and Cape Ann Granite Cos., st., 60.7¢ per s. t., **01,** 1049.

1903. Rockport and Pigeon Hill Granite Cos., constr. break'r, st., 73¢ s. t., **03,** 741.

1905. The Federal Contracting Co. constr. break'r, 300,000 t. st., 60¢ s. t., **05,** 806.

1908. Rockport Granite Co. and Pigeon Hill Granite Co., constr. superstr. of break'r, **08,** 945.

1909. Rockport Granite Co. and Pigeon Hill Granite Co., supplemental to above (prices given), and for concrete blocks at superstr. angle, **09,** 980.

1911. The Breakwater Co., superstr. of breakr. (prices given), **11,** 1169.

ENGINEERS.

Chief of Engineers. R., 84, 79; **85,** 66, 522; **86,** 67; **87,** 24; **88,** 25; **89,** 34; **90,** 29; **91,** 36; **92,** 42; **93,** 41; **94,** 39; **95,** 42; **96,** 44; **97,** 49; **98,** 56; **99,** 65, 81, 82; **00,** 72, 77; **01,** 141; **02,** 85; **03,** 62; **04,** 43; **05,** 46; **06,** 45; **07,** 47; **08,** 48; **09,** 52; **10,** 63; **11,** 66; **12,** 72.

Boards:

Constituted by S. O., No. 91, 1884, to consider ocation, plan, and est. for national H. of refuge at Sandy B., Mass. **R., 85,** 523, 528. (Col. Blunt, Lt. Cols. Craighill and McFarland, and Maj. Raymond.)

Convened at Boston, Mass., Mar. 2, 1892, by S. O., No. 91, to consider and report upon the location, plan, and est. for national H. of refuge at Sandy B. **R., 92,** 560. (Col. Craighill, Lt. Col. Mansfield, and Maj. Raymond.)

Constituted by S. O., No. 14, Mar. 16, 1899, to consider proj. for imp. H. of refuge at Sandy B., Cape Ann, Mass., and est. of cost of completing said imp., **00,** 1184. (Col. C. R. Suter, Majs. D. W. Lockwood, and S. S. Leach.)

Constituted by S. O., No. 19, July 5, 1902, to ex. into the feasibility and advisability of completing the existing proj. for a break'r (Col. Chas. R. Suter, Lt. Col. W. S. Stanton, and Maj. S. W. Roessler). **R.** fav. to continuing existing proj., **03,** 742.

In charge:

Col. G. Thom, 1882–83. **R., 84,** 555.

Maj. C. W. Raymond, 1883–86. **R., 84,** 565; **85,** 520, 530.

Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 580; **87,** 497; **88,** 439.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 561; **90,** 488; **91,** 632; **92,** 558; **93,** 748; **94,** 536; **95,** 606; **96,** 593; **97,** 832; **98,** 853.

Col. C. R. Suter, 1899. **R., 99,** 1064.

Maj. W. L. Fisk, 1900. **R., 00,** 1161, 1184.

Capt. H. Taylor, 1901–03. **R., 01,** 1048; **02,** 854; **03,** 740.

Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 835; (Col.) **05,** 805.

Maj. Edw. Burr, 1906–09. **R., 06,** 872; **07,** 903; (Lt. Col.) **08,** 944; **09,** 984.

Col. F. V. Abbot, 1910. **R., 10,** 1102; **11,** 1168; **12,** 1379.

Assistant. S. Haagensen. **R., 84,** 576.

OPERATIONS.

1885–86. 49,762 t. rubblest. placed in break'r, **86,** 582.

1886–87. 109,237 t. st. deposited in break'r; iron spindle erected on Averys Ledge, **87,** 498.

1887–88. 83,935 t. rubblest. deposited on break'r; hole drilled and new spindle placed, **88,** 439.

1888–89. 41,965 t. rubblest. deposited in break'r, **89,** 562.

1889–90. 68,035 t. rubblest. deposited in break'r, **90,** 490.

1890–91. 54,239 t. rubblest. deposited in break'r, **91,** 634.

1891–92. 108,515 t. rubblest. deposited in break'r, **92,** 559.

1892–93. About 76,109 t. st. deposited in break'r, **93,** 749.

1893–94. About 80,000 t. st. deposited, **94,** 538.

1894–95. About 12,000 t. st. deposited, **95,** 607.

1895–96. About 87,000 t. st. deposited, **96,** 595.

1896–97. About 147,000 t. st. deposited, **97,** 833.

1897–98. About 141,000 t. st. deposited, **98,** 854.

1898–99. 67,527 t. st. deposited, **99,** 1065.

1899–00. 57,055 t. st. deposited, **00,** 1162.

1900–01. 107,868 t. st. placed, **01,** 1048.

1901–02. 113,202 t. rubblest. placed, **02,** 855.

1902–03. 137,682 t. st. placed, **03,** 741. Condition of work to end of fiscal year, **03,** 63.

1903–04. 116,340½ t. st. placed, **04,** 835.

1904–05. 94,296.5 t. st. placed, **05,** 805.

1906–07. 80,413 t. st. placed, **07,** 903.

1907–08. 136,205 t. st. placed; work started on superstr., **08,** 944–45.

1908–09. 83,382 t. st. placed; work in progress on superstr., **09,** 984.

1909–10. Superstr. on southern arm of break'r continued for a distance of 67.6′, **10,** 1102.

1910–11. Superstr. continued for 33′ on southern arm, 110.6′ on western arm, and junction between these two arms bonded with concrete blocks, **11,** 1168.

1911–12. 97.2 l. f. superstr. of southern arm rebuilt, and 90.8 l. f. superstr. on western arm built, **12,** 1379.

PHYSICAL CHARACTERISTICS.

Description of Sandy B., **84,** 565, 577.
Tidal observations, **84,** 577.
Character of bottom, **84,** 577.
Resistance of break'r to heavy storms, **11,** 67.

PLANS. (See Projects.)

Location of break'r proposed by Col. Thom, 1882, **84,** 566.

Location proposed by Maj. Raymond, 1883, beginning at Averys Ledge, thence n. by w., one-half west, for 3,000′; thence curving to the w. for 1,200′; thence nw. for 4,820′, break'r to consist of an enrockment of granite quarry grout, with its top surface 15′ below l. w., surmounted with masonry superstr. carried 8′ above h. w.; est., $4,000,000, **84,** 567–570; **85,** 520; **86,** 581. Consideration of cross section, **84,** 571.

B. of E. recom. location proposed by Maj. Raymond if national H. of refuge of first class to be constr., **85,** 529.

Location suggested by B. of E., 1884, for smaller break'r; est., $1,000,000, **85,** 529, 531.

Cross sections of various types shown, **11,** 1168.

PROJECTS. (See Plans.)

Proj. of Maj. Raymond, 1884, contemplated "national H. of refuge of the first class" at Sandy B., Mass. Proj. appr. by B. of E. of 1884 was for break'r about 9,000′ l., starting at Averys Ledge and running to Abners Ledge; thence nw. to the 86′ curve off Andrews Pt.; break'r to be formed to level of 22′ below l. w. of random st., with w. at top of 40′, above which would be built a masonry wall whose top would be 15′ w. and carried 8′ above h. w. Details of masonry constr. were not definitely adopted. Est. about $5,000,000, with $2,500,000 for buoyage, lighting, and defense. **84,** 567, 570; **85,** 529; **86,** 67, 581, 582; **87,** 24, 497, 498.

In 1885 Maj. Raymond proposed constr. of p. upon Averys Ledge to define locality and to form one end of a future break'r, **86,** 581.

In 1892 B. of E. proposed constr. of both substr. and superstr. of rubblest., and est. $5,000,000 as required for completion, **92,** 560.

By B. of E., 1892, rubblest. break'r, with, on the sea side, from the bottom to 15′ below m. l. w., a slope of 1 on 1½; thence to m. l. w., 1 on 3; thence to 18′ above m. l. w., 1 on 1; the width on the crest, 20′; and the rear slope 1 on $\frac{73}{100}$ to m. l. w.; thence to the bottom, 1 on 1, **93,** 749.

In 1892 by Lt. Col. Mansfield, use of available funds to complete as much of the full section of the break'r as possible, working s. from Abners Ledge, **93,** 749.

In 1894 by Lt. Col. Mansfield, use of available funds to constr. substr. of break'r, **95,** 608.

B. of E., 1899, recom. extension of substr., **99,** 1065.

By B. of E., 1899, substr. of 1 on 1 on both sides below plane of 25′ below l. w.; 1 on 2 outside, 1 on 1 inside, above this plane; width of 30′ at reference 17 above m. l. w.; division of the substr. and superstr. by a plane 12′ below l. w.; superstr. to have its front area faces composed of selected st., body of the superstr. to be of selected stones deposited at random; the substr. to be composed of random rubble; the substr. to be in place at least 1 year before superstr. is begun; the connection of the str. with Averys Ledge to be determined by experience and a later investigation, **00,** 1186.

Type of structure modified, **09,** 53; experimental, **10,** 64.

SURVEYS.

Au. act Aug. 2, 1882, pre. ex. made by Col. Thom, **84,** 565. Sur., 1883, by Maj. Raymond, **84,** 565.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 73.

Maps. Showing proposed location of break'r, **86,** 582; **87,** 498.

88, 440; **92,** Atlas, 3; **00,** 1186; **02,** 854; **11,** 1168.

B-79 ROCKPORT HARBOR, MASS.[1]

(See also B77.)

APPROPRIATIONS.

1829,	$150.00,	act Mar. 2 (sur.).
1836,	10,000.00,	act July 4.
1837,	20,000.00,	act Mar. 3.
1838,	20,000.00,	act July 7.
1845,	18,437.27,	act Feb. 13.
1847,	645.30,	act Mar. 3.
1902.	22,000.02,	856.
Total.	91,232.57	**05,** 807.

COMMERCE.

An. C., $820,000, **00,** 1178, 1181.

Chiefly coal, st., and fresh fish; in 1904, 2,450 t., **05,** 48.

CONTRACTS.

1903. Rockport & Pigeon Hill Granite Co., constr. break'r, s. $1.53 s. t., shifting stone, 50¢ per s. t., **03,** 743.

1904. H. W. Phillips, removing ledge r., $17.33 c. y., **05,** 807.

ENGINEERS.

Chief of Engineers. R., 99, 81; **1900,** 77; **02,** 87; **03,** 64; **04,** 45; **05,** 48.

In charge:

Col. C. R. Suter, 1900. **R., 00,** 1177.

Maj. W. L. Fisk, 1900. **R., 00,** 1178.

Capt. H. Taylor, 1902–03. **R., 02,** 856; **03,** 743.

Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 836; (Col.) **05,** 807.

OPERATIONS.

1902–03. 1,332 t. st. placed in break'r at Bearskin Neck, completing it for 160′ to h. of 18.5′, m. l. w., **03,** 65.

1903–04. 9,721.5 t. st. deposited in break'r, completing the 2 break'rs, **04,** 837.

1904–05. 130.6 c. y. r., removed, proj. completed, **05,** 807.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1177. (Inner H. of Sandy B. break'r H.)

Storms damaging works, **00,** 1180.

PRIVATE WORK.

Early built break'rs, **00,** 1180.

PROJECT.

Maj. Fisk est. $22,481.80 to rebuild inner break'rs to 10′ above h. w., **00,** 1182.

Act June 13, 1902, au. rebuilding break'rs to 10′ above h. w., with heavy rubblest, and removal of principal rs. in harbor; est., $22,481.80,[2] **02,** 88.

SURVEYS.

Ex. and sur. of the ps. and break'r of inner H. au. act Mar. 3, 1899. Ex. made, 1899, by Col. Suter; sur. made, 1900, by aj. Fisk (R. fav.) (see Projects). 1177, 1178.

Maps.[2]

B-83 GLOUCESTER HARBOR, MASS.

APPROPRIATIONS.

1823,	$6,00 ,	act Mar. 3.
1872,	10,000,	**72,** 92.
1886,	5,000,	**87,** 504.
1888,	10,000,	**88,** 444.
1890,	15,000,	**90,** 492.
1892,	40,000,	**92,** 568.
1894,	40,000,	**95,** 611.
1896,	34,000,	**96,** 597.
1899,	40,000,	**99,** 1067.
1902,	75,000,	**02,** 857.
1903,	60,000,	**03,** 744.
1904,	100,000,	**04,** 838.
1905,	50,000,	**05,** 808.
1906,	17,083,	**06,** 873.
1910,	25,000,	**10,** 1104.
1911,	15,000,	**11,** 1170.
Total,	542,083	

COMMERCE.

Important, **71,** 870, 871, 875; **85,** 541; **87,** 503.

Vested interests of the H., **88,** 444.

Importance of the H., **90,** 491.

Large; mostly fishing, **10,** 66.

1906, 276,000± t.; 1909, 218,000± t.; 1911, 200,000± t., 42,000± passengers, **12,** 76.

CONTRACTS.

1872. With G. W. Townsend, r. excavation, **73,** 1083.

1888. Duncan & Nickerson, r. removal, $14.75 per c. y., **88,** 444.

1889. G. W. Townsend, blasting and removing r., $20 c. y.; removal of loose overlying material, $15 c. y., **89,** 566. Bay State Dredging Co., dr., 30¢ c. y., **89,** 566.

1890. Bay State Dredging Co., dr., 22¢ c. y.; removal of bowlders weighing over 3 t., $8, **91,** 637.

[1] Ex.—**R.** (fav.) Apr. 1, 1830. Sur.—**R.** May 10, 1830; est., $33,151.80 and $445,237.10 (H. D. 482, 55th, 2d).
[2] H. D. 363, 56th, 1st.

1892. National Dredging Co., dr., 23¢ c. y.; removal of bowlders over 3 t., $15 (173,913 c. y.), **93,** 753.

1893. Townsend & Johnston, ledge removal, $9.86 in situ c. y. ($5,413.14), **94,** 541.

1894. Rockport Granite Co., st., 87¢ s. t. (41,379 t.), **95,** 611.

1896. Rockport Granite Co., Pigeon Hill Granite Co., and Cape Ann Granite Co., st. 83¢ s. t. (34,000 t.), **97,** 836. H. M. Phillips, r. removal, $15.85 c. y. ($1,664.25), **97,** 836.

1899. Rockport, Pigeon Hill, and Cape Ann Granite Cos., st., 89¢, $3.75, and $1.39 s. t.; mortar, $9.50 c. y.; iron in place, 27.5¢ lb. ($40,765), 1165.

1903. Rockport and Pigeon Hill Granite Cos., break'r, unit prices given, **03,** 744.

1904. Rockport and Pigeon Hill Granite Cos., supple., for stone for leveling break'r, **04,** 838.

1905. Rockport and Pigeon Hill Granite Cos., supple., for rubblemound at end of break'r, for site of lighthouse, **06,** 873.

1911. The Breakwater Co., rubblest. for break'r, 79¢ t., **11,** 1170.

1912. J. J. Fitzpatrick & Sons, r. excavation $8.88 c. y.; est. quantity, 2,183 c. y., **12,** 1380, 1381.

DEFENSE.

Land ceded to U. S. by selectmen of Gloucester for fortification, **71,** 876.

ENGINEERS.

Chief of Engineers. R., 70, 32, 78; **71,** 93; **72,** 92; **73,** 102; **74,** 111; **75,** 116; **76,** 42; **85,** 67; **88,** 25; **89,** 35; **90,** 30; **91,** 36; **92,** 43; **93,** 42, 52; **94,** 40; **95,** 43; **96,** 45; **97,** 49; **98,** 57; **99,** 66, **00,** 74; **01,** 143; **02,** 88; **03,** 65; **04,** 46; **05,** 48; **06;** 46; **07,** 49; **08,** 50; **09,** 54, 78; **10,** 65; **11,** 68; **12,** 74.

In charge:

Lt. Col. J. G. Foster, 1870–71. **R., 70,** 467; **71,** 869.

Lt. Col. G. Thom, 1871–76. **R., 72,** 941; **73,** 1083; **74,** ii, 311; **75,** ii, 402; **76,** 166.

Maj. C. W. Raymond, 1885. **R., 85,** 534, 540, 541.

Lt. Col. G. L. Gillespie, 1886–89. **R., 87,** 500, 505; **88,** 442.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 564; **90,** 491; **91,** 635; **92,** 566; **93,** 751, 787; **94,** 539; **95,** 609; **96,** 596; **97,** 835; **98,** 856.

Col. C. R. Suter, 1899. **99,** 1066.

Maj. W. L. Fisk, 1900. **00,** 1164.

Capt. Harry Taylor, 1901–03. **R., 01,** 1049; **02,** 857; **03,** 744.

Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 837; (Col.) **05,** 808.

Maj. Edw. Burr, 1906–09. **R., 06,** 872; **07,** 903; (Lt. Col.) **08,** 946; **09,** 985.

Col. Frederic V. Abbot, 1910–. **R., 10,** 1103; **11,** 1169; **12,** 1380.

Assistant. H. F. Bothfeld. **R., 71,** 873; **85,** 542; **87,** 506.

ESTIMATES. (See Projects.)

By H. F. Bothfeld, break'r, $494,148.65, **71,** 874, 876.

OPERATIONS.

1872–73. Rs. removed, **73,** 102, 1083.

1888–89. 70 c. y. loose r. and 100 c. y. ledge removed; 17,596 c. y. dr., **89,** 565.

1891–92. 47,298 c. y. dr., **92,** 568.

1893–94. 386 c. y. r. removed, and the dr. called for by the proj. completed, **94,** 540.

1894–95. About 160 c. y. r. removed, and 35,497 t. of st. placed in break'r, **95,** 610.

1895–96. 17,101 t. st. placed in break'r, **96,** 597.

1896–97. 21,870 t. st. placed in break'r, **97,** 835.

1897–98. 16,322 t. st. placed in break'r, and 105 c. y. r. removed, **98,** 857.

1899–00. 15,896 t. st. placed in break'r, **00,** 1165.

1900–01. Break'r completed for 284′ from shore end, **01,** 1049.

1902–03. 2,364 t. dimension st. and 1,743 t. rubblest. placed in break'r, **03,** 744.

1903–04. 52,050 t. rubblest. placed in substr. and superstr. and 16,236½ t. dimension st. in superstr. of break'r, **04,** 837.

1904–05. 34,040.5 t. st. deposited in break'r, **05,** 808.

1905–06. 12,117 t. st. placed in break'r, **06,** 872.

1908–09. 12 cap st. reset in break'r, **09,** 985.

1910–11. 1,353 t. rubblest. deposited in front of seaward wall of superstr., **11,** 1169.

1911–12. 14,991 t. rubblest. deposited, **12,** 1380.

PHYSICAL CHARACTERISTICS.

Presence of rs. and ledges in H., **71,** 870, 874, 875.

Locality described, **85,** 534, 542.

Description, Gloucester H., **93,** 787; Vincent Cove, **93,** 789.

Max. drafts, tides, etc., **12,** 76.

At s. extremity of Cape Ann, 30 m. ne. from Boston, **12,** 74.

PLANS. (See Projects.)

By H. F. Bothfeld, break'r, 3,870′ x 50–100′ x 20′ at the top, and 11–35′ h.; the substr. of riprap, and the superstr. of cut-granite facings, with coping and concrete filling, **71,** 873.

By Maj. Raymond, 1885, removal of a part of Babsons Ledge in completion of the orig. proj.; est., $4,800, **85,** 541, 543.

By Maj. Raymond, 1885, a H. of refuge with 2 break'rs, aggregate l. 7,250′; est., $1,359,000, **85,** 535; **87,** 501, 502.

By Lt. Col. Gillespie, removal of Babsons Ledge, based upon late sur.; dr. chan. 15′ l. w., Harbor Cove to Pews Wharf, also the d. of Harbor Cove to 10′; est., $65,000; **87,** 503.

PROJECTS. (See Plans.)

Proj., 1871, proposed to clear the H. of sunken rs. and to build a st. break'r, Eastern Pt. to Round Rock Shoal; est., $504,754.85, **71,** 870; **87,** 500.

App. of $10,000 of 1872 expended upon removal of r., **73,** 1083; **87,** 501.

By Lt. Col. Gillespie, 1887, removal from the inner H. of 101 c. y. r. and 216,000 c. y. material; also for break'r recom. in proj. of 1884, extending from Eastern Pt. to Round Rock Shoal; est., $817,000, **88,** 443.

By Lt. Col. Mansfield, 1892, use of available funds to complete proposed dr., **93,** 752.

By Lt. Col. Mansfield, 1894, use of available funds to commence constr. of substr. of break'r at Eastern Pt., est., $752,000, **95,** 610; **12,** 75.

By Lt. Col. Mansfield, 1896, removal of some rs. in and about the H., **97,** 835.

Modified by act of 1902 to end break'r at Cat Ledge and expend remainder of app. toward removal of Round Rock, **02,** 89.

By Lt. Col. Burr, imp. of H. by removing ledges, etc.; est., $51,000,[1] **09,** 78.

On account of excessive cost (est. $800,000) of removing Round Rock, BERH recom. return to orig. proj. for break'r from Eastern Pt. to Round Rock shoal; est., $354,000, **09,** 54.

Act June 25, 1910, au. removal of 8 groups of ledges, etc., in inner and outer Hs.; est., $51,000, **12,** 75.

SURVEYS.

By H. F. Bothfeld, 1870. **R., 71,** 873.

Au. act July 5, 1884, made by Maj. Raymond, **85,** 540; **87,** 502, 505.

Ex. Five Pound Isld. to R. head, au. act July 13, 1892, made by Lt. Col. Mansfield, 1892; **R.** fav., **93,** 787.

Ex. Vincent Cove au. act July 13, 1892, made by Lt. Col. Mansfield, 1892; **R.** unfav., **93,** 788.

Round Rock shoal, and site for extension of break'r, 1908, **09,** 985.

Au. act Mar. 2, 1907; made, 1907–08, by Lt. Col. Burr,[1] **09,** 78.

Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 75.

Maps.[1]

87, 504.

Of inner H., **87,** 506.

[1] H. D. 1112, 60th, 2d.

B-89 MANCHESTER HARBOR, MASS.

APPROPRIATIONS.

1888, $2,500, **89,** 567.
1890, 5,000, **90,** 494.
1892, 6,800, **92,** 570.
1899, 5,000, **99,** 1069.
1902, 5,000, **02,** 859.

Total, 24,300

COMMERCE.

Coal, lumber, etc., required for local consumption, **96,** 599.
Small and local, no great increase to be expected, **04,** 842.
1907, 6,400± t., **08,** 52.

CONTRACTS.

1890. Hamilton & Sawyer, dr., 29¢ c. y.; removal of bowlders, $6, **91,** 639.
1892. E. P. Lovering, dr. at 27¢, removal of bowlders over 3 t., $7 ($6,000), **93,** 755.
1899. A. B. Martin, dr., 33½¢ c. y.; removing bowlders over 3 t., $5 c. y. (13,433 c. y.), **99,** 1069.
1903. C. H. Souther, dr., 38⅛¢ c. y., **03,** 746.

ENGINEERS.

Chief of Engineers. R., 88, 26, 32; **89,** 36; **90,** 31; **91,** 37; **92,** 44; **93,** 43; **94,** 41; **95,** 44, 53; **96,** 46; **97,** 51, 64, 65; **98,** 58; **99,** 68; **00,** 75; **01,** 144; **02,** 90; **03,** 67; **04,** 47, 840; **05,** 50; **06,** 47; **07,** 50; **08,** 51.
Boards. BERH. **R., 04,** 841.
In charge:
Lt. Col. G. L. Gillespie, 1888–89. **R., 88,** 463, 466.
Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 567; **90,** 493; **91,** 638; **92,** 569; **93,** 754; **94,** 542; **95,** 612, 643; **96,** 598; **97,** 837, 866, 869; **98,** 859.
Col. C. R. Suter, 1899. **R., 99,** 1068.
Maj. W. L. Fisk, 1900. **R., 00,** 1167.
Capt. H. Taylor, 1901–03. **R., 01,** 1051; **02,** 858; **03,** 745.
Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 839, 844; (Col.) **05,** 809.
Maj. Edw. Burr, 1906–. **R., 06,** 874; **07,** 904; (Lt. Col.) **08,** 946.
Assistant. S. Haagensen. **R., 88,** 467.

OPERATIONS.

1890-91. 7,316 c. y. dr., **91,** 638.
1891-92. 14,736 c. y. dr., **92,** 569.
1893-94. About 22,000 c. y. dr., **94,** 542.
1899-00. 12,935 c. y. dr., **00,** 1167.
1903-04. 10,499.6 c. y. dr., **04,** 839.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 644; **97,** 868.

PRIVATE (STATE AND MUNICIPAL) WORK.

1907. Mass. completed the dr. necessary to extend the chan. to the R. R. br., and the town of Manchester dr. the remaining section of chan. to d. of 4′, substantially completing proj., **08,** 946.

PROJECTS.

By Lt. Col. Gillespie, 1887, restoring the chan. to its former d. of from 3′ to 4′ m. l. w. by excavation of chan. 4,000′ x 60′ x 4′, Proctors Pt. to town wharves, 46,000 c. y.; est., $14,300, **88,** 464, 466; **89,** 567; **92,** 569.
In 1892 Lt. Col. Mansfield proposed that available funds be used to complete the proj. imp., **93,** 755.
Col. Mansfield est., 1897, further chan. imp. would cost $139,966.09 (not recom.) or $25,000 (recom.), covering chan. 6′ x 7,200′ to town wharves, 100′ at entrance and bends and at least 75′ w. throughout, with 2 turning basins, **97,** 837, 869, 870.
BERH. recom., 1903, that 6′ proj. be completed, modified to provide only for chan. 6′ x 75′ up to town wharves, and turning basin 125′ x 250′ at town landing, and after completion its mainten. left to interested parties; if such a course should not be practicable, that proj. be discontinued at once,[1] **04,** 842, 844. (See Private Work.)
Lt. Col. Stanton est., 1903, $18,117 to complete proj. as recom. by BERH.,[1] **04,** 844.
Proj. being completed (see Private Work), Chief of Engineers appr. recom. dropping work as a U. S. proj., **08,** 52.

SURVEYS.

Au. act Aug. 5, 1886; made, 1887, by Lt. Col. G. L. Gillespie, **88,** 466.
Ex. au. act Aug. 17, 1894; made by Lt. Col. Mansfield, 1894 (**R.** fav. to limited imp.), **95,** 643.
Sur. au. act June 3, 1896; made by Lt. Col. Mansfield, 1896 (see Projects) (**R.** unfav.), **97,** 866.
Resur. au. act June 3, 1897; made by Lt. Col. Mansfield, 1897 (**R.** fav. to limited imp.), **97,** 869.
By Lt. Col. Stanton, 1903,[1] **04,** 839, 844.
Cong. docs., etc., relating to exs., surs., plans, etc., **08,** 52.
Maps.[1] **88,** 466; **97,** 870.

B-92 BEVERLY HARBOR, MASS.

APPROPRIATIONS.

1902, $10,000, **02,** 859.
1907, 38,500, **07,** 906.

Total, 48,500 ($48,622.24, including damages from surety of failing contractor, $122.24), **12,** 1382.

COMMERCE.

Character and amount of, **01,** 1068; probable value, $135,000, **01,** 1069, 1071.
Chiefly coal and building material, **04,** 49; **10,** 68; **11,** 71; 245,000 t. 1911, 18′ d. gained reduction of 25¢ t. on coal, **12,** 78.
Description of, **11,** 70, 71.
Reduction in rates of 25¢ t. on coal, **12,** 78.

CONTRACTS.

1903. Charles H. Souther, dr., 33¾¢ c. y., **03,** 747.
1905. Michael J. O'Donnell, r. removal, $11 c. y. (annulled Oct. 21, 1905), **06,** 874.
1907. Bay State Dredging Co., dr., 38.5¢ c. y.; removing bowlders, $5 c. y., **07,** 906.
1908. Johnston & Virden, r. excavation, $11.47 c. y., **09,** 986.

ENGINEERS.

Chief of Engineers. R., 89, 44; **90,** 38; **99,** 81; **00,** 77, 78; **01,** 150, 1065; **02,** 90; **03,** 68; **04,** 48; **05,** 51; **06,** 49, 73; **07,** 51; **08,** 52; **09,** 55; **10,** 67; **11,** 70; **12,** 77.

In charge:
Lt. Col. S. M. Mansfield, 1890. **R., 90,** 524.
Col. C. R. Suter, 1900. **R., 00,** 1182.
Maj. W. L. Fisk, 1901. **R., 01,** 1065, 1068.
Capt. Harry Taylor, 1902–03. **R., 02,** 859; **03,** 746.
Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 845; (Col.) **05,** 810.
Maj. Edw. Burr, 1906–09. **R., 06,** 874; **07,** 905; (Lt. Col.) **08,** 947; **09,** 986.
Col. Frederic V. Abbot, 1910–. **R., 10,** 1104; **11,** 1171; **12,** 1382.
Assistant. T. T. Hunter Harwood. **R., 90,** 526.

[1] H. D. 58, 58th, 2d.

OPERATIONS.

1903-04. 18,206.6 c. y. drd., **04,** 845.
1907-08. 41,378 c. y. drd., **08,** 947.
1909-10. 1,057.5 c. y. blasted material drd., completing proj. **1910,** 1104.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 524; **00,** 1183; **12,** 77.
Shoaling, **01,** 1066.

PLANS.

By Lt. Col. Mansfield, 1889, imp. of H. entrance by removal of obstr. r. opposite Tucks Pt., **90,** 525.

PROJECTS.

By Maj. Fisk, dr. chan. 18, d. m. l. w., and 200′ w.; est., $10,000,[1] **01,** 1068.
By Col. Stanton, dr. and removal of ledge r.; est., $40,000,[2] **06,** 73; au. by R. and H. act Mar. 2, 1907, chan. 18′ x 200–250′, **07,** 52.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Mansfield, **90,** 525.
Ex. au. act Mar. 3, 1899; made, 1899, by Col. Suter (**R.** unfav.), **00,** 1183.
Au. act June 6, 1900; made, 1900, by Maj. Fisk,[1] est., $10,000, **01,** 1065.
Au. act Mar. 3, 1905; made, 1905–06, by Col. Stanton,[2] **06,** 73.
Pre. ex. an. act June 25, 1910, with view to removing shoal in outer harbors of Salem and Beverly. **R.** by Col. Abbott, Sept. 30, 1910;[3] (unfav.), **11,** 92.
Ex. of shoal; found to be outside limits of imp. chan., **11,** 1171.
List of Cong. docs., etc., referring to surs., exams., plans, etc., **12,** 77.
Maps.[2]

B-96-97 CRANE AND WATERS RIVERS, MASS.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 44; **90,** 38.
In charge. Lt. Col. S. M. Mansfield, 1888. **R.,** **90,** 517.
Assistant. T. T. H. Harwood. **R.,** **90,** 519.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 517.

PLANS.

By Lt. Col. Mansfield, 1889; imp. of Waters R. by enlarging the existing l.-w. chan. to 100′ x 8′ m. l. w. from d. w. of Essex Branch to the wharves at the head of navigation; est., $14,000. Imp. of Crane R. by excavation of a chan. 2,850′ x 100′ x 8′ m. l. w.; est., $30,000. **90,** 518, 519.

SURVEY.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Mansfield, **90,** 517.

B-98 NORTH RIVER, MASS. (from Beverly Br. to the North St. Br.).

ENGINEERS.

Chief of Engineers. **R.,** **91,** 46.
In charge. Lt. Col. S. M. Mansfield, 1890. **R.,** **91,** 669, 670.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 669, 670.

SURVEY.

Ex., 1890, by Lt. Col. Mansfield (**R.** unfav.), **91,** 669, 670.

B-100 SALEM HARBOR, MASS.

APPROPRIATIONS.

1873,	$15,000, **73,** 102.
1874,	10,000, **74,** 111.
1890,	14,000, **91,** 640.
1892,	14,000, **92,** 571.
1905,	12,000, **05,** 811.
Total,	65,000

COMMERCE.

Principally coal, **04,** 884.
In 1905, 130,800 t., **06,** 50.

CONTRACTS.

1873. A. R. Wright, dr., 44¢ c. y., **73,** 1085.
1874. Curtis, Fobes & Co., dr., 20–35¢ c. y., **74,** ii, 313; **75,** ii, 403.
1890. A. R. Wright, dr., 22¢ c. y.; removal of bowlders, $5, **91,** 641.
1892. A. R. Wright, dr., 62,500 c. y., at 20¢; removal of bowlders over 3 t., $3, **93,** 757.
1905. Eastern Dredging Co., dr. about 41,000 c. y., 26.5¢ c. y., **06,** 875.

ENGINEERS.

Chief of Engineers. **R.,** **73,** 102, 106; **74,** 111; **75,** 116; **76,** 42; **77,** 37; **85,** 67; **89,** 44; **90,** 38; **91,** 38; **92,** 44; **93,** 43; **94,** 41; **95,** 45, 54; **04,** 69; **05,** 52; **06,** 50; **11,** 92.
Boards. BERH., **R.,** **04,** 881, 883.

In charge:
Lt. Col. G. Thom, 1872–77. **R.,** **73,** 1084, 1109; **74,** ii, 312; **75,** ii, 402; **76,** 167; **77,** 171.
Maj. C. W. Raymond. **R.,** **85,** 537.
Lt. Col. S. M. Mansfield, 1888–95. **R.,** **90,** 528; **91,** 639; **92,** 570; **93,** 756; **94,** 543; **95,** 613, 651.
Lt. Col. W. S. Stanton, 1904–05. **R.,** **04,** 879, 884; (Col.) **05,** 811.
Maj. Edw. Burr, 1906. **R.,** **06,** 875.
Col. F. V. Abbot, **11,** 62.

Assistants:
S. Haagensen. **R.,** **73,** 1109; **90,** 530.
T. T. H. Harwood. **R.,** **95,** 652; **04,** 885.

OPERATIONS.

1872-73. Removal of 9,266.5 c. y. by dr., **73,** 102, 1085.
1873-74. Removal of 31,496 c. y.; chan. 160′ x 8′ from d. w. to South R. entrance, **74,** 111, ii, 313.
1874-75. Removal of 43,503 c. y., completing proj., **75,** 116, ii, 403; **76,** 43. History of operations, **76,** 167; **77,** 172.
1891-92. 50,213 c. y. dr.; r. ledge near Derby Wharf Light removed, **92,** 571.
1893-94. 54,652 c. y. dr. and proj. completed, **94,** 544.
1905-06. 37,823 c. y. dr., completing proj., **06,** 875.

[1] H. D. 129, 56th, 2d. [2] H. D. 916, 59th, 1st. [3] H. D. 79, 62d, 1st.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 531; **95,** 651.

Outer H. protected by islds., and forms an excellent H. of refuge. Extensive flats make long wharves necessary to reach d. w., **04,** 879.

PLANS.

In 1884 Maj. Raymond did not consider that H. would be imp. by the j. proposed, **85,** 538.

PRIVATE AND CORPORATE WORK.

Long Pt. protected by private parties, **77,** 172.

PROJECTS.

By Lt. Col. Thom, 1873, excavation of chan. 300′ x 1,730′ x 8′ m. l. w.; sea wall and break'r for protection of Long Pt.; est., $55,000, **73,** 102, 1084, 1109–1111; **74,** 111, ii, 312. Deemed unnecessary by Lt. Col. Thom, as the pt. had been protected by private parties, **77,** 37, 172.

By Lt. Col. Mansfield, 1889, imp. of the entrance to South R. by chan. 5,100′ x 100′–300′, and from 6′–8′ d., m. l. w.; est., $28,000, **90,** 530; **91,** 640.

By Lt. Col. Mansfield, 1892, completing imp. with available funds, **93,** 756.

Lt. Col. Mansfield, 1895, est. $14,000 to imp. R. from mouth to Derby Wharf, and $535,000 to remove Middle Ground, **95,** 651, 652.

By Lt. Col. Stanton, chan. 10′ d., m. l. w., and about 5,700′ l. from the H. to head of South R. at Lafayette St., w. 300′ at entrance, narrowing to 200′ at Derby Wharf Light; est., $54,549.50, and $2,000 an. mainten., **04,** 884.

Act Mar. 3, 1905, au. proj. for chan. 10′ d. from H. to outer end of wharves, 300′ w. at entrance, and gradually narrowing to 200′ at Derby Wharf Light; est., $12,000, **05,** 52.

SURVEYS.

By S. Haagensen, 1872, **73,** 102, 106, 1109, 1110.

Ex. au. act July 5, 1884; made by Maj. Raymond (**R.** unfav.; see Plans), **85,** 537.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Mansfield, [1] **90,** 529.

Sur. au. act Aug. 17, 1894; made by Lt. Col. Mansfield, 1895 (see Projects; Maps), **95,** 651.

Ex. and sur. au. act June 13, 1902. **R.** by Lt. Col. Stanton (see Projects), [2] **04,** 879, 884.

Pre. ex. au. act June 25, 1910, with view to removing shoal in outer Hs. of Salem and Beverly. **R.** by Col. Abbot, Sept. 30, 1910 [3] (unfav.), **11,** 92.

Map. [1 2] **95,** 652.

B-107 MARBLEHEAD, MASS.[4]

APPROPRIATIONS.

1825,	[4] $400, sur. act Mar. 3.	
1852,	[5] 500, act Aug. 30.	
1899,	1,000, **99,** 1070.	
Total,	1,900	

COMMERCE.

Description of, **03,** 755, 756.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **97,** 65; **99,** 68; **00,** 76; **01,** 145; **02,** 91; **03,** 68; **04,** 49; **05,** 53.

Boards. BERH., **R., 03,** 756.

In charge:

Col. J. D. Graham, 1865. **R., 66,** 36.
Lt. Col. S. M. Mansfield, 1897. **R., 97,** 870.
Col. C. R. Suter, 1899. **R., 99,** 1069.
Maj. W. L. Fisk, 1900. **R., 00,** 1168.

Capt. H. Taylor, 1901–03. **R., 01,** 1052; **02,** 860; **03,** 747, 753.

Lt. Col. W. S. Stanton, 1904–. **R., 04,** 846; (Col.) **05,** 812.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 871; **03,** 754.

PROJECTS.

Act 1899 app. $1,000 for repairs of sea wall; no repairs needed, **00,** 1168, 1169.

Capt. Taylor, 1903, reported new sea wall entirely unnecessary; such a wall would cost $25,000, **03,** 755.

SURVEYS.

Sur. for preventing H. injury by sea breaching isthmus, au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (**R.** unfav.), **97,** 870.

Ex. by Maj. Fisk, 1899, **00,** 1169.

Au. act June 13, 1902, for break'r; made, 1903, by Capt. Taylor (**R.** unfav.), **03,** 753.

B-108 LYNN HARBOR, MASS.[6]

APPROPRIATIONS.

1882,	$60,000, **83,** 461.	
1886,	6,000, **86,** 578.	
1888,	10,000, **88,** 446.	
1890,	15,000, **90,** 496.	
1892,	[7] 10,000, **92,** 573.	
1894,	7,500, **95,** 617.	
1896,	20,000, **96,** 601.	
1902,	25,000, **02,** 868.	
1905,	40,000, **05,** 813.	
1906,	97,937, **06,** 876.	
1910,	60,000, **10,** 1105.	
1912,	35,000, **12,** 1383.	
1912,	[7] *5,000, **12,** 1383.	
Total,	391,437, **12,** 1383.	

COMMERCE.

Important, **83,** 462.

Cost of transportation reduced 25¢ or more per t., **10,** 69.

In 1911, 478,574 t., **12,** 79.

CONTRACTS.

1884. Moore & Wright, dr., 23½¢ c. y., **84,** 522.

1886. A. R. Wright, dr., 21½¢ c. y., **87,** 510.

1888. Bay State Dredging Co., dr., 29¢ c. y. in main chan., 45¢ c. y. in Saugus R. Chan.; removal of bowlders over 3 t. each, $10 c. y., **89,** 570.

1890. New England Dredging Co., dr., 18¢ c. y., **91,** 643.

1893. Boynton Bros., dr. 41,322 c. y., at 33⅞¢; removal of bowlders over 3 t., $10, incl. w. chan., **93,** 760.

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[1] H. Ex. D. 28, 51st, 1st.
[2] H. D. 303, 58th, 2d.
[3] H. D. 79, 62d, 1st.
[4] Sur., Marblehead H. and Holmes Hole, Mass., to ascertain the practicability and necessity of building a p. at the mouth of H. of Marblehead, for security of shipping, and also a p. in the H. of Holmes Hole for the same purpose. (Treas. Doc. 373, 1882.) **R.,** Apr. 24, 1826. (H. D. 482, 55th, 2d.)
[5] For sea walls.
[6] Sur.—**R.,** Sept. 20, 1837, est., $30,000. (H. D. 482, 55th, 2d.)
[7] May be expended on western (or Saugus R.) chan.
* Allotment.

1894. A. B. Martin, dr. 32,608 c. y., at 23¢ c. y., **95,** 617.
1897. A. B. Martin, dr., 21⅞¢ c. y. ($8,750); removal of bowlders over 3 t. each, $8, **97,** 840.
1902. Bay State Dredging Co., dr., 23.5¢ c. y., **03,** 760.
1905. Bay State Dredging Co., dr., 20.95¢ c. y., **05,** 813.
1910. Bay State Dredging Co., dr., 21.4¢ c. y., **11,** 1173.

ENGINEERS.

Chief of Engineers. R., 81, 77; **82,** 77; **83,** 71; **84,** 77, 523; **85,** 65; **86,** 65; **87,** 26; **88,** 26; **89,** 37; **90,** 31; **91,** 39; **92,** 45; **93,** 44; **94,** 42; **95,** 45; **96,** 46; **97,** 52, 65; **98,** 59; **99,** 69; **00,** 78, 94; **01,** 150, 159, 1092; **02,** 95; **03,** 73; **04,** 50; **05,** 53; **06,** 50; **07,** 52; **08,** 53, 77; **09,** 56; **10,** 68; **11,** 71; **12,** 78.

Boards. Convened, New York, Apr. 10, 1884, to **R.** upon Col. Thom's proj. for imp. of Lynn H. **R., 84,** 524. (Lt. Cols. Abbot and Comstock.)

In charge:
Col. G. Thom, 1881. **R., 82,** 544.
Maj. C. W. Raymond, 1883–86. **R., 83,** 460; **84,** 520, 531, 549; **85,** 516.
Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 577; **87,** 508; **88,** 445.
Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 568; **90,** 494; **91,** 641; **92,** 572; **93,** 758; **94,** 545; **95,** 615; **96,** 599; **97,** 839, 872; **98,** 860.
Col. C R. Suter, 1899–1901. **R., 99,** 1070; **00,** 1189; **01,** 1092, 1093.
Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1075; **02,** 867; **03,** 759; **04,** 847; (Col.) **05,** 812.
Maj. Edw. Burr, 1906–09. **R., 06,** 876; **07,** 906; (Lt. Col.) **08,** 948; **09,** 987.
Col. F. V. Abbot, 1910–. **R., 10,** 1105; **11,** 1172; **12,** 1383.

Assistants:
H. F. Bothfeld. **R., 84,** 531.
T. T. H. Harwood. **R., 01,** 1095.

OPERATIONS.[1]

1884–85. 170,445 c. y. dr. from the lower and upper chans., **85,** 517.
1886–87. 50,089 c. y. dr. from inner chan., **87,** 509.
1889–90. 25,571 c. y. dr., **90,** 495.
1891–92. 40,000 c. y. dr. from the H. basin, **92,** 573.
1892–93. 4,583 c. y. dr. from w. chan., **93,** 759.
1893–94. About 35,000 c. y. dr., incl. 13794 c. y. in completing w. chan., **94,** 546.
1894–95. 7,020 c. y. dr., **95,** 616.
1895–96. About 25,000 c. y. dr., **96,** 600.
1897–98. About 54,000 c. y. dr., **98,** 861.
1902–03. 44,783 c. y. d., **03,** 759.
1903–04. 49,449 c. y. dr. from main ship chan., **04,** 847.
1904–05. 1,161 c. y. dr., **05,** 812.
1905–06. 240,668 c. y. dr., **06,** 876.
1906–07. 320,379 c. y. dr., **07,** 906.
1907–08. About 22,185 c. y. dr., proj. completed, **08,** 948.
1910–11. 218,670 c. y. dr. in w. chan.; and 4,748 c. y.,[2] **11,** 1172.
1911–12. 12,595 c. y. dr., w. chan.; and 2,680 c. y. dr.,[2] **12,** 1383.

PHYSICAL CHARACTERISTICS.

Prevailing winds and tidal data, **84,** 536, 537.
Current observations, **84,** 546.
Description of, **97,** 873.
Max. draft, 15′; range of tide, 9.3′, **12,** 79.
L. H. 14± m. ne. from Boston; is 3 m. from n. to s., and has average w. e. and w. of 1½± m., the greater part being bare at l. w., **12,** 78.

PLANS.

By Col. Thom, imp. H. by means of 2 rubble break'rs, **84,** 524, 529.

PROJECTS.

By B. of E., 1884, chan. 200′ x 10′ m. l. w. from a point near the White Rocks to d. w. opposite Little Nahant, and from d. w. opposite Sand Pt. to Lynn H. line; the upper part of the chan. to be maintained by occasional dr., the lower part by a training wall joining the land at Little Nahant; est., $145,000, **84,** 521, 528. Cost revised to $157,000, **85,** 517; **87,** 509.
In Sept., 1888, proj. modified by extending the inner chan. 400′ inside the H. line and making at its inner end an anchorage basin 500′ x 300′ x 10′ m. l. w.; revised cost, $182,000, **89,** 37; **92,** 573.
By Lt. Col. Mansfield, 1892, chan. 150′ x 8′ at entrance to w. chan., and for wi. inner chan. of main H. to full proj. dimensions as far as available funds would permit, **93,** 759.
Col. Mansfield, 1897, est. $441,813.07 for chan. 300′ x 15′ m. l. w., **97,** 872.
By Col. Suter, chan. 200′ x 15′ x 4,500′ from sea to opposite Little Nahant, incl. the basin extending beyond the inner ship chan., and the removal of a small pt. on e. bank of chan. near said basin; est., $162,937,[3] **01,** 1094; au. act June 13, 1902, **02,** 95; completed 08, **12,** 78.
By Lt. Col. Burr, 1908, turning basin 500′ square x 15′, straightening chan., and dr. to 300′ x 15′ from d. w. to wharves at head of H.; est., $179,000,[4] **08,** 77; **10,** 69; au. act June 25, 1910, **10,** 69.

SURVEYS.

Au. act Mar. 3, 1881; made, 1881, by Col. Thom, **82,** 544.
Of H., 1885, **85,** 517.
Of the imp. chans., made, 1888, by Lt. Col. Gillespie, **88,** 446.
Sur. au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (**R.** partly fav.), (see Projects), **97,** 872.
Au. act June 6, 1900; made, 1900, by Col. Suter,[3] **01,** 1092.
Au. act Mar. 2, 1907; made, 1907–08, by Lt. Col. Burr,[4] **08,** 77.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 79.
Maps.
84, 532.
Of upper chan., **86,** 578.

B-109 SAUGUS RIVER, MASS.

COMMERCE.

Description of, **93,** 790.

ENGINEERS.

Chief of Engineers. R., 93, 52; **06,** 72.
In charge:
Lt. Col. S. M. Mansfield, 1893. **R., 93,** 789.
Col. W. S. Stanton, **06,** 41.

PHYSICAL CHARACTERISTICS.

Description, **93,** 790.

SURVEY.

Ex. au. act July 13, 1892; made by Lt. Col. Mansfield, 1892 (**R.** unfav.), **93,** 790.
Pre. ex. au. act Mar. 3, 1905. **R.** by Col. Stanton, May 22, 1905[5] (unfav.), **06,** 72.

[1] History of H., **84,** 538.
[2] Maintenance.
[3] H. D. 78, 56th, 2d.
[4] H. D. 948, 60th, 1st.
[5] H. D. 139, 59th, 1st.

B-114 WINTHROP HARBOR, MASS.

APPROPRIATIONS.

1888, $1,000, **89,** 571.
1890, 5,000, **90,** 497.
1892, 3,000, **92,** 575.

Total, 9,000

CONTRACTS.

1890. Boynton Bros., dr., 24¢ c. y., **91,** 645.
1892. O. E. Lewis, dr., $3,000 for all, **93,** 762.

ENGINEERS.

Chief of Engineers. **R., 88,** 27,32; **89,** 37; **90,** 32; **91,** 40; **92,** 46; **93,** 45; **94,** 43; **95,** 46; **99,** 81; **00,** 93.

In charge:
Lt. Col. G. L. Gillespie, 1888–89. **R., 88,** 468, 470.
Lt. Col. S. M. Mansfield, 1889–95. **R., 89,** 571; **90,** 496; **91,** 644; **92,** 574; **93,** 761; **94,** 547; **95,** 618.
Col. C. R. Suter, 1900. **R., 00,** 1219.

Assistant. S. Haagensen. **R., 88,** 471.

OPERATIONS.

1890-91. 20,060 c. y. dr., **91,** 644.
1892-93. Dr. sufficient to complete proj., **93,** 761.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1220.

PROJECTS.

By Lt. Col. G. L. Gillespie, 1887, imp. by conversion of tidal depression into a chan. 3,900′ x 50′ x 6′ m. l. w., "Back Channel" to "Rices Wharf"; est., $17,600, **88,** 470, 471; **89,** 571; **92,** 574.

SURVEYS.

Ex. au. act Aug. 5, 1886, **87,** 31.
Au. act Aug. 5, 1886; made, 1887, by Lt. Col. Gillespie, **88,** 470.
Ex. au. act Mar. 3, 1899; made by Col. Suter, 1899 (**R.** unfav.), **00,** 1220.
Maps. **88,** 470.

B-113 BOSTON HARBOR, MASS.[1]

(See also B-118, B-123; B-145.)

APPROPRIATIONS.[2]

1825,[3] $52,972.56, act Mar. 2.
1828,[3] 2,000.00, act Mar. 19.
1828, 87,000.00, act May 23.
1829,[3] 7,310.54, act Mar. 2.
1831,[3] 5,000.00, act Mar. 2.
1831, 12,390.00, act Mar. 2.
1832,[3] 9,000.00, act Feb. 24.
1832, 60,000.00, act July 3.
1836, 15,000.00, act July 4.
1838, 7,353.00, act July 7.
1841, 1,000.00, act Mar. 3.
1841,[3] 1,500.00, act Mar. 3.
1842,[3] 2,000.00, act Aug. 31.
1843,[3] 16,000.00, act Mar. 3.
1848,[3] 40,000.00, act July 20.
1852, 30,000.00, act Aug. 30.
1864, 40,000.00, act July 2.
1864,[3] 10,000.00, act July 2.
1865,[3] 3,000.00, act Feb. 28.
1865, 20,000.00, act Feb. 28.
1866, 50,000.00, act June 12.
1866,[3] 75,000.00, act July 12.
1867, 375,000.00, **71,** 886.
1868, *43,000.00, **68,** 25.
1869, *82,170.00, **69,** 22.
1869, *24,750.00, **69,** 23.
1870, 100,000.00, **70,** 78; **71,** 94.
1871, 100,000.00, **71,** 94.
1872, 75,000.00, **72,** 93.
1873, 150,000.00, **73,** 104.
1874, 100,000.00, **74,** 114.
1875,[4] 90,000.00, **75,** 119.
1876, 50,000.00, **76,** 46.
1878, 55,000.00, **78,** 44.
1879, 50,000.00, **79,** 50.
1880,[5] 75,000.00, **80,** 346.
1881,[6] 100,000.00, **81,** 515.
1882, 96,500.00, **82,** 513.
1884, 5,000.00, **84,** 513.
1886, 56,250.00, **86,** 570.
1888, 125,000.00, **88,** 455.
1890, 145,000.00, **90,** 505.
1892, 300,000.00, **92,** 582.
1894, 200,000.00, **95,** 628.
1896, 70,000.00, **96,** 606.
1897, 400,000.00, **97,** 845.
1898, 250,000.00, **98,** 870.
1899, 75,000.00, **99,** 1078.
1899, 163,751.00, **99,** 1078.
1900, 317,000.00, **00,** 1201.
1901, 133,000.00, **01,** 1082.
1902, {175,000.00, 100,000.00, 600,000.00} **02,** 876.
1903, 150,000.00, **03,** 769.
1904, 350,000.00, **04,** 855.
1905, {970,000.00, 100,000.00} **05,** 821.
1906, 600,000.00, **06,** 882.
1907, {50,000.00, 500,000.00, 930,000.00} **07,** 913.
1909, 1,200,000.00, **09,** 991.
1910, {900,000.00, 25,000.00} **10,** 1109.
1911, 900,000.00, **11,** 1180.
1912, {85,000.00, 25,000.00} **12,** 1390.

Total, 12,012,947.10 (including "Sales, etc.," $12,013,845.27, **12,** 1390).

COMMERCE.

Dangers to shipping from Corwin Rock, **69,** 422.
Benefits from the imp. stated by the collector of customs, **70,** 471.
C. interests affected by imp. of Hingham H., **75,** ii, 420.
Large and increasing. The port the second greatest on the Atlantic seaboard, 1898. **98,** 889. Details **08,** 956.
Value, 1900, $184,500,000; revenue collected, $18,871,848.99, **01,** 1096.
Large, mostly grain, and rapidly increasing; over 1,000,000 t. 1901, **02,** 99. Valued at $189,575,378, 1911, **12,** 89.
Increase in value since 1867; value, 1903, about $66,000,000, **03,** 78; 1912, over $122,000,000, **12,** 89.

*Allotment.
[1] Boston H. and Narragansett B. Canal. Ex.—**R.** (fav.), Feb. 3, 1825. (H. D. 482, 55th, 2d.)
[2] App. to June 12, 1866, and allotment of Apr. 10, 1869, of $24,750, are for sea walls and preservation of islds.
[3] Fortification act.
[4] $10,000 not included allotted to Hingham H.
[5] $22,500 at mouth of Charles R. in Boston H. and up to Watertown, $17,500 at mouth of Mystic R. $5,000 from Boston H. to Nantasket Beach.
[6] $35,000 for mouth of Charles R. in Boston H. and up to Watertown, $20,000 at mouth of Mystic R., $5,000 from Boston H. to Nantasket Beach.
[7] Chelsea Creek.

Entire cost of imp. less than 2% of foreign com. an., **03**, 78; **04**, 55.

Details of, Chelsea Creek, **04**, 57; **93**, 791.

Charles R. imp. enables delivery of large shipments of coal, wood, etc., at wharves on R., saving handling and rail transfer, **02**, 100; **09**, 64.

Freight rates some 50% less than 15–20 years ago, at 1905, **05**, 59.

Effect on f. rates owing to increased size of steamers, **10**, 75.

Details of, **11**, 1181; **12**, 1392.

Diagrams of freight valuations and of appns., **12**, 1392.

"The foreign exports and imports for the port of Boston during the calendar year ending Dec. 31, 1911, amounted in value to $189,575,378, being an increase of $122,888,857 over the valuation in 1867, when the systematic improvement of the channels was begun.

"As to the effect of the improvement on freight rates the general manager of the principal foreign steamship lines entering this port states that about 30 years ago steamers were employed with a loaded draft of 20 to 24 feet; 22 or 23 years ago, of 25 to 26 feet; 14 years ago, 27 or 28 feet; 10 years ago, 28 feet 9 inches; later, 31 feet; and recently one of 33 feet 10½ inches. He states, generally, 'that freight rates, caused by the larger class of steamers being used, are about 50 per cent less than they were some 15 or 20 years ago, when very much smaller steamers were engaged in the trade.'" **12**, 89

CONTRACTS.[1]

1868. Albert Boschke, dr., 50¢, **68**, 806, 818. Charles Wooley, dr., 75¢. (abandoned), **68**, 818. William W. Wright, dr., 75¢ (transferred), **68**, 807, 818. George W. Townsend, blasting, **68**, 807, 811, 818. James Andrews, work and granite, **68**, 808, 818. T. W. Hoxie & Co., sand and cement, **68**, 808, 818. Franklin Mead, st., concrete, **68**, 808, 818. Edmund Langley, sea walls, **68**, 835. Samuel R. Edwards, sea walls, **68**, 836. Derry & Edwards, sea walls, **68**, 836. James Phillips, sea walls, **68**, 839.

1870. James M. Andrews, sea walls, **70**, 466. W. A. Kenrick, wharf, **70**, 465. E. R. Seward, dr., 85¢, **71**, 880.

1871. James M. Andrews, sea walls, **71**, 881. R. G. Packard, dr., 57¢, **71**, 880; **72**, 947.

1872. James Andrews, sea walls, **72**, 945. James M. Andrews, sea walls, **72**, 945.

1873. James Andrews, sea walls, **73**, 1094; **74**, ii, 313, 315. James M. Andrews, sea walls, **73**, 1086; **74**, ii, 313, 315.

1874. W. H. Lloyd, r. removal, **74**, ii, 318. Boynton Bros., dr., 38¢, **75**, ii, 407. Atlantic Dredging Co., dr., 64¢; r., $35, **74**, ii, 317. Harbor Imp. Co., dr., 85¢, **74**, ii, 317. New England Dredging Co., dr., 39¢, **75**, ii, 406.

1875. G. W. Townsend, Kelleys Rock, **75**, ii, 409. G. W. Townsend, rockwork, Hingham H. $39, **75**, ii, 410; **76**, 176. G. W. Townsend, rockwork, at $50–65, **77**, 179, 180. Curtis, Fobes & Co., dr., 75¢, **75**, ii, 408. Curtis, Fobes & Co., Nash's Rock, **75**, ii, 409. Curtis, Fobes & Co., dr., 18¢, Hingham H. **75**, ii, 410; **76**, 176.

1877. New England Dredging Co., dr., 24¢, **77**, 177.

1878. Isaac A. Sylvester, granite and rockwork, **78**, 209; **79**, 269. Cape Ann Granite Co., rubblest., **78**, 209. Joseph E. Bartlett, dr., 27¢, **79**, 268.

1879. New England Dredging Co., dr., 74¢ and 33¢ c. y., **80**, 347.

1880. Moore & Wright, dr., 39¢ c. y., **81**, 516, 517. Eastern Dredging Co., dr., 37¢ c. y., **81**, 517.

1881. Eastern Dredging Co., dr., 22¢ c. y., **81**, 518. R. Hamilton, jr., dr., 18¾¢ c. y., **81**, 518. Eastern Dredging Co., dr., 43¢ c. y., **82**, 513, 519.

1882. Eastern Dredging Co., dr., 23¢ c. y., **82**, 519. H. W. Phillips, r. removal, $90 c. y., **82**, 519. G. W. Townsend, r. removal, $35 c. y., **83**, 454.

1883. J. McDermott, dr., 39¢ c. y., **83**, 454.

1886. Bay State Dredging Co., dr. in Fort Pt. Chan., 15¢ c. y., **87**, 519.

1887. J. E. Chapman, dr., 23¢ c. y., **87**, 519.

1888. G. W. Townsend, r. removal, $22 c. y., **88**, 455.

1889. Pigeon Hill Granite Co., granite ashlar, $4,747. New England Dredging Co., dr., 35¢ c. y.; removal of bowlders weighing over 6 t. each, $10, **89**, 579, 580.

1890. G. W. Townsend, r. removal, $29 c. y. Bay State Dredging Co., dr., 20¢ c. y.; removal of bowlders, $8 c. y., **90**, 505, 506. C. W. Lampee, dr. in Nantasket Beach Chan., 25¢ c. y., **91**, 653. New England Dredging Co., dr. in Nixs Mate Chan., 19¼¢ c. y., **91**, 653. A. R. Wright, dr. at Brewster Spit, 14¢ c. y., **91**, 654. Rockport Granite Co., granite ashlar for Gallops Isld., $3,917, **91**, 654.

1891. A. R. Wright, dr. in main ship chan., 17¢ c. y., **91**, 654.

1892. A. B. Martin, dr. Nantasket Beach chan., 24,324 c. y., 37¢, **93**, 771. C. H. Souther, dr. Jeffries Pt., 34½¢ c. y. ($18,975). C. H. Souther and A. R. Wright, dr. 500,000 c. y. main ship chan., 49½¢ c. y., **93**, 772.

1894. E. Townsend and C. W. Johnston, ledge removal, Nantasket Beach chan., $3,456.25; Boston H., $144,562.56. C. H. Souther and A. R. Wright, dr. 155,555 c. y., Narrows, 29¢ c. y., **95**, 628–629.

1896. A. B. Martin, dr. 24,137 c. y., Chelsea Creek, 29¢ c. y., **97**, 846.

1897. Breymann Bros., dr. Boston H., 17½¢ c. y. ($509,375.65), **97**, 847.

1900. Breymann Bros., dr. Broad Sound, 35¢ c. y. ($292,628.70), **00**, 1202. Charles W. Johnston, removing r. from main ship chan., $15.80 c. y., **01**, 1082.

1902. G. H. Breymann & Bros., r. removal, $9.73 c. y., p. m.; Bay State Dredging Co., dr. in Chelsea Creek, 25¢ c. y., **02**, 876.

1903. Breymann Brothers, dr., 20 and 39¢ c. y.; Morris & Cumings Dredging Co., dr., 23.4 and 40¢ c. y.; George H. Breyman, dr., 23.5 and 39¢ c. y.; Eastern Dredging Co., and New England Dredging Co. dr., 23.9 and 39.7¢ c. y., **03**, 769. Jos. J. Callahan, riprap in place in dike, $1.67 t., **03**, 770. Submarine Contracting Co., removing ledge, $15.50 and $18.50 c. y.; John H. Gerrish, dr., $247.50 per day, **04**, 856.

1904. G. H. Breymann & Bros., removing r., $30 c. y., p. m.; John H. Gerrish, dr., $247 per day, **05**, 822.

1905. G. H. Breymann & Bros., removing r., $16 c. y., p. m., **05**, 821. C. W. Howard, hire of ss. *Comet*, $9 per day; Commercial Wharf Co., rent of wharf, $150 per month, **05**, 822. Bay State Dredging Co., dr. Chelsea Creek, 29¢ c. y.; New England Granite Co., st. in place at Gallops Isld., $1 per short t., **06**, 883.

1906. Eastern Dredging Co., removing 2 ledges, $1,975; Eastern Dredging Co., dr. from Fort Pt. chan., 28.9¢ c. y. and $5 for bowlders; Boston & Maine RR., rent of wharf, $150 per month, **07**, 914.

1907. G. H. Breymann & Bros., dr., 22 and 40¢ c. y.; G. H. Breyman & Bros., r. removal, $21.74 c. y., p. m., **08**, 955.

1908. Trustees of Barristers Hall, rent of office, $250 per month; Boston & Maine RR., rent of wharf, $150 per month, **09**, 992.

1909. G. H. Breymann & Bros., r. removal, $1,950; Bay State Dredging Co., dr. Fort Pt. chan., 25.75¢ c. y., and $5 c. y. for bowlders, **09**, 992.

1910. S. W. K. Brooks, 2 sur. scows, $2,698, **10**, 1110. W. H. Ellis, riprap st. at Lovells and Long Islds.; $2.08 per t. for Lovells Isld. and $2.18 per t. for Long Isld., **11**, 1180. Trustees of Barristers Hall, rent of office, $300 per month; Boston & Maine RR., rent of wharf, $150 per month, **11**, 1181.

1911. Great Lakes Dredge & Dock Co., r. excavation, 32,602 c. y. at $6.45 per c. y.; Daly & Hannan Dredging Co., dr. and removal of bowlders, about 140,000 c. y. at 64¢ per c. y., **12**, 1391. Boston & Maine RR., use of dock and wharf, $40 per month; New England Telephone & Telegraph Co., telephone service, $176 per year, **12**, 1392.

1912. Great Lakes Dredge & Dock Co., r. excavation, 78,792 cy. at $7.50 per c. y., **12**, 1391. Boston & Maine RR., use of dock and wharf, $40 per month, **12**, 1392.

[1] Remarks by Col. Benham on relative economy of work done by contract or by hired labor, **68**, 838.

ENGINEERS.

Chief of Engineers. Report to Sec. War on works necessary for preservation and imp. of Boston H., Feb. 11, 1867, **67,** 476.

R., 66, ii, 30–35; **67,** 17, 47; **68,** 68, 70; **69,** 59, 60; **70,** 76, 77; **71,** 87, 93; **72,** 86, 92; **73,** 102; **74,** 111; **75,** 117, 121; **76,** 43, 45; **77,** 37, 40; **78,** 41, 41; **79,** 49; **80,** 69; **81,** 73; **82,** 73; **83,** 68; **84,** 75; **85,** 63; **86,** 63; **87,** 26; **88,** 27; **89,** 38, 368; **90,** 33, 331; **91,** 40, 424; **92,** 46; **93,** 46, 52; **94,** 44; **95,** 47, 54; **96,** 48; **97,** 55; **98,** 61, 70; **99,** 71; **00,** 81, 94; **01,** 152, 159, 1096; **02,** 98; **03,** 77; **04,** 53; **05,** 57; **06,** 55, 72, 73; **07,** 56; **08,** 58; **09,** 60; **10,** 73; **11,** 77; **12,** 85, 102, 103.

Boards:

Had extensive sur. made, 1860. Extract from **R., 71,** 885. (Gen. Totten, Prof. Bache, Commander Davis.)

Convened, Boston, July 20, 1889, by S. O. No. 38, to report upon the establishment of H. lines in Boston H. **R., 89,** 601; **90,** 532. (Col. Abbot, Lt. Cols. Gillespie and Mansfield, and Maj. Livermore.)

Convened, Boston, Jan. 23, 1891, by S. O. No. 38, to report upon the establishment of H. lines in Boston H. **R., 91,** 688. (Col. Abbot, Lt. Cols. Gillespie and Mansfield, and Maj. Livermore.)

In charge:

Col. H. W. Benham (Capt.), 1849, sea walls for protection of islds. in Boston H., **66,** ii, 33.

1866–1873. **R., 66,** ii, 30; **67,** 467, 470; **68,** 833; **69,** 439; **70,** 460; **71,** 828; **72,** 923.

Lt. Col. S. Thayer, 1852, sea walls, **66,** ii, 34.

Maj. C. E. Blunt, **66,** ii, 32.

Col. J. D. Graham, 1864, sea walls, **66,** ii, 30, 34.

Lt. Col. J. G. Foster. Preservation and imp. of Boston H., 1867 to 1871, **67,** 474.

R., 67, 474; **68,** 806; **69,** 417; **70,** 464.

Removal of Tower and Corwin Rocks, **68,** 811; **69,** 421.

History and scope of the works in Boston H., **71,** 881.

Lt. Col. G. Thom, 1871–83. **R., 71,** 878; **72,** 942; **73,** 1085; **74,** ii, 313; **75,** ii, 403, 410, 417; **76,** 167, 176; **77,** 173, 181; **78,** 207; **79,** 267; (Col.) **80,** 346; **81,** 515; **82,** 512; **84,** 588.

Maj. C. W. Raymond, 1883–86. **R., 83,** 445; **84,** 503, 510, 589; **85,** 502, 543, 545.

Maj. G. L. Gillespie, 1886–89. **R., 86,** 564; **87,** 511; (Lt. Col.) **88,** 447.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 572; **90,** 497; **91,** 645; **92,** 575, 584; **93,** 763, 790; **94,** 549; **95,** 620, 648; **96,** 603; **97,** 843; (Col.) **98,** 864, 886.

Col. C. R. Suter, 1899–1901. **R., 99,** 1074; **00,** 1194; **01,** 1097, 1098.

Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1078; **02,** 871; **03,** 764; **04,** 850; (Col.) **05,** 815.

Maj. Edw. Burr, 1906–09. **R., 06,** 879; **07,** 910; (Lt. Col.) **08,** 952; **09,** 990.

Col. Frederic V. Abbot, 1910–. **R., 10,** 1108; **11,** 1178; **12,** 1388.

Assistants:

H. L. Whiting, U. S. C. S., surveys, **71,** 886.

Lt. M. B. Adams, **66,** ii, 34.

Capt. G. Burroughs, **67,** 46.

Capt. G. L. Gillespie, **69,** 59.

H. F. Bothfeld, sur. of "Narrows," **73,** 1089; **74,** ii, 316, 317. **R., 73,** 1094. Sur. of Hingham H., **75,** ii, 417. **R., 75,** ii, 418; **85,** 546.

T. T. H. Harwood. **R., 98,** 890; **01,** 1102.

ESTIMATES.

(See Plans and Projects.)

1852. By Col. Benham, Great Brewster Isld. sea wall, $35,000, **66,** ii, 34.

1866. By Col. Benham, Great Brewster Isld. sea wall (repairs), $38 000, **66,** ii, 32. Lovells Isld. sea wall (repairs), $12,000, **66,** ii, 32. Lovells Isld. sea wall, se. head (repairs), $25,000, **66,** ii, 33.

1867. By Col. Benham, Great Brewster Isld. connecting wall, $34,000, **67,** 469, 470. Lovells Isld. wall (additional), $12,500, **67,** 472. Deer Isld. wall (additional), $23,500, **67,** 473. By Lt. Col. Foster, Boston H. imp., $714,467,[1] **67,** 475; **70,** 468.

1869. By Col. Benham, Deer Isld. wall (additional), $8,000, **69,** 441; **70,** 462.

1870. By Col. Benham, Lovells Isld. wall (additional), $15,000, **70,** 461; **71,** 829. Deer Isld. wall (additional), $18,000, **70,** 462; **71,** 829.

1871. By Lt. Col. Thom, Boston H. (additional), $231,000, **71,** 880.

1873. By Lt. Col. Thom, Boston H. (future work), **73,** 1092; **74,** ii, 321; **75,** ii, 410.

1874. By Lt. Col. Thom, Hingham H., $11,000, **75,** ii, 418.

1876. By Lt. Col. Thom, completion of all work, $75,000, **76,** 177.

1877. By Lt. Col. Thom, completion of work, $55,000, **77,** 182. Man-of-war Shoal, $43,000, **77,** 183.

1878. By Lt. Col. Thom, Anchorage and Mystic R. shoals, and Lower Middle Chan., $165,000, **78,** 218.

1879. By Lt. Col. Thom, final completion, $195,000, **79,** 270.

EXPENDITURES.

(See Estimates, Financial Statements, Operations, Plans, and Projects.)

1866–67, at Deer Isld., $43.58 per l. f. of wall, **67,** 471; in 1867–68, $24 per l. f. of wall, **67,** 471.

At Rainsford Isld. sea wall to 1870, $22,353, **78,** 207.

At Great Brewster Isld. sea wall to 1870, $277,082.55, **76,** i, 168; $269,000, **78,** 207.

At Deer and Lovells Islds., 1866–70, $133, 420.24, **76,** i, 168.

At Deer and Lovells Islds., up to 1870, $322,000, **78,** 207.

Corwin and Tower Rocks, removal; cost, $31,228.61, **69,** 425.

Barrel Rock, removal; cost, $5,218, **70,** 465.

Hingham H. work; cost, $9,116.58, **76,** 45.

FINANCIAL STATEMENTS.

(See Expenditures.)

Deer Isld., **66,** ii, 31. Deer and Lovells Islds., **67,** 47, 473; **69,** 61, 442; **70,** 76, 462; **71,** 829. Great Brewster Isld., **66,** ii, 34; **67,** 470; **68,** 838; **69,** 60, 440; **70,** 464. Boston H. imp., **68,** 820; **69,** 419; **70,** 77, 470; **71,** 94, 878; **72,** 93, 942; **73,** 104; **74,** ii, 321; **75,** ii, 411; **76,** 46, 177; **77,** 40, 182; **78,** 44, 218; **79,** 50, 267, 270.

LEGISLATION.

By Mass., app. $175 for purchase of land for Pt. Allerton sea wall, **68,** 807; providing for the sale of land on Long Isld. Head to the U. S., **68,** 808; **69,** 418; asking app. from Congress (in 1843), **71,** 885; prohibiting the removal of st., gravel, and sand from Islds. and headlands (1856), **71,** 885.

OBSTRUCTIONS.

R. and H. act Sept. 19, 1890, app. $20,000, Charles R., not to be used until draws in Arsenal and Market St. Br. conformed to proj., **02,** 873.

Plans, lock and dam, of State of Mass., across Charles R., Boston, appr. by Sec. of War, 1904, **05,** 730.

Mount Washington Ave. Br., Fort Pt. chan., removed, **09,** 65.

OPERATIONS.

1825–32. Sea wall built at Deer Isld., **71,** 885.

1836–38. Sea wall built at Rainsford Isld., **78,** 207.

1843. 750 l. f. sea wall built at Lovells Isld., **66,** ii, 32; **71,** 885.

1849–50. 720 l. f. sea wall built at Great Brewster Isld., **66,** ii, 31, 33, 34.

1851. Repairs to sea wall at Great Brewster Isld., **66,** ii, 33.

1853–54. 640 l. f. sea wall built at Great Brewster Isld., **66,** ii, 34.

[1] By Chief of Engineers for same, **67,** 477; by H. commissioners for same, $690,467.50, **76,** i, 168; stated in detail as $725,467.50, **68,** 809. The est. was exceeded 50%, **76,** 177.

1864-65. 150 l. f. sea wall built at Great Brewster Isld. and 300 l. f. at Deer Isld., **66,** ii, 31, 35; **67,** 470.

1866-67. 490 l. f. sea wall built at Great Brewster Isld. and 340 l. f. at Deer Isld., **67,** 467–469, 471. Rock work at Tower Rock, **68,** 68, 811; **69,** 421; **71,** 886.

1867-68. 550 l. f. sea wall built at Great Brewster Isld. and 826 l. f. at Deer Isld. 92,899 c. y. dr. from Lovells Isld., sw. pt.; rockwork at Tower Rock (excavated to 23′), **68,** 68, 811; **69,** 421; **71,** 886.

1868-69. Paving sea wall at Great Brewster Isld.; 980 l. f. sea wall built at Deer Isld., 800 l. f. at Lovells Isld., and 456 l. f. at Gallops Isld. 66,909½ c. y. dr. from Lovells Isld., sw. pt., and 450 c. y. from Upper Middle Bar; rockwork at Corwin Rock (excavated to 23′), **69,** 59, 417, 440, 441.

1869-70. 250 l. f. sea wall built at Great Brewster Isld., filling sea wall at Deer Isld., repairs to sea wall at Lovells Isld., wharf at Pt. Allerton, 867 l. f. sea wall built at Gallops Isld. 47,294½ c. y. dr. from Lovells Isld., sw. pt.; rockwork at Barrel Rock (excavated to 23′), **70,** 460–470.

1870-71. 440 l. f. sea wall built at Pt. Allerton, 422 l. f. at Gallops Isld., and 670 l. f. at Long Isld. 26,120 c. y. dr. from Upper Middle Bar; rockwork at Kelleys Ledge (excavated to 23′), **71,** 87, 93, 828, 878.

1871-72. 219 l. f. sea wall built at Pt. Allerton; paving sea wall at Gallops Isld. and 522.7 l. f. sea wall built at Long Isld. 20,355 c. y. dr. from Upper Middle Bar; rockwork at Kelleys Ledge (excavated to 23′), **72,** 92.

1872-73. Jetty and apron at Lovells Isld.; 382.1 l. f. sea wall built at Pt. Allerton and 490 l. f. at Long Isld. Rockwork at Kelleys Ledge, wreck of *Delos*, **73,** 102, 1085–1093.

1873-74. Repairs to sea wall at Deer Isld.; 132.2 l. f. (1,005′ apron, 8 jetties) sea wall built at Pt. Allerton; 1,655′ apron and 8 jetties at Gallops Isld., and 380½ l. f. sea wall at Long Isld., 8,476 c. y. dr. from Upper Middle Bar; rockwork at ledge in Narrows (excavated to 23′), **74,** 111, ii, 313.

1874-75. 975′ apron and 10 jetties built at Long Isld. 21,295 c. y. dr. from Lovells Isld., sw. pt.; 52,755 c. y. from Upper Middle Bar, and 19,820 c. y. from Great Brewster Spit; sur. at Hingham H.; rockwork at Kelleys Ledge and State and Palmyra Rocks (excavated to 23′), **75,** 117, ii, 403–10, 417.

1875-76. 9,763 c. y. dr. from Lovells Isld., sw. pt.; 95,002 c. y. from Upper Middle Bar, 9,406 c. y. from Great Brewster Spit, and 25,160 c. y. from Hingham H.; rockwork at Kelleys Ledge, ledge in Narrows, and Hingham H., **76,** 168, et seq.

1876-77. Repairs to sea wall at Deer Isld. 64,136 c. y. dr. from Upper Middle Bar; rockwork at Great Brewster Spit, Nashs Rock (excavated to 21′), and Kelleys Ledge, **77,** 173, et seq.

1877-78. Rebuilt sea wall at Lovells Isld. 29,133½ c. y. dr. from Lovells Isld., sw. pt., and 1,484½ c. y. from Upper Middle Bar; rockwork at ledge Middle Bar, Nashs Rock, and Kelleys Ledge, **78,** 207, et seq.

1878-79. Repairs to sea walls at Rainsford Isld., Deer Isld., Gallops Isld., and Long Isld., and rebuilt sea wall at Lovells Isld. 46,000 c. y. dr. from Man-of-war Shoal; rockwork at Upper Middle Bar, Nashs Rock (excavated to 20½′), and Kelleys Ledge, **79,** 268, et seq.

1879-80. 146 c. y. removed from Kelleys Ledge; 39,917 c. y. dr. from Man-of-war Shoal; 21,054 c. y. dr. from Anchorage; 47,953 c. y. dr. from Mystic R. near mouth of Boston H.; sea wall repaired, **80,** 347.

1880-81. 30,409 c. y. dr. from Anchorage Shoal; 5,007 c. y. dr. from Lower Middle Shoals; 33,114 c. y. dr. from Charles R.; 48,343 c. y. dr. from Mystic R. near mouth of Boston, H.; 21,924 c. y. dr. from Nantasket Beach Chan.; sea walls repaired, **81,** 516.

1881-82. 63,453 c. y. dr. from Anchorage Shoal; 48,530 c. y. dr. from Mystic R. near mouth of Boston H.; 29,885 c. y. dr. from Charles R.; 19,998 c. y. dr. from Nantasket Beach Chan.; sea walls repaired, **82,** 513, 519.

1882-83. 40,327 c. y. dr. from Anchorage Shoal; 33,490 c. y. dr. from Mystic R. near mouth of Boston H.; 12,500 c. y. dr. from Charles R.; 50 c. y. r. removed from Nantasket Beach Chan.; sea walls repaired, **83,** 447.

1883-84. 19,990 c. y. dr. from Nixs Mate Chan.; 31,950 c. y. dr. from Castle Isld. Shoal; 57,631 c. y. dr. from Charles R.; sea walls repaired, **84,** 504.

1884-86. Repairs to sea walls, **85,** 63. **86,** 63.

1886-87. 94,211 c. y. dr. from Fort Pt. Chan.; repair to e. sea wall at Lovells Isld. and s. and middle walls at Deer Isld., **87,** 512, 516.

1887-88. 69,000 c. y. dr. from main ship chan., **88,** 450.

1888-89. Repairs made to granite sea wall at Georges Isld., by hired labor. 1,500 running f. of granite ashlar and 300 s. y. of shell-st. paving delivered on Gallops Isld. sea wall; work begun by hired labor on extension of sea wall; 146,556 c.y. dr. in "Upper and Lower Middles," **89,** 573, 574, 575.

1889-90. Extension of granite wall at Gallops Isld. completed by hired labor; repairs made to middle and north head walls at Deer Isld. by hired labor; 5,942 c. y. dr. and 111 c. y. ledge removed from "Upper and Lower Middles"; 9,025 c. y. dr. from Nantasket Beach Chan., **90,** 499–504.

1890-91. Constr. of Gallops Isld. sea wall in progress; repairs to n. and middle head walls at Deer Isld., **91,** 647. 19,724 c. y. dr. from Nantasket Beach Chan., **91,** 651. 16,440 c. y. dr. from the w. end of Brewster Spit, **91,** 652.

1891-92. Repairs to sea wall at Great Brewster Isld.; extension of sea wall at Gallops Isld. completed; 1,100 t. of rubblest. used as riprap protection for the beach w. of sea wall at Long Isld.; 12,070 c. y. dr. from w. end of Brewster Spit; 130,962 c. y. dr. in extension of main ship chan.; 74,779 c. y. dr. from main ship chan. at upper middle bar; 70,674 c. y. dr. from chan. between Nixs Mate and Long Isld., **92,** 576–581.

1892-93. Sea wall at Great Brewster Isld. repaired, and riprap at w. end of the Long Isld. sea wall extended, **93,** 764. 137,213 c. y. dr. from Middle Shoal, **93,** 767. 21,594 c. y. dr. from Nantasket Beach Chan., **93,** 769. 20,697 c. y. dr. from Jeffries Pt. Chan., **93,** 770.

1893-94. Proj. for Jeffries Pt. and Nantasket Beach Chans. completed; 302,231 c. y. dr. from main ship chan. (maps), **94,** 552–554.

1894-95. Ledge in Nantasket Beach Chan. removed; dr. in main ship chan. in progress; 80,048 c. y. dr. from the Narrows, **95,** 624–627.

1895-96. Ledge removal in progress; sea walls in course of repair, **96,** 604–605.

1896-97. Repairs made to about 150′ of sea wall and about 400′ of dike; in connection with preceding years, 6,421 c. y. ledge removed, **97,** 843–845. About 21,000 c. y. dr. from Chelsea Creek, **97,** 845.

1897-98. 228 l. f. sea wall repaired; 2,301 c. y. ledge removed from main ship chan.; 479,308 c. y. dr. from Narrows, **98,** 865–867.

1898-99. Sea walls under repair; 671,394 c. y. dr. from main ship chan., **99,** 1075–1076.

1899-00. Sea wall repairs in progress; 875,505 c. y. dr., **00,** 1195–1197.

1900-01. 554,503.5 c. y. dr. and 3,200 c. y. ledge removed from main chan.; 206,072 c. y. dr. and 18 c. y. bowlders removed from Broad Sound; sea walls at Rainsford and Castle Islds. repaired; repairs in progress to sea wall at Middle Head, Deer Isld., **01,** 1079.

1901-02. 388,384.5 c. y. dr. and 246 c. y. r. removed from main ship chan.; 380,844 c. y. dr. and about 15 c. y. bowlders removed from Broad Sound Chan.; sea walls repaired at Pt. Allerton, Great Brewster and Deer Islds., **02,** 871, 873. 13,255 c. y. dr. from Chelsea Creek, **02,** 874.

1902-03. 12,260 c. y. dr. and 1,651 holes drilled and blasted in main ship chan.; 240,681.5 c. y. and about 85 c. y. bowlders dr. and about 21 c. y. ledge removed from Broad Sound Chan.; 60,881 c. y. clay and 4.2 c. y. bowlders removed from section 2, 35′ chan.; sea wall on Deer Isld. completed, and sea walls repaired on Castle, Georges, Gallops, Great Brewster, and Long Islds., **03,** 764, 765. 4,732 c. y. dr. from Chelsea Creek, **03,** 767.

1903-04. 11,993 c. y., s. m., r. and 23,147 c. y. other material removed from main ship chan. under 27′ proj.; 61,359.4 c. y. dr. and about 66 c. y. bowlders removed under 30′ proj.; 1,203,349 c. y. dr. under 35′ proj.; repairs made to sea walls on Deer, Long, Lovells, and Great Brewster Islds., **04,** 850–52.

1904-05. Rock removal continued; and 26,600 c. y. dr. (in mainten) under 27′ proj. by hired plant, at cost of .759¢ c. y., and 46,841 c. y. by U. S. hydraulic dredge "General Gillespie" at cost of 44¢ c. y.; 39,568 c. y. dr. and 156 c. y., p. m., rock removed under 30′ proj.; 2,242,502.5 c. y. dr. and 4.2 c. y. bowlders removed under 35′ proj., **05,** 815–17. Repairs made to sea walls on Deer, Rainsford, Great Brewster, and Georges Islds., **05,** 818.

1905-06. 11,983.5 c. y., s. m., rock removed from main ship chan. under 27′ proj.; 36,859 c. y. dr. and about 14 c. y. bowlders removed in completing 30′ proj.; 3,039,763 c. y. dr. 6.221 c. y. bowlders and 10,985 c. y. rock removed under 35′ proj., **06,** 879. Sea walls repaired on Deer, Gallops, and Lovells Islds., **06,** 880. 125,261 c. y. dr. from Chelsea Creek, **06,** 881.

1906-07. 1,363 c. y. rock removed under 27′ proj.; 1,670,394 c. y. dr. and about 20 c. y. bowlders and 33,091 c. y., s. m., rock removed under 35′ proj., **07,** 910, 911. Sea walls on Deer Isld. repaired; 152,053 c. y. dr. from Fort Pt. Chan., **07,** 911. 69,830 c. y. dr. and 3.65 c. y. bowlders removed from Chelsea Creek completing the au. chan., **07,** 912.

1907-08. 1,846,721 c. y. dr., 67 c. y. bowlders, and 36,463 c. y. ledge rock removed under 35′ proj.; 5,887 c. y. dr. from Fort Pt. Chan., completing the proj., **08,** 953. Table showing progress of work on 35′ chan., **08,** 953.

1908-09. 3,408,450 c. y. dr., 5.43 c. y. bowlders removed, and rock removal continued (contract of Apr. 26, 1905, completed, and contract of July 11, 1907, 98% completed), **09,** 990. 17,262 c. y. dr. from Fort Pt. Chan., at site of removed Mt. Washington Ave. br., **09,** 991.

1909-10. 4,168,039 c. y. dr., 42 c. y. bowlders removed, 3,010 c. y. rock removed, completing contract of July 11, 1907, and ledge points containing 5.26 c. y. removed under emergency contract; 195 c. y. dr. from Fort Pt. Chan. at site of removed Mt. Washington Ave. br., **10,** 1108.

1910-11. Sea walls on Lovells, Great Brewster, and Georges Islds., and riprap beach protection at Lovells Isld. repaired; riprap protection extended around Lovells Isld. and placed in front of sea wall around Long Isld. Head; 20 points of loose broken r. removed from imp. (27′) chan., **11,** 1178. Progress of work on 35′ chan., **11,** 1179.

1911-12. Repairs made to sea walls at Rainsford, Deer, Gallops, and Castle Islds. and Pt. Allerton; riprap beach protection at Lovells Isld. completed; riprap beach protection placed in front of sea wall around Long Isld. Head; tide gauge placed off Spectacle Isld., **12,** 1388. Progress of work on 35′ chan., **12,** 88, 1389.

PHYSICAL CHARACTERISTICS.

Of Deer Isld., **66,** ii, 30; **67,** 472; of Lovells Isld., **66,** ii, 32; **67,** 472; of Great Brewster Isld., **66,** ii, 33; of Tower Rock, **68,** 811; of Tower and Corwin Rocks, **69,** 422; of Barrel Rock, **70,** 465; of Pt. Allerton, **71,** 889; of Boston H., **71,** 882; islds. and anchorages, **71,** 882; destruction of islds., **71,** 884; extent of same, **71,** 886, 889; **74,** ii, 320; of Lovells Isld. Shoals, **73,** 1089; of "Narrows," **73,** 1096; of Hingham H., **75,** ii, 417, et seq.; of Man-of-war Shoal, **77,** 183; of Chelsea Cr.,[1] **93,** 791.

Details of, **91,** 646.

Description of, sur. of 1897, for 30′ chan., **98,** 887.

Storms damaging seawalls, **00,** 1195; **01,** 1079.

Details sur. of 1900, Boston H., borings, ledges, etc., for 35′ chan., **01,** 1096.

Charles R., **09,** 63; Fort Pt. Chan., **09,** 65; **12,** 89.

PLANS.

(See also Projects.)

For Hingham H. imp., **75,** ii, 417, 419.

PRIVATE (CITY AND STATE) WORK.

Sur. by city of Boston. (See Surveys.)

Est. by H. commissioners. (See Estimates.)

Details of imp. made by Charles R. Basin Commission (see Obstructions), **08,** 61; **09,** 63.

PROJECTS.

(See Estimates and Plans.)

By Lt. Col. Thayer, 1849, for Great Brewster Isld. sea wall, **66,** ii, 33.

By Col. Graham, 1865, for repairs of Deer Isld. sea walls, **66,** ii, 31.

By Lt. Col. Benham, 1866, for repairs, **66,** ii, 31.

By Lt. Col. Foster, for imp. of Boston H. by dr., sea walls, and removal of rocks, **67,** 474; **70,** 468.

By Lt. Col. Thom, 1873, for new work, removing Nashs Rock, Narrows Rock, State Rock, and wreck of Delos, **73,** 1091.

By Lt. Col. Thom, 1874, for sundry rockwork, **74,** ii, 318.

By Lt. Col. Thom, 1874, for imp. Hingham H., **75,** ii, 410, 418.

By Lt. Col. Thom, 1878, for Anchorage Shoal, Lower Middle Bar, and Mystic R., **78,** 217.

The projects for the imp. of Boston H. have had for their object, first, its preservation by protecting the shores of the islds. and headlands by sea walls, aprons, and jetties, thus preventing additional wash into the chans., controlling the tidal scour, and preserving the full height of anchorage shelter for vessels in the roadsteads; secondly, the imp. of the H. by w., d., and straightening the chans. through dr. and r. removal, **90,** 498.

The imp. undertaken since 1866 have been proj. as the necessities of the H. required, being in general conformity with the recoms. of the U. S. commissioners, whose labors terminated in 1866.

The projects in detail have been as follows: Protection of w. shore line of Georges Isld. by st. apron, to cost $10,000, **88,** 449. Increased in 1889 to $35,000, **89,** 579. Extension of sea wall at Gallops Isld., to cost $15,000, **88,** 449. Repair and extension of rubblest. apron protection to Long Isld., to cost $3,000, **88,** 449. Constr. of sea walls at s. and e. bluffs of Governors Isld., to cost $80,000, **88,** 450.

TRIBUTARY CHANNELS.—Charles R.—Existing proj., that of 1880; i. e., to w. and d. from mouth to Western Ave. Br., 7′ x 200′; thence to Market St. Br., 6′ x 80′; thence to dam at tide water head, 60′ x 2′; est., $125,000, **98,** 868; **01,** 153. Fort Pt. Channel—Existing proj., that of 1886, chan., 175′ x 23′, from entrance to near Federal St. Br.; est., $78,750, **98,** 868; **01,** 153. Chelsea Creek—Existing proj., those of 1896, dr. chan., 18′ x 150′, m. h. w. from head of navigation, 5,500′; est., $65,000, **95,** 649; **98,** 869; **00,** 1199; **01,** 153; that of 1912, dr. chan. 25′ x 150′ from 25′ chan., Boston H., for about ⅞ m.; est., $85,000, **12,** 86.

In 1867 it was proposed to dr. the main ship chan. to a d. of 23′ at m. l. w., 1,000′ w. at the "Upper" and "Lower Middles," and 685′ w. at the "Narrows." In 1870 the proposed w. at the Narrows was reduced to 625′, and increased to 1,100′ at Anchorage Shoal in the inner H. In 1887 it was proposed to straighten the passage through the "Narrows" by cutting off a spur projecting from Lovells Isld. In 1888 it was est. that to complete the imp. the main ship chan. would require 687,500 c. y. to be dr. from the "Upper Middle" in the inner H.; est. cost, $250,000, **88,** 450, 451.

The proj. proposed by Maj. Raymond in 1885 for the imp. of the Fort Pt. Chan. was for the excavation of a chan., 175′ w. and 23′ d. m. l. w., from the entrance to near Federal St. Br., 4,100′; est., $100,000. $60,000 still required for completion in 1888. **88,** 452, 453.

The proj. for imp. of the chan. between Nixs Mate and Long Isld., au. 1883, was to dr. a chan. 200′ w., 12′ d., m. l. w., and about 550′ l. In 1887 it was recom. that the axis of the cut be shifted 30° to the westward, and that it be w. to 300′, 15′ d. at m. l. w. Orig. proj. est. to cost $9,000. Proj. as revised in 1887 was est. at $25,000, **88,** 453, 454. Sur. of the main ship chan. e. of Long Isld. Head was provided for in 1888, at a cost of $6,000, **88,** 454.

The general proj. in 1889 included, in addition to the above, a proj. for the extension of Pt. Allerton

[1] H. D. 272, 62d, 2d.

sea wall, to cost $15,000, and for the repair of Great Brewster Isld. sea wall, to cost $10,000, **89,** 579. Also, in 1890, a proj. for dr. at the w. end of Brewster Spit, to cost $15,000, **90,** 505.

The aggregate cost of the foregoing proj. is $455,000, and the aggregate est. for completion in 1890 was $395,000, **90,** 505.

The proj. for imp. Boston H. by the excavation of a chan. of 23′ d., m. l. w., having been essentially completed in 1891, Lt. Col. Mansfield proposed d. the main ship chan. in Boston H. to 30′ m. l. w.; est., $1,500,000, **92,** 584.

By Lt. Col. Mansfield, 1892, for revising proj. to provide for a 27′ chan. 1,000′ w. in main ship chan., m. l. w.; est., $1,250,000, **93,** 766.

By Lt. Col. Mansfield, 1893, for expend. of available funds in imp. of main ship chan., **93,** 767; for use of available funds for Nantasket Beach Chan. in obtaining a d. of 12′ m. l. w., **93,** 769; and for completion of proj. for Jeffries Pt. Chan. with available funds, **93,** 770.

By Lt. Col. Mansfield, 1894, for an 18′ chan., 150′ w., in Chelsea Creek, m. h. w. from B. & M. R. R. Br. to head of navigation; est., $65,000, **95,** 649.

In 1898 Col. Mansfield est. $858,750.78 to complete the proj. of 1892, **98,** 867.

By Col. Mansfield, 1898, for dr. a 30′ x 1,200′ chan. in main ship chan., m. l. w., from President Roads through Broad Sound Chan.; est., $481,941.57, **98,** 867, 889.

By Col. Suter, 1900, for removal of some ledges uncovered in main ship chan.; est., $75,900, **1900,** 1197.

In 1901, max. dr. over shoalest part of main ship chan. was 26′ m. l. w., **01,** 152; Broad Sound Chan., 30′, **01,** 153.

Lt. Col. Stanton est., 1901, $79,428.60 to repair sea walls on Deer, Great Brewster, and Gallops Islds., and Pt. Allerton, **01,** 1080.

To 1890, $77,500 had been appr. for Charles R.; 1904, that proj. 40% done, **04,** 853.

By Col. Suter, for a chan. 35′ d. and 2,000′ w., to Broad Sound, and 35′ d. and 1,500′ w. through the upper H.; est., $10,612,710.46,[1] **01,** 1096, 1101; modified by act of 1902 for w. of 1,500′ and 1,200′; est., $7,994,248.68,[1] **02,** 98; act of 1907 au. the completion of the 35′ chan. to the full proj. w., **07,** 58.

Lt. Col. Stanton recom. that $20,000 appr. 1890 for Charles R. be expended on chan. only up to Bracketts Wharf; chan. above considered unworthy, **03,** 79; **04,** 56; appr. carried to surplus fund by act Mar. 4, 1909, **09,** 64.

Act July 25, 1912, provides for imp. of Chelsea Creek from 35′ chan., Boston H., for about ⅞ m., chan. to be 150′ x 25′ m. l. w.; est., $85,000; provided 24-in. water main is lowered without expense to U. S.,[2] **12,** 86.

SURVEYS.

Made by the H. commissioners of Boston during several years, **67,** 477.

Extensive sur. made, 1860, by U. S. Coast Sur. at cost of city of Boston for the U. S. commission, **71,** 885.

Of Narrows, by H. F. Bothfeld, 1872, **73,** 1089. **R.,** **73,** 1095.

For sunken rs., 1873, **74,** 114, ii, 316, 317, 319.

Of Hingham H., 1874, **75,** ii, 410. **R.,** **75,** ii, 417.

Of Man-of-war Shoal, 1877. **R.,** **77,** 183.

Of Anchorage Shoal and mouth of Mystic R., 1878, **78,** 216.

Of lower part of H., 1884, **85,** 504.

Sur. of Fort Pt. Chan. au. act Aug. 2, 1882, made by Maj. Raymond, who reported that a sur. had just been made by Mass., **84,** 588.

Ex. of Fort Pt. Chan. au. act July 5, 1884, made by Maj. Raymond, **85,** 545.

Detailed sur. of lower H. from Long Isld. to the sea, with bottom ex. and current observations, made, 1888, by Lt. Col. Gillespie, **88,** 451.

Detailed sur. of chan. between Brewster Spit and Georges Isld. Shoal, made, 1890, by Lt. Col. Mansfield, **90,** 501.

Pre. ex. Chelsea Cr., Grand Jct. R. R. Br. to B. & M. R. R. Br., au. act July 13, 1892; made 1892 by Lt. Col. Mansfield (**R.** fav.)[3], **93,** 790.

Sur. Chelsea Cr., au. act Aug. 17, 1894, made 1894, by Lt. Col. Mansfield (see Projects)[4], **95,** 648.

Sur. with a view to securing a 30′ chan., 1,200′ w., from the navy yard to the entrance to the existing ship chan., and from the main ship chan. in President Roads through Broad Sound Chan., au. act June 3, 1896; made, 1897, by Col. Mansfield (**R.** partly fav.) (see Projects), **98,** 886.

Pre. ex. and sur. au. by E. R. and H. A., June 6, 1900, for chan. 2,000′ w. or necessary w., and 35′ d., from navy yard at Charlestown, and Chelsea Br. and Charles R. Br. to President Roads, and from President Roads through Broad Sound Chan. to ocean, made by Col. Suter (see Projects), **00,** 1199; **01,** 1096.[1]

Of Allerton Pt., au. act of 1905, to determine need of making sea wall to protect navigation; made, 1905, by Col. Stanton (**R.** unfav.),[1] **06,** 72.

Ex. of Winthrop Head, au. act Mar. 3, 1905, to determine need of making sea wall to protect navigation; made, 1905, under direction of Col. Stanton (**R.** unfav. as proposed),[5] **06,** 73.

R. and H. A., July 25, 1912, au. ex. and sur. for deeper chan., President Roads to ocean, **12,** 88.

Pre. ex., au. by act Feb. 27, 1911, view to constr. of sea wall along Winthrop Beach, made by Col. Abbot; **R.** dated July 31, 1911 (unfav. to plan presented), **12,**[7] 102, 103.

Ex. and sur., au. act June 25, 1910, of Chelsea Creek, Meridian St. Br. to old E. Boston Br., made by Col. Abbot; **R.,** 1910 and 1911; est., $85,000, first constr.,[2] **12,** 102.

Pre. ex. of s. chan., Mystic R. and South Bay, au. act June 25, 1910, made by Col. Abbot, and **Rs.** dated Oct. 27 and Nov. 7, 1910, submitted (unfav.),[2] **12,** 102.

Finns Ledge, **12,** 88.

Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 154; **01,** 1108; **02,** 99, 101; **03,** 78; **04,** 53–57; **05,** 57–61; **06,** 55, 72, 73; **07,** 58; **08,** 59; **09,** 65; **11,** 78; **12,** 87, 89, 97.

Maps.[2]

Of Boston H., **80,** 348; **83,** 454; **87,** 517; **94,** 554; **03,** 770; **11,** 1178.

Of Chelsea Cr.[2]

Of Charles R., **84,** 512.

Of chan. between Nixs Mate and Long Isld., **87,** 517; **88,** 454.

35′ chan., **03,** 770.

Sketches.—Location of works, **75,** ii, 404; sea walls at Pt. Allerton, Gallops Isld. and Long Isld. **75,** ii, 406.

B-117 EAST BOSTON CHANNEL, MASS.

COMMERCE.

Large and important, **93,** 794.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 53; **95,** 54.

In charge. Lt. Col. S. M. Mansfield, 1893–. **R.,** **93,** 793; **95,** 649.

PHYSICAL CHARACTERISTICS.

Description of. At l. w., 1899, the area almost entirely bare, **93,** 794.

PROJECTS.

In 1894 Lt. Col. Mansfield est. $60,000 to imp. chan., **95,** 649.

SURVEYS.

Ex. sse. line of the Boston, Revere Beach & Lynn RR. to chan. at Jeffries Pt., au. act July 13, 1892; made, 1892, by Lt. Col. Mansfield (**R.** fav.), **93,** 793.

Sur. au. act Aug. 17, 1894; made by Lt. Col. Mansfield, 1894 (see Projects), **95,** 649.

[1] H. D. 119, 56th, 2d.
[2] H. D. 272, 62d, 2d.
[3] H. Ex. D. 40, 52, 2d.
[4] H. Ex. D. 162, 53, 3d.
[5] H. D. 140, 59th, 1st.
[6] H. D. 144, 59th, 1st.
[7] H. D. 258, 62d, 2d.

B-118 CHELSEA (CREEK) RIVER, MASS.

(See also B–113)

COMMERCE.

Description of, **93,** 791.

ENGINEERS.

Chief of Engineers. R., 93, 52; **95,** 54.
In charge. Lt. Col. S. M. Mansfield, 1893–95. **R., 93,** 790; **95,** 648.

PHYSICAL CHARACTERISTICS.

R. empties into Boston H. near mouth of Mystic R. Distance between brs. (see Surveys) 7,500′, its w. for about ¾ of this l. 300′, when it narrows to 100′, **93,** 791.

PROJECTS.

Lt. Col. Mansfield est. $65,000 to imp. R., **95,** 649.

SURVEYS.

Ex., Grand Junction RR. br. to Boston & Maine RR. br., au. act July 13, 1892, by Lt. Col. Mansfield (**R.** fav.), **93,** 790.
Sur. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Mansfield (see Projects), **95,** 64

B-119 MYSTIC RIVER (below mouth of Island End River), MASS.

APPROPRIATIONS.

1899,	$50,000.00,	**99,** 1073.
1902,	*19,000.00,	**02,** 870, 871.
1905,	27,005.12,	**05,** 814; **07,** 909.
1907,	40,000.00,	**07,** 908.
1910,	72,000.00,	**10,** 1106.
1912,	50,000.00,	**12,** 1385.

Total, 258,005.12 (incl. misc., $258,005.57, **12,** 1385).

COMMERCE.

Water front rapidly increasing in importance. **99,** 1073; **00,** 1193.
In 1901, 1,430,650 t., **03,** 76; 1905, 3,274,812 t., **06,** 54; 1909, 4,894,088 t., **10,** 72; 1911, 3,562,870 t.,[1] ¾ of which was coal, **12,** 84.
No material reduction in rates effected; larger vessels permitted, **12,** 84.

CONTRACTS.

1899. C. H. Souther, dr., 22¢ c. y.; removal of bowlders, over 3 t. each, $5 c. y. (204,545 c. y.), **00,** 1194.
1902. Bay State Dredging Co., dr. about 80,000 c. y., 23.5¢ c. y., **03,** 763.
1905. J. S. Packard Dredging Co., dr. about 100,000 c. y., 27.9¢ c. y., **06,** 878.
1907. Bay State Dredging Co., dr. about 13,000 c. y., between Chelsea Br. and Island End R., 49½¢ c. y.; G. H. Breymann & Bros., dr. about 120,000 c. y. below Chelsea Br., 22¢ c. y., **08,** 951.
1910. Daly & Hannan Dredging Co., dr. 250,000 c. y., 25.9¢ c. y., **11,** 1175.
1912. Bay State Dredging Co., dr. 17,500 c. y. 23½¢ c. y., **12,** 1385.

ENGINEERS.

Chief of Engineers. R., 99, 71, 81; **00,** 80; **01,** 152; **02,** 97; **03,** 76; **04,** 52; **05,** 56; **06,** 54, 73; **07,** 55; **08,** 57; **09,** 59, 78; **10,** 71; **11,** 75; **12,** 83.

In charge:
Col. C. R. Suter, 1899–1900. **R., 99,** 1073, 1096; **00,** 1193.
Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1078; **02,** 870; **03,** 763; **04,** 850; (Col.) **05,** 814.
Maj. Edw. Burr, 1906–09. **R., 06,** 877; **07,** 908; (Lt. Col.) **08,** 950; **09,** 988.
Col. F. V. Abbot, 1910–. **R., 10,** 1106; **11,** 1174; **12,** 1384.

Assistant. T. T. H. Harwood. **R., 99,** 1097.

OPERATIONS.

1899-00. 97,753 c. y. dr., **00,** 1193.
1900-01. 86,511 c. y. dr., completing contract Dec. 19, 1900, increasing chan. to 25′, m. l. w., and w. of 100′ to 125′, **01,** 1078.
1902-03. 81,241.5 c. y. dr.; water-logged timber removed from draw of Chelsea Br., **03,** 763.
1904-05. Proposals opened June 26, 1905, for dr. chan. 25′ d., m. l. w., making w. of 200′ below Chelsea Br. and 300′ above; 43% of proj. completed, **05,** 814.
1905-06. 88,641 c. y. dr., **06,** 877.
1906-07. Proposals for dr. to complete chan. below Chelsea Br. opened June 29, 1907, **07,** 908.
1907-08. 18,215 c. y. dr. from above, and 38,732 c. y. from below Chelsea Br., **08,** 950.
1908-09. Dr. for completion of 25′ chan. below Chelsea Br. suspended during year, **09,** 988.
1909-10. 24,942 c. y. dr., **10,** 1106.
1910-11. 55,853 c. y. dr., completing proj. for 25′ chan.; 226,924 c. y. dr., completing chan. 30′ x 300′ from Chelsea Br. to above mouth of Island End R., except section near Chelsea Br. entrance to chan. leading to Mystic R. enlarged to 30′ d., **11,** 1174.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 1073; **02,** 97, **12,** 83, 84.
Island End R. 1.6 m. above mouth of Mystic at navy yard, Charlestown, and 2,700′ above Chelsea drawbr. over Mystic R., **12,** 83.

PROJECTS.

Congress by joint res., Jan. 21, 1899, au. chan. 25′ d. m. l. w., and 300′ w., from mouth to point 3,500′ above Chelsea Br. Col. Suter est. cost at $321,445.52. **99,** 1097.[2] Revised est., $267,547.50, **00,** 1193. Extension above mouth of Island End R., abandoned, **11,** 75.
By Col. Suter, Aug., 1899, for expend. available funds dr. chan. 100′ x 25′ m. l. w. from the upper end of main ship chan. of Boston H. to mouth of Island End R., **00,** 1193
Act June 25, 1910, au. chan. 30′ d. from mouth of Island End R. to Chelsea Br. and through draw to 35′ chan., 600′ w. at upstream end, narrowing to 300′, and including w. of chan. to Mystic Wharf, abandoning proposed extension of 25′ chan. above mouth of Island End R.; est., $172,000,[3] **10,** 72, **11,** 75.

SURVEYS.

Pre. ex. and sur. au. act Mar. 2, 1907, for chan. 30′ d. from mouth of Island End R. to Chelsea Br. **R.,** Lt. Col. Burr, June 19, 1907, and May 2, 1908; est., $172,000[3] (see Project), **09,** 78.
Cong. Docs., etc. relating to exs. survs., etc., **12,** 83.

Maps.[3]

*Allotment.
[1] Omitting South Chan., and Mystic wharf below br,
[2] H. D. 178, 55th, 3d.
[3] H. D. 1086, 60th, 2d.

B-119 and 121 MYSTIC AND MALDEN RIVERS, MASS.

APPROPRIATIONS.

1882,	[1]$10,000.00,	**83,** 465.
1892,	10,000.00,	**93,** 763.
1894,	10,000.00,	**95,** 620.
1896,	10,000.00,	**96,** 603.
1899,	5,000.00,	**99,** 1072.
1900,	5,000.00,	**01,** 1077.
1902,	6,000.00,	**02,** 870.
1905,	22,994.88,	**05,** 814.
1907,	20,000.00,	**07,** 907.
1911,	10,000.00,	**11,** 1175.
1912,	[1]80,000.00,	**12,** 1385.
Total,	188,994.88,	($33,994.88 for Mystic R. (upper), and $155,000 for Malden R.), **12,** 1385.

COMMERCE.

Description of, **02,** 96, 97; **04,** 51, 52; **10,** 70, 71.

In 1902, 84,200± t., **03,** 75, 76; 1903, 109,650 t., **04,** 51, 52; 1909, 144,771 t., **10,** 70, 71.

Mystic R. traffic, 1910, 21,966 t.; 1911, 43,800 t., mostly coal; and Malden R., 1910, 88,834 t.; and 1911, 80,033 t., **12,** 81, 82.

Coal can be freighted to Medford and Malden, thus saving the lighterage of 50¢ per t., **12,** 81, 82.

CONTRACTS.

1883. R. Hamilton, jr., dr., Mystic R., 24½¢ c. y., **83,** 465.

1894. C. H. Souther, dr. 79,581 c. y., Mystic and Malden Rs., 23⅞¢ c. y., **95,** 620.

1896. A. B. Martin, dr. Mystic and Malden Rs. 28,985 c. y., 34½¢ c. y.; removal of bowlders over 3 t., $5 c. y., **97,** 842.

1903. Bay State Dr. Co., dr. about 6,000 c. y. from Malden R., 48¢ c. y., **03,** 762; **04,** 848.

1905. Eastern Dredging Co., dr. about 20,000 c. y. from Mystic R., 44¢ c. y., and 28,000 c. y. from Malden R., 46¢ c. y., **06,** 878.

1906. Eastern Dredging Co., supple., dr. 7,000 c. y. from Mystic R., 44¢ c. y., **07,** 909.

1908. Bay State Dredging Co., dr. about 22,000 c. y. from Malden R., 49⅞¢ c. y., **08,** 951.

ENGINEERS.

Chief of Engineers. R., 80, 72; **81,** 77; **83,** 72; **84,** 78; **85,** 66; **86,** 66; **87,** 28; **88,** 29; **89,** 43; **91,** 63; **93,** 45; **94,** 43; **95,** 46; **96,** 47; **97,** 53; **98,** 60; **99,** 70; **00,** 79; **01,** 151; **02,** 96; **03,** 75; **04,** 51; **05,** 55; **06,** 52, 73; **07,** 53; **08,** 54; **09,** 57; **10,** 69, 70; **11,** 73, 92; **12,** 80, 81, 102.

In charge:

Col. G. Thom, 1880–83. **R., 81,** 532.

Maj. C. W. Raymond, 1883–86. **R., 83,** 464; **84,** 551; **85,** 519.

Lt. Col. G. L. Gillespie, 1886–88. **R., 86,** 579; **87,** 520; **88,** 456.

Lt. Col. S. M. Mansfield, 1888–98. **R., 89,** 594; **91,** 672; **93,** 762; **94,** 547; **95,** 618; **96,** 601; **97,** 841; **98,** 862.

Col. C. R. Suter, 1899–00. **R., 99,** 1071; **00,** 1191.

Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1077; **02,** 869; **03,** 761; **04,** 848; (Col.) **05,** 815.

Maj. Edw. Burr, 1906–09. **R., 06,** 877; **07,** 907; (Lt. Col.) **08,** 949; **09,** 987.

Col. V. F. Abbot, 1910–. **R., 10,** 1105, 1106; **11,** 1174; **12,** 1384.

Assistants:

S. Haagensen. **R., 81,** 533.

T. T. H. Harwood. **R., 91,** 675.

OPERATIONS.

1882–83. 4,420 c. y. dr. from chan. below Malden R; drawbr., **83,** 464.

1883–84. 30,811 c. y. dr., Malden R., **84,** 551.

1894–96. 5,000 l. f. of R. dr., Malden R., **95,** 618; 75,229 c. y. dr., Mystic and Malden, **96,** 602.

1896–97. 1,864 c. y. dr., Malden R., **97,** 842.

1897–98. About 26,000 c. y. dr., Mystic and Malden, **98,** 863.

1899–00. Shoal in Malden R. removed, **00,** 1192.

1900–01. 13,576 c. y. dr. from Malden R., **01,** 1077.

1903–04. 5,654 c. y. dr. from Malden R., **04,** 848.

1905–06. 9,672 c. y. dr. from Mystic and 17,807 c. y. from Malden R., **06,** 877.

1906–07. 19,093 c. y. dr. from Mystic R., completing proj., **07,** 907; 9,573 c. y. dr. from Malden R., **07,** 908.

1907–08. 15,494 c. y. dr. from Malden R., **08,** 950.

1908–09. 4,857 c. y. dr. from Malden R., restoring chan. to full proj. dimensions, **09,** 988.

1909–10. 21,331 c. y. dr. from Malden R., **10,** 1106.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 532; **01,** 151; **05,** 55, 56; **10,** 69, 70, 71; **12,** 80–82.

Description of, Mystic R., **91,** 672.

Mean range of tides, 1903, 9.8′, **03,** 75, 76.

Mystic R. rises in Mystic Lakes, Mass., flows for 7 m. se. to Boston H., near Charlestown navy yard; Malden R. rises in Melrose, Mass., flows 4½ m. s., and empties into Mystic, 3 m. above latter's mouth; proj. section on Malden, 1.6 m. above junct., **12,** 81.

PLANS. (See Projects.)

In 1888, after ex., Lt. Col. Gillespie reported that the cost of straightening and d. the existing chan. in Malden R. to admit of 12′ at h.-w. range of tides (est., $37,000) was incommensurate with the C. interests, **89,** 594.

PROJECTS. (See Plans.)

Proj. orig. proposed by Col. Thom, 1880, was to excavate a chan. 100′ x 12′ m. h. w. up to the second br. in Malden, with 2 cut-offs, one e. of the isld. near the mouth of R., and one through the marsh ½ m. above; est., $40,000. Proj. modified, 1882, when it was proposed to make the natural chan. of R. 100′ x 12′ m. h. w., to the first br. in Malden, thence to the second br. 75′ w. with the same d.; est., $47,000, **81,** 532, 533; **85,** 519; **86,** 580.

Lt. Col. Gillespie stated, 1888, that the imp. chan. met all existing requirements, and further app. not recom., **88,** 456.

By Lt. Col. Mansfield, 1891, Mystic R., Boston & Maine RR. br. to the head of navigation, w. and d. the natural chan. to 100′ x 6′ m. l. w. to the first turn above Dennings Wharf, thence to the head of navigation 4′, with the w. gradually reduced to 50′ at Cradock Br.; est., $25,000, **91,** 47, 674, 675.

In 1890, Mystic R. and Malden R. works combined; proj. being the completion of the proj. of 1882; est., $37,000, for Malden R., **00,** 1191.

By Lt. Col. Mansfield, 1892, using $5,000 of 1892 app. to imp. Malden R. whenever additional funds would be available, and for expend. $5,000 for Mystic R. as proposed, **93,** 762.

In 1894 Lt. Col. Mansfield proposed to use available funds to complete the proj. for imp. of Mystic R. to a point 1,500′ above Dennings Wharf, and to w. the imp. chan. of Malden R. to 70′ to the first br., **95,** 619.

By Lt. Col. Mansfield, 1896, expend. of available funds in completing the imp. of Mystic R. as far as funds would permit, in completing the proj. for the imp. of Malden R. below the first br., and in making a cut of full d. and 25′ w. above the br., **97,** 841.

Malden R. above Medford St. Br. unworthy of U. S. imp., **02,** 97.

Act July 25, 1912, au. increasing d. Malden R. to 6′ m. l. w. by dr., material placed behind dikes on shore; conditional on local and State coöperation; est., $80,000[2]; **12,** 82.

[1] Malden R. only.

[2] H. D. 77, 62d, 1st.

SURVEYS.

Sur. Malden R. au. act June 14, 1880; made, 1880, by Col. Thom, **81,** 532.

Ex. Malden R. for straightening and d. chan. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie, **89,** 594.

Sur., Mystic R., au. act Sept. 19, 1890; made, 1891, by Col. Mansfield, **91,** 674.

Pre. ex. of Mystic R., to upper limits of city of Somerville, au. act Mar. 3, 1905. **R.** by Col. Stanton, June 24, 1905[1] (unfav.), **06,** 73.

Pre. ex. and sur. au. act June 25, 1910, of Malden R. **R.** by Col. Abbot, Oct. 27, 1910, and Mar. 7, 1911; est., $80,000,[2] **11,** 92.

Pre. ex. au. act June 25, 1910, of s. chan. of Mystic R., with view to securing increased d. **R.** by Col. Abbot (unfav.), Oct. 27, 1910,[3] **12,** 102.

Cong. docs., etc., relating to exs., surs., etc., **12,** 81, 82.

Maps.[2] Mystic R., **91,** 674.

B-123 CHARLES RIVER, MASS.

(See also B–113)

ENGINEERS.

Chief of Engineers. R., 78, 46; **79,** 52.

In charge. Lt. Col. G. Thom, **78,** 46; **79,** 52. **R., 79,** 290.

Assistant. R. A. Shailer. **R., 79,** 292.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 291, 292.

Rise and fall of tide, **79,** 291, 292.

PLANS.

By R. A. Shailer, 1879, dr. chan. 100′ x 6′ from Western Ave. Br. to Market St. Br.; also a chan. 75′ x 3′ from latter pt. to head of tide water; est., $70,000, **79,** 292, 293.

By Lt. Col. Thom, 1879, dr., the same as above, with addition of a chan. from mouth to Western Ave. Br., 200′ x 7′; est., $85,000, **79,** 291.

SURVEYS.

Ordered and in progress, **78,** 46.

Mouth to Western Ave. Br., 1861, **79,** 290.

By R. A. Shailer, to head of tide water, **79,** 52, 290.

B-132 and 134—DORCHESTER BAY AND NEPONSET RIVER, MASS.

APPROPRIATIONS.

1907, $125,233, **07,** 918.

COMMERCE.

Principally coal, **10,** 78.

In 1911, 256,039 t., **12,** 92.

Decrease in, due to discontinuance by Boston Consolidated Gas Co. of their gas-making plant at Dorchester B., **10,** 1114.

CONTRACTS.

1908. Charles M. Cole, dr. 17¢ c. y., **08,** 960.

ENGINEERS.

Chief of Engineers. R., 7, 62, 74; **08,** 63; **09,** 67; **10,** 77; **11,** 82; **12,** 91.

In charge:

Maj. Edw. Burr, 1907–09. **07,** 918; (Lt. Col.) **08,** 959; **09,** 996.

Col. Frederic V. Abbot, 1910–. **R., 10,** 1113; **11,** 1185; **12,** 1396.

OPERATIONS.

1908–09. 301,306 c. y. dr., **09,** 996.

1909–10. 202,117 c. y. dr., **10,** 1113; proj. completed, **10,** 1114.

PHYSICAL CHARACTERISTICS.

Dorchester B. at mouth of Neponset R. in Boston H. Neponset R. flows ne. 25 m. before emptying into D. B.; section of R. in proj. 1½ m. l., **12,** 91.

Description of, **07,** 62.

Max. draft 18′ and 15′ at various points, **12,** 92.

PRIVATE WORK.

$34,270.44 app. by State of Mass. for imp. of R. above Neponset highway br. (see Project, etc., 1907), **07,** 62.

PROJECTS.

Act 1907, au. chan. 175′ x 18′, m. l. w., through Dorchester B. and the mouth of the R. to Commercial Pt., and 100′ x 15′, m. l. w., in Neponset R. to Neponset highway br.; est., $125,233.34, provided that R. above br. mentioned be imp. by State or other agency,[4] **07,** 62, 74.

SURVEYS.

Au. act Mar. 3, 1905; made, 1905–06, by Col. Stanton,[4] **07,** 74.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 92.

Maps.[4]

B-134 NEPONSET RIVER, MASS.

(See also B–132 and 134)

COMMERCE.

In 1891, 15,825 t. of coal, 2,736,000′ of lumber, and 441,000 of brick an., **93,** 802.

ENGINEERS.

Chief of Engineers. R., 93, 53; **97,** 65.

In charge. Lt. Col. S. M. Mansfield, 1893–97. **R., 93,** 800; **97,** 875.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 800.

PROJECTS.

Col. Mansfield, 1897, est. $35,000 to imp. chan., **97,** 876.

SURVEYS.

Ex. au. act July 13, 1892; made by Lt. Col. Mansfield, 1892 (**R.** fav.), **93,** 800.

Sur. au. act June 3, 1896; made by Lt Col. Mansfield, 1897 (see Projects), **97,** 876.

[1] H. D. 145, 59th, 1st. [2] H. D. 77, 62d, 1st. [3] H. D. 272, 62d, 2d. [4] H. D. 83, 59th, 2d.

B-138 and 193—WEYMOUTH RIVER, MASS. (Fore and Back).

APPROPRIATIONS.

1890,	$10,000,	**91,** 656.
1892,	10,000,	**92,** 585.
1894,	5,000,	**95,** 630.
1896,	15,000,	**96,** 608.
1899,	10,000,	**99,** 1082.
1902,	5,250,	**02,** 879.
1905,	57,500,	**05,** 826.
1907,	9,500,	**07,** 919.
1910,	5,000,	**10,** 1115.
1911,	140,000,	**11,** 1186.
Total,	267,250 ($240,250 for Fore R. and $27,000 for Back R., **12,** 1397–99).	

COMMERCE.

Saving in freight charges to be derived from impt., (Fore) **90,** 521; (Back) **91,** 682.

Character of C. benefited, **97,** 851.

Small, (Back, above Hingham Br.) 1897, **97,** 875.

Imp. necessary to permit large vessels to approach and leave Fore R. Ship & Engine Co.'s docks, **04,** 895.

About 188,000 t. coal and bldg. material (Fore), 1903, **04,** 896.

Imp. in Fore R. of vast importance; benefits shipbuilding industry, **10,** 79.

1911, Fore R., 173,445 t.; Back R., 204,625 t., **12,** 94–95.

CONTRACTS.

1890. A. R. Wright, dr. (Fore), 37½¢ c. y.; removal of bowlders, $9 each, **91,** 656.

1894. S. Perkins and J. E. White, dr. (Fore), 29¢ c. y. (37,931 c. y.), **95,** 631.

1896. A. B. Martin, dr., 47¢ c. y.; removal of bowlders, over 6 t., $10 (10,638 c. y.) (Fore), **97,** 851. C. H. Souther, dr., 23¢ c. y., **97,** 850; removal of bowlders, over 6 t., $10 (54,347 c. y.) (Back), **97,** 851.

1899. J. E. White, dr., 27¢ c. y.; removal of bowlders, over 3 t., $10 (33,333 c. y.) (Fore), **99,** 1083.

1905. Eastern Dredging Co., dr. (Fore) 219,000 c. y., 23.75¢ c. y. (Fore), **06,** 886. S. J. Donovan, dr. 11,250 c. y., 40¢ c. y. (Fore), **06,** 887.

1907. S. J. Donovan, dr. about 26,000 c. y. from Back R., 33¢ c. y., **08,** 961.

1910. Bay State Dredging Co., dr. in Back R., 39¢ c. y., **10,** 1116.

1911. Daly & Hannan Dredging Co., dr. in Fore R., 13¾¢ c. y., **11,** 1187. Eastern Dredging Co., r. excavation in Fore R., about 3,414 c. y., $8.70 c. y., **12,** 1398.

ENGINEERS.

Chief of Engineers. R., 89, 44; **90,** 38; **91,** 42, 47; **92,** 48; **93,** 47; **94,** 45; **95,** 49; **96,** 50; **97,** 58, 65; **98,** 64; **99,** 75; **00,** 86; **01,** 155; **02,** 102; **03,** 81; **04,** 58, 70; **05,** 62; **06,** 60; **07,** 63; **08,** 64; **09,** 68; **10,** 78; **11,** 83, 92; **12,** 92.

Boards. BERH. concurs in Lt. Col. Stanton's opinion on desirability of imp. Weymouth Fore R.' **04,** 893–94.

In charge:

Lt. Col. S. M. Mansfield, 1888–98. **R., 90,** 521; **91,** 655; **92,** 584; **93,** 773; **94,** 556; **95,** 630; **96,** 607; **97,** 849, 873; **98,** 873.

Col. C. R. Suter, 1899–1900. **R., 99,** 1081; **00,** 1204.

Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1084; **02,** 879; **03,** 771; **04,** 858, 894; (Col.) **05,** 824.

Maj. Edw. Burr, 1906–09. **R., 06,** 886; **07,** 918; (Lt. Col.) **08,** 960; **09,** 997.

Col. F. V. Abbot, 1910–. **R., 10,** 1114; **11,** 1186; **12,** 1399.

Assistants:

S. Haagensen. **R., 90,** 522; **91,** 683.

T. T. H. Harwood. **R., 04,** 897.

LEGISLATION.

Mass. passed act providing for mainten. of Weymouth R. above the Weymouth Fore R. Br., **05,** 825.

OPERATIONS.

1890–91. 18,389 c. y. dr. (Fore), **91,** 655.

1891–92. 5,585 c. y., dr. **92,** 585.

1894–95. 18,528 c. y. dr. **95,** 630.

1895–96. About 17,000 c. y. dr. **96,** 607.

1896–97. 9,000 c. y. dr. **97,** 849, and 48,086 c. y. dr. (Back), **97,** 850.

1899–00. 34,789 c. y. dr. **00,** 1205.

1905–06. 148,995 c. y. dr. below and 11,245 c. y. above Weymouth Fore R. Br., **06,** 886–87.

1906–07. 49,714 c. y. dr., completing proj. below br., **07,** 918.

1907–08. 26,236 c. y. dr., completing and restoring the au. chan. in Back R., **08,** 961.

1911–12. 268,451 c. y. sand and gravel, 2.889 c. y. bowlders, and 1,051 c. y., s. m., broken r. removed from Fore R.; 10,030 c. y. dr. from Back R., **12,** 1397, 1399.

PHYSICAL CHARACTERISTICS.

Description of (Fore), **90,** 523, **12.** 93; (Back) **91,** 682; **97,** 874; **12.** 94.

PROJECTS.

By Lt. Col. Mansfield, 1889, dr. from Quincy Pt. to E. Braintree, chan. 7,000′ x 50′–100′ w. and 6′ d. m. l. w.; est., $40,000, **90,** 522; **92,** 584.

By Lt. Col. Mansfield, 1891, excavation of chan. (Back) through outer bar 200′ w. and 12′ d. m. l. w., and also w. and d. natural chan. to the same dimensions up to the wharf of the Fertilizer Co.; est., $22,000, **91,** 683.

By Lt. Col. Mansfield, 1892–96, use of available funds to w. the main chan. to 60′ below Braintree Br., and to complete chan. above br., **93,** 773; **95,** 630; **97,** 849.

By Lt. Col. Mansfield, 1896, chan. in Weymouth (Back) R. from outer bar to wharf of the Fertilizer Co., 100′ w. and of full proj. d., **97,** 850.

Lt. Col. Mansfield, 1897, est. $49,834.01 for further advisable impt. (Back R.), **97,** 875.

By Lt. Col. Stanton, for chan. 18′ x 300′ to Weymouth Fore R. Br.; est., $57,500, **04,** 896. Au. act Mar. 3, 1905, **05,** 62.

Dr. of 5′ chan. (Back R.) to naval magazine at Hingham wharves undertaken, to be paid from R. and H. funds, and to be reimbursed from app. for naval magazine, **10,** 80.

Act Feb. 27, 1911, au. proj. to w. and straighten, by dr. and ledge removal, existing chan. below Weymouth Fore R. Br., incl. removal of Channel Rock; est., $140,000,[1] **11,** 83.

SURVEYS.

Au. act Aug. 11, 1888 (Fore); made, 1889, by Lt. Col. Mansfield, **90,** 522.

Sur. au. act Sept. 19, 1890 (Back); made, 1891, by Lt. Col. Mansfield, **91,** 683.

Sur. (Back) au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (see Projects), **97,** 873.

Pre. ex. and sur. of Weymouth Fore R. au. act June 13, 1902. **R.** by Lt. Col. Stanton[2] (see Projects), **04,** 70, 891.

Pre. ex. and sur. below Quincy Pt. Br., with view to straightening and imp. chan., au. act June 25, 1910. **R.** by Col. Abbot, 1910 and 1911; est., $140,000,[1] **11,** 92.

Cong. docs., etc., relating to exs., surs, plans, etc., **12,** 93, 95.

[1] H. D. 1334, 61st, 3d.

[2] H. D. 36, 58th, 2d.

B-139 TOWN RIVER, MASS.

APPROPRIATIONS.

1896, $10,000.00, **96,** 607.
1899, 8,000.00, **99,** 1081.
1902, 9,750.00, **02,** 878.
1905, 9,827.41, **05,** 826.

Total, 37,577.41

COMMERCE.

Description of, **98,** 873.
Value, $200,000 an., **00,** 1204.
1906, 22,126 t.; decreasing, **07,** 66.

CONTRACTS.

1896. Perkins & White, dr., 27¢ c. y.; removal of bowlders over 3 t., $8 c. y. (37,037 c. y.), **97,** 849.
1899. J. E. White, dr., 24½¢; removal of bowlders over 3 t., $10 c. y. (29,387 c. y.), **99,** 1081.
1905. S. J. Donovan, dr. 55,500 c. y., 32¢ c. y., **06,** 888.

ENGINEERS.

Chief of Engineers. R., 91, 47; **96,** 50; **97,** 57; **98,** 64; **99,** 75; **00,** 85; **01,** 154; **02,** 102; **03,** 82; **04,** 59; **05,** 64; **06,** 63; **07,** 65.

In charge:
Lt. Col. S. M. Mansfield, 1890–98. **R., 91,** 680; **96,** 606; **97,** 848; **98,** 872.
Col. C. R. Suter, 1899–1900. **R., 99,** 1080; **00,** 1203.
Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1083; **02,** 878; **03,** 772; **04,** 859; (Col.) **05,** 826.
Maj. Edw. Burr, 1906–07. **R., 06,** 888; **07,** 920.

Assistant. S. Haagensen. **R., 91,** 680.

LEGISLATION.

Mass. passed act providing for mainten., **05,** 825.

OPERATIONS.

1897-98. 34,494 c. y. dr., **98,** 872.
1899-1900. 30,007 c. y. dr., **00,** 1203.
1905-06. 50,984 c. y. dr., restoring chan. to its proj. dimensions, **06,** 888.

PROJECTS.

By Lt. Col. Mansfield, 1890, dr. chan. 4,500′ x 100′ x 4′; est., $20,000, **96,** 606.
By Lt. Col. Mansfield, 1896, dr. s. half of chan.; est. increased to $25,000, **97,** 848.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 681.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Mansfield,[1] **91,** 680.
Ex. made June, 1900, by Col. Suter, **1900,** 1204.
Maps.[1]

B-145 HINGHAM HARBOR, MASS.

(See also B–113.)

APPROPRIATIONS.

1875, [2]$10,000, **75,** 119; **87,** 521.
1886, 6,000, **87,** 522.
1888, 5,000, **88,** 457.
1890, 5,000, **90,** 507.
1892, 3,000, **92,** 586.
1907, 10,000, **07,** 921.

Total, 39,000

COMMERCE.

Slowly diminishing; 1911, 9,443 t., valued at $84,742.80, **12,** 97.

CONTRACTS.

1886. Boynton Bros., dr., 92¢ c. y.; r. removal, $27 c. y., **87,** 522.
1888. G. W. Townsend, r. removal, $25 c. y.; removal of loose overlying material, $9 c. y., **89,** 582.
1890. A. R. Wright, dr., 18¢ c. y., **91,** 658.
1892. G. W. Townsend & Co., ledge removal, in situ, $23.74 c. y. ($3,038.72), **93,** 775.
1910. Chas. M. Cole, dr., 37¢ c. y., **11,** 1189.

ENGINEERS.

Chief of Engineers. R., 85, 67; **87,** 28; **88,** 29; **89,** 39; **90,** 34; **91,** 42; **92,** 48; **93,** 48; **94,** 46; **95,** 50; **07,** 66; **08,** 67; **09,** 70; **10,** 80, 89; **11,** 86; **12,** 96.

In charge:
Maj. C. W. Raymond. **R., 85,** 553.
Lt. Col. G. L. Gillespie, 1887–89. **R., 87,** 520; **88,** 456.
Lt. Col. S. M. Mansfield, 1889–95. **R., 89,** 580; **90,** 506; **91,** 656; **92,** 585; **93,** 774; **94,** 557; **95,** 631.
Maj. Edw. Burr, 1907–09. **R., 07,** 920; (Lt. Col.) **08,** 962; **09,** 998.
Col. F. V. Abbot, 1910–. **R., 10,** 1116; **11,** 1189; **12,** 1400.

Assistant. H. F. Bothfeld. **R., 85,** 555.

OPERATIONS.

1875-76. 25,160 c. y. earth and 83 c. y. r. removed, **76,** 176; **87,** 521.
1886-87. 1,247 c. y. gravel and 143 c. y. r. removed, **87,** 521.
1888-89. 80 c. y. r. removed, **89,** 581.
1889-90. 93 c. y. r. removed, **90,** 507.
1890-91. 20,400 c. y. dr., **91,** 656.
1892-93. 128 c. y. r. removed. Proj. completed, **93,** 775.
1910-11. 23,771 c. y. dr., **11,** 1189.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 553; **87,** 520.
Max. draft, 8′ to steamboat wharf, and 6′ for 500′ farther, **12,** 97.

PRIVATE WORK.

Mass. dr. anchorage basin 6′ d., and a chan. 75′ x 6′, **11,** 87.

PROJECTS.

Orig. proj. of 1874 provided for an imp. chan. on e. side of Sailors Isld., past the w. side of Beacon to the Hingham Wharf, 100′ x 8′ m. l. w.; est., $11,000. This proj. modified Jan. 20, 1885, when it was proposed to d. the imp. chan. to 10′ m. l. w., and to remove a midchan. ledge lying between Chandlers and Ragged Islds., meas. 128 c. y.; total cost, $18,700, **88,** 457.
By Lt. Col. Mansfield, 1892, expend. of available funds in completing the proj. by removal of a midchan. ledge, **93,** 775.
Lt. Col. Burr, 1909, did not consider H. worthy of imp. beyond what could be accomplished with unexpend. balance, **10,** 89.

SURVEYS.

Au. act July 5, 1884; made by Maj. Raymond (**R.** fav.), **85,** 555.
Of chan., **07,** 920.
Ex. au. act Mar. 3, 1909; made, 1909, by Lt. Col. Burr,[3] **10,** 89.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 97.
Maps. **88,** 456.

[1] H. Ex. D. 155, 51st, 2d. [2] Allotment from Boston H. app. [3] H. D. 355, 61st, 2d.

B-146 WEIR RIVER, MASS.

ENGINEERS.

Chief of Engineers. **R., 89,** 43.
In charge. Lt. Col. G. L. Gillespie, 1888. **R., 89,** 597.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 597.

PLANS.

By Lt. Col. Gillespie, 1888, imp. of the chan. entrance by r. removal and buoyage; est., $7,000 **89,** 597.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie (see Plans), **89,** 597.

B-148 HULL, MASS. (Headland).

ENGINEERS.

Chief of Engineers. **R., 84,** 78.
In charge:
Col. G. Thom. **R., 84,** 552.
Maj. C. W. Raymond. **R., 84,** 553.
Assistant. H. F. Bothfeld. **R., 84,** 554.

PLANS.

By Maj. Raymond, protecting headland in the town of Hull, at entrance to Boston H., by sea wall; est., $181,000, **84,** 553, 557.

SURVEY.

Au. act Aug. 2, 1882; made by Maj. Raymond (**R.** unfav.), **84,** 552.

B-150 COHASSET HARBOR, MASS.

APPROPRIATIONS.

1902, $10,000, **02,** 880.

COMMERCE.

Est. value, $25,000 an., **00,** 1221.
Insignificant, **03,** 775; **04,** 60.

CONTRACTS.

1903. Bay State Dredging Co., dr., 34.75¢ c. y., and removing about 105 c. y. ledge r. at $17 c. y., **03,** 774.

ENGINEERS.

Chief of Engineers. **R., 89,** 43; **99,** 81; **00,** 93; **02,** 104; **03,** 83, 776; **04,** 60; **12,** 103.

Boards. BERH recom. proj. be completed, except the turning basin, and that no mainten. work be done; or if it seem impracticable to relieve the U. S. from mainten., that the work be discontinued at once,[1] **03,** 774.

In charge:
Lt. Col. G. L. Gillespie, 1888. **R., 89,** 595.
Col. C. R. Suter, 1900–. **R., 00,** 1221, 1222.
Lt. Col. W. S. Stanton, 1902–. **R., 02,** 880; **03,** 773, 776; **04,** 859.
Col. F. V. Abbot, 1912–. **12,** 67.

Assistant. T. T. H. Harwood. **R., 00,** 1223.

OPERATIONS.

1902-03. 10,330 c. y. dr., 15 holes drilled in ledge which was uncovered by dr., **03,** 773.
1903-04. 10,299 c. y. dr. and 105 c. y. r. removed, **04,** 859.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1221; **03,** 774.

PROJECTS.

Col. Suter, 1899, est. $21,670 to imp. the H. **1900,** 1223.
By Lt. Col. Stanton, au. act June 13, 1902, for a chan. 4′ x 60′; 75′ w. at curve; from roadstead to wharf; and a turning basin 350′ x 350′; est., $21,670,[2] **02,** 104.
Chief of Engineers recom. discontinuance of work and of app., **04,** 60.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie (**R.** unfav.), **89,** 595.
Ex. and sur. au. act Mar. 3, 1899, by Col. Suter 1899 (**R.** fav.),[2] **00,** 1221, 1222. (See Projects.)
Ex. and sur. au. act Feb. 27, 1911, for chan. 150′ x 8′; **Rs.** to come, **12,** 103.
Maps.[2]

B-151 SCITUATE HARBOR, MASS.[3]

APPROPRIATIONS.

1829,	$180 (sur.), act Mar. 2.
1852,	1,000 (sur.), act Aug. 30
1880,	7,500, **80,** 351.
1881,	10,000, **81,** 523.
1882,	10,000, **82,** 521.
1884,	10,000, **84,** 503.
1886,	10,000, **86,** 563.
1888,	5,000, **88,** 459.
1890,	10,000, **90,** 509.
1892,	10,000, **92,** 588.
1894,	10,000, **95,** 634.
1896,	6,000, **96,** 610.
1899,	15,000, **99,** 1084.
Total,	104,680

COMMERCE.

Requirements of, **79,** 287, 290.
Important, **79,** 287, 289.
Imp. of chan. admits to wharves barges carrying 700 to 800 t. of coal each, in place of schooners carrying 150 to 200 t., and has reduced rates 50 to 75¢ a t., **06,** 64.

CONTRACTS.

1881. C. H. Edwards, granite quarry grout or bowlders, $1.56 or $1.25 t., **81,** 523.
1882. C. H. Edwards, rubblest., **83,** 444.
1886. H. W. Phillips, r. blasting, $8.50 c. y. Boynton Bros., dr., 38¢ c. y., **87,** 525.
1888. Boynton Bros., dr., 45¢; removal of bowlders, $12 c. y., **89,** 584.

[1] Comm. Doc. 30, 61st, 2d.
[2] H. D. 284, 56th, 1st.
[3] Sur.—**R.:** Feb. —, 1830, est. $16,283.02, and Nov. 16, 1853, est. $250,000. (H. D. 482, 55th, 2d.)

1890. A. R. Wright, dr., 32½¢ c. y.; removal of bowlders, $5 each, **91,** 660.
1892. J. H. White, 3,643 t. st., $2.47 s. t., **93,** 778.
1894. Pigeon Hill Granite Co., 9,677 t. st., 93¢ s. t., **95,** 634.
1896. Eastern Dredging Co., 15,584 c. y. dr., 38½¢ c. y.; removal of bowlders over 3 t., $3, **97,** 853.
1899. C. H. Souther, dr., 34.4¢ c. y.; removal of bowlders over 3 t., $5 c. y., 36,627 c. y., **00,** 1208.
1901. Eastern Dredging Co. (emerg.), dr. **01,** 1085.

ENGINEERS.

Chief of Engineers. **R., 78,** 46; **79,** 52; **80,** 70; **81,** 75, 523; **82,** 75; **83,** 67; **84,** 75; **85,** 62; **86,** 62; **87,** 29; **88,** 30; **89,** 40; **90,** 34; **91,** 43; **92,** 49; **93,** 48; **94,** 46; **95,** 50; **96,** 51; **97,** 59; **98,** 65; **99,** 76; **00,** 88; **01,** 156; **02,** 104; **03,** 84; **04,** 60; **05,** 65; **06,** 64; **07,** 67; **08,** 68.

Boards. Convened, New York, Sept. 13, 1880, to report upon proj. for imp. of Scituate H. **R., 81,** 524. (Cols. Tower and Newton.)
BERH. Report on advisability of continuing the present proj. (see Projects), **03,** 777, 780.

In charge:
Col. J. D. Graham, 1865. **R., 66,** 36.
Lt. Col. G. Thom, 1878–83. **R., 79,** 284; (Col.) **80,** 350; **81,** 521; **82,** 519.
Maj. C. W. Raymond, 1883–86. **R., 83,** 443; **84,** 502; **85,** 501.
Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 562; **87,** 522; **88,** 458.
Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 582; **90,** 508; **91,** 658; **92,** 586; **93,** 776; **94,** 558; **95,** 632; **96,** 608; **97,** 851; **98,** 875.
Col. C. R. Suter, 1899–1900. **R., 99,** 1083; **00,** 1206.
Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1085; **02,** 880; **03,** 777, 780; **04,** 860; (Col.) **05,** 827.
Maj. Edw. Burr, 1906–08. **R., 06,** 889; **07,** 921; (Lt. Col.) **08,** 963.

Assistant. S. Haagensen, **79,** 285.

ESTIMATES. (See Plans and Projects.)
By Lt. Col. Thom, 1878, dr. 10′, $120,000; 2 break'rs, $55,000; if dr. to 15′, $80,000 additional, **79,** 286.

OPERATIONS.

1881-82. 10,024 t. rubblest. placed in 470 l. f. of break'r, **82,** 520.
1882-83. 4,953 t. st. placed in break'r, extending same 250′, **83,** 444.
1884-85. 22,724 c. y. sand dr., **85,** 501.
1886-87. 65 c. y. r. removed and 18,326 c. y. dr., **87,** 524.
1889-90. 8,386 c. y. dr., **90,** 509.
1891-92. 30,000 c. y. dr., **92,** 587.
1892-93. 2,745 t. of st. deposited in break'r, **93,** 777.
1893-94. About 900 t. of st. deposited in break'r, **94,** 559.
1894-95. 3,823 t. of st. deposited in break'r, **95,** 633.
1895-96. About 5,500 t. of st. deposited in break'r, **96,** 609.
1896-97. 6,114 c. y. dr., **97,** 852.
1897-98. Dr. in progress, **98,** 876.
1899-00. 34,814 c. y. dr., **00,** 1207.
1900-01. 1,583 c. y. dr., **01,** 1085.
1901-02. 2,887 c. y. dr., **02,** 880.

PHYSICAL CHARACTERISTICS.
Description, **79,** 285, 288, 289.

PLANS. (See Estimates and Projects.)
By Lt. Col. Thom, 1878, 2 break'rs, 800′ and 730′ l., and dr. the basin 10′ to 15′ d.; the former recom., **79,** 285, 286.

PROJECTS.
Proj. for the imp. proposed by Lt. Col. Thom (1878), and adopted in 1880, was for 2 rubblest. jetties converging from opposite banks, and for dr. an anchorage basin with chans. connecting with the sea and the town wharves, the n. j. from Cedar Pt. to be 800′ l., and the s. j. from the pt. of the "First Cliff" to be 730′ l.; both js. to be 20′ w. on top and 4′ above m. h. w., except at their outer ends, which are to be built 6′ higher to serve as sites for entrance beacons; the anchorage basin to be approx. 30 acres in area; the entrance chan. to be 2,700′ l. and 300′ average w.; recom. by BE., 1880, that area behind inner break'r be excavated to 12′, increasing to 15′ at the s. end of the outer break'r, **81,** 526; **87,** 523.
Est. dr. (including the entrance chan.) was 500,000 c. y.; est. cost of js., $100,000, and of the dr., $190,000, making a total for the proj. of $290,000, **88,** 458; **92,** 587.
By Lt. Col. Mansfield, 1892, use of available funds to constr. 300′ of s. break'r, **93,** 777.
By Lt. Col. Mansfield, 1894, use of available funds to extend the s. break'r, **95,** 633.
By Lt. Col. Mansfield, 1896, dr. entrance chan. 7′ x 75′, **97,** 852.
By Col. Suter, 1899, redr. chan. from the anchorage basin; est., $7,500, **99,** 1084.
BERH. recom. that proj. be abandoned, and a chan. 6′ x 100′ be dr. from the entrance to the docks; est., $18,000, **03,**[1] 780.
Benefits to be expected disproportionate to cost of completing and mainten. imp.; no further est. submitted, **08,** 69.

SURVEYS.
By S. Haagensen, 1878, by Lt. Col. Thom. **R., 79,** 284.
Of chan., 1886, **86,** 563.
In 1899 by Col. Suter. (See Projects.)
Maps.
Showing the imp. proposed for making it a H. of refuge, **79,** 284.
81, 522; **86,** 562.

B-160 DUXBURY BEACH AND HARBOR, MASS.

APPROPRIATIONS.

1836,	$5,000,	act July 4.
1872,	10,000,	**72,** 93.
1873,	10,000,	**73,** 104.
1899,	12,000,	**99,** 1086.
Total,	37,000	

COMMERCE.
Absence of, **66,** ii, 36.
Obstr. to, **72,** 947.
Benefit of imp., **72,** 964, 965.
Petition of citizens praying for imp., **72,** 968.
Description of, **97,** 860.
No increase, and none expected, **08,** 70.

CONTRACTS.
1872. A. R. Wright, dr., 50¢ c. y.; contract extended, **73,** 1098.
1873. Hugh Cummiskey, dr., 49¢ c. y., **73,** 1098.
1899. A. B. Martin, dr. 44,042 c. y., 23.5¢ c. y.; bowlder removal over 3 t., $5 c. y., **00,** 1210.

DEFENSE.

Field works in vicinity, at Gurnet and Saquish Head, **66,** ii, 36.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 35; **67,** 46; **71,** 96; **72,** 93; **73,** 104; **74,** 115; **88,** 32; **97,** 63, 64; **99,** 78; **00,** 89; **01,** 156; **02,** 105; **03,** 85; **04,** 62; **05,** 66; **06,** 65; **07,** 68; **08,** 69.

In charge:

Col. J. G. Totten, 1836; **66,** ii, 36.
Maj. G. H. Mendell, 1866. **R., 66,** ii, 35.
Capt. J. A. Smith, 1867. **R., 67,** 456.
Lt. Col. G. Thom, 1872–74. **R., 72,** 947, 963; **73,** 1097; **74,** ii, 322.
Lt. Col. G. L. Gillespie, 1888. **R., 88,** 472, 473.
Lt. Col. S. M. Mansfield, 1897. **R., 97,** 860, 862.
Col. C. R. Suter, 1899–1900. **R., 99,** 1085; **00,** 1209.
Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1086; **02,** 881; **03,** 781; **04,** 861; (Col.) **05,** 828.
Maj. Edw. Burr, 1906–08. **R., 06,** 889; **07,** 922; (Lt. Col.) **08,** 964.

Assistants:

G. B. Weston, **66,** ii, 35.
S. Haagensen. **R., 72,** 965; **88,** 475.

ESTIMATES. (See Plans and Projects.)

By Maj. Mendell, repairs, $4,000, **66,** ii, 36.
By S. Haagensen, dr. w. chan., $66,000 and $37,600, **72,** 964, 966.

OPERATIONS.

1836. Rows of stakes driven and the space inclosed filled in with brush and seaweed, to collect and retain sand, **66,** ii, 36.
1872–73. 2,638 c. y. dr., **73,** 1098.
1873–74. 32,020½ c. y. dr., **74,** ii, 323.
1899–00. 43,928 c. y. dr., **00,** 1209.

PHYSICAL CHARACTERISTICS.

General, **66,** ii, 36; **72,** 966.
Description of Duxbury Beach, **97,** 862.

PLANS. (See Estimates and Projects.)

By Maj. Mendell, repairs, **66,** ii, 36.
By S. Haagensen, dr. w. chan.; 1st, to give 6′; 2d, to give 4′ at m. l. w., **72,** 964, 966.

PROJECTS. (See Estimates and Plans.)

By Col. Totten, 1836, planting 2 rows of stakes, 3′ or 4′ apart, and filling the inclosed spaces with brush and seaweed, to collect and retain the sand, **66,** ii, 36.
By Lt. Col. Thom, dr. Miles Chan. to 250′ x 8′ m. l. w., together with the preservation of the beach; est., $20,000, **72,** 947, 964.
By Lt. Col. Gillespie, 1887, imp. of the w. branch of the Duxbury Chan. by dr. a cut 3,600′ x 60′ x 6′ m. l. w.; est., $13,200, **88,** 474.
By Col. Suter, 1899, expend. $650 in ex. chan., **99,** 1085.
By Col. Suter, 1899, modifying proj. 1886 by relocating chan. proposed, making it 60′ w. in straight section to 100′ w. in curved section; est. revised, increasing it to $17,820, **00,** 1209.
Lt. Col. Burr of opinion that h. unworthy of restoration or further imp., **08,** 70.

SURVEYS.

Ex., Maj. Mendell, 1866, **66,** ii, 35.
Ex., 1867. **R.** by Maj. Mendell, **67,** 456.
By S. Haagensen, 1871. **R., 72,** 965.
By Lt. Col. Thom, 1872, **73,** 1097.
Au. act Aug. 5, 1886; made, 1887, by Lt. Col. Gillespie, **88,** 473.
Ex. of the h. au. act June 3, 1896: made by Lt. Col. Mansfield, 1897 (**R.** fav.), **97,** 860.
Ex. Duxbury Beach au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (**R.** unfav.), **97,** 862.
Sur. made, 1899, by Col. Suter, **00,** 1209.
Maps. **88,** 474.

B-165 KINGSTON HARBOR, MASS.

(See also B–168.)

APPROPRIATION.

1892, $10,000, **93,** 782.

COMMERCE.

Not unimportant, **91,** 686.

CONTRACTS.

1892. National Dredging Co., dr., 24¢ c. y.; removal of bowlders over 3 t., $15 (37,500 c. y.), **93,** 782.

ENGINEERS.

Chief of Engineers. **R., 91,** 47; **93,** 50; **94,** 47; **95,** 52; **06,** 73.

In charge:

Lt. Col. S. M. Mansfield, 1890–95. **R., 91,** 686; **93,** 781; **94,** 562; **95,** 637.
Col. W. S. Stanton, **06,** 41.

Assistant. T. T. H. Harwood. **R., 91,** 688.

OPERATIONS.

1892–93. 30,000 c. y. dr.; proj. completed, **93,** 781.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 685.

PROJECTS.

By Lt. Col. Mansfield, 1891, chan. 6′ x 100′ m. l. w. up to the Cordage Co.'s wharf in North Plymouth; est., $10,000, **91,** 687.
By Lt. Col. Mansfield, 1892, use of available funds to complete imp., **93,** 781.

SURVEY.

Sur. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Mansfield, **91,** 687.
Pre. ex. au. act Mar. 3, 1905; **R.,** May 26, 1905 (unfav.),[1] **06,** 73.
Maps. **91,** 688.

[1] H. D. 176, 59th, 1st.

B-168 PLYMOUTH BEACH AND HARBOR, MASS.[1]

(See also B–165.)

APPROPRIATIONS.

1824,	$20,000.00,	act May 26.
1825,	5,712.00,	act Mar. 3.
1826,	13,184.90,	act Mar. 25.
1830,	1,850.00,	act Apr. 23.
1831,	2,820.00,	act Mar. 2.
1832,	2,500.00,	act July 3.
1833,	600.00,	act Mar. 2.
1834,	2,000.00,	act June 28.
1835,	700.00,	act Mar. 3.
1836,	500.00,	act July 2.
1838,	2,400.00,	act July 7.
1852,	5,000.00,	act Aug. 30.
1866,	*8,315.00,	**66,** ii, 24, 28; **76,** 178.
1870,	10,000.00,	**70,** 79; **71,** 95, 893.
1871,	10,000.00,	**71,** 95, 893; **72,** 948.
1872,	2,500.00,	**72,** 93, 948.
1873,	3,000.00,	**73,** 1099.
1874,	5,000.00,	**74,** 115, ii, 324.
1875,	10,000.00,	**75,** 120, ii, 415.
1878,	5,000.00,	**78,** 45, 221.
1879,	3,500.00,	**79,** 51, 273.
1880,	10,000.00,	**80,** 353.
1881,	10,000.00,	**81,** 529.
1882,	14,000.00,	**82,** 523.
1884,	10,000.00,	**84,** 516.
1886,	6,000.00,	**86,** 572.
1888,	6,000.00,	**88,** 461.
1890,	8,000.00,	**90,** 511.
1892,	9,500.00,	**92,** 590.
1894,	1,500.00,	**95,** 636.
1896,	1,500.00,	**96,** 612.
1899,	85,000.00,	**99,** 1088.
1902,	4,000.00,	**02,** 883.
1909,	*19,500.00,	**10,** 1117.
1910,	10,000.00,	**10,** 1117.
Total,	309,581.90	(total, incl. $4,530.12 recd. from surety of failing contractor, $314,112.02 **12,** 1401).

COMMERCE.

Requirements of, **76,** 181.

Imp. has effected a saving of 50¢ t. on rates, **11,** 88; **12,** 99.

1908, 39,860 t., **09,** 999.

1911, 48,657 t.; over 50,000 passengers, **12,** 1402.

CONTRACTS.

1866. J. and W. Hall, 1,300′ break'r, $4,736, **66,** ii, 28.

1870. J. E. and G. Bowley, 1,700′ brush bulkhead and js., **71,** 893.

1871. G. Clapp, 2,000 t. granite, $2.25 t., **71,** 895. J. A. Blaisdell, 450′ bulkhead and js., $3.86 per f., **71,** 895.

1875. A. R. Wright, dr., 23¢ c. y., **75,** ii, 415.

1880. R. Hamilton, jr., dr., 17¢ c. y., **81,** 530.

1881. Eastern Dredging Co., dr., 23¢ c. y., **81,** 530. C. M. Holden, loose st., $1.55 t., **82,** 523.

1882. C. H. Edwards, loose st., $1.70 t., **83,** 456.

1886. New England Dredging Co., dr., 24¢ c. y., **87,** 527.

1888. A. R. Wright, dr., 29⅞¢ c. y.; removal of bowlders over 3 t., $10 c. y., **89,** 586.

1890. National Dredging Co., dr., 27¢ c. y.; removal of bowlders over 3 t., $10 each, **91,** 662.

1892. National Dredging Co., dr., 29¢ c. y., removal of bowlders over 3 t., $15 ($3,480), **93,** 780.

1897. Burgess & Marks, bulkhead constr., $1.44½ per f., **97,** 855.

1899. Hartford Dredging Co., dr. 45,000 c. y., at 20¢, **00,** 1213. Bell & Co., 45,676 t. riprap st., $1.33 s. t., **00,** 1214, annulled, **01,** 1087.

1901. Rockport Granite Co., st. in place in dike, $1.89 t., **01,** 1088.

1903. Clark Finney, dr. about 1,829 c. y. from the former bed of Eel R., 49¢ c. y. Wonson & Latimer, st. in place in dike, $2.38 t., **03,** 783.

1904. Smith & Robinson, st. in place in dike, about 3,150 t., $2.09 t., **05,** 829.

1909. Rowe Bros., extension of riprap dike, st. at $2.97 t., **10,** 1118.

1910. The Breakwater Co., repair of dike on Long Beach, st. at $2.43 t., **10,** 1118.

ENGINEERS.

Chief of Engineers. **R., 66,** 7, ii, 28; **67,** 46; **68,** 68; **69,** 58; **70,** 78; **71,** 94; **72,** 93; **73,** 105; **74,** 115, 117; **75,** 119; **76,** 46; **77,** 40; **78,** 45; **79,** 50; **80,** 70; **81,** 75; **82,** 76; **83,** 70; **84,** 76; **85,** 67; **86,** 64; **87,** 30; **88,** 31; **89,** 41, 43; **90,** 35; **91,** 44; **92,** 50; **93,** 49; **94,** 47; **95,** 51, 54; **96,** 52; **97,** 61, 64, 66; **98,** 67; **99,** 78; **00,** 90; **01,** 157; **02,** 106; **03,** 86; **04,** 63; **05,** 67; **06,** 66; **07,** 69; **08,** 70; **09,** 71, 78; **10,** 81; **11,** 87; **12,** 97.

In charge:

Col. J. D. Graham, 1865; **66,** 36.

Maj. G. H. Mendell, 1866; **66,** ii, 28.

Capt. J. A. Smith, 1867–69; **67,** 46. **R., 69,** 410.

Maj. D. C. Houston, 1869–70. **R., 69,** 410; **70,** 455.

Lt. Col. J. G. Foster, 1870–71. **R., 70,** 467.

Lt. Col. G. Thom, 1871–83. **R., 71,** 893; **72,** 948; **73,** 1098; **74,** ii, 323, 348; **75,** ii, 413; **76,** 177; **77,** 184; **78,** 221; **79,** 271; (Col.) **80,** 351; **81,** 527; **82,** 521.

Maj. C. W. Raymond, 1883–86. **R., 83,** 455; **84,** 514; **85,** 510, 538.

Lt. Col. G. L. Gillespie, 1886–89. **R., 86,** 571; **87,** 525; **88,** 459.

Lt. Col. S. M. Mansfield, 1889–98. **R., 89,** 584, 596; **90,** 510; **91,** 660; **92,** 588; **93,** 778; **94,** 560; **95,** 635, 645; **96,** 610; **97,** 854, 863, 877; **98,** 877.

Col. C. R. Suter, 1899–1900. **R., 99,** 1086; **00,** 1210.

Lt. Col. W. S. Stanton, 1901–05. **R., 01,** 1087; **02,** 882; **03,** 782; **04,** 862; (Col.) **05,** 829.

Maj. Edw. Burr, 1906–09. **R., 06,** 890; **07,** 922; (Lt. Col.) **08,** 964; **09,** 998.

Col. F. V. Abbot, 1910. **R., 10,** 1116; **11,** 1190; **12,** 1401.

Assistant. S. Haagensen, **73,** 1099. **R., 74,** ii, 349.

ESTIMATES. (See Plans and Projects.)

By Maj. Mendell, 1866, break'r and js., $8,300 **66,** ii, 28.

By Capt. Smith, 1868, permanent completion, save repairs, $20,000, **68,** 804.

By Maj. Houston, 1869, 1,200′ of break'r and repairs, $30,000, **70,** 458.

By Lt. Col. Thom, 1879, completion of existing proj., $21,500, **79,** 273.

OPERATIONS.[2]

1866–67. 1,300 l. f. break'r completed, **67,** 46; **69,** 410.

1867–68. Slight repairs, **68,** 803.

1868–69. Constr. of cribs and repairs by hired labor, **69,** 58, 411.

1869–70. Constr. of brush bulkhead and js. by contract, **70,** 78, 467.

1870–71. 1,700 l. f. bulkhead and js. constr.; repairs to old works, **71,** 95, 893.

1871–72. 641½ l. f. brush bulkhead and js. constr.; 2,028 t. st. placed on st. bulkhead; repairs and planting of beach grass, **72,** 93, 948.

1872–73. 200 l. f. brush bulkhead and js. constr.; repairs, and 10,000 hills of beach grass planted, **73,** 105, 1099.

1873–74. Constr. of 3,000 l. f. brush and st. groins, 534 l. f. brush groins; repairs, and 10,000 hills of beach grass planted, **74,** 115, ii, 323.

1874–75. Works repaired and strengthened, **75,** 119, ii, 414.

*Allotment.

[1] Sur.—**R.,** Aug. 20, 1824, est. $21,592, and Oct. 31, 1824, est. $40,000. (H. D. 482, 55th, 2d.)

[2] History of operations, **69,** 410; **70,** 455; **75,** ii, 414; **76,** 178; **77,** 185.

1875-76. Dr. chan. 100′ x 6′ to Plymouth wharves; repairs to beach protection, **76,** 46, 181.
1878-79. Extension of st. bulkhead and repair of js.; 1,648 t. st. and 35 t. of brush used, **79,** 51, 272.
1879-80. 1,693 t. rubblest. placed in bulkhead work, extending same 700′, **80,** 352.
1880-81. 43,950 c. y. drd., from main chan., **81,** 527.
1881-82. 186½ t. bowlders furnished for repair of Long Beach; 44,969 c. y. drd. from chan. and basin, **82,** 522.
1882-83. 5,006 t. st. placed in bulkhead, extending same 830′; 640 l. f. of bulkhead backed with trees and st.; leak n. of old cribwork stopped, **83,** 455.
1883-84. Repairs to Long Beach bulkhead, **84,** 515.
1884-85. 36,426 c. y. drd., from chan., **85,** 511.
1885-86. 9 breaches in Long Beach repaired with brush and st. bulkhead work, **86,** 572.
1886-87. 14,812 c. y. drd., **87,** 524.
1887-88. 8,312 c. y. drd. from basin and chan., **88,** 460.
1888-89. Breaches in plank bulkheads at Long Beach repaired by hired labor, **89,** 585.
1889-90. 13,000 c. y. drd. from the basin, **90,** 511.
1890-91. 6,918 c. y. drd., **91,** 662.
1891-92. 11,586 c. y. drd., and 1,300 l. f. Long Beach bulkheads repaired, **92,** 589, 590.
1892-93. 14,998 c. y. drd., **93,** 779.
1893-94. Repair of bulkhead walls on s. end of Long Beach in progress, **94,** 561.
1895-96. Proj. completed, **97,** 855.
1896-97. 1,216.5′ of bulkhead constr., **97,** 855.
1899-00. 44,232 c. y. drd.; 550′ riprap constr., **00,** 1212.
1900-01. 12,256.75 t. st. deposited, forming 3,391.5 l. f. of dike on Long Beach, **01,** 1087.
1901-02. 13,728 t. st. placed, completing 6,526.5 l. f. dike, **02,** 882.
1902-03. 12,200 c. y. dr. in mainten. of turning basin, **03,** 782.
1903-04. 2,085 c. y. drd., from orig. bed of Eel R.; dam of earth and sandbags built across new bed, and 891 l. f. st. dike built, **04,** 862.
1904-05. 4,256 t. st. deposited in dike, **05,** 829.
1905-06. Repairs made to dike on Long Beach, **06,** 890.
1909-10. Riprap dike extended 616 l. f., using 2,499 t. rubblest.; repairs to dikes, **10,** 1116.
1910-11. 2,133′ riprap dike repaired by deposit of 3,990 t. st., **11,** 1190.
1911-12. 1,301′ riprap dike repaired by deposit of 3,230 t. st., **12,** 1401.

PHYSICAL CHARACTERISTICS.

Description, **67,** 46; **69,** 411; **70,** 455, 456; **71,** 893; **75,** ii, 413; **76,** 177; **77,** 184; **78,** 219; **79,** 271; **95,** 646; **97,** 878; **99,** 1088.
Of Goose Pt. chan., **85,** 538; **89,** 596.
Description of Gurnet Rock and other rs. at mouth of Plymouth H., **97,** 863.
Dr. chan. and basin shoaling, **99,** 1088.
H. 45 m. by water s. of Boston. H. contains 2,000 acres, almost all of which, except chans., is dry at l. t., **12,** 97.

PLANS. (See Estimates and Projects.)

By S. Haagensen, 1874, dr. a good beating chan., **74,** ii, 350.
By Maj. Houston, 1869, break'r of st., or béton-coignet, **70,** 457, 458.
By Maj. Raymond, 1884, excavating a chan. 100′ x 5′ m. l. w., Goose Pt. to Cordage Co.'s wharf, 1 m.; est., $42,000. Maj. Raymond does not, however, consider the H. worthy of imp., **85,** 538, 539.
In 1888 Lt. Col. Gillespie est. cost of imp. of Goose Pt. Chan. by dr. and r. removal at $40,000, and did not consider the imp. warranted by the C. interests involved, **89,** 597.

PRIVATE (CORPORATE) WORK.

Constr. and repairs, 1868, by the State authorities; expense, $2,000, **68,** 804; **69,** 410; **76,** 178; **77,** 185.
Town of Plymouth at its own expense undertakes to restore and d. to 10′, m. l. w., chan. and basin completed by U. S., **09,** 72.

PROJECTS. (See Estimates and Plans.)

By Maj. Mendell, 1866, break'r and js., **66,** ii, 28.
By Capt. Smith, 1868, stronger work, consisting of cribs, **68,** 804; **69,** 411; **70,** 456.
By Maj. Houston, 1869, bulkhead, with js. in front and rear, **70,** 457.
Prior to 1875 apps. were applied to the protection and preservation of Long Beach; the aggregate of apps. from 1824 to 1874, incl., was $103,566.90.
By Lt. Col. Thom, 1874, dr. a chan. 100′ x 6′ from the "Middle Ground" to "Long Wharf" at Plymouth, **75,** ii, 414. Modified, in 1876, to provide for dr. a basin 866′ x 150′ x 8′ in front of the town wharves, **76,** 181; **77,** 188; **78,** 221; **81,** 528; **86,** 571; est., $28,000, **12,** 98.
In 1884–85 it was proposed to w. the chan. to 150′ and d. to 9′, **84,** 516; **85,** 511. The amount appd. from 1875 to 1886, incl., was $68,500, when it was est. that $15,500 would be required to complete existing proj., **86,** 65; **88,** 460. Increased to $17,500 in 1889, **89,** 586.
By Lt. Col. Mansfield, 1892, repairing protecting works of Long Beach, est. $2,000; repairing and extending the works on the s. part of the beach, est. $2,500; the balance of available funds to be used in w. the imp. chan. to 150′ to complete proposed dr., **93,** 779.
Lt. Col. Mansfield est., 1897, $8,716.95 for further imp. of the H. in the vicinity of Middle Ground, **97,** 877.
By Col. Suter, 1899, repairing beach; est., $95,700. Congress app. $75,000, **99,** 1087.
By Col. Suter, 1899, redr. chan. and basin with $10,000 app. by Congress, **99,** 1088.

SURVEYS.

Ex. by Maj. Mendell, 1866, **66,** ii, 28; **67,** 456.
By S. Haagensen, 1872, under direction of Lt. Col. Thom, **73,** 1099. 1874. Resur. **R., 74,** ii, 348, 349.
Of chan. and basin, 1884, **84,** 515.
Of Long Beach, 1886, **86,** 572.
Ex. of chan. from Goose Pt., in Plymouth H., to the wharf of the Cordage Co. au. act July 5, 1884; made, 1884, by Maj. Raymond (**R.** unfav.; see Plans), **85,** 538.
Ex. of Goose Pt. Chan. to public wharf at Kingston au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie (see Plans and Projects), **89,** 596.
Ex. with a view to removing obstr. shoals in the H., and to d. excavated chan., au. act Aug. 17, 1884; made by Lt. Col. Mansfield, 1894 (**R.** fav. for limited imp.), **95,** 646.
Ex. Gurnet and other rs. at the H. mouth au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (**R.** unfav.), **97,** 863.
Sur. au. act June 3, 1896; made by Lt. Col. Mansfield, 1897 (**R.** fav.; see Projects), **97,** 877.
Minor sur. made by Col. Suter, 1899, **99,** 1088.
Pre. ex. and sur. au. act Mar. 2, 1907, with view to constr. rubblest. break'r from Long Beach e. along crest of Browns Isld. **R.** by Lt. Col. Burr, 1907 and 1908[1] (unfav.), **09,** 78.
Pre. ex. and sur. au. act June 25, 1910 (**R.** to come.), **12,** 102.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 98–99.
Maps.[1] **81,** 528; **86,** 572; **88,** 460.
H. D. 39, 55th, 1st.

[1] H. D. 1168, 60th, 2d.

B-176 CAPE COD SHIP CANAL, MASS.[1]

COMMERCE.

History of C. passing across the isthmus of Cape Cod since 1623, **70,** 478, 479.
Importance of, during the war of 1812, **70,** 478, 479.
Benefit of imp. to C., **70,** 477, 481, 485, 486, 487, 492, 495.
Value of facilitating inland coastwise trade, especially during war, **70,** 487, 488, 494.

ENGINEERS.

Chief of Engineers. R., 70, 476, 491; **97,** 64.
Boards:
1825. Board of internal imp. report in favor of a canal route via Buzzards and Barnstable Bs., **70,** 480. **R., 70,** 491. (Gen. Bernard, Maj. Totten, and J. L. Sullivan.)
1860. Advice of board to committee appointed by the State legislatire to investigate the proposed location and constr. of canal, **70,** 481.
In charge:
Lt. Col. J. G. Foster, 1870, **70,** 477. **R., 70,** 477, 489.
Lt. Col. S. M. Mansfield, 1897. **R., 97,** 864.

ESTIMATES. (See Plans.)

By Lt. Col. Foster, break'r to protect the canal, $1,923,400, **70,** 477. For ship canal, $9,703,525, **70,** 490.
Early est. for canal, **70,** 494.

LEGISLATION.

Resolution of Mass. in favor of granting aid to the Cape Cod ship canal by the constr. of a break'r at the e. end of the canal, **70,** 477.
Charter granted by Mass. for canal, **70,** 477.
1791. Committee appointed by the State legislature to investigate practicability and cost of a navigable chan. across the isthmus, **70,** 479.
Subsequent legislation, **70,** 478, 479, 481, 490.

PHYSICAL CHARACTERISTICS.

Tidal record, **70,** 482, 483, 492, 494.
Max. velocity in canal that would be caused by tide, **70,** 483, 484.
Temperature of water and climate, **70,** 484, 494.
Sand at Barnstable B., **70,** 495.
Description of Cape Cod Hs., **70,** 495.

PLANS. (See Estimates.)

History of early plans, **70,** 478, 479.
By G. R. Baldwin, canal to begin at Back R. H., to be 7.6 m. l., 120′ w. at bottom, 204′ at w. line, and 18′ d., to be fed from Barnstable B. Locks and receiving basins at each end, and a break'r at Barnstable B. side, **70,** 481.
By Lt. Col. Foster, break'r to form an artificial H. and protection to canal, **70,** 488, 489. General conclusions of Lt. Col. Foster, strongly advocating an open canal, **70,** 483–489.

SURVEYS.

By Mr. Machin, to determine the practicability of a canal, 1776, **70,** 479.
By John Hills, 1791, **70,** 479.
By L. Baldwin, 1818, **70,** 479, 492.
By Maj. Perault, 1825, **70,** 480.
By State of Mass., 1860, **70,** 481.
Ex. and sur. au. act Mar. 3, 1881, of Buzzards B. and Barnstable B., Mass., at the entrances of the proposed Cape Cod canal; made, 1882, by Lt. Col. G. K. Warren. **82,** 579–592.
Ex. of approaches au. act June 3, 1896; made by Lt. Col. Mansfield in 1897 (no canal), **97,** 864.

B-177 SANDWICH HARBOR, MASS.

COMMERCE.

Future, probably on Cape Cod Ship Canal, **00,** 1225.

ENGINEERS.

Chief of Engineers. R., 99, 81; **00,** 94.
In charge. Col. C. R. Suter, 1900. **R., 00,** 1224.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1225.
H. lies behind sand beaches, **00,** 1225.

SURVEY.

Ex. au. act Mar. 3, 1899; made by Col. Suter, 1899 (**R.** unfav.), **00,** 1225.

B-194 EAST DENNIS, BARNSTABLE BAY, MASS.

APPROPRIATION.

1852, $1,500.

SURVEY.

Sur. for break'r—**R.,** Nov. 19, 1852; est., $500,000. (H. D. 482, 55th, 2d, 1898.)

B-203 WELLFLEET HARBOR, MASS.

APPROPRIATIONS.

1872,	$5,000,	**72,** 94.
1888,	7,000,	**89,** 588.
1890,	4,000,	**90,** 513.
Total,	16,000	

COMMERCE.

Important, **72,** 973.
Value of fishermen's yield, **88,** 476, 477.

CONTRACTS.

1873. S. Dyer, r. removal, **73,** 1100.
1889. A. R. Wright, dr., 42¢ c. y.; removal of bowlders weighing over 3 t., $10 c. y., **89,** 588.

ENGINEERS.

Chief of Engineers. R., 71, 96; **72,** 94; **73,** 105; **74,** 115; **88,** 31, 32; **89,** 42; **90,** 36; **91,** 44; **92,** 50; **93,** 51; **94,** 48; **95,** 52.
In charge:
Lt. Col. G. Thom, 1871–74. **R., 72,** 949, 969; **73,** 1100; **74,** ii, 324.
Lt. Col. G. L. Gillespie, 1888–89. **R., 88,** 476, 477.
Lt. Col. S. M. Mansfield, 1889–95. **R., 89,** 587; **90,** 512; **91,** 663; **92,** 591; **93,** 782; **94,** 563; **95,** 638.
Assistant. S. Haagensen. **R., 72,** 969; **88.** 479.

OPERATIONS.

1872–74. R. removal, **73,** 1100; **74,** 115, ii, 325.
1889–90. 16,984 c. y. dr., **90,** 512.

[1] Cape Cod Canal, from Hyannis to Barnstable B., Mass. Ex.—**R.** (unfav.), Feb. 3, 1825. Sur—**R.,** Feb. 15, 1825, and Nov. 13, 1829; est., $455,815.68 and $704,437.20. (H. D. 482, 55th, 2d.)
Cape Cod and Cape Cod H., Mass. Sur.—**R.,** Dec. 21, 1835. (H. D. 482, 55th, 2d.)

PHYSICAL CHARACTERISTICS.

Presence of r., **72,** 94, 949, 971.
Character of H. bed, **72,** 971. Tides, **72,** 971.

PLAN. (See Projects.)

By S. Haagensen, dr. e. and w. chans. to various w. and d. ($1,976 to $31,004), **72,** 971–972.

PROJECTS. (See Plan.)

By Lt. Col. Thom, removal of r.; est., $4,080, **72,** 972.

By Lt. Col. Gillespie, 1888, chan. 4,200′ x 100′ at bottom, and 6′ d. m. l. w., Deep Hole to the wharves; est., $24,000, **88,** 476; **89,** 587; **92,** 591. Increased, 1889, on account of rise in prices, to $38,000, **89,** 588.

SURVEYS.

Included in the Coast Sur., 1850, **72,** 969.
By S. Haagensen, 1871. **R.,** **72,** 969.
Au. act Aug. 5, 1886; made, 1887, by Lt. Col. Gillespie, **88,** 477.
Maps. **88,** 478.

B-208 PROVINCETOWN HARBOR, MASS.[1]

APPROPRIATIONS.

1826,	$3,500.00,	**66,** iii, 28.
1829,	3,500.00,	act Mar. 2.
1831,	2,050.00,	**66,** iii, 28.
1832,	4,600.00,	**66,** iii, 28.
1834,	4,400.00,	**66,** iii, 28.
1835,	4,400.00,	**66,** iii, 28.
1836,	4,400.00,	**66,** iii, 28.
1838,	4,500.00,	**66,** iii, 28.
1852,	5,000.00,	**66,** iii, 28.
1864,	*[2] 30,000.00,	**66,** ii, 24, iii, 28.
1866,	43,068.44,	**66,** iii, 28.
1866,	8,000.00,	act July 28.
1869,	*[3] 8,910.00,	**69,** 22.
1871,	6,000.00,	**71,** 95, 898.
1872,	5,000.00,	**72,** 94, 951.
1873,	6,000.00,	**73,** 106, 1102.
1874,	6,000.00,	**74,** 116, ii, 326.
1875,	5,000.00,	**75,** 120, ii, 417.
1876,	4,000.00,	**76,** 47, 183; **77,** 42, 189.
1878,	1,000.00,	**78,** 46, 223.
1879,	1,000.00,	**79,** 52.
1880,	500.00,	**80,** 354.
1881,	5,000.00,	**81,** 531.
1882,	5,000.00,	**82,** 526.
1884,	2,000.00,	**84,** 520.
1886,	3,000.00,	**86,** 577.
1888,	7,000.00,	**88,** 463.
1890,	7,500.00,	**90,** 515.
1892,	1,500.00,	**92,** 594.
1894,	1,500.00,	**95,** 640.
1896,	1,500.00,	**96,** 614.
1899,	10,000.00,	**99,** 1091.
1902,	11,000.00,	**02,** 884.
1905,	5,000.00,	**05,** 831.
1907,	5,000.00,	**07,** 924.
1910,	140,000.00,	**10,** 1117.
Total,	365,828.44	

COMMERCE.

Of great importance, **66,** 11.
C. to be benefited by imp., **82,** 526.
Benefits to C. by mainten. of a H. of refuge, **88,** 463.
Considered one of the most important Hs. on the Atlantic coast, **97,** 879.
In 1902, 24,000 t., **03,** 87; 1906, 20,900 t., **07,** 71.
C. is small factor compared with preservation of works as H. of refuge, **09,** 74. Affording protection to vessels of all sizes and descriptions, **12,** 1403.

CONTRACTS.

1868. J. H. Blaisdell & Co., materials and work, **68,** 832.
1869. I. Gifford, bulkhead and js., **69,** 420. G. Currier, building dike, **69,** 420.
1870. I. Gifford, pile and brush dike, **70,** 467.
1871. S. Dyer, building dike, **72,** 952.
1877. A. C. Pierce, quarry grout, **77,** 191. I. A. Sylvester, bowlders, **77,** 191.
1880. J. H. White, rubblest., $1.24 and $1.39 t., **81,** 532.
1881. C. M. Holden, bowlders, $1.55 t., **82,** 527.
1882. J. H. White, granite quarry grout, $1.72 l. t., **82,** 526.
1883. J. H. White, brush and st., **83,** 460.
1888. C. H. Edwards, delivery of st., $1.38 t.; brush, $4 cord, **89,** 591.
1903. J. G. Thompson, piles driven in beach near Abel Hill dike, $5.25 each, **04,** 864.
1904. Edwin Canney, st. in place in break'r, $2.17 t., **05,** 831.
1910. The Breakwater Co., for st. in dike and break'r, $1.40 t., **11,** 1192.

ENGINEERS.

Chief of Engineers. **R.,** **66,** 2, 3, 11, ii, 24, 28, 41, iii, 19, 28; **67,** 46; **68,** 70, 828; **69,** 60; **70,** 78; **71,** 95; **72,** 94; **73,** 105; **74,** 115; **75,** 120; **76,** 47; **77,** 41; **78,** 45; **79,** 51; **80,** 71; **81,** 76; **82,** 76; **83,** 71; **84,** 77; **85,** 64; **86,** 65; **87,** 30; **88,** 32; **89,** 42; **90,** 36; **91,** 45; **92,** 51; **93,** 51; **94,** 48; **95,** 52; **96,** 53; **97,** 62, 66; **98,** 68; **99,** 80; **00,** 92; **01,** 157; **02,** 107; **03,** 87; **04,** 64; **05,** 69; **06,** 67; **07,** 70; **08,** 72; **09,** 73; **10,** 83, 89; **11,** 87; **12,** 100.

Boards. Convened, Boston, June 26, 1867. Recom. carrying out of plan by Col. Benham and Maj. Blunt, modified as follows: That the closing of the inlet be deferred; that the deposit of st. be continued. **67,** 464. (Cols. Bache and Benham and Lt. Col. Foster.)

In charge:

Col. J. D. Graham, 1865; **66,** 3, 36, 42.
Col. H. W. Benham, 1866–68; **66,** ii, 28. **R.,** **67,** 457, 462, 465; **68,** 829.
Lt. Col. J. G. Foster, 1868–71. **R.,** **68,** 808, 810, 832; **69,** 420, 433; **70,** 466, 468–470.
Lt. Col. G. Thom, 1871–83. **R.,** **71,** 897; **72,** 949; **73,** 1101; **74,** ii, 325; **75,** ii, 415; **76,** 181; **77,** 189; **78,** 221; **79,** 273; (Col.) **80,** 353; **81,** 530; **82,** 525.
Maj. C. W. Raymond, 1883–86. **R.,** **83,** 458; **84,** 518; **85,** 513.
Lt. Col. G. L. Gillespie, 1886–89. **R.,** **86,** 574; **87,** 528; **88,** 462.
Lt. Col. S. M. Mansfield, 1889–98. **R.,** **89,** 589; **90,** 513; **91,** 665; **92,** 593; **93,** 784; **94,** 564; **95,** 639; **96,** 613; **97,** 856, 878; **98,** 879.
Col. C. R. Suter, 1899–1900. **R.,** **99,** 1090; **00,** 1214.
Lt. Col. W. S. Stanton, 1901–05. **R.,** **01,** 1089; **02,** 884; **03,** 783; **04,** 864; (Col.) **05,** 830.
Maj. Edw. Burr, 1906–09. **R.,** **06,** 890; **07,** 923; (Lt. Col.) **08,** 965; **09,** 999.
Col. F. V. Abbot, 1910–12. **R.,** **10,** 1117; **11,** 1191; **12,** 1402.

Assistants:

Lt. Adams, **66,** 45.
Capt. G. Burroughs, **67,** 46; **68,** 70, 829, 833; **69,** 60, 433.
W. J. Martin, **69,** 947.
S. Haagensen, **73,** 1102; **76,** 183.
Lt. A. H. Payson, **75,** 111.

*Allotment.
[1] Sur.—**R.,** Dec. 21, 1835. (H. D. 482, 55th, 2d.)
[2] Called $15,000, **76,** 181; **77,** 189; **78,** 221; **79,** 273. Allotted from app. for preservation and repair of Hs.
[3] Called $9,000, **69,** 60; and $8,000, **66,** ii, 30; **69,** 420. Allotted from app. for preservation and repair of Hs.

ESTIMATES. (See Projects.)

By Col. Graham, aggregate, $43,068.44, **66,** 49.

By Col. Benham and Maj. Blunt, bulkhead, fence, and js. at Long and Beach Pts., $8,000, **66,** ii, 29.

By Lt. Col. Foster, completion, $20,000, **68,** 808; beach protection and dike, aggregate, $38,000, **68,** 810; for fiscal year, $11,600, **70,** 78, 469.

By Lt. Col. Thom, completion and repairs, $10,000, **71,** 95, 898; **72,** 951; fiscal year, 1875–76, $5,000, **74,** ii, 326; for 1876–77, $5,000, **75,** 120, ii, 416; completion of existing proj., $1,000, **76,** 47, 183.

For completion of existing proj., **79,** 275.

LEGISLATION.

Resolution of Mass. in favor of an app., **66,** 11.

OPERATIONS.[1]

1865-66. Planting brush fence and beach grass at head of East H., and commencement of extension of bulkhead js. at Long Pt., **66,** ii, 30.

1866-67. Plank fence, bulkheads, js., and other beach protections made at Long Pt., E. H. Beach, and Beach Pt., **67,** 46, 458.

1867-68. Protection of beach at Long Pt. and Beach. Pt. continued and constr. of dike at the "wading place" commenced, **68,** 70, 830.

1868-69. Bulkhead and js. at Beach Pt.; dike across Salt Meadows completed, **69,** 60, 420.

1869-70. Repairs to js. made and bulkhead and js. extended, **70,** 78, 466.

1870-71. Repairs to bulkhead and js.; constructing dike, **71,** 95, 897.

1871-72. Dike at Abel Hill completed; sundry repairs made, **72,** 94, 950.

1872-73. Extension and repairs of bulkheads and js., by hired labor; beach grass planted on Beach Pt., **73,** 106, 1101.

1873-74. Repairs and constr. of js. and bulkheads at Beach Pt., State Dike, Long Pt., and Cove Section, **74,** 116, ii, 326.

1874-75. Bulkhead and js. at Cove Section completed; st. bulkhead at Long Pt. enlarged and imp.; bulkhead and js. on Beach Pt. repaired and groins built; dikes at High Head and Abel Hill repaired; beach grass planted at Beach Pt. and Cove Section, **75,** 120, ii, 416.

1875-76. General repairs, **76,** 47, 182.

1876-77. Work on st. bulkhead at Long Pt. in progress; beach grass planted at Cove Section, **77,** 41, 190.

1877-78. Long Pt. bulkhead raised and extended, and sundry repairs at other pts., completing all the works proj., **78,** 222.

1878-79. Extending bulkhead and planting beach grass, **79,** 52.

1881-82. 1,753 t. st. placed in bulkhead at Long Pt., **82,** 526.

1882-83. 1,085 t. st. placed in bulkhead, extending same 367 f., **83,** 458.

1883-84. 276 t. st. placed in bulkhead, **84,** 519.

1884-85. Extensive repairs to dike at Abel Hill and break'r at Long Pt.; breaches in beach closed by 148 l. f. of brush bulkheads, **85,** 514.

1886-87. 103 l. f. sand-catch work built, **87,** 529.

1887-88. 232 l. f. j. and 257 l. f. sand catches built, **88,** 462.

1888-89. 770 t. st. and 135 cords brush delivered in Long Pt. bulkhead, **89,** 590.

1889-90. 1,188 t. st. and 150 cords brush delivered in Long Pt. bulkhead; 60' breach near Abel Hill Dike closed with plank bulkhead, **90,** 514.

1890-91. Bulkhead constr. at Long Pt. by hired labor, **91,** 666.

1891-92. Break'r protecting the e. shore of Long Pt. extended 150'; Long Pt. bulkhead completed; repairs to brush and wood sand catches at Abel Hill Dike, **92,** 593.

1894-95. Repairs to bulkheads in progress, **95,** 640.

1897-98. Work of protection near Wood End Light extended 227' and a portion of the old work repaired, **98,** 880.

1899-00. 1,409 running f. of bulkhead built and 400' of old bulkhead repaired at Wood End; 108' of new bulkhead built and 105' of old bulkhead repaired at Abel Hill, **00,** 1215.

1900-01. 553 l. f. plank bulkhead, with sand and gravel filling, constr., **01,** 1089.

1901-02. Dike and bulkhead built along 2,800 l. f. of beach, **02,** 884.

1902-03. Three timber groins built at Abel Hill Dike; repairs made to dike near the Abel Hill Dike, and 545' of sand-catching fences built, **03,** 783, 784.

1903-04. 995 l. f. of pile and timber groins built near Abel Hill Dike, **04,** 864.

1904-05. 1,093 t. st. placed in break'r; 611 l. f. bulkhead and 10,964 l. f. sand catches built near Abel Hill Dike; 1,750 l. f. sand catches built at Wood End; bulkhead and sand catches repaired, **05,** 830.

1905-06. 405 t. rubblest. deposited at Long Pt.; 4,658' sand catches, 460' single and 794' double bulkhead built, and beach grass planted at Abel Hill, **06,** 890.

1906-07. 115 l. f. bulkheads built and repairs made to bulkheads and sand catches near Abel Hill Dike by hired labor, **07,** 923.

1907-08. 1,418 l. f. new double bulkheads of timber built by hired labor near Abel Hill Dike; repairs made to bulkheads and sand catches near Abel Hill Dike and Wood End, **08,** 965.

1908-09. 48 l. f. bulkhead built at Abel Hill Dike, and repairs to bulkhead made, **09,** 999.

1910-11. 5,938 t. st. deposited in dike across House Pt. Isld. flats, **11,** 1191.

1911-12. 32,145 t. st. deposited in dike across House Pt. Isld. flats, **12,** 1402.

PHYSICAL CHARACTERISTICS.

Described, **66,** 12, 43; **76,** 184; **97,** 879. Current and tidal observations, **69,** 433.

Description of, **01,** 157–58; **04,** 64; **08,** 72.

Max. draft that can be carried to anchorage is ample for largest vessels, **10,** 84; **12,** 101.

Sand movement, by wind and sea, **12,** 101. (See Projects.)

Important H. of refuge at extremity of Cape Cod, **12,** 100.

PRIVATE AND CORPORATE WORK.

$100,000 app. by Mass.; $300 or $400 expend., **66,** ii, 28. Dike built across E. H. Creek by State authorities, **70,** 78; **71,** 897; **72,** 950; **76,** 187; **77,** 189; **78,** 222. Bulkhead and js. built along Beach Pt. by the local authorities, **71,** 897; **72,** 950; **76,** 185; **77,** 189; **78,** 222.

PROJECTS. (See Estimates.)

The object for which app. have been made is the prevention or arrest of the movement of sand by the winds and waves, and the consequent protection of Provincetown H. by the perpetuation of its low shore lines. The works of preservation have consisted mainly of detached bulkheads of timber and st., js. of wood and brush, dikes, sand-catch fences, and beach grass planting. The earliest app. was made in 1826; between this date and 1864 $32,850 was app. for the constr. of js. and sand catches. **66,** iii, 28.

In 1866 the proj. for the protection of Beach Pt. and Long Pt. by the constr. of bulkhead js. was adopted, **66,** ii, 29; **67,** 464.

In 1869 the constr. of a dike at High Head was undertaken to prevent a breach through the outer beach across the salt meadows and E. H. Creek, **69,** 60, 420.

In 1872 a dike was built at Abel Hill across the head of Lancey's H. to prevent the flow of the tide and sand into the inner H., **72,** 950.

Under subsequent app. the works of protection have been extended and maintained.

From 1864 to 1886, incl., $139,478.44 was app., **86,** 575; **87,** 528. From the nature of the work it can at no time be considered completed, **88,** 462; **92,** 593.

Col. Mansfield est., 1897, $13,200 for riprapping near Wood End Light, **97,** 880.

By Lt. Col. Burr, 1910, for rubblest. dike and head protection, **10,** 89.

[1] History of operations, **71,** 897; **72,** 949; **73,** 105, 1101; **74,** 115, ii, 325; **75,** 120, ii, 415; **76,** 47, 182, 185; **77,** 189; **78,** 222; **79,** 51, 273.

SURVEYS.

By Lt. Col. Graham, 1833–35 and 1865, **66,** 43.
By Lt. Col. Thom, an., 1871 to 1875, incl., **71,** 897; **72,** 950; **73,** 1102; **77,** 189.
Sur., with a view to protecting H. by a dike, au. act June 3, 1896; made by Lt. Col. Mansfield, 1896, and a comparison with other sur. made (see Projects) (**R.** unfav.), **97,** 879.
Pre. ex. and sur. au. act Mar. 3, 1909, with view to protection of H. **R.** by Lt. Col. Burr, July 6, 1909, and Feb. 18, 1910, for rubble st. dike and beach protection; est., $140,000,[1] **10,** 89.
Cong. Docs. etc., relating to exs. surs. etc., **12,** 100
Maps.[1]
Of. Col. Graham's sur., **66,** i.
By Capt. Burroughs mentioned, **69,** 433.
Under direction of Lt. Col. Thom, by S. Haagensen (4 sheets), **76,** 188; **86,** 576.
97, 878.

B-217 CHATHAM HARBOR (Stage Harbor), MASS.

APPROPRIATIONS.

1890,	$5,000.00,	**91,** 667.
1896,	5,000.00,	**96,** 615.
1899,	3,732.79,	**99,** 1093.
Total,	13,732.79	

COMMERCE.

Local, **01,** 158.
1902, 6,000 t., **03,** 88.

CONTRACTS.

1891. C. W. Anthony, dr., 41¢ c. y., **92,** 596.
1899. A. E. Smith, dr. 25,312 c. y., 32¢ c. y.; bowlder removal over 3 t., $10, **99,** 1094; annulled, **00,** 1217.
00. R. B. Rodermond, dr., **01,** 1091.

ENGINEERS.

Chief of Engineers. R., 91, 46; **92,** 51; **93,** 52; **94,** 49; **95,** 53; **96,** 53; **97,** 62; **98,** 69; **99,** 80; **00,** 92; **01,** 158; **02,** 107; **03,** 88.
In charge:
Lt. Col. S. M. Mansfield, 1890–98. **R., 91,** 667; **92,** 595; **93,** 786; **94,** 566; **95,** 641; **96,** 615; **97,** 858; **98,** 882.
Col. C. R. Suter, 1899–1900. **R., 99,** 1093; **00,** 1217.
Lt. Col. W. S. Stanton, 1901–03. **R., 01,** 1090; **02,** 885; **03,** 785.

OPERATIONS.

1891-92. 8,794 c. y. dr., **92,** 595.
1899-1900. 1,447 c. y. dr. (contract annulled), **1900,** 1217.
1901-02. 16,599 c. y. dr., proj. completed, **02,** 885; H. dropped from list of works under imp., **03,** 785.

PROJECTS.

By Lt. Col. Mansfield, 1890, inner H. excavation, chan. 6′ m. l. w., through the 3 obstr. bars, 100′ w. at inner and 200′ w. at outer end; est., $10,000, **91,** 667; est. increased by $3,732.79, 1896, **97,** 859.
By Col. Suter, 1899, for expend. of available funds, **99,** 1093.

B-218 STAGE HARBOR, MASS.

ENGINEERS.

Chief of Engineers. R., 89, 44.
In charge. Lt. Col. S. M. Mansfield, 1888. **R., 89,** 599.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 599.

PLANS.

By Lt. Col. Gillespie, 1888, imp. H. entrance by dr.; est., $15,000, **89,** 600.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie, **89,** 599.

B-219 CHATHAM NEW HARBOR, MASS.

COMMERCE.

Sixty to 100 catboats make the H. in the summer season, **95,** 648.

ENGINEERS.

Chief of Engineers. R., 95, 54.
In charge. Lt. Col. S. M. Mansfield, 1894–95. **R., 95,** 647.

PHYSICAL CHARACTERISTICS.

Description of; a pool or inlet formed, 1851, in the drifting sands, **95,** 647.

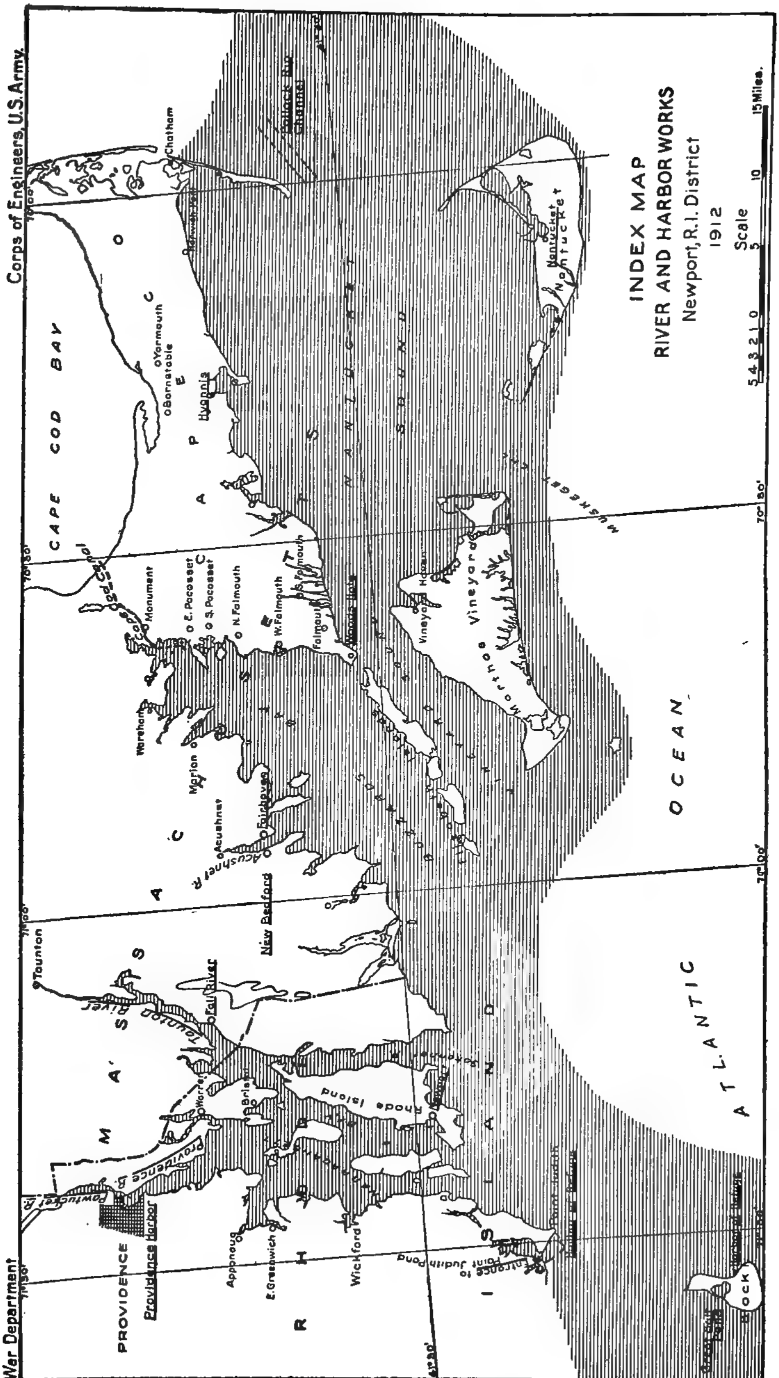
SURVEY.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Mansfield, 1894 (**R.** unfav.), **95,** 647.

[1] H. D. 821, 61st, 2d.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

C.—NEWPORT, R. I., DISTRICT.


War Department
Corps of Engineers, U.S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Newport, R.I. District
1912
Scale
15 Miles.
CAPE COD BAY
ATLANTIC OCEAN
PROVIDENCE
Providence Harbor
Pawtucket R.
Providence R.
Taunton
Taunton River
Fall River
Warren
Bristol
Rhode Island
New Bedford
Acushnet R.
Fairhaven
Marion
Wareham
Apponaug
E. Greenwich
Wickford
Entrance to Point Judith Pond
Monument
Cape Cod Canal
Falmouth
Woods Hole
Vineyard Haven
Hyannis
Yarmouth
Barnstable
Chatham
Nantucket
Muskeget
Pollock Rip Channel

C.—NEWPORT, R. I., DISTRICT.

In charge of U. S. Engineer Office,
Newport, R. I.

C 1 Nantucket Sound, Mass. (*)
C 2 Nantucket and Vineyard Sounds, Mass., and Cape Cod, Mass. (*)
C 3 Nantucket Sound, Mass. (Pollock Rip Channel) (*)
C 4 Oyster Cr., Mass. (1)
C 5 Herring R., Mass. (1)
C 6 Sevan Pond R., Mass. (1)
C 7 Bass R., Mass. (1)
C 8 Parkers R., Mass. (1)
C 9 Hyannis Harbor of Refuge, Mass. (1)
C 10 Centerville R., Mass. (1)
C 11 Poponesset B., Mass. (1)
C 12 Cotuit R., Mass. (11)
C 13 Cotuit H., Mass. (1)
C 14 Mashpee R., Mass. (11)
C 15 Waquoit B., Mass. (1)
C 16 Falmouth H., Mass. (1)
C 17 Great R., Mass. (15)
C 18 Woods Hole H. and Chan., Mass. (23)
C 19 Little H., Woods Hole, Mass. (23)
C 20 Quostinet R., Mass. (15)
C 21 Eel Pond, Mass. (1)
C 22 Childs R., Mass. (21)
C 23 Vineyard Sound, Mass. (1)
C 24 Tarpaulin Cove (H. of Refuge), Naushon Isld., Mass. (23)
C 25 Canapitsit Chan., Mass. (23 and 34)
C 26 Menemsha (Bite or Bight) H., Mass. (23)
C 27 Vineyard Haven H., Mass. (23)
C 28 Cottage City H., Mass. (1)
C 29 Edgartown H., Mass. (1)
C 30 Marthas Vineyard (Edgartown H.), Mass. (1)
C 31 Nantucket H., Mass. (1)
C 32 Nantucket, Mass. (Bar at entrance to H.), (1)
C 33 Nantucket, Mass. (Break'r at Great Pt.), (1)
C 34 Buzzards B., Mass. (*)
C 35 Pocasset R., Mass. (34)
C 36 Back R., Mass. (34)
C 37 Monument R., Mass. (34)
C 38 Cohasset Narrows, Mass. (34)
C 39 Onset B., Mass. (34)
C 40 Onset H., Mass. (39)
C 41 East R., Mass. (39)
C 42 Wareham R., Mass. (34)
C 43 Wareham H., Mass. (34)
C 44 Crooked R., Mass. (42)
C 45 Agawam R., Mass. (42)
C 46 Wankinco R., Mass. (42)
C 47 Broad Marsh R., Mass. (42)
C 48 Weweantitt R., Mass. (34)
C 49 Mattapoisett H., Mass. (34)
C 50 Mattapoisett R., Mass. (49)
C 51 Nasketucket B., Mass. (34)
C 52 Nasketucket R., Mass. (51)
C 53 New Bedford H., Mass. (34)
C 54 Acushnet R., Mass. (53)
C 55 Apponegansett H., Mass. (34)
C 56 Apponegansett R., Mass. (55)
C 57 Little R., Mass. (*)
C 58 Westport R., Mass. (*)
C 59 Westport (Point) H., Mass. (58)
C 60 Westport R. (E. Br.), Mass. (*)
C 61 Westport R. (W. Br.), Mass. (*)
C 62 Churches Cove H., Little Compton, R. I. (*)
C 63 Sakonnet R., R. I. (*)
C 64 Sakonnet Pt. H., R. I. (*)
C 65 Newport H., R. I. (Spit), (78)
C 66 Coasters Island H., R. I. (78)
C 67 Newport H., R. I. (78)
C 68 Mount Hope B., Mass. (63)
C 69 Taunton R., Mass. (68)
C 70 Fall River H., Mt. Hope Bay, Mass. (69)
C 71 Assonet R., Mass. (69)
C 72 Mill R., Mass. (69)
C 73 Three Mile R., Mass. (69)
C 74 Segreganset R., Mass. (69)
C 75 Lees R., Mass. (68)
C 76 Coles R., Mass. (68)
C 77 Kickemuit R., Mass. (68)
C 78 Narragansett B., R. I. (*)
C 79 Narragansett Bay, R. I. (Ohio Reef), (78)
C 80 Warren R., R. I. (78)
C 81 Providence R., R. I. (78)
C 82 Bullock Cr., R. I. (81)
C 83 Seekonk (Pawtucket) R., R. I. (81)
C 84 Pawtuxet Cove, R. I. (81)
C 85 Pawtuxet H., R. I. (84)
C 86 Pawtuxet R., R. I. (85)
C 87 Narragansett Bay Channel, R. I. (78)
C 88 Greenwich Bay, R. I. (78)
C 89 Greenwich H., R. I. (87)
C 90 Apponaug R., R. I. (78)
C 91 Apponaug H., Cowessett Bay, R. I. (87)
C 92 Potowomut R., R. I. (78)
C 93 Wickford H., R. I. (78)

*Atlantic Ocean.

C 94 Mill Cr., R. I. (78)
C 95 Nannacatucket R., R. I. (78)
C 96 Pattaguomscott R., R. I. (*)
C 97 Conanicut Island, R. I. (78)
C 98 Bissells Cove, R. I. (78)
C 99 Narragansett Bay, Narrow R., R. I. (78)
C 100 Narragansett Pier, R. I. (78)
C 101 Point Judith Pond, R. I. (*)
C 102 Pt. Judith, R. I., Harbor of Refuge (*)
C 103 Great Salt Pond, Block I., R. I. (*)
C 104 Block Isld., R. I., Harbor of Refuge (*)
C 105 Watch Hill, R. I. (*)
C 106 Little Narragansett Bay, Conn. and R. I. (*)

C-2 NANTUCKET AND VINEYARD SOUNDS, MASS., AND CAPE COD, MASS.

ENGINEERS.

Chief of Engineers. R., 04, 87.

Boards. R. regarding adaptability of Vineyard and Nantucket Sounds, Cape Cod, as a H. of refuge (Col. C. R. Suter, Col. S. M. Mansfield, and Maj. Geo. W. Goethals). Board favored Vineyard Haven as best location for H. of refuge, and H. dr. also at or near Falmouth; est., $1,132,500, **04,** 951, 959.

PHYSICAL CHARACTERISTICS.

Details, **05,** 950.

Vineyard and Nantucket Sounds combined form the greatest C. highway in the world; owing to shoals, fogs, and strong tidal currents it is extremely dangerous, **04,** 959.

SURVEY.

Act June 13, 1902, au. ex. of various Hs. in Newport district (Pt. Judith, Block Isld., Great Salt Pond, Vineyard and Nantucket Sounds, Menemsha Bight, Squash Meadow, Edgartown H., Falmouth H., L'Homme Dieu Shoals, Hyannis, Handkerchief and Chatham Roads, Pleasant B., Great Pt., etc.), with view to constr. H. of refuge. (See BE., **R.,** Oct. 30, 1903,[1] **04,** 959.)

C-3 NANTUCKET SOUND, MASS. (Pollock Rip Channel).

APPROPRIATION.

1912, $125,000, **12,** 1406.

COMMERCE.

Est. that C. of over 20,000,000 t. will be greatly benefited if new chan. is constr. and maintained. **12,** 103.

ENGINEERS.

Chief of. R., 11, 118; **12,** 103, 136.

In charge:

Lt. Col. J. C. Sanford, **11,** 92.

Col. F. V. Abbot. **R., 12,** 1405.

PROJECTS.

Act July 25, 1912, provides for imp. of Pollock Rip Chan. through shoals lying near entrance to Nantucket Sound, by dr. to 30′ d., m. l. w.; est., $250,000,[2] **12,** 103.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909, for removal of n. end of Stone H. Shoal and of such portions of Bearse Shoal and Pollock Rip Shoal as might be necessary, **11,** 118. **R.,** Lt. Col. Sanford, Nov. 16 1909, and Nov. 21, 1911; est., $250,000,[2] **12,** 136.

Map.[2]

C-5 HERRING RIVER, HARWICH, MASS.

COMMERCE.

Description of, **98,** 932.

ENGINEERS.

Chief of Engineers. R., 98, 84.

In charge. Maj. D. W. Lockwood, 1897–98. **R., 98,** 932.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 933.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Lockwood, 1897 (**R.** unfav.), **98,** 933.

C-5(a) SALT POND, HARWICH, MASS.

COMMERCE.

Description of, **98,** 934.

ENGINEERS.

Chief of Engineers. R., 98, 84.

In charge. Maj. D. W. Lockwood, 1897–98. **R., 98,** 934.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 934.

SURVEY.

Ex. au. act June 3, 1896; made by Maj. Lockwood, 1897 (**R.** unfav.), **98,** 934.

C-7 BASS (Harbor) RIVER, MASS.[3]

APPROPRIATIONS.

Mar. 2, 1829,	[4] $150.00 (sur.).
July 4, 1836,	[4] 10,000.41
July 7, 1838,	[4] 10,000.00
Total,	20,150.41

COMMERCE.

Description of. Purely local, with no prospect of increase. **95,** 739; **00,** 1283.

ENGINEERS.

Chief of Engineers. R., 95, 72; **99,** 97; **00,** 110

* Atlantic Ocean.
[1] H. D. 60, 58th, 2d.
[2] H. D. 536, 62d, 2d.
[3] Sur.—**R.,** Feb., 1830, est., $19,930.41. (H. D. 482, 55th, 2d.)
[4] Treas. Dept. Doc. No. 373, 1882.

In charge:
Capt. W. H. Bixby, 1895. **R., 95,** 739.
Maj. D. W. Lockwood, 1900. **R., 00,** 1282.

PHYSICAL CHARACTERISTICS.

Probable effect on the proposed imp. by the constr. of the Cape Cod Ship Canal in the vicinity, **95,** 739, 743.
Description of, **95,** 739, 743; **00,** 1283.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1895, by Capt. Bixby (**R.** unfav.), **95,** 739.
Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Lockwood (**R.** unfav.), **00,** 1283.

C-9 HYANNIS HARBOR OF REFUGE, MASS.[1]

APPROPRIATIONS.

1827,	$10,650.00,	act Mar. 2.
1830,	6,517.82,	act Apr. 30.
1831,	8,400.00,	act Mar. 2.
1832,	7,600.00,	act July 3.
1833,	5,000.00,	act Mar. 2.
1834,	10,000.00,	act June 28.
1835,	9,000.00,	act Mar. 3.
1837,	5,000.00,	act Mar. 3.
1838,	8,764.00,	act July 7.
1852,	5,000.00,	act Aug. 30.
1870,	12,000.00,	**70,** 79; **71,** 895.
1871,	10,000.00,	**71,** 95, 895; **72,** 953.
1873,	10,000.00,	**73,** 86.
1874,	5,000.00,	**74,** 96, ii, 181; **75,** 106.
1878,	3,000.00,	**78,** 46, 226.
1879,	2,500.00,	**79,** 53, 297.
1881,	5,000.00,	**81,** 540.
1886,	10,000.00,	**86,** 586.
1888,	10,000.00,	**88,** 485.
1890,	8,000.00,	**90,** 553.
1892,	6,000.00.	**92,** 599.
1894,	3,500.00,	**95,** 657.
1896,	6,000.00,	**96,** 625.
1899,	2,162.00,	**99,** 1104.
1902,	20,000.00,	**02,** 891.
1905,	*[2] 8,173.25,	**07,** 930.
Total,	197,267.07 (incl. sales, recovery of bond, $197,787.75, **12,** 1457).	

COMMERCE.

Description of, **70,** 459; **73,** 86.
Small; H. chiefly valuable as place of refuge; actual (local) C., 1911, 2,434 t.; **10,** 90; **12,** 105.

CONTRACTS.

1870. G. Clapp, repairing break'r, $38.62 l. f., **71,** 897.
1871. G. Clapp, repairing and completing break'r. $37.50 l. f., **71,** 897.
1873. Dawson, Tank & Co., granite, $4.40 t., **73,** 949.
1878. J. H. White, granite, $1.45 t., **79,** 296.
1879. F. Crocker, removal of wreck, $370, **79,** 296; J. H. White, granite riprap, $1.43 t., **80,** 366.
1881. C. E. Davis, riprap granite, $1.69 t., **81,** 539.
1886. Frank Pidgeon Dredging Co., dr., 14.9¢ c. y., **87,** 533.
1893. J. H. Fenner, dr., 16.5¢ c. y. ($3,600), **93,** 805.
1895. Hartford Dredging Co., dr., 17.3¢ c. y. ($2,000), **95,** 657.
1896. Hartford Dredging Co., dr., 21¢ c. y., **97,** 885.
1902. C. H. Latham, dr., 19.7¢ c. y., **03,** 789; annulled Sept. 5, 1903, **04,** 904.
1903. J. S. Packard Dredging Co., dr., 24¢ c. y., **04,** 905.
1905. Morris & Cumings Dredging Co., dr., 23.9¢ c. y., **05,** 843.

DOCUMENTS. (Not printed in reports.)

R., Lt. C. E. Blunt, 1852, **73,** 948; **R.,** Maj. Warren, 1873, **73,** 947; **R.,** importance of early removal of a wreck, **79,** 296.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **70,** 79; **71,** 95; **72,** 94; **73,** 86; **74,** 96; **75,** 106; **76,** 48; **77,** 42; **78,** 46; **79,** 52; **80,** 72; **81,** 77; **82,** 77; **83,** 72; **84,** 79; **85,** 68; **86,** 68; **87,** 31; **88,** 33; **89,** 44; **90,** 38; **91,** 48; **92,** 52; **93,** 53; **94,** 50; **95,** 55, 72; **96,** 55; **97,** 66; **98,** 70; **99,** 82, 97; **00,** 94, 111; **01,** 160; **02,** 108; **03,** 88; **04,** 70; **05,** 74; **06,** 73; **07,** 75; **09,** 78; **10,** 90; **11,** 92; **12,** 104.

In charge:
Col. J. D. Graham, 1865. **R., 66,** 41.
Maj. D. C. Houston, 1869. **R., 70,** 459.
Lt. Col. J. G. Foster, 1870. **R., 70,** 467.
Lt. Col. G. Thom, 1871–73. **R., 71,** 895; **72,** 952.
Maj. G. K. Warren, 1873–83. **R., 73,** 947; **74,** ii, 180; **75,** ii, 266; **76,** 203; **77,** 193, 194; **78,** 225; **79,** 295; (Lt. Col.) **80,** 365; **81,** 539; **82,** 548.
Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 467; **84,** 591; **85,** 560, 619; **86,** 585.
Maj. W. R. Livermore, 1887–92. **R., 87,** 532; **88,** 484; **89,** 606; **90,** 552; **91,** 694.
Capt. W. H. Bixby, 1892–95. **R., 92,** 598; **93,** 804; **94,** 571; **95,** 656, 744.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 624; **97,** 884; **98,** 896; **99,** 1104; **00,** 1234, 1284, 1286.
Maj. G. W. Goethals, 1901–02. **R., 01,** 1110; **02,** 890.
Capt. C. E. Gillette, 1903. **R., 03,** 788.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 904; **05,** 842; **06,** 896; **07,** 930.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1005; **10,** 1123.
Col. F. V. Abbot, 1911–. **R., 11,** 1195; **12,** 1406

Assistant. P. M. Blake. **R., 74,** ii, 181.

ESTIMATES. (See Projects.)

By Maj. Houston, 1870, completion of the work, $93,000, **70,** 460.
By Lt. Col. Thom, 1871, completion of the work, $10,000, **71,** 95; **72,** 94, 952.
By Maj. Warren, 1873, increasing the w. of the base of the break'r, $25,000, **73,** 86, 948, 949.
By Maj. Warren, 1879, completion of existing proj., $5,000, **79,** 297.

LEGAL PROCEEDINGS.

$500 accepted in compromise of suit of U. S. vs. James E. Payne and A. J. Rose, sureties on the bond of C. H. Latham, failing contractor for work at Hyannis, brought Nov. 3, 1905, for recovery of $3,065.15, damages, etc., **09,** 1005.

OPERATIONS.[3]

1870–71. 300 l. f. break'r rebuilt, **71,** 95, 895
1871–72. 250 l. f. break'r rebuilt, **72,** 94, 953.
1872–73. Repairs in progress, **73,** 86, 949.
1873–74. 220 l. f. break'r rebuilt, **74,** 96, ii, 180.
1874–75. 1,450 t. riprap placed, on the outside mainly, **75,** ii, 267.
1878–79. Strengthening the break'r by riprap; 1,675 t. of granite used, **79,** 52, 296.
1879–80. 1,211 t. st. deposited at outside base of break'r, **80,** 366.
1881–82. 2,550 t. st. placed in break'r, **82,** 548.
1886–87. 2,441 c. y. dr., **87,** 532.

* Allotment.
[1] Sur.—**R.,** 1826, est. $10,560. (H. D. 482, 55th, 2d.)
[2] $9,200 less $1,026.75 transferred to Nantucket H., **07,** 75.
[3] Summary of, prior to 1870, **70,** 459; **73,** 947; **75,** ii, 267; **79,** 295.

1887-88. 21,389 c. y. dr., **88,** 484.
1889-90. Dr. in 15½′ area, **90,** 552.
1890-91. 22,100 c. y. dr., **91,** 694.
1891-92. 6,360 c. y. dr., **92,** 598.
1893-94. 21,880 c. y. dr., **94,** 572.
1896-97. About 15,000 c. y. dr., **97,** 884.
1897-98. 25,803 c. y. dr., **98,** 896.
1903-04. 25,346 c. y. dr., **04,** 904.
1904-05. 49,654 c. y. dr., **05,** 842.
1905-06. 28,874 c. y. dr.; proj. completed, **06,** 896.

PHYSICAL CHARACTERISTICS.

Description, **70,** 459; **74,** ii, 182; **95,** 744.
Deterioration in depth has occurred along s. and w. sides of area protected by break'r, **11,** 1195.
On s. shore of Cape Cod, 15± m. to w. of heel of cape; important H. of refuge for smaller vessels passing through Nantucket Sound, **12,** 104.

PROJECTS. (See Estimates.)

The orig. proj. was for a break'r of riprap st. 1,170′ l., covering an anchorage area of 175± acres and having an entrance d. of 15′. This was commenced in 1827 and completed in 1838; cost, $70,931. **80,** 366; **86,** 586.
By Maj. Warren, 1873, increasing w. of base of break'r and otherwise strengthening it; est., $25,000, **73,** 86, 948, 949.
By Lt. Col. Elliot, 1885, increasing the d. of the anchorage area within the H.; est., $45,743.20, **85,** 621; **86,** 586; **87,** 532; **92,** 598.
Maj. Lockwood est., 1899, $32,500 to complete the proj. of 1885, **1900,** 1286; $30,568.94, **12,** 104.
Lt. Col. Sanford est., 1910, $24,000 to restore d., **10,** 1124.

SURVEYS.

Ex., Lt. Blunt, 1852, **73,** 948.
Ex., Maj. Houston, 1869, **70,** 459.
By Maj. Warren, 1873, **73,** 948. **R., 74,** ii, 180 182.
Of H., 1884, **85,** 560, 619.
Ex. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** fav.), **95,** 744.
Ex. and sur. au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (limited imp. recom.), **00,** 1284, 1286.
Of dr. area, **10,** 1123.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 105.

Maps:
84, 592; **85,** 560; **93,** 804; **95,** 656; **03,** 788.
Sketch showing proposed work, by Maj. Houston, **70,** 460.

C-13 COTUIT HARBOR, MASS.

COMMERCE.

Description of, **00,** 1288.

ENGINEERS.

Chief of Engineers. R., 00, 111.
In charge. Maj. D. W. Lockwood, 1900. **R., 00,** 1287.

PHYSICAL CHARACTERISTICS.

Description of; series of sandy bays opening into Nantucket Sound, with 1 or 2 openings. Cotuit entrance is about 8 m. sw. from Hyannis. **00,** 1288.

SURVEYS.

Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Lockwood (**R.** unfav.), **00,** 1288.

C-16 FALMOUTH HARBOR, MASS.

ENGINEERS.

Chief of Engineers. R., 87, 43.
In charge. Maj. W. R. Livermore, 1886. **R., 00, 87,** 567.

PHYSICAL CHARACTERISTICS.

Description, **87,** 567.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Maj. Livermore (**R.** unfav.), **87,** 567.

C-18 WOODS HOLE HARBOR AND CHANNEL, MASS.

APPROPRIATIONS.

1852,	[1] $2,500,	**74,** ii, 277.
1879,	[2] 15,000,	**79,** 53, 298.
1882,	52,000,	**82,** 550.
1884,	25,000,	**84,** 600.
1886,	14,500,	**86,** 592.
1895,	5,000,	**95,** 667.
1896,	20,000,	**96,** 635.
1899,	20,000,	**99,** 1113.
1902,	20,000,	**02,** 895.
1905,	70,000,	**05,** 849.
1906,	100,000,	**06,** 901.
Total,	344,000	(total, less $400.08 returned to Treas., $343,599.92, **12,** 1410).

COMMERCE.

Important, **74,** ii, 277, 280, 281; **80,** 370.
1911, 49,128 t., **12,** 109.

CONTRACTS.

1879. G. W. Townsend, removal of bowlders, $7 c. y. J. McDermott, dr., 24¾¢ c. y., **80,** 368.
1883. G. W. Townsend, r. removal, $5 c. y., **83,** 473. I. A. Sylvester, dr., bowlder removal, riprap, and retaining and p. wall constr., **84,** 598.
1886. W. H. Molthorp & Co., wharf constr. C. E. Davis, r. removal, **87,** 539.
1887. Frank Pidgeon Dredging Co., dr., $1.10 c. y., **87,** 539. G. W. Townsend, r. removal, **87,** 540.
1897. C. W. Johnston, dr., $7.75 c. y.; removal of bowlders, $7.75 c. y. ($18.000), **97,** 896.
1899. R. G. Packard Co., dr., $2.23 c. y., **99,** 1113.
1903. R. G. Packard Co., dr., $3.47 c. y., **03,** 794.
1905. R. G. Packard Co., dr. shoals, about 20,000 c. y., $1.74 c. y., **06,** 902.
1907. C. M. Cole, dr., $2.24 c. y., and use of dr. for removing bowlders, etc., $249 per day, **08,** 975.
1911. C. E. Davis, removing bowlders, $69 per day, **11,** 1199. J. R. Burke, removing shoal spots to 13′, m. l. w., $49,650, **12,** 1410.

ENGINEERS.

Chief of Engineers. R., 66, 7, 37; **73,** 93; **74,** 103; **78,** 51; **79,** 53, 56; **80,** 73; **81,** 79; **82,** 79; **83,** 74; **84,** 81; **85,** 69; **86,** 69; **87,** 33; **88,** 34; **93,** 70; **95,** 58, 72; **96,** 57; **97,** 69; **98,** 73; **99,** 84; **00,** 97, **01,** 162; **02,** 111; **03,** 91; **04,** 73; **05,** 78; **06,** 77; **07,** 78; **08,** 80; **09,** 82; **10,** 92; **11,** 95; **12,** 108.

In charge:
Col. J. D. Graham, 1865–66; **66,** 37.
Maj. G. K. Warren, 1873–83. **R., 74,** ii, 275; **79,** 297, 299; (Lt. Col.) **80,** 367; **81,** 545; **82,** 549.

[1] Great Woods Hole H.

[2] Entrance.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 472; **84,** 597; **85,** 580; **86,** 591.
Maj. W. R. Livermore, 1887–88. **R., 87,** 537; **88,** 488.
Capt. W. H. Bixby, 1893–95. **R., 93,** 860; **95,** 666, 750.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 633; **97,** 894; **98,** 903; **99,** 1111; **00,** 1242.
Maj. G. W. Goethals, 1901–02. **R., 01,** 1117; **02,** 894.
Capt. C. E. Gillette, 1903. **R., 03,** 793.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 909; **05,** 849; **06,** 901; **07,** 935.
Maj. H. Taylor, 1908. **R., 08,** 975.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1009; **10,** 1127.
Col. F. V. Abbot, 1911–. **R., 11,** 1199; **12,** 1409.

Assistants:
J. P. Cotton. **R., 74,** ii, 277; **81,** 546.
C. R. Mather, **74,** ii, 277.
Lt. W. W. Harts. **R., 93,** 862; **95,** 752.

ESTIMATES. (See Plans and Projects.)

By J. P. Cotton, imp. of straits; 7 est., varying from $5,000 to $446,000, **74,** ii, 280, 281; **79,** 298.
By Maj. Warren, chan., $6,000, **79,** 299.

OPERATIONS.

1852-53. Break'r built on n. side of H., **74,** ii, 277, 279.
1879-80. 15,134 c. y. dr. from chan. at Little H.; 1,001 c. y. r. and bowlders removed from Woods Hole Straits, **80,** 369, 370.
1880-81. 71 c. y. bowlders removed from chan., **81,** 545.
1882-83. Bowlders removed from site of proposed p. and wharves, **83,** 473.
1883-84. 6,622 c. y. dr. for foundation; 162 t. bowlders removed; 3,440 t. granite masonry and riprap laid in p. and retaining walls, **84,** 599.
1884-85. Masonry walls of p. basin completed; interior of p. basin and berths for vessels at wharves dr. to 15′ and 18′, and coal, west, and the cross wharves completed, **85,** 583.
1886-87. Constr. of e. and s. wharves in progress; removal of rs. from the strait, **87,** 537.
1887-88. Proj. completed, **88,** 488.
1894-95. Repairs to sea wall and wharf in progress, **95,** 666.
1895-96. Repairs and misc. work in progress on sea wall, etc., **96,** 634.
1897-98. 2,450.68 c. y. dr., **98,** 904.
1899-00. 7,683 c. y. sand, and 86 c. y. bowlders removed, **00,** 1243.
1902-03. 4,341 c. y. dr. and 42,272 c. y. bowlders removed, **03,** 793.
1903-04. 998 c. y. dr. and 10 c. y. bowlders removed, **04,** 909.
1905-06. 10,928 c. y. dr. in removing shoals, **06,** 901.
1906-07. 17,849 c. y. dr. **07,** 935.
1907-08. 4,091 c. y. dr., **08,** 975.
1908-09. Small shoal blasted in e. end of chan., **09,** 1009.
1910-11. 5 shoals removed, **11,** 1199.
1911-12. Work of removing shoal spots in progress, **12,** 1410.

PHYSICAL CHARACTERISTICS.

Tidal observations, **74,** ii, 276, 278, 279; **79,** 298; **80,** 370.
Description, **80,** 367; **93,** 862; **95,** 751.
Importance of proposed p. and break'r constr. to U. S. fisheries, **82,** 552.
Number of small shoal spots, **10,** 1127.
Max. draft 10′, m. l. w., **12,** 109.

PLANS. (See Estimates and Projects.)

By J. P. Cotton, imp. of strait by removing bowlders and drg. chan., **74,** ii, 280.
By Maj. Warren, 1873, imp. of Hr. by excavation of chan. 800′ w. with central d. of 18′ m. l. w.; est., $446,000, **80,** 370.

PRIVATE WORK.

Break'r completed by private parties, **74,** ii, 277.

PROJECTS. (See Estimates and Plans.)

App. of $15,000, made 1879, expend. in drg. and removing the bowlders from entrance to the Hr., **80,** 369; **81,** 545.
Proj. 1882 proposed retaining walls on shore, a hollow p. and wharves for the use of the Fish Commission and other branches of the public service, and removal of rs. from the straits; est., $52,775, **82,** 550, 551; **84,** 598. Work under this proj. completed July, 1887, **88,** 488.
By Capt. Bixby, 1895, executing work by hired labor and purchase of materials in open market, **95,** 666.
By Lt. Harts, 1895, chan. w. of 300′ and l. w. d. of 13′ through the strait and its se. branch; est. $396,000, **95,** 752; **97,** 895.

SURVEYS.

By J. P. Cotton, 1873, **73,** 93; **74,** 103, ii, 275, 277.
Made, 1878, **78,** 51; **79,** 53, 56, 298, 299.
Soundings and observations for velocity and direction of currents, **74,** ii, 278; **79,** 299.
For p. and break'r in "Great Hr.," Woods Hole, **82,** 550.
Ex. au. act July 14, 1892; made by Capt. Bixby, 1893 (**R.** fav.), **93,** 860.
Sur. au. act Aug. 17, 1894; made by Lt. Harts, 1895 (**R.** fav.), **95,** 751.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 109.
Maps. **80,** 368; **84,** 598; **95,** 666; **03,** 793.

C-19 LITTLE HARBOR, WOODS HOLE, MASS.

APPROPRIATIONS.

1905, $18,000, **05,** 848.

COMMERCE.

None, except in connection with Lighthouse Estab., **04,** 932.

CONTRACTS.

1905. C. M. Cole, dr. about 66,000 c. y., 21¢ c. y., **05,** 848.

ENGINEERS.

Chief of Engineers. **R., 04,** 86, 930; **05,** 78; **06,** 77; **1910,** 113.

Boards. BERH. **R., 04,** 932, 933.

In charge:
Maj. Geo. W. Goethals, 1904. **R., 04,** 931.
Capt. C. E. Gillette, 1904. **R., 04,** 934.
Lt. Col. J. H. Willard, 1905–06. **R., 05,** 848; **06,** 900.
Lt. Col. J. C. Sanford, 1910; **10,** 89.

OPERATIONS.

1904-05. 3,114 c. y. dr., **05,** 848.
1905-06. 72,686 c. y. dr.; proj. completed, **06,** 900.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 931.

PROJECTS.

By Capt. Gillette, 1903, chan. 12′, x 150′ and a turning basin 300′ w. opposite the wharf; est., $18,000,[1] **04,** 934.

SURVEYS.

Ex. and sur. au. act June 13, 1902; made, 1903, by Maj. Goethals and Capt. Gillette, resp.,[1] **04,** 930.
Au. act Mar. 3, 1909 for imp. by dr.; made, 1909, by Lt. Col. Sanford (unfav.),[2] **10,** 113.
Map.[2]

[1] H. D. 162, 58th, 2d. [2] H. D. 692, 61st, 2d.

C-24 TARPAULIN COVE (Harbor of Refuge), NAUSHON ISLAND, MASS.

COMMERCE.

Place has no C.; used principally as a H. of refuge, **96,** 668.

ENGINEERS.

Chief of Engineers. R., 93, 71; **95,** 73; **96,** 70.
In charge:
Capt. W. H. Bixby, 1892–95. **R., 93,** 864.
Maj. D. W. Lockwood, 1896. **R., 96,** 667.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 864.
Vineyard Haven, 20 m. e., furnishes an anchorage for refuge from storms to which Tarpaulin Cove is especially open, **96,** 668.

PROJECTS.

Maj. Lockwood, 1896, est. $108,704 for 2 short break'rs, **96,** 667.

SURVEYS.

Ex. au. act July 13, 1892; made by Capt. Bixby, 1893 (break'r constr. recom.), **93,** 864.
Sur. au. act Aug. 17, 1894; made by Maj. Lockwood, 1895 (see Projects), **96,** 667.

C-25 CANAPITSIT CHANNEL, MASS.

APPROPRIATIONS.

1892,	$4,800, **93,** 820.
1894,	5,000, **95,** 673.
Total,	9,800

CONTRACTS.

1895. Hartford Dredging Co., dr., 36¢ c. y. ($3,500), **95,** 673.

ENGINEERS.

Chief of Engineers. R., 91, 62; **92,** 66; **93,** 59; **94,** 54; **95,** 60; **96,** 59; **97,** 71; **98,** 74; **99,** 86.

In charge:
Capt. W. H. Bixby, 1892–95. **R., 93,** 820; **94,** 584; **95,** 672.
Maj. W. R. Livermore, 1892. **R., 92,** 645.
Maj. D. W. Lockwood, 1896–99. **R., 96,** 640; **97,** 900; **98,** 908; **99,** 1117.

OPERATIONS.

1892-93. About 3,300 c. y. dr., and 1,155 t. bowlders removed, **93,** 820.
1893-94. Removal of bowlders in progress, **94-**584.
1897-98. 5,638 c. y. dr.; about 90 c. y. bowlders removed. Proj. completed, **98,** 908.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 820.

PROJECTS.

In 1891 by Maj. Livermore, 6′ x 250′, est. $4,800, **93,** 820. Est. increased, 1893, to $9,800, **93,** 821.
By Capt. Bixby, 1893, doing work with hired labor and U. S. plant, **93,** 820.
By Capt. Bixby, 1895, dr. by contract, **95,** 672.

SURVEY.

Sur. of the chan. between Cuttybunk and Nashawena Islds.; made, 1891, by Maj. Livermore, **92,** 646.
Maps. **93,** 820; **95,** 672.

C-26 MENEMSHA (Bite or Bight) HARBOR, MASS.

ENGINEERS.

Chief of Engineers. R., 87, 43; **91,** 62; **92,** 66.
In charge:

Lt. Col. G. H. Elliot, 1886. **R., 87,** 569.
Maj. W. R. Livermore. **R., 92,** 642.

PHYSICAL CHARACTERISTICS. (See Plans.)

Description of, **87,** 570; **92,** 642.

PLANS.

By Maj. Livermore, 1891, confining the current and producing a scour across the bar with brush and st. js. extending out from the banks on either side of the mouth of the outlet to 10′ in the bight; est., $20,000. In view of the uncertainty of mainten. and the demands of C., Maj. Livermore considered expediency of imp. doubtful. **92,** 645.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Elliot (**R.** unfav.) (see Plans), **87,** 569.

C-27 VINEYARD HAVEN HARBOR (Holmes Hole), MASS.[1]

APPROPRIATIONS.

1888,	$25,000, **88,** 34.
1890,	10,000, **90,** 557.
1892,	7,500, **92,** 606.
1894,	7,500, **95,** 665.
1896,	7,000, **96,** 632.
1899,	3,000, **99,** 1110.
Total,	60,000

CONTRACTS.

1893. J. V. Luce, st., $2.40 s. t. ($4,000), **93,** 812.
1897. W. S. White, st., $1.95 s. t. ($12,000), **97.** 893.

ENGINEERS.

Chief of Engineers. R., 82, 90; **87,** 43; **88,** 34; **89,** 45; **90,** 39; **91,** 50; **92,** 54; **93,** 55; **94,** 52; **95,** 57; **96,** 57; **97,** 69; **98,** 72; **99,** 84, 97; **00,** 96, 111; **01,** 162; **02,** 110; **03,** 90; **04,** 72, 87; **05,** 77; **06,** 76; **07,** 77; **08,** 79; **09,** 82.

[1] Sur.—**R.,** Apr. 24, 1826. (H. D., 482, 55th, 2d.) Sur., Marblehead H. and Holmes Hole, Mass., to ascertain the practicability and necessity of building a p. at the mouth of H. of Marblehead, for security of shipping, and also a p. in the H. of Holmes Hole for the same purpose. (Treas. Doc. 373, 1882.)

Boards. Special BE. (Col. Chas. R. Suter, Col. S. M. Mansfield, and Maj. Geo. W. Goethals) recom. H. of refuge should be constr., and one in connection with it at Falmouth, off Nohska Pt.; also js. extending out from the East and West Chops; est., $1,132,500, **04,** 959, 961, 967.

In charge:
Lt. Col. G. K. Warren, 1881. **R., 82,** 592.
Maj. W. R. Livermore, 1882–92. **R., 87,** 572, 573; **89,** 611; **90,** 556; **91,** 700.
Capt. W. H. Bixby, 1892–95. **R., 92,** 604; **93,** 811; **94,** 578; **95,** 664.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 631; **97,** 892; **98,** 901; **99,** 1109; **00,** 1240, 1289.
Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1115; **02,** 893.
Capt. C. E. Gillette, 1903. **R., 03,** 791.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 908; **05,** 847; **06,** 899; **07,** 934.
Maj. H. Taylor, 1908. **R., 08,** 973.
Lt. Col. J. C. Sanford, 1909. **R., 09,** 1008.

LEGAL PROCEEDINGS.

War Dept., July 10, 1905, granted State of Mass. au. to constr. break'r 1,200′ l. on w. side of H., **06,** 899.

OPERATIONS.

1889–90. Temporary wharf and 3 riprap js. built, **90,** 557.
1890–91. 1,064 t. st. used in j. constr., **91,** 700.
1891–92. 3,386 t. st. used in j. constr., **92,** 605.
1893–94. About 1,600 t. st. deposited in sea walls and js., **94,** 578.
1894–95. About 500 t. st. deposited in sea walls and js., **95,** 664.
1896–97. 388 t. st. deposited in sea wall, **97,** 892.
1897–98. 4,974 t. st. deposited in sea walls and js., **98,** 902.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 592; **87,** 574; **89,** 611; **1900,** 1290.

PLANS. (See Projects.)

By Lt. Col. Warren, protection of 5,000 l. f. of bluff by deposit of 40,000 t. of riprap; est., $60,000, **82,** 594.
By Maj. Livermore, 1887, H. of refuge by break'r and j. constr.; est., $3,983,936, **87,** 579.

PRIVATE (STATE) WORK.

700′ break'r built by State of Mass., **07,** 934.

PROJECTS. (See Plans.)

By Lt. Col. Warren, 1882, protection of 5,000 l. f. of bluff by constr. of riprap js. and shore protection, requiring the deposit of 40,000 t. of riprap; est., $60,000, **82,** 594; **90,** 556.
By Capt. Bixby, 1895, st. work by contract, **95,** 664.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1881; made by Lt. Col. Warren, **82,** 594; **87,** 572.
Sur. of "East" and "West Chops"; made, 1889, by Maj. Livermore, **89,** 611.
Ex. for H. of refuge au. act Mar. 3, 1899; **R.** made by Maj. Lockwood, 1899, recom. that Congress be asked to make a general investigation to determine best site for H. of refuge, **00,** 1290, 1292.
Ex. by special BE., au. act June 13, 1902, of various Hs. with view to constructing H. of refuge. Vineyard Haven recom. (see Board of Engineers[1]), **04,** 87, 949.
Maps. **87,** 580; **93,** 812; **95,** 664.

C-28 COTTAGE CITY HARBOR, MASS.

COMMERCE.

Unimportant, **87,** 569; **00,** 1294.

ENGINEERS.

Chief of Engineers. R., 87, 43; **00,** 111.
In charge:
Lt. Col. G. H. Elliot, 1886. **R., 87,** 568.
Maj. D. W. Lockwood, 1900. **R., 00,** 1293.

PHYSICAL CHARACTERISTICS.

Description, **87,** 569; **00,** 1294.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Elliot (**R.** unfav.), **87,** 569.
Ex. au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (**R.** unfav.), **00,** 1294.

C-29 EDGARTOWN HARBOR, MASS.

SURVEYS.

R., 1826; est., $4,273.56; H. D. 482, 52d, 2d.

C-30 MARTHAS VINEYARD (Edgartown Harbor), MASS.[2]

APPROPRIATIONS.

1826,	$500 (sur.), act May 20.	
1829,	2,500, act Mar. 2.	
1872,	20,000,	**72,** 95.
1890,	2,000,	**91,** 699.
1892,	2,500,	**92,** 604.
1894,	2,500,	**95,** 662.
Total,	30,000	

COMMERCE.

Important, **72,** 978; **74,** ii, 209, 215; **75,** ii, 276; **82,** 578.

CONTRACTS.

1895. Hartford Dredging Co., dr., 27.5¢ c. y. ($1,200), **95,** 663.

ENGINEERS.

Chief of Engineers. R., 72, 95; **73,** 86; **74,** 96; **75,** 106; **81,** 89; **82,** 89; **89,** 56; **90,** 50; **91,** 49; **92,** 53; **93,** 55; **94,** 51; **95,** 56; **96,** 56; **97,** 68.

Boards. U. S. advisory council, 1872, cooperating with the H. commissioners of Mass., approv. plan of commissioners to reopen inlet. **R.** (extract), **74,** ii, 195. (Admiral C. H. Davis, U. S. N., and Profs. Benjamin Pierce and Henry Mitchell, U. S. C. S.)

In charge:
Lt. Col. G. Thom, 1872. **R., 72,** 955, 976.
Maj. G. K. Warren, 1872–82. **R., 73,** 949; **74,** ii, 182; **75,** ii, 268; (Lt. Col.) **82,** 566.
Maj. W. R. Livermore, 1888–92. **R., 90,** 585; **91,** 698.

[1] H. D. 60, 58th, 2d.
[2] Sur. of Edgartown H. and South Beach, May 10, 1872; est., $22,000; and Jan. 27, 1882; est., $39,050.—H. D. 421, 57th, 2d.

Capt. W. H. Bixby, 1892–95. **R., 92,** 602; **93,** 809; **94,** 576; **95,** 661.
Maj. D. W. Lockwood, 1896–97. **R., 96,** 629; **97,** 890.

Assistants:
S. Haagensen. **R., 72,** 979.
H. S. Van Ingen. **R., 74,** ii, 210; **75,** ii, 272.

ESTIMATES. (See Plans and Projects.)

By S. Haagensen, dr. straight chans., $17,897, $26,473, $45,000; dr. S-curved chan., $49,306, **72,** 981.
By Maj. Warren, break'r, js., sand catchers, dr., etc., $220,000, **74,** ii, 208.
By H. S. Van Ingen, js., $1,300; dr., $19,000 and $80,000, **75,** ii, 275.

OPERATIONS.

1872–74. 42,568 c. y. dr., **74,** ii, 212.
1891–92. 15,385 c. y. dr., **92,** 603.
1892–93. About 10,000 c. y. dr., **93,** 809.
1896–97. About 6,500 c. y. dr., **97,** 890.

PHYSICAL CHARACTERISTICS.

General, **72,** 980; **74,** ii, 203; **75,** ii, 274, 276, 277; **82,** 567; **90,** 586.
Effect of waves, **72,** 976, 977, 981; **74,** ii, 199, 200, 205, 212.
Discussion of tides, **74,** ii, 189, et seq.
Tidal curves, **74,** ii, 198; **75,** ii, 272.

PLANS. (See Estimates and Projects.)

By Prof. H. L. Whiting, to open chan. through Cotamy Beach, **74,** ii, 186.
By S. Haagensen, 4′ chan., w. of 100, 200, or 300′; dr. an S-curved chan. to 4′ x 300′, Cotamy B. to the ocean, **72,** 981.
By Maj. Warren, to open a chan. 4′ x 300′ at the e. end of the bay; protection of beach with js. 50′ x 50′ apart, and riprapping; break'r 20′ x 300′ on top; also for sand catchers, **74,** ii, 208.
By H. S. Van Ingen, dr. middle ground to 12′ or 18′; js. at Cape Poge and s. of Cape Poge Pond, **75,** ii, 275.
By Lt. Col. Warren, 1882, chan. through South Beach 6′ x 300′ m. l. w. and the protection of the chan. by a pile j. on the w. side of the chan.; est., $39,000, **82,** 578.
By Maj. Livermore, 1889, outer H. of Edgartown, ice breaker and break'r of riprap granite; est., $96,800, **90,** 588, 589.

PRIVATE (STATE) WORK.

Board of H. commissioners of Mass. referred to, **74,** ii, 184; **75,** ii, 269.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Thom, chan. 4′ x 150′; est., $22,000, **72,** 978. Failure of work, **74,** 97.
By Maj. Livermore, 1891, removal of a shoal called "Middle Ground" in the center of the H. to 10′ at m. l. w.; est., $4,500, **91,** 698; **92,** 603.
By Capt. Bixby, 1893–95, doing work with hired labor and U. S. plant, **93,** 809; for expend. of available funds, dr. to be done by contract, **95,** 662.

SURVEYS.

Included in Coast Sur., 1846–54–56 and 1871, **72,** 980; **74,** ii, 185.
By S. Haagensen. **R., 72,** 979.
By H. S. Van Ingen, 1874. **R., 75,** ii, 272. Comparison between surs. of 1846 and 1871, **74,** ii, 209; 1871 and 1874, **75,** ii, 273.
History of previous surs., **82,** 568.
Au. act Mar. 3, 1881; made by Lt. Col. Warren, **82,** 566, 574.
Au. act Aug. 11, 1888; made, 1889, by Maj. Livermore, **90,** 587.
Maps:
Vineyard and Nantucket Sounds, **74,** ii, 192.
Edgartown H., **75,** ii, 276.
Sketch of beach, **74,** ii, 204.
93, 810; **95,** 622.

C-31 NANTUCKET HARBOR, MASS.

APPROPRIATIONS.

1828,	$300.00,	act May 23 (sur.).
1829,	30,000.00,	act Mar. 2.
1831,	8,265.00,	act Mar. 2.
1832,	6,000.00,	act July 3.
1844,	1,269.75,	act June 15 (relief claims).
1880,	50,000.00,	**80,** 365.
1881,	25,000.00,	**81,** 541.
1882,	25,000.00,	**82,** 549.
1884,	10,000.00,	**84,** 596.
1886,	15,000.00,	**86,** 589.
1888,	20,000.00,	**88,** 487.
1890,	25,000.00,	**90,** 555.
1892,	25,000.00,	**92,** 602.
1894,	25,000.00,	**95,** 660.
1896,	20,000.00,	**96,** 628.
1899,	20,000.00,	**99,** 1108.
1902,	*15,000.00,	**02,** 892.
1905,	*71,826.75,	**06,** 898.
1907,	42,500.00,	**07,** 932.
1909,	*20,000.00,	**09,** 1007.
1910,	50,000.00,	**10,** 1126.
1911,	20,000.00,	**11,** 1197.
Total,	525,161.50	

COMMERCE.

Former importance of Nantucket as a mercantile port, **75,** ii, 375.
Importance as a H. of refuge, **75,** ii, 375, 381.
Petition of citizens relative to proposed imp., **75,** ii, 381.
In 1911, 36,630 t.; value, $1,283,173, **12,** 106.
Imp has had no effect on rates; H. used only to small extent as H. of refuge by small craft, **12,** 106, 107.

CONTRACTS.

1880. J. Scully, riprap granite, $1.87 t., **81,** 540.
1882. C. H. Edwards, riprap, $2.37 to $2.57 t., **83,** 469.
1885. C. H. Edwards, riprap granite, $1.96 t., **86,** 590.
1886. J. A. Bouker, riprap granite j. constr., **87,** 536.
1889. James Scully, riprap granite, $2.40 t., **89,** 610.
1894. S. & E. S. Belden, st., $1.85 and $2 s. t., **94,** 574.
1895. H. Toomey, st., $1.59 s. t. ($18,000), **95,** 660.
1896. S. & E. S. Belden, st., $1.93 and $2.47 s. t., **97,** 889.
1899. E. S. Belden, j. constr., st., $1.47 s. t., **99,** 1108.
1903. E. S. Belden & Sons, st. in place in j., $2.97 t., **03,** 791. Modified by supp. contract Nov. 23, 1903, $2.75 t., **04,** 906.
1904. E. S. Belden & Sons, st. in place in j., $2.75 t., **05,** 846.
1905. E. S. Belden & Sons, st. in place in j., $1.73 t.; Morris & Cummings Dredging Co., dr. about 50,000 c. y., 23.9¢ c. y., **05,** 846.
1907. E. S. Belden & Sons, st. in place in js., $1.69 and $2.39 t. (about $39,000), **07,** 933.
1911. Coastwise Dredging Co., dr. about 142,000 c. y., 19.9¢ c. y., **11,** 1197; and dr. about 111,000 c. y., 22.7¢ c. y., **12,** 1408.

ENGINEERS.

Chief of Engineers. R., 75, 111; **79,** 56; **80,** 72, 76; **81,** 78, 541; **82,** 78; **83,** 73; **84,** 79; **85,** 68, 579; **86,** 68; **87,** 32; **88,** 33; **89,** 45; **90,** 39; **91,** 48;

*Allotments.

92, 53; **93,** 54; **94,** 50; **95,** 56; **96,** 55; **97,** 67; **98,** 71; **99,** 82; **00,** 95; **01,** 161; **02,** 109; **03,** 89; **04,** 71; **05,** 75; **06,** 74; **07,** 75; **08,** 77; **09,** 79; **10,** 91; **11,** 92; **12,** 106.

Boards:

Convened, New York, Aug. 23, 1880, to consider proj. of Gen. Warren for imp. of Nantucket H. **R., 81,** 542. (Cols. Tower and Newton.)

Convened, New York, July 17, 1885, to report upon further prosecution of adopted proj. for imp. and upon location and plan for e. j. **R., 85,** 576. (Col. Duane and Lt. Col. Comstock.)

In charge:

Maj. J. G. Totten, 1827; **75,** ii, 376.

Lt. Prescott, 1828; **75,** ii, 376.

Maj. G. K. Warren, 1874–82. **R., 75,** ii, 374; **79,** 56; (Lt. Col.) **80,** 365, 423; **81,** 540; **82,** 548.

Maj. J. W. Barlow, 1882–83; **83,** 468.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 468; **84,** 593; **85,** 561, 564; **86,** 587.

Maj. W. R. Livermore, 1887–92. **R., 87,** 534; **88,** 486; **89,** 608; **90,** 554; **91,** 696.

Capt. W. H. Bixby, 1892–95. **R., 92,** 600; **93,** 806; **94,** 573; **95,** 658.

Maj. D. W. Lockwood, 1896–1900. **R., 96,** 626; **97,** 886; **98,** 898; **99,** 1106; **00,** 1236.

Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1112; **02,** 892.

Maj. C. E. Gillette, 1903. **R., 03,** 790.

Lt. Col. J. H. Willard, 1904–07. **R., 04,** 906; **05,** 844; **06,** 897; **07,** 931.

Maj. H. Taylor, 1908. **R., 08,** 971.

Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1007; **10,** 1125.

Col F. V. Abbot, 1911–. **R., 11,** 1197; **12,** 1407.

Assistants:

H. S. Van Ingen. **R., 75,** ii, 374.

Lt. R. P. Johnston, **01,** 160; **02,** 108.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Anderson, 1827 (**R.** of Maj. Totten), break'r, $898,393.14.

By H. S. Van Ingen, 1874, for the same, $3,622,553, **75,** ii, 376.

By Lt. Prescott, 1828, dr., $41,541.50.

By H. S. Van Ingen, 1874, for the same, $128,741, **75,** ii, 376.

By H. S. Van Ingen, dr., $80,395.15, **75,** ii, 377; opening a chan. through the Haulover, $95,000, **75,** ii, 378.

OPERATIONS.[1]

1880–81. 3,989 t. granite placed in j., making l. 850′, **81,** 540.

1881–82. 8,134 t. granite placed in j., making l. 1,650′; 6 spurs built on Coatue Pt., **82,** 548, 549.

1882–83. 9,223 t. st. placed in j., completing the work 2,894′, **83,** 469.

1883–84. 9,223 t. st. placed in j., completing the work 2,894′, **83,** 469; 7,713 t. st. delivered in j., extending the same 440′, **84,** 594.

1884–85. 4,986 t. granite riprap placed in j., **85,** 562.

1885–86. 2,000 t. st. placed in j., making l. 3,955′, **86,** 588.

1886–87. 250 t. st. placed in j., **87,** 535.

1887–88. 2,941 t. of st. placed in e. j., completing 385′ of the same and partially completing an additional 200′, **88,** 487.

1888–89. 673 t. st. placed in e. j., **89,** 609.

1889–90. 6,055 t. st. placed in e. j., **90,** 554.

1890–91. Extension of e. j. continued by hired labor, **91,** 697.

1891–92. 7,146 t. st. placed in e. j., **92,** 601.

1893–94. About 2,000 t. st. deposited in js., **94,** 574.

1894–95. About 10,000 t. st. deposited in e. j. **95,** 659.

1895–96. About 8,000 t. st. deposited in e. j. and necessary repairs made on account of storms, **96,** 627.

1896–97. About 3,000 t. st. deposited in js. and used for repairs on account of storms, **97,** 888.

1897–98. About 10,000 t. st. deposited in w. j., **98,** 899.

1899–00. 11,703 t. st. placed in js., **00,** 1238.

1903–04. 2,653 t. st. deposited in gap in e. j., **04,** 906.

1904–05. 1,950 t. st. placed in e. j., completing contract; 7,039 c. y. dr.; 2,909 t. st. placed in e. j. extension, **05,** 844.

1905–06. 7,694 t. st. placed in extension of e. j.; 187,024 c. y. dr., **06,** 897.

1906–07. 5,280 t. st. placed in extension of e. j. under contract; 1,356 t. st. placed in j. across Coatue Flats, **07,** 931.

1907–08. 6,528 t. st. placed in j. extension, and 6,451 t. in bldg. up j. across Coatue Flats, **08,** 972.

1909–10. U. S. dr. Gedney removed 32,874 c. y. sand in mainten. dr. on outside of outer bar of entrance chan., **10,** 1125.

1910–11. Dr. work under contract begun May 8, 1911, and 110,841 c. y. removed; work done by suction dr. of light draft, **11,** 1197.

1911–12. Total of 207,004 c. y. dr. under contract between j.; chan. 17′ d. and 100′ w., **12,** 1407. 92,538 c. y. removed from either side of 17′ chan., making d. of 15′, **12,** 1408.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 376.

Character of beach, **75,** ii, 375.

Movements of tidal currents, **75,** ii, 375, 379, 380.

Comparison between Edgartown and Nantucket Hs., **75,** ii, 378, 379.

Description of, **01,** 161, 1112; **08,** 77; **12,** 106.

Shoaling of passage through breach known as the Haulover, **07,** 931.

Depth of chan. on outer bar from 17′ to 20′; shoaling left these depths 15′ to 18′, **12,** 107.

Shoalest part of locality under imp., 12.8′, m. l. t., **12,** 107.

Rise and fall of tide is 3′, **12,** 107.

Length of chan. between inside and outside 12′ contours, 1.32 m., **12,** 107.

H. only one between Hs. of Marthas Vineyard (32 m.) and Provincetown (80 m.), except Hyannis, a small H. on n. side of Nantucket Sound. Never used to great extent as H. of refuge. Incidentally, H. is C. H. of Nantucket Isld., **12,** 106.

PLANS. (See Estimates and Projects.)

By Lt. Col. Anderson, 1827, break'r in 7 fathoms of water, to contain 1,317,292 t. of st., in the bight s. of Great Pt., and connected with the shore by scattering ps., allowing the passage of littoral sands and the entrance of light-draft vessels, but yet breaking the force of any seas from the sw., **75,** ii, 376.

By H. S. Van Ingen, dr. chan. through the bars at the entrance of the H. to 12′, **75,** ii, 377; for opening a chan. through the Haulover to Nantucket, **75,** ii, 378.

By Lt. Col. Warren, 1880, experimental chan. through Haulover Beach 2′ x 10′, est. $1,200; for chan. 6′ x 100′, est. $32,000, **80,** 436.

By Lt. Col. Elliot, 1885, location of e. j., **85,** 564–576.

Plan submitted to BE., 1885. **R., 85,** 576–579.

PRIVATE (CORPORATE) WORK.

Boston H. commissioners referred to, **75,** ii, 377.

PROJECTS. (See Estimates and Plans.)

Between 1828 and 1832 $44,265 app., expend. in ineffectual dr., **75,** ii, 376; **80,** 435.

In 1880 Lt. Col. Warren proposed H. of refuge by the extension of a w. j. of random st. about 4,000′ l. from near Bug Light on Brant Pt. Should a second or e. j. be required, it should extend from Coatue Beach. Est. cost of w. j., $112,000; for both js., $224,000. Est., BE., $238,000, **80,** 423; **81,** 543; **82,** 549.

[1] Apps. of 1829, 1831, and 1832 expend. in ineffectual dr., **75,** ii, 376. History of previous plans and operations for H. imp., **80,** 435.

Recom. by BE., 1880, **81,** 542, 545. Concurred in by the Chief of Engineers, **81,** 542.

In 1885, the w. j. having been nearly completed to its proposed l., the question of the location of the e. j. was submitted to the BE., which recom. the curvature to the w. of the further extension of the w. j.; the constr. of the e. j. parallel to the w. j. at its outer end and distant about 1,000′ therefrom, thence connecting by a curve with the outer beach, recourse to be had to dr. where the scour did not result in a chan. d. of from 12′ to 15′; est. of proj. for 2 js., excl. of dr., $375,000, **85,** 564, 576, 579.

Amount app. 1880 to 1886, incl., $125,000; est. for completion of proj., $250,000, **86,** 69; **87,** 536; **92,** 600.

By Maj. Lockwood, 1899, expend. of available funds, **99,** 1107.

By au. Chief of Engineers $50,000 was allotted from funds au. act Mar. 3, 1905, for dr., **05,** 76; amount given as $100,000, **12,** 106; making total cost of proj. $375,000+$100,000, or $475,000, **12,** 106.

SURVEYS.

By Lt. Prescott, 1828, **75,** ii, 376.
Included in the Coast Surs., 1872–73, **75,** ii, 376.
By H. S. Van Ingen, 1874. **R.,** **75,** ii, 374.
Au. act Mar. 3, 1879; made, 1879, by Lt. Col. Warren, **79,** 56; **80,** 423.
Full sur. of outer H. made, 1882, **82,** 548.
Sur. of area e. of w. j. and within the H., **84,** 594.
Minor sur. of j. chan., **09,** 1007.

Maps:
80, 423, 427; **85,** 576, 578; **93,** 806; **95,** 660; **96,** 628; **03,** 790.

C-32 NANTUCKET, MASS. (Bar at entrance to harbor.)

SURVEY.

R., Jan. 13, 1829; est., $41,541.50. (H. D. 482, 55th, 2d.)

C-33 NANTUCKET, MASS. (Breakwater at Great Point.)

SURVEYS.

Rs.: 1826; Mar. 24, 1827; est., $250,000 and $898,393.14. (H. D. 482, 55th, 2d.)

C-34 BUZZARDS BAY, MASS. (Removing Weepecket Rock.)

APPROPRIATIONS.

1905, $2,500, **05,** 851.

COMMERCE.

All C. passing through strait at Woods Hole benefited by r. removal, **06,** 79.

CONTRACTS.

1905. Chas. E. Davis, removal of Weepecket Rock, $1,380, **05,** 851.

ENGINEERS.

Chief of Engineers. **R.,** **04,** 87; **05,** 80; **06,** 79.
BERH. reviews Capt. Gillette's **R.** and indorses recom. for removal of r.; est., $2,500, **04,** 947, 948.

In charge:
Maj. Geo. W. Goethals, 1904. **R.,** **04,** 946.
Capt. Cassius E. Gillette, 1904. **R.,** **04,** 948.
Lt. Col. J. H. Willard, 1905–06. **R.,** **05,** 850; **06,** 902.

OPERATIONS.

1904–05. Drilling r., preparatory to blasting, commenced, **05,** 850.
1905–06. Removal of r. completed, finishing proj. (about 40 t. removed), **06,** 902.

PHYSICAL CHARACTERISTICS.

Weepecket Rock off Uncatena Isld., and almost in direct line of travel, New Bedford to Woods Hole, **04,** 946.

PROJECT.

Act Mar. 3, 1905, au. removing Weepecket Rock to a d. of about 10′ (see Survey, 1903), **06,** 79.

SURVEY.

Ex. and sur. au. act June 13, 1902, of Weepecket Rock; **Rs.,** Maj. Goethals, Jan. 16, 1903, and Capt. Gillette, Aug. 13, 1903; est., $2,500,[1] **04,** 945.

C-40 ONSET HARBOR, MASS.

COMMERCE.

Imports, 1894, 1,000 t. of coal; exports, 6,000 t. of fire sand. Over 10,000 persons conveyed to the place by SS., 1894, to attend the an. camp meeting held there. **95,** 738.
Amount and description, **04,** 943.

ENGINEERS.

Chief of Engineers. **R.,** **95,** 72; **04,** 87, 943.
Boards. BERH. **R.,** **04,** 945.
In charge:
Capt. W. H. Bixby, 1894–95. **R.,** **95,** 737.
Maj. G. W. Goethals, 1904. **R.,** **04,** 943.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 738; **04,** 943.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** unfav.), **95,** 737.
Pre. ex. au. act June 13, 1902. **R.** by Maj. Goethals,[2] (unfav.), **04,** 943.

[1] H. D. 164, 58th, 2d.

[2] H. D. 75, 58th, 2d.

C-43 WAREHAM HARBOR, MASS.

APPROPRIATIONS.

1872,	$10,000,	**72,** 94.
1873,	10,000,	**73,** 87.
1874,	10,000,	**74,** 97.
1875,	10,000,	**75,** 107.
1881,	10,000,	**81,** 550.
1882,	5,000,	**82,** 554.
1884,	10,000,	**84,** 602.
1886,	15,000,	**86,** 594.
1888,	4,000,	**88,** 491.
1890,	5,000,	**90,** 560.
1892,	7,236,	**92,** 608.
Total,	96,236	

COMMERCE.

C. importance of Wareham, **72,** 94, 794; **74,** ii, 218; **79,** 302.

CONTRACTS.

1872. M. F. Brainard, dr. 23,877 c. y., 34½¢, **73,** 951; **74,** ii, 219.
1873. M. F. Brainard, dr. 22,886 c. y., 36¾¢, **73,** 951; **74,** ii, 219.
1874. S. F. Shelbourne, dr. 43,514 c. y., 20¢, **75,** ii, 277.
1875. Curtis, Fobes & Co., dr. 33,397 c. y., 20¢, **75,** ii, 278; **77,** 195.
1881. J. McDermott, dr., 24½¢ c. y., **81,** 549.
1884. Atlantic Dredging Co., dr., 16.9¢ c. y., **85,** 586.
1886. F. Pidgeon, dr., 14¢ c. y., **87,** 543.
1891. J. H. Fenner, dr., 20¢ c. y., **91,** 703.

ENGINEERS.

Chief of Engineers. R., 71, 96; **72,** 94; **73,** 87; **74,** 97; **75,** 107; **76,** 48; **77,** 42; **78,** 46; **79,** 53; **80,** 73, 76; **81,** 79, 89; **82,** 80; **83,** 76; **84,** 82; **85,** 70; **86,** 70; **87,** 34; **88,** 35; **89,** 46; **90,** 40; **91,** 50; **92,** 54; **93,** 56; **94,** 52; **95,** 58; **96,** 58, 70.

In charge:
Lt. Col. G. Thom, 1871–72. **R., 72,** 953, 973.
Maj. G. K. Warren, 1872–82; **72,** 954. **R., 73,** 950; **74,** ii, 216; **75,** ii, 277; **76,** 203; **77,** 194; **78,** 226; **79,** 300; (Lt. Col.) **80,** 371; **81,** 549, 550; **82,** 553.
Maj. J. W. Barlow, 1882; **83,** 475.
Maj. F. Harwood, 1883; **83,** 475.
Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 475; **84,** 600; **85,** 585; **86,** 593.
Maj. W. R. Livermore, 1887–92. **R., 87,** 540; **88,** 489; **89,** 612; **90,** 558; **91,** 701.
Capt. W. H. Bixby, 1892–95. **R., 92,** 607; **93,** 813; **94,** 580; **95,** 667.
Maj. D. W. Lockwood, 1896. **R., 96,** 636, 669.

Assistants:
S. Haagensen. **R., 72,** 974.
H. S. Van Ingen, **73,** 952. **R., 74,** ii, 218.
J. P. Cotton. **R., 81,** 550.

OPERATIONS.

1873–74. 46,763 c. y. dr.; 28 t. r. removed, **74,** ii, 216, 219.
1874–75. 43,514 c. y. dr., **75,** ii, 277.
1875–77. 33,397 c. y. dr., **77,** 197.
1877–79. Brush sand fence constr., **79,** 301.
1881–82. 28,383 c. y. dr. from chan., **82,** 553.
1882–83. 1,100 l. f. brush and st. wall built across w. end of beach; 1,864 l. f. catch-sand fence built, **83,** 475.
1883–84. 1,143 l. f. brush and st. wall built; repairs made to wall already built, **84,** 602.
1884–85. 3,235 c. y. dr. from chan., **85,** 586.
1885–86. 43,444 c. y. dr. from chan., **86,** 594.
1886–87. 25,448 c. y. dr. from chan., **87,** 541.
1887–88. 10,680 c. y. dr., **88,** 490.
1889–90. S. half of "Reach No. 8" dr. to 10′ x 175′ d.; "Middle Ground" removed, **90,** 559.
1891–92. 7,292 c. y. dr., **92,** 608.
1892–94. About 37,500 c. y. dr., **94,** 581.

PHYSICAL CHARACTERISTICS.

Presence of bars and sunken rs., **72,** 94, 975.
Tides and currents, **72,** 975; **76,** 48.
Formation of bars, **74,** ii, 219.
Site described, **79,** 300.
Description of, **81,** 551; **90,** 558; **96,** 670.

PROJECTS.

Proj. of 1871 proposed formation, by dr., of chan. 9′ l. w. across Quahaug Bar, the w. of chan. below Franconia Iron Works, and removal of ledge from the Weweanlight R. at its junction with Wareham R.; est., $45,000, **72,** 953.

By Lt. Col. Warren, 1880, imp. of H. by w. the chan. through the "upper bar" to 350′, with d. of 10′, w. and straightening chan. thence to Barneys Pt. to 10′ x 250′; also w. chan. at Quahaug Bar, and constr. of brush and st. barriers for preservation of Long Beach; est., $44,050, **81,** 553, 554; **87,** 541. Increased, 1887, by $12,186, **87,** 542; **92,** 607.

By Capt. Bixby, 1893, doing work by hired labor and U. S. plant, **93,** 814.

Maj. Lockwood est., 1895, it would cost $36,749.08 to complete existing proj., **96,** 671.

SURVEYS.

Included in Coast Sur., 1870, **72,** 974.
By S. Haagensen, 1871. **R., 72,** 974.
By H. S. Van Ingen, 1873, **74,** ii, 218.
By Maj. Warren, 1876–77, **77,** 195.
Au. act June 14, 1880; made, 1880, by Lt. Col. Warren, **81,** 550.
Resur. au. act Aug. 17, 1894; made by Maj. Lockwood, 1895 (see Projects), **96,** 670.
Maps. **84,** 602; **85,** 586; **93,** 814.

C-53 NEW BEDFORD (and Fairhaven) HARBORS, MASS.[1]

APPROPRIATIONS.

1836,	$10,000,	**75,** ii, 285.
1852,	[2] 3,000,	act Aug. 30.
1874,	[3] 500,	**75,** ii, 284.
1875,	10,000,	**75,** 107, ii, 286.
1876,	10,000,	**77,** 42.
1888,	10,000,	**88,** 36.
1890,	10,000,	**90,** 562.
1892,	7,500,	**92,** 611.
1894,	7,500,	**95,** 671.
1896,	10,000,	**96,** 638.
1899,	44,000,	**99,** 1115.
1902,	$37,700,	**02,** 896.
1905,	11,000,	**05,** 852.
1907,	100,000,	**07,** 937.
1908,	200,000,	**08,** 977.
1910,	50,000,	**10,** 1129.
1911,	50,000,	**11,** 1201.
1912	127,000 / 56,610	**12,** 1412.
Total,	754,810 (total, incl. misc., and less $500 allotted in 1874 for sur., $754,351.28, **12,** 1412).	

[1] Sur.—**R.** Nov. 1, 1853, est. $70,300. (H. D. 482, 55th, 2d.)
[2] Sur. of New Bedford H. and Taunton R.
[3] Allotment for sur.

COMMERCE.

Important, **75,** ii, 284, 285; **78,** 227.
New Bedford the principal whaling port of the world, **75,** ii, 285.
Growth of C. and increase in draft of SS. engaged, **88,** 513.
Description of, **93,** 867; **00,** 1296.
Effect of d. w. upon C. allows the use of deeper draft vessels, large cargoes, and a consequent possibility of reduction in rates, **05,** 81.
1900, 651,875 t., **01,** 1121; 1906, 899,632 t., **07,** 938; 1911, 1,563,908 t.; value, $40,275,611, **12,** 112.

CONTRACTS.

1875. Atlantic Dredging Co., dr., 17½¢ c. y., **75,** ii, 286.
1877. W. H. Molthrop, dr., 10¼¢ c. y., **77,** 197; **78,** 227.
1893. J. H. Fenner, dr., 16½¢ c. y. ($5,000), **93,** 817.
1895. Hartford Dredging Co., dr., 17¢ c. y. ($5,000), **95,** 671.
1896. Hartford Dredging Co., dr., 12.7¢ c. y. ($8,500), **97,** 899.
1899. Cole Bros., dr. draw chans., 17⅞¢ c. y.; Hartford Dredging Co., dr. anchorage area, 16¢ c. y., **99,** 1116.
1902. Charles M. Cole, dr., 19½¢ c. y., **03,** 795; **04,** 910.
1905. Charles M. Cole, dr. about 55,000 c. y. sand and 9.22 c. y. bowlders, 19¢ c. y., **05,** 851–52.
1907. Coastwise Dredging Co., dr. $270,000 worth, 12.7¢ c. y., **08,** 977.
1911. G. H. Breymann & Bro., dr., 11¾¢ c. y., and $5 for bowlders, **12,** 1412.

ENGINEERS.

Chief of Engineers. **R., 66,** 37; **75,** 107; **76,** 48; **77,** 42; **78,** 47; **79,** 53; **80,** 73; **87,** 43; **88,** 36, 44; **89,** 47; **90,** 41; **91,** 51; **92,** 55; **93,** 57, 71; **94,** 53; **95,** 59; **96,** 59, 71; **97,** 70, 80; **99,** 85, 97; **00,** 98, 111; **01,** 163; **02,** 112; **03,** 92; **04,** 74; **05,** 80; **06,** 79, 92; **07,** 79, 95; **08,** 81; **09,** 83; **10,** 94; **11,** 79; **12,** 110.

In charge:
Maj. G. K. Warren, 1874–80. **R., 75,** ii, 283; **76,** 204; **77,** 196; **78,** 226; **79,** 303; (Lt. Col.) **80,** 371.
Lt. Col. G. H. Elliot, 1886–89. **R., 88,** 513.
Maj. W. R. Livermore, 1887–92. **R., 88,** 514; **89,** 615; **90,** 560; **91,** 704.
Capt. W. H. Bixby, 1892–95. **R., 92,** 609; **93,** 815, 866; **94,** 582; **95,** 669.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 638, 672; **97,** 897, 930; **98,** 906; **99,** 1114; **00,** 1245, 1295, 1297.
Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1119; **02,** 896.
Capt. C. E. Gillette, 1903. **R., 03,** 794.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 911; **05,** 851; **06,** 903; **07,** 937.
Maj. H. Taylor, 1908. **R., 08,** 976.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1010; **10,** 1128.
Col. F. V. Abbot, 1911–. **R., 11,** 1200; **12,** 1412.

Assistants:
Lt. W. S. Rosecrans, **75,** ii, 284.
Capt. G. Dutton, **75,** ii, 284, 285.
H. A. Bentley, **78,** 227.

OBSTRUCTIONS.

Approaches to br., between New Bedford and Fairhaven, obstr. chan., **97,** 930.

OPERATIONS.

1836-40. Wreck removed, dr., **75,** ii, 285.
1874-75. Sur., **75,** 107.
1875-76. Chan. 105′ w. dr. from d. w. to New Bedford wharves to 15′ m. l. w., **76,** 48. 48,224 c. y. removed, **76,** 204; **77,** 196.
1877-78. Imp. completed by the formation of a chan. 300′ w., **78,** 47, 227; **79,** 303.
1889-90. 43,665 c. y. dr., **90,** 562.
1891-92. 28,720 c. y. dr., **92,** 610.
1893-94. About 31,500 c. y. dr., **94,** 583.
1895-96. About 31,000 c. y. dr., **96,** 639.
1896-97. About 70,000 c. y. dr., **97,** 898.
1899-00. 226,332 c. y. sand and mud and 11 c. y. bowlders removed, **00,** 1246.
1902-03. 45,124 c. y. dr. under contract, **03,** 795.
1903-04. 133,248 c. y. dr., completing contract and projs., **04,** 911.
1904-05. 54,446 c. y. sand and 9.22 c. y. bowlders excavated under contract; small r. area uncov. by dr., **05,** 851.
1905-06. Small area of r. just n. of Fish Isld., referred to in **R.** for 1905 as having been uncov. by dr., was blown off by dynamite to plane below required grade of bottom, **06,** 903.
1907-08. 1,195,913 c. y. mud, sand, and gravel, and 3.667 c. y. bowlders removed from H., **08,** 976.
1908-09. 880,746 c. y. mud, sand, and gravel, and 446.733 c. y. bowlders removed from H., **09,** 1010.
1909-10. 9,328 c. y. mud, sand, and gravel, and 65.430 c. y. bowlders removed, completing contract; area of ledge r. uncov. near n. end of Palmers Isld.; U. S. dr. *Gedney* worked on mainten. and removed 17,012 c. y. material from chan., **10,** 1128.
1911-12. 973,552 c. y. mud, clay, and sand dr., and 21.898 c. y. bowlders removed under continuing contract, **12,** 1412.

PHYSICAL CHARACTERISTICS.

Description of shoals, **75,** ii, 284; **78,** 226.
Tidal observations, **78,** 227.
Description of, **93,** 866; **97,** 930; **00,** 1296, 1297.
New Bedford H. an estuary of Buzzards B. at the mouth of the Acushnet R., the Fairhaven side of the H. being called Fairhaven H.; is the port of cities of New Bedford and Fairhaven, Mass., which are largely interested in the manuf. of cotton goods, **01,** 1120.
Mean rise of tide, 4.2′, **01,** 1120.
Chan. above drawbr. and chan. leading from anchorage area to drawbr. for w. of 200′ practically completed; one-half of anchorage area has d. of 25′ and chan. from Buzzards B. to anchorage area has been dr. 300′ w., **12,** 112.
Draft from Buzzards B. through H. to drawbr. 24.2′, m. l. t.; from br. through turning-basin, 25′; up Acushnet R. from 6′ to 15′ natural d. for about 2 m., **12,** 112.
Limiting d., 18′, at New Bedford and Fairhaven br. is due to a city water pipe crossing chan., **12,** 112.

PLANS.

1874. By Maj. Warren, to w. the draw spans and remove a portion of the wharves, **75,** ii, 284.

PRIVATE AND CORPORATE WORK.

Dr. by private parties, **75,** ii, 284; by Reading RR. Co., **78,** 227.

PROJECTS. (See Estimates.)

By Maj. Warren, 1874, dr. chan. 15′ d. m. l. w. and 200′ w., from Palmers Isld. to New Bedford wharves; est., $24,000, **75,** ii, 284. Modified to 300′ w., **78,** 227.
Orig. imp. of this H. completed in 1878; cost, $20,000, **78,** 227; **80,** 73.
In 1887 Maj. Livermore proposed further imp. of H. by excavation of a chan. 18′ x 200′ d. w. off Clarks Pt. to the wharves of New Bedford near the br.; est., $34,749, **88,** 514, 515; **92,** 610.
Maj. Lockwood est., 1895, $57,689.33 for further imp., **96,** 673.
Maj. Lockwood est., 1896, $34,000 to imp. chan. leading to proposed draw in br. between Fish and Popes Islds., **97,** 931.
Maj. Lockwood est., 1899, cost of further imp., $11,000, **1900,** 1298.
Act. Mar. 3, 1905, au. dr. chan. 18′ x 150′, along the city wharf from immediately above and below the New Bedford and Fairhaven br., and dr. to same d. a turning area connecting the chan. above the br. with chan. dr. in 1899, through the drawbr.; est., $11,000, **05,** 81.
Act Mar. 2, 1907, adopted proj. for dr. a chan. 25′ x 300′ w., m. l. w., Buzzards B. to n. end of Fish Isld. just above the New Bedford and Fairhaven br., New Bedford, 250′ w. through draw in New Bedford and Fairhaven br., a turning-basin

above br., and anchorage area of 114 acres, 25′ d., between Fairhaven and New Bedford; est., $527,000,[1] **07,** 80.

Act July 25, 1912, au. extension of chan. up the Acushnet R. 2.15 m., 18′ x 100′ at bottom, turning-basin 300′ w. at upper end; est., $56,610, and $3,000 an. mainten., conditional on local interests constr. new drawbr. at Coggeshall St., and building substantial wharf by city upon its property at Belleville,[2] **12,** 111.

SURVEYS.

By Lt. W. S. Rosecrans, 1852 (**R.** by Capt. G. Dutton in 1853, **77,** 196), **75,** ii, 284.

Au. and made, 1874, **75,** 107, ii, 284.

Au. act Aug. 5, 1886; made, 1887, by Maj. Livermore, **87,** 43; **88,** 514.

Ex. au. act July 13, 1892; made by Capt. Bixby, 1893 (**R.** fav.), **93,** 866.

Sur. with a view to larger anchorage area au. act Aug. 17, 1894; made by Maj. Lockwood in 1895 (see Projects), **96,** 672.

Sur. of chan. between New Bedford and the br. between it and Fairhaven, with a view to changing position of draw, au. act June 3, 1896; made by Maj. Lockwood, 1896 (see Projects), **97,** 930.

Ex. and sur. au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (**R.** fav.), **00,** 1296, 1297.

Pre. ex. au. act Mar. 3, 1905, of New Bedford and Fairhaven Hs., with view to additional anchorage grounds and increased d. **R.** by Lt. Col. J. H. Willard, Aug. 3, 1905, and May 18, 1906; est., $527,000,[1] **06,** 92; **07,** 94.

Minor sur. of ledge r. at junction of approach chan. with anchorage area near n. end of Palmers Isld. completed, showing existence of 2,429.4 c. y. r. above plane of bottom of anchorage area, **11,** 1200.

Pre. ex. with plan and est. of cost of imp., au. act June 25, 1910. **R.** by Col. Abbot, Dec. 28, 1910, and Apr. 21, 1911; est., $56,610, and $3,000 an. mainten.,[2] **12,** 111.

Maps.[2] **93,** 816; **95,** 670; **11,** 1201.
H. and Buzzards B., **03,** 794.

C-59 WESTPORT (Point) HARBOR, MASS.

APPROPRIATIONS.

1886,	$1,000,	**86,** 592.
1890,	1,000,	**91,** 707.
1892,	1,000,	**92,** 613.
Total,	3,000	

COMMERCE.

Entirely local, **1900,** 1300.

CONTRACTS.

1887. W. H. Motthorp & Co., js., **87,** 544.

ENGINEERS.

Chief of Engineers. R., 79, 56; **86,** 70; **87,** 35; **88,** 36; **89,** 55; **91,** 52; **92,** 56; **93,** 58; **99,** 97; **00,** 111.

In charge:
Maj. G. K. Warren, 1879. **R., 79,** 320.
Lt. Col. G. H. Elliot, 1886–87. **R., 86,** 592.
Maj. W. R. Livermore, 1887–92. **R., 87,** 543; **88,** 491; **89,** 645; **91,** 706.
Capt. W. H. Bixby, 1892–93. **R., 92,** 612; **93,** 818.
Maj. D. W. Lockwood, 1900. **R., 00,** 1298.

Assistant. J. P. Cotton, **79,** 320.

OPERATIONS.

1886–87. Constr. of js. commenced, **87,** 543.

1887–88. Imp. completed by constr. of a brush at Horse Neck Pt., **88,** 492.

1891–92. 230 t. st. used in reconstr. of Horse Neck Jetty, **92,** 612.

1892–93. 6,500 c. y. dr., **93,** 819.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 320; **00,** 1299.
Location, **88,** 491; **89,** 645.

PROJECTS.

By Maj. Warren, 1878, protection of Horse Neck Pt. from erosion by constr. of js. at that pt.; est., $1,000, **86,** 592; **87,** 543.

By Maj. Livermore, 1888, further imp. by extension of j. on Horse Neck Pt., and dr.; est., $2,000, **89,** 646; **91,** 706.

By Capt. Bixby, 1893, doing work by hired labor and U. S. plant, **93,** 818.

SURVEYS. (See Plans.)

Sur. au. act June 18, 1878; made, 1878, by Maj. Warren, **79,** 320.

Ex. of Westport H. and e. and w. branches of Westport R. au. act Aug. 11, 1888; made, 1888, by Maj. Livermore, **89,** 645.

Ex. Westport Pt. H. au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (**R.** unfav.), **00,** 1299.

Maps. **93,** 818.

C-62 CHURCHES COVE HARBOR, LITTLE COMPTON, R. I. (Breakwater).

APPROPRIATIONS.

1827,	$200,	Mar 2 (sur.).
1836,	10,000,	July 4.
1838,	18,000,	July 7.
Total,	28,200	

SURVEYS.

R., Feb. 9, 1828; est., $24,062.85. (H. D. 482, 55th, 2d.)

C-63 SAKONNET RIVER, R. I.

APPROPRIATIONS.

1896,	$20,000,	**96,** 644.
1899,	20,000,	**99,** 1121.
Total,	40,000	

COMMERCE.

Over 17,000 pass. carried an., **95,** 731.
In 1908, 74,323 t., **09,** 87.

CONTRACTS.

1905. C. M. Cole, dr. about 12,000 c. y., $1.87 c. y., **06,** 906.

ENGINEERS.

Chief of Engineers R., 95, 71; **96,** 61; **97,** 72; **98,** 76; **99,** 87; **00,** 100; **01,** 165; **02,** 113; **03,** 94; **04,** 76; **05,** 82; **06,** 81; **07,** 82; **08,** 84; **09,** 87.

[1] H. D. 271, 59th, 2d.

[2] H. D. 442, 62d, 2d.

In charge:
Capt. W. H. Bixby, 1894–95. **R., 95,** 729.
Maj. D. W. Lockwood 1896–1900. **R., 96,** 644; **97,** 904; **98,** 911; **99,** 1120; **00,** 1251.
Maj. G. W. Goethals, 1901–02. **R., 01,** 1124; **02,** 898.
Capt. C. E. Gillette, 1903. **R., 03,** 798.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 914; **05,** 855; **06,** 905; **07,** 940.
Maj. H. Taylor, 1908. **R., 08,** 981.
Lt. Col. J. C. Sanford, 1909. **R., 09,** 1014.

LEGISLATION.

State's permission to allow U. S. to w. and d. the draw opening in its br. such as to make it inoperative until the railroad-br. draw adjacent should be w. and d.; work of constr. a suitable draw in progress, **00,** 1251.

Approved proj., 1896, proposed to increase w. and d. of chan. through the draw opening of the R. I. State br. to 25′ x 100′. May 5, 1901, Sec. of War wrote the Governor of R. I. that under existing legislation it would not be possible to begin the work, as such work involves the total destruction of the br. and highway, while no provision is made for rebuilding them. No action taken by legislature, **01,** 1125.

R. I. Legislature passed bill granting U. S. unconditional right to proceed with the work au. by U. S., and a board of State commissioners commenced the reconstr. of approaches to the br., **05,** 83.

OBSTRUCTIONS. (See Projects.)

Bridges obstr. the R., **95,** 730.

OPERATIONS.

1905-06. 14,299.29 c. y., p. m., removed from causeway at Stonebridge; proj. completed, **06,** 905.

PRIVATE WORK.

N. Y., N. H. & H. RR. Co. completed new drawbr. and its approaches May 1, 1901, **01,** 1125.

PROJECTS.

By Capt. Bixby, 1895, opening in the State br. 25′ x 100′; est., $40,000, **95,** 737.

In 1897–98 the Sec. of War ordered the N. Y., N. H. & H. RR. to constr. a suitable draw in its br. across the R., **98,** 912.

SURVEYS.

Ex. at stone or State br. over the R. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** fav.), **95,** 730. (See Projects.)

C-64 SAKONNET POINT HARBOR, R. I. (Fishing Place Cove).

APPROPRIATIONS.

1899,	$25,000,	**99,** 1122.
1907,	10,000,	**07,** 938.
1909,	4,000,	**12,** 1414.
Total,	39,000	

COMMERCE.

Description of, **95,** 749; **97,** 935.

About 12,000 t. an.; SS. lines only means of communication; H. used by fishing boats, **01,** 1150.

CONTRACTS.

1899. E. S. Belden, break'r constr., $1.19 s. t., p. m., **99,** 1123.

1908. R. H. Beattie, removing r. No. 1 to 8′, m. l. w., $7,600, **08,** 979.

1910. E. S. Belden & Sons, 1,500 t. st., $1.63 t., and $6 per hour for lighter, **11,** 1203.

ENGINEERS.

Chief of Engineers. **R., 89,** 55; **95,** 72; **97,** 81; **99,** 88; **00,** 101; **01,** 166, 175, 1148; **07,** 81; **08,** 83; **09,** 85; **10,** 95; **11,** 99; **12,** 113.

In charge:
Maj. W. R. Livermore, 1888–89. **R., 89,** 649.
Capt. W. H. Bixby, 1891–95. **R., 95,** 749.
Maj. D. W. Lockwood, 1897–1901. **R., 97,** 934; **99,** 1122; **00,** 1252; **01,** 1148.
Maj. G. W. Goethals, 1901. **R., 01,** 1126, 1150.
Lt. Col. J. H. Willard, 1907. **R., 07,** 938.
Maj. H. Taylor, 1908. **R., 08,** 978.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1011; **10,** 1130.
Col. F. V. Abbot, 1911–. **R., 11,** 1202; **12,** 1413.

Assistant. Edward Parrish. **R., 01,** 1151.

OPERATIONS.

1899-1900. 16,745 t. st. placed in break'r, **1900,** 1253.

1900-01. 1,660 t. st. placed in break'r, completing the work, **01,** 1126.

1907-08. Drilling and blasting r. in progress, **08,** 978.

1908-09. Removal of r. completed, **09,** 1011.

1910-11. 1,502 t. st. placed in break'r, **11,** 1202.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 649; **95,** 749; **97,** 936.

Rocks (3) e. of SS. wharf are granite, and dangerous to SS., **01,** 1151.

PLANS.

By Maj. Livermore, 1888, restoration of existing break'r, and dr. an anchorage area inside the cove; est., $5,000, **89,** 649.

PROJECTS.

By Maj. Lockwood, 1897, to prolong a then existing old work out to the r. nearly n. of it, and to raise the whole to 8′ above m. l. w.; the w. on top to be 15′; the sea or weather slope to be 1 on 2, and the inner slope 1 on 1; est., $25,000, **97,** 936; **99,** 1122.

By Maj. Goethals, removal of the r. lying nearest the SS. landing to 8′, m. l. w., the other 2 not being considered obstr. to navigation; est., $10,000, **01,** 1150. Au. act Mar. 2, 1907,[1] **07,** 81.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Livermore, **89,** 649.

Ex. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** fav.), **95,** 749.

Sur. au. act June 3, 1896; made by Maj. Lockwood, 1897 (**R.** fav.), **97,** 935. (See Projects.)

Pre. ex. and sur. au. act June 6, 1900, to ascertain advisability and cost of removing rs. which obstr. navigation. **R.** by Maj. Lockwood, on ex., July 11, and Maj. Goethals, on sur., Nov. 19, 1900; est., $10,000,[1] **00,** 175, 1148.

Pre. ex. and sur. au. act June 25, 1910. **R.** by Lt. Col. Sanford, Dec. 24, 1910[2] (unfav.), **12,** 136.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 113.

[1] H. D. 99, 56th, 2d.

[2] H. D. 264, 62d, 2d.

C-65 NEWPORT HARBOR, R. I. (Spit at south end of island.)

ENGINEERS.

Chief of Engineers. **R., 91,** 62.
In charge. Maj. W. R. Livermore, 1890. **R., 91,** 736.

PLANS.

By Maj. Livermore, 1890, dr. shoal at the s. end of Goat Isld. to 15′ m. l. w.; est., $24,200, **91,** 736.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Livermore, **91,** 736.

C-66 COASTERS ISLAND HARBOR, R. I.

APPROPRIATIONS.

1890,	$5,500.00,	**91,** 719.
1900,	*4,661.87,	**04,** 923.
1902,	*8,338.13,	**04,** 923.
1909,	*150.00,	**10,** 1139.
Total,	18,650.00	(total, less $82 returned to Treas., $18,568, **11,** 1210).

CONTRACTS.

1904. J. S. Packard Dredging Co., dr., 21¢ c. y., **04,** 923.
1911. C. M. Cole, dr. 6,500 c. y., 25¼¢ c. y., **11,** 1211.

ENGINEERS.

Chief of Engineers. **R., 89,** 56; **90,** 51; **91,** 57; **92,** 60; **93,** 63; **04,** 81; **05,** 88; **10,** 103; **11,** 108.

In charge:
Maj. W. R. Livermore, 1888–92. **R., 90,** 590, 591; **91,** 718.
Capt. W. H. Bixby, 1892–93. **R., 92,** 624; **93,** 835.
Lt. Col. J. H. Willard, 1904–05. **R., 04,** 923; **05,** 862.
Lt. Col. J. C. Sanford, 1910. **R., 10,** 1138.
Col. F. V. Abbot, 1911–. **R., 11,** 1210.

OPERATIONS.

1890–91. 31,281 c. y. dr., **91,** 718.
1891–92. Work of cutting through the causeway and erecting brs. begun, **92,** 625.
1892–93. Proj. completed, **93,** 836.
1904–05. 56,658 c. y. dr. and 17.78 c. y. bowlders removed, **05,** 862.
1910–11. 11,321 c. y. dr. for the Navy Dept., **11,** 1210.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 835.
Isld. used by the Navy Dept. as a training station and site of the War College, **05,** 88.
Locality off Newport, R. I., **11,** 108.

PROJECT.

By Maj. Livermore, 1889, dr. the cove, and making 2 additional openings in the causeway, spanned by wooden brs.; est., $5,500, **90,** 591.
Allots. made, 1900, etc., to restore depths, etc., **04,** 81.
Sec. War decided, **R.** 1911, that Engr. Dept. should be reimbursed $2,923.02 by Navy Dept. for dr., **11,** 109.

SURVEY.

Sur. au. act Aug. 11, 1888; made, 1889, by Maj. Livermore, **90,** 591.
Maps. **93,** 836.

C-67 NEWPORT HARBOR, R. I.[1]

APPROPRIATIONS.

1873,	$8,500.00,	**73,** 88.
1874,	10,000.00,	**74,** 98.
1875,	10,000.00,	**75,** 108.
1881,	25,000.00,	**81,** 563.
1882,	20,000.00,	**82,** 561.
1884,	20,000.00,	**84,** 624.
1886,	15,000.00,	**86,** 608.
1888,	12,000.00,	**88,** 504.
1890,	12,500.00,	**90,** 574.
1892,	25,000.00,	**92,** 627.
1894,	7,500.00,	**95,** 685.
1896,	15,000.00,	**96,** 653.
1899,	15,000.00,	**99,** 1134.
1901–2,	*341.67,	**02,** 905.
1902,	39,000.00,	**02,** 905.
1905,	*10,000.00,	**06,** 911.
1907,	85,000.00,	**07,** 946.
1908,	112,100.00,	**08,** 988.
1909,	53,800.00,	**09,** 1018.
1910,	50,000.00,	**10,** 1139.
1911,	183,000.00,	**11,** 1211.
Total,	728,741.67	(total, incl. misc., and less amounts returned to Treas., $728,814.48, **12,** 1423).

COMMERCE.

Important, **73,** 964–966; **74,** ii, 226; **76,** 209; **77,** 200.
Large, increase in size and number of vessels using H., **01,** 171.
1900, 498,000 t., **01,** 171; in 1911, 247,697 t., and 497,758 t. passed through, using H. as H. of refuge; no known effect of imp. on rates, **12,** 126.

CONTRACTS.

1874. With E. R. Seward, dr. 43,303 c. y., 15¢, **75,** ii, 287, 288.
1875. William Flannery, dr. 58,928 c. y., 14¢, **75,** ii, 288.
1881. H. E. Du Bois, dr., 11¢ c. y., **81,** 562.
1882. E. M. Payn, dr., 19.9¢ c. y., **82,** 561. J. H. Fenner, dr., 24½¢ c. y., **83,** 493.
1884. Hardford Dredging Co., dr., 19¢ c. y., **85,** 604.
1886. Hartford Dredging Co., dr., 21⅞¢ c. y., **87,** 557.
1891. Hartford Dredging Co., dr., 20⅞¢ c. y., **91,** 721.
1893. C. W. Anthony, dr., 12.9¢ c. y. ($19,000), **93,** 838.
1895. J. S. Rogers, ledge removal, $10.57 c. y. ($5,000), **96,** 653.
1896. Hartford Dredging Co., dr., 37¢ c. y. ($13,000), **97,** 917.
1899. J. H. Fenner, dr., 11¢ c. y., **00,** 1268.
1903. Charles M. Cole, dr., 32¢ c. y., and removing large bowlders, $18 c. y., **03,** 806.
1906. Charles M. Cole, hire of dr. plant and outfit, $17 per hour, **06,** 912.
1907. International Contracting Co., dr. about 582,000 c. y., 22¢ c. y., **08,** 988.
1908. J. K. Sullivan, removal of ledge r. to 18′, m. l. w., $6,450, **08,** 988.

*Allotment.

[1] Sur.—**R.** Feb. 9, 1828; est., $13,669.12. (H. D. 482, 55th, 2d.)

1911. Daly & Hannan, removing 769,930 c. y. mud, etc., and 100 c. y. bowlders, 20¢ and $8 c. y., resp., **11,** 1211, 1212.

ENGINEERS.

Chief of Engineers. R., 72, 85; **73,** 87; **74,** 98; **75,** 108; **76,** 50; **77,** 44; **78,** 48; **81,** 84; **82,** 84; **83,** 81; **84,** 87; **85,** 75; **86,** 75; **87,** 38; **88,** 40; **89,** 51; **90,** 46; **91,** 57; **92,** 61; **93,** 64; **94,** 57; **95,** 64; **96,** 64; **97,** 76; **98,** 79; **99,** 91; **00,** 105; **01,** 170; **02,** 117; **03,** 98; **04,** 80, 87; **05,** 87; **06,** 86; **07,** 87, 94; **08,** 89; **09,** 92; **10,** 104, 113; **11,** 109; **12,** 124.

Boards. BERH. concurs in the recom. of Maj. Goethals, contained in **R.** of Apr. 28, 1903, **04,** 940.

In charge:

Maj. G. K. Warren, 1872–83. **R., 73,** 964; **74,** ii, 225; **75,** ii, 287; **76,** 208; **77,** 200; **78,** 241; (Lt. Col.) **81,** 562; **82,** 560.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 493; **84,** 623; **85,** 603; **86,** 606.

Maj. W. R. Livermore, 1887–92. **R., 87,** 554; **88,** 502; **89,** 628; **90,** 572; **91,** 719.

Capt. W. H. Bixby, 1892–95. **R., 92,** 625; **93,** 836; **94,** 593; **95,** 683.

Maj. D. W. Lockwood, 1896–1900. **R., 96,** 651; **97,** 915; **98,** 921; **99,** 1132; **00,** 1265.

Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1136; **02,** 904.

Capt. C. E. Gillette, 1903. **R., 03,** 805.

Lt. Col. J. H. Willard, 1904–07. **R., 04,** 921; **05,** 860; **06,** 911; **07,** 945.

Maj. H. Taylor, 1908. **R., 08,** 987.

Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1018; **10,** 1139.

Col. F. V. Abbot, 1911. **R., 11,** 1211; **12,** 1423.

Assistant. J. P. Cotton. **R., 73,** 965; **74,** ii, 226.

LEGISLATION.

R. I. au. from time to time encroachments upon navigable area of H. In 1899, a wharf was built under said au. extending out into H., in defiance of U. S. acts bearing on navigable waters, **01,** 1137.

OBSTRUCTIONS.

Wharf extending too far into H., built on au. of a State act, removed, **01,** 1137.

Report by New York, New Haven & Hartford RR. Co. that Fall River line SS. had been seriously injured by striking an obstr. in chan.; ex. made and ledge r. discovered, **04,** 921.

OPERATIONS.

1873–74. 11,530 c. y. dr. (j. 150′ long, built at Goat Isld.), **74,** ii, 226; **75,** ii, 289.

1874–75. 43,303 c. y. dr., **75,** ii, 288.

1875–76. 58,928 c. y. dr. (small bowlders removed), **76,** 208.

1876–77. Large bowlders removed, **77,** 44, 200.

1881–82. 115,697 c. y. dr. from anchorage area, **82,** 561.

1882–83. 130,395 c. y. dr. from below Long Wharf and from spit s. of Goat Isld., **83,** 493, 494.

1884–85. 62,634 c. y. dr. from various points in the chan., **85,** 604.

1885–86. 20,184 c. y. dr. from s. H. entrance, **86,** 607.

1886–87. 56,353 c. y. dr., **87,** 556.

1887–88. Excavation of 13′ anchorage area completed, **88,** 503.

1889–90. 39,601 c. y. dr., **90,** 574.

1890–91. 34,846 c. y. dr., **91,** 720.

1893–94. 152,340 c. y. dr.; 1,134 c. y. of bowlders removed, **94,** 594.

1894–95. 2,000 c. y. dr., **95,** 684.

1896–97. 194 c. y. of r. removed, **96,** 653.

1897–98. 38,715 c. y. dr.; 215 c. y. of r. removed, **97,** 916.

1899–00. 97,833 c. y. of gravel, clay, and mud; 14 c. y. of bowlders removed, **00,** 1267.

1901–02. 600 c. y. dr. from shoal off the end of SS. wharf; monuments placed to mark H. lines, **02,** 904.

1902–03. 90,445 c. y. dr., and 10.76 c. y. bowlders removed, **03,** 805.

1903–04. Contract for dr. shoal places and removing bowlders completed July, 1903; total amount of sand, clay, and mud removed, 95,069 c. y., at 32¢, and 13.87 c. y. bowlders at $10 c. y., and 7,414 c. y. at $18 c. y., completing proj.; work of removing r. ledges complained of in progress, **04,** 921.

1904–05. Removal of small ledge of r. in front of New York, New Haven & Hartford RR. Co.'s wharf completed, **05,** 860.

1905–06. 34,608 c. y. dr., working 557.62 hours, **06,** 911.

1907–08. 422,179 c. y. dr. and 67 c. y. bowlders removed, **08,** 987.

1908–09. 322,712 c. y. dr. and about 415 c. y. bowlders removed; removal of Nourmahal Rock in Brenton Cove completed, **09,** 1018.

1910–11. 4,069 c. y. dr., **11,** 1211.

1911–12. 72% of existing proj. completed; entire 18′ anchorage area completed June 26, 1912; final sur. and computation of quantity in progress, **12,** 1423.

PHYSICAL CHARACTERISTICS.

Tides, **73,** 965; **76,** 50.

Description of, **89,** 628; **01,** 170, 1136; **02,** 117; **03,** 98; **04,** 940; **12,** 124, 126.

At main entrance of Narragansett B.; is a distributing point of tows of barges for Narragansett B. and points farther e., **12,** 124.

PRIVATE (CORPORATE) WORK.

Commission appointed to establish a new p. line, **73,** 965, 966. $40,000 expended by citizens for imp., **73,** 966. Dr. done and wharves built by citizens, **74,** ii, 227; **75,** ii, 289.

PROJECTS.

By Lt. Col. Warren, 1873, and modified in 1882, imp. of the H. by dr. the s. entrance to 15′, m. l. w., and w. the same to a line drawn from the dolphin which marks the spit, clearing the permanent dock at Fort Adams by 100′; by excavation of a chan. 15′ x 750′ m. l. w. around and to the entrance of the buoy marking Goat Isld. Spit; by excavation of anchorage area to a m. l. w. d. of 13′; also for excavation of a 10′ chan. s. to a pt. opposite the Gas Co.'s wharf, and constr. of js. on w. shore of Goat Isld.; est., 1873, $72,000, **73,** 964; **82,** 561. Est. of revised proj., 1882, $132,000, **82,** 561; **85,** 603, 604; **86,** 606.

In 1890, after the app. of $133,000, it was est. that $27,500 would be required for completion of the proj., **90,** 575.

In 1892 proj. was extended to include the removal of the spit at the s. end of Goat Isld. to 15′; est., $24,200, increasing the total est. to $156,200, **92,** 627.

By Capt. Bixby, 1895, dr., and removal of Spindle Rock by contract, **95,** 684.

By Maj. Lockwood, 1899, d. a small area near the dolphin on Goat Isld., and extending the 10′ anchorage area, **99,** 1133.

Submitted by Maj. Goethals, for a chan. 18′ x 750′, m. l. w., from the 18′ contour of the outer H. around the s. and e. end of Goat Isld. to the 18′ contour at the n. end of break'r; est., $85,000, **04,** 941.

Act Mar. 2, 1907, au. dr. a chan. 18′ x 750′, m. l. w., around the s. end of Goat Isld. and n. through the H.;[1] extension of 13′ anchorage area s. to the H. line and shore to 18′, and removal of Nourmahal Rock; est., $250,900,[2] **07,** 88.

Act June 25, 1910, modified existing proj. so as to provide for an anchorage area 18′ d., m. l. w., to extend from chan. e. to the Newport H. line, limited on n. by city wharf, and e. and w. prolongations of line of its s. face, and on s. by line running in a general sw. direction from Perry Mill wharf; also by removal of portion of shoal around s. end of Goat Isld.; est., $233,000;[3] total est. of existing proj. as modified, $483,900, **10,** 105.

[1] H. D. 121, 58th, 2d. [2] H. D. 438, 59th, 2d. [3] H. D. 610, 61st, 2d.

SURVEYS.

Included in Coast Sur., 1871, **73,** 966.
By J. P. Cotton, 1872. **R.,** **73,** 965.
Sur. was made in 1897 by Maj. Lockwood for the estab. of H. lines in Newport H., **98,** 922.
Au. by act June 13, 1902, with view to securing 18′ through the chan. and its approaches, e. of Goat Isld. **R.** by Maj. Goethals (see Projects),[1] **04,** 940.
Pre. ex. and sur. au. act Mar. 3, 1905, with view to extending the space for light-draft anchorage in the s. part thereof (see Projects). **R.** by Lt. Col. Willard, Feb. 7 and Sept. 20, 1906; est., $165,900,[2] **07,** 94.
Borings made in s. part of H., **07,** 945.
Pre. ex. and sur. au. act Mar. 3, 1909, with view to modification and enlargement of existing proj. as indicated in plans B and C of H. D. 438, 59th Cong., 2d sess. **R.** by Lt. Col. Sanford, Apr. 17 and Dec. 18, 1909; est., $233,000,[3] **10,** 113.
Minor s. of ledge rock areas uncov. in dr. in s. part of H., **10,** 1139.
Ref. to ex. and sur., etc., **12,** 125.
Maps.[2 3] **84,** 624; **85,** 603; **93,** 838; **95,** 684; **03,** 806; **12,** 1423.

C-69 TAUNTON RIVER, MASS.[4]

APPROPRIATIONS.

1852 (see C-53).		
1870,	$10,000,	**70,** 79.
1871,	10,000,	**71,** 94.
1872,	10,000,	**72,** 95.
1873,	10,000,	**73,** 87.
1874,	10,000,	**74,** 98.
1874,[5]	250,	act June 23.
1875,	10,000,	**75,** 107.
1878,	2,000,	**78,** 47.
1879,	1,000,	**79,** 54.
1880,	17,500,	**80,** 377.
1881,	25,000,	**81,** 556.
1882,	25,000,	**82,** 555.
1884,	26,500,	**84,** 607.
1890,	7,000,	**90,** 564.
1892,	7,000,	**92,** 615.
1894,	5,000,	**95,** 673.
1896,	5,000,	**96,** 643.
1899,	7,000,	**99,** 1119.
1902,	5,000,	**02,** 898.
1905,	5,000,	**05,** 854.
1909,	*5,000,	**09,** 1013.
1910,	5,000,	**10,** 1132.
1911,	5,000,	**11,** 1204.
Total,	213,250	(total, less $250 allotd. for sur. in 1874, $213,000, **12,** 1415).

COMMERCE.

Important, **68,** 804; **79,** 305.
1911, 137,854 t., **12,** 115.

CONTRACTS.

1870. E. M. Payne, dr., $1.50 c. y., **71,** 891.
1871. E. R. Seward, dr., $5 c. y., **71,** 891. Staples & Phillips, dr., $3.45 c. y., **73,** 952.
1872. Staples & Phillips, removal of rs., $10 c. y., **73,** 958.
1873. E. R. Seward, dr., $2 c. y., **74,** ii, 220.
1874. E. R. Seward, dr., $1.25 c. y., **75,** ii, 280. W. Flannery, dr., 95¢ c. y., **75,** ii, 280. Staples & Phillips, removal of rs., $9 c. y., **75,** ii, 280.
1879. G. & H. Phillips, removal of bowlders, $4.75 c. y., **79,** 304.
1880. G. W. Townsend, removal of bowlders, **80,** 372. W. Flannery, dr., 47¢ c. y., **81,** 555.
1881. W. H. Beard, dr., 49⅞¢ c. y., **81,** 555.
1882. W. H. Beard, dr., 97¢ c. y. J. H. Fenner, dr., 35¢ c. y., **83,** 478.
1883. C. H. Edwards, r. removal, **84,** 606.
1884. J. H. Fenner, dr., **85,** 590.
1895. Columbia Dredging Co., dr., 81¢, $1, and $1.35 c. y. ($3,000), **95,** 675.
1896. Hartford Dredging Co., dr., $1.18 c. y., **97,** 903.
1899. Cole Bros., dr., 98¢ c. y., **99,** 1120.
1903. C. M. Cole, dr., 88¢ c. y., **03,** 797.
1908. J. S. Packard Dredging Co., dr., 64¢ c. y., **09,** 1013.

ENGINEERS.

Chief of Engineers. **R.,** **68,** 68; **70,** 79; **71,** 94; **72,** 95; **73,** 87; **74,** 97; **75,** 107; **76,** 48; **77,** 43; **78,** 47; **79,** 54; **80,** 73; **81,** 80; **82,** 80; **83,** 77; **84,** 83; **85,** 71; **86,** 72; **87,** 35, 43; **88,** 37, 44; **89,** 47, 55; **90,** 42; **91,** 53; **92,** 57; **93,** 59; **94,** 54; **95,** 60; **96,** 60; **97,** 71; **98,** 75; **99,** 86; **00,** 99; **01,** 164; **02**[6] 113; **03,** 93; **04,** 75; **05,** 81; **06,** 80; **07,** 81; **08,** 83; **09,** 86; **10,** 96; **11,** 100; **12,** 115.

In charge:
Capt. J. A. Smith, 1868. **R.,** **68,** 804.
Col. H. W. Benham, 1870–71. **R.,** **70,** 467.
Lt. Col. J. G. Foster, 1871; **71,** 87.
Lt. Col. G. Thom, 1871–72. **R.,** **71,** 891; **72,** 954.
Maj. G. K. Warren, 1872–82. **R.,** **73,** 952; **74,** ii 220; **75,** ii, 279; **76,** 205; **77,** 197; **78,** 229; **79,** 303; (Lt. Col.) **80,** 371; **81,** 554.
Maj. J. W. Barlow, 1882. **R.,** **82,** 554.
Lt. Col. G. H. Elliot, 1882–89. **R.,** **83,** 477; **84,** 604; **85,** 588; **86,** 595; **88,** 515.
Maj. W. R. Livermore, 1887–92. **R.,** **87,** 544; **88,** 492, 517; **89,** 618, 647; **90,** 563; **91,** 707.
Capt. W. H. Bixby, 1892–95. **R.,** **92,** 613; **93,** 822; **94,** 586; **95,** 674.
Maj. D. W. Lockwood, 1896–1900. **R.,** **96,** 642; **97,** 901; **98,** 910; **99,** 1118; **00,** 1248.
Maj. G. W. Goethals, 1901–02. **R.,** **01,** 1122; **02,** 897.
Capt. C. E. Gillette, 1903. **R.,** **03,** 796.
Lt. Col. J. H. Willard, 1904–07. **R.,** **04,** 913; **05,** 853; **06,** 904; **07,** 939.
Maj. H. Taylor, 1908. **R.,** **08,** 980.
Lt. Col. J. C. Sanford, 1909–10. **R.,** **09,** 1012; **10,** 1132.
Col. F. V. Abbot, 1911–. **R.,** **11,** 1204; **12,** 1415.

Assistants:
H. S. Van Ingen. **R.,** **73,** 954; **74,** ii, 221.
J. P. Cotton. **R.,** **80,** 373.
E. Parrish. **R.,** **93,** 825.

OPERATIONS.[6]

1871–72. Completion of chan. at the "Needles," 26.45 c. y. r. removed, **72,** 954, 956.
1872–73. Chan. through Burts Shoal 5′ x 60′ x 73′, 200 c. y. dr.; chan. through Ponds Rock Shoal 4.5′–5′ x 60′ x 590′, 2,104 c. y. dr., **73,** 953, 956.
1873–74. Chan. through Blakes Table Rock, Sheep Pen Shoals, and Chabbot Rock Shoal, 224.5 c. y. r. removed and 3,443 c. y. dr., **74,** 97, ii, 221.
1874–75. Continuation of above work, 1,925 c. y. r. removed and 6,319.2 c. y. dr., **75,** ii, 280.
1875–76. Rock removed between Weir and lower part of "Needles;" chans. dr. through Cobbs Shoal and Johns Rock Shoal; upper part completed, 204.95 c. y. r. removed and 3,940.6 c. y. dr., **76,** 205.
1876–77. The "Nook" and Peters Point, 93 c. y. r. removed, **77,** 43, 197.
1878–79. Bowlders removed, 232.4 c. y. r. removed, **79,** 54, 304.
1879–80. 190 c. y. r. and bowlders removed from upper R., **80,** 372.
1880–81. 12,190 c. y. dr. from the chan., **81,** 555.

*Allotment.
[1] H. D. 121, 58th, 2d.
[2] H. D. 438, 59th, 2d.
[3] H. D. 610, 61st, 2d.
[4] Sur.—**R.,** Dec. 7, 1853; est., $20,000. (H. D. 482, 55th, 2d.)
[5] Survey.
[6] Previous to 1871, **68,** 805; **73,** 954; **74,** ii, 221; **75,** ii, 281; **78,** 229.

1881-82. 12,268 c. y. dr., **82,** 554.
1882-83. 5,672 c. y. dr., **83,** 478.
1883-84. 27,170 c. y. dr. and 715 c. y. r. removed, **84,** 605, 606.
1884-85. 4,811 c. y. dr. and 100 c. y. bowlders and r. removed, **85,** 590.
1885-86. Dr. and r. removal continued, **86,** 596.
1886-87. Dr. and r. removal combined, **87,** 545.
1887-88. Chan. completed as proj., **88,** 493.
1890-91. Dr. by hired labor, **91,** 708.
1891-92. 2,650 c. y. dr., **92,** 615.
1892-93. About 5,000 c. y. dr. and 174 t. bowlders removed, **93,** 823.
1895-96. 3,943 c. y. dr., **96,** 643.
1896-97. 3,355 c. y. dr., **97,** 902.
1899-00. 5,165 c. y. sand and some bowlders removed, **00,** 1249.
1902-03. Shoals dr. at Dighton Wharf and below Wickamount, **03,** 796.
1903-04. Dr. of shoals completed, a total of 5,112 c. y. removed, **04,** 913.
1908-09. 4,270 c. y. dr. and bowlders removed, **09,** 1012.

PHYSICAL CHARACTERISTICS.

Described, **68,** 805; **71,** 891; **73,** 954–958; **74,** ii, 222–224; **78,** 229.
Tidal observations, **73,** 956, 959–963; **88,** 515, 516.
Shoaling, **11,** 1204.

PLAN. (See Projects.)

By Capt. Dutton, 1853, imp. of R. by chan. 4′ x 60′ from Dighton to Weir; est., $20,000, **73,** 954.

PROJECTS. (See Plan.)

By Capt. Smith, 1868, chan. 4′ x 60′ below l. w. mark, from Dighton to Taunton, by dr. bars and removing bowlders; est., $26,000, **68,** 805, 806.
Proj. of 1871 proposed chan. by dr. 9′ d. h. w. through shoals between Dighton and Weir Village; est., $54,400, **71,** 94, 891.
Proj. for this imp. in 1880 had as its object a navigable d. at h. w. of 11′ and a w. of 60′ from Weir Br. to Shipyard, 11′ x 80′ to the Needles; thence to Berkley Br. same w. and 12′ d., and from Berkley Br. to Dighton 12′ x 100′; est., $94,000, **80,** 376; **86,** 595.
In 1888 Maj. Livermore proposed continuation of imp. by w. the 80′ chan. to its full dimensions where too narrow; removal of bowlders obstr. chan. between Berkley Br. and Taunton; also removal of ledge r. in the chan. below Peters Pt.; est., $14,051, **88,** 518.
This additional proj. increased the total est. to $108,000 in 1889, **89,** 619; **92,** 614.
Est. of imp. increased to $125,000 in 1893, **93,** 825.
By Capt. Bixby, 1893, doing all work by hired labor and U. S. plant, **93,** 823.
By Capt. Bixby, 1895, dr. by contract, **95,** 672.
By Maj. Lockwood, 1899, expend. of available unds, **99,** 1119.

SURVEYS.

By Lt. W. S. Rosecrans, 1852, **68,** 805; **71,** 891.
By H. S. Van Ingen, 1872, **73,** 955.
By H. S. Van Ingen, 1873, Taunton to Dighton, **74,** ii, 222.
Au. act Aug. 5, 1886; made, 1887, by Maj. Livermore (see Projects), **87,** 43; **88,** 517; **89,** 647.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 114.
Maps. **84,** 606; **93,** 824; **95,** 674; **03,** 796.

C-70 FALL RIVER HARBOR (Mount Hope Bay), MASS.

APPROPRIATIONS.

1874,	$10,000,	**74,** 98.
1875,	10,000,	**75,** 107.
1876,	10,000,	**76,** 49.
1899,	20,000,	**99,** 1131.
1902,	38,000,	**02,** 903.
1903,	117,412,	**03,** 804.
1909	*500 / *20,000	**10,** 1133.
1910,	143,000,	**10,** 1133.

Total, 368,912 (total, incl. sales, $368,930.35; "unexpended balance of 51¢ returned to U. S. Treasury"; **12,** 1416.)

COMMERCE.

Important, **74,** ii, 286.
C. importance of Fall R., **78,** 227.
Description of, **95,** 728.
Large; no effect on freight rates, **10,** 98.
City of Fall R. is largest cotton manuf. city in US., **12,** 115.
1911, 1,389,000± t., **12,** 116.

CONTRACTS.

1874. Morris & Cummings,[1] r. removal, **75,** ii, 282.
1875. Curtis, Fobes & Co., dr. 21,222 c. y., **75,** ii, 283.
1877. J. H. Fenner, dr. 12,857 c. y., r. removal, **77,** 198.
1899. P. Sanford Ross, Inc., dr., 9¢ c. y., **99,** 1132.
1902. J. S. Packard Dredging Co., dr., 13.1¢ c. y., **03,** 804.

ENGINEERS.

Chief of Engineers. **R., 73,** 93; **74,** 98, 103; **75,** 107; **76,** 49; **77,** 43; **78,** 47; **95,** 71; **97,** 81; **9,** 991; **00,** 104; **01,** 169; **02,** 116; **03,** 97; **04,** 79; **05,** 86; **06,** 85; **07,** 86; **08,** 89; **10,** 97, 113; **11,** 101; **12,** 115.

In charge:
Maj. G. K. Warren, 1873–78. **R., 74,** ii, 225, 284; **75,** ii, 282; **76,** 206; **77,** 198; **78,** 227.
Capt. W. H. Bixby, 1895. **R., 95,** 727.
Maj. D. W. Lockwood, 1896–. **R., 97,** 931; **99,** 1130; **00,** 1263.
Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1134; **02,** 903.
Capt. C. E. Gillette, 1903. **R., 03,** 803.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 919; **05,** 859; **06,** 910; **07,** 944.
Maj. Harry Taylor, 1908. **R., 08,** 986.
Lt. Col. J. C. Sanford, 1910. **R., 10,** 1133.
Col. F. V. Abbot, 1911–. **R., 11,** 1205; **12,** 1416.

Assistants:
J. P. Cotton. **R., 74,** ii, 284.
H. A. Bentley, **78,** 228.
E. Parrish. **R., 97,** 934.

OPERATIONS.

1874-75. 1,047¾ t. large bowlders, 364 t. small bowlders and gravel excavated, **75,** 107, ii, 282.
1875-76. 136.53 c. y. bowlders, 21,222.19 c. y. fine material excavated, **76,** 206.
1877-78. 12,857 c. y. dr., **78,** 47. Imp. completed at a cost less than the orig. est., **78,** 228.
1899-00. 193,579 c. y. mud and sand removed, **00,** 1264.
1902-03. 293,235 c. y. dr., **03,** 804.
1903-04. 654,998 c. y. dr., **04,** 919.
1904-05. 143,229 c. y. dr., **05,** 859.
1909-10. 86,046 c. y. dr., **10,** 1133.
1910-11. 36,951 c. y. dr. for mainten., and 236,187 c. y. for imp. work by US. dr., **11,** 1205.
1911-12. 240,668 c. y. dr. for imp. **12,** 1416.

PHYSICAL CHARACTERISTICS.

Obstructions: Bowlders and bars, **74,** ii, 285.
Tides, **74,** ii, 285; **78,** 228.
Description of, **95,** 728; **10,** 97.
Water d., tides, etc., **12,** 116.
At mouth of Taunton R. in ne. angle of Mt. Hope B., which empties into Atlantic through Narra-

*Allotment.

[1] Contract abandoned, **75,** ii, 282.

gansett B. and Sakonnet R.; about 2 m. long x ½ m. to 1 m.; about 23 m. to se. from Providence, and 18 m. n. from Newport H., **12,** 115.

PROJECTS.

By Maj. Warren, removal of bowlders; for dr. chan. 50′ from the wharves to 12′ x 100′; also for placing dolphins to mark chan.; est., $45,000, **74,** ii, 284. Proj. completed; cost, $30,000, **78,** 228.

By Maj. Lockwood, 1897, chan. 25′ x 300′ m. l. t., along the city front between the Old Colony wharf and d. w. at upper end of city front; est., $58,060.47, **99,** 1131.

Enlarged by act of 1902 to include chan. 25′ x 300′, city front through Mt. Hope B. to Narragansett B.; est., $175,411.94, **02,** 117.

By Lt. Col. Sanford, anchorage area 25′; est., $143,000, and $6,000 an. mainten.;[1] au. act June 25, 1910, **10,** 98, 113.

SURVEYS.

1873. By J. P. Cotton. **R., 74,** ii, 284.

Ex. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** fav.), **95,** 727.

Sur. au. act June 3, 1896; made by Maj. Lockwood, 1897 (see Projects), **97,** 932.

H. line sur., 1899, made by Maj. Lockwood, **1900,** 1264.

Au. act Mar. 3, 1909; made, 1909, by Lt. Col. Sanford; est., $143,000,[1] **10,** 113.

Cong. docs., etc., relating to exs., surs., plans etc., **12,** 116.

Maps.[1] **03,** 804.

C-70(a) TAUNTON AND WEYMOUTH CANAL, MASS.[2]

C-71 ASSONET RIVER, MASS.

COMMERCE.

Description of, **00,** 1301.

ENGINEERS.

Chief of Engineers. R., 00, 111.

In charge. Maj. D. W. Lockwood, 1900. **R., 1900,** 1300.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1301.

SURVEYS.

Ex. au. act Mar. 3, 1899; made by Maj. Lock wood, 1899 (**R.** unfav.), **00,** 1301.

C-79 NARRAGANSETT BAY, R. I. (Ohio Reef in east passage of.)

ENGINEERS.

Chief of Engineers. R., 01, 175.

In charge:

Maj. D. W. Lockwood, **01,** 160.

Maj. G. W. Goethals, **01,** 160.

SURVEYS.

Pre. ex. and sur. au. act June 6, 1900, of Ohio Reef (Ledge) located in e. passage of Narragansett B., R. I., with view to its removal. **R.,** Maj. Lockwood, July 5, 1900, and Maj. Goethals, Dec. 8, 1900; est., $307,200,[3] **01,** 175.

C-80 WARREN RIVER, R. I.[4]

APPROPRIATION.

1886, $5,000, **86,** 605.

ENGINEERS.

Chief of Engineers. R., 85, 80; **86,** 75; **87,** 36; **88,** 38; **89,** 48; **90,** 43.

In charge:

Lt. Col. G. H. Elliot, 1884–87. **R., 85,** 625, 627; **86,** 605.

Maj. W. R. Livermore, 1887–91. **R., 87,** 547; **88,** 494; **89,** 620; **90,** 565.

Assistant. G. Alexander. **R., 85,** 629.

OPERATIONS.

1887–88. 811 t. of bowlders, ledge r., and gravel removed, completing proj., **88,** 495.

PHYSICAL CHARACTERISTICS.

Description, **86,** 605.

PROJECTS.

By Lt. Col. Elliot, 1885, removing Bushworth Rock and bowlders in narrow part of chan. below Little Isld.; est., $5,000, **85,** 628; **87,** 547.

SURVEY.

Au. act July 5, 1884; made, 1885, by Lt. Col. Elliot, **85,** 627.

Maps. **85,** 630.

C-81 PROVIDENCE RIVER, HARBOR, BULKHEAD ROCK, AND NARRAGANSETT BAY, R. I.

APPROPRIATIONS.

1852,	$1,500 (sur.), act Aug. 30.
1852,	[5] 5,000, act Aug. 30.
1867,	25,000, **70,** 449; **71,** 730.
1870	5,000, **70,** 75, 449; **71,** 83, 727, 733.
1870	[6] 2,500, **70,** 75, 449; **71,** 83, 727, 733.
1872,	$10,000, **72,** 81, 820.
1873,	10,000, **73,** 88, 969.
1878	50,000, **78,** 48, 232.
1878	[5] 5,000, **78,** 48, 232.
1879,	60,000, **79,** 54, 311.
1880,	60,000, **80,** 386.

[1] H. D. 778, 61st, 2d.

[2] Ex.—**R.** (fav.), Feb. 2, 1825. Sur. 1833, by Lt. Col. J. Anderson, T. E., but report not on record in office of Chief of Engineers. (H. D. 482, 55th, 2d.)

[3] H. D. 217, 56th, 2d.

[4] Sur.—**R.,** Feb. 15, 1827. Est., $3,953.25. (H. D. 482, 55th, 2d.)

[5] Removal of r. near mouth of Pawtucket R., R. I.

[6] Bulkhead Rock.

1881,	$60,000,	**81,** 559.
1882,	125,000,	**82,** 557.
1884,	85,000,	**84,** 620.
1886,	30,000,	**86,** 603.
1888,	40,000,	**88,** 499.
1890,	50,000,	**90,** 570.
1892,	50,000,	**92,** 620.
1894,	17,500,	**95,** 680.
1896,	25,000,	**96,** 648.
1897,	125,000,	**97,** 910.
1898,	125,000,	**98,** 917.
1899,	10,000,	**99,** 1126.
1900,	54,489	**00,** 1259.
1901,	59,000,	**01,** 1131.
1902	100,000 / 84,560	**02,** 901.
1905,	100,000,	**05,** 858.
1906,	305,000,	**06,** 908.
1907	90,750 / 102,778	**07,** 943.
1909,	*15,000,	**09,** 1017.
1910,	75,000,	**10,** 1137.
1911,	300,000,	**11,** 1208.
1912,	104,000,	**12,** 1421.

Total, 2,367,077 (total, incl. misc., $2,367,303.83, **12,** 1421).

COMMERCE.

Requirements of, **68,** 746; **78,** 237, 241.

1897, 2,000,000± t., **00,** 1308; 1900, 2,763,500 t. **01,** 168; 1905, 3,244,248 t., **06,** 84; 1911, 3,887, 858 t. **12,** 122, 1422.

Imp. great benefit to C., **01,** 168.

Diagram of t., valuation, freight, and apps., **12,** 1422.

So far as known, 1912, imp. has had no effect on rates, **12,** 122.

CONTRACTS.

1867. G. W. Townsend, removal of wreck, $2,000, **67,** 448, 453.

1870. T. J. Hill, dr., 25¢ c. y., **70,** 449, 453.

1873. S. F. Shelbourne, dr., 29¢ c. y., **73,** 968.

1878. E. R. Seward, dr., 11½¢ c. y. (annulled), **79,** 308, 309.

1879. Atlantic Dredging Co., dr., 16¢ c. y., **80,** 385. I. A. Sylvester, r. removal, **80,** 385.

1880. Atlantic Dredging Co., dr., 16¾¢ c. y., **81,** 557.

1881. Atlantic Dredging Co., dr., 17¢ and 19¢ c. y., **81,** 558.

1882. Atlantic Dredging Co., dr., 16¢ c. y., **83,** 484.

1884. Atlantic Dredging Co., dr., 12¢ c. y., **85,** 598.

1891. C. & H. E. Du Bois, dr., 9¢ c. y., **91,** 714.

1893. R. G. Packard, dr., 11.5¢ c. y. ($40,000), **93,** 832.

1895. R. G. & J. S. Packard, dr., 15¢ c. y. ($11,000), **95,** 681.

1897. P. S. Ross, dr. 1,222,000 c. y. under continuous contract, 8⅞¢, **97,** 910.

1899. Perkins & O'Brien, dr., 10.8¢ c. y., **99,** 1127.

1901. International Contracting Co., dr., 16.4¢ c. y., **01,** 1130.

1903. International Contracting Co., dr. anchorage area in Providence H., 12¼¢ c. y., **03,** 801.

1905. Columbia Dredging Co., dr., 8.45¢ c. y., **05,** 85, 857, 858.

1907. Columbia Dredging Co., dr. 30,000 c. y., 22¢ c. y. J. S. Packard Dredging Co., dr., 7.3¢ c. y., **08,** 985.

1909. J. S. Packard Dredging Co., dr., 18.44¢ c. y., **09,** 1017.

1911. Coastwise Dredging Co., dr. 1,698,240 c. y. mud, .0784¢, and 50 c. y. bowlders at $5 c. y. C. M. Cole, dr. 70,000 c. y. mud, 24.9¢ c. y., and 10 c. y. bowlders, $8 c. y., **11,** 1209. Daly & Hannan Dredging Co., dr. sec. A, 1,691,321 c. y., 8.7¢ c. y.; sec. B, 308,679 c. y., 22¢ c. y.; removing bowlders, $8 c. y.; removing lighthouse, $1,200, **12,** 1421.

DOCUMENTS. (Not printed in reports.)

R. Lt. Rosencrans, Capt. Dutton, and F. P. Webber, **71,** 728, 729; of Capt. Holgate, **71,** 733.

ENGINEERS.

Chief of Engineers. R., 66, 7; **67,** 45; **68,** 67; **69,** 58; **70,** 75; **71,** 83; **72,** 81, 85; **73,** 88; **74,** 99; **75,** 108; **76,** 49; **77,** 43; **78,** 48, 232; **79,** 54; **80,** 74; **81,** 82; **82,** 82; **83,** 79; **84,** 85; **85,** 73; **86,** 74; **87,** 37; **88,** 39; **89,** 49; **90,** 44; **91,** 54; **92,** 59; **93,** 61; **94,** 56; **95,** 62; **96,** 62; **97,** 74; **98,** 77; **99,** 89, 97; **00,** 102, 112; **01,** 167; **02,** 115; **03,** 95; **04,** 77; **05,** 84; **06,** 83; **07,** 84; **08,** 86; **09,** 90; **10,** 101, 112; **11,** 105; **12,** 120, 136.

Boards. Advisory council to the R. I. H. commissioners, appointed by the President of the U. S. in 1878; recom. dr. from the city to Fields Pt., 18′ x 725′ and 23′ x 150′; est., $428,571. **R., 78,** 234. (Rear Admiral Daniel Ammen, U. S. N., Prof. Henry Mitchell, U. S. C. S., and Maj. G. K. Warren.)

In charge:

Capt. G. Dutton, 1853; **71,** 728.

Col. J. D. Graham, 1865; **66,** 37.

Maj. D. C. Houston, 1867–70. **R., 67,** 448; **68,** 745; **69,** 408.

Maj. G. K. Warren, 1870–82. **R., 70,** 449, 450; (on Bulkhead Rock, **70,** 733); **71,** 727; **72,** 820; **73,** 968, 969; **74,** ii, 237; **75,** ii, 291; **76,** 207; **77,** 199; **78,** 231, 233; **79,** 306; (Lt. Col.) **80,** 383; **81,** 557; **82,** 555, 557.

Maj. J. W. Barlow, 1882; **83,** 483.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 483; **84,** 617; **85,** 596; **86,** 602.

Maj. W. R. Livermore, 1887–92. **R., 87,** 550; **88,** 498; **89,** 623; **90,** 568; **91,** 712.

Capt. W. H. Bixby, 1892–95. **R., 92,** 618; **93,** 830; **94,** 589; **95,** 679.

Maj. D. W. Lockwood, 1896–1900. **R., 96,** 647; 908; **98,** 915; **99,** 1125; **00,** 1257, 1307, 1309.

Maj. G. W. Goethals, 1901–02. **R., 01,** 1129; **02,** 900.

Capt. C. E. Gillette, 1903. **R., 03,** 801.

Lt. Col. J. H. Willard, 1904–07. **R., 04,** 917; **05,** 857; **06,** 908; **07,** 942.

Maj. H. Taylor, 1908. **R., 08,** 983.

Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1016; **10,** 1137.

Col. F. V. Abbot, 1911–. **R., 11,** 1208; **12,** 1420.

Assistants:

Capt. A. H. Holgate, **70,** 74, 450; **71,** 733.

N. E. Russell. **R., 71,** 730.

G. H. Mann, **71,** 733.

H. A. Bentley. **R., 73,** 970; **74,** ii, 238; **80,** 387.

ESTIMATES. (See Estimates and Projects.)

By Capt. Dutton, 1853, w. chan. 100′ to the westward, $7,800, **71,** 729.

By F. P. Webber, 1867, removal of r., $5,000, and dr. a 14′ chan. to Fox Pt. Wharf, $21,600, **71,** 729, 730.

By Maj. Houston, 1868, an. dr. below Fox Pt. Wharf, $10,000, **68,** 67, 746; **69,** 408; **70,** 449.

By Capt. Holgate, 1870, removal of Bulkhead Rock to 16′, $2,500, **70,** 450; **71,** 733.

By Maj. Warren, 1871, w. chan. in the R., $10,000 an., **71,** 730.

By Maj. Warren, 1873, removal of the pt. at Long Bed, by dr., $10,000, **73,** 970.

By Maj. Warren, 1875, removal of Bulkhead Rock to 18′, $5,000, **75,** ii, 291; **76,** 207; **77,** 199. In 1878 to 20′, $10,000, **78,** 232.

By Maj. Warren, 1878, 23′ chan. from Providence to the sea, $500,000, **78,** 48, 235; **79,** 54, 308.

By Maj. Warren, 1879, completion of existing proj., $390 000, **79,** 311.

OPERATIONS.[1]

1867. Removal of sunken wreck, 42,219 c. y. dr. at the "Crook," **67,** 45, 449.

1868. Chan. w. and d. at the "Crook" by dr.; d. of 12′ obtained, **68,** 745, 746.

1870. Dr. at the "Crook" to obtain 14′ chan., **70,** 449.

1871. Dr., extraction of piles, and removal of Bulkhead Rock to d. 14′, **71,** 727, 730, 733.

1872. Dr. chan. below Fox's Pt., to w., **73,** 968

*Allotment.

[1] History of early operations, **71,** 728; **79,** 307, 730, 734.

1873. Dr. to remove the pt. of Long Bed, **73,** 88, 969.

1874. Dr. completed, the remains of an old pile dolphin removed, **74,** 99, ii, 237.

1878-79. 72,314 c. y. dr., **79,** 309.

1879-80. 327,559 c. y. dr. from chan. through Pawtuxet Shoal; removal of Bulkhead Rock commenced, **80,** 385, 386.

1880-81. 483,768 c. y. dr. from Pawtuxet Shoal; 794 t. r. blasted and removed from Bulkhead Rock, **81,** 557, 558.

1881-82. 322,255 c. y. dr., **82,** 556.

1882-83. 502,304 c. y. dr. from Gaspee, Sassafras, and Fox Pt. chans., **83,** 484.

1883-84. 217,724 c. y. dr., **84,** 619.

1884-85. 625,073 c. y. dr. from chan. below Field's Pt.; also obstr. at mouth of Pawtuxet R. removed, **85,** 598.

1886-87. 111,372 c. y. dr. from chan. and anchorage basin, **87,** 551.

1887-88. 199,580 c. y. dr., completing the excavation of the 20′ anchorage area, **88,** 499.

1889-90. 96,034 c. y. mud dr., **90,** 570.

1890-91. 140,673 c. y. dr., **91,** 713.

1891-92. 87,776 c. y. dr., **92,** 620.

1892-93. 75,489 c. y. dr., **93,** 831.

1893-94. 276,474 c. y. dr. and 900 c. y. of r. blasted, **94,** 591.

1895-96. 73,479 c. y. dr., **96,** 648.

1896-97. 145,372 c. y. dr., **97,** 909.

1897-98. 745,655 c. y. dr., **98,** 916.

1898-99. 502,487 c. y. dr., **99,** 1126.

1899-00. 495,686 c. y. dr., **00,** 1258.

1900-01. 180,053 c. y. dr., **01,** 1130.

1902-03. 301,027 c. y. dr. in Green Jacket Shoal and the adjacent part of H., **03,** 801.

1903-04. Total amount of 749,270 c. y. dr., completing contract, **04,** 917.

1905-06. 1,946,074 c. y. removed, **06,** 908.

1906-07. 2,173,911 c. y. dr., **07,** 942.

1907-08. 559,968 c. y. dr., completing contract; 535,024 c. y. removed from main chan. between Long Bed and Kettle Pt.; 226,519 c. y. sand and 34.458 c. y. bowlders removed from se. portion of anchorage area, **08,** 985.

1908-09. 152,261 c. y. removed from main chan. between Long Bed and Kettle Pt., completing contract; 155,718 c. y. sand, gravel, etc., and 19.238 c. y. bowlders removed from Long Bed; 64,954 c. y. sand, etc., and 5.793 c. y. bowlders removed from Long Bed, **09,** 1016.

1909-10. U. S. dr. *Gedney* removed 20,285 c. y. mud from Providence H. and R., **10,** 1137.

1910-11. 1,083,197 c. y. dr. in w. the 25′ deep approach chan. leading to Providence H.; 15,711 c. y. dr. from Long Bed, Providence H., **11,** 1208.

1911-12. 1,119,912 c. y. dr. from deep approach chan.; 63,433 c. y., p. m., dr. from Long Bed, completing contract; 1,159,460 c. y. mud, etc., dr. and 10.506 c. y. bowlders removed from deep approach chan., **12,** 1420.

PHYSICAL CHARACTERISTICS.

Discussed, **78,** 237.

Description, **79,** 306.

Record of tidal observations, **71,** 732; **73,** 971.

Tide-gauge record at Providence from Apr. 12, 1853, to May 31, 1853, **80,** 387.

Ice and stormy weather stopped work, **12,** 120, 122, 1420.

R. formed by union of Seekonk (Pawtucket R.) with several smaller streams at Providence; it is tidal; extends s. for 8±m. to Conimicut Pt., where it widens into Narragansett B., **12,** 120.

PLANS. (See Estimates and Projects.)

By F. P. Webber, 1867, removal of wreck and imp. of chan., **71,** 729, 730.

By Capt. Holgate, 1870, removal of Bulkhead Rock to 16′, **71,** 733.

PRIVATE AND CORPORATE WORK.

Dr. by city authorities from time to time, **67,** 449; H. much improved by the city, **68,** 746; $90,000 expended by the city for dr., **78,** 232, 238.

PROJECTS. (See Estimates and Plans.)

The early proj. dates from the first app. in 1852, and proposed, by dr., the formation of a chan. at the "Crook" and "Point of Long Bar" 9′ m. l. w.; under subsequent app. to 1874 it was expanded to 12′ and 14′, together with the removal of Bulkhead Rock. The amount app. between 1852 and 1883, incl., was $59,000. **71,** 728; **79,** 307; **80,** 383; **81,** 82.

Proj. of 1878, modified by Lt. Col. Warren, 1882, provided for a chan. 25′ x 300′, suitable for large ocean vessels, extending from Fox Pt., in Providence, to the d. w. of Narragansett B., and for an anchorage basin between Fox and Fields Pts., with cross-section dimensions from 300′ w. and 25′ d. to 1,060′ w. and 6′ d.; est., $675,000; est. for completion in 1889, $165,000, **89,** 625; **91,** 712; **92,** 619.

By Capt. Bixby, 1895, dr. by contract, **95,** 680.

Act June 3, 1896, au. chan. 25′ x 400′ from Sassafras Pt. to the ocean; est., $732,820, **96,** 647.

By Maj. Lockwood, 1898, extension of the imp. from Conimicut Pt. to d. w. in Narragansett B., **99,** 1125.

Maj. Lockwood est., 1899, $607,777.50 for further imp., **00,** 1311.

1904, Chief of Engineers au. use of $2,000 to make chan. through Western Passage of Narragansett B. "for removal of" rs. in Dutch I. H., R. I., **12,** 120.

Act June 13, 1902, au. new proj. for enlarged anchorage area of 25′ d.; est., $607,778,[1] **02,** 115; **12,** 120.

Proj. of 1902 enlarged by act Mar. 2, 1907, to include area of uniform w. and 25′ d. to e. of main ship chan. between Long Bed and Kettle Pt.; est., $90,750, making total est. $698,528, **07,** 85.

Act June 25, 1910, adopted 2 projs., 1 providing for removal to d. 25′ of a triangular shoal area in se. part of H. n. of Kettle Pt., limited on e. by H. line and on n. and w. by areas already dr.; est., $184,800;[2] the other proj. provides for extending 25′ deep anchorage to w. H. line from just above Harbor Junction Pier to Fields Pt., back to H. line, and w. the existing 400′ chan. between Kettle Pt. and Gaspee Pt. to 600′., with easements of bends; est., $459,000,[3] **10,** 102.

Act June 25, 1910, also provides that no part of the sum of $459,000 shall be expend. until the Sec. of War shall have received satisfactory assurance that the city of Providence, or other local agency, will expend on the imp. of the H. front an equal sum, **10,** 102.

SURVEYS.

By Lt. Rosencrans, 1853, **71,** 728; **79,** 307.

By F. P. Webber, 1867, **71,** 729.

Under direction of Maj. Warren, by N. E. Russell, 1870, **71,** 729.

Under direction of Maj. Warren, by H. A. Bentley, 1872, between Fox Pt. and Fields Pt. **R., 73,** 969, 970.

Of R. from Fields Pt. to Conimicut Pt., **83,** 484.

Of H. between Fox and Fields Pts., 1885, **85,** 597.

Ex. and sur. with a view to obtaining 25′ between Wilkesbarre Pier, Kettle Pt., and the existing ship chan., au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (**R.** fav.), (see Projects), **00,** 1308, 1309.

Pre. ex. and sur. au. act Mar. 2, 1907, with view to extending d. w. area to Kettle Pt. **R.** by Lt. Col. Willard, 1907 and 1908; est., $184,800,[2] **08,** 97.

Pre. ex. and sur. au. act Mar. 3, 1909, of Providence R. and H., with view to w. and straightening chan. between Kettle Pt. and Gaspee Pt., etc. **R.** by Lt. Col. Sanford, 1909 and 1910; est., $459,000,[3] **10,** 112.

Pre. ex. and sur. au. act Feb. 27, 1911, of Providence R. and H., with view to d. chan. to 30′. **R.** to come, **12,** 136.

Maps.[2 3] **81,** 558; **84,** 622; **85,** 599; **93,** 830; **95,** 680; **03,** 802; **12,** 1420.

[1] H. D. 108, 56th, 1st. [2] H. D. 919, 60th, 1st. [3] H. D. 606, 61st, 2d.

C-81(a) PROVIDENCE RIVER, R. I. [Green Jacket Shoal at Providence H. (q. v.)]

APPROPRIATIONS.

1886,	$26,250,	**86,** 605.
1888,	28,000,	**88,** 501.
1890,	25,000,	**90,** 572.
1892,	10,000,	**92,** 623.
1894,	7,500,	**95,** 683.
1896,	7,500,	**96,** 650.
Total,	104,250	

CONTRACTS.

1887. W. H. Beard, dr., 10½¢ c. y., **87,** 554.
1893. R. G. Packard, dr., 11½¢ c. y. ($7,500), **93,** 834.
1895. R. G. & J. S. Packard, dr., 15¢ c. y. $5,500), **95,** 683.
1896. R. G. & J. S. Packard, dr., 18¢ c. y. $7,191.18), **97,** 912.

ENGINEERS.

Chief of Engineers. **R., 85,** 73; **86,** 75; **87,** 38; **88,** 40; **89,** 50; **90,** 45; **91,** 55; **92,** 59; **93,** 62; **94,** 57; **95,** 63; **96,** 63; **97,** 75; **98,** 78; **99,** 90 **00,** 103; **01,** 168; **02,** 116; **03,** 96; **04,** 78; **05,** 85; **06,** 84; **07,** 86; **08,** 88; **09,** 91; **10,** 102; **11,** 107; **12,** 122, 123.

In charge:
Lt. Col. G. H. Elliot, 1885–87. **R., 85,** 601; **86,** 605.
Maj. W. R. Livermore, 1887–92. **R., 87,** 553; **88,** 500; **89,** 626; **90,** 571; **91,** 715; **92,** 621.
Capt. W. H. Bixby, 1892–95. **R., 93,** 832; **94,** 552; **95,** 682.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 649; **97,** 911; **98,** 918; **99,** 1127; **00,** 1260.
Maj. G. W. Goethals, 1901–02. **R., 01,** 1132; **02,** 902.
Capt. C. E. Gillette, 1903. **R., 03,** 803.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 919; **05,** 858; **06,** 908, 909; **07,** 942, 943.
Maj. Harry Taylor, 1908. **R., 08,** 983–85.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1016; **10,** 1137.
Col. F. V. Abbot, 1911–. **R., 11,** 1208, 1209; **12,** 1420, 1421.

OPERATIONS.

1886-87. Preparations for removal of shoal, **87,** 553.
1887-88. 206,431 c. y. dr., **88,** 501.
1889-90. 147,520 c. y. dr., **90,** 572.
1891-92. 125,104 c. y. dr., **92,** 622.
1893-94. 65,272 c. y. dr., **94,** 592.
1895-96. 36,647 c. y. dr., **96,** 650.
1896-97. 39,951 c. y. dr., **97,** 911.
1902-03. Remaining portions of shoal are being removed under proj. for enlarging 25 deep-anchorage area in Providence H., **03,** 803.
1903-04. Nearly all of the shoal has been removed, **04,** 919.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 601; **89,** 626; **01,** 168, 1132.
Removal of shoal enables vessels to anchor outside of chan. and thus removes an obstr. to vessels going to or from Providence wharves, **07,** 86.

PROJECTS.

By Lt. Col. Elliot, 1885, removal, by dr., of Green Jacket Shoal, in the H. of Providence, to 25′ m. l. w.; est., $112,346, **85,** 602; **86,** 75, 605; **87,** 553; **92,** 621, 622.
By Capt. Bixby, 1895, dr. by contract, **95,** 682.
Act June 13, 1902, au. removal of remaining portion of this shoal in connection with proj. for an enlarged anchorage area in Providence H., **02,** 116.

SURVEY.

Of 1884 of Green Jacket Shoal, **85,** 597.
Maps:
Of Providence H., **85,** 599.
93, 832; **95,** 682.
Of Providence R. and Green Jacket Shoal, **03,** 802.

C-83 PAWTUCKET (Seekonk) RIVER, R. I.

APPROPRIATIONS.

1867,	$17,000,	**67,** 450.
1870,	8,000,	**70,** 75.
1871,	7,000,	**71,** 84.
1872,	10,000,	**72,** 81.
1873,	10,000,	**73,** 88.
1884,	50,000,	**84,** 608.
1886,	30,000,	**86,** 599.
1888,	35,000,	**88,** 497.
1890,	30,000,	**90,** 568.
1892,	35,000,	**92,** 618.
1894,	25,000,	**95,** 678.
1896,	20,500,	**96,** 646.
1899,	30,000,	**99,** 1124.
1902,	28,500,	**02,** 900.
1905,	30,000,	**05,** 856.
1907,	135,584,	**07,** 941.
1911,	5,000,	**11,** 1207.
Total,	506,584	(total, incl. misc., $506,635.47, **12,** 1418).

COMMERCE.

Important, **67,** 450; **79,** 306.
Injury to navigation from brs., **74,** ii, 227; **81,** 556; **82,** 555. Removed in 1883, **83,** 78, 480.
Importance of imp., **80,** 378; **83,** 483; **86,** 601.
Effect of imp. is to cause use of vessels of deeper draft than formerly, larger cargoes, and probably cheaper rates, **01,** 167; **12,** 119.
1900, 216,060 t., mostly cotton products, lumber, coal, minerals, fertilizer, etc., **01,** 1129; 1911, 508,625 t.; 9,311 American vessels and 8 foreign vessels entered waterway, **12,** 1419.

CONTRACTS.

1870. E. R. Seward, dr., 27¢ c. y., **70,** 451.
1871. T. J. Hill, dr., 33¢ c. y. (annulled), **71,** 735. E. M. Payn, dr., 33¢ c. y., **71,** 735.
1872. E. M. Payn, dr., 32½¢ c. y., **72,** 818. E. R. Seward, dr., 17¢ c. y., **75,** ii, 290.
1884. Brainard & Benton, dr., 21¢ c. y., **85,** 593.
1886. E. Brainard, dr., 25¢ c. y., **87,** 549.
1893. R. G. Packard, dr., 42¢ c. y. ($14,000), **93,** 828. E. Brainard, dr. 6,000 c. y., 32¢ c. y., **94,** 588.
1894. Rogers & Fitzpatrick, ledge removal, $7.74 t. ($9,000), and 16,000 c. y., $7.73 c. y.; the latter price in 1895, **95,** 678. E. Brainard, dr., 45¢ and 50¢ c. y., s. m. ($2,500), **95,** 677.
1897. J. J. Fitzpatrick, ledge removal, 1,300 c. y., $6.66 c. y., **97,** 907.
1899. J. S. Packard, dr., 14⅞¢ c. y., **00,** 1256.
1902. J. S. Packard Dredging Co., dr., 24.9¢ c. y., **02,** 800.
1905. R. G. Packard Co., removing ledge r. to extent of about $25,000, $6.70 c. y., **06,** 907.
1908. J. S. Packard, dr. 545,000 c. y., 14¾¢ c. y.; John J. Fitzpatrick, removal of ledge r., 5,500 c. y., at $6.66 c. y., **09,** 1015.
1911. J. S. Packard Dredging Co., dr. 145,770 c. y., 19.9¢ c. y., and $9.50 for bowlders Eastern Dredging Co., removing ledge r. from sec. 1, 2, and 3, at $8.40, $7.90, and $5.90 c. y., resp., **12,** 1419.

ENGINEERS.

Chief of Engineers. **R., 67,** 45; **68,** 67; **69,** 58; **70,** 75; **71,** 83; **72,** 81; **73,** 88; **74,** 98; **75,** 108; **76,**

49; **77,** 43; **78,** 48; **79,** 54; **80,** 74; **81,** 81; **82,** 81; **83,** 78; **84,** 84; **85,** 73; **86,** 73; **87,** 36; **88,** 38; **89,** 49; **90,** 43; **91,** 54; **92,** 58; **93,** 60; **94,** 55; **95,** 61; **96,** 61; **97,** 73; **98,** 76; **99,** 88, 97; **00,** 101, 112; **01,** 166, 175; **02,** 114; **03,** 95; **04,** 77; **05,** 83; **06,** 82, 92; **07,** 83; **08,** 85; **09,** 88; **10,** 99; **11,** 103; **12,** 117.

In charge:

Col. D. C. Houston, 1867–70. **R., 67,** 449; **68,** 746; **69,** 407.

Maj. G. K. Warren, 1870–82. **R., 70,** 450; **71,** 734; **72,** 818; **73,** 967; **74,** ii, 227; **75,** ii, 289; **76,** 207; **77,** 199; **78,** 231; **79,** 305; (Lt. Col.) **80,** 377; **81,** 556; **82,** 555.

Lt. Col. G. H. Elliot, 1882–87. **R., 83,** 480; **84,** 608, 609; **85,** 592; **86,** 598.

Maj. W. R. Livermore, 1887–92. **R., 87,** 548; **88,** 496; **89,** 621; **90,** 566; **91,** 709.

Capt. W. H. Bixby, 1892–95. **R., 92,** 616; **93,** 828; **94,** 587; **95,** 676.

Maj. D. W. Lockwood, 1896–1901. **R., 96,** 645; **97,** 905; **98,** 913; **99,** 1123; **00,** 1254, 1302, 1304; **01,** 1152.

Maj. G. W. Goethals, 1901–02. **R., 01,** 1127; **02,** 899.

Capt. C. E. Gillette, 1903. **R., 03,** 799.

Lt. Col. J. H. Willard, 1904–07. **R., 04,** 915; **05,** 855; **06,** 906; **07,** 940.

Maj. H. Taylor, 1908. **R., 08,** 982.

Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1014; **10,** 1135.

Col. F. V. Abbot, 1911–. **R., 11,** 1206; **12,** 1418.

Assistants:

N. E. Russell. **R., 71,** 736.

J. H. Dager, **71,** 736.

H. A. Bentley. **R., 72,** 819; **74,** ii, 229; **80,** 378.

LEGISLATION.

Act of R. I. providing for clearing chan. from obstr. and for constr. of br. near site of former br., **84,** 614.

Act Mar. 2, 1907, making app. of $135,584, provides that no part of it shall be expend. unless further amount of $67,792 shall be provided by R. I., or other agency, made subject to order of Sec. War, under whose direction it may be expend. upon said proj. for its completion, **07,** 83, 84.

General Assembly of R. I. passed act providing that one-half of required sum be paid on or after July 1, 1908, and the other half on or after July 1, 1909, to Sec. War, **07,** 84.

General Assembly of R. I. resolved that consent of R. I. be given for application, to d. to 18′ and w. chan. of R., of portion of balance of app. theretofore contributed and pledged by R. I., for said imp., **09,** 89.

OBSTRUCTIONS.

Situation and condition of RR. br. at India Pt. makes passage of draws difficult, **00,** 1305.

OPERATIONS.

1866–67. Removal of 12,430 c. y., **67,** 45, 499.

1867–68. Dr., **68,** 67.

1868–69. Chan. dr. to 6′, **69,** 58, 407.

1870–71. Removal of 16,257 c. y.; chan. 6′ deep, **71,** 83, 735.

1871–72. Removal of 21,122 c. y., **72,** 81, 818, 820.

1872–73. Removal of 26,073 c. y., **73,** 88, 967.

1874–75. Removal of 7,248 c. y., **75,** 108, ii, 290.

1875–76. Completion of work; removal of 31,347 c. y.; 752 c. y. of st. removed, **76,** 49, 207.

1884–85. Preparations for dr., **85,** 593.

1885–86. 212,735 c. y. dr., **86,** 599.

1886–87. 31,069 c. y. dr., **87,** 548.

1887–88. 72,248 c. y. dr., **88,** 496.

1889–90. 54,923 c. y. sand and 128 c. y. bowlders and ledge rs. removed, **90,** 567.

1891–92. 70,213 c. y. dr., **92,** 617.

1893–94. About 39,000 c. y. dr.; 406 c. y. r. excavated, **94,** 588.

1894–95. About 500 c. y. r. excavated; 3,352 c. y. dr., **95,** 677.

1895–96. About 2,000 c. y. r. excavated, **96,** 645.

1896–97. About 250 c. y. r. excavated, **97,** 906.

1897–98. 1,643 c. y. r. removed, **98,** 914.

1900–01. 133,145 c. y. sand dr. under contract, **01,** 1128.

1902–03. Dr. worked for 2 days when sudden freezing stopped work, **03,** 799.

1903–04. 101,424 c. y. dr. under contract, completing same, and making chan. 12′ x 100′, between Ten-mile R. and Bucklin Isld., **04,** 915.

1905–06. 3,420.3 c. y. r. excavated, **06,** 906.

1906–07. Work consisted in redr. shoal places in chan., **07,** 941.

1907–08. Proposals for completion of existing proj. invited and opened July 22, 1908, **08,** 982.

1908–09. 393,477 c. y. sand, gravel, and clay, and 70 c. y. bowlders excavated under contract; 2,140 c. y. r., **09,** 1014.

1909–10. 205,123 c. y. sand, gravel, clay, and mud dr., and 183 c. y. bowlders and 3,557 c. y. r. removed, **10,** 1135.

1910–11. Advertisement made inviting proposals for dr. to complete 100′ wide chan. and increase chan. w. opposite Phillipsdale, R. I., **11,** 1207.

1911–12. 112,572 c. y. mud, sand, and gravel, 51 c. y. bowlders and 2,156 c. y. ledge r. dr. from 16′ chan., **12,** 1418.

PHYSICAL CHARACTERISTICS.

Description, **71,** 735, 736; **74,** ii, 230; **79,** 305; **84,** 610; **90,** 566; **1900,** 1303.

Bars and brs., **74,** ii, 231.

Tidal observations, **71,** 736, 738; **74,** ii, 230, 236; **80,** 379.

Changes since 1873, **84,** 611.

Mean rise of tide about 5′, **03,** 799.

Shoaling in R. due to spring freshets and large inflow of gravel, **10,** 1135.

R. is the upper portion of Providence R.; the navigable section is from Pawtucket to Providence, 4 m.; head of navigation is dam at Pawtucket; above dam R. is known as Blackstone R.; lower reaches of R. known as Seekonk R., **12,** 117.

PLANS. (See Estimates and Projects.)

By H. A. Bentley, 1874, w. and d. chan. to 7′ x 75′ x 140′, between the wharves; est., $6,534, **74,** ii, 231.

PRIVATE WORK. (See Legislation.)

PROJECTS. (See Estimates and Plans.)

Projs. of 1868 to 1874 proposed the formation, by dr., of a chan. 7′ d. at l. w. and 75′ w. from the mouth to the city of Pawtucket, **70,** 450; **75,** ii, 290. This work was completed in 1875, **76,** 49, 207; **80,** 74; **83,** 78; **84,** 609.

By Lt. Col. Elliot, 1884, chan., by r. removal and dr., 12′ x 100′ m. l. w. from the Red Br. to the r. cutting at Pawtucket; thence a chan. to Pawtucket Br. 12′ x 40′; est., $382,478, **84,** 85, 613; **85,** 593; **87,** 548.

By Capt. Bixby, 1895, dr. and r. work by contract, **95,** 677.

Maj. Lockwood est., 1899, $237,875 to further imp. chan. from Red Br. up, **00,** 1306.

Act Mar. 3, 1905, au. proj. to provide chan. d. of 16′, m. l. w., and w. of 100′ from Providence to Pawtucket, and chan. of same d. and w. of 50′ through ledge r. at Pawtucket; est., $237,875,[1] **05,** 856.

Provision to apply $25,000 to excavate portion of chan. through ledge r., and $5,000 to d. shoal points in 12′ chan., **06,** 82.

Act Mar. 3, 1909, modified proj. and provided that any balance remaining unexpend. after completion of existing contracts may be used in d. chan. of R. to 18′., and increasing w. thereof at such places between Pawtucket and Providence as may best subserve interests of C., provided that work therein au. shall not be undertaken until the consent of R. I. has been given for application to this purpose of portion of balance theretofore contributed and pledged by said State; consent given, **09,** 89.

[1] H. D. 113, 56th, 1st.

SURVEYS.

By N. E. Russell, 1870, **71,** 735, 736.
By J. H. Dager, 1870, **71,** 735, 736.
By H. A. Bentley, 1870, **71,** 735, 736.
Au. act Aug. 2, 1882; made by Lt. Col. Elliot, **84,** 609.
Ex. and sur. au. act Mar. 3, 1899; made by Maj. Lockwood, 1899 (**R.** fav. only on condition that India Pt. Br. be reconstr.), **1900,** 1303–1304.
Pre. ex. au. act June 6, 1900, with view to securing chan. 18′ x 200′, mouth of R. at Providence to lower wharves in city of Pawtucket. **R.** by Maj. Lockwood, July 5, 1900[1] (unfav.), **01,** 175.
Pre. ex. au. act Mar. 3, 1905, with view to d. chan. to 18′. **R.** by Lt. Col. Willard, Aug. 3, 1905[2] (unfav.), **06,** 92.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 118.
Maps:
Sketch of chan., **74,** ii, 235.
93, 828; **95,** 678; **03,** 800.

C-84 PAWTUXET COVE, R. I.

ENGINEERS.

Chief of Engineers. **R., 06,** 92.
In charge. Lt. Col. J. H. Willard, **06,** 73.

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.** by Lt. Col. Willard, Feb. 6, 1906[3] (unfav.)[3] **06,** 92.

C-85 PAWTUXET HARBOR, PROVIDENCE RIVER, R. I.

COMMERCE.

Local; would not be increased for several years after imp., **93,** 868.

ENGINEERS.

Chief of Engineers. **R., 93,** 71.
In charge. Capt. W. H. Bixby, 1892–93. **R., 93,** 868.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 868.
H. the mouth of Pawtuxet R., which is shut off from the H. by a dam, **93,** 868.

SURVEY.

Ex. au. act July 13, 1892; made by Capt. Bixby, 1893 (**R.** unfav.), **93,** 868.

C-86 PAWTUXET RIVER, R. I.

ENGINEERS.

Chief of Engineers. **R., 84,** 91.
In charge. Maj. J. W. Barlow. **R., 84,** 633.

PLANS.

By Maj. Barlow, 1882, removing bowlders from entrance, **84,** 633.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Barlow **84,** 633.

C-87 NARRAGANSETT BAY CHANNEL (Pawtuxet H.), R. I.

ENGINEERS.

Chief of Engineers. **R., 91,** 62, 733.
In charge. Maj. W. R. Livermore, 1890. **R., 91,** 734.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 734.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Livermore (**R.** unfav.), **91,** 734.

C-88 GREENWICH BAY, R. I.

APPROPRIATION.

1890, $2,000, **91,** 717.

ENGINEERS.

Chief of Engineers. **R., 89,** 56; **91,** 56; **92,** 60; **93,** 63.
In charge:
Maj. W. R. Livermore, 1888–92. **R., 89,** 650; **91,** 716.
Capt. W. H. Bixby, 1892–93. **R., 92,** 623; **93,** 834.

OPERATIONS.

1890–91. 19,592 c. y. dr., **91,** 717.
Proj. completed, **92,** 624.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 650.

PROJECTS.

By Maj. Livermore, 1888, entrance to the B., w. the chan., and giving a l. w. d. of 10′ by dr.; est., $2,000, **89,** 651; **91,** 717; **92,** 623.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Livermore, **89,** 650.
Maps. **93,** 834.

C-89 GREENWICH HARBOR, GREENWICH BAY, R. I.

COMMERCE.

Description of; entirely local and small, **93,** 871.

ENGINEERS.

Chief of Engineers. **R., 93,** 71.
In charge. Capt. W. H. Bixby, 1892–93. **R., 93,** 871.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 871.
The H. a cove about 8′ x 300′ x 2,500 y. along its wharf front, **93,** 871.

SURVEY.

Ex. au. act July 14, 1892; made by Capt. Bixby, 1893 (**R.** unfav.), **93,** 871.

[1] H. D. 89, 56th, 2d. [2] H. D. 141, 59th, 1st. [3] H. D. 603, 59th, 1st.

C-91 APPONAUG HARBOR, COWESSET BAY, R. I.

COMMERCE.

In 1893 the interests involved seemed to make the desired imp. of local but not of national importance, **93,** 870.

ENGINEERS.

Chief of Engineers. R., 93, 71.
In charge. Capt. W. H. Bixby, 1892–93. **R., 93,** 869.

PHYSICAL CHARACTERISTICS.

H. is at the nw. corner of Greenwich B., on the w. side of Narragansett B., and about 10 m. s. of Providence, **93,** 869.

SURVEY.

Ex. au. act July 14, 1892; made by Capt. Bixby, 1893 (**R.** unfav.), **93,** 869.

C-92 POTONOWUT (Potowomut, Potowannet) RIVER, R. I.

APPROPRIATION.

1881, $5,000, **81,** 560.

CONTRACT.

1881. S. A. Hammond, dr., 23¢ c. y., **81,** 559.

ENGINEERS.

Chief of Engineers. R., 80, 76; **81,** 84, 89; **82,** 84.
In charge. Lt. Col. G. K. Warren, 1880–82. **R., 81,** 559, 560; **82,** 560.
Assistant. H. A. Bentley. **R., 81,** 560.

OPERATIONS.

1881–82. 15,012 c. y. dr. from bar at R. mouth, 63 t. of r. removed from Eustons Rocks, completing proj., **82,** 560.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 560.

PROJECTS.

By Col. Warren, imp. mouth of Potonowut R. by excavating chan. 5′ x 150′ x 2,500′ m. l. w.; also removing Eustons Rocks; est., $5,587.50, **81,** 562; **82,** 560.

SURVEY.

Au. act June 14, 1880; made, 1880, by Lt. Col. Warren, **81,** 560.

C-93 WICKFORD HARBOR, R. I.

APPROPRIATIONS.

1873,	$5,000,	**73,** 89.
1874,	5,000,	**74,** 99.
1896,	6,300,	**96,** 651.
Total,	16,300	

COMMERCE.

C. advantages of Wickford, **73,** 973, 975.
Petition of citizens asking for removal of rs. and for erection of lighthouse, **75,** ii, 292.
SS. *Eolus* wrecked on James's Ledge, **76,** 208.
Description of, **93,** 873.
Existing C. does not justify imp. For purpose of getting r. for break'rs it may be advantageous "at some future time" to dr. a chan. to quarries nearby, **04,** 938.

CONTRACTS.

1873. T. J. Hill, dr. 11,213 c. y., 40¢, **73,** 972; **74,** ii, 239.
1874. J. Van Patten, dr. 13,574 c. y., 18¢. J. Waters & Co., removal of Van Buren Rock, **75,** ii, 291.
1896. Hartford Dredging Co., dr., 15.7¢ c. y.; bowlder removal, $16.50 c. y. ($5,000), **97,** 914.

ENGINEERS.

Chief of Engineers. R., 72, 85; **73,** 88; **74,** 99; **75,** 108; **76,** 49; **93,** 71; **95,** 73; **96,** 64; **97,** 75; **98,** 79; **99,** 90; **00,** 104; **04,** 87; **08,** 97.

In charge:
Maj. G. K. Warren, 1872–76. **R., 73,** 972; **74,** ii, 239; **75,** ii, 291; **76,** 208.
Capt. W. H. Bixby, 1892–95. **R., 93,** 873; **95,** 753.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 651; **97,** 913; **98,** 919; **99,** 1129; **00,** 1261.
Maj. G. W. Goethals, 1904. **R., 04,** 935.
Capt. C. E. Gillette, 1904. **R., 04,** 938.
Col. J. H. Willard, **08,** 77.

Assistants:
H. N. Babcock. **R., 73,** 974.
Lt. W. W. Harts. **R., 93,** 874.

OPERATIONS.

1873–74. 11,213 c. y. dr.; r. removed, **74,** ii 239.
1874–75. 13,574 c. y. dr.; r. removed, **75,** ii, 291.
1875–76. Dr. to w. chan., **76,** 208.
1896–97. 30,265 c. y. dr. and some bowlders removed, **97,** 913.
1899–00. Some bowlders removed from entrance to H., completing proj., **00,** 1262.

PHYSICAL CHARACTERISTICS.

Site described, **73,** 88, 973; **93,** 873; **95,** 753.
Presence of rs. and shoals, **73,** 973.
Tides, **73,** 974, 975.

PRIVATE AND CORPORATE WORK.

Constr. of wharf, and dr. of chan. undertaken by private enterprise, **73,** 973.

PROJECTS.

By Maj. Warren, dr. and removal of r.; est., $25,000, **73,** 972, 974.
By Lt. Harts, 1896, removal of some bowlders and dr. chan. 9′ x 60′; est., $6,300, **95,** 754.

SURVEYS.

By H. N. Babcock, 1872. **R., 73,** 974.
Ex. au. act July 13, 1892; made by Capt. Bixby, 1893 (**R.** fav. to moderate imp.), **93,** 873.
Sur. au. act Aug. 17, 1894; made by Lt. Harts, 1895 (see Projects), **95,** 753.
Pre. ex. of Mill Cove au. act June 13, 1902. **R.** by Maj. Goethals, Feb. 2, and Capt. Gillette, Aug. 13, 1903; 2 plans presented at est. costs of $30,000 and $18,000[1] (locality not considered worthy of further imp.; concurred in by BERH., **04,** 87, 934).
Pre. ex. and sur. au. act Mar. 2, 1907, with view to obtaining 15′, and for removal of ledge known as General Rock. **R.** by Col. Willard, 1907 and 1908; est., $56,800,[2] **08,** 97.
Maps.[2]

[1] H. D. 52, 58th, 2d.

[2] H. D. 905, 60th, 1st.

C-97 CONANICUT ISLAND, R. I.

COMMERCE.
Description of, **95,** 745; **97,** 928.

ENGINEERS.
Chief of Engineers. **R., 95,** 72; **97,** 80.
In charge:
Capt. W. H. Bixby, 1894–95. **R., 95,** 745.
Maj. D. W. Lockwood, 1896. **R., 97,** 929.

PHYSICAL CHARACTERISTICS.
Description of, **95,** 745; **97,** 929.

SURVEYS.
Ex. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** unfav.), **95,** 745.
Ex. au. act June 3, 1896; made by Maj. Lockwood, 1897 (**R.** unfav.), **97,** 928.

C-98 BISSELLS COVE, R. I.

ENGINEERS.
Chief of Engineers. **R., 84,** 99.
In charge. Maj. J. W. Barlow, 1884. **R., 84,** 663.

PLANS.
Imp. desired, chan. 6′ x 60′ between Narragansett B. and the wharves, 1,200 y. Doubtful whether the work constituted a public necessity, **84,** 663.

SURVEYS.
Ex. au. act Aug. 2, 1882; made by Maj. Barlow (see Plans), **84,** 663.

C-99 NARRAGANSETT BAY AT THE MOUTH OF NARROW RIVER, R. I.

ENGINEERS.
Chief of Engineers. **R., 89,** 56; **90,** 51.
In charge. Maj. W. R. Livermore, 1888. **R., 90,** 595.

PHYSICAL CHARACTERISTICS.
Description of, **90,** 597.

PLANS.
By Maj. Livermore, 1889, constr. riprap granite break'r at the mouth of Narrow R.; est., $24,000, **90,** 597.

SURVEY.
Au. act Aug. 11, 1888; made, 1889, by Maj. Livermore, **90,** 596.

C-100 NARRAGANSETT PIER, R. I.

COMMERCE.
Important, **71,** 820.

ENGINEERS.
Chief of Engineers. **R., 70,** 31, 76; **71,** 86.

In charge:
Maj. D. C. Houston, 1870. **R., 70,** 76.
Maj. G. K. Warren, 1870–71. **R., 70,** 452, 453; **71,** 818.

Assistants:
J. A. Judson. **R., 71,** 819.
A. H. Dager, C. E., **71,** 819.
J. Pierpont, C. E., **71,** 819.

PLANS.
By Maj. Warren, sea wall; est., $500,000, **71,** 818.
By J. A. Judson, sea wall and basin for local purposes, $12,326.24, **71,** 822.

PRIVATE (CORPORATE) WORK.
In 1836 the Narragansett Pier Co. organized to constr. a wharf available in all weather. Pier completed, 1840, 435′ l.; cost, $18,000, **71,** 821.

SURVEYS.
Included in the Coast Sur., 1844, **70,** 453.
Ex. or sur. au. act July 11, 1870, **70,** 31; made, 1871, by J. A. Judson, under direction of Maj. G. K. Warren. **R., 71,** 819.

C-101 POINT JUDITH POND, R. I. (Entrance to).

APPROPRIATIONS.

1892,	$7,500, act July 13.
1894,	2,500, **95,** 688.
1905,	2,000, **05,** 864.
1907,	8,000, **07,** 949.
Total,	20,000

COMMERCE.
In 1895 the only apparent benefit to be derived from imp. of the entrance would be a small increase in the fishing industry, **95,** 691.
Description of, **98,** 936.
Very small; consists mostly of oysters, **09,** 96; **12,** 130.

CONTRACTS.
1905. E. S. Belden & Sons, st. in j., $1.93 t., **06,** 915.

ENGINEERS.
Chief of Engineers. **R., 73,** 93; **74,** 103; **89,** 55; **93,** 66; **95,** 66; **96,** 66; **97,** 78; **98,** 84; **99,** 93; **00,** 108; **01,** 172; **02,** 120; **03,** 100; **04,** 83, 949; **05,** 89; **06,** 88; **07,** 90; **08,** 93; **09,** 96, 100; **10,** 108; **11,** 113; **12,** 129.

Boards. Special (Col. Chas. R. Suter, Col. S. M. Mansfield, and Maj. Goethals) recom. app. of $10,000 be made to be applied to extending the js., or to dr., as determined by the local officer, **04,** 967.

In charge:
Maj. G. K. Warren, 1873. **R., 74,** ii, 286.
Maj. W. R. Livermore, 1888. **R., 89,** 642.
Capt. W. H. Bixby, 1892–95. **R., 93,** 841; **95,** 688.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 656; **97,** 921; **98,** 926, 935; **99,** 1138, 1271.

Maj. G. W. Goethals, 1901–02. **R., 01,** 1140; **02,** 907.
Capt. C. E. Gillette, 1903. **R., 03,** 814.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 925; **05,** 864; **06,** 914; **07,** 949.
Maj. H. Taylor, 1908. **R., 08,** 991.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1021; **10,** 1143.
Col. F. V. Abbot, 1911–. **R., 11,** 1214; **12,** 1427.,

Assistants:
C. R. Mather. **R., 74,** ii, 287.
Lt. W. W. Harts. **R., 95,** 689.

OPERATIONS.

1905–06. 4,632 t. st. placed in seaward extension of j., **06,** 914.

PHYSICAL CHARACTERISTICS.

General, **74,** ii, 287, 288.
Changes that have taken place, **74,** ii, 288.
Description of, **89,** 642; **95,** 689.
Place a shallow, salt pond in rear of beach just w. of Pt. Judith; bar at entrance, **12,** 129.

PLANS.

By C. R. Mather, (1) making a navigable connection with the ocean by means of a canal and lock between the pond (lake) and the ocean; (2) for enlarging the existing breach by dr., **74,** ii, 289.
In 1888 Maj. Livermore did not consider the locality worthy of imp. to the extent of constr. a H. of refuge, **89,** 643.

PRIVATE WORK.

R. I. and town of South Kingston making the opening into the pond; R. I. app. $6,000, **07,** 91.

PROJECTS.

Capt. Bixby, 1893, recom. return of all money to the Treas., **93,** 842.
Maj. Lockwood, 1897, est. cost of imp. entrance would be $473,490, **98,** 935.
Extension of w. j. seaward and landward, **06,** 89.
Act Mar. 2, 1907, app. $8,000 for continuing imp. and mainten., "amount for dr.;" recom. that app. be returned to Treas., **12,** 130.
Place considered unworthy of further imp., **10,** 1143.

SURVEYS.

By C. R. Mather, 1873. **R., 74,** ii, 287.
Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Livermore (see Plans), **89,** 642.
Sur. au. act Aug. 17, 1894; made by Capt. Bixby, 1895 (**R.** unfav.), **95,** 689.
Sur. inner H. au. act June 3, 1896; made by Maj. Lockwood, 1897 (**R.** unfav.; see Projects), **98,** 935.
See Engineer Boards.
For preparing a proj. for expend. of available funds, **05,** 864.
Pre. ex. au. act Mar. 3, 1909, with view to obtaining navigable d. **R.** by Lt. Col. Sanford, Apr. 13, 1909[1] (unfav.), **09,** 100.
Map. **95,** 692.

C-102 POINT JUDITH, R. I. (Harbor of refuge).

APPROPRIATIONS.

1890,	$75,000,	**91,** 723.
1892,	75,000,	**92,** 629.
1893,	100,000,	**93,** 840.
1894,	100,000,	**95,** 687.
1895,	300,000,	**95,** 687.
1896,	300,000,	**96,** 656.
1897,	300,000,	**97,** 919.
1902,	100,000,	**02,** 906.
1905,	100,000,	**05,** 863.
1906,	100,000,	**06,** 913.
1907,	100,000,	**07,** 948.
1907,	*10,000,	**09,** 1020.
1908,	170,000,	**08,** 990.
1909,	*10,000,	**09,** 1020.
1910,	175,000,	**10,** 1142.
1911,	50,000,	**11,** 1213.
1912,	160,000,	**12,** 1425.
Total,	2,225,000	(total, incl. misc., and less $1,556.65 returned to Treas., $2,223,523.66, **12,** 1425).

COMMERCE.

Description of, **93,** 879; **97,** 937.
"The result of the improvement has been to create a harbor of refuge fairly suitable for sailing vessels and steamers, though the holding ground is poor, but not well suited for tows of barges, on account of the narrowness of the entrances, the direction of the entering courses with respect to that of the worst seas, the lack of room necessary for maneuvering barges in tow, and the fact that the central part of the area is obstructed by a dangerous reef.
"About 30 feet can be carried at mean low water into the eastern, and from 18 to 19 feet into the western, entrance. The mean range of tide is 3.1 feet.
"One hundred and seventy-three vessels used the harbor during the fiscal year. Of these there were 142 sailing vessels, 12 steamers, and 19 barges." **12,** 129.

CONTRACTS.

1893. Hughes Bros. & Bangs, core st., $1.27⅞ t.; facing st., $1.27⅞ t. ($1,034,000), **93,** 840.
1903. J. F. Donovan, st. in place in break'r, $2.75 t., **03,** 808.
1905. J. F. Donovan, st. in place in break'r, $1.80 t. (about $200,000); E. S. Belden, st. for repairs to break'r (2,000± t.), $3.13 t., **06,** 914.
1907. Sea Coast Construction Co., bldg. break'r extension, st. $2.18 t. ($260,000±), **07,** 948.
1909. The T. A. Scott Co., Inc., lighter for replacing displaced st., $65 per day; E. S. Belden & Sons, furn. and placing st., $1.97 and $2.23 t., **10,** 1142.
1911. The Breakwater Co., break'r constr., $1.73 t. for st., **12,** 1425.
1912. The Breakwater Co., repairs to break'r, $2.47 for resetting st., and $1.39 t. for furn. st., **12,** 1426.

ENGINEERS.

Chief of Engineers. R., 89, 56; **90,** 51; **91,** 58; **92,** 62; **93,** 65, 71; **94,** 58; **95,** 65; **96,** 65; **97,** 77, 81; **98,** 80; **99,** 93; **00,** 106; **01,** 171; **02,** 119; **03,** 99, 811; **04,** 82, 949; **05,** 88; **06,** 87; **07,** 89; **08,** 91, 97; **09,** 93; **10,** 106; **11,** 111; **12,** 127.

Boards of Engineers:
Convened, Newport, R. I., Oct. 20, 1896, S. O. No. 34, Sept. 26, 1896, to consider and report upon constr. of H. of refuge at Pt. Judith, R. I. **R., 97,** 920, 921. (Lt. Col. S. M. Mansfield, Majs. C. W. Raymond, W. R. Livermore, D. W. Lockwood, and Capt. S. S. Leach.)
Convened, S. O. No. 19, recom. constr. break'r out from shore to provide landing place (Col. Chas. R. Suter, Col. S. M. Mansfield, Maj. G. W. Goethals), **03,** 809.
Appointed au. act 1902 (Col. Chas. R. Suter, Col. S. M. Mansfield, and Maj. Goethals) to make an ex. of Hs. of refuge at Pt. Judith, Block Isld., and Great Salt Pond, with a view to determining the relative merits of each, what further constr. advisable, and cost. Recom. no further work be done at Pt. Judith save protection to the shore, removal of bowlders and mainten. of existing structures, **04,** 952, 958.

In charge:
Maj. W. R. Livermore, 1888–92. **R., 90,** 592; **91,** 722.

*Allotment.

[1] H. D. 79, 61st, 1st.

Capt. W. H. Bixby, 1892–95. **R., 92,** 628; **93,** 839, 877; **94,** 596; **95,** 686.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 654; **97,** 918, 937; **98,** 923; **99,** 1135; **00,** 1269.
Maj. G. W. Goethals, 1901–02. **R., 01,** 1138; **02,** 906.
Capt. C. E. Gillette, 1903. **R., 03,** 807.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 923; **05,** 862; **06,** 912; **07,** 947.
Maj. H. Taylor, 1908. **R., 08,** 989.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1019; **10,** 1141.
Col. F. V. Abbot, 1911–. **R., 11,** 1213; **12,** 1424.

LEGAL PROCEEDINGS.

Judge Advocate General of opinion that shore extension of break'r may be undertaken, and the whole of app., 1903, available for that purpose, **03,** 814.
Proceedings for condemnation of land needed for shore extension of break'r instituted, **06,** 913. Commissioners viewed the land May 23, 1907, **07,** 947. Hearing held Aug. 14, 1907, **08,** 92. Land damages, amount, $7,100; expenses, $4,138.75, paid by U. S., **11,** 1213.

OPERATIONS.

1890-91. Beacon estab., and 3,000 t. r. used in the constr. of a portion of n. and e. arms of break'r, **91,** 722.
1891-92. 8,630 t. riprap st. placed in break'r, extending it 200′ along both arms, **92,** 629.
1893-94. 92,939 t. st. deposited in break'r, **94,** 596.
1894-95. 193,087 t. st. deposited in break'r, **95,** 687.
1895-96. 237,315 t. st. deposited in break'r; 2 additional beacons placed, **96,** 655.
1896-97. 111,681 t. st. deposited in break'r, **97,** 918.
1897-98. 130,792 t. st. deposited in break'r, **98,** 924.
1898-99. 110,059 t. st. deposited in break'r, **99,** 1136.
1899-1900. Lighting of break'r maintained, **00,** 1269.
1900-01. Lighting of break'r maintained, **01,** 1139.
1901-02. Break'r lights maintained, **02,** 906.
1902-03. Constr. of break'r begun; lights maintained, **03,** 807.
1903-04. 32,568.89 t. st. deposited in shore end of e. detached break'r; lights maintained, **04,** 924.
1904-05. Break'r lights maintained, **05,** 863.
1905-06. 87,920 t. st. placed in extension of break'r; 2,005 t. st. used for repairs to break'r; lights maintained, **06,** 913.
1906-07. 9,871.45 t. st. placed in break'r; lights maintained, **07,** 947.
1907-08. 42,192.4 t. st. placed in break'r; lights maintained, **08,** 989.
1908-09. 59,036.22 t. st. placed in shore arm of break'r; 3,496.33 t. st. used in repairs to break'r; lights maintained, **09,** 1020.
1909-10. Mainten. work, 6,957 t. st. placed in break'r, misplaced st. rearranged and replaced, 219 t. st. placed to repair damages by storms, and lights maintained, **10,** 1141.
1910-11. Lights maintained, **11,** 1213.
1911-12. Work for constr. of w. shore arm of break'r in progress, 41,112 t. st. placed; lights maintained, **12,** 1425.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 594; **93,** 877; **97,** 937.
Storm, 1896, damaged top of break'r, **97,** 919.
Papers relative to necessity for H. of refuge, extracts from journals, etc.[1]
Severe storms in winter of 1907–08, damaged main break'r, **08,** 92.
Place at s. extremity of township of Narragansett, R. I., and marks the sw. entrance to Narragansett B. Locality dangerous for craft in a storm, such as light-built coal barges towed from N. Y. points, **12,** 127.

PROJECTS.

By Maj. Livermore, 1889, H. at Pt. Judith by constr. of a riprap granite break'r along the course of Squid Ledge and between the s. extremity of the ledge and Pt. Judith; est., $1,250,000, **90,** 595.
By Capt. Bixby, 1893, stonework by contract, **93,** 840.
Board, 1896, recom. crest of e. arm be raised to 9′ above h. w.; est., $444,311; and that constr. of detached e. break'r be postponed until necessity for it would be shown after completion of main work, **97,** 919.
Maj. Lockwood, 1897, est. cost of closing interval between the main break'r and shore at $187,558.80, **97,** 937.
Act June 13, 1902, modified proj. by au. constr. of e. detached break'r; est., $196,193; and continuing it to shore, with view to providing shelter for landing place; est., $187,558.80, **02,** 119.
Act Mar. 2, 1907, au. further extension of e. shore arm of break'r; est., $186,248.20, **07,** 89.
Act June 25, 1910, au. constr. of a detached w. shore arm of break'r; est., $665,000,[2] **10,** 106.
Total est. to 1912, $2,485,000.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Maj. Livermore (see Projects), **90,** 594.
Ex. of inner H. au. act July 13, 1892; made by Capt. Bixby in 1893 (**R.** unfav.), **93,** 877.
Sur. for e. break'r to shore au. act June 3, 1896; made by Maj. Lockwood in 1897 (**R.** unfav.); (see Projects), **97,** 937.
Ex. au. act June 13, 1902, of various Hs., with view to constr. H. of refuge and enlarging ocean entrance to Pt. Judith. **R.** by BE. (q. v.), Oct. 30, 1903,[3] **04,** 87.
Ex. au. act Mar. 2, 1907. **R.** by Col. Willard, Jan. 22, 1908; est., $921,502.80,[2] **08,** 97.
Cong. docs., etc., relating to ex., surs., plans, etc. **12,** 1424.
Maps.[2 3] **93,** 840; **95,** 686; **96,** 656; **03,** 808.

C-103 BLOCK ISLAND, R. I., GREAT SALT POND.

APPROPRIATIONS.

1896,	$40,000,	**96,** 660.
1899,	50,000,	**99,** 1143.
1902,	50,000,	**02,** 910.
1905,	30,000,	**05,** 867.
1907,	30,000,	**07,** 952.
1909,	*12,500,	**09,** 1023.
1910,	30,000,	**10,** 1145.
Total,	242,500,	**12,** 1529.

COMMERCE.

Unimportant, **93,** 880.
Many passengers in summer season; no effect on rates, **10,** 111.
1911, 8,736 t., valued at $626,929, **12,** 134.

CONTRACTS.

1896. S. & E. S. Belden, j. constr., $1.33 t., **97,** 927.
1900. J. P. Randerson, dr., 14½¢ and 29¾¢ c. y. Estate of John Beattie, repairing s. j., st. $1.40 s. t., **1900,** 1280, 1281. John P. Randerson, dr. (center of chan. to 25′), 29¼¢ c. y., **01,** 1145.
1901. E. S. Belden, st., $1.23 t., **02,** 910.
1903. E. S. Belden & Sons, st. in place in j., $1.23 t. Charles H. Latham, dr., 26.7¢ c. y., **03,** 818.
1905. E. S. Belden & Sons, st. in place in j., $1.23 t. Charles M. Cole, dr., 27¢ c. y., **06,** 918.
1907. J. S. Packard Dredging Co., dr., 28.5¢ c. y., **08,** 994.

*Allotment. [1] H. D. 935, 60th, 1st. [2] H. D. 911, 60th, 1st. [3] H. D. 60, 58th, 2d.

ENGINEERS.

Chief of Engineers. **R., 93,** 71; **96,** 54, 67; **97,** 79; **98,** 83; **99, 00,** 95; 109; **01,** 174; **02,** 121; **03,** 102; **04,** 85, 949; **05,** 92; **06,** 90; **07,** 92; **08,** 95; **09,** 98; **10,** 110, 112; **11,** 116; **12,** 133.

Boards. BE. appointed by an act 1902 (Col. Suter, Col. Mansfield, Maj. Goethals) to make an ex., to include H. of refuge at Great Salt Pond, and to report on its merits and what further imp. might be advisable, and the cost, **04,** 952.

In charge:
Capt. W. H. Bixby, 1892–93. **R., 93,** 880.
Lt. Col. S. M. Mansfield, 1896. **R., 96,** 620.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 660; **97,** 925; **98,** 929; **99,** 1141; **00,** 1276.
Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1144; **02,** 909.
Capt. C. E. Gillette, 1903. **R., 03,** 817.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 927; **05,** 867; **06,** 917; **07,** 951.
Maj. Harry Taylor, 1908. **R., 08,** 993.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1023; **10,** 1145.
Col F. V. Abbot, 1911–. **R., 11,** 1216; **12,** 1429.

OPERATIONS.

1896-97. 25,701 t. st. deposited in j., **97,** 926.
1897-98. 1,200 t. st. deposited in j., **98,** 930.
1898-99. 10,756 c. y. dr., **99,** 1143.
1899-00. 79,763 c. y. dr.; 69 c. y. bowlders removed; 705 t. riprap st. placed to repair s. j., **00,** 1279.
1900-01. 52,447 c. y. dr. and 76.2 c. y. bowlders removed, completing the chan., 18′ x 300′, from the ocean to the pond; 907 t. st. placed in outer end of f.; 43,786 c. y. dr. and 45.1 c. y. bowlders removed from center of 18′ chan. 25′, **01,** 1145.
1901-02. 3,958 t. st. placed in repairs to outer end of s. j., **02,** 910.
1902-03. 12,545 t. st. placed in s. j.; 1,992 c. y. dr., **03,** 817.
1903-04. 11,444 t. st. placed in extension of s. j.; 2,618 c. y. dr. from entrance to chan., **04,** 927.
1905-06. 12,013 t. st. placed in j.; 33,977 c. y. dr. and 1 c. y. bowlders removed, **06,** 917.
1906-07. 65,406 c. y. dr. and 46 c. y. bowlders removed, **07,** 951.
1907-08. 87,640 c. y. dr. and 199.4 c. y. bowlders removed, **08,** 993.
1908-09. 1,751 c. y. dr. by U. S. dredge *Gedney*. **09,** 1023.
1909-10. 716 c. y. dr., **10,** 1145.

PHYSICAL CHARACTERISTICS.

Details of, **93,** 881; **96,** 621; **04,** 955; **12,** 134.
G. S. P. located about center of Block Isld.; contains anchorage area of 150 acres for vessels drawing 18′ or over, **12,** 133.

PRIVATE (STATE) WORK.

Description of the js., etc., built by R. I., and New Shoreham, R. I., **96,** 620; the orig. work of converting "pond" into H. of refuge, **12,** 133.

PROJECTS.

In 1896, by Lt. Col. Mansfield, extension of the s. j. 1,197′ in l. and the n. j. 500′ in l. (see Private Work); also for the dr. of a chan. 25′ x 150′, shoaling to 12′ for 504′ and thence to h. w. line with a slope of 1 on 4; est., $97,567.94, **96,** 620, 660.
Sec. War, 1899, au. use of available funds to secure chan. 12′ d. at H. entrance, **99,** 1143.
Maj. Lockwood, 1899, est. cost of completion of proj. would be $71,220, **00,** 1277.
B. of E. recom., 1903, that further work be limited to dr. to 18′ for w. of 300′, then sloping to 12′, thereby reducing d. orig. proj.; est., $30,000, **04,** 959.

SURVEYS.

Ex. of breachway into pond with a view to constr. a H. of refuge, au. act July 13, 1892; made by Capt. Bixby, 1892 (**R.** unfav.), **93,** 881.
Sur. for H. of refuge, au. act Aug. 17, 1894; made by Lt. Col. Mansfield, 1895 (see Projects), **96,** 620.
By Maj. Lockwood, 1899, **100,** 1277.
Ex. of several s. New England ports, including Great Salt Pond, au. act June 13, 1902; made, 1903, by B. of E., **04,** 955.
Ex. au. act Mar. 3, 1909, with view to w. chan. and providing increased anchorage; made, 1909, by Lt. Col. Sanford (**R.** unfav.),[1] **10,** 112.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 134.
Maps. **03,** 818.

C-104 BLOCK ISLAND, R. I.—Harbor of Refuge at.

APPROPRIATIONS.

1870,	$30,000,	**70,** 75.
1871,	75,000,	**71,** 84.
1872,	50,000,	**72,** 81.
1873,	50,000,	**73,** 89.
1874,	20,000,	**74,** 100.
1875,	20,000,	**75,** 109.
1876,	40,000,	**76,** 50; **77,** 44.
1880,	6,000,	**80,** 390.
1882,	19,000,	**82,** 562.
1884,	15,000,	**84,** 628.
1886,	20,000,	**86,** 612.
1888,	15,000,	**88,** 507.
1890,	15,000,	**90,** 578.
1892,	24,000,	**92,** 632.
1894,	2,500,	**95,** 695.
1896,	5,000,	**96,** 659.
1899,	10,000,	**99,** 1140.
1902	*4,500,	**02,** 908.
	30,000,	**02,** 908.
1905,	50,000,	**05,** 865.
1907,	20,000,	**07,** 950.
1909,	*12,500,	**09,** 1022.
1910,	12,500,	**10,** 1144.
1911,	12,500,	**11,** 1215.
1912,	30,000,	**12,** 1428.

Total, 588,500 ($586,403.40, sales, and amount returned to Treas., **12,** 1428).

COMMERCE.

Important, **67,** 45, 451; **68,** 749, 785, 788, et seq.; **72,** 821; **74,** ii, 241; **78,** 242; **79,** 312.
Increase of C., **82,** 85.
Value of H., **85,** 611.
Affected C., large, **04,** 954.
Local C., chiefly fish and general merchandise, **10,** 110.
Traffic, 10,000 t. (decreasing), 1911, **12,** 1428.

CONTRACTS.

1870. John Beattie, st. for substr., **70,** 451.
1871. Finch, Engs & Co., lumber and cement. R. S. Place & Co., bolts. C. C. Campbell, granite. **71,** 741.
1872. J. G. Sheffield, granite, **72,** 822.
1873. F. H. Smith, granite, **73,** 977.
1874. F. H. Smith, granite, **75,** ii, 293.
1877. P. Harrington & Co., granite, **77,** 201.
1878. F. H. Smith, granite, **78,** 243.
1880. McDermott & Daly, dr., 28¢ c. y., **81,** 563.
1883. C. H. Edwards, granite riprap, $1.89 t., **83,** 496. J. Scully, building H. wall, **83,** 496.
1884. J. Scully, depositing riprap in break'r gap, $1.65 t., **85,** 608.
1887. W. H. Molthrop & Co., granite riprap for break'r and enlargement of inner H., **87,** 560.
1893. W. H. Molthrop & Co., fender piers, $750; st., $2.10 t. ($14,000), **93,** 844.
1895. Hartford Dredging Co., dr., 33⅓¢ c. y., s. m. ($1,000), **95,** 694.
1896. T. A. Scott, dr., 30¢ c. y. ($800), **96,** 658.
1897. T. A. Scott, dr., 35¢ c. y. ($1,750), **97,** 924.
1899. J. Beattie, st., $2.25 s. t., **00,** 1275.
1900. Cole Bros., dr., 32¢ c. y., **00,** 1275.

*Allotment.

[1] H. D. 313, 61st, 2d.

1902. Charles M. Cole, dr., 24¢ c. y., **02,** 909.
1902. J. S. Packard Dredging Co., dr., 23¢ c. y., **03,** 815.
1903. E. S. Belden & Sons, st. in place in break'r, $2.17 t.; about $20,000, **03,** 816.
1903. T. A. Scott., dr., 50¢ c. y., **03,** 815.
1905. J. S. Packard Dredging Co., dr., 24¢ c. y. E. S. Belden & Sons, repairing break'r, st. in place, $2.13 t., **05,** 866.
1907. Charles M. Cole, dr., 38¢ c. y., **08,** 993.
1909. J. S. Packard Dredging Co., dr., 21¾¢ c. y., **10,** 1143.

DOCUMENTS.

S. Doc. 81, 40th Cong., 2d sess. **R.** of BE. of 1868, **70,** 451; **71,** 741; **77,** 201.

ENGINEERS.

Chief of Engineers. **R., 67,** 17, 18, 45; **68,** 67; **70,** 75; **71,** 84; **72,** 81; **73,** 89; **74,** 99; **75,** 109; **76,** 50; **77,** 44; **78,** 48; **79,** 55; **80,** 75; **81,** 85; **82,** 85; **83,** 82; **84,** 88; **85,** 76; **86,** 77; **87,** 40; **88,** 41; **89,** 52; **90,** 47; **91,** 59; **92,** 63; **93,** 66; **94,** 59; **95,** 66; **96,** 66, 71; **97,** 78; **98,** 82; **99,** 94; **00,** 108; **01,** 172; **02,** 120; **03,** 101; **04,** 83, 949; **05,** 90; **06,** 89; **07,** 91; **08,** 94, 97; **09,** 97; **10,** 109; **11,** 114; **12,** 131.

Boards.

Col. H. Bache, president. Convened Feb. 18, 1868. Three plans for break'rs were proposed, 1 for a H. large enough to shelter vessels of the largest class, and the other 2 for a H. for local purposes. The board adopted the plan for a break'r on a line extending 500′ from a pt. near Sands Landing to Five-foot Rock, for local purposes. **70,** 75, 451; **75,** ii, 294; **77,** 201.

Appointed by au. act of 1902 (Col. Chas. Suter, Col. S. M. Mansfield, Maj. G. W. Goethals) to determine what further constr. was advisable and the cost; recom. imp. be continued to amount of orig. est. still unapp., $53,989, in tightening and raising the main break'r and dr. the inner H., **04,** 949, 968.

In charge:

Maj. D. C. Houston, 1867–70, **67,** 18. **R., 67,** 451; **68,** 749, 785.
Lt. Col. G. K. Warren, 1870–82, **70,** 74. **R., 70,** 451; **71,** 739; **72,** 821; **73,** 976; **74,** ii, 240; **75,** ii, 292; **76,** 209; **77,** 201; **78,** 241; **79,** 311; **80,** 390; **81,** 563; **82,** 562.
Lt. Col. G. H. Elliot, 1882–87. **R., 83,** 496; **84,** 626; **85,** 606, 610; **86,** 609.
Maj. W. R. Livermore, 1887–92. **R., 87,** 558; **88,** 504; **89,** 631; **90,** 575; **91,** 723.
Capt. W. H. Bixby, 1892–95. **R., 92,** 630; **93,** 842; **94,** 597; **95,** 693.
Maj. D. W. Lockwood, 1896–1900. **R., 96,** 657, 673; **97,** 922; **98,** 926; **99,** 1139; **00,** 1272.
Maj. Geo. W. Goethals, 1901–02. **R., 01,** 1141; **02,** 908.
Capt. C. E. Gillette, 1903. **R., 03,** 815.
Lt. Col. J. H. Willard, 1904–07. **R., 04,** 925; **05,** 865; **06,** 915; **07,** 949.
Maj. Harry Taylor, 1908. **R., 08,** 992.
Lt. Col. J. C. Sanford, 1909–10. **R., 09,** 1022; **10,** 1143.
Col. Frederic V. Abbot, 1911–. **R., 11,** 1215; **12,** 1427.

Assistants:

G. W. Dresser, **67,** 451. **R., 67,** 454; **68,** 788.
J. P. Cotton. **R., 72,** 823; **73,** 977; **74,** ii, 241; **80,** 391.

OBSTRUCTIONS.

To C., **68,** 795. List of vessels wrecked off Block Island, **68,** 802.

OPERATIONS.

1870–71. Break'r extension, 500 l. f., **71,** 739.
1871–72. Jetty extension, 270 l. f.; cribwork ommenced, **72,** 821, 823, 824.
1872–73. Jetty extension, 80 l. f.; cribs finished; dr. and r. excavation from inner H., **73,** 976, 978.
1873–74. Rock removed, 446 t.; break'r extension, 330 l. f., **74,** 99, ii, 240.
1874–75. Rock removed, 594½ t.; bulkhead wall constr.; break'r enlarged, **75,** 109, ii, 293.
1875–76. Repairs, **76,** 210.
1876–77. Break'r enlarged, **77,** 201, 202.
1877–78. Rock removed, 517 t.; break'r extension, 300 l. f., **78,** 48, 242.
1878–79. Repairs, **79,** 311, 313.
1880–81. Removal of wreck and dr. 16,146 c. y. from inner H., **81,** 563.
1882–83. Constr. of j. with hired labor and building H. wall by contract, **83,** 496.
1883–84. Completion of sea wall and j.; repair of wharf at inner H., **84,** 627.
1884–85. 5,795 t. riprap placed in break'r gap, **85,** 608.
1885–86. 2,376 t. riprap placed in break'r gap; repairs to ps. of inner H., **86,** 611.
1887–88. Six-sevenths of the gap filled; timber j. forming shore end of w. wall completed and filled with st.; n. wall commenced, **88,** 506.
1888–89. 3,530 t. riprap granite placed in n. wall of inner H., **89,** 632.
1889–90. 1,941 t. riprap granite placed in n. wall of inner H., and 420 t. on the break'r; 3,025 c. y. sand dr. from shoal at entrance to H., **90,** 576.
1890–91. 3,711 t. riprap granite placed in extension of n. wall of enlarged inner H., **91,** 725.
1891–92. 2,381 t. riprap granite placed in extension of n. sea wall, **92,** 631.
1892–93. 1,044 t. st. deposited in break'r, **93,** 843.
1893–94. 6,915 t. st. deposited in break'r, 38 fender piles placed, about 5,500 c. y. dr., and 1,013 t. of bowlders removed from old j. and placed in the new one, **94,** 599.
1894–95. About 2,800 c. y. dr., **95,** 694.
1895–96. About 3,300 c. y. dr., **96,** 658.
1896–97. 2,258 c. y. dr., **97,** 924.
1897–98. 2,742 c. y. dr., **98,** 928.
1899–00. 2,901 t. st. placed to repair break'r and 5,500 c. y. dr. from inner H. entrance, **00,** 1273.
1900–01. Lights at entrance of H. maintained, **01,** 1142.
1901–02. 9,068 c. y. dr. from shoal at entrance to inner H., **02,** 908.
1902–03. 14,594 c. y. dr. from entrance to H. and near SS. wharf; 610 t. st. placed on break'r, **03,** 815.
1903–04. 8,752 t. st. placed on break'r, completing repairs to 650′, **04,** 926.
1904–05. 1,571 t. st. placed on break'r, **05,** 865.
1905–06. 8,429 t. st. placed in main break'r, 89,384 c. y. dr., and about 266 c. y. bowlders removed, **06,** 915.
1906–07. Lights at entrance to H. maintained, **07,** 949.
1907–08. 32,226 c. y. dr. and about 682 c. y. bowlders removed, **08,** 992.
1908–09. Lights at entrance to H. maintained **09,** 1022.
1909–10. 40,000 c. y. sand and about 17 c. y. bowlders removed, **10,** 1143.
1910–11. Light maintained at entrance to H. during year by Eng. Dept., **11,** 1215.

PHYSICAL CHARACTERISTICS.

General, **67,** 454; **68,** 793, 794; **90,** 575; **96,** 674.
Site described, **68,** 789; **78,** 241; **79,** 311, 312.
Tides, **68,** 796, 799; **75,** ii, 294; **79,** 311.
North wall damaged by storms, winter, 1898–99, **99,** 1140.
Description of, **04,** 954; **11,** 115.

PLANS.

By G. W. Dresser, for dr. chan. 25′ x 633′ x 2,465′; for constr. of ps., 17½′ x 20′ x 900′, $1,000,000, **68,** 793, 794. For break'r 3,000′ l., substr. 30′ w., superstr. 15′ w. on top, 20′ w. at base, 12′ h.; also for a lighthouse, $1,445,000, **68,** 795.

By B. E., 1868: (1) For a break'r sheltering a H. of sufficient capacity for vessels of largest class. (2) For a break'r extending 300′ beyond Five-foot Rock and sheltering a H. for local purposes. Est., $553,798 and $3,000,000. (3) See Projects. **75,** ii, 294; **77,** 201, 202.

By J. P. Cotton, for j. extension of 700′, and p. constr., $86,000, **74,** ii, 242.

PRIVATE (CORPORATE) WORK.

Constr. of a wharf by Fall River Iron Co., **74,** ii, 240.

PROJECTS.

By B. E., 1868, for break'r extending from the shore to Five-foot Rock, faced with cut st., est. $372,000; subsequently modified so as to dispense with this facing; ultimately extended to a pt. 500′ beyond Five-foot Rock, **70,** 452; **75,** ii, 294; **77,** 202.

By Lt. Col. Warren, temporary H. to consist of 2 cribs, with wings approaching each other, leaving an opening of 60′, **71,** 739; **72,** 823; **79,** 311. For a detached break'r 300′ l., to protect H. from ne. winds; est., $60 000, **74,** ii, 242, 243.

By Lt. Col. Warren, 1880, dr. inner H. to 9′, with the removal of a wreck therefrom; est., $8,000, **80,** 391, 392; completed, 1881, **81,** 563.

By Lt. Col. Warren, 1881, H. wall on the e. side of the inner H., and j. to protect the H. from material washed from the sw. and e.; est., $19,000, **82,** 563.

The proj. under which work was being carried on in 1888 was a consolidation of 4 prior projs., namely, one by Lt. Col. Elliot, 1883, for replacing the timber cribs on n. and w. sides of the inner H. by walls of st. and for replacing s. wharf by a retaining wall backed by earth; est., $30,000, **83,** 497; another by Lt. Col. Elliot in 1884, for closing a gap 200′ in the main break'r; est., $30,000, **84,** 628; another by Lt. Col. Elliot, 1885, for enlargement of the inner H. to about 18¾ acres; est., $46,189, **86,** 611, 613; and lastly a proj. by Maj. Livermore, 1888, for removal of a shoal obstr. navigation at the entrance to Block Isld. H., giving 9′ to a line 20′ from the break'r; est., $5,000, **88,** 505, 506; total est., $111,189. These combined projs. provided for a H. of refuge on the e. side of the isld., consisting of an inner H. or basin for small vessels and ar exterior H. for large ones. The basin was to be about 250′ x 300′ in area and inclosed, save for an opening 80′ w. The exterior H. was to be formed by a riprap break'r 1,000′ l., **91,** 724; **92,** 631.

By Maj. Lockwood, 1895, raising the height of the break'r, stopping sand leaks at certain points, and dr. in the main H. to 10′; est., $83,985, **96,** 658.

By Capt. Bixby, 1895, dr. and all other work to be done with hired labor and the U. S. plant, **95,** 694.

By Maj. Lockwood, 1899, repairing and strengthening n. wall of the inclosed H., **99,** 1140.

Action, 1902. (See Board of Engineers.)

Act June 25, 1912, adopted proj., by Lt. Col. Willard, for straightening and rebuilding certain portions of breakw'r and for dr. anchorage basin to 15′, m. l. w.; cost, $132,000,[1] **08,** 97; **12,** 132.

SURVEYS.

By G. W. Dresser, 1867–68, **67,** 45; **68,** 749. **R., 67,** 454; **68,** 788.

Sur. au. act Aug. 17, 1894; made by Maj. Lockwood, 1895 (see Projects), **96,** 673.

Ex. of several s. New England ports, incl. Block Isld., au. act June 13, 1902, by B. of E.[2] (q. v.), **04,** 949, 954.

Au. act Mar. 2, 1907; made, 1907–08, by Lt. Col. Willard,[1] **08,** 97.

Of entrance to H., showed no serious shoaling since dr. of Oct., 1909, **11,** 1215.

Maps.[1] **80,** 390; **85,** 612; **88,** 506, soundings; **93,** 844; **95,** 694; **03,** 816.

Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 173; **02,** 121; **01,** 84, 87; **05,** 91; **08,** 97; **10,** 110; **11,** 115; **12,** 132.

C-105 WATCH HILL COVE, LITTLE NARRAGANSETT BAY, R. I.

ENGINEERS.

Chief of Engineers. R., 91, 62.

In charge. Maj. W. R. Livermore, 1890. **R., 91,** 735.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 735.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Livermore (**R.** unfav.), **91,** 735.

C-106 LITTLE NARRAGANSETT BAY, CONN. AND R. I.

APPROPRIATIONS.

1876,	$5,000,	**77,** 44.
1878,	10,000,	**78,** 49.
1879,	5,000,	**79,** 55.
1880,	5,000,	**80,** 394.
1881,	5,000,	**81,** 565.
1882,	6,000,	**82,** 564.
Total,	36,000	

COMMERCE.

Benefit of imp., **76,** 218, 221; **77,** 204; **79,** 315.

CONTRACTS.

1877. W. H. Molthrop, dr. 4,084 c. y., average price of 39.4¢ c. y., **77,** 204; **78,** 245.

1878. E. R. Seward, dr. 19,777 c. y., 30¢ c. y., and excavating r., **79,** 314.

1879. J. McDermott, dr., 23½¢ c. y., **80,** 393.

1880. W. H. Beard, dr., 18¢ c. y., **81,** 564.

1882. Hartford Dredging Co., dr., 21¢ c. y., **83,** 498.

ENGINEERS.

Chief of Engineers. R., 76, 51; **77,** 44; **78,** 49; **79,** 55; **80,** 75; **81,** 86; **82,** 86; **83,** 83; **84,** 89; **85,** 78; **86,** 78; **87,** 41, 43.

In charge:

Maj. G. K. Warren, 1875–83. **R., 76,** 217; **77,** 203; **78,** 243; **79,** 313; (Lt. Col.) **80,** 392; **81,** 564; **82,** 563.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 498; **84,** 629; **85,** 615; **86,** 613; **87,** 571.

Maj. W. R. Livermore, 1887–88. **R., 87,** 561; **88,** 508.

Assistant. H. A. Bentley, **78,** 245; **79,** 315. **R., 76,** 218.

OPERATIONS.

1877-78. Dr. 4,015 c. y.; r. removal, 200 c. y., **78,** 49, 245.

1878-79. Dr. 19,776.85 c. y.; r.removal, 348.6 c. y., **79,** 314.

1879-80. 17,935 c. y. dr., **80,** 393.

1880-81. 8,092 c. y. dr., **81,** 564.

1881-82. 33,686 c. y. dr., 25 rs. removed with hired labor from e. entrance of new chan., and 57 bowlders removed at Watch Hill, **82,** 563.

1882-83. 20,867 c. y. dr. from chan., completing proj., **83,** 498.

1883-84. 100 bowlders removed from main and Watch Hill chans.; proj. completed, **84,** 629; **86,** 614; **87,** 561.

[1] H. D. 828, 60th, 1st.

[2] H. D. 60, 58th, 2d.

PHYSICAL CHARACTERISTICS.

General, **76,** 217, 219; **79,** 313; **88,** 508. Tides, **76,** 218, 220; **78,** 245. Obstrs., rs., and shoals, **76,** 218, 220, 221.

PROJECTS.

By Maj. Warren, 1876, chan. 7½′ x 200′ m. l. w., across n. shore of the B., Pawcatuck Pt. to d. w. near the mouth of the B. at Sandy Pt.; also removing dangerous rs. in chan. near Rhodes Folly and Watch Hill. Est., $51,000, **76,** 221; **80,** 392; **86,** 78; proj. completed in 1884, **86,** 78, 614; **87,** 561.

SURVEYS.

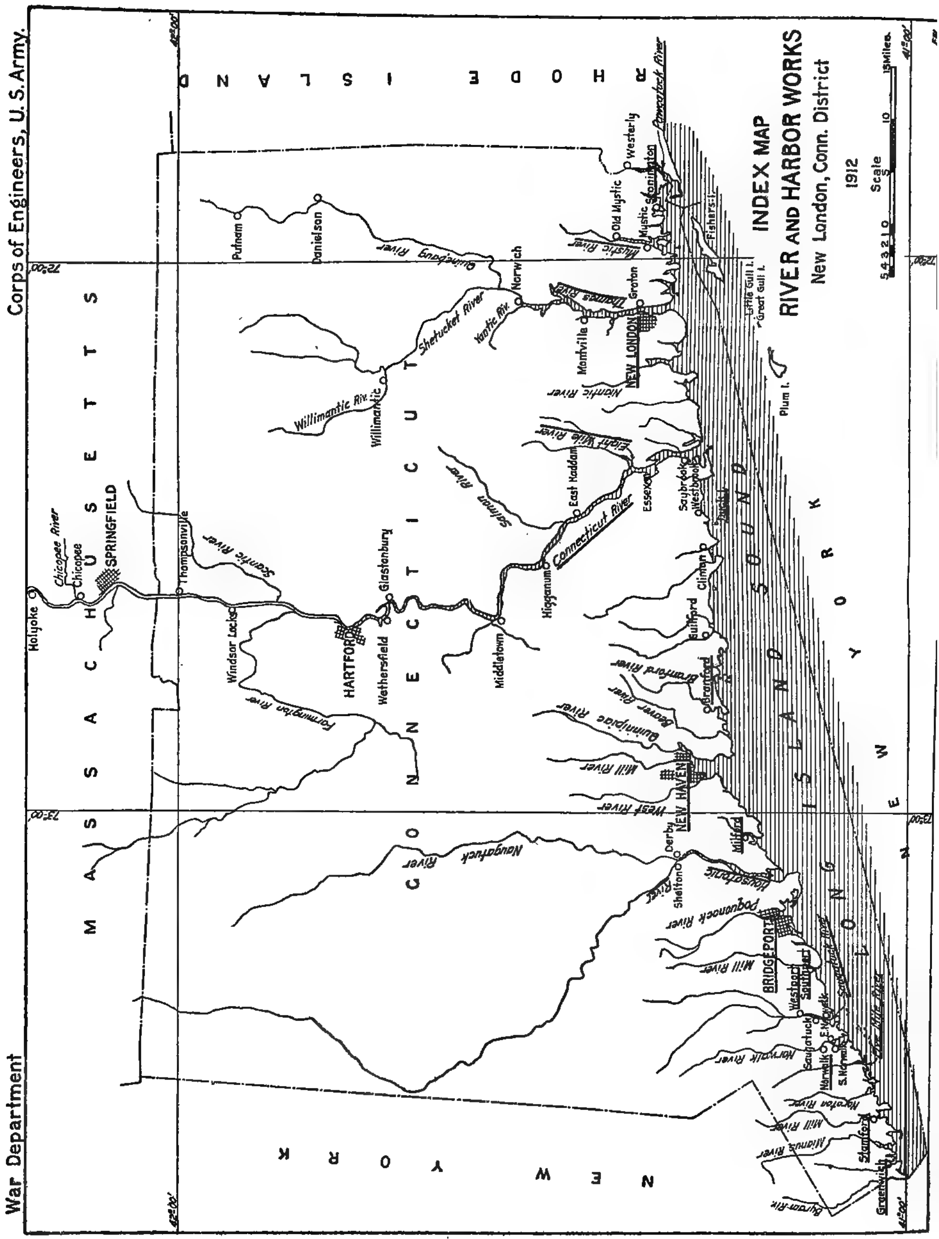
Included in C. S., 1839, 1855, **76,** 217.

By H. A. Bentley, 1875. **R.,** **76,** 218. Comparison of surs. of 1839, 1855, and 1875, **76,** 219.

Ex. of entrance to wharves at Watch Hill au. act Aug. 5, 1886; made by Lt. Col. Elliot (**R.** unfav.), **87,** 571.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

D.—NEW LONDON, CONN., DISTRICT.


Corps of Engineers, U.S. Army.
War Department
INDEX MAP
RIVER AND HARBOR WORKS
New London, Conn. District
1912
Scale
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
NEW YORK
LONG ISLAND SOUND
SPRINGFIELD
HARTFORD
NEW LONDON
NEW HAVEN
BRIDGEPORT
Norwich
Connecticut River
Thames River
Housatonic River
Naugatuck River

D.—NEW LONDON, CONN., DISTRICT.

In charge of U. S. Engineer Office,
New London, Conn.

D 1 Pawcatuck R., R. I. and Conn. (*)
D 2 Stonington H., Conn. (*)
D 3 Wequetequock R., Conn. (*)
D 4 Quiambog Cove, Conn. (*)
D 5 Mystic R., Conn. (*)
D 6 Poquonock R., Conn. (*)
D 7 New London H., Conn. (*)
D 8 Winthrop Cove, Conn. (7)
D 9 Shaws Cove, Conn. (7)
D 10 Hay (West) H., Fishers Isld., N. Y. (*)
D 11 Thames R., Conn. (*)
D 12 Long Cove, Conn. (11)
D 13 Poquetannuck Cove, Conn. (11)
D 14 Shetucket R., Conn. (11)
D 15 Yantic R., Conn. (11)
D 16 Trading Cove, Conn. (11)
D 17 Hortons Cove, Conn. (11)
D 18 Smith Cove, Conn. (11)
D 19 Jordan Creek, Conn. (*)
D 20 Niantic R., Conn. (*)
D 21 Pataguanset R., Conn. (*)
D 22 Four Mile R., Conn. (*)
D 23 Connecticut R., Conn. and Mass. (*)
D 24 Westbrook H., Conn. (23)
D 25 Fifteen-mile Falls, N. H. (23)
D 26 Black Hall R., Conn. (23)
D 27 Duck R., Conn. (23)
D 28 Lieutenants R., Conn. (23)
D 29 Lords Cove, Conn. (23)
D 30 Eightmile R., Conn. (23)
D 31 Salmon R., Conn. (23)
D 32 Chicopee R., Conn. (23)
D 33 Westfield R., Conn. (23)
D 34 Farmington R., Conn. (23)
D 35 Farmington Canal, Conn. (34)
D 36 Park R., Conn. (23)
D 37 Wethersfield Cove, Conn. (23)
D 38 Chester Creek, Conn. (23)
D 39 Deep R., Conn. (23)
D 40 Oyster R., Conn. (*)
D 41 Duck Island H., Conn. (*)
D 42 Patchogue R., Conn. (41)
D 43 Menunketesuck R., Conn. (41)
D 44 Clinton H., Conn. (*)
D 45 Indian R., Conn. (44)
D 46 Hammonasset R., Conn. (44)
D 47 Madison H., Conn. (*)
D 48 Guilford H., Conn. (*)
D 49 Falkners Isld., Conn. (*)
D 50 East R., Conn. (48)
D 51 West R., Conn. (48)
D 52 Stony Creek, Conn. (*)
D 53 Branford H., Conn. (*)
D 54 Branford R., Conn. (53)
D 55 East Haven R., Conn. (*)
D 56 New Haven H., Conn. (*)
D 57 New Haven, Conn. (break'r) (*)
D 58 Quinnipiac R., Conn. (56)
D 59 Mill R., Conn. (56)
D 60 West R., Conn. (56)
D 61 Milford H., Conn. (*)
D 62 Indian R., Conn. (61)
D 63 Wepowage R. (Wopowaug), Conn. (61)
D 64 Housatonic R., Conn. (*)
D 65 Naugatuck R., Conn. (64)
D 66 Bridgeport H., Conn. (*)
D 67 Lewis Gut, Conn. (66)
D 68 White Rock Creek, Conn. (66)
D 69 Johnsons Creek, Conn. (66)
D 70 Yellow Mill Pond, Conn. (66)
D 71 Poquonock R., Conn. (66)
D 72 Black Rock H., Conn. (*)
D 73 Cedar Creek, Conn. (72)
D 74 Burr Creek, Conn. (72)
D 75 Ash Creek, Conn. (*)
D 76 Southport H., Conn. (*)
D 77 Mill R., Conn. and N. Y. (76)
D 78 Saugatuck R., Conn. (*)
D 79 Westport H., Conn. (78)
D 80 Norwalk H., Conn. (*)
D 81 Norwalk R., Conn. (80)
D 82 Wilsons Point H., Conn. (*)
D 83 Farm Creek, Conn. (82)
D 84 Fivemile R., Conn. (*)
D 85 Fivemile R. Harbor, Conn. (*)
D 86 Scotts Cove, Conn. (*)
D 87 Darien R. (Goodwives Creek), Conn. (*)
D 88 Darien H., Conn. (*)
D 89 Westcott Cove, Conn. (*)
D 90 Tomac H., Conn. (*)
D 91 Cove H., Conn. (89)
D 92 Stamford H., Conn. (*)
D 93 East Branch, Conn. (92)
D 94 Mill R., Conn. and N. Y. (92)
D 95 Cos Cob H., Conn. (*)
D 96 Mianus R., Conn. and N. Y. (95)
D 97 Greenwich H., Conn. (*)
D 98 Byram R., Conn. and N. Y. (*)

* Long Island Sound.

D-1 PAWCATUCK RIVER, R. I. AND CONN.

APPROPRIATIONS.

1871,	$10,000,	**71,** 84.
1872,	10,000,	**72,** 82.
1873,	10,000,	**73,** 89.
1874,	10,000,	**74,** 100.
1875,	10,000,	**75,** 109.
1886,	12,000,	**86,** 617.
1888,	10,000,	**88,** 510.
1890,	16,600,	**90,** 580.
1892,	3,800,	**92,** 634.
1894,	6,000,	**95,** 697.
1896,	15,000,	**96,** 662.
1899,	15,000,	**99,** 1150.
1902,	9,000,	**02,** 922.
1904,	*4,100,	**05,** 872.
1905,	1,000,	**05,** 872.
1907,	33,000,	**07,** 956.
1910,	15,000,	**10,** 1151.

Total, 190,500 (total, incl. misc., $191,130.67, **12,** 1434).

COMMERCE.

Important, **71,** 744, 745; **74,** ii, 246; **76,** 211.
Increasing, **95,** 677.
1900, 57,530 t., **01,** 1161; 1904, 141,832 t., **05,** 873; 1911, 53,921 t., **12,** 1434.
Effect of imp. permits coal, lumber, and bldg. material to be delivered by vessels at Westerly, gaining lower rates, **12,** 138.

CONTRACTS.

1871. E. R. Seward, dr., 35¢ c. y., **71,** 741; **72,** 825.
1872. T. J. Hill, dr., 35¢ c. y., **72,** 825. E. M. Payn, dr., 36¼¢ c. y., **72,** 825. M. F. Brainard, dr., $8.75 per hour, **72,** 825, 826.
1875. J. H. Fenner, dr., 22¢ c. y., **75,** ii, 295. T. J. Hill, dr., 28¢ c. y., **75,** ii, 295.
1886. A. J. Beardsley & Son, dr., 12½¢ c. y., **87,** 566.
1890. Hartford Dredging Co., dr., 21¢ c. y., **91,** 728.
1895. J. H. Fenner, dr., 29.5¢ c. y. ($4,000), **95,** 697.
1897. Hartford Dredging Co., dr., 23¢ c. y. ($6,900), **97,** 941. S. C. Fraser, r. removal, $9.50 c. y. or t. ($3,800), **97,** 941.
1899. Hartford Dredging Co., dr., 30¢ c. y. ($13,000), **99,** 1151.
1902. Hartford & New York Trans. Co., dr., 18¢ c. y., **03,** 832.
1905. John Randerson, dr., 22¢ c. y., and r. removal, $15 c. y., **06,** 921.
1906. T. A. Scott Co., removing bowlders, $15 c. y., **06,** 922.
1908. T. A. Scott Co., dr., 21¼¢ c. y.; removing bowlders exceeding 1 c. y., $10 each, **08,** 998.
1909. T. A. Scott Co., removal of ledge opposite Pawcatuck Pt. (about 54 c. y.), and one about 600′ e.; and removal of all material within area 75′ x 100′ along chan. for lump sum of $1,850, **09,** 1028.
1912. J. S. Packard Dredging Co., dr. about 40,000 c. y., 26½¢ c. y., s. m., **12,** 1434.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 76; **71,** 84; **72,** 81; **73,** 89; **74,** 100; **75,** 109; **76,** 50; **77,** 44; **78,** 49; **85,** 80; **87,** 42; **88,** 43; **89,** 53; **90,** 48; **91,** 60; **92,** 64; **93,** 67; **94,** 60; **95,** 67; **96,** 68, 71; **97,** 82; **98,** 85; **99,** 97; **00,** 112; **01,** 175; **02,** 114, 123; **03,** 104; **04,** 88; **05,** 93; **06,** 93; **07,** 95; **08,** 97; **09,** 100; **10,** 113; **11,** 118; **12,** 137.

In charge:
Maj. D. C. Houston, 1870; **70,** 74.
Maj. G. K. Warren, 1870–78. **R., 70,** 453; **71,** 741, 743; **72,** 824; **73,** 979; **74,** ii, 243; **75,** ii, 295; **76,** 210; **77,** 203; **78,** 243.
Lt. Col. G. H. Elliot, 1884–87. **R., 85,** 622; **86,** 616.
Maj. W. R. Livermore, 1887–92. **R., 87,** 565; **88,** 509; **89,** 635; **90,** 578; **91,** 726.
Capt. W. H. Bixby, 1892–95. **R., 92,** 633; **93,** 845; **94,** 600; **95,** 696.
Maj. D. W. Lockwood, 1896. **R., 96,** 661, 676.
Maj. S. S. Leach, 1897–1901. **R., 97,** 940; **98,** 941; **99,** 1149; **00,** 1320; **01,** 1159.
Maj. C. F. Powell, 1902–05. **R., 02,** 921; **03,** 831; (Lt. Col.) **04,** 969; **05,** 871.
Maj. H. Taylor, 1906–10. **R., 06,** 921; **07,** 955; **08,** 997; (Lt. Col.) **09,** 1027; **10,** 1149.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1221; **12,** 1433.

Assistants:
J. H. Dager. **R., 71,** 744.
H. S. Van Ingen. **R., 72,** 826.
H. A. Bentley. **R., 74,** ii, 244.
Lt. E. H. Schulz, **01,** 175; **02,** 123.
Capt. C. H. McKinstry, **03,** 104.
Lt. W. D. Connor, **03,** 104; (Capt.) **04,** 87.
Lt. William Kelly, **03,** 104; **04,** 87, 88; (Capt.) **05,** 93.
Capt. G. R. Lukesh, **06,** 93.

OPERATIONS.

1871-72. Removal of 12,930 c. y. by dr.; chan. 5½′ x 43′ x 945′, **72,** 82, 826.
1872-73. Removal of 21,922½ c. y.; 2′ d. to Westerly, **73,** 89, 979.
1873-74. Depth of chan. to Westerly increased to 5′ x 5½′ x 40′, **74,** 100, ii, 243.
1874-75. Removal of 38,650 c. y. from chan.; 20 t. of r. removed, **75,** 109, ii, 295.
1875-76. Removal of 22,618 c. y.; bowlders removed; chan. completed to Westerly, and continued 2,400′ beyond, the property owners bearing half the expense, **76,** 50, 210.
1886-87. Under proj. of 1885, 19,721 c. y. dr., **87,** 556.
1887-88. 48,939 c. y. sand, mud, and bowlders excavated, **88,** 509.
1888-89. 8,355 c. y. and 6 c. y. bowlders removed, **89,** 635.
1889-90. 339 t. of r. and 7,509 c. y. of sand and gravel removed, **90,** 579.
1890-91. 17,316 c. y. dr., **91,** 727.
1891-92. 25,416 c. y. dr., **92,** 634.
1893-94. 67 t. of bowlders and 59 t. of r. removed, **94,** 601.
1894-95. 6,548 c. y. dr. and some bowlders removed, **95,** 697.
1895-96. 8,815 c. y. dr. and some bowlders removed, **96,** 662.
1896-97. 266 c. y. of bowlders removed, **97,** 940.
1897-98. About 114 c. y. of r. removed, and 34,980 c. y. dr., **98,** 942.
1899-00. 43,797 c. y. dr., **00,** 1320.
1902-03. 28,617 c. y. clay, sand, and gravel removed, **03,** 832.
1905-06. 15,779 c. y. mud, sand, and clay dr., and 73.45 c. y. bowlders removed, **06,** 921; 55.82 c. y. bowlders removed under agreement with T. A. Scott, and 39.83 c. y. bowlders in Watch Hill chan. removed by same party; work completed Feb. 8, 1906, **06,** 921, 922.
1906-07. Sur. in upper part of 40′ chan. at Westerly, R. I., **07,** 955.
1907-08. 1,460 c. y. earth and 34.93 c. y. of bowlders removed from chan. at Westerly, and 39, 561 c. y. earth and 18.54 c. y. bowlders removed from Little Narragansett B., **08,** 998.
1908-09. 19,336 c. y. earth and 47.28 c. y. bowlders removed from Little Narragansett B., and 60,966 c. y. earth and 2.21 c. y. bowlders removed, **09,** 1028.
1909-10. Ledge opposite Pawcatuck Pt. at mouth of R., and a few scattered bowlders removed and contract completed Sept. 10, 1909, **10,** 1150.
Proj. about 30% done, **12,** 137.

PHYSICAL CHARACTERISTICS.

Description, **71,** 744; **72,** 826; **74,** ii, 244, 245; **85,** 622.
Character of dr. material, **74,** ii, 245.
Tidal observations, **71,** 742.

*Allotment.

Navigable part of R. extends 5 m. from town of Westerly, R. I., to its outlet in Little Narragansett B.; thence through Little Narragansett B. to Stonington outer H., 2½ m., **01,** 175.

Chan. of R. in good condition, while that in B. is in poor shape, **03,** 831.

Max. draft 10′ in B. chan., 7′ in R., and 6′ near Watch Hill; mean rise of tide 2.6′ at mouth and 2.3′ at Westerly, **09,** 101.

Little Narragansett B. chan. is 10′ x 100′ x 10,400′ l.; chan. from Avondale to lower wharves at Westerly is 10′ x 100′ x 14,000′; with exception of a stretch in vicinity of Stantons Weir Pt., about 1,800′ l., now under contract; and a chan. 10′ x 40′ has been dr. between lower and upper wharves at Westerly, about 3,000′ l., to head of navigation, **12,** 137, 138.

See last paragraph of Surveys.

PRIVATE AND CORPORATE WORK.

Chan. excavated by citizens of Westerly for $4,200, **71,** 744.

1876. One-half the cost of extending chan. 2,400′ above Westerly paid by property owners, **76,** 211.

PROJECTS.

From 1871 to 1875, incl., $50,000 expend. upon chan. 5½′ x 75′ below the wharves, and from 35 to 40′ w. between the upper and the lower wharves, **71,** 741, 744; **75,** ii, 296; **87,** 565.

Proj. 1888 contemplated w. the chan. to 100′ below the wharves and to 40′ between the upper and lower wharves, the entire chan. to be dr. to 8′ m. l. w.; est., $38,637, **88,** 43; **91,** 727.

By Capt Bixby, 1893, doing work by hired labor and use of US. plant, **93,** 846.

By Capt. Bixby, 1895, dr. by contract, **95,** 697.

By Capt. Bixby, 1895, chan. 10′ d. from Stonington H. to Westerly, 200′ w. from Stonington to Avondale, R. I., with w. of 40′ between the upper and lower wharves at Westerly; total est., $200,-361.60, **96,** 661.

Act Mar. 3, 1905, au. $1,000 for obstr. removal at Watch Hill, at se. part of Little Narragansett B., **12,** 137.

Est., to connect the 2 portions of chan. already dr., to straighten chan. where necessary, and to remove crooked bends, $15,000, **10,** 1150.

Expend. of large amount necessary to obtain increased w. of chan., considered inadvisable, **10,** 1150.

SURVEYS.

By J. H. Dager, 1870; **70,** 31, 76; **71,** 84, 741, 744; **74,** ii, 243.

By H. A. Bentley, 1873; **74,** ii, 243–245.

Ex. and sur. au. act July 5, 1884; made, 1884 and 1885, by Lt. Col. Elliot, **85,** 622, 623.

Sur. au. act Aug. 17, 1894; made by Maj. Lockwood, 1895 (**R.** fav.) (see Projects), **96,** 676.

Minor sur. made of chan. across B. and at mouth of R., and an ex. of R. to Westerly, R. I., the head of navigation, **03,** 831.

Minor sur. made, 1904, and proddings and soundings taken of bowlder bottom in chan. off Pawcatuck Pt., near entrance of R., **04,** 970.

Minor sur., 1907, of shoal in upper part of 40′ chan. at Westerly, R. I., **07,** 955.

Minor sur., 1908, made from lower end of dr. done in 1900 to Avondale, and from Stonington Pt. up Little Narragansett B., 4,000′ e. of Folly Beacon, **08,** 997.

Minor sur. made, 1909, of shore line from Stonington Pt. to mouth of Pawcatuck R., n. of B., and of Sandy Pt., on s. side; also of w. side from mouth of R. to Davis Dock, and on e. side from mouth to about 2½ m. above mouth, **09,** 1028.

Minor sur. across B. and up R. about 1,300′ above Clark Thread Co.'s wharf, discloses but little shoaling, **12,** 1434.

Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 137.

Maps: Of Pawcatuck R. and Little Narragansett B., **79,** 314.

85, 624; **93,** 846; **95,** 696.

D-2 STONINGTON HARBOR, CONN.[1]

APPROPRIATIONS.

1827,	$200.00 (sur.), act Mar. 2.	
1828,	20,000.00,	**79,** 327.
1830,	16,491.67,	**79,** 327.
1834,	262.16, act June 27.	
1873,	25,000.00,	**73,** 90.
1874,	20,000.00,	**74,** 100.
1875,	25,000.00,	**75,** 103.
1878,	40,000.00,	**78,** 51.
1879,	37,500.00,	**79,** 57.
1880,	25,000.00,	**80,** 438.
1881,	30,000.00,	**81,** 581.
1882,	25,000.00,	**82,** 598.
1884,	10,000.00,	**84,** 632.
1886,	20,000.00,	**86,** 616.
1888,	8,000.00,	**88,** 512.
1890,	12,500.00,	**90,** 582.
1892,	12,500.00,	**92,** 637.
1894,	5,000.00,	**95,** 700.
1896,	5,000.00,	**96,** 664.
Total,	337,453.83	

COMMERCE.

Important, **72,** 918, 920, 921; **73,** 89; **76,** 222; **77,** 210; **78,** 393; **79,** 329.

Description of, **93,** 894.

Increasing C. an urgent reason for further imp. of H., **96,** 678.

CONTRACTS.

1873. S. F. Shelbourne, dr. 91,087 c. y., 20¢, **73,** 981; **74,** ii, 247.

1874. M. F. Brainard, dr. 118,422 c. y., 16½¢, **75,** ii, 238; **76,** 222.

1875. J. S. Schuyler, furnishing st. for break'r, **76,** 223.

1878. I. A. Sylvester, furnishing st. for break'r, **79,** 325.

1879. F. K. Ballou, riprap granite, 90¢ t., **80,** 438.

1880. F. K. Ballou, riprap granite, 88¢ t., **81,** 581.

1881. F. K. Ballou, riprap granite, $1.14 t., **81,** 581.

1882. F. K. Ballou, riprap granite, $1.10 t., **83,** 500.

1884. J. A. Bouker, riprap st., $1.15 t., **85,** 617.

1886. J. A. Bouker, riprap granite in place, $1.03 t., **87,** 564.

1889. C. F. Stoll, furnishing and placing riprap granite, $11.07 t., **89,** 640.

1894. S. & E. S. Belden, st., $1.03 t. ($8,000), **95,** 700.

1895-96. A. J. Beardsley & Son, dr. amounting to $2,713.45, **96,** 664.

1897. D. Toomey, sea-wall constr., $4.30 c. y. ($3,354), **97,** 943.

DOCUMENT. (Not in reports.)

R. of Lt. J. Prescott to Lt. Col. J. Andrews, Dec. 1, 1827; referred to, **72,** 919.

ENGINEERS.

Chief of Engineers. R., 71, 86; **72,** 85; **73,** 90; **74,** 100; **75,** 103; **76,** 51; **77,** 46; **78,** 51; **79,** 56; **80,** 76; **81,** 89, 583; **82,** 90; **83,** 84; **84,** 90; **85,** 79; **86,** 78; **87,** 41; **88,** 43; **89,** 54; **90,** 49; **91,** 60; **92,** 65; **93,** 68, 71; **94,** 61; **95,** 68; **96,** 69, 71; **97,** 83; **98,** 86; **99,** 99; **00,** 114; **01,** 177.

Boards:

Convened, Stonington, Conn., June 29, 1875. Submitted 3 plans: (1) Break'r extending about

[1] Sur.—**R.,** Dec. 1, 1827; est., $44,337. (H. D. 482, 55th, 2d.)

2,000′ se. from vicinity of Wampasset Pt.; (2) break'r off s. end of Penguin Shoal, providing a small exterior H.; (3) break'r along s. edge of Penguin Shoal, covering interior waters only. **R., 75,** ii, 243. (Lt. Cols. Wright, Newton, Thom, and Kurtz, and Maj. Barlow.)

Convened, New York, Aug. 24, 1880, to report upon further imp. at Stonington H. **R., 81,** 583. (Cols. Tower and Newton.)

In charge:

Lt. Col. J. Anderson, 1827; **72,** 919.

Maj. G. K. Warren, 1871–74. **R., 71,** 828; **72,** 917; **73,** 981; **74,** ii, 246.

Maj. J. W. Barlow, 1874–83. **R., 75,** ii, 238; **76,** 222; **77,** 209; **78,** 393; **79,** 325; **80,** 437; **81,** 579; **82,** 597.

Lt. Col. G. H. Elliot, 1883–87. **R., 83,** 500; **84,** 616; **85,** 616; **86,** 614.

Maj. W. R. Livermore, 1887–92. **R., 87,** 562; **88,** 511; **89,** 637; **90,** 581; **91,** 729.

Capt. W. H. Bixby, 1892–95. **R., 92,** 635; **93,** 847, 891; **94,** 602; **95,** 698.

Maj. D. W. Lockwood, 1896. **R., 96,** 663, 678.

Maj. S. S. Leach, 1897–01. **R., 97,** 942; **98,** 944; **99,** 1152; **00,** 1322; **01,** 1161.

Assistants:

Lt. J. Prescott, 1827; **72,** 919.

J. H. Dager. **R., 72,** 919.

H. A. Bentley. **R., 74,** ii, 247.

G. C. Almy. **R., 75,** ii, 240; **76,** 222; **79,** 329; **80,** 439.

Lt. W. W. Harts. **R., 93,** 893.

ESTIMATES. (See Plans and Projects.)

By J. H. Dager, in accordance with plan No. 1 (see Plans), $139,205; No. 2, $100,214.40; No. 3, $51,579; No. 4, $21,186. Removal of break'r, $180,989.60. Constr. of j., $20,000, **72,** 919–921.

By Maj. Warren, break'r and j., $420,000, **72,** 85, 918.

By BE., 1875, break'rs, $182,000 and $125,000, **75,** ii, 245, 246.

By G. C. Almy, break'r, $150,000, **79,** 326, 331.

OPERATIONS.

1828–34. 740 l. f. break'r, 82,268 t. st. used, according to Lt. Prescott's proj., **72,** 918; **79,** 327.

1873–74. 91,087 c. y., dr., **74,** ii, 247.

1874–75. 63,562 c. y. dr., **75,** ii, 238.

1875–76. 770[1] l. f. break'r, 14,507 t. st. used, 54,860 c. y. dr., according to proj. of BE., **76,** 222, 223.

1878–79. 662 l. f. break'r, 35,746 t. st. used, **79,** 57, 330.

1879–80. 34,800 t. granite delivered in break'r, extending same 483′, **80,** 437.

1880–81. 9,113 t. granite delivered in break'r, completing the same; 24,750 t. st. delivered in new break'r, completing 500′ of same, **81,** 579, 580.

1881–82. 22,900 t. st. delivered in break'r, extending the same 570′, **82,** 598.

1882–83. Break'r extended 451′, **83,** 501.

1883–84. 4,896 t. riprap st. used in break'r extension, **84,** 631.

1884–85. 7,500 t. st. delivered in work, extending same 205′, **85,** 617.

1886–87. 12,835 t. riprap granite delivered in e. break'r, **87,** 563.

1887–88. 3,550 t. riprap st. placed in break'r, **88,** 512.

1888–89. 3,664 t. riprap granite placed in break'r, **89,** 638.

1889–90. 1,925 t. st. placed in e. break'r, **90,** 581.

1890–91. 10,701 t. st. placed in e. break'r, **91,** 729.

1891–92. 447 t. st. placed in e. break'r, **92,** 636.

1894–95. About 7,700 t. st. deposited in break'r, **95,** 699.

1895–96. 9,566 c. y. dr., **96,** 664.

1896–97. 540 c. y. sea wall built, **97,** 942.

1900–01. Light on break'r maintained, **01,** 1162.

PHYSICAL CHARACTERISTICS.

Of H. bed, **75,** ii, 240; **79,** 330.

Tides, **72,** 919; **74,** ii, 246; **79,** 326.

Description of locality, **90,** 581; **93,** 893.

PLANS. (See Estimates and Projects.)

By J. H. Dager: (1) Dr. H. above the SS. wharf to 15′ m. l. w.; (2) dr. Penguin Shoal entirely; (3) dr. Penguin Shoal partly; (4) dr. chan. 500′ w. from break'r to the SS. wharf, **72,** 919, 920. Removal of break'r, extension of 900′, and constr. of j. from Wampasset Pt.; modified by Maj. Warren to extend break'r 2,000′, **72,** 918, 920, 921.

By Maj. Warren, break'r from Stonington Pt. 20′ x 2,000′ on top; also for a sea wall at Wampasset Pt., **72,** 85, 918. Break'r in 3 sections: (1) One portion extending from Stonington; (2) one portion extending from Wampasset Pt., leaving an opening between shore and shore end for a chan.; (3) detached break'r, covering the open distance between the ends of sections 1 and 2, **75,** ii, 247.

By BE., 1875, 3 break'rs. (See Projects and Engineers.)

By G. C. Almy, break'r at Bartletts Reef 3,000′ l., **79,** 331. Recom. by eng. in charge, **79,** 326.

PRIVATE AND CORPORATE WORK.

Remonstrance of citizens against break'r across Penguin Shoal, **75,** ii, 242.

PROJECTS. (See Estimates and Plans.)

Earliest proj., 1827, au. short break'r at the lower end of the city wharves; completed, 1831; cost, $34,766.65, **72,** 920; **79,** 327; **87,** 41.

Proj. 1871 proposed dr. chan. 12′ d. between the break'r and the SS. wharf; est., $51,368, **72,** 919; **73,** 980.

By BE., 1875, break'r of granite riprap to extend se. from vicinity of Wampasset Pt., 2,000′; est., $231,000, **75,** ii, 244, 246. Break'r completed, 1881; cost, $103,190, **81,** 579; **87,** 562.

By Maj. Barlow, 1880, e. break'r between the Middle Ground and Bartletts Reef, 2,000′ l., to be built of st. and granite riprap; est., $100,000, **81,** 585. Approv. by BE., 1880, **81,** 585.

Necessity for increasing length of break'r to 2,600′, making est. $130,000, **82,** 598. Est. for completion, 1888, $25,000, **88,** 512.

By Capt. Bixby, 1893, minor work and surs. to be done by hired labor and U. S. plant, **93,** 848; dr. by contract, 1895, **95,** 699.

Maj. Lockwood est., 1895, $64,576.60 for deeper city front chan., and a cut through Noyes Shoal, **96,** 678.

In 1896 U. S. app. $5,000 for dike to prevent erosion at Stonington Pt., **96,** 664.

SECRETARY OF WAR.

Approv. recom. of the Chief of Engineers and also of BE. (see Projects), **75,** ii, 243.

SURVEYS.

By Lt. Prescott, 1827, **72,** 919.

Included in Coast Sur., 1839, **72,** 917.

By J. H. Dager, 1871. **R., 72,** 919.

Ex. of entrance made, 1893, by Capt. Bixby (**R.** fav.), **93,** 891.

Sur. of Stonington H. au. act Aug. 17, 1894; made, 1895, by Maj. Lockwood (**R.** fav.) (see Projects), **96,** 678.

Maps. **82,** 598; **84,** 632; **93,** 848; **95,** 700.

Diagram of break'r proposed by Maj. Warren, **75,** ii, 247. Map of H., **79,** 328.

[1] Given as 750′, **79,** 330.

D-5 MYSTIC RIVER, CONN.

APPROPRIATIONS.

1890,	$10,000,	**91,** 741.
1892,	10,000,	**92,** 651.
1894,	3,500,	**95,** 760.
1896,	3,500,	**96,** 684.
1899,	9,600,	**99,** 1153.
1912,	3,500,	**12,** 1463.
Total,	40,100	

CONTRACTS.

1891. Hartford Dredging Co., dr., 14.7¢ c. y., **91,** 741.

1892. Hartford Dredging Co., dr., 14.3¢ c. y., s. m. ($3,575), **93,** 900.

1894. Hartford Dredging Co., dr., 13.7¢ c. y. ($21,898), **95,** 760.

1896. J. P. Randerson, dr., 10⅞¢ c. y. ($2,175), **97,** 945.

1899. T. A. Scott, r. removal, $8 c. y. ($4,000), **99,** 1154.

1900. Hartford Dredging Co., dr., 9½¢ c. y. $4,500), **00,** 1324.

ENGINEERS.

Chief of Engineers. **R., 89,** 70; **91,** 47; **92,** 67; **93,** 72; **94,** 64; **95,** 73; **96,** 72; **97,** 84; **98,** 88; **99,** 100; **00,** 115; **01,** 178; **10,** 138; **12,** 176, 178.

In charge:
Col. D. C. Houston, 1888–92. **R., 89,** 746; **91,** 740; **92,** 650.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 898; **94,** 622; (Col.) **95,** 758.
Maj. H. M. Adams, 1896. **R., 96,** 682.
Maj. S. S. Leach, 1897–1901. **R., 97,** 945; **98,** 945; **99,** 1153; **00,** 1323; **01,** 1162.
Lt. Col. H. Taylor, **10,** 113.
Capt. A. E. Waldron, 1912–. **R., 12,** 1463.

Assistant. H. N. Babcock. **R., 89,** 747.

OPERATIONS.

1890-91. 10,821 c. y. dr., **91,** 741.
1891-92. 49,179 c. y. dr., **92,** 651.
1892-93. 38,034 c. y. dr., **93,** 899.
1893-94. 20,000 c. y. dr., **94,** 623.
1894-95. 21,600 c. y. dr., **95,** 759.
1897-98. 25,088 c. y. dr., **98,** 945.
1899-00. 466 c. y. r. removed, and 45,655 c. y. dr., **00,** 1323.
1900-01. Imp. dropped from list after final **R.** in March, 1901, **01,** 1162.
1911-12. New proj. adopted July 25, 1912, **12,** 1463.

PHYSICAL CHARACTERISTICS.

Chan. 15′ x 100′ throughout R. below br. at Mystic, Conn., **01,** 1162.
Narrow tidal stream in e. Conn. Village of Mystic on e. and w. sides about 3 m. above Fisher I. Sound, **12,** 176.

PROJECTS.

By Col. Houston, 1888, cutting of 5 bends and d. the chan. so as to make 15′ m. l. w. up to the highway br.; est., $30,000, **89,** 747; later modified and increased, making total est. $36,600.
Act July 25, 1912, au. restoring chans. estab. by U. S., **12,** 176.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Col. Houston.
Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Lt. Col. Taylor, 1909 and 1910; est., $3,500,[1] **10,** 138.
Pre. ex. and sur. au. act Feb. 27, 1911, of Mystic R., Conn., from drawbr. between Groton and Stonington to head of navigation. **R.,** Capt. Waldron, June 21 and Nov. 14, 1911, with map; est., $8,160, 1st constr., and $1,000 every 10 years for mainten.,[2] **12,** 178.
Maps.[2] **93,** 898.
(See above ¶.)

D-7 NEW LONDON HARBOR, CONN.

APPROPRIATIONS.

1880,	[3] $2,500,	**81,** 586.
1881,	4,300,	**81,** 587.
1882,	9,000,	**82,** 601.
1884,	2,000,	**84,** 638.
1886,	2,000,	**86,** 634.
1902,	25,000,	**02,** 923.
1903,	60,000,	**03,** 834.
1904,	60,000,	**04,** 971.
1905,	2,000,	**05,** 874.
1910,	12,000,	**10,** 1151.
Total,	[4] 178,800	

COMMERCE.

C. to be benefited by future imp., **89,** 745..
Description of, **00,** 1354, 1356.
1901, 750,390 t., **02,** 125; 1912, 816,980 t. for main H.; 24,133 t. for Shaws Cove; rates reduced, **12,** 140.

CONTRACTS.

1880. W. Flannery, dr., $1.87 c. y., **81,** 588.

1882. J. H. Fenner, dr. and removal of bowlders, the former at 49¢ c. y. and the latter at $5.50 t. **83,** 507.

1885. E. Brainard, dr., 39¢ c. y., and removal of bowlders at $3.90 c. y., **85,** 642.

1886. R. M. Payne, dr. sand, 40½¢ c. y.; bowlders, $3.98 c. y., **87,** 586.

1903. Morris & Cumings Dredging Co., dr., $9\frac{4}{11}$¢ c. y., **03,** 834.

1906. T. A. Scott Co., Inc., removing about 637 c. y. r., $12 c. y., p. m., **07,** 957.

ENGINEERS.

Chief of Engineers. **R., 81,** 90; **82,** 90; **83,** 86; **84,** 92; **85,** 82; **86,** 83; **87,** 44; **88,** 45; **89,** 57, 70; **90,** 51; **91,** 64; **00,** 141; **02,** 124; **03,** 105; **04,** 89, 1004, 1007; **05,** 94; **06,** 94, 115; **07,** 96, 117; **08,** 98, 122; **09,** 102; **10,** 114; **11,** 119; **12,** 138.

Boards. BERH. **R., 04,** 1006, 1008.

In charge:
Maj. J. W. Barlow, 1881–83. **R., 81,** 586; **82,** 600.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 506; **84,** 638; **85,** 641.
Lt. Col. D. C. Houston, 1886–91. **R., 86,** 632; **87,** 585; (Col.) **88,** 525; **89,** 659, 744; **90,** 604; **91,** 746.
Maj. S. S. Leach, 00. **R., 00,** 1351.
Maj. C. F. Powell, 1902–05. **R., 02,** 923; **03,** 833; (Lt. Col.) **04,** 971, 1004, 1007; **05,** 873.
Maj. H. Taylor, 1906–10. **R., 06,** 922; **07,** 956; **08,** 999; (Lt. Col.) **09,** 1029; **10,** 1151.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1222; **12,** 1435.

OPERATIONS.

1880-81. 1,222 c. y. material dr. from shoal e. of RR. wharf, **81,** 586.

1881-82. 140 t. bowlders and 6,619 c. y. st. and sand removed from shoal, **82,** 600.

1882-83. 636 t. bowlders and 9,794 c. y. sand and st. removed, **83,** 506.

1884-85. 2,725 c. y. sand and gravel dr.; 132 c. y. bowlders removed, **85,** 642.

[1] H. D. 858, 61st, 2d.
[2] H. D. 637, 62d, 2d.
[3] From Thames R. app., **81,** 586; **87,** 586.
[4] Includes $3,600 carried to surplus fund.

1886-87. 2,542 c. y. sand and 45 c. y. bowlders removed from shoal; work practically completed, **87,** 586.
1902-03. Dr. begun June 30, 1903; about 4,000 c. y. per day removed, **03,** 833.
1903-04. 1,159,635 c. y. dr., **04,** 971.
1904-05. Dr. under continuous contract completed; 1,273,229 c. y. removed, **05,** 873.
1906-07. 2 r. ledges in Fort Trumbull-Shaws Cove chan., removed (about 637 c. y.), **07,** 957.
1909-10. Proj. completed, **10,** 1151.
1910-11. Proposals for deepening Shaws Cove adv. for, but no bids recd.; work to be done by open-market agreement, **11,** 1222.
1911-12. Efforts to obtain price for deepening Shaws Cove; unsuccessful, **12,** 1435.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 525; **89,** 744; **00,** 1353; **02,** 124; **06,** 94.

H. 14 m. e. of mouth of Conn. R., and comprises lower 3 m. of Thames R., **12,** 138.

PLANS.

By Col. Houston, 1888, d. the shoal between the city wharves and the main chan. by excavation of 15′ chan. 200′ x 3,000′, extending from the upper end of the SS. wharf to Chappell's lower wharf; est., $15,000, **89,** 745.

PROJECTS.

By Maj. Barlow, 1878, removal of sand and bowlder shoal in New London H. lying e. of the New London Northern RR. wharf to 16′ at m. l. w.; est., $6,800, **78,** 397. Afterwards increased on account of difficulty in excavation to $24,000, **81,** 586; **86,** 632, 633; **87,** 585. Proj. completed, 1888, **88,** 526.

Maj. Leach est., 1900, $145,000 to imp. H. with $1,000 an. mainten., **00,** 1355.

Act June 13, 1902, au. chan. 400′ or more x 23′ x 6,000′, from opposite Fort Trumbull along the water front of the city, incl. Winthrop Cove, to natural deep chan. opp. the Central Vermont RR. dock, 4,000′ upstream from point of beginning; est., $145,000, and $1,000 an. mainten.,[1] **02,** 124.

Act June 25, 1910, au. restoring 12′ in Shaws Cove, and increase in depth to 15′; est., $12,000, with $3,000 every 10 yrs. for mainten.,[2] **12,** 139.

SURVEYS.

Sur. au., and est. called for, act Mar. 3, 1899. **R.,** 1900, by Maj. Leach (**R.** fav.) (see Projects), **00,** 1352, 1355.

Ex. and sur. au. act June 13, 1902, of 30′ in Winthrop Cove. **R.,** Lt. Col. Powell[3] (unfav.), **04,** 1004.

Of ledge r. in Fort Trumbull-Shaws Cove chan. Necessary to remove 640 c. y. ledge to clear chan., **06,** 922.

Ex. and sur. au. act Mar. 3, 1905, for 30′ in main chan. to RR. br. and thence with a w. of 400′ to naval station. **R.,** Maj. Taylor[4] (unfav.), **07,** 117.

Ex. and sur. au. act Mar. 2, 1907, of H., for 15′ d. in Shaws Cove. **R.,** Maj. Taylor; est., $12,000,[5] **08,** 122.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 139.

Maps.[1] **85,** 642.

D-9 SHAWS COVE, NEW LONDON HARBOR, CONN.

ENGINEERS.

Chief of Engineers. **R., 91,** 79.
In charge. Col. D. C. Houston, 1890. **R., 91,** 833.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 833.

PLANS.

By Col. Houston, 1890, excavating chan. 12′ x 100′ m. l. w., from drawbr. along the n. and w. sides of the cove 2,000′; also an anchorage basin in the bend of the chan. 400′ x 800′; est., $48,000, **91,** 834.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Col. Houston, **91,** 833.

D-10 HAY (West) HARBOR, FISHERS ISLAND, N. Y.

ENGINEERS.

Chief of Engineers. **R., 07,** 118.

PHYSICAL DATA.

H. on n. shore of Fishers Isld., nearly opposite New London H., Conn., and 8 m. from latter. About ½ m. x 1¼ m.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1905; made, 1905-06, by Lt. Col. Powell and Maj. Taylor, resp. (unfav. to present imp.),[6] **07,** 118.

D-11 THAMES RIVER, CONN.[7]

APPROPRIATIONS.

1821,	$150,	**79,** 333.
1829,	150,	act Mar. 2.
1836,	10,000,	**66,** ii, 29; **73,** 983; **79,** 334.
1837,	20,000,	**66,** ii, 29; **73,** 983; **79,** 334.
1838,	10,000,	**66,** ii, 29; **73,** 983; **79,** 334.
1866,	10,000,	**66,** 19; **70,** 448; **71,** 749, 750; **79,** 334.
1867,	{36,000 / 36,000}	**70,** 448; **71,** 749, 750; **79,** 334.
1871,	15,000,	**71,** 748; **72,** 82; **73,** 983; **79,** 334.
1872,	10,000,	**72,** 82, 827; **79,** 334.
1878,	10,000,	**78,** 51, 398; **79,** 334.
1879,	12,000,	**79,** 57, 335.
1880,	[8] 22,500,	**80,** 443.
1881,	30,000,	**81,** 589.
1882,	$35,000,	**82,** 604.
1884,	25,000,	**84,** 637.
1886,	22,500,	**86,** 632.
1888,	50,000,	**88,** 525.
1890,	20,000,	**90,** 603.
1892,	30,000,	**92,** 655.
1894,	12,500,	**95,** 765.
1896,	12,000,	**96,** 688.
1899,	20,000,	**99,** 1150.
1902,	15,000,	**02,** 925.
1905,	34,100,	**05,** 875.
1907,	30,000,	**07,** 959.
1910,	11,500,	**10,** 1153.
Total,	539,400.	(total, incl. misc., $540,104.54, **12,** 1437).

[1] H. D. 392, 56th, 1st.
[2] R. & H. C. 9, 62d, 2d.
[3] H. D. 395, 58th, 2d.
[4] H. D. 178, 59th, 2d.
[5] H. D. 329, 60th, 1st.
[6] H. D. 269, 59th, 2d.
[7] Sur.—**R.,** Feb. 18, 1830; est., $72,650. (H. D. 482, 55th, 2d.)
[8] Part of $25,000, $2,500 of which was to be applied to removal of shoal at New London, **81,** 586.

COMMERCE.

Benefits of imp., **66,** iv, 198; **78,** 396.
C. importance of R., **71,** 755; **78,** 396.
Reduction in rates; freight can be brought in vessels of 16′ and 22′ draft, instead of 8′, **12,** 141; 1911, 480, 445 t., **12,** 141.

CONTRACTS.

1867. E. A. Bill, dr., 45¢ c. y., **67,** 448; **71,** 551.
1871. E. R. Seward, dr., 20¢ c. y., **72,** 827; **73,** 983; contract extended, **72,** 827.
1872. E. R. Seward, dr., 19¢ c. y., **72,** 828; **79,** 334.
1878. Morris & Cumings Dredging Co., dr., 15¢ c. y., **79,** 331.
1879. Morris & Cumings Dredging Co., dr., 28¢ c. y., **80,** 443.
1880. W. Flannery, dr., 23¢ c. y., **81,** 590.
1881. W. Flannery, dr., 27¢ c. y.; annulled after repeated failures to complete, **82,** 605.
1882. F. K. Ballou, st., $1.19 t., **82,** 605. F. K. Ballou, st.-dike constr., $1.25 t., **84,** 637. Hartford Dredging Co., dr., 14⅜¢ c. y., **84,** 637. F. K. Ballou, pile and st.-dike constr., $8 l. f., **84,** 637.
1884. C. H. Edwards, st.-dike constr., $1.07 t., **85,** 640.
1887. J. A. Bouker, st.-dike constr., 98¢ t., **87,** 584. Hartford Dredging Co., dr., 12¢ c. y., **87,** 585.
1888. Hartford Dredging Co., dr., 19¢ c. y., **88,** 525.
1889. Hartford Dredging Co., dr., 15.7¢ c. y., **89,** 658. E. Brainard, dr., 18.9¢ c. y., **89,** 658.
1890. S. & E. Belden, riprap st., 96¢ t.; flat st., $1.13 t., **90,** 603.
1891. E. Brainard, dr., 24½¢ c. y., **91,** 745.
1892. Hartford Dredging Co., dr., 24½ and 16 1/10¢ c. y., s. m. ($24,485), **93,** 906.
1894. J. H. Fenner, dr., 9 and 16¢ c. y., s. m. ($11,000), **95,** 765.
1896. Newburg Dredging Co., dr., 14¢ c. y. ($8,400), **97,** 947.
1899. F. H. Brainard, dr., 11 1/10¢ c. y. ($15,989.50) (annulled), **99,** 1156; **00,** 1325.
1900. T. A. Scott, dr., 13 1/10¢ c. y., **00,** 1325.
1901. John P. Randerson, dr. 15¢ c. y. **01,** 1163.
1905. John P. Randerson, dr. 15¢, 18¢, 20¢ c. y., **06,** 923.
1906. T. A. Scott Co., dr. about 108,000 c. y., 19.75¢ c. y., **06,** 924.
1908. Atlantic Dredging Co., dr. about 100,000 c. y., 14.3¢ c. y., **08,** 1002.
1911. The Thames Tow Boat Co., removing ledges in Shetucket R., $1,500, **12,** 1436.

DEFENSE.

Forts Trumbull and Griswold located near the mouth of the R., **77,** 212.

DOCUMENTS. (Not published in reports.)

R. of Gen. Delafield, dated Feb. 14, 1868, **71,** 749.

ENGINEERS.

Chief of Engineers. R., 66, 3, ii, 41, iii, 19, 29; **67,** 44; **68,** 67; **69,** 58; **70,** 75; **71,** 84; **72,** 82; **73,** 90; **77,** 46; **78,** 51; **79,** 57; **80,** 77; **81,** 90; **82,** 91; **83,** 85; **84,** 92; **85,** 81; **86,** 82; **87,** 43; **88,** 45; **89,** 56; **90,** 51; **91,** 63; **92,** 67; **93,** 72; **94,** 64; **95,** 74; **96,** 72; **97,** 85; **98,** 89; **99,** 102; **00,** 117; **01,** 178; **02,** 125; **03,** 106; **04,** 90; **05,** 95; **06,** 95; **07,** 96, 118; **08,** 99; **09,** 102; **10,** 115, 138; **11,** 120; **12,** 140, 177.

Boards. Convened, New York, Mar. 14, 1882, to report upon proj. of Maj. Barlow for imp. of the Upper Thames. **R., 82,** 606. (Col. Z. B. Tower.)

In charge:

Capt. D. C. Houston, 1866–70; **66,** 41. **R., 66,** iv, 195, 197; **67,** 448; (Maj.) **68,** 747, 752; **69,** 408.
Maj. G. K. Warren, 1870–77. **R., 70,** 448; **71,** 748; **72,** 827; **73,** 981.
Maj. J. W. Barlow, 1877–83. **R., 77,** 210; **78,** 394; **79,** 331; **80,** 441; **81,** 588; **82,** 601.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 503; **84,** 636; **85,** 638.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 629; **87,** 582; (Col.) **88,** 521; **89,** 654; **90,** 600; **91,** 742; **92,** 652.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 901; **94,** 624; (Col.) **95,** 760.
Maj. H. M. Adams, 1896. **R., 96,** 684.
Maj. S. S. Leach, 1897–1901. **R., 97,** 946; **98,** 947; **99,** 1155; **00,** 1325; **01,** 1163.
Maj. C. F. Powell, 1902–05. **R., 02,** 924; **03,** 834; (Lt. Col.) **04,** 972; **05,** 875.
Maj. H. Taylor, 1906–10. **R., 06,** 923; **07,** 958; **08,** 1000; (Lt. Col.) **09,** 1030; **10,** 1153.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1224; **12,** 436

Assistants:

Capt. A. H. Holgate, **70,** 74.
H. A. Judson. **R., 71,** 750.
H. A. Bentley. **R., 73,** 982.

ESTIMATES. (See Plans and Projects.)

By Maj. Houston, dr., removal of old ps., and repairs, $42,959, **66,** iv, 197. Increased, **68,** 752.
By H. A. Judson, aggregate for dr., $33,079.62, **71,** 753, 754.
By Maj. Barlow, dr. chan. from Indian Pt. to Norwich 14′ d., $75,000; for chan. 11′ d., $39,600, **78,** 395. For imp. of Thames R. near New London, $6,800, **78,** 397; aggregate, $81,000, **78,** 398. For increasing w. and d. of chan., $164,000, **79,** 57, 332.

LEGAL PROCEEDINGS.

In 1893–94, Dept. of Justice made the owner of a wharf take up a part of the wharf that had been built beyond the H. line of Shaws Cove, **94,** 627.

OPERATIONS.

1821. Obstr. placed in the R. during the War of 1812 removed, **79,** 333. Canal cut across a bend in the Shetucket R., causing great damage to the Thames R. navigation, **66,** iv, 196; **71,** 752.
1866–67. 14,820 c. y. dr., **67,** 45, 148.
1867–68. 67,201 c. y. dr., **68,** 67, 747.
1868–69. Dr. chan. to 14′, **69,** 58, 408.
1871–72. 45,454 c. y. dr., **72,** 827.
1872–73. 37,604 c. y. dr., **73,** 987.
1878–79. 55,000 c. y. dr., **79,** 57, 331.
1879–80. 38,614 c. y. dr. from chan. through the shoals, **80,** 441.
1880–81. 9,387 c. y. dr. from the bar, **81,** 588.
1881–82. 6,595 t. riprap st. placed in training wall, extending the same 750′, **82,** 602.
1882–83. 10,612 t. st. placed in dike, extending same 1,620′; 53,192 c. y. dr., **83,** 504.
1883–84. 41,819 c. y. sand dr. from chans.; training wall completed, **84,** 636.
1884–85. 11,254 t. st. placed in 2,500 l. f. of training wall, **85,** 640.
1885–86. E. dike completed by addition of 691 t. riprap; 8,000 t. st. delivered in the Rolling Mill dike, **86,** 630.
1886–87. 4,479 t. st. placed in the Rolling Mill dike; repairs to the Mohegan pile dike, **87,** 582.
1887–88. 6,542 t. st. delivered, completing 1,513 l. f. of dike; 37,953 c. y. dr., **88,** 523.
1888–89. 222,392 c. y. dr., **89,** 656.
1889–90. 50,421 c. y. dr.; 894 t. st. and 247 t. riprap delivered, **90,** 601, 602.
1890–91. 28,414 c. y. dr., **91,** 744.
1891–92. 73,419 c. y. dr., **92,** 654.
1892–93. 89,420 c. y. dr., **93,** 904.
1893–94. 37,715 c. y. dr., **94,** 627.
1895–96. 60,728 c. y. dr., **96,** 687.
1896–97. 32,797 c. y., dr., **97,** 946.
1897–98. 60,446 c. y. dr., **98,** 947.
1899–00. 106,936 c. y. dr., **00,** 1325.
1900–01. 18,290 c. y. dr., and 27 c. y. r. removed from Shaws Cove; 19,259 c. y. dr. at Central Dock, **01,** 1163.
1902–03. 15,915 c. y. dr. and range targets estab., **03,** 834.
1905–06. 11,095 c. y. dr. from Shaws Cove, 1,350 c. y. from Bartletts crossover, 12,477 c. y. from Norwich anchorage basin, and 21,447 c. y. from between Allyns Pt. and Norwich; 3,470 t. st. placed in dikes, **06,** 923, 924.
1906–07. 4,220 t. st. deposited, completing fifth dike; 33,673 c. y. dr., **07,** 958.
1907–08. 74,340 c. y. dr., **08,** 1000.

1908-09. 83,368 c. y. dr., **09,** 1030.
1911-12. Two points of ledge removed, in Shetucket R., **12,** 1436.

PHYSICAL CHARACTERISTICS.
Tides of Thames, **72,** 830.
Dimensions of chan., shoal spots, etc., **08,** 1001.
Shoaling, **12,** 1436.

PLANS. (See Estimates and Projects.)
By Maj. Houston, to increase w. of chan., remove sunken trees, etc., **68,** 753.
By H. A. Judson, (1) removal of middle ground to 14′; (2) to obtain a chan. connecting the d.-w. chan. w. of the middle ground with that below coal yards; (3) to obtain chan. from the upper rolling mill to and beyond Bushnells Reef; (4) to obtain chan. over the Haycocks, **71,** 753, 754.

PRIVATE AND CORPORATE WORK.
In 1835–36, $3,679 expended by private enterprise with the privilege of collecting tolls on the R., **79,** 334.

PROJECTS. (See Estimates and Plans.)
The first definite proj. for imp. the R. that of 1836, which proposed, by dr. and constr. of wing dams, to provide a chan. 14′ x 100′ h. w.; the desired results were obtained, but the shoals subsequently reformed, **73,** 983; **86,** 630.
Proj. of 1866 proposed reformation, by dr., of chan. 14′ x′ 100 h. w. across the bars below Norwich; est., $65,000, **66,** iv, 197; **68,** 752; **73,** 983.
In 1878 proj. modified to provide for a chan. 14′ x 100′ l. w. from Indian Pt. to Norwich; est., $75,000, **78,** 395, 398. Increased in 1880 for removal of Middle Grounds at Norwich to $101,000, **80,** 442.
In 1882 proj. further modified to provide for increasing the w. of the chan. to 200′ over the first 3½ m. below Norwich, together with the constr. of training walls if necessary for the rectification of the R.; est., $208,080, **82,** 603; **87,** 582.
In 1888 proj. further extended to secure, by dr., a 16′ chan. up to Allyns Pt., and a 14′ chan. from Allyns Pt. to the end of the existing imp.; this increased the total est. to $248,280, making the "present," 1889, est. for completion $95,600, and increasing the est. for an. mainten. to $8,000, **89** 655; **92,** 654.
By act 1892 for expend. of $10,000 for imp. of Shaws Cove by dr., **93,** 904.
Act Mar. 2, 1907, extended proj. to provide a chan. 20′ x 200′ to Allyns Pt., and 14′ thence to Norwich; est., $16,250, and $1,500 an. mainten., **07,** 97, 118.
Act June 25, 1910, modified proj. to provide for removal of rs. and other obstr. in Shetucket R. est., $1,500,[2] **10,** 116, 138.

SURVEYS.
$150 app. for sur., 1829, **79,** 333.
Of Thames R. for 3 m. below Norwich, Conn., 1866, **66,** iv, 197.
By J. A. Judson, 1868, under direction of Maj. Houston, **79,** 334.
Of Thames R. by J. A. Judson, 1870. **R., 71,** 750.
By H. A. Bentley, 1872, from Norwich to Coopers Pt., **79,** 334.
H. lines W. estab. by the Sec. War in Shaws Cove in 1893, **94,** 626.
Of r. obstr. in Shetucket R., and Bartlett's cross-over chan., **04,** 972.
Of dr. chans., **05,** 875.
Pre. ex. of Thames R. to Allyns Pt., au. act Mar. 3, 1905. **R.** by Maj. Taylor, Oct. 22, 1906; est., $16,250, with $1,500 an. mainten.,[1] **07,** 118.
Pre. ex. and sur. of Shetucket R., with view to removing rs. and other obstr. in chan., au. act Mar. 3, 1909. **R.** by Maj. Taylor, May 27 and Aug. 31, 1909; est., $1,500,[2] **10,** 138.
Pre. ex. au. act June 25, 1910, of w. chan. from Poquetanuck drawbr. to Kiteamang for 14′ chan. **R.** by Lt. Col. Taylor, Sept. 26, 1910[3] (unfav.), **12,** 177.

Maps:[1 2]
Of Thames R., Conn., **66,** i.
Of the R. from Norwich to Indian Pt., **79,** 332. **82,** 606; **84,** 636; **85,** 640; **89,** 656; **93,** 904; **94,** 628.

D-20 NIANTIC RIVER, CONN.

COMMERCE.
Important, **73,** 1046, 1049, 1050; **85,** 711. RR. br. an obstr. to C., **73,** 1047, 1048.
Description of, **97,** 973.
Insignificant when compared with the natural advantages, **97,** 974.

ENGINEERS.
Chief of Engineers. R., 72, 85; **73,** 93; **85,** 963; **97,** 104.

In charge:
Maj. G. K. Warren, 1872. **R., 73,** 1045.
Lt. Col. W. McFarland, 1885. **R., 85,** 710.
Maj. S. S. Leach, 1897. **R., 97,** 972.

Assistant. J. P. Cotton. **R., 73,** 1047.

LEGISLATION.
Conditions (relating to brs.) upon which the New Haven & New London RR. was chartered **73,** 1048.

OBSTRUCTIONS. (See Commerce.)

PHYSICAL CHARACTERISTICS.
Description of site, **73,** 1045.
Bars, **73,** 1046.
Tides, **73,** 1048, 1050.
Description of, **97,** 973.
In the 10 years previous to 1896 the H. depths seem to have naturally increased, **97,** 972.

PLANS.
By J. P. Cotton, drg. to give a chan. 9′ d. on the bar outside of the drawbr. and 8′ d. in the R.; est., $26,000, **73,** 1046, 1049.
By Lt. Col. McFarland, 1884, dr. chan. 9′ x 100′ l. w. below the RR. br.; est., $4,000, **85,** 711.

PRIVATE (CORPORATE) WORK.
Piles driven and drg. done, 1867, by J. Beattie; expend., $500, **73,** 1047.

SURVEYS.
By J. P. Cotton, 1872. **R., 73,** 1047.
Ex. au. act July 5, 1884; made by Lt. Col. McFarland, **85,** 710.
Sur. au. act June 3, 1896; made by Capt. Leach in 1896 (**R.** unfav.), **97,** 972.

[1] H. D. 265, 59th, 2d. [2] H. D. 397, 61st, 2d. [3] H. D. 260, 62d, 2d.

D-23 CONNECTICUT RIVER, CONN., MASS.[1]

Part.	Title.	Period.	Appropriations.
a	Connecticut River	1867–1879	$327,804.57
b	Below Hartford, Conn	1880–1912	559,836.12
c	Above Hartford, Conn. (or between Hartford, Conn., and Holyoke, Mass.)	1880–1912	70,000.00
	Total		957,640.69

Part (a), D-23 Connecticut River.[2]

APPROPRIATIONS.

1829, $130.00, act Mar. 2.
1836, [3] 20,000.00, **73,** 990.
1843, [3] 3,471.57, Treas. Doc. No. 373, 1882.
1870 { 20,000.00 [3], 20,000.00 [4] } **70,** 74, 447; **71,** 84, 756; **73,** 1003.
1871 { 35,000.00 [3], 20,000.00 [4] } **71,** 85, 756, 762.
1872 { 40,000.00 [3], 25,000.00 [4] } **72,** 82, 835.
1873 { 20,000.00 [3], 20,000.00 [4] } **73,** 90, 91.
1874, 20,000.00, **74,** 101, ii, 249.
1875, 20,000.00, **75,** 110, ii, 300.
1876, 20,000.00, **76,** 51, 212; **77,** 45, 205.
1878 { 30,000.00, 4,203.00, } **00,** 1330.
1879, 10,000.00, **79,** 56, 316.

Total, 327,804.57

CONTRACTS.

1870. Albany Dredging Co., dr.; E. R. Seward, pile work, **70,** 448; **71,** 756.
1871. M. F. Brainard, drg.; W. D. Daisley,[5] removal of r.; C. McClellan & Son, building wing dams, **71,** 760.
1872. M. F. Brainard, dr.; G. W. Townsend, removing wreck, **72,** 835.
1873. W. E. Redding, granite, $2.23 t., **73,** 985.
1874. F. H. Smith, granite, $1.93 t.; —— Goodspeed, drg., $90 per day, **75,** ii, 297.
1875. —— Goodspeed, drg., $75 per day; F. H. Smith, granite, $1.59 t., **75,** ii, 298.
1877. G. W. Townsend, removal of wreck, **77,** 205.
1878. Sidney Edsall, building wing dams, **78,** 248; E. N. & A. J. Beardsley, dr., **79,** 317; F. H. Smith, granite, 77¢ t., **79,** 318.

ENGINEERS.

Chief of Engineers:
Suggesting the use of Long's scraper, **68,** 782.
R., 67, 18, 44; **68,** 66; **69,** 57; **70,** 74; **71,** 84, 85; **72,** 82; **73,** 90; **74,** 100, 101; **75,** 109, 110; **76,** 50, 51; **77,** 45; **78,** 49, 50, 249; **79,** 55, 56.

In charge:
Capt. W. H. Swift, 1836–37, **68,** 782; **73,** 993, 996.
Maj. D. C. Houston, 1867–70. **R., 67,** 448; **68,** 754, 782; **69,** 409.
Maj. G. K. Warren, 1870–83. **R., 70,** 446; **71,** 756, 760, 762; **72,** 830, 835, 836; **73,** 984, 986, 1003; **74,** ii, 248, 249; **75,** ii, 297, 300; **76,** 212, 213; **77,** 204, 206; **78,** 246, 247; **79,** 316, 319.

Assistant. T. G. Ellis, **67,** 450.
Sur., Hartford to mouth, **68,** 756; above Hartford, **71,** 763.
Sur. of Enfield Rapids and plan for imp., **72,** 840
Sur. and plan for imp. of Saybrook Bar, **73,** 990.
Canal from Hartford to Warehouse Pt., **73,** 1005.
Sur. from Hartford to Holyoke, **74,** ii, 250; **75,** ii, 303; **78,** 264.
Resistance of cords and floats, **76,** 213; **78,** 380.

ESTIMATES. (See Plans and Projects.)

By Maj. Houston, chan. Hartford to mouth, 8′ d., $70,000, and $10,000 an. mainten., **68,** 67, 750, 756; **69,** 58, 409; **70,** 74. Revised for 9′ chan. over Saybrook Bar, $17,500; for 12′ chan. over Saybrook Bar, $62,000, **68,** 784.
By T. G. Ellis, aggregate for existing needs, $64,310, **68,** 779. Js., dikes, and dr. at Saybrook Bar, $336,610, **73,** 989, 1000. 5 wing dams and locks at Enfield Rapids, $850,000, **71,** 762, 768. Various plans submitted, **72,** 857. Canal from Enfield Dam to Hartford, $2,306,345, **73,** 1011.
By Maj. Warren, j. and dr., Saybrook Bar, $116,410, **73,** 989. (1877) To complete js., $45,000, **77,** 45, 206. (1878) To complete proj., $30,000, **78,** 50, 247. Enfield Falls, $870,000, **72,** 835, 838. Thorough imp., Hartford to Holyoke, $3,000,000, **72,** 836. Canal, Enfield Dam to Hartford, $2,306,345, **73,** 1011. Completion of proposed proj. above Hartford, $835,801, **78,** 50, 248; **79,** 56, 320.

EXPENDITURES. (See Private work.)

Union Co., 1800 to 1835, $44,271, **68,** 767.
SS. Co., $34,000, **68,** 768.
City, $12,000, **68,** 768.

OPERATIONS.

1836–37. Believed to have been dr. at Saybrook Bar, **73,** 990, 996. Former referred to, **67,** 450; **68,** 67, 767, 768.

Below Hartford:
1870–71. Dr. bars and piling, **71,** 84. 63,541 c. y. removed, **71,** 756.
1871–72. 8′ chan. at lowest water obtained by dr., **72,** 82, 833. 114,063 c. y. dr. from various bars, 25 c. y. solid r. removed, and 547 piles driven, **72,** 831, 834.
1872–73. W. j. at Saybrook Bar in progress, 19,289 c. y. dr. from bars, **73,** 985; and a wreck removed, **73,** 985.
1873–74. R. bars dr., giving chan. 9½′ x 50–70′; w. j. at Saybrook Bar built out 1,600′, **74,** 100, ii, 248.
1874–75. Dr. on bars continued; w. j. completed, total l. 2,432′; e. j. commenced, 247′ built, **75,** ii, 297, 298.

[1] Burnet to L. Connecticut: Sur.—**R.,** Dec. 1, 1825. Canal from Dodges Falls to Hartford: Sur.—**R.,** Jan. 13, 1831; est., $3,311,149. At Saybrook Bar: Sur.—**R.,** Jan. 31, 1837; est., $54,380.50. Canal to Memphremagog Lake: Sur.—**R.,** Dec. 1, 1825. H. Doc. No. 482, 55th Cong., 2d sess. Hampshire and Hampden Canal Mass.—**R.** (indefinite), Jan. 22, 1830—H. D. 482, 55th Cong., 2d sess. Champlain Lake and Memphremagog Lake Canal: Sur.—**R.,** Dec. 1, 1825; ests., $306,419.84 and $358,751.54. (H. D. 482, 55th, 2d.) Montpelier Canal, Vt.: Sur.—**R.,** Feb. 18, 1828. (H. D. 482, 55th, 2d.) Passumpsic Canal, Vt.: Sur.—**R.,** Feb. 18, 1828; est. indefinite. (H. D. 482, 55th, 2d.) Rutland Canal, Vt.: Sur.—**R.,** Feb. 18, 1828. (H. D. 482, 55th, 2d.) Sunapee Canal, Conn.: Sur.—**R.,** Feb. 18, 1828; est. indefinite. (H. D. 482, 55th, 2d.) Wells River to Burlington Canal: Sur.—**R.,** Nov. 12, 1836. (H. D. 482, 55th, 2d.)
[2] Including imp. below Hartford, at Saybrook Bar, at mouth of Salmon R., and above Hartford.
[3] Saybrook H.
[4] Above Hartford.
[5] Failed to enter into contract, **72,** 831.

1875-76. 14,820 c. y. dr. from bars; e. j. lengthened to 1,144′, **76,** 212.
1876-77. Dr. and removal of a wreck in progress; repairs to w. j. made, **77,** 45, 205.
1877-78. Bars dr.; wreck removed, **78,** 49, 246.
1878-79. Bars and Salmon R. dr.; e. j. extended 220′, **79,** 55, 56, 316.

Above Hartford:
History of operations, **73,** 1003, 1006; **78,** 247; **79,** 319.
1870-71. Building wing dams, **71,** 84; in progress, **71,** 760.
1871-72. Wing dams built on Scantic R. Bar, Strongs Isld. Bar, and Farrington Bar, **72,** 82, 835.
1872-73. Dr. at Barbers Landing Bar, **73,** 1005.
1873-74. Dr. at Barbers Landing Bar, **74,** 101, ii, 249.

PHYSICAL CHARACTERISTICS.
Described, **67,** 450.
General discussion, **68,** 759; **71,** 765; **72,** 839, 845.
Saybrook Bar, **73,** 988, 993.
Hartford to Enfield, **73,** 1007.
Hartford to Holyoke, **74,** ii, 251; **75,** ii, 313, 369; **78,** 267, 291.

PLANS. (See Estimates and Projects.)
By T. G. Ellis, wing dams, **71,** 765. Canal around Enfield Falls, various plans proposed, **72,** 837, 847.
By T. G. Ellis, dr. and piling, **68,** 778. Ps. and dr. at Saybrook Bar, details, **73,** 997.

PRIVATE (city and corporate) WORK.
(See also Expenditures.)
Summary of, Union Co., 1800–1835, **68,** 766.
Dr. by the SS. Co. and city, **68,** 768; **70,** 447.
Summary of, Connecticut R. Co., **72,** 843.
Dr. andscraping by the SS. Co. at Saybrook Bar, **73,** 996.
Dr. bars by Hartford & New York SS. Co., 1876, **77,** 45, 204.

PROJECTS. (See Plans.)
By Maj. Warren, wing dams at 5 places, Hartford to Enfield Rapids, **71,** 84, 757.
By Maj. Houston, chan. 8′ x 200′, below Hartford, by dr. and scraping bars, **68,** 66, 750, 755, 776; **69,** 57, 409; **70,** 447.
By Maj. Warren, js. and dr., Saybrook Bar, **73,** 985.

SECRETARY OF WAR.
Recom. publication in full of Maj. Warren's surs. and exs. between Hartford and Holyoke, **78,** 248.

SURVEYS.
Above Hartford:
1871-75. By T. G. Ellis, under direction of Maj. Warren. **R.,72,** 836, 840; **73,** 1003, 1005; **74,** ii, 250; **75,** ii, 300, 303; **78,** 249, 264.

Below Hartford:
1720. J. Copp, **73,** 992.
1770. Capt. A. Parker, **73,** 993.
1836. J. W. Adams, under direction of Capt. Smith, **73,** 993.
1835-36-45-49-50. By Coast Sur., **73,** 993.
1867. By T. G. Ellis, under direction of Maj. Houston, **67,** 18, 44, 450. **R., 68,** 754, 756.
1872. By T. G. Ellis, under direction of Maj. Warren. **R., 73,** 986, 990.
1875. By T. G. Ellis, under direction of Maj. Warren. **R., 76,** 212.
1879. By T. G. Ellis, under direction of Lt. Col. Warren, **79,** 316.

Maps:
Saybrook Bar, 1873, **73,** 987.
Surs. between Hartford and Holyoke, 1871–1875, by T. G. Ellis, Plates Nos. I to XVI, inclusive, **78,** 392.
Sur., Saybrook Bar **79,** 318.

Part (b), D-23 Connecticut River, below Hartford, Conn.

APPROPRIATIONS.

1880,	$10,000.00,	**80,** 398.
1881,	30,000.00,	**81,** 578.
1882,	45,000.00,	**82,** 566.
1884,	35,000.00,	**84,** 642.
1884,	6,479.32,	act July 7.
1886,	26,250.00,	**86,** 629.
1888,	10,000.00,	**88,** 535.
1888,	2,606.80,	act Aug. 19.
1890,	12,500.00,	**90,** 613.
1892,	20,000.00,	**92,** 663.
1894,	20,000.00,	**95,** 773.
1896,	20,000.00,	**96,** 693.
1899,	20,000.00,	**99,** 1159.
1902	30,000.00,	**02,** 927.
	*2,000.00,	**03,** 837.
1904,	*12,000.00,	**05,** 878.
1905,	40,000.00,	**05,** 878.
1907,	40,000.00,	**07,** 961.
1909,	*15,000.00,	**09,** 1033.
1910	*10,000.00,	**10,** 1155.
	36,000.00,	**10,** 1155.
1911,	77,000.00,	**11,** 1227.
1912,	40,000.00,	**12,** 1440.
Total,	559,836.12	

COMMERCE.
Business influenced by proposed imp., **80,** 399.
Detailed description, and amount, **02,** 928.
Rates reduced materially; C. dependent entirely on imp., **10,** 118; **12,** 145.
Diagram showing tonnage, valuation, and app., 1880 to 1912, **12,** 1441.
1911, 684,000 t.±, **12,** 145.

CONTRACTS.
1879. Hartford & New York SS. Co., dr., 16⅜¢ c. y., **80,** 397.
1880. J. Beattie, riprap granite, $1.05 t., **81,** 575. McDermott & Daly, dr., 15¾¢ c. y., **81,** 575.
1881. J. Beattie, dr., 13¢ c. y., **81,** 576. E. H. Williams, wing-dam constr., $1.60 c. y., **81,** 577. E. H. Williams, riprap granite, $1.29 t., **81,** 577. J. McDermott, dr., 14⅝¢ c. y., **82,** 565.
1884. H. N. & A. J. Beardsley, dr., 15¢ c. y., **85,** 636. J. Beattie, j. constr., $1.16 t., of st., **85,** 636.
1886. C. H. Edwards, dike constr., Hartford, **87,** 595. J. V. Luce, dike constr. at Saybrook, **87,** 595.
1887. Pidgeon Dredging Co., dr., 11$\frac{7}{10}$¢ c. y., **87,** 595.
1889. J. H. Fenner, hire of dr. plant, $8.45 per hour, **89,** 668.
1891. Hartford Dredging Co., hire of dr. plant, $8.20 per hour, **91,** 756.
1892. C. C. Goodrich, dr., 12¢ c. y., **93,** 911.
1895. Newburg Dredging Co., dr., 10½¢ c. y. s. m. ($9,000), **95,** 774.
1896. J. P. Randerson, dr., 9¾¢ c. y., s. m. ($9,000), **96,** 693.
1897. Hartford Dredging Co., dr., 9¢ c. y. ($9,000), **97,** 950.
1898. Hartford Dredging Co., dr., 7.8¢ c. y. ($7,800), **98,** 952.
1899. J. P. Randerson, dr., 9⅞¢ c. y. ($8,999.98) **99,** 1160.
1900. Hartford Dredging Co., dr., 12¢ c. y. ($7,980), **00,** 1330.
1902. Hartford & New York Transportation Co., dr., 11.9¢ c. y., **02,** 927.
1903. Hartford & New York Transportation Co., dr., 11.45¢ c. y., **03,** 837.
1904. Hartford & New York Transportation Co., dr., 9¢ c. y., **04,** 975. E. S. Belden & Sons, st. in place in js., $1.23 t., **05,** 878.
1906. Hartford & New York Transportation Co., dr., 9¢ c. y., **06,** 925. Hartford & New York

* Allotments.

Transportation Co., removing sunken ps., 30¢ c. y., s. m., for material dumped in R., and 60¢ c. y. for r. placed on Hartford Dike, **07,** 962.

1907. Hartford & New York Transportation C., dr., 11¢ c. y., s. m., **07,** 961. New York & Hartford Transportation Co., dr., 20¢ c. y., s. m., **08,** 1005.

1908. Hartford & New York Transportation Co., dr., 11¢ c. y., s. m., **08,** 1005.

1909. Hartford & New York Transportation Co., dr., 11¢ c. y., s. m., **09,** 1034.

1910. Hartford & New York Transportation Co., dr., 11¢ c. y., s. m., **10,** 1156.

1911. Hartford & New York Transportation Co., dr., 11¢ c. y., s. m., **11,** 1227. Taylor Dredging Co., dr. y., 13.8¢ c. c. y., s. m., **12,** 1440.

1912. Hartford & New York Transportation Co., dr., 11¢ c. y., s. m., **12,** 1440.

ENGINEERS.

Chief of Engineers. R., 80, 76; **81,** 88; **82,** 88; **83,** 87; **84,** 93; **85,** 80; **86,** 82; **87,** 45; **88,** 46; **89,** 58; **90,** 52; **91,** 65; **92,** 69; **93,** 74; **94,** 66; **95,** 75; **96,** 73; **97,** 6; **98,** 91; **99,** 104; **00,** 119; **01,** 180; **02,** 126; **03,** 107; **04,** 91; **05,** 96; **06,** 96; **07,** 99; **08,** 101; **09,** 104; **10,** 117; **11,** 122, 149; **12,** 143.

In charge:

Lt. Col. G. K. Warren, 1870–83. **R., 80,** 396, 398; **81,** 575; **82,** 564.

Lt. Col. W. McFarland, 1883–86. **R., 83,** 508; **84,** 640; **85,** 633.

Lt. Col. D. C. Houston, 1886–92. **R., 86,** 625; **87,** 590; **88,** 530, 536; **89,** 663; **90,** 608, 614, 615; **91,** 750; **92,** 658.

Lt. Col. H. M. Robert, 1893–95. **R., 93,** 908; **94,** 632; (Col.) **95,** 768.

Maj. H. M. Adams, 1896. **R., 96,** 689.

Maj. S. S. Leach, 1897–1901. **R., 97,** 948; **98,** 949; **99,** 1158; **00,** 1328; **01,** 1166.

Maj. Chas. F. Powell, 1902–05. **R., 02,** 925; **03,** 836; (Lt. Col.) **04,** 973; **05,** 876.

Maj. Harry Taylor, 1906–10. **R., 06,** 925; **07,** 960; **08,** 1003; (Lt. Col.) **09,** 1032; **10,** 1154.

Capt. A. E. Waldron, 1911–12 **R., 11,** 1225; **12,** 1438.

Assistants:

T. G. Ellis, **R., 80,** 400.

William C. Lynch. **R., 05,** 878.

OBSTRUCTIONS.

N. Y., N. H. & Hartford RR. Co., notified to remove br. at Old Saybrook and Old Lyme, **07,** 100.

OPERATIONS.

1879-80. 8,136 t. st. placed in 765 l. f. of j., 34,692 c. y. dr., **80,** 397.

1880-81. 26,062 c. y. dr., 6,184 t. st. placed in e. j., **81,** 576.

1881-82. 9,017 c. y. dr., 7,109 c. y. st. placed in dam, 4,984 t. granite placed in js., **82,** 565, 566.

1882-83. 31,433 c. y. dr., 10,307 t. st. placed in wing dam, **83,** 509.

1883-84. 61,342 c. y. dr., **84,** 641.

1884-85. 148,366 c. y. dr., 8,840 t. st. placed in j. extension, **85,** 636.

1885-86. 1,582 t. st. placed in j. extension, 24,054 c. y. dr., **86,** 627, 628.

1886-87. 51,261 c. y. dr. from shore areas, 2,346 t. st. placed in Hartford Dike, 6,829 t. st. placed in Saybrook js., **87,** 592.

1887-88. 1,080 t. granite delivered in w. j.; 46,604 c. y. dr., **88,** 533.

1888-89. 98,511 c. y. dr., **89,** 666.

1889-90. 63,441 c. y. dr., **90,** 611.

1890-91. 37,763 c. y. dr. from the bars, **91,** 754.

1891-92. 58,058 c. y. dr., **92,** 661.

1892-93. 42,424 c. y. dr., **93,** 912.

1893-94. 68,147 c. y. dr., **94,** 635.

1894-95. 60,425 c. y. dr., **95,** 771.

1895-96. 65,315 c. y. dr., **96,** 691.

1896-97. 73,370 c. y. dr., **97,** 949.

1897-98. 110,503 c. y. dr., **98,** 951.

1898-00. 99,883 c. y. dr., **99,** 1158; **00,** 1329.

1900-01. 64,284 c. y. dr., **01,** 1167.

1901-02. 18,516 c. y. dr., **02,** 925.

1902-03. 122,369 c. y. dr., **03,** 836.

1903-04. 63,245 c. y. dr.; 35 stumps, trees, etc., removed, **04,** 973.

1904-05. 102,685 c. y. dr.; 7,646.88 t. st. placed in repairs to Saybrook js., **05,** 877.

1905-06. 89,101 c. y. dr., **06,** 925.

1906-07. 88,815 c. y. dr., **07,** 960.

1907-08. 115,118 c. y. dr.; 2,182 t. st. placed in Hartford Dike, **08,** 1003, 1004.

1908-09. 104,480 c. y. dr.; 11,780 t. st. placed in Hartford Dike, **09,** 1032, 1033.

1909-10. 115,079 c. y. dr.; 6,577 t. st. placed in Hartford Dike, **10,** 1154, 1155.

1910-11. 168,355 c. y. dr.; 1484 t. st. placed in Hartford Dike, **11,** 1225, 1226.

1911-12. 155,147 c. y. dr.; 39 snags removed, **12,** 1438, 1439.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 401; **93,** 908; **05,** 96.

Discharge and height, Hartford, 1878, **80,** 408.

Height of freshets above l. w., **80,** 403.

Slope of R., **80,** 411.

Table of borings, Hartford to Rocky Hill, **80,** 420.

Description of, rise and fall of tides, **88,** 530.

Source of R. in Conn. Lake in extreme n. part of N. H. and it flows between that State and Vt.; then through Mass. and Conn., emptying into L. I. Sound at Saybrook, 30 m.± to e. of New Haven, and 14 m.± to w. of New London, 345 m. l. Proj. section, 51.9 m., Hartford to L. I. Sound, **12,** 143.

PRIVATE WORK.

Hartford & New York Transportation Co., dr. shoals, **01,** 1167.

PROJECTS.

The proj. of 1868 proposed dr. chan. 8′ d. at l. w. and 100′ w. at Hartford, Clay Banks, Pratts Ferry, Glastonbury, and Pistol Pt., and a chan. 200′ w. and 8½′ d. at Saybrook Bar; shore protection at Hartford and Weathersfield, and the removal of Chester Rock, **68,** 66, 750, 776; **69,** 409; **70,** 447; **87,** 591.

In 1873 js. were proposed for the imp. of Saybrook Bar, with dr. to form a chan. 9′ x 400′, **73,** 985; **87,** 591.

By Lt. Col. Warren, 1879, chan. 9′ x 200′, Hartford to Long Isld. Sound, by mattress protection of banks; rectification of banks at Clay Banks and Glastonbury Bar; wing dams at Hartford Bar, Pratts Ferry Bar, Press Barn Bar, Glastonbury Bar, and Dividend Bar; est., $330,000, **80,** 417, 418, 419, 420.

By Col. Houston, 1887, completion of the js. at the mouth of R. to a height of 5′ above h. w. and a top w. of 6′, w. the chan. between the js. to 400′, with a d. of 12′ at m. l. w., and an. dr. to maintain the chan. from Hartford to Long Isld. Sound; est., $90,000, **88,** 532.

By Col. Houston, 1889, raising the dike at Hartford to 15′ above l. w.; est., $50,000. Thus increasing the total cost for completion of the proj. to $140,000, **90,** 614, 615; **92,** 659.

Act 1902 au. expend. of $1,000 at mouth of Salmon R., **03,** 107.

Act of Feb. 27, 1911, au. proj. for chan. 12′ x 100′ at m. l. w. from Hartford to the bar at the mouth, and for a chan. across the bar 15′ x 300′ m. l. w., the chans. to be obtained by dr. and the constr. of dikes, training walls, and revet.; est., $177,000[1] (see Surveys), **11,** 123.

SURVEYS.

Ex. of chan., 1880, **80,** 397.

Sur. between Hartford and Rocky Hill; made, 1879, by Lt. Col. Warren, **80,** 398.

Of Saybrook Bar and js., **04,** 973.

Ex. and sur. au. act Mar. 2, 1907, for removing obstr. in Eightmile R. and East Branch, Conn. **Rs.,** Maj. Taylor, May 9 and Oct. 15, 1907. East Branch "unfavorable." Est. for Eightmile R., $9,000 (see Eightmile R., Conn.),[2] **08,** 122.

Ex. and sur. from mouth to Hartford, au. act Mar. 3, 1909, made; **Rs.** by Lt. Col. Taylor, 1909 and 1910; plan presented for imp. at est. cost of $177,000, with $15,000 an. for mainten. until after constr. of dikes and training walls, and then $7,000 an.,[1] **11,** 149.

Maps.[2] **83,** 510; **85,** 636.

[1] H. D. 1294, 61st, 3d.

[2] H. D. 327, 60th, 1st.

Part (c), D-23 Connecticut River above Hartford, Conn.

APPROPRIATIONS.

1880, $15,000, **80,** 396.
1902, [1] 25,000, **05,** 900.
1907, 5,000, **07,** 960.
1912, 25,000, **12,** 1438.

Total, [2] 70,000 (incl. $85,000 under Part a, app. for this part of R., $155,000, **12,** 1438).

COMMERCE.

Probable, description of, **98,** 981.
Important, Hartford to Holyoke, **98,** 988.
Est. that 500,000 t. would be carried by water, **05,** 951.
No permanent benefit, 1912, from work already done, **12,** 143.

CONTRACTS.

1880. H. & N. Y. Transportation Co., building wing dams, $1.85 c. y., **80,** 395.
1886. C. C. Goodrich, repair of dikes, **87,** 589.

ENGINEERS.

Chief of Engineers. R., 80, 75; **81,** 86; **82,** 87; **83,** 87; **84,** 93, 99; **85,** 80; **86,** 81; **87,** 44; **88,** 46; **89,** 57; **90,** 52; **91,** 64; **92,** 68; **93,** 73; **94,** 65; **95,** 75; **98,** 111; **05,** 113, 899; **06,** 115; **07,** 97, 118; **08,** 100; **09,** 100, 103; **10,** 116, 138; **11,** 121; **12,** 142.

Boards. (Lt. Col. Rossell, Maj. Geo. W. Goethals, and Maj. J. G. Warren.) Appointed under act 1902, for making ex., surs., etc., of Connecticut R. from Hartford, Conn., to Holyoke, Mass.; **R., 05,** 902. Board reconvened by order act 1905, for preparing and submitting an additional **R.** on imp. of R. by open-chan. work or other methods than those already reported on, **06,** 115.
BERH. **R., 05,** 950.
Supple. **R.** by BE., Feb. 6, 1905. Desirable chan. can not be obtained by dr.[3]

In charge:
Lt. Col. G. K. Warren, 1870–83. **R., 80,** 394; **81,** 565, 566; **82,** 564.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 507; **84,** 639; **85,** 632.
Maj. J. W. Barlow. **R., 84,** 659.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 623; **87,** 587; (Col.) **88,** 527; **89,** 660; **90,** 606; **91,** 748; **92,** 656.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 907; **94,** 630; (Col.) **95,** 766.
Maj. S. S. Leach, 1898–. **R., 98,** 976.
Maj. Harry Taylor, 1907–10. **R., 07,** 959; **08,** 1003; (Lt. Col.) **09,** 1032; **10,** 1154.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1225; **12,** 1438.

Assistants:
T. G. Ellis. **R., 81,** 568.
Arthur J. Ober. **R., 05,** 919.

OBSTRUCTIONS.

At Holyoke navigation interrupted by a dam for the development of power which has no provision for the passage of vessels, **98,** 977.
Description of dam, etc., at Enfield, built by the Connecticut Power Co., **98,** 978.
List of 13 brs. crossing the R. from Hartford to Holyoke, **98,** 981.

OPERATIONS.

1880–81. 820 l. f. of upper dam and 643 l. f. of lower dam finished, **81,** 565.
1881–82. 180 l. f. of upper dam and 185 l. f. of lower dam completed, **82,** 564.
1884–85. 1,029 c. y. st. placed in dike, **85,** 633.
1886–87. Repair of wing dams at mouth of Farmington R. and at Barbers Landing, **87,** 588.

PHYSICAL CHARACTERISTICS. (See Part a.)

Description of, above Hartford, **81,** 569; **88,** 528.
Bellows Falls, Vt., to Pittsburgh, N. H., **84,** 659.
Description of, Hartford to Holyoke, **98,** 976.
The part designated in act June 3, 1896 (Surveys), 34 m. l., consists of 2 stretches of diverse character. From Holyoke to Enfield dam, 18 m., the bed is erosible, while from the dam to the foot of the rapids it is mostly nonerosible, **98,** 977.
Table showing duration of certain stages above Hartford for 7 years, 1871–77, **98,** 980.
General description and character of R., river banks, tributaries, and water sheds, **05,** 919.

PLANS. (See Projects.)

By Lt. Col. Warren, 1880, canal around Enfield Falls, on e. bank of R., extending down to mouth of Hockanum R., opposite Hartford; est., $1,322,805, **81,** 566; **87,** 588.

PROJECTS. (See Plans.)

By Maj. Warren, 1871, increased d. to chan. with wing dams at 5 places between Hartford and Enfield Rapids, and by dr.; est., $850,000, **71,** 84, 757. No general proj. adopted, **87,** 588; **88,** 528; **91,** 749; **92,** 657.
In 1897 Maj. Leach est. $1,825,000 or $2,075,000 to imp. R. between Hartford and Holyoke with ls. and ds., etc., **98,** 988.
By BE., 1904, plans for securing d. of 9′ by means of ls. and ds.; est., dependent on type of dams, $2,725,000, $2,621,000, and $2,393,500,[4] **05,** 905.
By BE., plan for imp. by means of dr., wing dams, and training walls from Hartford to above mills at Windsor Locks, thence by new lock and existing canal, and thence to Holyoke; est., $1,564,600, **07,** 98; locality not worthy of imp. in manner proposed, **07,** 118.[5]
Maj. Taylor, 1908, reported cost of imp. out of proportion to probable benefit,[6] **09,** 100.
BERH. recom. adoption of plan presented in H. Doc. No. 323, 59th Cong., 2d sess., for l. and d. surmounting Enfield Rapids, to be built by private parties, become property of U. S., and maintained by U. S.; est., $1,015,600, with $10,000 an. mainten.,[7] **10,** 117.

SURVEYS.

Of Farmington R. Bar, 1879, to ascertain condition of chan., **80,** 394.
Ex., 1884, Bellows Falls, Vt., to Pittsburgh, N. H. **R.** (unfav.), **84,** 659.
Sur., Holyoke, Mass., to foot of Enfield Rapids au. act June 3, 1896; made, 1897, by Maj. Leach (**R.** fav. to imp. between Hartford and Holyoke), **98,** 976.
Au. act June 13, 1902; made, 1904, by BE.,[4] **05,** 902, 919.
Au. act Mar. 2, 1907; made, 1908, by Maj. Taylor (**R.** unfav.),[6] **09,** 100.
Au. act Mar. 3, 1909, Hartford, Conn., to Holyoke, Mass.; **Rs.,** 1909 and 1910, by Lt. Col. Taylor; plan for imp. at est. of $1,015,600 submitted, subject to certain conditions,[7] **10,** 138.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 142.

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[1] For sur.
[2] Of which $8,786.56 was carried to surplus fund in 1907 and 1909, **10,** 1154.
[3] Comm. Doc. 41, 61st, 2d.
[4] H. D. 231, 58th, 3d.
[5] H. D. 323, 59th, 2d.
[6] H. D. 1311, 60th, 2d.
[7] H. D. 818, 61st, 2d.

D-24 WESTBROOK HARBOR, CONN.[1] (Near Connecticut River mouth.)

APPROPRIATION.
Mar. 2, 1829, $130.

D-25 FIFTEEN-MILE FALLS, N. H.

COMMERCE.
Important, **71,** 861, 866.
Obstructions to C., **71,** 863, 864.

ENGINEERS.
Chief of Engineers. R., 70, 31, 83; **71,** 96.
In charge. Lt. Col. G. Thom. **R., 71,** 861; **72,** 957.

OBSTRUCTIONS. (See Commerce; Physical Characteristics.)

PHYSICAL CHARACTERISTICS.
Presence of ledges and bowlders; forms part of Conn. R., beginning at Dalton, N. H., about 275 m. above mouth of river, **71,** 863, 864.

PLANS.
By Lt. Col. Thom, running of logs, cribwork, and removing bowlders and ledges; est., $18,000. Rafting of sawed lumber, and running of logs, sluiceways, and cribwork, and removing ledges and bowlders; est., $25,000, **71,** 864, 865, 866. Modified by the substitution of booms for cribwork, at an est. cost, for running logs only, of $15,000; for running logs and rafting sawed lumber, $22,000, **72,** 960.

PRIVATE (CORPORATE) WORK.
Imp. made by, at worst points by removing bowlders, and constructing slips, sluiceways, and locks at various points, **71,** 862.

SURVEYS.
By Lt. Col. Thom, 1870–71. **R., 71,** 861; **72,** 957.

D-30 EIGHTMILE RIVER, CONN.

APPROPRIATIONS.
1910, $9,000, **10,** 1156.

COMMERCE.
1911, 1,479 t.; no apparent effect of imp. on rates, **12,** 147.

CONTRACTS.
1910. T. A. Scott Co. (Inc.), dr., 13½¢ c. y., and removal of bowlders; $10 c. y. for bowlders over 1 c. y. in volume, **11,** 1228.

ENGINEERS.
Chief of Engineers. R., 08, 122; **10,** 119; **11,** 124; **12,** 146.

In charge:
Maj. H. Taylor, 1908–10. **08,** 97; (Lt. Col.) **R., 10,** 1156.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1228; **12,** 1441.

OPERATIONS.
1910–11. 54,482 c. y. removed, 43 c. y. bowlders over 1 c. y. each, and 11 old logs and piles, **11,** 1228.
1911–12. 44 c. y. bowlders removed; proj. about 90% completed, **12,** 1441.

PHYSICAL CHARACTERISTICS.
Details; empties into Conn. R. about 9 m. above mouth; 11 m. l.; proj. part about 1.53 m. l., mouth to head of turning-basin, **10,** 119; **12,** 146.
Max. draft, 1912, 8′, **12,** 147.

PROJECTS.
Act June 25, 1910, au. chan. 8′ x 75′, with small turning-basin at inner end of chan.,[2] **10,** 119; est., $9,000, **12,** 146.

SURVEYS.
Ex. and sur. au. act Mar. 2, 1907, for removing obstr., Eightmile R. and East Branch, Conn.; **Rs.,** Maj. Taylor, May 9 and Oct. 15, 1907; East Branch unworthy of imp. by U. S.; est., Eightmile R., $9,000,[2] **08,** 122.
Maps.[2] **11,** 1228.
Cong. docs., etc., relating to exs., surs., plans etc., **12,** 146.

D-35 FARMINGTON CANAL, CONN.[3]

D-41 DUCK ISLAND HARBOR, CONN.

APPROPRIATIONS.

1890,	$25,000,	**91,** 758.
1892,	35,000,	**92,** 666.
1894,	30,000,	**95,** 776.
1896,	24,000,	**96,** 696.
1900,	*202,	**01,** 1170.
1905,	6,000,	**05,** 881.
1910,	60,000,	**10,** 1157.
1911,	100,000,	**11,** 1230.
1912,	50,000,	**12,** 1444.
Total,	330,202	(total, incl. sales, etc., $331,211.08, **12,** 1444).

COMMERCE.
No local C., **84,** 684.
Necessity for H. of refuge, **87,** 642.
Impossible to satisfactorily est. value of passing C. of Long Isld. Sound, C. likely to use H. of refuge, **10,** 120; 1912, 1,121 vessels anchored in H., **12,** 149.
Great value of imp. to C., **10,** 1157.
Increase in traffic due to break'r constr., **12,** 1445.

CONTRACTS.
1891. E. S. Belden, riprap break'r constr., 94¢ t., **92,** 666.

*Allotment.
[1] Sur.—**R.,** Jan. 12, 1830; est., $17,921.39 and $23,678.57. (H. D. 482, 55th, 2d.)
[2] H. D. 327, 60th, 1st.
[3] Ex.—**R.** (indefinite), Jan. 22 1830. (H. D. 482, 55th, 2d.)

1892. S. & S. E. Belden, st., 89¢ t. ($26,700), **93,** 916.
1894. Hughes Bros. & Bangs, 38,255 t. st., 68¢ l. t., **95,** 777.
1896. J. F. Quinn, st., 65¢ t. ($16,250), **97,** 952. (Annulled—no st. delivered, **98,** 952.)
1897. J. Beattie, st., 77¢ t. ($19,250), **98,** 955.
1910. E. S. Belden & Sons, placing st. in break'r (54,000 t.), at 90¢ t. of brownst. (40%) and $1.10 t. of granite in place (60%), **11,** 1230.
1912. Estate of John Beattie, furnishing 14,213.46 t. riprap st., at 75¢ l. t.; placing 170,000 t. st. in break'r, at $1.05 t. in place, **12,** 1444.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 99; **87,** 56; **91,** 66; **92,** 70; **93,** 76; **94,** 67; **95,** 77; **96,** 75; **97,** 89; **98,** 94; **99,** 106; **00,** 122; **01,** 181; **02,** 128; **03,** 108; **04,** 92; **05,** 98; **06,** 97; **07,** 100; **08,** 103, 122; **09,** 106; **10,** 119; **11,** 125; **12,** 147.

In charge:
Maj. J. W. Barlow. **R.,** **84,** 684.
Lt. Col. D. C. Houston, 1887–92. **R.,** **87,** 641; (Col.) **91,** 757; **92,** 664.
Lt. Col. H. M. Robert, 1893–95. **R.,** **93,** 914; **94,** 638; (Col.) **95,** 774.
Maj. H. M. Adams, 1896. **R.,** **96,** 694.
Maj. S. S. Leach, 1897–1901. **R.,** **97,** 951; **98,** 953; **99,** 1161; **00,** 1331; **01,** 1169.
Maj. Chas. F. Powell, 1902–05. **R.,** **02,** 929; **03,** 838; (Lt. Col.) **04,** 975; **05,** 881.
Maj. Harry Taylor, 1906–10. **R.,** **06,** 926; **07,** 962; **08,** 1006; (Lt. Col.) **09,** 1034; **10,** 1156.
Capt. A. E. Waldron, 1911–12. **R.,** **11,** 1229; **12,** 1442.

OPERATIONS.

1890-91. 5,126 t. riprap placed in break'r, completing 270 l. f. of work, **91,** 758.
1891-92. 18,336 t. riprap placed in break'r, completing 676 l. f., **92,** 665.
1892-93. 8,087 t. st. placed in break'r, **93,** 915.
1893-94. 25,925 t. st. deposited, **94,** 639.
1895-96. 39,414 t. deposited, **96,** 695.
1897-98. 20,935 t. deposited, **98,** 953.
1898-99. About 4,000 t. deposited, **99,** 1161.
1900-01. 200 t. riprap used in repairs to break'r, **01,** 1169.
1905-06. 3,700 t. riprap placed in repairs to break'r, **06,** 926.
1908-09. Unfinished break'r damaged by wave action, **09,** 1034.
1909-10. 3,278 t. st. placed in repairs to break'r, **10,** 1157.
1910-11. 16,289 t. granite and 8,998 t. brownst. placed in Kelsey Pt. break'r, **11,** 1239.
1911-12. 29,053 t. st. under one contract, and 8,548 t. st. under another contract placed in Kelsey Pt.; U. S. steam lighter *Panuco* placed 14,213.46 t. st. in n. break'r, **12,** 1442.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 757; **10,** 119.
Shoaling near n. break'r necessitated rehandling st. by light-draft lighter, **12,** 1442.
D. Isld. H. Small bay on n. shore, Long Isld. Sound, 7 m. w. of mouth of Conn. R. and midway between New London and New Haven—about 23 m. from each, **12,** 147.

PROJECTS.

By Maj. Barlow, 1882, for small H. of refuge by break'r from 1,200 to 1,800 y. in l.; est., $200,000, **84,** 684.
Modified and enlarged by Lt. Col. Houston, 1886, providing for the constr. of 3 break'rs of riprap, 1 extending w. from Duck Isld., 3,000′ l.; 1 extending ne. from Duck Isld., 1,750′ l.; and the 3d extending sw. from Menunketesuck Pt., 1,130′ l. These break'rs to be 10′ w. at top, to extend to 6′ above h. w., and to inclose an area of about 115 acres; est., $463,540, **87,** 642; **91,** 757.
By Maj. Taylor, 1907; proj. modified by omitting the 2 break'rs between Duck Isld. and Menunketesuck Pt.; omission of additional l. orig. planned for break'r extending w. from Duck Isld., and constr. break'rs extending n. from Duck Isld. 1,100′ and s. from Stone Isld. 3,750′; est. of modified proj., $350,000, with $5,000 once in 10 years for mtns.,[1] **08,** 122; au. act June 25, 1910, **10,** 120.

SURVEYS.

Ex. au. acts Aug. 2, 1882, and Aug. 5, 1886; made by Maj. Barlow, **84,** 684; by Lt. Col. Houston (see Projects), **87,** 641.
Of H. of refuge, and for a break'r at Kelsey Pt., au. act Mar. 2, 1907; made, 1907, by Maj. Taylor,[1] **08,** 122.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 148.
Maps.[1]

D-44 CLINTON HARBOR, CONN.

APPROPRIATIONS.

1882,	$3,000,	**83,** 512.
1890,	3,500,	**90,** 617.
1892,	2,000,	**92,** 668.
Total,	8,500	

COMMERCE.

Important, **82,** 631.

CONTRACTS.

1883-84. D. V. Howell, riprap dike constr., $1.41 t., **84,** 644.
1892-93. Hartford Dredging Co., drg. 10,500 c. y., at 28½¢ c. y., **93,** 918.

ENGINEERS.

Chief of Engineers. **R.,** **81,** 97; **82,** 97; **83,** 88; **84,** 94; **85,** 83; **86,** 83; **87,** 46; **88,** 47; **89,** 59; **90,** 54; **91,** 66; **92,** 71; **93,** 76; **94,** 68.

In charge:
Maj. J. W. Barlow, 1881–83. **R.,** **82,** 630.
Lt. Col. W. McFarland, 1883–86. **R.,** **83,** 511; **84,** 643; **85,** 643.
Lt. Col. D. C. Houston, 1886–92. **R.,** **86,** 634; **87,** 596; **88,** 538; **89,** 669; **90,** 616; **91,** 759; **92,** 667.
Lt. Col. H. M. Robert, 1893–94. **R.,** **93,** 917; **94,** 640.
Assistant. H. N. Babcock. **R.,** **82,** 630.

OPERATIONS.

1883-84. 375′ of riprap dike built, **84,** 643.
1890-91. 836 t. of riprap granite used in extension of dike, **91,** 760.
1892-93. 10,500 c. y. drd., and proj. completed, **93,** 918.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 538.

PROJECTS.

By Maj. Barlow, 1882, closing the breach with a riprap st. dike, and if the desired d. was not restored by the increased tidal flow, to dr. chan. 6′ x 100′ m. l. w. through the 2-shoals; est., dike, $3,000; dike and drg., $10,000, **82,** 630; **86,** 634; **87,** 596; **92,** 667.
By Lt. Col. Robert, 1893, modified proj. providing for w. of 75′; total est., $8,500, **93,** 917.

SURVEY.

Au. act Mar. 3, 1881; made, 1882, by Maj. Barlow, **82,** 630.
Maps. **83,** 511; **86,** 634.

[1] H. D. 398, 60th, 1st.

D-47 MADISON HARBOR, CONN.

COMMERCE.

Necessity for break'r, **82,** 629; **84,** 685.

ENGINEERS.

Chief of Engineers. **R., 81,** 97; **82,** 97; **84,** 100.
In charge. Maj. J. W. Barlow. **R., 82,** 627; **84,** 685.
Assistant. H. N. Babcock. **R., 82,** 627.

PHYSICAL CHARACTERISTICS.

Madison, Conn., a village 1 m. back from a point on shore of Long Isld. Sound, bet. Sachems Head on w. and Hammonasset Pt. on e., **82,** 627.

PLANS.

By Maj. Barlow, 1882, break'r covering the landing at Milford; est., $285,000, **82,** 627.

SURVEYS.

Au. acts Mar. 3, 1881, and Aug. 2, 1882; made by Maj. Barlow, **82,** 627; **84,** 685.

D-49 FALKNERS ISLAND, CONN.

COMMERCE.

Necessity for H. of refuge, **85,** 708.

ENGINEERS.

Chief of Engineers. **R., 85,** 96.
In charge. Lt. Col. W. McFarland. **R., 85,** 707.

PHYSICAL CHARACTERISTICS.

Locality described, **85,** 707.
3 m. off shore, almost due n. of Guilford, Conn., and about 14 m. e. by s. of the lighthouse on the w. end of New Haven break'r, **85,** 707.

PLANS.

By Lt. Col. McFarland, 1884, for 2 break'rs, each about 600 y. long, covering an anchorage area of 120 acres, with a d. of 15'; est., $700,000, **85,** 708, 709.

SURVEY.

Ex. au. act July 5, 1884; made by Lt. Col. McFarland, **85,** 707.

D-52 STONY CREEK RIVER, CONN.

ENGINEERS.

Chief of Engineers. **R., 91,** 79.
In charge. Col. D. C. Houston, 1890. **R., 91,** 831.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 832.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Col. Houston (**R.** fav.), **91,** 831.

D-53 BRANFORD HARBOR, CONN.

APPROPRIATIONS.

1902,	$5,000,	**02,** 930.
1905,	3,000,	**05,** 882.
1907,	5,000,	**07,** 963.
1910,	2,000,	**10,** 1158.
1912,	3,000,	**12,** 1445.
Total,	18,000,	**12,** 1445.

COMMERCE. (See Plans.)

Details. Over 39,000 t.; granite quarries in vicinity, **01,** 1190; 25% increase, **06,** 99; 41,744 t., value, $237,899.08, **12,** 151.
Navigation facilitated, and rates reduced, **10,** 121; **11,** 128.

CONTRACTS.

1904. John P. Randerson, dr., 15¢ c. y., s. m., **05,** 882.
1907. John P. Randerson, dr'ng, 15¢ c. y., s. m., **07,** 963.

ENGINEERS.

Chief of Engineers. **R., 84,** 99; **01,** 198, 1188; **02,** 128; **03,** 109; **04,** 93; **05,** 99; **06,** 98; **07,** 101; **08,** 104, 122; **09,** 107; **10,** 121; **11,** 127; **12,** 149.

In charge:
Maj. J. W. Barlow. **R., 84,** 678.
Maj. W. McFarland. **R., 84,** 679.
Maj. Smith S. Leach, 1901. **R., 01,** 1189.
Maj. Chas. F. Powell, 1902–05. **Rs., 02,** 929; **03,** 839; (Lt. Col.) **04,** 976; **05,** 881.
Maj. Harry Taylor, 1906–10. **Rs., 06,** 926; **07,** 963; **08,** 1006; (Lt. Col.) **09,** 1035; **10,** 1157.
Capt. A. E. Waldron, 1911–12. **Rs., 11,** 1231; **12,** 1445.
Assistant. H. N. Babcock. **R., 84,** 680.

OBSTRUCTION.

Dumping in objectionable places at instigation of State agents, **05,** 882.

OPERATIONS.

1902–03. Work advertised, all bids rejected **03,** 839.
1904–05. 35,395 c. y. dr., **05,** 882.
1906–07. 14,000 c. y. dr., **07,** 963.
1907–08. 23,013 c. y. dr., proj. completed, **08,** 1006.

PHYSICAL CHARACTERISTICS.

Details. H. mouth, 15', thence to R. 7.5', **01,** 1189; **11,** 127; shoaling, **12,** 150.

PLANS.

C. of port, 1883, would not justify expend. $78,000 required to form a chan. 9' x 100' through the shoal areas in the H., **84,** 679, 680.

PRIVATE WORK.

Turning-basin about 75'–100' x 600' dr. between chan. and docks, **08,** 1007.
Malleable Iron Fittings Co. dr. 11,811 c. y., straightening and extending chan., **10,** 1157.

PROJECTS.

By Maj. Leach, chan. 8½' x 100' f. m. l. w., through the upper part of Branford R. from the lower to the upper docks; est., $5,000, and $250 an. mainten.,[1] **01,** 1193; proj. 1907 to include dr. shoals at R. mouth, increasing est. to $13,000, **07,** 101; $1,000 an. needed for mainten., **10,** 1158.

[1] H. D. 100, 56th, 2d.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Maj. Barlow, **84,** 678.
Sur. by Maj. McFarland (see Plans), **84,** 679.
Au. act Mar. 2, 1900; made by Maj. Leach,[1] **01,** 188.
Ex. au. act Mar. 2, 1907; made, 1907, by Maj. Taylor (**R.** unfav.),[2] **08,** 122.
Cong. docs., etc., relating to exs., surs., Plans, etc., **12,** 150.

D-55 EAST HAVEN RIVER, CONN.

ENGINEERS.

Chief of Engineers. R., 11, 149.
In charge. Lt. Col. H. Taylor, **11,** 118.

SURVEY.

Ex. au. act June 25, 1910; **R.,** Lt. Col. Taylor Sept. 26, 1910 (unfav.),[3] **11,** 149.

D-56 NEW HAVEN HARBOR, AND WEST RIVER, CONN.

Part.	Title.	Period.	Appropriation.
a	New Haven Harbor, Conn	1852–1908	$637,073.90
b	West River Conn	1904–1908	38,500.00
c	New Haven Harbor and West River, Conn	1909–1912	161,200.00
	Total, **12,** 1447		836,773.90

Part (a), D-56 New Haven Harbor, Conn.[4]

APPROPRIATIONS.

1852, $6,000.00, **66,** 7; **67,** 451.
1870, 15,000.00, **71,** 85.
1871, 40,000.00, **71,** 85.
1872, [5] 35,000.00, **72,** 83.
1873, 25,000.00, **73,** 91.
1875, 10,000.00, **75,** 104.
1878, 25,000.00, **78,** 52.
1879, 15,000.00, **79,** 58.
1880, 15,000.00, **80,** 445.
1881, 15,000.00, **81,** 593.
1882, 30,000.00, **82,** 609.
1884, 10,000.00, **84,** 646.
1886, 20,000.00, **86,** 637.
1888, 15,000.00, **88,** 543.
1890, 15,000.00, **90,** 621.
1892, 15,000.00, **92,** 672.
1894, 10,000.00, **95,** 781.
1896, 10,000.00, **96,** 698.
1899, 50,000.00, **99,** 1163.
1900, 50,000.00, **00,** 1334.
1901, 50,000.00, **01,** 1172.
1902, 67,000.00, **02,** 931.
1903, 63,073.90, **03,** 841.
1904, *9,000.00, **05,** 884.
1905, 9,000.00, **05,** 884.
1907, *10,000.00, **07,** 965.
1907, 3,000.00, **09,** 1036.

Total, 637,073.90

COMMERCE.

New Haven H. a H. of refuge, **71,** 775.
Shipping on Mill R., **75,** ii, 249.
Description of, **97,** 975; **01,** 183; **04,** 95; **08,** 106. 1900, 3,472,200 t., **01,** 183; 1903, 2,257,197 t., **04,** 95; 1907, 1,875,295 t., **08,** 106.

CONTRACTS.

1871. G. W. Townsend, outfit for the removal of Middle Rock, at $80 per day; Morris & Cummings, dr., 17¢ c. y.; Eugene Sullivan, removal of r., $25 c. y., **67,** 451; **68,** 751; **71,** 769, 770.
1872. Shortland & Bros., dr., 19.73¢ c. y., **72,** 863, 1011; contract annulled, **73,** 1011.
1873. H. N. & A. J. Beardsley, dr., 19½¢ c. y.; Atlantic Dredging Co., dr., 17½¢ c. y.; J. F. Ward, removal of r., $11,000, **73,** 1012; **74,** ii, 257; **75,** ii, 252.
1876. E. R. Seward, w. chan., 12¢ c. y., **76,** 224.
1879. Morris & Cummings, dr., 8¾¢ c. y., **79.** 335. H. N. & A. J. Beardsley, dr., 9⅝¢ c. y., **80,** 446.
1880. Morris & Cummings, dr., 12½¢ c. y., **81,** 593.
1881. H. N. & A. J. Beardsley, dr., 11½¢ c. y. **82,** 609.
1882. D. V. Howell, riprap dike, $1.37 t., **83,** 514. A. M. Newton, pile and st. dike, $21.83 l. f., **83,** 514.
1885. H. Du Bois & Sons, dr., 8½¢ c. y., **86,** 638.
1886. J. Roddin, extension of dike, **87,** 601.
1887. O. J. Conley, riprap dike extension, $1.03 t., **87,** 601.
1889. John Beattie, furnishing st., $1.16 t., **89,** 674.
1891. C. Du Bois and H. E. Du Bois, dr., 9.9¢ c. y., **91,** 765.
1892. A. J. Beardsley, dr., 12¢ c. y., s. m. ($15,600), **93,** 923.
1895. R. G. & J. S. Packard, dr., 9¢ c. y. ($9,000), **95,** 782.
1897. W. H. Taylor, jr., dr., 8¢ c. y. ($7,200), **97,** 954.
1899. J. T. Regan, dr., 6¢ c. y. ($197,220), **99,** 1163.
1903. W. H. Taylor, dr., 15¢ to 35¢ c. y., according to section, **03,** 841.
1904. Henry Du Bois' Sons Co., dr. about 100,000 c. y., 9.9¢ c. y., **05,** 884.
1907. Atlantic Dredging Co., dr. about 60,000 c. y. from Mill R., at 25.5¢ c. y., and 6,000 c. y, s. m., from West R., at 23¢ c. y., s. m., **07,** 965.

ENGINEERS.

Chief of Engineers. R., 66, 7; **67,** 44; **68,** 66; **69,** 57; **70,** 74; **71,** 85; **72,** 83; **73,** 91; **74,** 101; **75,** 104; **76,** 52; **77,** 46; **78,** 51; **79,** 57; **80,** 77; **81,** 91; **82,** 92; **83,** 88; **84,** 94; **85,** 83; **86,** 84; **87,** 46; **88,** 48; **89,** 59; **90,** 54; **91,** 67; **92,** 71; **93,** 77; **94,** 68; **95,** 78; **96,** 75; **97,** 89, 104; **98,** 95; **99,** 107; **00,** 123; **01,** 182; **02,** 128; **03,** 110; **04,** 94; **05,** 100; **06,** 99; **07,** 102; **08,** 105.

In charge:

Col. J. D. Graham, 1864–67; **67,** 450. **R., 66,** 37.
Maj. D. C. Houston, 1867–70. **R., 67,** 450; **68,** 748, 750.
Maj. G. K. Warren, 1870–75. **R., 70,** 445; **71,** 768, 771; **72,** 860, 863, 890; **73,** 1011; **74,** 257.

*Allotments.
[1] H. D. 100, 56th, 2d.
[2] H. D. 80, 60th, 1st.
[3] H. D. 11, 62d, 1st.
[4] Sur.—**R.,** Nov. 8, 1853; est., $72,000. (H. D. 482, 55th, 2d.)
[5] $20,000 for imp. and $15,000 for removal of r., **72,** 83.

Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 248, 249; **76,** 224; **77,** 212; **78,** 398; **79,** 336; **80,** 444; **81,** 591; **82,** 607.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 512; **84,** 645; **85,** 644.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 636; **87,** 597; (Col.) **88,** 540; **89,** 670; **90,** 617; **91,** 761; **92,** 668.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 919; **94,** 642; (Col.) **95,** 777.
Maj. H. M. Adams, 1896. **R., 96,** 697.
Maj. S. S. Leach, 1897–1901. **R., 97,** 953, 974; **98,** 955; **99,** 1162; **00,** 1333; **01,** 1170.
Maj. C. F. Powell, 1902–05. **R., 02,** 930; **03,** 889; (Lt. Col.) **04,** 977; **05,** 883.
Maj. H. Taylor, 1906–08. **R., 06,** 927; **07,** 964; **08,** 1008.

Assistants:
Capt. G. Dutton, **71,** 771.
G. H. Mann. **R., 71,** 776; **72,** 865.
C. R. Mather, **72,** 865.
H. N. Babcock **72,** 865; **73,** 1012. **R., 74,** ii, 234.
W. A. Peck. **R., 80,** 447.

ESTIMATES. (See Plans and Projects.)

By Capt. Dutton, 1853, removal of Middle Rock and the 2 adjacent rs., $78,000, **71,** 774.
By Maj. Houston, 1868, removal of Middle Rock and others, $65,000, **68,** 752.
By Maj. Warren, 1871, removal of Middle Rock and the 2 adjacent rs., $167,669, **71,** 774. For dr. a chan. 14′ x 200′, $64,815, **71,** 775.
By Maj. Warren, 1872, completion of proj. for a chan. 16′ d., $62,000, **72,** 865.
By H. N. Babcock, 1874, dr. chan. from Long Wharf to Tomlinson's Br., 13′ x 200′, $20,000, **74,** 259.
By Maj. Barlow, 1875, for chan. 18′ x 300′–500′ x 16,500′, $208,890, **75,** ii, 250. For break'r at sw. ledge, $248,000, and $465,000, **75,** ii, 252.
1879. D. chan. to 16′, and w., $90,000, **79,** 337.

OPERATIONS.

1867-68. Removal of Middle Rock commenced, 14′ m. l. w. obtained, **67,** 44, 451; **71,** 772.
1870-71. 70,615 c. y. dr. and 54 c. y. of r. removed; progress on Middle Rock unsatisfactory, **71,** 85, 769 to 776; **72,** 864.
1871-72. 153,718 c. y. dr., 127 c. y. of r. removed; work commenced on Ludington Rock. Chans. dr., 13′ x 100′ x 2,125′, 13′ x 200′ x 3,125′, and 13′ x 300′ x 750′, **72,** 860, 863, 865, 875.
1872-73. 98,527 c. y. dr. and 422 c. y. of r. removed; dr. across the bar, **72,** 860; **73,** 1012.
1873-74. 78,955 c. y. dr.; w. of the chan. unsatisfactory; j. commenced at Fort Hale; work on Ludington Rock delayed, **74,** 101, ii, 257, 259, 260.
1874-75. 523 c. y. of r. removed and j. extended with material from Ludington Rock, **75,** 104, ii, 248, 252, 254.
1875-76. 43,606 c. y. dr.; chan. 13′ x 315′; work suspended on Ludington Rock, **76,** 224; **77,** 212.
1876-77. 89,331 c. y. dr., w. chan. to 16′ x 415′, **77,** 46, 212.
1878-79. 250,000 c. y. dr., **79,** 57, 336.
1879-80. 125,890 c. y. dr. from chan., **80,** 444.
1880-81. 129,110 c. y. dr. from chan., **81,** 591.
1881-82. 117,400 c. y. dr., completing a 16′ l.-w. chan., with a w. of from 440′ below Long Wharf to 600′ at bend opposite the same, **82,** 608.
1882-83. 1,575 t. granite delivered and 600 l. f. dike built; also 100′ pile dike completed and 350′ partially completed, **83,** 512.
1883-84. 2,094 t. granite delivered and 694 l. f. riprap dike built; damage to latter repaired and barrel beacons placed on chan. ends, **84,** 645.
1885-86. Old ps. at Tomlinson's Br. and portion of e. abutment of same removed; 64,192 c. y. dr. from chan. area above and below the br., **86,** 636, 637.
1886-87. Chan. arm of dike extended 515′, and log and riprap ice breaker built, **87,** 598.
1887-88. 4,951 t. st. delivered in dike, completing same for 570′, **88,** 542.
1888-89. 5,081 t. st. placed in the dike, **89,** 673.
1889-90. 5,379 t. riprap placed in the Sandy Pt. dike, and 11,308 c. y. dr., **90,** 620.
1890-91. 139,806 c. y. dr., **91,** 763.
1892-93. 117, 908 c. y. dr., **93,** 922.
1895-96. 93,501 c. y. dr., **96,** 698.
1897-98. 98,000 c. y. dr., **98,** 956.
1899-00. 474,304 c. y. removed, **00,** 1333.
1900-01. 653,766 c. y. dr., **01,** 1171.
1901-02. 1,006,999 c. y. dr., **02,** 930.
1902-03. 1,130,763 c. y. dr., completing contract; 32,893 c. y. dr. from Mill R., **03,** 839, 840.
1903-04. 297,235 c. y. dr.; 7,417 c. y. dr. in extending the 8′ chan. in Quinnipiac R., **04,** 977.
1904-05. Rs. removed from Quinnipiac R.; 70,352 c. y. dr. from main chan., and 58,713 c. y. from 12′ anchorage, **05,** 883.
1906-07. 38,581 c. y. dr., **07,** 964.
1907-08. 28,143 c. y. dr., **08,** 1008.

PHYSICAL CHARACTERISTICS.

Description of chans. and rs., **68,** 751; **71,** 769, 771, 776; **72,** 866; **74,** ii, 259; **75,** ii, 250; **78,** 399; **79,** 337.
Tidal observations, **71,** 775; **72,** 879; **79,** 341.
Table of d. over rs., **72,** 867, 869, 870, 874.
Description of New Haven H. and its surroundings, **86,** 636; **88,** 540; **97,** 975.
H. is naturally formed by an indentation of the n. shore of Long Isld. Sound about 4 m. long and 1 to 2 m. wide, into which flows 2 small streams, **97,** 978.
Description of, **01,** 182; **02,** 128; **03,** 110; **04,** 94; **05,** 100; **06,** 99; **07,** 102; **08,** 105.

PLANS. (See Estimates and Projects.)

Capt. Prime's method, 1871, removing rs.; G. H. Mann's method, **71,** 773.
By G. H. Mann, 1872, to discontinue removal of Middle Rock and remove Big Boil Rock to 17′ below m. l. w. and Ludington Rock to 16′; also dr. of bar and other minor imp.; est., $58,554, **72,** 878.
By Maj. Warren, removal of lighthouse from entrance to sw. ledge of New Haven H., **72,** 890.
H. N. Babcock, 1874, recom. discontinuance of w. chan. below Fort Hale, but to make chan. from Long Wharf to Tomlinson's Br. 13′ x 200′; est., $20,000, **74,** ii, 259.
By Maj. Barlow, 1879, to modify the Tomlinson Br., **79,** 339.
By Col. Houston, 1889, larger H. by constr. of 2 breakw'rs, the first commencing at Ludingtons Rock and extending sw. about 2 m.; second, a breakw'r to commence at a point in the prolongation of the first and about ½ m. from its w. extremity, and extending nw. about a mile; est., $5,000,000, **89,** 679, 680.

PRIVATE WORK.

City of New Haven dr. receiving basin 18′ to 20′ d., and about 75′ x 100′, **05,** 883.

PROJECTS. (See Estimates and Plans.)

Earliest proj. for the expend. of the app. of $6,000 in 1852 seems to have been for the removal of Middle Rock, **66,** 7, 37, which was in progress in 1866–67, **67,** 44, 451.
Proj. of 1870 proposed dr. chan. 13′ l. w. up to the city wharves, **71,** 85, 769, 779. In 1871, 1872, 1875, and 1877 proj. modified to provide for chan. 16′ d. above Fort Hale Bar, **72,** 861; **75,** ii, 249–251; **77,** 212; **79,** 336.
In 1879 proposed to increase the d. over Fort Hale Bar with dike from Sandy Pt., **79,** 338.
From 1852 to 1886, incl., $261,000 app., when it was est. that $80,000 would be required to complete the proj., **86,** 637.
In 1887 est. for Sandy Pt. dike and dr. through Fort Hale Bar revised; requiring $93,000 to complete existing proj., **87,** 600; **91,** 761.
By Maj. Leach, 1897, chan. 20′ d. through Long Isld. Sound from Tomlinson's Br.; 3 interior basins affording anchorage with ds. of 20′, 16′, and 12′, resp., and adequate connecting chans.; est., $400,000, **97,** 978; **99,** 1162.
Act 1899 the proj. au. chan. 16′ x 400–700′ Long Isld. Sound to head of H. and dike across Fort

Hale Bar; total est. from beginning, $348,000. This proj. nearly completed, deficiency being in l. of chan. arm of dike and in w. of chan. across Fort Hale Bar, only 200′ w. Total expend., $325,695.66.

Act Mar. 3, 1899, au. $345,000 for chan. 20′ x 400′ x 4 m., Long Isld. Sound to Canal Dock, thence 300′ x ½ m. to Tomlinsons Br., 3 basins below latter 12, 16, and 20′; chan. up Quinnipiac R. 12′ x 200′ to Grand Ave.; chan. up Mill R. 12′ x 200′ to junction of 2 branches above Chapel St.; thence 12′ x 75′ up each branch to Grand Ave., **12,** 152.

Act June 13, 1902, au. extension of present proj. to include the Quinnipiac and Mill Rs. to Grand Ave., provided there were no increase in cost over present proj., **02,** 129.

Protests being received from oyster-bed owners, and on au. of Chief of Engineers, 2 short chans. 8′ x 50′, making available a natural chan. up along e. side of R. in which existing d. was 6′ or more, or Quinnipiac R. between Ferry St. and Grand Ave., **12,** 152.

SURVEYS.

By G. H. Mann, 1871. **71,** 769; **72,** 867.

By H. N. Babcock, 1873. **74,** ii, 259.

Borings made in bar below Fort Hale, 1880, **81,** 592.

Ex. of chan., 1882, **82,** 608.

Resur. and submission of plan and est. au. act June 3, 1896; made, 1897, by Maj. Leach (**R.** fav.), (see Project), **97,** 975.

Minor, of main entrance Quinnipiac and Mill Rs., **03,** 840.

Of chans. and anchorage area, **04,** 977.

Maps. **79,** 340; **82,** 610; **84,** 646; **85,** 644.

Part (b), D-56 West River, Conn.

APPROPRIATIONS.

1905, $38,500, **05,** 887.

COMMERCE.

About 120,000 t., **04,** 999.

Lack of suitable chan. hampers C.; vessels are obliged to wait for high tide, and often can not be fully loaded on account of shallow chans., **04,** 998

CONTRACTS.

1905. Geo. W. Catt., dr., 13.1¢ c. y., p. m., **06,** 929.

ENGINEERS.

Chief of Engineers. **R., 04,** 107, 996; **05,** 102; **06,** 102; **07,** 105; **08,** 108.

Boards. BERH. concurs in Maj. Powell's opinion on advisability of imp., **04,** 999.

In charge:

Maj. C. F. Powell, 1904–05. **R., 04,** 997, 1000 (Lt. Col.); **05,** 887.

Maj. H. Taylor, 1906–08. **R., 06,** 929; **07,** 967; **08,** 1012.

OPERATIONS.

1905-06. 108,614 c. y. dr., **06,** 929.

1906-07. 140,529 c. y. dr., completing proj. **07,** 967.

PRIVATE WORK.

Chan. 9′ x 75′ and nearly ½ m. l. dr. by private enterprise, **07,** 967.

PHYSICAL DATA.

R. between New Haven and W. Haven, **12,** 152.

PROJECTS.

Act Mar. 3, 1905, au. proj. for 9′ x 100′ chan., from downstream corner of 16′ anchorage basin of New Haven H., via Oyster Pt. and dock frontage of W. Haven to Kimberly Ave. Br.; est., $38,500, and $500 an. mainten.,[1] **05,** 102.

Act Mar. 2, 1907, consolidated Parts a and b, **12,** 153.

SURVEYS.

Pre. ex. and sur. from New Haven H., via Oyster Pt. to Kimberly Ave. Br. on West R., Conn., au. act June 13, 1902. **R.** by Maj. Powell, 1902, and Aug. 13 and Sept. 11, 1903; est., $38,500, and $500 an. mainten.,[1] **04,** 107, 996.

Part (c), D-56 New Haven Harbor and West River, Conn.

APPROPRIATIONS.

1909,	*$20,000,	**09,** 1036.
1910,	68,000,	**10,** 1160.
1912,	[2] 54,000,	**12,** 1447.
1912,	[3] 19,200,	**12,** 1447.
Total,	161,200	(incl. misc., $161,620.45, **12,** 1447).

COMMERCE.

Description of, **09,** 110.

1908, 1,921,123 t., **09,** 110; 1911, 1,995,401 t.; "value given as $124,261,691.17," **12,** 1448.

Diagram of app., com., and valuation, **12,** 1448.

Deeper dr. vessels have made lower rates and oyster business helped, **12,** 154.

CONTRACTS.

1908. Atlantic Dredging Co., dr. 31,264 c. y., 13.8¢ c. y., s. m., **09,** 1036.

1909. J. S. Packard Dredging Co., dr. approx. 120,000 c. y., 8.89¢ c. y., **10,** 1160.

1909. J. S. Packard Dredging Co., dr. 49,560 c. y., 8.89¢ c. y., **10,** 1159.

1911. Taylor Dredging Co., dr. approx. 405,000 c. y., 7.6¢ c. y., **11,** 1233. T. A. Scott Co. (Inc.), open-market agreement for removing r. in Morris Cove, for lump sum of $200, **11,** 1232. Taylor Dredging Co., supple., extending time and increasing amount of dr. to 800,000 c. y., **12,** 1446.

ENGINEERS.

Chief of Engineers. **R., 09,** 100, 108; **10,** 122, 138; **11,** 128; **12,** 151.

In charge:

Lt. Col. H. Taylor, 1909–10. **R., 09,** 1036; **10,** 1159.

Capt. A. E. Waldron, 1911–12. **R., 11,** 1231; **12,** 1446.

OPERATIONS.

1908-09. 31,264 c. y. dr. from West R., **09,** 1036.

1909-10. 49,560 c. y. dr. from main chan. by the contractors for the work just completed; 61,558 c. y. dr. from basin and 71,366 c. y. from Mill R. chan., restoring basin to full d., and both branches of Mill R. chan. to full proj. dimensions, **10,** 1159.

1910-11. 59,521 c. y. dr., completing 12′ chan. toward Brewery St.; 75,149 c. y. dr., d. 12′ basin; 50 t. obstructive rs. removed from Morris Cove; automatic self-recording tide-gauge in operation at Tomlinson Br.; and for part of the year one at the lighthouse, **11,** 1232.

1911-12. 47,626 c. y. dr. from 15′ basin, completing basin; 523,807 c. y. removed from main chan., **12,** 1446.

Existing proj. 90% done, **12,** 154.

*Allotment.

[1] H. D. 73, 58th, 2d.

[2] West R.

[3] Mill and Quinnipiac Rs.

PHYSICAL CHARACTERISTICS.

Description of, **09,** 108; **10,** 122; **12,** 155.

PRIVATE WORK.

New Haven removed 13,156 c. y. from vicinity of mouth of East St. sewer, making basin 200′ x 200′, for catching street washings brought down by sewer, **12,** 1446.

PROJECTS.

Act June 25, 1910, au. d. the 12′ anchorage basin to 15′, dr. chan. 12′ x 100′ and 1,500′ from 12′ anchorage basin toward Brewery St., and removing certain obstructive rs. in Morris Cove; est., $68,000, **10,** 1159; **12,** 153.

Act June 25, 1910, gives est. cost of entire imp. as $280,000,[1] the greater part of which is for w. main chan. from Tomlinson Br. downstream for 6,000′, which part of proj. is urgently needed and entirely meritorious; to be completed with available funds on hand, **11,** 1232.

Act July 25, 1912, modified proj. in accordance with H. D. 26, 62d, 1st, to provide for w. e. and w. branch chans. in Mill R. from bifurcation n. to Grand Ave., the e. one to 100′ w. and w. one to 125′, increased to 150′ at turn and decreased to 75′ at head; also au. chan. 8′ x 50′–100′ in Quinnipiac R. bet. Ferry St. and Grand Ave.; est., $19,200.

Same act further modified proj. (H. D. 535, 62d 2d) to provide d. West R. chan. to 12′, giving addl. w. 25–50′ at turns and along West Haven water front; also for extending this chan. with d. of 12′ and prevailing w. of 75′ from Kimberley Ave. Br. upstream approx. to br. of N. Y., N. H. & H. RR.; also for dr. anchorage basin 6′ d. opposite Mahers Dock, and to s. of chan.; est., $50,000, and $4,000 an. mainten.

SURVEYS.

Pre. ex. and sur. au. act Mar. 2, 1907, with view to determining whether greater d. needed; also of rs. in Morris Cove. **R.** by Maj. Taylor, 1907 and 1908; ests., $68,000 and $212,000, resp.,[1] **09,** 100.

Pre. ex. and sur. au. act Mar. 3, 1909, of H. above Tomlinson Br., incl. Mill R., and Quinnipiac R.; to report whether cost of imp. should be borne by US., **10,** 138.

R. by Lt. Col. Taylor, Sept. 30, 1909, and Sept. 20, 1910; est., $19,200,[2] **11,** 149.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 153.

Maps. **11,** 1232.

D-57 NEW HAVEN, CONN. (Breakwater).

APPROPRIATIONS.

1879,	$30,000,	act of Mar. 3.
1880,	30,000,	**80,** 449.
1881,	60,000,	**81,** 595.
1882,	60,000,	**82,** 612.
1884,	40,000,	**84,** 648.
1886,	75,000,	**86,** 640.
1888,	75,000,	**88,** 547.
1890,	120,000,	**90,** 626.
1892,	120,000,	**92,** 676.
1894,	125,000,	**95,** 786.
1896,	100,000,	**96,** 702.
1902,	44,000,	**02,** 933.
1907,	100,000,	**07,** 966.
1908,	150,000,	**08,** 1011.
1910,	100,000,	**10,** 1162.
1911,	35,000,	**11,** 1235.

Total, 1,264,000 (incl. misc., $1,267,243.46, **12,** 1450).

COMMERCE.

C. of the Sound, **81,** 597.

Shipments, **89,** 681, 684.

Value of the H. to shipping, **89,** 683.

C. benefited mainly passing C. of Long Isld. Sound. Imp. provides also an outer anchorage for vessels bound to and from New Haven, and helps protect entrance from seas and diminishes chan. filling, **11,** 132.

About 6,000 vessels used H. 1910; insurance rates probably checked, **12,** 1450.

CONTRACTS.

1880. F. H. Smith, riprap granite, 89¢ t., **80,** 455. J. Beattie, riprap granite, 81¢ t., **81,** 596. Arnold & Stevens, riprap granite, 88¾¢ t., **81,** 596.

1881. J. P. Stanton, riprap granite, $1.13 t., **82,** 612.

1882. F. K. Ballou, break'r constr., $1.14 t., **83,** 516. J. A. Bouker, riprap, $1.15 t., **83,** 516.

1886. T. J. Allen, granite riprap, $1.12 t., **87,** 604.

1888. J. Beattie, riprap break'r extension, $1.35 t., **88,** 548.

1889. J. Beattie, riprap break'r extension, $1.22 t., **89,** 679.

1890. J. J. Moran, break'r constr., riprap granite, $1.07 t., **91,** 769.

1891. J. J. Moran, break'r constr., riprap sandstone, $1.04 t., **92,** 677.

1892. J. J. Moran, break'r enlargement, $1.14 t. for riprap, **92,** 677.

1892. J. Beattie, st., $1.09 t., ($109,000), **93,** 928.

1894. Hughes Bros. & Bangs, st., 74¢ t. ($110,000), **95,** 786.

1896. Same firm and material, 88¢ t. ($88,000), **97,** 956.

1903. E. S. Belden & Sons., st. in place in break'r, $1.17 t., **04,** 981.

1907. Seacoast Construction Co., st. in break'r, about 225,000 t., 99¢ t., **07,** 967.

1910. The Breakwater Co., 80,000 t. st. in break'r, $1.09 t., **11,** 1235.

ENGINEERS.

Chief of Engineers. R., 80, 78, 449; **81,** 92; **82,** 92; **83,** 89; **84,** 95; **85,** 84; **86,** 84; **87,** 47; **88,** 48; **89,** 60; **90,** 54; **91,** 68; **92,** 72; **93,** 77; **94,** 69; **95,** 78; **96,** 76; **97,** 91; **98,** 96; **99,** 109; **00,** 125; **01,** 183; **02,** 130; **03,** 112; **04,** 95; **05,** 101; **06,** 101; **07,** 103; **08,** 107; **09,** 110; **10,** 124; **11,** 132; **12,** 156.

Boards. Convened, New York, Nov. 29, 1879, to **R.** upon projs. by Maj. Barlow for break'r at entrance to New Haven H., Conn. **R., 80,** 450. (Cols. Tower and Newton and Maj. Abbot.)

In charge:

Maj. J. W. Barlow, 1875–83. **R., 80,** 448, 452; **81,** 594; **82,** 611.

Lt. Col. W. McFarland, 1883–86. **R., 83,** 514; **84,** 647; **85,** 646.

Lt. Col. D. C. Houston, 1886–92. **R., 86,** 639; **87,** 602; (Col.) **88,** 544; **89,** 675, 679; **90,** 622; **91,** 766; **92,** 673.

Lt. Col. H. M. Robert, 1893–95. **R., 93,** 924; **94,** 646; (Col.) **95,** 783.

Maj. H. M. Adams, 1896. **R., 96,** 700.

Maj. S. S. Leach, 1897–1901. **R., 97,** 955; **98,** 958; **99,** 1165; **00,** 1336; **01,** 1173.

Maj. C. F. Powell, 1902–05. **R., 02,** 932; **03,** 842; (Lt. Col.) **04,** 980; **05,** 885.

Maj. H. Taylor, 1906–10. **R., 06,** 928; **07,** 966; **08,** 1010; (Lt. Col.) **09,** 1038; **10,** 1161.

Capt. A. E. Waldron, 1911–. **R., 11,** 1234; **12,** 1449.

Assistant. H. B. Gorham. **R., 80,** 456; **81,** 596; **82,** 613.

OPERATIONS.

1879–80. 5,976 t. granite riprap placed in break'r, extending it 70′, **81,** 594.

1880–81. 64,392 t. granite riprap delivered and 620 l. f. of break'r built, **81,** 594.

1881–82. 49,500 t. riprap granite delivered and break'r extended 535′, **82,** 611.

[1] H. D. 1159, 60th, 2d.

[2] H. D. 26, 62d, 1st.

1882-83. 13,097 t. riprap delivered, adding 153′ to break'r, **83,** 515.
1883-84. 34,903 t. riprap delivered and 439 l. f. break'r built, **84,** 647.
1884-85. 28,006 t. riprap delivered and 330 l. f. break'r built, **85,** 647.
1886-87. 22,643 t. granite delivered in e. break'r, extending the same 265′, **87,** 603.
1887-88. 34,430 t. st. received and 406 l. f. break'r built, **88,** 546.
1888-89. 20,294 t. st. delivered in break'r, **89,** 677.
1889-90. 26,512 t. st. delivered in break'r, **90,** 624.
1890-91. 18,019 t. riprap delivered in break'r, **91,** 768.
1891-92. 46,774 t. granite and 24,491 t. sandstone placed in break'r, **92,** 675.
1892-93. 81,921 t. st. placed in break'r, **93,** 926, 927.
1893-94. 48,849 t. placed, **94,** 649.
1894-95. 51,048 t. placed, **95,** 785.
1895-96. 106,078 t. placed, **96,** 701.
1896-97. 100,676 t. placed, **97,** 955.
1900-08. Light maintained on w. break r, **01,** 1174. See each an. report to 1908.
1903-04. 33,846 t. st. placed, 251 t. in Ludington break'r for repairs, 1,944 t. in w. break'r for repairs, and 31,651 t. for its extension, **04,** 980.
1907-08. 12,457.76 t. st. placed in repairing and enlarging break'r; 86,844.96 t. st. deposited in extending break'r 985′, **08,** 1010.
1908-09. 41,703.74 t. st. placed in break'r, **09,** 1038.
1909-10. 95,554.26 t. st. delivered, of which 327.89 t. were used in repairing break'r previously built, and 95,226.37 t. applied to extending break'r; entire break'r is 3,603′ l.; 597′ short of proj. length, **10,** 1162.
1910-11. Repairs to e. break'r completed, using 2,914.78 t. st.; 25,825.60 t. st. placed in extension of w. break'r, **11,** 1234.
1911-12. Extension of w. break'r completed and additional section 347′ l. built, making full l. under proj. 4,200′; 43,253.22 t. st. delivered during year; 1430′ of middle break'r enlarged to full cross section, using 10,556.74 t. st.; total st. delivered under contract, 53,809.96 t., **12,** 1449.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 544; **93,** 924.
Only natural H. of notable area and d. on Long Isld. Sound, bet. New London, 45 m. to e., and Huntington B., 32 m. to sw. Opp. H., Long Isld. Sound is at widest, 19 m. w. of H. from Morgans Pt. to Oyster R. Pt., 4½ m.; d. for anchorage, 20–28′ m. l. w.

PLANS.

By Maj. Barlow, 1879, 4 different sites for break'r, **80,** 452–455. Considered by BE., 1879 (see Projects), **80,** 450.

PROJECTS.

By BE., 1879, H. of refuge for vessels of 2 by 20′ break'rs of riprap granite, 1 extending from sw. ledge in a ne. direction to Quixes Ledge 3,300′, the average height being 32′; the other beginning at Ludington Rock, with a w. direction and a l. of 4,200′, and average h. of 28′; w. at top, 12′; h. above h. w. plane, 6′; est., e. and w. break'rs, $1,311,134, **80,** 448, 450; **87,** 602.
In 1889 the proj. was modified by Col. Houston by the relocation of the w. break'r 6,000′ to the sw., the constr. of a middle break'r, commencing at a point 1,000′ N., 54° E. from Ludington Rock and extending S. 54°, W. 5,000′, crossing the rock; and also a break'r about 1,200′ l. to partly close the space between Quixes Ledge and the e. shore; the cross section of these break'rs to be the same as that of the one from the sw. ledge to Quixes Ledge; est. of revised proj., $2,151,134, **89,** 678; **91,** 768.
Orig. proposed section reduced during constr., **97,** 955.
Approved by Chief of Engineers, Apr. 21, 1910. Modifications: Omission of Morgan Pt. break'r, omission of further extension of middle break'r, and modification of cross sections of all break'rs to call for outer slope of 1 on 1½ and inner slope of 1 on 1, **10,** 124; revising orig. est. to $1,264,000, 1162.

SURVEYS.

Maps. **82,** 610; **84,** 646; **89,** 678; **96,** 702.

D-60 WEST HAVEN (West River) HARBOR, CONN.

COMMERCE.

Description of. Est. to be worth $350,000 an., **95,** 854.

ENGINEERS.

Chief of Engineers. **R., 76,** 53; **95,** 93.

In charge:
Maj. J. W. Barlow, 1875. **R., 76,** 233.
Lt. Col. H. M. Robert, 1895. **R., 95,** 853.

Assistant. H. N. Babcock. **R., 76,** 234.

PHYSICAL CHARACTERISTICS.

Tides, **76,** 234.
Description of **95,** 853.

PLAN.

By Maj. Barlow, 1875, dr. chan. 60′ x 6′ m. l. w.; est., $11,340, **76,** 234.

SURVEYS.

By H. N. Babcock, 1875, **76,** 234.
Ex. an. act Aug. 17, 1894, of West Haven, and the R. from the RR. crossing to the main chan. in New Haven H.; made, 1894, by Lt. Col. Robert (**R.** unfav.), **95,** 853.

D-61 MILFORD HARBOR, CONN.

APPROPRIATIONS.

1874,	$5,000,	**74,** 101.
1875,	13,000,	**75,** 104.
1878,	10,000,	**78,** 52.
1880,	5,000,	**80,** 458.
1882,	5,000,	**82,** 615.
1888,	5,000,	**88,** 550.
1890,	2,500,	**91,** 772.
1892,	*250,	**94,** 652.
1902,	15,000,	**02,** 934.
1905,	10,000,	**05,** 888.
1910,	2,000,	**10,** 1165.
Total,	72,500	

COMMERCE.

C. advantages of Milford, **73,** 1042.
Important, **73,** 1042, 1043; **75,** ii, 254; **76,** 225; **78,** 402.
Description of, **00,** 1358.
Many small pleasure craft, **10,** 1164.
In 1911, 34,350 t. (mainly oysters), **12,** 159.
Navigation in lower part of H. facilitated, and extension of 6′ chan. to town dock renders it practicable to land cargoes there, **12,** 159.

CONTRACTS.

1875. S. F. Shelbourne, dr. 24,232 c. y., 18¢; contract extended, **75,** ii, 255; **76,** 225; **77,** 213.

*Allotment.

1878. G. C. Fobes & Co., dr. 2,406 c. y., 28¢; 12,261 c. y., 10¢, **79,** 341, 342.
1880. J. M. Seward, dr., 17¢ c. y., **81,** 600.
1882. H. J. Lewis, dr., 14½¢ c. y., **83,** 518; **84,** 649.
1889. Hartford Dredging Co., dr., 18¢ c. y., **89,** 688.
1904. John P. Randerson, dr., 16 and 14¢ c. y., **05,** 889.
1905. John & Joseph McSpirit, dr., 13.8¢ c. y., **05,** 889.

ENGINEERS.

Chief of Engineers. **R., 72,** 85; **73,** 93; **74,** 101; **75,** 104; **76,** 52; **77,** 47; **78,** 52; **79,** 58; **80,** 78; **81,** 92; **82,** 93, 97; **83,** 89; **84,** 95; **85,** 84; **86,** 85; **87,** 48; **88,** 49; **89,** 61; **90,** 55; **91,** 69; **92,** 73; **93,** 78; **94,** 70; **99,** 125; **00,** 141; **02,** 131; **03,** 112; **04,** 96; **05,** 103; **06,** 103; **07,** 105; **08,** 109; **09,** 111; **10,** 126; **11,** 133; **12,** 157.

In charge:
Maj. G. K. Warren, 1872–74. **R., 73,** 1041; **74,** ii, 260.
Maj. J. W. Barlow, 1874–83. **R., 75,** ii, 254; **76,** 225; **77,** 213; **78,** 402; **79,** 341; **80,** 457; **81,** 598; **82,** 614, 632.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 517; **84,** 648; **85,** 648.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 640; **87,** 604; (Col.) **88,** 548; **89,** 685; **90,** 626, 629; **91,** 770; **92,** 677.
Lt. Col. H. M. Robert, 1893–94. **R., 93,** 929; **94,** 650.
Maj. S. S. Leach, 1900. **R., 00,** 1356, 1359.
Maj. C. F. Powell, 1902–05. **R., 02,** 934; **03,** 843; (Lt. Col.) **04,** 982; **05,** 888.
Maj. H. Taylor, 1906–10. **R., 06,** 930; **07,** 969; **08,** 1013; (Lt. Col.) **09,** 1040; **10,** 1163.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1236; **12,** 1450.

Assistants:
J. P. Cotton. **R., 73,** 1043.
S. Dale. **R., 75,** ii, 255.
W. A. Peck. **R., 81,** 600.
H. N. Babcock. **R., 82,** 633.
G. E. Verrill. **R., 03,** 844.

ESTIMATES. (See Plans and Projects.)

By J. P. Cotton, break'r, $67,000, **73,** 1043, 1044. Modified by Maj. Barlow to $47,000, **75,** ii, 254; to $55,000, **75,** 104; **76,** 225; to $45,000, **79,** 342. Dr., $12,500, **73,** 1043, 1044.
By Maj. Barlow, dr., $3,500, **79,** 342.

OPERATIONS.

1874–75. 12 js. built, **75,** ii, 255.
1875–76. 18,799 c. y. dr.; long j. commenced, **76,** 225.
1876–77. 5,433 c. y. dr.; long j. completed except coping, **77,** 213, 214.
1877–78. Repairs, **78,** 402.
1878–79. 14,667 c. y. dr.; coping placed on long j., **79,** 342.
1879–80. 47,156 c. y. dr. from chan. above and below the long j.; 250 l. f. of j. built at Burnes's Pt., **80,** 457.
1880–81. 27,068 c. y. dr. from vicinity of Town and Merwin Wharves, **81,** 598.
1881–82. Sur. for break'r off Welch's Pt., **82,** 614, 632. Orig. proj. completed, **84,** 96; **86,** 641.
1882–83. 10,819 c. y. dr. from chan. below Merwins Wharf, **83,** 517.
1883–84. 20,049 c. y. dr. from chan. below Merwins Wharf, **84,** 648.
1888–89. 18,000 c. y. dr., **89,** 687.
1889–90. 10 t. st. removed from chan. and placed upon long j.; proj. imp. practically completed, **90,** 628.
1890–91. 170 t. st. used in repairing 160 l. f. of long j., **91,** 772.
1891–92. 670 t. granite delivered and placed in repair of long j., **92,** 679.
1893–94. Repairs made to long j., **94,** 652.
1902–03. Work advertised, bid rejected, **03,** 843.
1904–05. 88,395 c. y. dr. from chans., and 8,177 c. y. dr. and about 4.5 c. y. bowlders removed from anchorage basin, **05,** 888.
1905–06. 46,831 c. y. dr., **06,** 930.

PHYSICAL CHARACTERISTICS.

Formation of bar, **73,** 1042; **74,** ii, 261; **77,** 214.
Site of Milford, Conn., described, **73,** 1042.
Tides, **73,** 1043.
Description of the H., **88,** 548; **00,** 1359.
8 m. sw. of New Haven H., and 10± m. to ne. of Bridgeport H., and on n. shore of Long Isld. Sound. A broad, open B., 1 m. sq., from head of which a small tidal stream extends nearly a mile inland to head of navigation, **12,** 157.
Ledge r. prevented completion of proj. at orig. est., **06,** 930; **10,** 1164.

PLANS. (See Estimates and Projects.)

By J. P. Cotton, breakw'r at Welch's Pt., 890′ l.; dr. chan. to 8′, **73,** 1044.
By Maj. Barlow, dr. chan. up the R., **79,** 342.
By Maj. Barlow, 1882, breakw'r from Welch's Pt.; est., $87,000, **82,** 614, 632–634; **85,** 648.

PRIVATE WORK.

Attempt of citizens to protect the highway from the undermining action of the waves by driving rows of piles parallel with the shore, **73,** 1044.

PROJECTS. (See Estimates and Plans.)

By Maj. Warren, 1872, breakw'r about 890′ l. from Welch's Pt.; protection of bluffs from erosion one. shore of H. with small js.; chan. 4′ x 100′ across the bar at the mouth of the Wepanwog R.; j. about 550′ l. on the e. side of the chan. to aid the action of the tide and prevent the dr. area from refilling; est., $85,000, **73,** 1043, 1044; **74,** ii, 260; **86,** 640.
The proj., except the breakw'r, completed in 1881, under aggregate app. of $33,000, when Maj. Barlow proposed chan. through the bar at the mouth of the R., B. to Merwins Wharf, 8′ x 100′; est., $11,000 **81,** 599; **82,** 614; **84,** 96; **86,** 641; **91,** 771.
$250 was allotted for repair of js. injured by severe storm, **94,** 652.
Maj. Leach, 1899, est. $15,000 for further imp. and $500 an. for mainten., **00,** 1362.
By Maj. Leach, 1899, au. act of 1902, for a chan. across the bar and through the lower H. 10′ x 100′, with an anchorage basin of about 6 acres on e. side of chan., and a chan. through the upper H. from Merwins Wharf to the straw works wharf 6′ x 90′ m. l. w.; est., $15,000 (subsequently found to be $25,000), and $500 yearly for mainten., **02,** 131.
Lt. Col. Taylor recom., 1910, that proj. be modified to omit 6′ chan. above a point 500′ above town wharf, to w. chan. at upper end to 150′ and to provide additional anchorage of 1½ acres 6′ d. adjoining existing basin, **10,** 1164.

SURVEYS.

1872. By J. P. Cotton. R., **73,** 1043.
Au. act Mar. 3, 1881, for a H. of refuge, **82,** 97; made by Maj. Barlow, 1882, **82,** 632.
Sur. for H. lines made in 1894 by Lt. Col. Robert, **94,** 653; **95,** 894.
Ex. and sur. au. act Mar. 3, 1899; ex. only made, 1899, by Maj. Leach (R. fav.) (see Projects), **00,** 1357, 1359.
Maps. **79,** 342; **82,** 614; **84,** 648; **86,** 640.

D-64 HOUSATONIC RIVER, CONN.

APPROPRIATIONS.

1870, [1] $2,700, **79,** 345.
1871, 15,000, **71,** 85.
1872, 15,000, **72,** 83.
1873, 10,000, **73,** 91.
1874, 10,000, **74,** 102.
1875, 5,000, **75,** 105.
1878, 5,000, **78,** 52.
1880, 2,000, **80,** 461.
1881, 2,000, **81,** 602.
1882, 2,000, **82,** 616.
1884, 2,500, **84,** 651.
1886, 5,000, **86,** 643.
1888, 35,000, **88,** 552.
1890, 35,000, **90,** 634.
1892, 20,000, **92,** 683.
1894, 25,000, **95,** 790.
1896, 25,000, **96,** 705.
1899, 15,000, **99,** 1167.
1902, 10,000, **02,** 935.
1904, *3,950, **05,** 890.
1905, 10,000, **05,** 890.
1907, 20,000, **07,** 971.
1909, 5,000, **09,** 1042.
1910, 20,000, **10,** 1167.
1912, 10,000, **12,** 1453.

Total, 310,150 (incl. sales, $308,501.12, **12,** 1453; does not include $2,700 allotted in 1870 for sur.).

COMMERCE.

Important, **73,** 1019; **72,** 894.
Obstructions to navigation, **72,** 894.
Description of, **97,** 983.
Freight rates materially reduced, **10,** 128; **12,** 161.
In 1911, 97,098 t.; more than double t. of 1902, **12,** 161, 1453.

CONTRACTS.

1871. R. W. Meyers, dr., 18¢ c. y.; r. removal, $1.90 c. y., **71,** 779.
1872. F. H. Smith, dr., 23.95¢ c. y., **72,** 891. A. A. Bouker, building embankment, **72,** 891.
1877. M. F. Brainard, dr., scows, and tug, **77,** 215.
1878. J. M. Seward, dr., 16¢ c. y., **79,** 344.
1881. J. M. Seward, dr., 16 and 20¢ c. y., **81,** 602. J. McDermott, dr., 23¢ c. y., **82,** 617.
1885. Lewis & Merwin, dr., **86,** 643.
1886. F. H. Smith, removal of Davis Rock and j., **87,** 609.
1889. R. Parrott, hire of dr. plant, $8.50 per hour, **89,** 692. Wm. H. Morton, riprap granite, $1.49 t., **89,** 692.
1890. Brown & Fleming, breakw'r extension; total, $26,600, **91,** 777. R. Parrott, hire of dr. plant, $16 per hour, **91,** 777.
1892. E. Brainard, dr. 18,300 c. y., 24½¢ c. y., **93,** 934. Brown & Fleming, $1.12 t. for breakw'r st. ($8,400), **93,** 936. W. H. Beard, dr., hire of dr. plant, $18.50 per hour, **93,** 936.
1893. D. V. Howell, dike constr., st., $1.27 t. ($2,540), **93,** 936.
1894. S. & E. S. Belden, st. for breakw'r, $1.09 t. ($25,000), **95,** 790.
1895. S. & E. S. Belden, 736 t. st., $1.33 t., **96,** 704.
1896. R. G. & J. S. Packard, dr., 19¾¢ c. y., s. m. ($7,000), **96,** 706.
1897. S. & E. S. Belden, repairs to break'r, st., at $1.11 t. ($6,660). J. P. Randerson, dr., 23½¢ c. y. ($11,750), **97,** 958. Last contract price reduced to 20¢, material being placed on shore, **98,** 959.
1900. Newburgh Dredging Co., dr., 28¢ c. y. ($4,999.40), **00,** 1338.
1903. John P. Randerson (2 contracts), dr., 25¢ and 16¢ c. y., **03,** 845.
1904. T. A. Scott Co., dr., 18¢, 20¢, and 25¢ c. y., **04,** 984.
1906. E. A. Berry, dr., 16¢ c. y., s. m., **07,** 971.
1907. E. A. Berry, dr., 17¢ c. y., s. m., **07,** 971.
1909. E. A. Berry, dr., 20¢ c. y., s. m.; removing logs, $10 each, **09,** 1042.
1910. John P. Randerson, dr. 30,612 c. y., at 16¢ c. y., s. m.; logs removed, $10 each, **11,** 1239.
1911. E. S. Belden & Sons, placing st. in break'r and dike, $1.27 t. (5,861.78 t.), **11,** 1239.

DOCUMENTS. (Not published in reports.)

H. Doc. 62, 41st Cong., 2d sess., **70,** 452. H. Doc. 95, 41st Cong., 3d sess., **71,** 777.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 76; **71,** 85; **72,** 83; **73,** 91; **74,** 102; **75,** 104; **76,** 52; **77,** 47; **78,** 52; **79,** 58; **80,** 79; **81,** 93; **82,** 94; **83,** 90; **84,** 96; **85,** 85; **86,** 85; **87,** 48; **88,** 50; **89,** 62; **90,** 56; **91,** 69; **92,** 73; **93,** 79; **94,** 71; **95,** 80; **96,** 77; **97,** 92, 105; **98,** 97; **99,** 110; **00,** 126; **01,** 184; **02,** 132; **03,** 114; **04,** 98; **05,** 104; **06,** 104; **07,** 107; **08,** 110; **09,** 113; **10,** 127; **11,** 135; **12,** 159.

In charge:
Maj. D. C. Houston, 1870. **R., 70,** 454.
Maj. G. K. Warren, 1870–75. **R., 70,** 452; **71,** 777, 781; **72,** 891, 893; **73,** 1013; **74,** ii, 261.
Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 256; **76,** 226; **77,** 215; **78,** 403; **79,** 344; **80,** 460; **81,** 601; **82,** 615.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 518; **84,** 650; **85,** 649.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 642; **87,** 606; (Col.) **88,** 551, 554; **89** 688; **90,** 631; **91,** 773; **92,** 680.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 932; **94,** 654; (Col.) **95,** 787.
Maj. H. M. Adams, 1896. **R., 96,** 703.
Maj. S. S. Leach, 1897–1901. **R., 97,** 956, 979; **98,** 959; **99,** 1166; **00,** 1337; **01,** 1175.
Maj. C. F. Powell, 1902–05. **R., 02,** 934; **03,** 844; (Lt. Col.) **04,** 983; **05,** 889.
Maj. H. Taylor, 1906–10. **R., 06,** 931; **07,** 969; **08,** 1014; (Lt. Col.) **09,** 1041; **10,** 1165.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1237; **12,** 1451.

Assistants:
T. G. Ellis, **70,** 453; **72,** 893.
W. S. Edwards, **70,** 453; **72,** 893. **R., 71,** 785.
H. Harding. **R., 72,** 894; **73,** 1015.
H. N. Babcock. **R., 74,** ii, 263.
T. N. Lincoln. **R., 75,** ii, 257.
G. H. Birnie. **R., 79,** 347.
G. E. Verrill. **R., 02,** 936.

ESTIMATES. (See Plans and Projects.)

By Maj. Warren, 1871, sea wall and filling, $130,700; break'r, $237,775; dr. at outer bar, $12,000, **71,** 783.
By W. S. Edwards, l. w. chan. 7′, $24,486, **71,** 711, 786.
By H. Harding, 1872, removal of Drews Rock, $6,285, **72,** 895. Building wing dam at Drews Rock, $627, **72,** 895.
By H. Harding, 1873, w. and d. chans. and removing rocks., $58,000, **73,** 1019.

OBSTRUCTION. (See Physical Characteristics.)

OPERATIONS.

1870–71. Operations commenced, **71,** 779.
1871–72. Wing dam built at Sow and Pigs Rocks; 28,922.4 c. y. dr. Drews Bar, making chan. 7′ x 80′; 9,447.85 c. y. dr. Mill Bar, making chan. 7′ x 42′, **72,** 83, 893, 894; **79,** 346.
1872–73. 7,739 c. y. dr. chan. between Derby and Huntington; chan. 6′ x 42′ x 1,500′; 20,385 c. y. dr. Two-Mile Isld. Bar; chan. 7′ x 75′ x 2,300′; 426 c. y. deposited on j., **73,** 91, 1013, 1018; **74,** ii, 263; **79,** 346.
1873–74. Removing 2,246 c. y. of ballast; dr. 17,019 c. y. at Mill Bar, 5,052 c. y. at Drews Bar, 10,197 c. y. at Crofuts Bar, **74,** 102, ii, 262, 263.

*Allotments. [1] Allotments for sur.

1874-75. 7,883 c. y. dr. Two-Mile Isld. Bar; 1,795 c. y. Drews Bar; 10,691 c. y. Huntington Dock; 7,186 c. y. Crofuts Bar, **75,** 104, ii, 256, 257, 258.

1875-76. 1,636 c. y. dr. chan. at Drews Rock, **76,** 52, 226.

1876-77. 21,682 c. y. dr. chan. at Drews Rock, **77,** 47, 215.

1878-79. 26,222 c. y. dr., **79,** 58, 347.

1880-81. 9,290 c. y. sand dr. chan., **81,** 601.

1881-82. 7,818 c. y. dr. chan., **82,** 616.

1885-86. 14,394 c. y. dr., **86,** 643.

1886-87. 37,494 c. y. dr. from bar at mouth of R. without cost to the U. S.; 169 c. y. r. removed from Drews Rock, **87,** 607.

1887-88. Removal of Drews Rock and j. completed to 7′ m. l. w.; tidal observations taken, **88,** 552.

1889-90. 5,063 t. granite riprap delivered in break'r; 35,674 c. y. dr., **90,** 633, 634.

1890-91. 7,443 t. st. delivered in the break'r, completing 2,090 l. f.; 2,176 c. y. dr., **91,** 775.

1891-92. 17,150 t. riprap granite placed in break'r, extending the same 1,282′; 13,613 c. y. dr., **92,** 682.

1892-93. 22,208 c. y. dr., and 3,300 t. st. placed in break'r, **93,** 934.

1893-94. 15,861 c. y. dr.; 5,482 t. st. placed in break'r, and 2,045 t. st. placed in bank below Stratford, **94,** 657.

1894-95. 7,197 t. st. placed in break'r, **95,** 789.

1895-96. 7,446 t. st. placed in break'r, and 5,074 c. y. dr., **96,** 704.

1896-97. About 36,000 c. y. dr., and 6,652 t. st. placed in repair of break'r, **97,** 957.

1897-98. 53,355 c. y. dr., **98,** 959.

1900-01. 21,514 c. y. dr., **01,** 1175.

1902-03. 400t. riprap used in repairs to break'r; 17,632 c. y. dr., **03,** 845.

1903-04. 22,232 c. y. dr., **04,** 983.

1904-05. 17,336 c. y. dr.; 3,188.67 t. st. used in repairs to break'r; 161.29 t. st. replaced in break'r, **05,** 889.

1905-06. 596.97 t. riprap used in repairs to break'r, **06,** 931.

1906-07. 44,208 c. y. dr. and 10 logs removed; 204.67 t. riprap used in repairs to break'r, **07,** 969, 970.

1907-08. 50,201 c. y. dr. and 18 sunken logs removed, **08,** 1014.

1908-09. 5,575.46 t. st. placed in Stratford dike; 6,551 c. y. dr., **09,** 1041.

1909-10. 23,568 c. y. dr., **10,** 1166.

1910-11. 30,612 c. y. dr. from various bars in R.; 3 logs removed; 710′ break'r repaired; Stratford Dike extended 200′, **11,** 1237.

1911-12. 249.9 t. st. placed in Stratford Dike, **12,** 1452.

PHYSICAL CHARACTERISTICS.

Descriptions of, **70,** 454; **71,** 781, 784; **72,** 894, 895; **73,** 1016–1019; **74,** ii, 263; **75,** ii, 256; **86,** 642; **88,** 551; **10,** 127.

Table of tidal observations, **71,** 779, 785; **73,** 1013, 1015.

Effect of j. at Drews Rock, **75,** ii, 256; **76,** 226; **77,** 216; **93,** 932; **96,** 703; **97,** 980.

Distances above Long Isld. Sound to the principal bars and other points on the R., **96,** 703.

An. dr. necessary; freshets, **10,** 1167.

Vessels enabled to enter in safety, **12,** 161.

A rapid R. running through Mass. and Conn. into Long Isld. Sound, about 5 m. to e. of Bridgeport H.; l., 130± m. At Derby, 13 m. from mouth, it receives discharge of Naugatuck R.; 1± m. above this point there is a large power dam across the Housatonic. Derby and Shelton are at head of navigation, **12,** 159.

PLANS. (See Estimates and Projects.)

By Maj. Warren, 1871, imp. mouth of R., by sea wall 12′ x 2,100′ above m. l. w., 8′ w. at top and 14′ w. at m. l. w., and by closing new outlet with riprap and brush; also to build a break'r 6′ x 2,100′ on top, with batter 4 to 1 foundation, latter to be of st. thrown to slope and paved and protected at foot by riprap; finally, to dr. a chan. through the outer bar 7′ x 200′; total, $380,475, **71,** 782.

By H. Harding, 1872, removal of Drews Rock; est., $6,285, **72,** 895.

By Maj. Barlow, 1877, removal of j. and Drews Rock, **77,** 215; **78,** 52, 403; **79,** 344.

By G. H. Birnie, 1879, removal of j., **79,** 348.

PRIVATE WORK.

Dr. done by oystermen on the outer bar an aid to imp., **97,** 985.

145,440 c. y. dr. by private interests for oyster culture; has resulted in d. the regular chan., **07,** 970.

PROJECTS. (See Estimates and Plans.)

In 1871 Maj. G. K. Warren proposed chan. 7′ x 100′ Derby to Long Isld. Sound by dr. and js.; also the formation and protection of a dr. chan. at the mouth, by a break'r from Milford Beach; est., $404,961, **71,** 781, 783, 786; **86,** 642; **87,** 606.

In 1879 Maj. Barlow proposed riprap j. in place of the previously proposed break'r, **79,** 345; **87,** 607.

In 1884, after an aggregate app. of $71,200, Lt. Col. McFarland proposed removal of Drews Rock and the constr. of the riprap j. as per previous proj.; est., $30,000, **84,** 650, 651; **87,** 607.

In 1887 Lt. Col. Houston recom. extension of riprap break'r, Milford Beach to 12′ curve, and dr. 7′ x 200′ through bar at the mouth of the R., thence to Derby 100′ w.; est., $202,000, **87,** 608; **91,** 774; **92,** 681.

1893, small dike below Stratford au., **12,** 160.

In 1897 Maj. Leach est. $19,000 to imp. R., and $4,000 every alternate year for mainten., **97,** 985.

In 1912 the total est. for the full proj., $275,500; revision of proj. recom., **12,** 160.

SURVEYS.

Sur. au. and in progress, **70,** 31, 76; **71,** 85, 785.

By W. S. Edwards, 1871, **72,** 893, 895.

By H. Harding, 1873, of R. at the mouth, and at Derby and Huntington, **73,** 1015, 1018.

By H. N. Babcock, 1874, Mill Bar to RR. br., **74,** ii, 264.

Ex. R., 1879, **79,** 344.

Sur. au. act June 3, 1896; made by Maj. Leach, 1897 (**R.** fav.) (see Projects), **97,** 979.

To head of navigation, **06,** 931.

Of shoals, **02,** 936.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 160.

Maps.

Section of proposed sea wall, **71,** 782.

82, 616; **86,** 642; **87,** 608.

D-66 BRIDGEPORT HARBOR, CONN.[1]

APPROPRIATIONS.

1836,	$10,000,	**66,** iii, 29; **71,** 788.
1852,	10,000,	**66,** iii, 29.
1871,	20,000,	**71,** 86.
1872,	40,000,	**72,** 84.
1873,	30,000,	**73,** 92.
1874,	20,000,	**74,** 102.
1875,	15,000,	**75,** 105.
1876,	10,000,	**76,** 53.
1878,	10,000,	**78,** 53.
1879,	10,000,	**79,** 59.
1880,	10,000,	**80,** 463.
1881,	10,000,	**81,** 604.
1882,	10,000,	**82,** 619.
1884,	5,000,	**84,** 652.
1886,	20,000,	**86,** 645.

[1] Sur.—**R.,** Sept. 26, 1838; est., $52,800, and Dec. 11, 1852, est., $10,000. (H. D. 482, 55, 2d.)

1888, $10,000, **88,** 557.
1890, 20,000, **90,** 639.
1892, 20,000, **92,** 688.
1894, 10,000, **95,** 795.
1896, 28,000, **96,** 709.
1899, 50,000, **99,** 1169.
1900, 50,000, **00,** 1340.
1901, 50,000, **01,** 1178.
1905, 10,000, **05,** 892.
1906, 72,500, **06,** 933.
1907 { 113,000, **07,** 973.
*10,000, **08,** 1019.
1908, 40,000, **08,** 1019.
1909, 100,000, **09,** 1044.
1910 { 100,000 / 25,000 } **10,** 1169.

Total,[1] 938,500 (does not include "Black Rock" app.; allot., 1909, $10,000, withdrawn; $25,000, collection from surety, and $1,177.26, sale of steamer, **12,** 1454).

COMMERCE.

Obstructions to C., **66,** iii, 20; iv, 199.
C. importance of Bridgeport, Conn., **71,** 797; **74,** ii, 267; **79,** 350.
Prospective increase in business consequent upon imp., **89,** 697, 700.
Description of, **99,** 1176; **11,** 140; **12,** 166, 1455.
Navigation facilitated, present C. made possible, and rates reduced, **10,** 131.
1,000,000 t., 1911; passengers, 146,888, **12,** 1455.
Break'rs and 22' anchorage basin form a much needed H. of refuge, **12,** 165.
Contiguous Hs. unimproved have freight rates, 25 to 50% high, **12,** 166.
Diagram showing relation of tonnage, etc., and app., **12,** 1455.

CONTRACTS.

1836. Holmes & Randall, dr., **79,** 351.
1853. S. N. Payne, dr. 27,649 c. y., 30¢, **79,** 351.
1871. F. H. Smith, dr. 24,494 c. y., 23 4/10¢. C. C. Campbell, riprapping, **71,** 788.
1872. D. V. Howell, riprapping. S. F. Shelbourne, dr. 28,058[2] c. y., 21¾¢, **72,** 900.
1873. H. N. & A. J. Beardsley, dr. 165,751 c. y., 18¢, **74,** ii, 267.
1874. E. R. Seward,[3] dr. 145,343 c. y., 14½¢, **75,** ii, 258.
1875. E. R. Seward, dr. 100,264 c. y., 12¾¢, **75,** ii, 259; **76,** 228.
1877. H. N. & A. J. Beardsley, dr. 85,603 c. y., 8¾¢, **77,** 217; **78,** 405.
1878. G. C. Fobes & Co., dr. 85,027 c. y., 10 and 14¢, **79,** 351.
1879. H. N. & A. J. Beardsley, dr., 15¢ c. y., **80,** 462.
1880. H. N. & A. J. Beardsley, dr., 10 and 20¢ c. y., **81,** 603.
1881. H. N. & A. J. Beardsley, dr., 10¢ c. y., **81,** 604.
1882. H. Du Bois & Sons, dr., 9¾¢ c. y., **83,** 521.
1885. H. Du Bois & Sons, dr., 7½¢ c. y., **85,** 651.
1886. A. J. Beardsley & Co., dr., 5 9/10¢ c. y., **87,** 612.
1888. C. Du Bois and H. N. Du Bois, dr., 14¢ c. y., **88,** 558.
1889. A. J. Beardsley & Son, dr., 18¢ c. y., **89,** 697.
1891. Brown & Fleming, st. break'r, $1.29 t., **91,** 782. G. B. Beardsley, dr., 14.6¢ c. y., **91,** 783.
1892. A. J. Beardsley, dr., 9½¢ c. y., s. m. ($19,000), **93,** 941.
1894. A. J. Beardsley, dr. 69,565 c. y., 11½¢ c. y., **95,** 795.
1896. G. B. Beardsley, dr., 10¢ c. y. ($14,000), **97,** 960.
1898. H. Du Bois' Sons, dr., 6 9/10¢ c. y. ($5,520), **99,** 1170, 1171.
1899. Hughes Bros. & Bangs, dr., 5¢ c. y.; stonework, $2 t. ($151,325), **99,** 1171.
1902. E. S. Belden & Sons, st. in place in break'r and js., $2.40 t., and paving, $3 s. y., **03,** 848.
1906. Hughes Bros. & Bangs, dated July 31, 1899, annulled May 10, 1906; P. Sanford Ross (Inc.), dr. about 679,000 c. y., 12.9¢ c. y., **06,** 933.
1907. Estate of John Beattie, about 70,000 t. st. in break'r, $1.17 t. in place, **07,** 974.
1907. Atlantic Dredging Co., dr. 83,428 c. y., 22¢ c. y., **07,** 972.
1908. John P. Randerson, dr. about 49,703 c. y., 12¾¢ c. y., s. m.; Maritime Dredging Co., dr. about 170,000 c. y., 10.65¢ c. y., s. m., **08,** 1019.
1909. American Dredging Co., dr. about 1,278,000 c. y., 12½¢ and 8¾¢ c. y., **09,** 1044.
1910. Coastwise Dredging Co., dr. 533,399 c. y., 11¢ c. y., s. m., **11,** 1242.
1911. J. H. Gerrish, dr. 78,783 c. y., at 13.3¢ and 16.7¢ c. y., **12,** 1454.

ENGINEERS.

Chief of Engineers. **R., 66,** 7, ii, 41, iii, 19; **68,** 68; **69,** 58; **70,** 31, 76; **71,** 85; **72,** 83; **73,** 92; **74,** 102; **75,** 105; **76,** 53; **77,** 47; **78,** 53; **79,** 59; **80,** 79; **81,** 94; **82,** 95; **83,** 90; **84,** 97; **85,** 85; **86,** 86; **87,** 49; **88,** 50; **89,** 63; **90,** 56; **91,** 70; **92,** 74; **93,** 80; **94,** 71; **95,** 80; **96,** 77, 102; **97,** 23; **98,** 99; **99,** 112, 124; **00,** 129; **01,** 186; **02,** 133; **03,** 115; **04,** 99; **05,** 106; **06,** 106; **07,** 108, 118; **08,** 112; **09,** 114; **10,** 128, 138; **11,** 136, 149; **12,** 162.

In charge:
Capt. W. H. Swift, 1838, **71,** 788.
Capt. George Dutton, 1852, **71,** 789.
Capt. D. C. Houston, 1866–70, **66,** ii, 41. **R., 66,** iv, 199; **68,** 750; **69,** 410, 412.
Maj. G. K. Warren, 1870–75, **70,** 74. **R., 70,** 453; **71,** 786; **72,** 895; **73,** 1019; **74,** ii, 265.
Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 258; **76,** 227; **77,** 217; **78,** 404; **79,** 349; **80,** 462; **81,** 603; **82,** 617.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 520; **84,** 652; **85,** 651.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 644; **87,** 610; (Col.) **88,** 555; **89,** 693, 698, 700; **90,** 637; **91,** 778; **92,** 685.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 937; **94,** 659; (Col.) **95,** 791.
Maj. H. M. Adams, 1896. **R., 96,** 707, 803.
Maj. S. S. Leach, 1897–1901. **R., 97,** 959; **98,** 961; **99,** 1168, 1173, 1187; **00,** 1339; **01,** 1177.
Maj. Chas. F. Powell, 1902–05. **R., 02,** 937; **03,** 846; (Lt. Col.) **04,** 985; **05,** 891.
Maj. Harry Taylor, 1906–10. **R., 06,** 932; **07,** 972; **08,** 1016; (Lt. Col.) **09,** 1043; **10,** 1168.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1240; **12,** 1453.

Assistants:
S. Simons, **79,** 351.
G. Beckwith. **R., 66,** iv, 201.
Capt. A. H. Holgate. **R., 69,** 413.
W. S. Edwards, **71,** 787; **72,** 896.
W. W. Starr, jr., **73,** 1021. **R., 74,** ii, 266; **75,** ii, 260; **76,** 228.

ESTIMATES. (See also Plans and Projects.)

By S. Simons, 1838, dr. through outer and inner bars, $52,800, **79,** 351.
By Maj. Warren, w. chan. to 200', $72,000 in addition to orig. est., **71,** 796. For a break'r, $371,000 to $567,000, **71,** 794 et seq.
By W. W. Starr, jr., w. chan. and constr. j., $126,050, **74,** ii, 268. Deepening chan., $16,442.75 to $147,673, **75,** ii, 260. Modified est., $25,017.30 to $45,757.90, **76,** 228.

LEGAL PROCEEDINGS.

Two tugboat captains prosecuted for dumping in violation of law, convicted, and fined $500 each and sentenced to 1 day in jail, **11,** 1241.

*Allotment.
[1] Not including $72,900 app. to 1894 for Black Rock H.
[2] Given as 28,303 c. y., **74,** ii, 266; as 45,518 (5,313+11,902+28,303), **79,** 352.
[3] Contract extended, **75,** ii, 258; **76,** 228.

OBSTRUCTIONS.

List of brs. crossing the H., **96,** 707; **99,** 1189.

Plans of the city of Bridgeport for drawbr. over Yellow Mill Cove approved, **98,** 962.

OPERATIONS.

1837-38. Chan. 60′ x 8′ dr. across outer bar, **70,** 453; **71,** 788; **79,** 351.

1853-54. 27,649 c. y. dr., **71,** 789; **79,** 351.

1871-72. 521 l. f. j. extension, 24,494 c. y. dr., **72,** 83, 896.

1872-73. 859 l. f. j. extension, 28,058 c. y. dr., **73,** 92, 1020.

1873-74. 165,751 c. y. dr.; 1 wreck removed, **74,** 102, ii, 265, 266.

1874-75. 126,671 c. y. dr., **75,** ii, 258, 260.

1875-76. 118,936 c. y. dr., **76,** 228.

1877-78. 85,603 c. y. dr., **78,** 404; **79,** 353.

1878-79. 85,027 c. y. dr., **79,** 59, 349.

1879-80. 89,417 c. y. dr., **80,** 462.

1880-81. 70,703 c. y. dr., **81,** 604.

1881-82. 90,000 c. y. dr., **82,** 618.

1882-83. 90,561 c. y. dr., **83,** 520.

1884-85. 59,352 c. y. dr., **85,** 651.

1886-87. 261,960 c. y. dr., **87,** 610.

1887-88. 14,000 c. y. dr., increasing d. over shoal to 12′ m. l. w., **88,** 556.

1888-89. 34,051 c. y. dr., **89,** 695.

1889-90. 10,946 c. y. dr., **90,** 638.

1890-91. 750 t. riprap placed in break'r, completing 300 l. f. of the same, **91,** 781.

1891-92. 9,077 t. riprap placed in break'r; 30,000 c. y. dr., **92,** 687.

1892-93. 190,132 c. y. dr., **93,** 939.

1894-95. 48,456 c. y. dr., **95,** 794.

1895-96. 21,523 c. y. dr., **96,** 708.

1897-98. 137,700 c. y. dr., **98,** 962.

1898-99. Chan. 12′ x 200′ m. l. w. dr. from the main chan. of the H. to a point 50′ below Yellow Mill Br., **99,** 1169.

1900-01. 458,241 c. y. dr., and 8,782 t. st. used in repairing and extending break'r and building 4 js.; 40,756 c. y. dr. below Naugatuck RR. dock, 18,079 c. y. dr. from Johnsons R., and 141,623 c. y. dr. from Poquonock R., **01,** 1177.

1901-02. 146,687 c. y. dr., **02,** 937.

1902-03. 266,619 c. y. dr., 2,424 t. riprap placed in break'r and js., and 165.79 s. y. paving laid, **03,** 847.

1903-04. 295,612 c. y. dr., **04,** 985.

1904-05. 64,366 c. y. dr., **05,** 891.

1905-06. 48,925 c. y. dr., 3,982 c. y. dr. from Burr Creek, and 23,175 c. y. dr. from Poquonock R., **06,** 932, 933.

1906-07. 796,793 c. y. dr. from chans., and 84,128 c. y. removed in mainten., **07,** 972.

1907-08. 59,567.22 t. st. placed in break'rs, extending e. one 2,063′ and completing 1,000′ of w. one; 49,703 c. y. dr. from Cedar Creek and Black Rock Chans.; Fayerweather Isld. break'r repaired; 773 c. y. dr. in removing shoals, **08,** 1016, 1017, 1018.

1908-09. 23,282.75 t. st. placed in w. break'r, extending it 1,010′; 150,619 c. y. dr. from 12′ anchorage, and 144,923 c. y. dr. from 22′ chan. and basin, **09,** 1043.

1909-10. 280,436 c. y. dr. from 22′ chan., and 558,315 c. y. from 22′ basin, **10,** 1168.

1910-11. 247,847 c. y. removed from 22′ basin, and contract completed Dec. 8, 1910; 250,342 c. y. removed from Poquonock chan. and 265,073 c. y. from Cedar Creek Chan.; permanent ranges estab. in Cedar Creek and Black Rock Chans., and automatic tide-gauge estab., **11,** 1241.

1911-12. 78,783 c. y. dr., restoring chans. and basins to proj. ds., **12,** 1454.

PHYSICAL CHARACTERISTICS.

Tides, **66,** iii, 20, iv, 199; **69,** 414, 415; **79,** 350.

Shores of Long Isld. Sound described, **71,** 791; **72,** 897.

Description of, **88,** 555; **93,** 937; **96,** 804; **11,** 136; **12,** 162.

About 57 m. ne. from N. Y. City; about 16 m. to s. westward from New Haven H., **12,** 162.

PLANS. (See Estimates and Projects.)

By S. Simons, 1838, dr. a chan. 8′ x 200′ through outer and inner bars, **79,** 351.

By Capt. Houston, break'r, **66,** iv, 201.

By Capt. Holgate, 6 ps. of loose st., to prevent further growth of sand spit, **69,** 415.

By Maj. Warren, break'r 1,200 y. l., 11′ h., 6′ w. on top, the body of break'r to be of solid masonry resting upon a bed formed by large blocks of st. and protected by riprap, **71,** 794.

By W. W. Starr, jr.: 1st, for dr. a 500′ chan. through outer bar, 600′ chan. through inner bar, 500′ chan. between inner beacon and Naugatuck Pier, and 20,000 c. y. at Flat Iron; also for extension of j.; 2d, for d. chans. to 12′ or 15′ with w. of 100′, 200′, or 300′; 3d, see Projects, **74,** ii, 268; **75,** ii 260, **76,** 228.

PRIVATE WORK.

New rolling lift br. built at Congress St.; N. Y., N. H. & Hartford RR. Co. began extensive work involving removal of Naugatuck Dock, **10,** 1168.

By the N. Y., N. H. & Hartford RR. Co., removal of Naugatuck Dock outside of the modified H. lines of 1906, and dr. area where dock stood to 18′ m. l. w.; also dr. w. side of Poquonock R. chan. and building bulkhead, **11,** 1241.

City of Bridgeport rebuilt fender pier of Stratford Ave. Br., **11,** 1241.

Various pieces of private work, au. by the Sec. War, completed, **12,** 1454.

PROJECTS. (See Estimates and Plans.)

By Capt. Swift, 1838, dr. chan. 8′ x 60′ across outer bar, **71,** 788.

By Capt. Dutton, 1853, dr. chan. 8′ x 200′ est. orig. $22,000, subsequently reduced to $14,000, **71,** 789.

By Maj. Warren, dr. chan. 14′ x 100′ through outer and inner bars; sea wall of a row of dolphins 2,600′ l., built in groups of 5 piles 8′ apart; also dry wall of split granite 400′ l.; est., $124,000, **71,** 86, 787, 791, 796; **79,** 352.

By Maj. Barlow, dg. chan. to 12′ with w. of 100′; est., $16,442.75, **75,** ii, 260. W. 12′ chan. to 300′; est., $25,200, **78,** 53, 404; **79,** 350.

Projs. of 1871–75 proposed chan. of navigable w. and 12′ d. from Long Isld. Sound to the lower br.; est., $138,000 for dr.; also a riprap j. 1,380′ l. from Long Beach; est., $35,000, **80,** 462. Work completed in 1880 under aggregate app. of $195,000, when Maj. Barlow proposed w. to 600′ of the chan. rom the inner beacon to the SS. wharf; est., $60,000. **81,** 604; **85,** 651; **86,** 644; **87,** 610.

By Col. Houston, 1887, dr. to 12′ m. l. w. chan. from the Naugatuck RR. wharf to the lower br.; also for increasing the w. of the chan. to 600′; est., $17,000, **88,** 557. In 1889 Col. Houston modified and extended his proj.: (1) Completion of a chan. 12′ d. m. l. w. and 300′ w., Long Isld. Sound to the lower br.; est., $17,000; (2) completion of a chan. 9′ x 100′ from the lower br. to the head of the H.; est., $8,000; (3) break'r extending from a point called The Tongue in the w. side of the H. entrance, se. to the inner beacon; est., $30,000. Total est. of proj., $55,000, with an an. expend. for mainten. of dr. chans. of $3,000, **89,** 696; **90,** 637, 638.

History of projs., **91,** 779.

In 1892 Col. Houston proposed to complete the chans. above the brs., to remove the shoal places above the Naugatuck RR. wharf, and to w. the chan. eastward to the H. lines an additional w. of about 200′; also to complete the break'r from The Tongue to the inner beacon; est., $35,000, **92,** 688.

By Lt. Col. Robert, 1894, chan. 15′ x 100′ through the outer bar, **95,** 793.

By Maj. Adams, 1895, extending the 15′ chan. to the lower br., making it 300′ w. up to the inner beacon and 200′ w. above that beacon, which. with the uncompleted work of the then existing proj., was est. to cost $90,000, **96,** 707.

By Maj. Leach, 1897, w. to 200′ the 15′ chan. on its e. side from the Sound to the outer beacon, about 4,700′, and extending the chan. from the bar to the inner beacon, about 1,300′, with w. of from 60′ to 100′, **97,** 959. Modified, **98,** 962.

By Maj. Leach, 1898, for (1) dr. main chan. 18′ x 300′ s. of the inner beacon and 200′ w. n. of it; 3 anchorage basins; chans. 12′ x 100′ and 1 m. l. each in Poquonnock R. and Yellow Mill Cove; chans. 9′ x 100′, and three-fourths, one-eighth, and one-half m. l. in Johnsons, Cedar, and Burr Creeks,

respectively; (2) repair and mainten. of the 4 break'rs already built, and constr. and mainten. of shore protection on Fayerweather Isld.; est., $300,000, **99,** 1175; **00,** 1339.

Maj. Leach est., 1899, $175,000 to extend and w. H. chan. in accordance with a plan of Congress, which plan Maj. Leach did not consider most suitable for the needs of the H., **99,** 1188.

By Maj. Taylor, plan of imp. at est. cost of $560,000, and $10,000 an. for mainten., **07,** 118. Act. 1907 au. part covering constr. of anchorage basin 22′ d., 1,280,000 s. f. area opposite inner break'r, d. of main entrance chan. to 22′ as far as inner end of anchorage basin, an additional 12′ basin, 608,600 s. f. in area, and 2 break'rs for protection of deep basin; est., $463,000,[1] **07,** 110; est. reduced, 1910, to $300,000 on account of decision on nonapplication of 8-hour law to dr. work, **10,** 130.

By Lt. Col. Taylor, 1910, incl. extension of 18′ chan. up Poquonock R. to within 1,500′ of dr. chan. and w. and straightening chan.; also d. chan. in Black Rock H. and Cedar Creek to 12′ and extending dr. to 12′ contour of Long Isld. Sound; est., $90,000, and $6,000 an. mainten.,[2] **10,** 130.

In 1912, entire existing proj. considered as almost entirely done, **12,** 165.

SURVEYS.

By Lt. Blade, U. S. N., 1837, **66,** iv, 199; **71,** 788.

By G. Beckwith, 1866–68, **69,** 413. **R., 66,** iv, 201.

By W. S. Edwards, **71,** 787.

By W. W. Starr, jr., **73,** 1021; **74,** ii, 267.

By Maj. Barlow, 1878, **79,** 349.

Sur. au. act Aug. 17, 1894; made, 1895, by Maj. Adams (see Projects), **96,** 803.

H. lines estab. by Sec. War in 1893, **94,** 661.

Of outer H. au. act Mar. 3, 1905; made, 1906. **R.** by Maj. Taylor,[1] **07,** 118.

Including Poquonock R. and Cedar Creek branches, au. act Mar. 3, 1909; made, 1909–10. **R.** by Lt. Col. Taylor,[2] **10,** 138.

Ex. au. act June 25, 1910, with view to protecting chans. from erosion of Long Beach; made, 1910, by Lt. Col. Taylor,[3] **11,** 149.

Minor, **11,** 1240.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 164.

Maps.[1 3] Map of H., **79,** 350; **82,** 618; **85,** 652; **87,** 612; **93,** 940.

D-72 BLACK ROCK HARBOR, CONN.[4]

APPROPRIATIONS.

1836,	[5] $10,000,	act July 4, **95,** 798.
1838,	[5] 11,550,	act July 7, **95,** 798.
1882,	[6] 350,	**95,** 798.
1884,	20,000,	**85,** 655.
1886,	5,000,	**86,** 647.
1888,	10,000,	**88,** 560.
1890,	5,000,	**90,** 642.
1892,	5,000,	**92,** 691.
1894,	*3,500,	**94,** 665.
1894,	2,500,	**95,** 798.
Total,	72,900	

COMMERCE.

Important, **84,** 666, 669.

Description of, **95,** 858.

Increasing at 1894–95, **95,** 859.

CONTRACTS.

1885. J. A. Bouker, constr. of break'r, $1.22 t. st. H. & A. Beardsley, dr., 15¢ c. y., **85,** 654.

1886. E. Brainard, dr., 9¢ c. y., **87,** 613.

1889. J. H. Fenner, dr., 16¢ c. y., **89,** 705.

1891. G. B. Beardsley, dr., 14.6¢ c. y., **91,** 785.

1892. A. J. Beardsley, dr., 17¢ c. y., s. m. ($6,800), **93,** 944.

1894. D. V. Howell, st., $1.37 and $2.27 t. ($1,820), **95,** 799.

1895. D. V. Howell, st., $2.57 and $1.47 t. ($643), **95,** 799.

ENGINEERS.

Chief of Engineers. **R., 84,** 99; **85,** 86; **86,** 87; **87,** 49; **88,** 51; **89,** 63, 70; **90,** 57; **91,** 70; **92,** 75; **93,** 80; **94,** 72; **95,** 82, 93.

In charge:

Lt. Col. W. McFarland, 1884–86. **R., 84,** 666; **85,** 653.

Lt. Col. D. C. Houston, 1886–92. **R., 86,** 646; **87,** 613; (Col.) **88,** 558; **89,** 702, 741; **90,** 640; **91,** 784; **92,** 689.

Lt. Col. H. M. Robert, 1893–95. **R., 93,** 942; **94,** 663; (Col.) **95,** 796, 856.

Assistant. H. N. Babcock. **R., 84,** 667.

OPERATIONS.

1884–85. 4,974 t. st. placed in break'r; 19,984 c. y. dr. from Cedar Creek Chan., of which half the cost was paid by private parties, **85,** 654.

1885–86. 5,440 t. st. placed in break'r, partly completing the work for the whole l., **86,** 647.

1886–87. 21,500 c. y. dr. from Cedar Creek Chan., **87,** 613.

1887–88. 24,868 c. y. dr. from chan., **88,** 559.

1889–90. 58,000 c. y. dr., **90,** 641.

1891–92. 28,000 c. y. dr., **92,** 690.

1893–94. 25,000 c. y. dr., 115 l. f. sea wall at Fayerweather Isld. rebuilt, and 160 l. f. added, using altogether 1,384 t. st., **94,** 665.

1894–95. 3 spur js. built, and riprapping done, **95,** 797.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 668; **88,** 558; **89,** 741; **93,** 942; **95,** 857.

H. includes the lower H., about 1½ m. long, and the upper H., consisting mainly of 2 tidal inlets, **95,** 857.

PRIVATE WORK.

Dr. in 1884–85, by private interests, **85,** 86, 654 (see Operations, 1884–85).

PROJECTS.

In 1836–38, $21,550 was expend. in closing a breach across Fayerweather Isld., **85,** 653.

By Lt. Col. McFarland, 1883, riprap break'r 2,700′ l., from Fayerweather Isld. to the mainland, and dr. chan. 6′ x 80′ x 3,300′ m. l. w., up Cedar Creek; est., $80,000, **84,** 667, 668; **85,** 653; **87,** 613; **92,** 690.

SURVEYS.

Au. act Aug. 2, 1882; made, 1883, by Lt. Col. McFarland, **84,** 666.

Ex. for break'r to Penfield Reef and s. from Fayerweather Isld. au. act Aug. 11, 1888; made, 1888, by Col. Houston, **89,** 741.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert (**R.** fav.), **95,** 856.

Maps. **85,** 654; **93,** 944.

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* Allotment, from ex., sur., and contingencies, for repair of old sea wall.

[1] H. D. 275, 521, 59th, 52d.

[2] H. D. 751, 61st, 2d.

[3] H. D. 89, 62d, 1st.

[4] Sur.—**R.,** Feb. 15, 1827; est., $6,201.20, and June 9, 1831, est., $10,900. (H. D. 482, 55th, 2d.)

[5] Sea wall, Fayerweather Isld.

[6] Sur.

D-76 SOUTHPORT HARBOR, CONN.[1]

APPROPRIATIONS.

1829,	$6,097.00,	act Mar. 2.
1832,	4,490.43,	act July 3.
1836,	1,500.00,	act July 4.
1837,	1,000.00,	act Mar. 3.
1870,	*500.00,	**79,** 356.
1875,	5,000.00,	**75,** 105.
1876,	5,000.00,	**76,** 53.
1880,	2,500.00,	**80,** 465.
1881,	2,500.00,	**81,** 608.
1882,	3,000.00,	**82,** 621.
1902,	8,889.00,	**03,** 852.
1905,	9,000.00,	**05,** 897.
1907,	2,000.00,	**07,** 979.
1910	500.00 / [2] 459.51	**10,** 1175.
1912,	15,000.00,	**12,** 1459.
Total,	67,435.94	(H. D. 421; 57th, 2d, gives amt. in 1832 as $4,490.43); A. R. gives same as $4,490.23;

COMMERCE.

Important, **71,** 828; **75,** ii, 262.
Description of, **97,** 987.
C. use of H. has been steadily decreasing for several years past, **11,** 1248.
1911, 5,368 t., **12,** 172.

CONTRACTS.

1875. Beattie & Dresser, repairing break'r $5.90 c. y., **75,** ii, 261.
1876. J. H. Fenner, dr. and filling between the walls of dike, 37¢ c. y.; depositing in d. w., 17¢ c. y., **78,** 406.
1881. J. M. Seward, dr., 19¢ c. y., **81,** 609. J. McDermott, dr., 33¢ c. y., **82,** 622.
1882. J. H. Fenner, dr., 32¢ c. y., **83,** 522.
1902. J. P. Randerson, dr., 28½¢ c. y., and removing bowlders, $10 t., **03,** 853.
1905. Atlantic Dredging Co., dr. about 36,000 c. y., 24¢ c. y., and r. removal, $13 c. y., **06,** 938.
1908. Maritime Dredging Co., ledge removal, lump sum, $1,972,000, **09,** 1049.

ENGINEERS.

Chief of Engineers. R., 70, 31, 76; **71,** 86; **75,** 105; **76,** 53; **77,** 48; **78,** 53; **79,** 59; **80,** 79; **81,** 94; **82,** 95; **83,** 91; **84,** 97; **85,** 86; **86,** 87; **87,** 50; **97,** 105; **02,** 138; **03,** 120; **04,** 104; **05,** 111; **06,** 112; **07,** 114; **08,** 118; **09,** 120; **10,** 134; **11,** 144; **12,** 171.

In charge:
Maj. D. C. Houston, 1870, **70,** 74.
Maj. G. K. Warren, 1870–71. **R., 70,** 453; **71,** 823.
Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 261; **76,** 229; **77,** 218; **78,** 406; **79,** 354; **80,** 464; **81,** 607; **82,** 620.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 521; **84,** 653; **85,** 655.
Lt. Col. D. C. Houston, 1886–88. **R., 86,** 648; **87,** 615; (Col.) **88,** 561.
Maj. S. S. Leach, 1897. **R., 97,** 986.
Maj. C. F. Powell, 1902–05. **R., 02,** 943; **03,** 851; (Lt. Col.) **04,** 989; **05,** 895.
Maj. H. Taylor, 1906–10. **R., 06,** 936; **07,** 977 **08,** 1025; (Lt. Col.) **09,** 1049; **10,** 1173.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1245; **12,** 1458.

Assistant. W. W. Starr, jr. **R., 76,** 229.

ESTIMATES. (See Plans and Projects.)

For early projs., **71,** 826.
By Maj. Warren, 1871, repairing and raising break'r, $9,375; dike, $2,850, **71,** 827.
By W. W. Starr, 1876, chan. 5′ x 50′, $11,055; or 4′ x 50′, $8,085, **76,** 230.

OPERATIONS.

1829–32. Break'r built, $10,587, **70,** 453.
1836. Repairs, **70,** 453.
1875–76–77. Break'r raised 2′, with fence 2.5′ x 135′, **76,** 53, 229.
1877–78. Break'r and dike repaired; chan. dr. to 60′ x 4′ from outer beacon to break'r; 15,000 c. y. removed, **78,** 53, 406.
1880–81. 11,294 c. y. dr., **81,** 607.
1881–82. 6,768 c. y. dr., **82,** 621.
1882–83. 8,390 c. y. dr.; proj. for imp. completed, **83,** 522.
1902–03. Chan. dr. for about 2,200′, and break'r repaired, **03,** 851.
1903–04. 1,471 c. y. dr., **04,** 989.
1904–05. Break'r repaired, **05,** 895.
1905–06. 28,036 c. y. dr., and 114.73 c. y. bowlders removed, **06,** 936.
1907–08. 2 breaks repaired in break'r, **08,** 1025.
1908–09. 141 c. y. dr., and about 157 c. y. r. removed; break'r repaired, **09,** 1049.

PHYSICAL CHARACTERISTICS.

Described, **71,** 824; **88,** 561; **97,** 986.
Tidal observations, **71,** 828; **76,** 230.
H. formed by the lower part of Mill R., a small stream flowing into Long Isld. Sound, about 6 m. w. of Bridgeport; w. averages less than 100 y., and the part used for C. is about 1 m. l., **97,** 986.
Considerable shoaling outside of break'r, **11,** 1245.

PLANS. (See Estimates and Projects.)

History of early plans, **71,** 824.
By W. W. Starr, 1876, dr'g chan. 4′–5′ x 50′, **76,** 229, 230.

PROJECTS. (See Estimates and Plans.)

Earliest proj., 1827, provided for st. break'r, extending s. 1,420′ on the e. side of the H., and a dike extending n. 1,450′ from head of the break'r. Work completed, 1838; cost, $10,587.23, **70,** 453; **86,** 648.
1875, break'r repaired and raised 2′, **76,** 53, 229; **86,** 648.
1876, proj. modified to provide for dr. chan. 50′ x 4′ l. w. from Long Isld. Sound to wharves at Southport. 1877, proj. amended to provide for 100′ w., **78,** 406; **79,** 59, 355; **86,** 648.
Proj. practically completed, 1883, **83,** 522; **84,** 653; **86,** 648.
1896, Capt. Leach est. $12,700 to imp. the H., with an. expend. of $300 for mainten., **97,** 987.
Act June 13, 1902, au. chan. 6′ x 100′ at the outer bar, and through the lower part of the H.; est., $12,500, and $200 for repairs to break'r with $300 ann. mainten., **02,** 138.
Capt. Waldron recom. modification of proj. to provide chan. 6′ x 100′ from 6′ curve in Long Isld. Sound to second turn inside of break'r, thence same d. and w. of 75′ upstream as far as docks, and 60′ along dock front; also an anchorage basin 6′ x 75′; and removal of 2 pieces of ledge r. to 7′; est. additional cost, $15,000, with $800 an. mainten., **11,** 1246. Au. act July 25, 1912, **12,** 171.

SURVEYS.

By J. Anderson, 1826, **71,** 824.
By Maj. Houston, 1870–71, ex. and sur., **70,** 31, 76, 453; **71,** 86.
Sur. au. act June 3, 1896; made by Capt. Leach, 1896 (**R.** fav.) (see Projects), **97,** 986.
By W. W. Starr, 1876, under direction of Maj. Houston, **76,** 229, 230.

Maps. Sketch of break'r, **71,** 824, 825.
Map of the H., **79,** 356.
82, 620; **86,** 648.

*Allotted.
[1] Sur.—**R.,** Feb. 19, 1827; est., $6,096.18, and Sept. 26, 1838, est. $2,581.60. (H. D. 482, 55th, 2d.)
[2] Trans. from Greenwich H.

D-79 WESTPORT HARBOR AND SAUGATUCK RIVER (Saugatuck Harbor, Cedar Point, Saugatuck River), CONN.[1]

APPROPRIATIONS.

1826, $400.00 (sur.), act May 20.
1827, 1,500.00, **71,** 801.
1830, [2] 28.00, act Apr. 30, 1830.
1836, 1,000.00, **00,** 1343.
1836, 3,000.00, act July 4.
1837, 3,734.00, act Mar. 3.
1838, 4,782.00, act July 7.
1867, 2,500.00, **67,** 44.
1870, 2,500.00, **70,** 74.
1892, 7,000.00, **93,** 947.
1894, 3,000.00, **95,** 803.
1896, 3,000.00, **96,** 712.
1907, 2,000.00, **07,** 980.
1910 { 500.00 / 270.99 } **10,** 1175.

Total, 35,214.99 (incl. misc., $35,341.12, **12,** 1460; see H. D. 421, 57th, 2d).

COMMERCE.

Important, **71,** 804; **73,** 1022, 1025; **79,** 323.
Description of, **96,** 806.
1911, 14,011 t., mainly coal, **12,** 175.

CONTRACTS.

1870. J. Beattie, dry rubblest. work, $10 c. y.; excavation in sand, 40¢ c. y., **70,** 444.
1893. E. R. Seward, dr'g, 27¢ c. y., s. m. ($5,400), **93,** 947.
1897. D. Toomey, $3.25 t. ($1,137.50). T. A. Scott, removal of bowlders, $7 t. ($700), **97,** 962.
1907. Thames Tow Boat Co., 130 c. y., ledge, lump sum, $1,942, **08,** 1026.

DOCUMENTS. (Not published in reports.)

H. Doc. 18, 39th Cong., 2d sess., **71,** 801.

ENGINEERS.

Chief of Engineers. R., 67, 44; **68,** 66; **69,** 57; **70,** 74; **71,** 86; **72,** 84; **73,** 92; **78,** 51; **84,** 99; **91,** 80; **93,** 81, 91; **94,** 73; **95,** 82; **96,** 78, 102; **97,** 96; **98,** 102; **99,** 115; **00,** 131; **01,** 189; **02,** 136; **03,** 118; **04,** 101; **05,** 108; **06,** 108; **07,** 116; **08,** 120; **09,** 122; **10,** 136; **11,** 146; **12,** 173.

In charge:

Maj. D. C. Houston, 1867–70. **R., 67,** 451; **68,** 749; **69,** 410.
Maj. G. K. Warren, 1870–73, 1879. **R., 70,** 444; **71,** 800; **72,** 900; **73,** 1021; **79,** 320.
Maj. W. McFarland, 1882. **R., 84,** 675.
Maj. J. W. Barlow, 1884. **R., 84,** 673.
Col. D. C. Houston, 1891–92. **R., 91,** 840.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 945, 990; **94,** 667; (Col.) **95,** 800.
Maj. H. M. Adams, 1896. **R., 96,** 710, 806.
Maj. S. S. Leach, 1897–1901. **R., 97,** 961; **98,** 964; **99,** 1177; **00,** 1342; **01,** 1180.
Maj. C. F. Powell, 1902–05. **R., 02,** 939; **03,** 849; (Lt. Col.) **04,** 987; **05,** 893.
Maj. H. Taylor, 1906–10. **R., 06,** 934; **07,** 978; **08,** 1026; (Lt. Col.) **09,** 1050; **10,** 1174.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1247; **12,** 1458.

Assistants:

Capt. W. H. Swift. **R., 71,** 801.
H. N. Babcock. **R., 71,** 802; **73,** 1022; **84,** 676.
Lt. W. E. Craighill. **R., 96,** 810.

OPERATIONS.

1837. Sea wall at Cedar Pt. completed for $1,000; chan. excavated to 4′, **71,** 801; **73,** 1022.
1867–70. Work suspended; sur. made, **67,** 451; **68,** 749; **70,** 74, 444.
1870–71. Sea wall at Cedar Pt. repaired; sur. made, **71,** 86, 801, 802.
1871–73. Work suspended; surs. made, **72,** 84; **73,** 92, 1021.
1892–93. 3,651 c. y. dr., **93,** 946.
1893–94. 12,991 c. y. dr., **94,** 670.
1895–96. 9,759 c. y. dr., **96,** 712.
1896–97. 400 t. st. placed in break'r; 36 t. bowlders removed, **97,** 961.
1897–98. 67 t. r. removed, **98,** 964.
1907–08. Rock removal in progress, **08,** 1026.
1908–09. Rock removal completed, **09,** 1050.

PHYSICAL CHARACTERISTICS.

General description, **71,** 802; **73,** 1021, 1022; **79,** 321; **84,** 674; **96,** 810.
Tidal observations, **73,** 92, 1022.
Description of, Westport H., **93,** 990.
Westport H. comprises the portion of Saugatuck R. below Westport, **93,** 990.

PLANS. (See Projects.)

By H. N. Babcock, 1871, repairs and protection of break'r and removing loose r. in chan.; est., $1,424, **71,** 803. For imp. canal by dr. to 5′, banking up and riprapping e. side, building wall, and paving both banks; est., $26,369, or without paving, $20,010, **71,** 803; **73,** 1025.
By H. N. Babcock, 1873, dr. chan. 6′ x 60′ to head of navigation; est., $54,000, **73,** 1022, 1025.
By Lt. Col. McFarland, 1883, imp. of the H. by increasing the d. of chan. between Saugatuck and Westport to 4′ l. w., and w. to 100′; est., $36,000, **84,** 675.
By Col. Houston, 1891, excavation of a chan. 6′ x 100′ m. l. w. between Saugatuck and Westport; est., $40,000, with an an. cost of $2,000 for mainten.; est. for a 4′ chan. 60′ w. up to Westport, $10,000, **91,** 842.

PROJECTS. (See Plans.)

By Lt. Col. Anderson, 1827, to straighten and d. chan. inside the bar and constr. of a canal 4′ x 68′ across the "Great Marsh" on w. side of R.; est., $6,128, **71,** 801; **73,** 1022.
By Maj. Houston, 1867, repair of break'r and walls of the canal; est., $12,153, **67,** 44, 452.
By Col. Houston, 1892, dr. a chan. 4′ x 100′ to the village of Westport; est., $10,000, **93,** 946.
By Maj. Adams, 1896, removal of rs., bowlders, etc., from the chan. of Westport H., and repair of break'r at Cedar Pt.; est., $8,000, **96,** 711, 806.

SURVEYS.

By Lt. Col. Anderson, 1827, **71,** 801.
By Maj. Houston, 1867, **67,** 451; **70,** 74, 444.
By H. N. Babcock, 1870, **71,** 802; **72,** 84.
By H. N. Babcock, 1872, **73,** 1021, 1022.
Bench marks described, **73,** 1023.
Au. act Aug. 2, 1882; made, 1883, by Maj. McFarland, **84,** 675.
Ex. of Saugatuck R. au. act Sept. 19, 1890; made, 1891, by Col. Houston, **91,** 840.
Ex. Westport H. au. act July 13, 1892; made by Col. Houston (**R.** fav.), **93,** 990.
Sur. Westport H. au. act Aug. 17, 1894; made by Maj. Adams, 1895 (**R.** fav. for limited imp.; see Projects), **96,** 806.
Maps. **94,** 670.

[1] Sur.—**R.,** Feb. 27, 1827; est., $6,128.65. (H. D. 482, 55th, 2d.)
[2] Removing obstr. in R.

D-80 NORWALK HARBOR, CONN.[1]

APPROPRIATIONS.

1829,	$80, act Mar. 3 (sur.).
1872,	10,000, **72,** 84.
1873,	10,000, **73,** 92.
1874,	10,000, **74,** 103.
1875,	7,000, **75,** 105.
1878	6,000, **78,** 54.
1879,	10,000, **79,** 59.
1880,	5,000, **80,** 466.
1881,	5,000, **81,** 610.
1882,	5,000, **82,** 623.
1884,	5,000, **84,** 654.
1886,	3,000, **86,** 651.
1888,	[2] 3,000, **88,** 564.
1890,	4,000, **90,** 645.
1894,	15,000, **95,** 806.
1896,	10,000, **96,** 715.
1899,	2,000, **99,** 1179.
1902,	*13,833, **03,** 852.
1904,	*7,000, **05,** 897.
1905,	4,000, **05,** 897.
1907,	63,500, **07,** 975.
1910,	4,000, **10,** 1171.
Total,	202,413 (incl. misc., $203,422.08, **12,** 1456).

COMMERCE.

C. advantages of Norwalk, **72,** 902.
Business of South Norwalk requires chan. of greater dimensions, **84,** 655.
Description of, **93,** 992.
For 1911, 206,248 t.; decrease of 11.9% from C. of 1910; rates lowered, **12,** 169, 1456.

CONTRACTS.

1872. G. H. Ferris, dr. 35,175 c. y., 24½¢, **72,** 901; **73,** 1025.
1873. E. R. Seward, dr. 19,895 c. y., 45¢, **73,** 1026; **74,** ii, 269.
1874. E. R. Seward, dr. 36,715 c. y., 23¢, **75,** ii, 262; **76,** 231; contract extended, **76,** 231.
1875. H. N. & A. J. Beardsley, dr. 44,444 c. y., 13½¢, **75,** ii, 263; **76,** 231.
1878. J. M. Seward, dr. 26,080 c. y., 40¢ and 14¢, **79,** 363.
1879. H. N. & A. J. Beardsley, dr., 10¢, 11¢, and 38¢ c. y., **80,** 467.
1880. H. N. & A. J. Beardsley, dr., 12¢ and 14¢ c. y., **81,** 611.
1881. F. Pidgeon, jr., dr., 17¢ c. y., **82,** 623.
1882. J. McDermott, dr., 18¢ c. y., **83,** 524.
1885. H. N. Beardsley, dr., 9¾¢ c. y., **85,** 657.
1886. A. J. Beardsley & Son, dr., 11½¢ c. y., **87,** 618.
1889. A. J. Beardsley & Son, dr., 11¢ and 15¢, c. y., **89,** 708.
1891. G. B. Beardsley, dr., 14.6¢ c. y., **91,** 787,
1894. A. J. Beardsley, dr. 83,916 c. y., 14.3¢ c. y., **95,** 806.
1896. G. B. Beardsley, dr., 8½¢ c. y. ($5,950) **97,** 964.
1899. Newburgh Dredging Co., dr., 19¢ c. y. ($1,999.94), **99,** 1179.
1902. John P. Randerson, dr., 16¢ c. y.; removing bowlders, $10 t., **03,** 853.
1905. John P. Randerson, dr. about 8,000 c. y., 18¢ and 25¢ c. y., **06,** 937.
1907. John P. Randerson, dr. 132,914 c. y., 14¢ c. y., s. m.; International Contracting Co., dr. about 141,000 c. y., 16¢ and 30¢ c. y., and removing r., $10 c. y., **08,** 1022.

ENGINEERS.

Chief of Engineers. R., 71, 87; **72,** 84; **73,** 92; **74,** 102; **75,** 105; **76,** 53; **77,** 48; **78,** 54; **79,** 59; **80,** 80; **81,** 95; **82,** 96; **83,** 91; **84,** 97; **85,** 87; **86,** 88; **87,** 50; **88,** 51; **89,** 64; **90,** 57; **91,** 71; **92,** 75; **93,** 82, 91; **95,** 83, 95; **96,** 79, 103; **97,** 98; **98,** 104, 111; **99,** 117; **00,** 133; **01,** 191; **02,** 137; **03,** 118; **04,** 102; **05,** 109; **06,** 109; **07,** 111, 118; **08,** 115; **09,** 117; **10,** 131, 138; **11,** 140; **12,** 166.

In charge:
Maj. G. K. Warren, 1871–75. **R., 72,** 900; **73,** 1025; **74,** ii, 268.
Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 262; **76,** 231; **77,** 219; **78,** 408; **79,** 363; **80,** 465; **81,** 609; **82,** 622.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 523; **84,** 654; **85,** 656.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 649; **87,** 616; (Col.) **88,** 562; **89,** 705; **90,** 643; **91,** 786; **92,** 692.
Lt. Col. Robert, 1893–95. **R., 93,** 948, 991; (Col.) **95,** 804.
Maj. H. M. Adams, 1896. **R., 96,** 713, 813.
Maj. S. S. Leach, 1897–1901. **R., 97,** 963; **98,** 966, 989; **99,** 1178; **00,** 1344; **01,** 1181.
Maj. C. F. Powell, 1902–05. **R., 02,** 940; **03,** 849; (Lt. Col.) **04,** 988; **05,** 894.
Maj. H. Taylor, 1906–10. **R., 06,** 935; **07,** 975; **08,** 1020; (Lt. Col.) **09,** 1046; **10,** 1171.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1243; **12,** 1456.

Assistants:
J. H. Dager. **R., 72,** 902.
L. S. Chase, **72,** 903.
W. W. Starr, jr. **R., 73,** 1026; **74,** ii, 269; **75,** ii, 264.

LEGISLATION.

Incorporation of the Norwalk H. Imp. Co. by the General Assembly of Connecticut, **72,** 904.

OPERATIONS.

1872–73. 35,175 c. y. dr., **73,** 1025.
1873–74. 19,895 c. y. dr., **74,** ii, 269.
1874–75. 20,730 c. y. dr., **75,** ii, 264.
1875–76. 60,429 c. y. dr., **76,** 231.
1878–79. 26,080 c. y. dr., **79,** 364.
1879–80. 45,519 c. y. dr., **80,** 466.
1880–81. 38,083 c. y. dr., **81,** 609.
1881–82. 26,159 c. y. dr., **82,** 622.
1882–83. 25,003 c. y. mud and shells dr., **83,** 523.
1884–85. 15,464 c. y. dr. from w. side of chan., **85,** 656.
1885–86. 34,824 c. y. dr., **86,** 650.
1886–87. 20,427 c. y. dr. from chan. above RR. br., **87,** 617.
1888–89. 122,332 c. y. dr. from chan., **89,** 706.
1889–90. 95,591 c. y. dr., **90,** 644.
1891–92. 28,000 c. y. dr., **92,** 693.
1896–97. 165,720 c. y. dr., **97,** 963.
1899–00. 10,500 c. y. dr., **00,** 1344.
1902–03. 78,492 c. y. dr., and 1¼ t. bowlder removed, **03,** 849.
1904–05. 35,234 c. y. dr., and 4.644 c. y. r. removed, **05,** 894.
1905–06. 18,505 c. y. dr., and 9.44 c. y. bowlders removed; proj. completed, **06,** 935.
1907–08. 206,656 c. y., s. m., dr., **08,** 1021.
1908–09. 80,032 c. y. dr., and 159,034 c. y. r. removed; proj. completed, **09,** 1046.
1909–10. 21,392 c. y. ordinary material, 3 piles, and 2.31 c. y. r. removed. Of this amount, 15,462 c. y. were from E. Norwalk Chan., 4,323 c. y. and 3 piles from 10′ chan. in vicinity of S. Norwalk, and 1,607 c. y. and 2 bowlders from 8′ chan. near Norwalk, **10,** 1171.

PHYSICAL CHARACTERISTICS.

Character of R. bed, **72,** 901, 902.
Tides, **72,** 902.
Situation and surroundings of Norwalk H., **85,** 656.
Description of the H., **88,** 562.
Description of, **93,** 992; (S. Norwalk) **98,** 990.
A narrow tidal estuary extending about 3 m. n. from Long Isld. Sound to Norwalk, **96,** 813.
Filling along sides of chans. running through tidal mud flats bare at l. w., **10,** 1171.

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*Allotment.
[1] Sur.—**R.,** May 10, 1830; est., $15,668.95. (H. D. 482, 55th, 2d.)
[2] Part of an app. of $28,000, of which $25,000 was required to be expended on chan. to Wilson's Pt., **92,** 694.

PRIVATE WORK.

Description of, **96,** 813.

PROJECTS.

By Maj. Warren, dr. and the removal of bowlders to give chan. 6′ x 100′; est., $35,000, **72,** 902.

By Maj. Barlow, additional dr., $30,000, **76,** 231.

In 1881 proj. modified to admit of d. of 8′ below S. Norwalk, **81,** 609. 1872 to 1886, incl., $76,000 app., when, in 1886, it was est. that $7,000 would be required to complete proj., **86,** 650.

By Col. Houston, 1888, dr. the lower chan. up to Wilsons Pt. to 15′ x 300′; est., $52,900, **89,** 64, 707. In consequence of the large amount of dr. done by private and corporate enterprise the cost of this proj. reduced to an est. of $4,000 for completion in 1889, **89,** 707.

By Col. Robert, removing shoal at Ferrys Pt., and, should funds permit, w. the bend near Keysers Isld., **95,** 805.

By Col. Robert, 1894, modification by Maj. Adams in 1896, for dr. away Ferry Pt. shoal on the w. side of the chan., between the RR. dock and Jennings Wharf, to 6′ m. l. w.; the 2 bends at the H. entrance to 10′ m. l. w.; and for w. to 150′ and d. to 10′ at m. l. w., the chan. up to S. Norwalk; est., $77,000, and $2,000 for mainten. an., **96,** 714, 814.

In 1897 Maj. Leach est. $18,960 to extend imp. up to S. Norwalk H., with an an. cost of $2,500 for mainten., **98,** 991.

Lt. Col. Powell est. for completion of proj. $4,000, and for mainten. $7,000, **04,** 988.

Au. act Mar. 2, 1907, for restoration of the 10′ x 150′ chan. to S. Norwalk, thence 8′ x 100′ to Norwalk, thence 6′ x 75′ to docks at E. Norwalk; est., $63,500, and $8,000 an. mainten., **07,** 111.

Reex. recom., **12,** 169.

SURVEYS.

By J. H. Dager, 1871. **R., 72,** 902.

Norwalk R., **82,** 622.

Ex. au. act July 13, 1892; made by Col. Houston (**R.** fav.), **93,** 991.

Sur. au. act Aug. 17, 1894; made by Maj. Adams, 1895 (see Projects), **96,** 813.

Sur. of S. Norwalk H. au. act June 3, 1896; made, 1897, by Maj. Leach (**R.** fav.; see Projects), **98,** 989.

Pre. ex. and sur. au. act Mar. 3, 1905. **R.** by Maj. Taylor, Dec. 16, 1905, and Oct. 23, 1906, with view to securing chan. 8′ d. to head of navigation, 6′ d. to E. Norwalk, and w. main chan. at S. Norwalk to afford turning basin,[1] **07,** 118.

Pre. ex. and sur. au. act Mar. 3, 1909, of Norwalk outer H., with view to removal of shoal near to and w. of White Rock, and straightening main chan. between Gregorys Pt. and S. Norwalk. **R.** by Lt. Col. Taylor, May 28, and Aug. 30, 1909; est., $3,500,[2] **10,** 138.

Cong. docs., etc., relating to exs., surs., plans, etc., **04,** 103; **12,** 167.

Maps.[1 2] Map, **79,** 364; **85,** 656; **89,** 708.

D-82 WILSON POINT HARBOR, CONN.

APPROPRIATIONS.

1888,	[3] $25,000,	**91,** 72.
1890,	30,000,	**91,** 791
Total,	55,000	

CONTRACTS.

1891. A. J. Beardsley & Son, dr., 8½¢ c. y., **91,** 790.

ENGINEERS.

Chief of Engineers. R., 91, 72; **92,** 76; **93,** 82; **94,** 73; **95,** 83.

In charge:

Col. D. C. Houston, 1890–92. **R., 91,** 789; **92,** 695.

Lt. Col. H. M. Robert, 1893–95. **R., 93,** 950; **94,** 671; (Col.) **95,** 807.

OPERATIONS.

1890-91. 124,974 c. y. dr., **91,** 790.

18991-92. 54,026 c. y. dr., **92,** 696.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 789.

PROJECTS.

By Col. Houston, 1888, excavation of chan. 15′ x 300′ up the H. to vicinity of the RR. wharves; est., $52,900, **91,** 790.

SURVEYS.

Maps. **93,** 950.

D-85 FIVEMILE RIVER HARBOR, CONN.

APPROPRIATIONS.

1888,	$5,000,	**88,** 52.
1890,	5,000,	**90,** 647.
1892,	5,000,	**92,** 698.
1894,	2,500,	**95,** 810.
1896,	2,500,	**96,** 717.
1899,	2,500,	**99,** 1181.
1902,	*4,500,	**03,** 852.
1905,	*6,000,	**05,** 897.
1907,	*7,000,	**07,** 979.
1910,	5,000,	**10,** 1174.
1911,	2,000,	**11,** 1247.
Total,	47,000 (less $209.56 trans. to Stamford H, and incl. sales, $46,895.55, **12,** 1459).	

COMMERCE.

Present and prospective, **87,** 640, 641.

Description of, **96,** 716.

Mostly oysters, 1911, 12,000± t., **10,** 133; **12,** 168.

CONTRACTS.

1889. R. Parrott, dr. plant, $8.50 per hour, **89,** 711.

1891. G. B. Beardsley, dr., 14.6¢ c. y., **91,** 794.

1892. A. J. Beardsley, dr., 14½¢ c. y., s. m., $2,900, **93,** 953.

1894. J. H. Fenner, dr. 14,815 c. y., at 13½¢ c. y., **95,** 811.

1896. G. B. Beardsley, dr., 8½¢ c. y., $1,700, **97,** 966; 4,453 c. y., at 14.3¢ c. y., **98,** 968.

1899. Hartford Dredging Co., dr., 18¢ c. y., $2,399.94, **99,** 1181.

1902. John P. Randerson, dr., 14¢ c. y.; removing bowlders, $10 t., **03,** 853.

1905. Atlantic Dredging Co., dr., 18¢ c. y., **06,** 938.

1907. John P. Randerson, dr., 15⅞¢ c. y., s. m., **08,** 1027.

1911. J. P. Randerson, dr. 40,000 c. y., at 18¢ c. y., s. m., **11,** 1249.

ENGINEERS.

Chief of Engineers. R., 87, 56; **88,** 52; **89,** 65; **90,** 58; **91,** 72; **92,** 76; **93,** 83; **94,** 74; **95,** 84; **96,** 80; **97,** 100; **98,** 105; **99,** 119; **00,** 135; **01,** 192; **02,** 137; **03,** 119; **04,** 103; **05,** 110; **06,** 110; **07,** 112; **08,** 116; **09,** 118; **10,** 133; **11,** 142; **12,** 168.

* Allotment.

[1] H. D. 262, 59th, 2d.

[2] H. D. 396, 61st, 2d.

[3] Part of an app. of $28,000 for Norwalk H.

In charge:
Lt. Col. D. C. Houston, 1886–92. **R., 87,** 639; (Col.) **89,** 710; **90,** 646; **91,** 792; **92,** 697.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 952; **94,** 674; (Col.) **95,** 809.
Maj. H. M. Adams, 1896. **R., 96,** 716.
Maj. S. S. Leach, 1897–1901. **R., 97,** 965; **98,** 968; **99,** 1180; **00,** 1346; **01,** 1183.
Maj. Chas. F. Powell, 1902–05. **R., 02,** 941; **03,** 850; (L. Col.) **04,** 988; **05,** 895.
Maj. Harry Taylor, 1906–10. **R., 06,** 935; **07,** 976; **08,** 1023; (Lt. Col.) **09,** 1048; **10,** 1172.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1244; **12,** 1457.

OPERATIONS.
1888–89. 10,976 c. y. dr., **89,** 711.
1889–90. 11,962 c. y. dr., **90,** 647.
1891–92. 30,000 c. y. dr., **92,** 698.
1893–94. 30,000 c. y. dr., **94,** 675.
1895–96. 15,014 c. y. dr., **96,** 717.
1897–98. 21,956 c. y. dr., **98,** 968.
1902–03. 28,928 c. y. dr., **03,** 850.
1905–06. 29,943 c. y. dr., **06,** 935.
1907–08. 38,284 c. y. dr., **08,** 1023.
1911–12. 31,549 c. y. dr., restoring chan. to proj. dimensions, **12,** 1457.

PHYSICAL CHARACTERISTICS.
Description of, **87,** 639; **89,** 710; **93,** 952; **01,** 192.
Rapid shoaling due to high banks and soft mud, **08,** 1023.
Max. drafts, tides, etc., **12,** 169.
3 m. to sw. of Norwalk H., and 16 m. sw. from Bridgeport H., **12,** 168.

PRIVATE WORK.
Chan. on e. side of R. dr. to the docks by the dock owners, **94,** 675.

PROJECTS.
By Col. Houston, 1886, d. the H. and approaches by a chan. 8′ x 100′ x 6,000′ m. l. w.; est. first cost, $25,000 with $1,000 for an. mainten., **87,** 641; **89,** 710; **92,** 697. Est. by Col. Robert, 1894, $45,000, **94,** 676.
Maj. Taylor, 1908, reported cost of extension necessary to complete proj. out of proportion to probable benefits, **08,** 1023; reex. desirable, **12,** 169.

SURVEYS.
Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Houston, **87,** 639.
Minor, **02,** 941; **03,** 850; **08,** 1023.
Maps. **94,** 676.

D-88 DARIEN HARBOR, CONN.

ENGINEERS.
Chief of Engineers. **R., 12,** 178.
In charge. Capt. A. E. Waldron, 1911–12, **12,** 137.

SURVEY.
Ex. and sur. au. act June 25, 1910, **12,** 178.

D-90 TOMAC HARBOR, CONN.

ENGINEERS.
Chief of Engineers. **R., 04,** 106, 993, 995.
Boards. BERH., **R., 04,** 996.
In charge. Lt. Col. C. F. Powell, 1902–05. **R., 04,** 993.

PHYSICAL CHARACTERISTICS.
H. a small cove at about middle point of n. shore of Stamford H., Conn., **04,** 995.

SURVEY.
Pre. ex. au. act June 13, 1902. **R.** by Lt. Col. Powell, Jan. 15, 1903[1] (unfav.), **04,** 106, 107, 993.

D-91 COVE HARBOR, CONN.

ENGINEERS.
Chief of Engineers. **R., 12,** 178.
In charge. Capt. A. E. Waldron, 1911–12, **12,** 137.

SURVEY.
Ex. and sur. au. act June 25, 1910, **12,** 178.

D-92 STAMFORD HARBOR, CONN.[2]

APPROPRIATIONS.

1829,	$100.00 (sur.), act Mar. 2.	
1886,	10,000.00,	**87,** 619.
1888,	5,000.00,	**88,** 564.
1890,	5,000.00,	**90,** 649.
1892,	15,000.00,	**92,** 700.
1894,	10,000.00,	**95,** 815.
1896,	10,000.00,	**96,** 720.
1899,	6,000.00,	**99,** 1183.
1902,	10,111.00,	**03,** 852.
1905,	18,000.00,	**05,** 897.
1907,	58,000.00,	**07,** 979.
1910	32,000.00; [3] 209.56; [4] 939.97	**10,** 1175.
Total,	180,360.53 (less $100 app. of 1829, and incl. misc., $180,680.98, **12,** 1459).	

COMMERCE.
Imp. enables SS. between Stamford and New York to run on time, and has greatly facilitated water traffic, **11,** 143.
1911, 260,469 t., **12,** 171.

CONTRACTS.
1887. Hartford Dredging Co., dr., 15.7¢ c. y., **87,** 619.
1889. Hartford Dredging Co., dr., 18¢ c. y., **89,** 714.
1893. Hartford Dredging Co., dr., 16½¢ c. y., s. m. ($8,650), **93,** 957.
1895. Hartford Dredging Co., dr., 12¢ and 9.6¢ c. y.; bowlder removal, $8.90 per hour ($73.70), **95,** 815.
1896. F. H. Brainard, dr., 9½¢ c. y. ($7,600), **97,** 968.
1899. Hartford Dredging Co., dr., 16¢ c. y. ($6,000); reduced to 8¢ c. y. for failure to commence work at given time, **99,** 1183.
1902. J. P. Randerson, dr., 25¢ c. y., and removing bowlders, $10 t., **03,** 853.
1905. J. P. Randerson, dr. about 50,000 c. y., 24.5¢ c. y., **06,** 937.
1907. Maritime Dredging Co., dr. about 187,500 c. y., 25¢ c. y., s. m., and removing r., at $10 c. y., **08,** 1027.
1911. Maritime Dredging Co., dr. 60,080 c. y., 25¢ c. y., s. m., **11,** 1249.

[1] H. D. 228, 58th, 2d.
[2] Sur.—**R.,** May 10, 1830; est., $13,250. (H. D. 482, 55th, 2d.)
[3] Trans. from Fivemile R.
[4] Trans. from Greenwich H.

ENGINEERS.

Chief of Engineers. **R., 84,** 99; **87,** 51; **88,** 52; **89,** 65; **90,** 58, 332; **91,** 72, 80; **92,** 77; **93,** 83; **94,** 75; **95,** 84; **96,** 81; **97,** 100; **98,** 107; **99,** 120; **00,** 137; **01,** 194; **02,** 138; **03,** 120; **04,** 103; **05,** 110; **06,** 111; **07,** 113; **08,** 117; **09,** 119; **10,** 133; **11,** 143; **12,** 169.

Boards. Convened, New York, Nov. 30, 1889, by S. O. No. 78, to report upon the location of H. lines in Stamford H., **90,** 332, 682, 683. Description of H. lines as recom. for approv., **90,** 686. (Col. Houston, Col. Gillespie, and Capt. Casey.)

In charge:
Maj. J. W. Barlow. **R., 84,** 670, 672.
Lt. Col. D. C. Houston, 1886–92. **R., 87,** 61; (Col.) **88,** 564; **89,** 712; **90,** 648; **91,** 795, 848, 849; **92,** 699.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 954; **94,** 677; (Col.) **95,** 811.
Maj. H. M. Adams, 1896. **R., 96,** 718.
Maj. S. S. Leach, 1897–1901. **R., 97,** 967; **98,** 970; **99,** 1182; **00,** 1347; **01,** 1184.
Maj. C. F. Powell, 1902–05. **R., 02,** 943; **03,** 850; (Lt. Col.) **04,** 988; **05,** 895.
Maj. H. Taylor, 1906–10. **R., 06,** 936; **07,** 976; **08,** 1024; (Lt. Col.) **09,** 1048; **10,** 1173.
Capt. A. E. Waldron, 1911–12. **R., 11,** 1244; **12,** 1457.

Assistant. H. N. Babcock. **R., 84,** 672; **91,** 850.

OPERATIONS.

1886-87. 23,616 c. y. dr. from chan. between B. and the br., **87,** 619.
1887-88. 30,846 c. y. dr. from chan., **88,** 565.
1888-89. 22,504 c. y. dr., **89,** 713.
1890-91. 15,550 c. y. dr., **91,** 796.
1891-92. 7,365 c. y. dr., **92,** 700.
1892-93. 20,877 c. y., s. m., dr., **93,** 956.
1893-94. 40,629 c. y. dr. and 612 c. y., s. m., r. removed, **94,** 679.
1894-95. Some large bowlders removed, **95,** 813.
1895-96. 65,745 c. y. dr. and 170 t. bowlders removed, **96,** 720.
1896-97. 7,034 c. y. dr., **97,** 967.
1897-98. 72,133 c. y. dr., **98,** 970.
1899-1900. 7,524 c. y. dr. from W. Branch and 21,714 c. y. dr. from E. Branch, **00,** 1347.
1902-03. 31,706 c. y. dr. and 72.34 t. bowlders removed, **03,** 850.
1905-06. 55,584 c. y. dr. and 189.42 c. y. bowlders removed, **06,** 936.
1907-08. 81,242 c. y. dr. for mainten., 81,095 c. y. for new work, and 1,105.61 c. y. r. removed, **08,** 1024.
1908-09. 9,991 c. y. dr. and 304.45 c. y. r. removed, **09,** 1048.
1910-11. 58,339 c. y. ordinary material and 238 c. y. r. removed from w. chan. and 18 c. y. r. from e. chan., **11,** 1244.
1911-12. 1,741 c. y. ordinary material and 23 c. y. r. removed, completing proj., **12,** 1457.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 564; **93,** 954.
To aid navigation, range lights have been estab., **11,** 1245.

PLANS. (See Projects.)

By Col. Houston, 1891, increasing chan. d. to 7′ m. l. w. and w. it to 150′; also further dr. in the H. basin; est., $95,000, **91,** 849.

PROJECTS. (See Plans.)

By Maj. Barlow, 1883, dr. chan. 5′ d. m. l. w., extending from the Oliver St. Br. across Mill Creek to the B.; est., $20,000, **84,** 672; **87,** 619.
By Lt. Col. Robert, 1892, enlarging chan. of the W. Branch to 150′ x 7′, and dr. out a basin between the H. lines at the head of the branch; also for dr. chan. in the E. Branch 9′ x 100′ x 8,535′, and 9′ x 50′ x 1,200′; est., $123,500, **93,** 955.
By Lt. Col. Powell, completing proj.; est., $75,000, and $3,000 an. mainten., **04,** 988.

SURVEYS.

Au. act Aug. 2, 1882; made by Maj. Barlow, **84,** 670.
Au. act Sept. 19, 1890; made, 1891, by Col. Houston, **91,** 849.
Minor ex. of r. obstr., **02,** 943.
Maps. **87,** 618; **93,** 956; **08,** 1024.

D-95 COSCOB HARBOR AND MIAMUS RIVER, CONN.

APPROPRIATIONS.

1892,	$7,000, **93,** 959.
1894,	4,000, **95,** 817.
1896,	8,000, **96,** 723.
Total,	19,000

COMMERCE.

Decreasing since 1897, **03,** 854.
Tonnage: 1897, 61,500 t.; 1903, 7,000 t., **04,** 106.

CONTRACTS.

1892. A. J. Beardsley, dr., 15¢ c. y., s. m. ($4,500), **93,** 959.
1895. G. B. Beardsley, dr., 9.3¢ c. y., s. m. ($3,000), **95,** 818.
1896. W. H. Taylor, jr., dr., 9¢ c. y. ($5,400), **97,** 969.
1899. Hartford Dredging Co., dr., 18¢ c. y. ($1,170), **99,** 1185.

ENGINEERS.

Chief of Engineers. **R., 91,** 81; **93,** 84; **94,** 75; **95,** 85, 95; **96,** 82; **97,** 102; **98,** 108; **99,** 122; **00,** 138; **01,** 195; **02,** 139; **03,** 122; **04,** 106; **08** 121.

In charge:
Col. D. C. Houston. **R., 91,** 852, 855.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 958; **94,** 681; (Col.) **95,** 816, 881.
Maj. H. M. Adams, 1896. **R., 96,** 721.
Maj. S. S. Leach, 1897–1901. **R., 97,** 969; **98,** 972; **99,** 1184; **00,** 1349; **01,** 1186.
Maj. Chas. F. Powell, 1902–05. **R., 02,** 945; **03,** 854; (Lt. Col.) **04,** 992.
Maj. H. Taylor, 1908, **08,** 97.

OPERATIONS.

1892-93. 23,953 c. y., s. m., dr., **93,** 959.
1893-94. 16,047 c. y. dr., **94,** 682.
1895-96. About 33,000 c. y. dr., **96,** 722.
1896-97. 1,876 c. y. dr., **97,** 969.
1897-98. 58,124 c. y. dr., **98,** 972.
1898-00. 6,500 c. y. dr., **99,** 1184; **00,** 1349.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 854; **93,** 958; **96,** 721.

PROJECTS.

By Col. Houston, 1891, dr. chan. 8′ x 150′; est., $36,000, **91,** 855; **93,** 958. Modified, 1896, to provide for a chan. 6′ x 150′ to the R.R. br. and thence 100′ w. to Miamus, with a turning-basin, inner H. entrance, 7′ x 300′; total est., $54,000, **96,** 722.
Maj. Powell, 1903, reported waterway not worthy of further imp., **03,** 854.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Col. Houston, **91,** 855.

Sur. with view to a turning-basin au. act Aug. 17, 1894; made by Col. Robert, 1895 (see Projects), **95,** 881.

R. by BE. reviewing **Rs.** of Col. Houston, 1891; Col. Robert, 1895. In opinion of board amt. necessary to imp. is disproportionate to benefits that would result. Would cost over $32,000, with $7,000 for an. mainten.[1]

Of H. au. act Mar. 2, 1907, to obtain sufficient d. to drawbr; Maj. Taylor's **R.** unfav.,[2] **08,** 121.

Maps. **93,** 958; **95,** 882.

D-97 GREENWICH HARBOR, CONN.

APPROPRIATIONS.

1896,	$6,000,	**96,** 725.
1902,	*6,667,	**03,** 853.
1904,	*2,100,	**05,** 897.
1905,	7,000,	**05,** 897.
1907,	1,000,	**07,** 979.
1910,	2,000,	**10,** 1175.
1911,	1,500,	**11,** 1248.
Total,	26,267 (less $1,670.47 transferred to other Hs., and incl. sales, $24,836.79, **12,** 1460).	

COMMERCE.

Description of, **95,** 862.

Effect on freight rates not known, **10,** 136.

In 1911, 101,500 t., **12,** 173.

Work done enables steamers to enter H. with 9′ draft without waiting for tide, **12,** 173.

Reduction in freight rates, **12,** 173.

CONTRACTS.

1896. Hartford Dredging Co., dr., 10.7¢ c. y. ($3,745), **97,** 971.

1902. John P. Randerson, dr., 14¢ c. y.; removing bowlders, $10 t., **03,** 853.

1905. Atlantic Dredging Co., dr., 17¢ c. y., **06,** 938.

1911. John P. Randerson, dr. approx. 15,000 c. y., 18¢ c. y., s. m., **11,** 1249.

ENGINEERS.

Chief of Engineers. R., 95, 93; **96,** 82; **97,** 103; **98,** 110; **99,** 123; **00,** 140; **01,** 197; **02,** 139; **03,** 121; **04,** 105; **05,** 112; **06,** 113; **07,** 115; **08,** 119; **09,** 122; **10,** 135, 137; **11,** 145; **12,** 172.

In charge:

Col. H. M. Robert, 1895, **95,** 860.

Maj. H. M. Adams, 1896. **R., 96,** 724.

Maj. S. S. Leach, 1897–1901. **R., 97,** 970; **98,** 974; **99,** 1186; **00,** 1350; **01,** 1187.

Maj. Chas. F. Powell, 1902–05. **R., 02,** 944; **03,** 851; (Lt. Col.) **04,** 989; **05,** 896.

Maj. Harry Taylor, 1906–10. **R., 06,** 936; **07,** 978; **08,** 1025; (Lt. Col.) **09,** 1049; **10,** 1173.

Capt. A. E. Waldron, 1911–12. **R., 11,** 1246; **12,** 1458.

Assistant. Lt. W. E. Craighill. **R., 95,** 861.

OPERATIONS.

1897–98. 35,000 c. y. dr., **98,** 974.
1902–03. 43,573 c. y. dr., **03,** 851.
1904–05. 11,000 c. y. dr., **05,** 896.
1905–06. 27,632 c. y. dr.; proj. completed, **06,** 936.
1910–11. 1,710 c. y. dr., **11,** 1247.
1911–12. 8,702 c. y. dr., **12,** 1458.

PHYSICAL CHARACTERISTICS.

Description of, **03,** 121.

Shallow B. 2 m. e. from N. Y. State line, and 5± m. sw. from Stamford H.

L. of imp. chan., 1 m. Navigation impossible beyond, **12,** 173.

PROJECTS.

By Lt. Col. Robert, 1894, dr. chan. 9′ x 90′ x 5,000′ to the lower docks and 6′ above them, the upper end to be slightly changed to form a turning-basin; est., $20,000, **96,** 724; **97,** 970.

By Lt. Col. Taylor, w. 9′ chan. to 100′ and extending same to head of H.; est., $8,000,[3] **10,** 137.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Robert (**R.** fav.), **95,** 860.

Sur. made, 1896, by Maj. Leach, **97,** 970.

Minor, **02,** 944; **09,** 1049.

Ex. au. act Mar. 3, 1909; made, 1909, by Lt. Col. Taylor,[3] **10,** 137.

Map.[3] **98,** 974.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 173.

D-98 BYRAM HARBOR, CONN.

COMMERCE.

Average yearly business, $96,000, **95,** 864.

ENGINEERS.

Chief of Engineers. R., 95, 93.

In charge. Lt. Col. H. M. Robert, 1894–95. **R., 95,** 863.

Assistant. Lt. W. E. Craighill. **R., 95,** 863.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 863.

SURVEY.

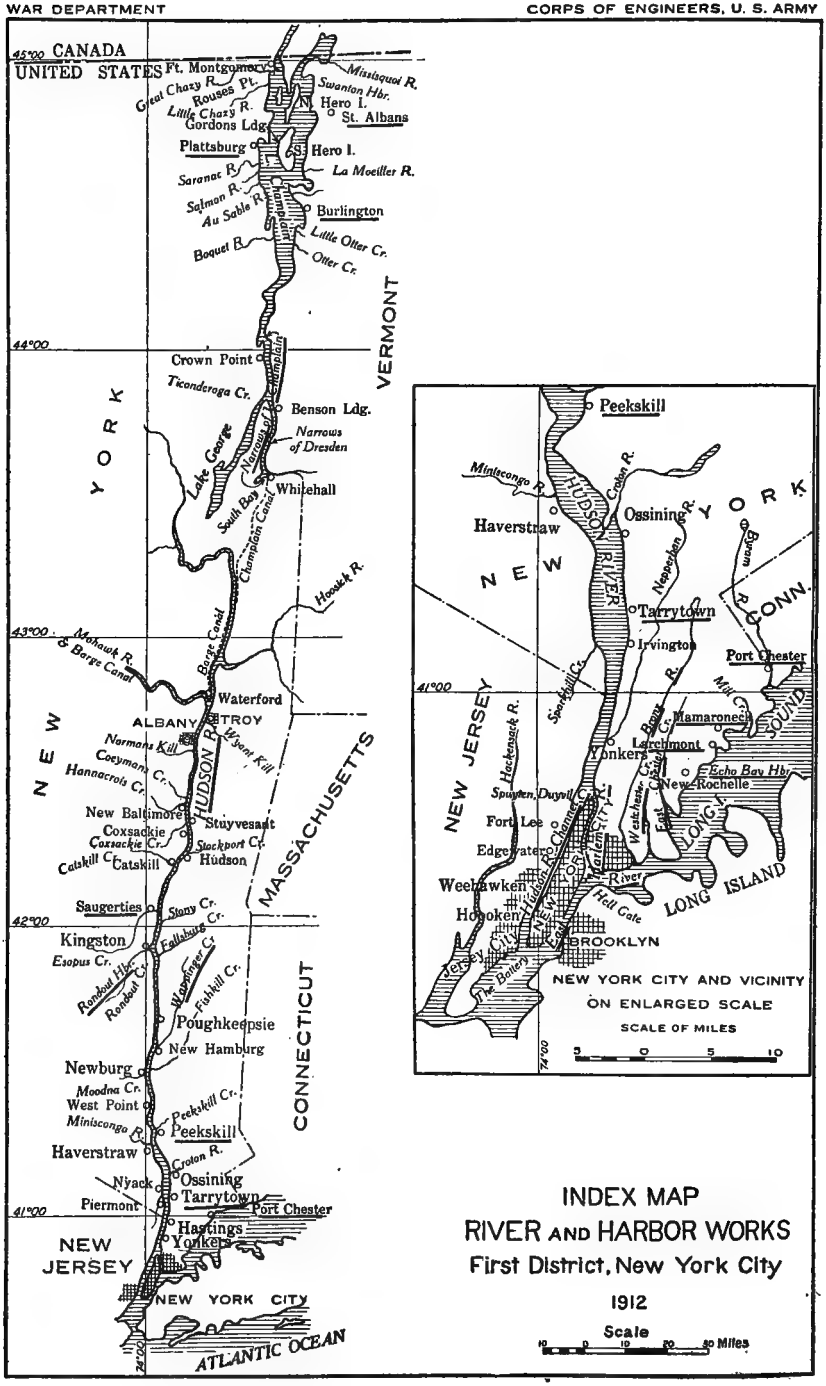
Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert, 1894. **R.** (fav.), **95,** 863.

*Allotment. [1] Comm. Doc. 49, 61st, 2d. [2] H. D. 74, 60th, 1st. [3] H. D. 309, 61st, 2d.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

E.—NEW YORK, N. Y., DISTRICT No. 1.

WAR DEPARTMENT CORPS OF ENGINEERS, U. S. ARMY



E.—NEW YORK, N. Y., DISTRICT NO. 1.

In charge of U. S. Engineer Office,
Army Bldg., New York City.

NOTE.—The following list begins at the Conn.-N. Y. line on Long Island Sound, follows the coast line in a southerly direction, and proceeds up the Hudson River and back to vicinity of Jersey City, N. J. The Lake Champlain group of waterways is given last.

E 1 Port Chester H., N. Y.*
E 2 Byram R., N. Y. (1)
E 3 The Gut., N. Y. (1)
E 4 Milton H., N. Y.*
E 5 Mill Cr., N. Y. (4)
E 6 Mamaroneck H., N. Y.*
E 7 Otter Cr., N. Y. (6)
E 8 Strong or Guion Cr., N. Y. (6)
E 9 Mamaroneck R., N. Y. (6)
E 10 Larchmont H., N. Y.*
E 11 Echo Bay H., N. Y.*
E 12 Premium R., N. Y. (11)
E 13 New Rochelle H., N. Y.*
E 14 Pelham B., N. Y.*
E 15 East Chester Cr., N. Y. (Hutchinson R.).*
E 16 Wier Cr., N. Y.*
E 17 East R., N. Y. (*, and N. Y. H.)
E 18 Baxter Cr., N. Y. (17)
E 19 Westchester Cr., N. Y. (17)
E 20 Pugsleys Cr., N. Y. (17)
E 21 Bronx R., N. Y. (17)
E 22 Harlem Kills, N. Y. (17)
E 23 Little Hell Gate, N. Y. (17)
E 24 Harlem R., N. Y. (17)
E 25 Mott Haven Canal, N. Y. (24)
E 26 Spuyten Duyvil Cr., N. Y. (24)
E 27 Sherman Cr., N. Y. (24)
E 28 Hudson R., N. Y. (N. Y. H., See Dis. F.)
E 29 Nepperhan R., N. Y. (28)
E 30 Tarrytown H., N. Y. (28)
E 31 Pocantico R., N. Y. (28)
E 32 Croton R., N. Y. (28)
E 33 Furnace Brook, N. Y. (28)
E 34 Lake Meahayh, N. Y. (28)
E 35 Peekskill H., N. Y. (28)
E 36 Peekskill Cr., N. Y. (28)
E 37 Indian Brook, N. Y. (28)
E 38 Foundry Brook, N. Y. (28)
E 39 Fishkill Cr., N. Y. (28)
E 40 Wappinger Cr., N. Y. (28)
E 41 Casper Cr., N. Y. (28)
E 42 Fallkill Cr., N. Y. (28)
E 43 Crum Elbo Cr., N. Y. (28)
E 44 Fallsburg Cr., N. Y. (28)
E 45 Stony Cr., N. Y. (28)
E 46 Livingstone Cr., N. Y. (28)
E 47 Roeliff Jansen Kill, N. Y. (28)
E 48 Stockport Cr., N. Y. (28)
E 49 Schodack Cr., N. Y. (28)
E 50 Papscanee Cr., N. Y. (28)
E 51 Wynants Kill, N. Y. (28)
E 52 Poesten Kill, N. Y. (28)
E 53 Waterford (head of navigation), N. Y. (28)
E 54 Mohawk R., N. Y. (28)
(E 54a Erie Canal, N. Y.)
E 55 Normans Kill (Isld. Cr.), N. Y. (28)
E 56 Coeyman Cr., N. Y. (28)
E 57 Hannacrois Cr., N. Y. (28)
E 58 Coxsackie Cr., N. Y. (28)
E 59 Murderers Cr., N. Y. (28)
E 60 Corlears Kill, N. Y. (28)
E 61 Catskill Cr., N. Y. (28)
E 62 Saw Kill, N. Y. (28)
E 63 Esopus Cr., N. Y. (28)
E 64 Rondout Cr., N. Y. (28)
E 65 Quassaic Cr., N. Y. (28)
E 66 Moodna Cr., N. Y. (28)
E 67 Popolopen Cr., N. Y. (28)
E 68 Doodletown Bight, N. Y. (28)
E 69 Cedar Pond Brook, N. Y. (28)
E 70 Minisceongo R., N. Y. (28)
E 71 Sparkill Cr., N. Y. (28)
E 72 Morris Canal, N. Y. (28)

E 73 LAKE CHAMPLAIN WATERS.
E 74 Lake Champlain, N. Y.
Commencing on the west shore at the international boundary and proceeding south to Wood Cr., thence going north on the east shore.
E 75 Kings B., N. Y. (74)
E 76 Great Chazy (Champlain) R., N. Y. (75)
E 77 Rouses Pt., N. Y. (74)
E 78 Little Chazy R., N. Y. (74)
E 79 Chan. bet. N. & S. Hero Islds. (74)
E 80 N. Hero H., Vt. (74)
E 81 Gordons Ldg., Vt. (74)
E 82 Adams Ldg., Vt. (74)
E 83 Little Monte or French B., N. Y. (74)
E 84 Monte B., N. Y. (74)
E 85 Treadwells B., N. Y. (74)
E 86 Plattsburg H., N. Y. (74)
E 87 Cumberland B., N. Y. (86)
E 88 Saranac R., N. Y. (87)
E 89 Au Sable R., N. Y. (74)
E 90 Port Kent H., N. Y. (74)
E 91 Corlears B., N. Y. (74)
E 92 Willsborough B., N. Y. (74)

* Long Island Sound.

E 93 Bouquet R., N. Y. (74)
E 94 Whalous B., N. Y. (74)
E 95 North West B., N. Y. (74)
E 96 Coles B., N. Y. (74)
E 97 Port Henry H., N. Y. (74)
E 98 Bulwagga B., N. Y. (74)
E 99 Ticonderoga R., N. Y. (74)
E 100 Lake George, N. Y. (99)
E 101 Port Marshall H., N. Y. (74)
E 102 South B., N. Y. (74)
E 103 Wood Cr., N. Y.* (74)
E 104 East Cr., Vt. (74)
E 105 The Narrows, N. Y. and Vt. (74)
E 106 East Cr., Vt. (74)
E 107 Hospital Cr., Vt. (74)
E 108 Button B., Vt. (74)
E 109 Fields B., Vt. (74)
E 110 Otter Cr., Vt. (109)
E 111 Kingsland B., Vt. (74)
E 112 Little Otter Cr., Vt. (74)
E 113 McNeils B., Vt. (74)
E 114 Shelburne B., Vt. (74)
E 115 Burlington H., Vt. (74)
E 116 Winooski R., Vt. (74)
E 117 Malletts B., Vt. (74)
E 118 La Moeille R., Vt. (74)
E 119 Keelers B., Vt. (74)
E 120 St. Albans B., Vt. (74)
E 121 Lapans B., Vt. (74)
E 122 Maquam B., Vt. (74)
E 123 Swanton H., Vt. (122)
E 124 Missisquoi B., Vt. (74)
E 125 Charcoal Cr., Vt. (124)
E 126 Missisquoi R., Vt. (124)
E 127 Goose B., Vt. (124)
E 128 Rock R., Vt. (124)
E 129 Chapmans B., Vt. (124)
E 130 Ransoms B., Vt. (124)

E-1 PORT CHESTER HARBOR, N. Y.

APPROPRIATIONS.

1872, $12,000, **72**, 80; **73**, 85; **77**, 250.
1882, 15,000, **80**,669.
1888, 5,000, **88**,568.
1890, 5,000, **90**,651.
1892, 5,000, **92**,703.
1894, 5,000, **95**,821.
1896, 5,000, **96**,727.
1899, 25,000, **99**,1209.
1902, 5,000, **02**,994.
1905, 3,000, **05**,954.
1907, 6,500, **07**, 984.
1910, 45,000, **10**, 1180
1912, 10,000, **12**, 1460.

Total, 146,500 (incl. misc., $146,509.20, **12**, 1466).

COMMERCE.

Trade and C., Port Chester, **84**, 712.
Description of, **95**, 867.
1904, 255,000 t., **05**, 955; 1911, 287,280 t., **12**, 1467.
Reduction in rates, **05**, 114.

CONTRACTS.

1872. R. W. Warren, blasting and removal of r., **73**, 940.
1884. R. Parrot, dr., 16¢ c. y., **85**, 659.
1886. M. K. Pidgeon, furnishing dr. and appliances, $83 per day, **86**, 652.
1889. S. & E. S. Belden, riprap r., $1.19 t., **89**, 717.
1890. J. A. Bouker, gneiss riprap, $1.07 t., **91**, 799.
1892. H. Toomey, riprap st., $1.24 t. ($3,100), **93**, 962.
1894. A. E. Smith, dr. 37,777 c. y., 10¢ and 15¢ c. y., **95**, 821. Annulled, **96**, 726.
1895. J. Voorhis, st. for break'r, 99¢ t. for 500 t. ($495), **95**, 821.
1896. Newburgh Dredging Co., dr. 32,727 c. y., 13¾¢ c. y., s. m., **97**, 1086.
1899. Newburgh Dredging Co., dr., 18¢ c. y.; r. removal, $8.80 c. y. ($19,760), **00**, 1380.
1903. John & Joseph McSpirit, dr., **03**, 858.
1905. John & Joseph McSpirit, dr. 12,000 c. y., 25¢ c. y., s. m., **06**, 942.
1909. John & Joseph McSpirit, dr. and removal of bowlders ($4,500), **10**, 1180.
1911. J. H. Gerrish, excavating and disposing of 4,500 c. y. ledge r., prices given ($34,327), **11**, 1254.

ENGINEERS.

Chief of Engineers. R., 71, 83; **72**, 80; **73**, 85; **74**, 95; **75**, 102; **76**, 56; **77**, 51; **78**, 56; **79**, 63; **80**, 84; **81**, 104; **82**, 105; **83**, 99; **84**, 105; **85**, 87; **86**, 88; **87**, 51; **88**, 53; **89**, 66; **90**, 59; **91**, 73; **92**, 77; **93**, 84; **94**, 76; **95**, 86, 94; **96**, 83; **97**, 116; **98**, 112; **99**, 125, 142; **00**, 142, 159; **01**, 198; **02**, 152; **03**, 123; **04**, 107; **05**, 113; **06**, 115; **07**, 118; **08**, 122, 155; **09**, 124, 158; **10**, 138; **11**, 149; **12**, 178.

In charge:

Lt. Col. J. Newton, 1872–84. **R., 72**, 806, 809; **73**, 940; **74**, ii, 167; **75**, ii, 222; **76**, 249; **78**, 417; **79**, 390; (Col.) **80**, 514; **81**, 647; **82**, 668; **83**, 548.
Capt. J. Mercur (temporary charge 1877), 1884–85. **R., 77**, 250; **84**, 712.
Lt. Col. W. McFarland, 1885–86. **R., 85**, 658.
Lt. Col. D. C. Houston, 1886–92. **R., 86**, 651; **87**, 620; (Col.) **88**, 567; **89**, 715; **90**, 650; **91**, 797; **92**, 702.
Lt. Col. H. M. Robert, 1893–95. **R., 93**, 960; **94**, 683; (Col.) **95**, 818, 865.
Maj. H. M. Adams, 1896–98. **R., 96**, 725; **97**, 1084; **98**, 993.
Lt. Col. W. H. H. Benyaurd, 1899–1900. **R., 99**, 1208; **00**, 1423.
Maj. E. H. Ruffner, 1900. **R., 00**, 1378, 1422.
Col. S. M. Mansfield, 1901. **R., 01**, 1198.
Capt. Spencer Cosby, 1902. **R., 02**, 994.
Col. Amos Stickney, 1903. **R., 03**, 858.
Capt. E. H. Schulz, 1904. **R., 04**, 1010.
Col. W. R. Livermore, 1905–06. **R., 05**, 954; **06**, 941.
Col. J. G. D. Knight, 1907–08. **R., 07**, 983; **08**, 1031.
Col. W. M. Black, 1909–. **R., 09**, 1055; **10**, 1179; **11**, 1253; **12**, 1465.

ESTIMATES. (See Projects.)

By Lt. Col. Newton, 1871, removing "Sunken Rock," $58,980; "Salt Rock," $12,652; break'r, 400' long, $25,000; total, $96,632, **72**, 809; **74**, ii, 167; **75**, ii, 222; **77**, 250.

OBSTRUCTIONS. (See Physical characteristics.)

OPERATIONS.

1872-73. "Salt Rock," comprising about 247 c. y., removed under contract, for $7,300, **73**, 85, 940.
1884-85. 55,062 c. y. dr., **85**, 659.
1885-86. 3,096 c. y. dr., **86**, 625.
1886-87. 9,232 c. y. dr., **87**, 621.
1888-89. 3,698 t. st. placed in break'r, **89**, 716.
1890-91. 3,369 t. riprap delivered in break'r, **91**, 798.
1892-93. 1,985 t. st. placed in break'r, **93**, 961.
1893-94. 1,529 t. deposited, **94**, 684.
1894-95. 713 t. st. placed at end of break'r, and 2,057 c. y. dr., **95**, 820.

*Now made into the new Champlain Canal.

1895-96. 28,905 c. y. dr. by U. S. plant, **96,** 726.
1896-97. 32,500 c. y. dr., **97,** 1085.
1899-00. 50,076 c. y. dr., **00,** 1378.
1900-01. 27,924 c. y. mud, etc., dr., and 713.58 c. y. r. removed, **01,** 1198.
1902-03. 9,385 c. y. dr., **03,** 858.
1903-04. 14,415 c. y. dr., **04,** 1010.
1905-06. 11,952 c. y. material dr. for mainten., restoring chan. to proj. w. and d.; proj. about 92% completed, **06,** 942.
1909-10. 17,347 c. y. mud excavated, restoring upper reaches of chan. to proj. d. and w., **10,** 1180.
1910-11. 576.67 c. y. ledge r., and 11,419.3 c. y. material other than r. excavated and disposed of under contract, **11,** 1254.
1911-12. 2,441.12 c. y. ledge r. removed under contract, completing work Oct. 12, 1911, **12,** 1466.

PHYSICAL CHARACTERISTICS.

Described, **72,** 809; **88,** 567; **93,** 960; **95,** 865.

H. consists of the tidal part of Byram R. and B. at its mouth opening into Long Isld. Sound. For 1½ m. it forms the boundary line between N. Y. and Conn. A highway br. without a draw crosses it a little more than a m. above its mouth, and a short distance above this is an old tide dam. Several rs. form obstructions above the entrance, **95,** 865; **07,** 118.

PROJECTS.

By Lt. Col. Newton, 1871, removing "Sunken Rock" to 11′ and "Salt Rock" to 9′; also constructing 400 l. f. of break'r at Byram Pt.; est., $96,632; **72,** 809; **86,** 652. Modified in 1884 to provide for dr. chan. 3′ x 60′–100′, B. to the vicinity of the wharves, **84,** 712; **86,** 88, 652; **87,** 621. Est. reduced to $59,000 in 1890, or to $25,000 for completion, **90,** 651.

Congress, 1899, au. enlarging chan. below and up to Town Dock to 12′ x 70′, and from Town Dock to the SS. dock to 9′ x 60′, and app. $25,000 for this work, **99,** 1208.

Act June 25, 1910, au. chan. 150′ x 12′, Long Isld. Sound to s. pt. of Fox Isld.; thence 100′ x 10′–900′ below fixed br. at Mill St., incl. turning-basin, thence 175′–100′ x 3′–100′ below fixed br.;[1] est., $188,000, and $2,500 an., **10,** 139; **12,** 179.

SURVEYS.

Under direction of Lt. Col. Newton, by J. H. Striedinger, 1871. **R., 72,** 809.

Of Byram R., by Lt. Col. Newton, 1877–78, **78,** 417.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert in that year (**R.** fav.), **95,** 865.

Ex. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (**R.** unfav.), **00,** 1423.

Minor, **08,** 1031.

Pre. ex. and sur. au. act Mar. 2, 1907, with view to 15′ with corresponding w. **R.** by Col. Knight; est., $188,000,[1] **08,** 155; **09,** 158.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 179.

Maps.[1] **85,** 658; **89,** 716.

E-4 MILTON HARBOR, N. Y.

COMMERCE.

Unimportant, **95,** 868.

ENGINEERS.

Chief of Engineers. R., 95, 94; **12,** 224.

In charge:
Lt. Col. H. M. Robert, 1895. **R., 95,** 867.
Col. W. M. Black, **12,** 178.
Assistant. Lt. W. E. Craighill. **R., 95,** 868.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 868.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert, 1894 (**R.** fav.), **95,** 868.

Pre. ex. au. act June 25, 1910, of Milton H. and Mill Creek, N. Y. (**R.** to come), **12,** 224.

E-5 MILL CREEK, N. Y.

ENGINEERS.

Chief of Engineers. R., 12, 224.
In charge. Col. W. M. Black, **12,** 178.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, of Milton H. and Mill Creek, N. Y., **12,** 224.

E-6 MAMARONECK HARBOR, N. Y.

APPROPRIATIONS.

1882,	$15,000,	**83,** 525.
1896,	10,000,	**96,** 729.
1899,	7,000,	**99,** 1211.
1902,	6,000,	**02,** 995.
1905,	2,000,	**05,** 955.
1912,	29,500,	**12,** 1467.
Total,	69,500	

COMMERCE.

Growth prevented by crooked, narrow, and shallow chan., **10,** 141.

Rates not affected, but transportation facilitated, **10,** 141.

In 1911, 26,000± t., **12,** 182.

CONTRACTS.

1883. J. H. Fenner, r. removed, $13,000, **83,** 525.

1896. J. McSpirit & Sons, dr. 46,154 c. y., 19.5¢ c. y., s. m., **97,** 1088.

1899. J. McSpirit & Sons, dr., 27½¢ c. y. ($6,050); excavation, $8 c. y., **99,** 1212.

1903. John & Joseph McSpirit, dr., 27¢ c. y., **03,** 859.

1905. John & Joseph McSpirit, dr., 27¢ c. y., s. m., **06,** 943.

ENGINEERS.

Chief of Engineers. R., 81, 97; **82,** 97; **83,** 92; **84,** 98; **85,** 89; **86,** 90; **87,** 52; **88,** 53; **96,** 83; **97,** 117; **98,** 113; **99,** 126; **00,** 143; **01,** 199; **02,** 152; **03,** 124; **04,** 108; **05,** 114; **06,** 116; **07,** 119; **08,** 123; **09,** 126; **10,** 140, 181; **11,** 151, 184; **12,** 180.

In charge:
Maj. J. W. Barlow, 1881–83. **R., 82,** 637.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 524; **84,** 655; **85,** 662.
Lt. Col. D. C. Houston, 1886–87. **R., 86,** 657; **87,** 622; (Col.) **88,** 569.
Maj. H. M. Adams, 1896–98. **R., 96,** 728; **97,** 1087; **98,** 995.
Lt. Col. W. H. Benyaurd, 1899. **R., 99,** 1210.

[1] H. D. 1165, 60th, 2d.

Maj. E. H. Ruffner, 1900. **R., 00,** 1381.
Col. S. M. Mansfield, 1901. **R., 01,** 1200.
Capt. Spencer Cosby, 1902. **R., 02,** 995.
Col. Amos Stickney, 1903. **R., 03,** 859.
Capt. E. H. Schulz, 1904. **R., 04,** 1011.
Col. W. R. Livermore, 1905–06. **R., 05,** 955; **06,** 943.
Col. J. G. D. Knight, 1907–08. **R., 07,** 985; **08,** 1033.
Col. W. M. Black, 1909–. **R., 09,** 1057; **10,** 1181; **11,** 1255; **12,** 1467.

Assistant. H. N. Babcock. **R., 82,** 638.

OPERATIONS.

1883-84. R. removed under Fenner's contract completed, **84,** 655.
1896-97. 47,800 c. y. dr., **97,** 1087.
1899-00. 22,677 c. y. dr., and ½ c. y. r. removed, **00,** 1382.
1903-04. 18,500 c. y. dr., **04,** 1011.
1905-06. 7,300 c. y. dr., **06,** 943.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 569.
On n. shore of Long Isld. Sound, 5± m. w. of Conn. line, and 27± m. from Battery, N. Y. C. An inlet opening into a shallow B. about 1 sq. m. in area, Mamaroneck R., rising 6 m. n. of H., empties into it at a fixed br. in town of Mamaroneck. Proj. section covers head of B. to br. 1 m. Rocks at mouth, **12,** 180.
Chan. deterioration, **12,** 181.

PROJECTS.

By Maj. Barlow, 1882, Mamaroneck H., removal of Round Rock and part of Nells Rock to 4′, and of Bush Rock, Inner and Outer Steamboat Rocks, and Little Nanhook to 7′, together with excavation of a 7′ chan. 100′ w. to the old SS. wharf, and continuing it with 4′ d. and 80′ w. to new SS. wharf; est., $43,000, **82,** 639, 640; **86,** 658; **87,** 623; **88,** 569.
By Lt. Col. Benyaurd, 1899, to omit the removal of the 3 outer rs., and to extend the chan., 7′ x 100′ w., from the old SS. wharf to the upper wharves, without changing the est. cost for completion, **99,** 1211.
Mainten., **03,** 859.
Act July 25, 1912, modified existing proj. so as to provide straighter chan. 7′ x 80′, provided right of way and disposition for dr. material on Harbor Isld. be furn. free,[1] turning-basin, cross section, and extension of main chan. up to Boston Post Road Br.; est., $29,500, and $1,000 an. mainten., **12,** 181.

SURVEYS.

Au. act Mar. 3, 1881; made, 1882, by Maj. Barlow, **82,** 637.
Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Col. Black, 1909 and 1910; est. (see Projects),[1] **10,** 181; **11,** 184.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 181.
Maps.[1] **83,** 524; **86,** 656; **03,** 859.

E-10 LARCHMONT HARBOR, N. Y.

APPROPRIATIONS.

1890,	$5,000,	**91,** 801.
1899,	50,000,	**99,** 1214.
1902,	10,000,	**02,** 997.
1905,	5,000,	**05,** 957.
1907,	14,000,	**07,** 986.
Total,	84,000	(incl. $6,905.04 received on bond of failing contractor and 65¢ from sales, $90,905.69, **12,** 1468).

COMMERCE.

Small; H. used chiefly by yachts, and coasting and fishing vessels for night anchorage, and as H. of refuge; local rates not affected, **10,** 142; yacht fleet valued at $2,000,000, **12,** 183.

CONTRACTS.

1890. J. A. Bouker, delivering and placing riprap gneiss, $1.07 t., **91,** 801.
1899. C. Frey, jr., riprap st., 43¢ s. t. ($44,720), **99,** 1215. J. P. Conkling, riprap st., 51¢ s. t. ($45,000). (Suit recom. for nonfulfillment of contracts.) **00,** 1385, 1386.
1900. Anderson-Murphy Co., riprap st., 54¢ s. t. ($45,000), **00,** 1386.
1902. P. Sanford Ross (Inc.), removing about 2300 t. riprap, $2 t., and about 336 c. y. ledge r., $11 c. y., **03,** 861.
1906. E. S. Belden & Son, repairing and enlarging break'r, riprap, $1.23 t., **06,** 944.
1910. Maritime Dredging Co., dr., $8,418, **11,** 1256

ENGINEERS.

Chief of Engineers. **R., 89,** 71; **90,** 63; **91,** 74; **92,** 78; **93,** 85; **94,** 77; **95,** 87; **99,** 127; **00,** 144; **01,** 199; **02,** 153; **03,** 125; **04,** 109; **05,** 115; **06,** 117; **07,** 120; **08,** 124; **09,** 127; **10,** 141; **11,** 153; **12,** 182, 224.

In charge:
Col. D. C. Houston, 1888–92. **R., 90,** 675; **91,** 800; **92,** 704.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 963; **94,** 686; (Col.) **95,** 821.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1213.
Maj. H. E. Ruffner, 1900. **R., 00,** 1383.
Col. S. M. Mansfield, 1901. **R., 01,** 1201.
Capt. Spencer Cosby, 1902. **R., 02,** 996.
Col. Amos Stickney, 1903. **R., 03,** 860.
Capt. E. H. Schulz, 1904. **R., 04,** 1012.
Col. W. R. Livermore, 1905–06. **R., 05,** 956; **06,** 944.
Col. J. G. D. Knight, 1907–08. **R., 07,** 986; **08,** 1034.
Col. W. M. Black, 1909–. **R., 09,** 1057; **10,** 1182; **11,** 1256; **12,** 1468.

Assistants:
Lt. J. C. Sanford. **R., 90,** 676.
H. N. Babcock. **R., 90,** 678.

OPERATIONS.

1890-91. 4,119 t. riprap delivered, completing 74 l. f. of Umbrella break'r, and 61 l. f. Huron break'r, **91,** 801.
1899-00. 3,362 t. st. delivered, **00,** 1385.
1900-01. 68,984 t. st. deposited in break'r, completing 820′, **01,** 1201.
1901-02. 13,967 t. st. deposited in break'r, **02,** 996.
1902-03. 2,008 t. r. removed from Huron break'r and about one-quarter of Huron Rock drilled, **03,** 860.
1903-04. 414 c. y. r. removed from Huron Rock and adjoining ledge, **04,** 1012.
1905-06. 3,368 t. st. placed in break'r, **06,** 944.
1910-11. 1,122 c. y. r. and other material dr., **11,** 1256.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 676; **91,** 800; **10,** 141, 142.
H. on nw. shore of Long Isld. Sound, 7 m. w. of Conn. State line, and 25 m. e. of Battery, N. Y. C., **12,** 182.

PLANS.

By Col. Houston, 1889, imp. of the anchorage area of the H. by removal of Umbrella and Huron Rocks to 15′ m. l. w.; est., $126,600, **90,** 678.

[1] H. D. 1087, 61st, 3d.

PROJECTS.

By Col. Houston, 1890, imp. of H. entrance by constr. of 2 riprap break'rs from Umbrella and Huron Rocks to the nearest shore; est., $105,000, **91,** 800; **92,** 705.

By Maj. Adams, 1899, building a break'r s. 1,440′ from the 6′ curve off Long Beach Pt., and for the removal of Huron Rock at entrance to 14′ m. l. w.; est., $108,000, **99,** 1214; **12,** 182.

Proj. extended act 1907 to include removal of ledges adjoining Huron Rock; no increase in est., **07,** 120.

SURVEY.

Au. act Aug. 11, 1888; made, 1899, by Col. Houston, **90,** 677.

Minor, **03,** 860.

Of Huron Rock, **04,** 1012.

Pre. to completing proj., **10,** 1182.

Pre. ex. au. act June 25, 1910; **R.,** Col. Black, Apr. 19, 1911 (unfav.),[1] **12,** 224.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 183.

Maps.[1] **03,** 860.

E-11 ECHO BAY HARBOR, N. Y.

APPROPRIATIONS.

1878,	$10,000,	**78,** 57, 420.
1879,	3,000,	**79,** 63, 390.
1880,	3,000,	**80,** 514.
1881,	3,000,	**81,** 642.
1882,	3,000,	**82,** 665.
1902,	17,000,	**03,** 862.
1907,	12,000,	**07,** 987.
1910,	22,110,	**10,** 1183.
Total,	73,110	(incl. sales, etc., $73,113.75, **12,** 1469).

COMMERCE.

C. materially benefited and rates probably reduced by imp., **10,** 143; **12,** 186.

In 1903, 129,400 t.; 1908, 245,000 t.; 1911, 388,000 t., **12,** 185.

CONTRACTS.

1878. Thomas A. Scott, removing Start Rock to 7′, $6,125, **79,** 390.

1881. G. W. Townsend, removing part of Sheepshead Reef, **82,** 666.

1902. P. Sanford Ross (Inc.), removing r., $10 c. y., **03,** 862.

1907. John & Joseph McSpirit, removing r., $8 c. y., **07,** 987.

1908. John & Joseph McSpirit, removing r., $8.50 c. y., **09,** 1059.

1910. P. S. Ross, dr. ledge r., bowlders, and other material; prices listed, **11,** 1257.

ENGINEERS.

Chief of Engineers. R., 76, 57; **78,** 57; **79,** 63; **80,** 83; **81,** 103; **82,** 104; **83,** 97; **84,** 104; **85,** 89; **86,** 89; **87,** 52; **88,** 54; **89,** 66; **90,** 60; **91,** 74; **92,** 79; **02,** 146; **03,** 126; **04,** 110; **05,** 116; **06,** 118, 141; **07,** 121, 148; **08,** 125, 155; **09,** 127, 158; **10,** 142; **11,** 154; **12,** 184.

In charge:

Lt. Col. John Newton, 1875–84. **R., 76,** 263; **78,** 420; **79,** 389; (Col.) **80,** 513; **81,** 641; **82,** 664; **83,** 545.

Capt. J. Mercur, 1884–85. **R., 84,** 708.

Lt. Col. W. McFarland, 1885–86. **R., 85,** 661.

Lt. Col. D. C. Houston, 1886–92. **R., 86,** 655; **87,** 624; (Col.) **88,** 570; **89,** 717; **90,** 652; **91,** 804; **92,** 706.

Col. Amos Stickney, 1903. **R., 03,** 861.

Capt. Edward H. Schulz, 1904. **R., 04,** 1014.

Col. W. R. Livermore, 1905–06. **R., 05,** 957; **06,** 945.

Col. John G. D. Knight, 1907–08. **R., 07,** 987; **08,** 1035.

Col. W. M. Black, 1909–. **R., 09,** 1058; **10,** 1182; **11,** 1257; **12,** 1468.

Assistants:

J. H. Striedinger, **76,** 265.

A. Doerflinger, **76,** 264.

ESTIMATES. (See Projects.)

By Lt. Col. Newton, removal of Sheep's Head Reef and Start Rock, $38,955.38. Removal of Long Rock, $37,696 additional, **76,** 265. To complete existing proj., $25,955.38, **79,** 390.

OPERATIONS.

1878–79. Removal of Start Rock, **79,** 63, 389.

1879–80. Removal of Start Rock completed, **80,** 513.

1881–82. 506 c. y. r. removed from Sheepshead Reef, **82,** 665.

1889–90. 9,122 c. y. dr. from the chan. by hired labor, **90,** 653.

1902–03. 351 c. y. r. removed, **03,** 861.

1903–04. 292 c. y., p. m., r. removed, proj. completed, **04,** 1014.

1906–07. 870 c. y. ledge r. removed from Long Rock, **07,** 987.

1908–09. 725 c. y. ledge r. removed from Long Rock, **09,** 1058.

1910–11. 17,898 c. y. other material than ledge r. and bowlders, 12.92 c. y. bowlders, and 1,006.16 c. y. ledge r. excavated, completing proj., **11,** 1257.

PHYSICAL CHARACTERISTICS.

Description of, **76,** 263–265; **88,** 570.

Chan. 10′ x 1,300′ and 100′ bottom w., with turning-basin of same d., resulted through dr.; water level, tides, etc., **11,** 154.

On n. shore Long Isld. Sound, 24 m. from N. Y. C.; shallow inlet about ⅝ m. l.

PROJECTS. (See Estimates.)

By Col. Newton, 1875, removal of Sheepshead Reef and Start Rock to d. 9′ and 6′, resp. Modified, 1878, removal of Start Rock to 7′ d.; est., $38,955.38, **76,** 264; **86,** 656; **87,** 624; **92,** 706.

Completing orig. plan by removing remainder of Sheepshead Reef and Start Rock; est., $17,000; au. 1902, **02,** 146.

By Col. Livermore, 1906, removing Long Rock to d. of 6′; est., $17,871.70,[2] **06,** 945; **07,** 148. Sec. War, 1906, au. expend. available funds ($8,453.32) in removal of Long Rock, act Mar. 2, 1907, app. $10,000 to complete proj., **07,** 122.

By Col. Knight, chan. 10′ x 100′, Echo B. to city wharf at Beaufort Pt., and a turning-basin; est., $22,110,[3] **09,** 158; au. act June 25, 1910, **10,** 142.

SURVEYS.

By J. H. Striedinger and A. Doerflinger, under direction of Lt. Col. Newton. **R., 76,** 263.

Minor sur., **80,** 513; **00,** 1424; **03,** 862.

Ex. Long Rock au. act Mar. 3, 1905; made, 1906, by Col. Livermore,[2] **07,** 148.

Of Long Rock, **08,** 1035.

Au. act Mar. 2, 1907; made, 1907–08, by Col. Knight,[3] **09,** 158.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 185.

Maps.[3] **80,** 513; **03,** 862.

[1] H. D. 418, 62d. 2d. [2] H. D. 182, 59th, 2d. [3] H. D. 1118, 60th, 2d.

E-11(a) ECHO BAY AND NEW ROCHELLE HARBOR, N. Y.

COMMERCE.

Consists of about 1 SS. a day from New York, **95,** 870.

Description of, **00,** 1425, 1426, 1428, 1430.

ENGINEERS.

Chief of Engineers. R., 95, 94; **99,** 142; **1900,** 160.

In charge:

Lt. Col. H. M. Robert, 1894–95. **R., 95,** 868.

Lt. Col. W. H. H. Benyaurd, 1900. **R., 00,** 1423, 1429.

Assistant. Lt. W. E. Craighill. **R., 95,** 869.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 869; **00,** 1424, 1425.

PROJECTS.

Lt. Col. Benyaurd est., 1899, $17,000 to complete work suspended at Echo B., New Rochelle, 1893; the removal of Start Rock to 7′, and of Sheepshead Reef to 9′, **00,** 1429.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Robert (**R.** unfav.), **95,** 868.

Ex. and sur. New Rochelle H. (**R.** unfav.) and Echo B., N. Y. (limited imp. recom.), au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd, **00,** 1424, 1429.

Sec. War, 1899, called for plan and est. of imp. Echo B. Submitted, 1899, by Lt. Col. Benyaurd (see Projects), **00,** 1429.

E-13 NEW ROCHELLE HARBOR, N. Y.

APPROPRIATIONS.[1]

1881,	$20,000,	**81,** 644.
1882,	15,000,	**82,** 667.
Total,	35,000	

CONTRACT.

1881. E. R. Seward, dr. and r. removal, **82,** 668.

ENGINEERS.

Chief of Engineers. R., 80, 85; **81,** 108; **82,** 105; **83,** 98; **84,** 105; **85,** 88; **86,** 89; **87,** 53; **88,** 54; **89,** 67; **90,** 60; **91,** 74.

In charge:

Col. J. Newton, 1880–84. **R., 81,** 643; **82,** 666; **83,** 547.

Capt. J. Mercur, 1884–85. **R., 84,** 709.

Lt. Col. W. McFarland, 1885–86. **R., 85,** 661.

Lt. Col. D. C. Houston, 1886–91. **R., 86,** 654; **87,** 626; (Col.) **88,** 572; **89,** 719; **90,** 654; **91,** 804.

Assistants:

R. H. Talcot. **R., 81,** 645.

Lt. G. McC. Derby. **R., 84,** 711.

OPERATIONS.

1881-82. Chan. 6′ x 100′ x 1,500′ l. dr. around Glen Isld., **82,** 666.

1883-84. Removal of Corning Rock to l. d. of 12′ at m. l. w. completed, **84,** 710.

1887-88. Steam drilling plant repaired, and 229 c. y. r. removed, **88,** 573.

1889-90. 40,700 c. y. dr. with hired labor, **90,** 655. Imp. practically completed save removal of Rock C., which is not considered necessary; no further work proposed, **90,** 656.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 572; **89,** 719.

PROJECTS.

By Col. Newton, 1881, excavation of a chan. 8′ x 100′ m. l. w. around s. end of Glen Isld.; also formation of approaches to Glen Isld. and Flat Isld. by removal of Corning Rock to 12′ and Rock C to a depth of 9′ l. w., and removal of part of a reef at the entrance to the dr. chan.; est., $40,825, **81,** 645; **86,** 654; **87,** 626.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Col. Newton, **81,** 644.

Ex. of chan. dr. in 1881, **86,** 654.

Maps. **82,** 654, 666.

E-15 EAST CHESTER CREEK (Hutchinson River), N. Y.

APPROPRIATIONS.

1873,	$25,000,	**73,** 85, 939; **74,** 95; **77,** 249.
1875,	12,000,	**75,** 102; **77,** 249.
1878,	10,000,	**78,** 56, 416.
1879,	3,500,	**79,** 63, 389.
1880,	3,500,	**80,** 513.
1886,	10,000,	**86,** 664.
1888,	5,000,	**88,** 576.
1894,	12,000,	**95,** 827.
1896,	10,000,	**96,** 732.
1902	*3,000,	**03,** 864.
	*10,000,	**04,** 1018.
1904,	*2,500,	**04,** 1018.
1905,	*3,000,	**05,** 961.
1907,	*6,000,	**07,** 990.
1910,	*24,000,	**10,** 1185.
1911,	10,000,	**11,** 1261.
1912,	10,000,	**12,** 1472.
Total,	159,500 (incl. sales, etc., $159,503.30, **12,** 1472).	

COMMERCE.

1896, no C. on the part of the stream mentioned by act 1896, **97,** 1175.

Amount and character, **04,** 1063.

No change in rates, but C. greatly increased, **10,** 146.

1903, 105,000 t.; 1908, 273,000 t.; 1911, 436,000 t., **12,** 190.

CONTRACTS.

1877. John Saterlee, dr., r. cutting, and building dikes, **77,** 249, 250.

1883. J. D. Flannery, dr., 27¢ c. y., **84,** 730.

1887. Frank Pidgeon Dredging Co., dr., 26. 9¢ c. y., **87,** 630.

1888. Hartford Dredging Co., dr., 45¢ c. y., **88,** 576.

1892. Mt. Vernon Suburban Land Co., dr., 22¢ c. y., p. m., **93,** 967.

1894. J. McSpirit, dr., 34¢ c. y., and 12¢ c. y., p. m. ($9,000), **95,** 828.

* Allotment.

[1] Act Aug. 11, 1888, reapp. remainder, $8,174.79 unused.

1897. J. McSpirit, dr., 41¢ c. y.; loose r. removal, $1.09 c. y., and solid r., $19 c. y., p. m. ($8,070), **97,** 1092.
1904. John & Joseph McSpirit, dr., 39¢ c. y., **05,** 961.
1907. Maritime Dredging Co., dr., 33½¢ c. y., **08,** 1037.
1911. John & Joseph McSpirit, dr. and r. removal; prices listed, **11,** 1261.

ENGINEERS.

Chief of Engineers. R., 71, 83; **73,** 85; **74,** 95; **75,** 102; **76,** 56; **77,** 50; **78,** 56; **79,** 63; **80,** 83; **81,** 102; **82,** 103; **83,** 102; **84,** 107; **85,** 98; **86,** 91; **87,** 53; **88,** 55; **89,** 67; **90,** 60; **91,** 75; **92,** 79; **93,** 86; **94,** 77; **95,** 87; **96,** 84; **97,** 118, 140; **98,** 113; **99,** 128; **00,** 145; **01,** 200; **02,** 155; **03,** 127; **04,** 111, 126, 1061; **05,** 118; **06,** 120; **07,** 123; **08,** 128; **09,** 130, 158; **10,** 145; **11,** 157; **12,** 188.

Boards. BERH. **R., 04,** 1064.

In charge:
Lt. Col. John Newton, 1872–83. **R., 72,** 812, 814; **73,** 939; **74,** ii, 166; **75,** ii, 221; **76,** 249; **78,** 416; **79,** 388; (Col.) **80,** 511; **81,** 640; **82,** 663.
Capt. James Mercur, in temporary charge, **77,** 223. **R., 77,** 249.
Lt. Col. G. L. Gillespie, 1883–86. **R., 83,** 563; **84,** 728; **85,** 738.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 663; **87,** 628; (Col.) **88,** 577; **89,** 721; **90,** 656; **91,** 806; **92,** 708.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 965; **94,** 688; (Col.) **95,** 823.
Maj. H. M. Adams, 1896–98. **R., 96,** 730; **97,** 1089, 1175; **98,** 997.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1215.
Maj. E. H. Ruffner, 1900. **R., 00,** 1387.
Col. S. M. Mansfield, 1901. **R., 01,** 1202.
Capt. Spencer Cosby, 1902. **R., 02,** 999.
Col. Amos Stickney, 1903. **R., 03,** 864; **04,** 1018.
Capt. Edward H. Schulz, 1904. **R., 04,** 1016.
Col. W. R. Livermore, 1905–06. **R., 05,** 960; **06,** 946.
Col. John G. D. Knight, 1907–08. **R., 07,** 989; **08,** 1037.
Col. W. M. Black, 1909–. **R., 09,** 1060; **10,** 1185; **11,** 1260; **12,** 1471.

Assistants:
Capt. J. Mercur, **78,** 416.
1st Lt. J. R. Slattery. **R., 04,** 1019.
Lt. R. D. Black, **11,** 149.

LEGISLATION.

Commissioners appointed by New York to condemn and purchase necessary land, **74,** 95, ii, 166.

OPERATIONS.

1872–76. Operations delayed owing to difficulties in obtaining the right of way across certain lands, **73,** 85, 939; **74,** 95; **75,** 102, ii, 221; **76,** 249.
1876–77. 906 c. y. r. removed; 5,936 c. y. mud, etc., dr., **77,** 249.
1877–78. 2,298 c. y. r. removed; 37,387 c. y. mud, etc., dr.; 1,235½ l. f. dike built, **78,** 416.
1878–79. 23,195 c. y. mud, etc., dr.; 85 st. removed, **79,** 63, 388.
1883–84. 18,236 c. y. dr., **84,** 729.
1886–87. Preparations for dr. in vicinity of Town Dock; history of operations, **87,** 629.
1887–88. 1,772 c. y. dr. near Town Dock, **88,** 575.
1888–89. 11,067 c. y. dr., **89,** 724.
1892–93. 27,700 c. y. dr., **93,** 967.
1894–95. 2,515 c. y., s. m., and 64,558 c. y., p. m., dr., and some st. removed, **95,** 826.
1895–96. 5,467 c. y., p. m., dr., **96,** 731.
1897–98. 12,960 c. y. dr., 1,843 c. y. loose r. removed, and 66½ c. y. r. removed, **98,** 997.
1899–00. 3,937 c. y. dr.; proj. completed, **00,** 1388.
1903–04. 5,600 c. y. dr., **04,** 1017.
1904–05. 28,846 c. y. dr., **05,** 960.
1907–08. 22,390 c. y. dr., **08,** 1037.
1910–11. 1,450 c. y. soft material dr.; 5 c. y. bowlders excavated, **11,** 1260.
1911–12. 1,239 c. y. ledge r., 24.38 c. y. bowlders, and 13,819.8 c. y. other material dr., **12,** 1471, 1472.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 812, 813; **88,** 574; **93,** 965; **97,** 1176; **04,** 1062.
Tidal stream with low, marshy banks on the n. shore of Long Isld. Sound and about 20 m. from the Battery, New York. Navigable for about 2½ m. from mouth, **97,** 1176.
Water depths, range of tides, etc., **12,** 189.

PLANS.

By Lt. Col. Newton, 1872, tidal reservoir, dr., diking, and revetting for 9′ chan. m. l. w.; est., $1,646,000. For 11′ chan. m. h. w.; est., $731,000. For slackwater navigation, affording 7′ draft, $300,000, **72,** 813.

PROJECTS. (See Plans.)

By Col. Newton, 1872, providing, by dr. and r. removal, chan. 9′ at h. w. from Pelhams Br. to a pt. 3,000′ above Lockwoods, 3 m., that part of chan. above Lockwoods to serve as a chan. and tidal basin. Modification, 1873, consisted of proposed timber dikes, 5,800′ l., to confine the chan.; est., $136,500, **72,** 815; **73,** 939; **77,** 249; **86,** 663.
In 1887 the est. raised to $221,100, **87,** 628.
In 1891, $55,000 est. as sufficient for completion of the imp. contemplated, **91,** 809; **92,** 708.
By Maj. Adams, 1896, dr. out shoals in the chan. and removing r. from below Lockwoods; and, should any money remain after completion of such work, extension of the chan. 9′ x 100′ m. h. w. toward head of t. w., provided the right of way for such extension could be obtained free; est., $27,000, **97,** 1091, 1177.
Col. Mansfield reported extension of chan. not advisable, but mainten. of chan. justified by C., **04,** 1063.
Col. Stickney est., 1903, $3,000 an. mainten. by dr., **04,** 1019.
By Col. Knight, chan. 5′, width varying from 150′–70′ from about 1,900′ below Pelham Highway Br. to about 300′ above Fulton Ave. Br.; est., $103,000, and $3,000 an. mainten.,[1] **09,** 158; au. act June 25, 1910, **10,** 145.

SURVEYS.

Under Lt. Col. Newton, **71,** 83, by J. H. Striedinger. **R., 72,** 812. Additional progress, **73,** 85.
Ex. chan. depths; made, 1882, by Col. Newton, **82,** 663.
Minor sur., **93,** 968.
Sur. for extension of imp. to head of t. w. au. act June 3, 1896; made by Maj. Adams, 1896 (**R.** unfav.), **97,** 1175.
Ex. au. act June 13, 1902; made, 1903, by Col. Mansfield,[2] **04,** 1061.
By Col. Stickney, 1903, **04,** 1018.
Au. act Mar. 2, 1907; made, 1907–08, by Col. Knight,[1] **09,** 158.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 189.
Maps. **86,** 664; **93,** 968; **04,** 1016.

[1] H. D. 1250, 60th, 2d.
[2] H. D. 186, 58th, 2d.

E-17 EAST RIVER, N. Y. (including Hell Gate, Battery, Diamond and Coenties Reefs).

APPROPRIATIONS.[1]

1852, [2] $20,000, **66,** iii, 29.
1868, *85,000, **68,** 66; **69,** 55, 388.
1869, [3] *178,200, **69,** 55; **70,** 435.
1870, [4] 250,000, **70,** 74, 435.
1871, [4] 250,000, **71,** 82; **77,** 230.
1872, [4] 225,000, **72,** 80; **77,** 230.
1873, [4] 225,000, **73,** 85; **77,** 230.
1874, [4 5] 225,000, **74,** 95; ii, 165.
1875, [4] 250,000, **75,** 101, ii, 203.
1876, [4] 250,000, **76,** 55; **78,** 413.
1878, [4] 350,000, **78,** 55, 413.
1879, [4] 250,000, **79,** 62, 376.
1880, 200,000, **80,** 499.
1881, 200,000, **81,** 624.
1882, 250,000, **82,** 649.
1884, 360,000, **84,** 692.
1886, 112,500, **86,** 678.
1888, 250,000, **88,** 606.
1890, 200,000, **90,** 719.
1892, 150,000, **92,** 805.
1894, 75,000, **95,** 934.
1896, 60,000, **96,** 858.
1899, 250,000, **99,** 1231.
1902, 100,000, **02,** 958.
1905, 200,000, **05,** 972.
1907, 250,000, **07,** 1000.
1910, 500,000, **10,** 1196.
1911, 200,000, **11,** 1265.
1912, 100,000, **12,** 1476.

Total, 6,015,700 (incl. sales, etc., $6,018,889.87, **12,** 1476).

COMMERCE.

Danger and difficulty in passing Hell Gate, **68,** 730, 731.

Amount of C. benefited by imp., **77,** 230.

1897 the increasing draft and t. of vessels indicated that a revision of the ruling depths even in imp. parts of the stream was needful, **97,** 1028.

Description of, **00,** 1437.

Traffic very great; details of, **10,** 158.

Traffic of E. R. very great, and, of course, is intimately connected with that of N. Y. H. Est. tonnage, 1911, 45,331,000±, which does not include through traffic. Trips of steamers and tugs through H. G. chan. average 450± daily; of ferryboats, in addition, 400 daily. Nor does this include, barges, lighters, car floats, or privately owned craft; about 100 of these car floats, of large dimensions, pass through H. G. every day.

Aside from lessening the dangers of navigation for such traffic, perhaps the most desirous effect of U. S. imp. is the increase of vessels of large tonnage using the R., with the consequent more economical rates.

See also Private work.
12, 197.

CONTRACTS.

1869. J. D. Shelbourne, removing Frying Pan and Pot Rock; unsatisfactory progress made, **69,** 55, 388. Contract expired by limitation, with no work done, **70,** 74, 434, 438. Maillefert & Co., removal of Pot Rock, Ways Reef, and Shelldrake Rock, **69,** 55, 388. Contract expired by limitation, with small amount of work done, **70,** 434, 439.

1876. E. R. Seward, removal of 24,000 t. broken r., Hallets Pt., **77,** 49, 227. Extended and completed, **78,** 55, 413.

1878. Atlantic Dredging Co., removing 25,000 t broken r., Hallets Pt., **78,** 55, 413. Completed, **79,** 61.

1879. Atlantic Dredging Co., removing 25,000 t. broken r., Hallets Pt., **79,** 61, 377.

1885. Rendrock Powder Co., copper cartridge cases, 225,000 lbs. rackarock, **85,** 719. R. W. Warren, 50,000 lbs. dynamite, **85,** 719. Atlantic Dredging Co., r. removal, Flood Rock, $3.19 t., **86,** 678.

1890. R. G. Packard, removal of material other than bowlders, 85¢ c. y.; bowlders, $2.50 t., **91,** 902.

1894. P. Ward, repair of dr. Hell Gate, $15,800, **95,** 935.

1899. R. G. Packard, removing Man-o'-War Rock, $159,000, **99,** 1232.

1900. George A. Rogers, removing 3d and 26th St. reefs, 1,001 c. y., $12.87 c. y.; R. G. Packard Co., removing r. and bowlders to d. of 26′, $2.65 gross t., **01,** 1214.

1903. R. G. Packard Co., removing ledge r., $17.50 t., and bowlders, $1.55 c. y., **04,** 1030.

1905. International Contracting Co., dr. and r. removal, 98¢ c. y., s. m., **06,** 956.

1908. R. G. Packard Co., dr. certain areas, 29½¢ s. f., area **08,** 1049. New London Marine Iron Works, wooden scow, $8,058, **09,** 1070.

1912. R. G. Packard Co., clearing certain areas to 26′ d.; unit prices listed; Timothy J. Dady, dr., 27¢ c. y.; removing large bowlders, $11.73; small, $12, **12,** 1477.

DOCUMENTS. (Not published in **Rs.**)

H. Doc. 90, 39th Cong., 2d sess., **67,** 17, 44; **68,** 733.

ENGINEERS.

Chief of Engineers. R., 66, 7, ii, 41, iii, 29; **67,** 17, 44; **68,** 65, 726, 729, 742; **69,** 55; **70,** 73; **71,** 82; **72,** 79; **73,** 84; **74,** 94; **75,** 100; **76,** 54; **77,** 49, 231; **78,** 55; **79,** 61; **80,** 81; **81,** 98; **82,** 99; **83,** 94; **84,** 100; **85,** 96; **86,** 95; **87,** 59; **88,** 60; **89,** 75; **90,** 66; **91,** 86; **92,** 90; **93,** 97; **94,** 87; **95,** 100; **96,** 106, **97,** 111; **98,** 126; **99,** 134, 142; **00,** 152, 160; **01,** 205; **02,** 143; **03,** 131; **04,** 116; **05,** 123; **06,** 128; **07,** 131; **08,** 137; **09,** 139, 157, 158; **10,** 156, 181; **11,** 160; **12,** 192.

Boards. 1856. (Advisory Council to New York H. Commission.) Recom. removal of Pot Rock, Frying Pan, Ways Reef, and a part of Hallets Pt., with other minor r.; the closing of small chan. between Bread and Cheese and head of Blackwell Isld.; the constr. of st. ps. on Hogs Back, Gridiron, and Bread and Cheese, and a beacon on Rylanders (Rhinelander) Reef, **68,** 65, 733. (Col. Totten, Chief of Engineers; Supt. Bache, U. S. C. S.; Commander Davis U. S. N.)

In charge:

E. Merrian, 1851–53; **68,** 732, 733.

Maj. W. D. Fraser, 1853–54; **68,** 727, 732.

Lt. Col. J. Newton, 1866–85. **R., 68,** 727, 730, 742; **69,** 388, 390, 391; **70,** 433; **71,** 723; **72,** 802; **73,** 934; **74,** ii, 160; **75,** ii, 200; **76,** 238; **77,** 227, 231, 232; **78,** 412; (Col.) **79,** 375; **80,** 496; **81,** 621; **82,** 649; **83,** 533; **84,** 689; **85,** 715; **86,** 680.

Capt. J. Mercur, temporarily in charge, 1877; **77,** 48, 227.

Lt. Col. W. McFarland, 1885–89. **R., 86,** 675; **87,** 689; **88,** 603.

Lt. Col. G. L. Gillespie, 1889–96. **R., 89,** 772; **90,** 713; **91,** 899; **92,** 797; **93,** 1034; **94,** 751; **95,** 930; (Col.) **96,** 853.

Lt. Col. W. Ludlow, 1897. **R., 97,** 1026.

Maj. H. M. Adams, 1898–1900. **R., 98,** 1036; **1900,** 1436.

Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1229,

Maj. E. H. Ruffner, 1900. **R., 00,** 1403.

Maj. W. L. Marshall, 1900. **R., 00,** 1439.

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*Allotment.
[1] By other than R. and H. act, prior to 1852, $13,861.59, **12,** 1476.
[2] Hell Gate.
[3] Given as $176,841.45, **12,** 1476.
[4] East R. and Hell Gate.
[5] Given as $214,000, **12,** 1476.

Col. S. M. Mansfield, 1901-02. **R., 01,** 1211; **02,** 957.
Col. Amos Stickney, 1903. **R., 03,** 871.
Capt. Edward H. Schulz, 1904. **R., 04,** 1028.
Col. W. R. Livermore, 1905-06. **R., 05,** 971; **06,** 954.
Col. John G. D. Knight, 1907-08. **R., 07,** 999; **08,** 1047.
Col. W. M. Black, 1909-. **R., 09,** 1068; **10,** 1194; **11,** 1262; **12,** 1474.

Assistants: (See also Surveys.)
Lt. Bartlett, **68,** 732.
W. Preuss, **72,** 803; **77,** 238.
F. Sylvester, **72,** 803.
Lt. W. H. Heuer, **73,** 936; **77,** 227. **R., 75,** ii, 203; **76,** 238.
Capt. J. Mercur, **77,** 227, 237; **79,** 60. **R., 79,** 375, 377; **80,** 499; **84,** 692.
J. H. Striedinger, **74,** ii, 164; **77,** 236. **R., 75,** ii, 208; **76,** 239; **77,** 227.
B. Boyle, **77,** 238.
A. Doerflinger, **77,** 238.
M. A. Lacy, **77,** 238.
R. Stone, **79,** 375. **R., 79,** 382; **80,** 503; **81,** 627; **82,** 653.
Lt. G. McC. Derby. **R., 82,** 651; **83,** 536; **85,** 720, 724, 734.
Lt. R. D. Black, **11,** 149; **12,** 178.

ESTIMATES. (See Plans and Projects.)

Maj. Fraser, 1853, removal of r. in Hell Gate, 1.14 c. f., **68,** 733, 738.
Lt. Col. Newton, 1867, removal of r. at Hell Gate (see Plans and Projects): 1st plan, to 25′, $5,008,580 or to 26′, $5,723,129, **68,** 738, 741; **70,** 437; 2d plan, to 25′, $7,737,974, or to 26′, $8,692,645; **68;** 741; **70,** 437; **74,** ii, 164; 3d plan, to 25′, $2,674,930, or to 26′, $2,877,000; **68,** 730, 741; **70,** 438.
Lt. Col. Newton, 1870, revised est., from experience gained: 1st plan, to 25′, $3,000,000; 2d plan, to 25′, $4,100,000; 3d plan, to 25′, $2,070,000, **70,** 438.
Lt. Col. Newton, 1874, revising previous 2d plan, to 26′, $4,689,820, **74,** ii, 164; **75,** ii, 202; **76,** 243.
Lt. Col. Newton, 1868, removing reefs at mouth of East R.: Battery Reef to 24′, $14,245; Diamond Reef to 22½′, $185,125; Diamond Reef to 24′, $309,400, Coenties Reef to 22½′, $100,000, or to 24′, $139,000, **68,** 66, 745; **74,** ii, 164; **76,** 243.
1879. For completion of existing proj., $2,615,078, **79,** 376.

LEGISLATION. (See Obstructions.)

Act by N. Y. incorporating the East River Bridge Co., **92,** 805.
Act amending act incorporating a company to erect a br. across the R. between New York and Long Isld., **93,** 1041.
Act May 27, 1895, passed and accepted by the city of New York, for br. across the R. between New York City and Brooklyn, **96,** 859.

OBSTRUCTIONS.

Brs. affected by Congressional or State acts, **95,** 933; **96,** 856; **97,** 1030.

OPERATIONS.

1851-52. Efforts to remove rs. in Hell Gate by surface blasts, **68,** 732.
1869-70. Work begun under proj. of Lt. Col. Newton; 1,621 c. y. r. removed from Ways Reef and 220 c. y. from Shelldrake Rock; unsatisfactory results from contracts; completion by hired labor of cofferdam at Hallets Pt. and removal of 4,841 c. y. r. from shaft; also constr. of drilling scow for the removal of chan. rs. Valuable experience gained by operations, **70,** 73, 434, 437, 439, 440.
1870-71. Completion by hired labor of shaft at Hallets Pt., and 709 l. f. tunnels, with 182 l. f. galleries, removing 8,306 c. y. r., **71,** 82, 724. Operations of steam drilling scow by hired labor at Diamond and Coenties Reefs, **71,** 725.
1871-72. Constr. at Hallets Pt. by hired labor of 1,653 l. f. tunnels and 653¾ l. f. galleries, removing 8,293 c. y. r. Removal of 6,119 c. y. r. from Diamond and Coenties Reefs by aid of steam drilling scow. Commencement of operations by drilling scow at Frying Pan Rock. Success of drilling scow, **72,** 80, 803, 805.
1872-73. At Hallets Pt., 2,731 l. f. tunnels and galleries driven, removing 9,554 c. y. r., **73,** 84, 934. 211 c. y. rs. dr. from Diamond Reef; operations of drilling scow on Frying Pan and Pot Rock; results from drilling experience, **73,** 84, 935, 937
1873-74. At Hallets Pt., 896 l. f. tunnels and galleries driven, removing 4,648 c. y. r.; at Coenties Reef, 2,805 c. y. r. removed, **74,** 94, ii, 160.
1874-75. Completion of tunnels and galleries at Hallets Pt. by driving 645 l. f., removing 13,838 c. y. r. Removal of 3,029 c. y. r. from Ways Reef, completing work thereat; 654 c. y. from Coenties Reef and 413 c. y. from Diamond Reef. Shaft on Flood Rock began. Dr. 1,260 c. y. from ps. and abutments of old br. (114th St.), Harlem R., **75,** 101, ii, 204.
1875-76. At Hallets Pt., drilling roof and ps. for final blast. At Flood Rock, 2 shafts sunk to d. of 51′ and 32′, removing 1,462 c. y. r., **76,** 54, 238. Operations of drilling scow. Completion of the removal of Coenties Reef to 25½′ l. w. At Diamond Reef, 972 c. y. r. removed, **76,** 54, 239.
1876-77. At Hallets Pt., completion of mining operation and successful explosion of mine Sept. 24, 1876. Removal by contract of 14,055 t. broken r. At Flood Rock, 1,772 c. y. r. removed. Operations of drilling scow; 916 c. y. r. removed from Diamond Reef; small amount of work done for lack of app., **77,** 49, 227, 231.
1877-78. At Hallets Pt., 23,258 t. broken r. removed by contract.
1878-79. At Hallets Pt., 19,706 t. r. removed by contract. At Flood Rock (work had been suspended since Jan., 1876), 1,307 l. f. galleries driven, removing 5,115 c. y. r. Ways Reef removed 26′. Coenties Reef removed 25½′. Operations of the steam drilling scow. Drilling at Diamond Reef, Shelldrake, and Frying Pan Rocks. Removal of 519 c. y. from Diamond Reef, **79,** 61, 62, 377, 378.
1879-80. At Hallets Pt., 15,195 t. broken r. removed by contract. At Flood Rock, 4,346 l. f. galleries driven, removing 12,941 c. y. r.; removal of small r. near North Brothers Isld.; Diamond Reef removed 26′; 2,596 c. y. r. and bowlders removed from Frying Pan, Shelldrake, and Diamond Reefs, **80,** 496-505.
1880-81. At Hallets Pt., 9,824 t. broken r. removed by contract. At Flood Rock, 7,312 l. f. galleries driven, removing 18,080 c. y. r.; 1,096 c. y. r. removed from Heel Tap and North Brothers Reef, **81,** 621-628.
1881-82. At Hallets Pt., 8,549 t. broken r. removed by contract. At Flood Rock, 6,453 l. f galleries driven, removing 21,690 c. y. r.; 2,112 c. y. r. removed from Heel Tap and North Brothers Reef, **82,** 646-654.
1882-83. Completion of r. removal at Hallets Pt. At Flood Rock, 204 l. f. galleries driven, removing 14,206 c. y. r.; 666 c. y. r. removed from Pot Rock and Frying Pan, **83,** 533-542.
1884-85. At Flood Rock, 1,488 l. f. galleries driven, removing 9,819 c. y. r., and completing all work preparatory to charging and exploding the mine, **85,** 715-722. Removal of Pilgrim Rock to 24′, **85,** 734. Experiments with explosives made, **85,** 724.
1885-86. Mine under Flood Rock fired Oct. 10, 1885, **86,** 675, 688. Details of charging and explosion, **86,** 680. 558 t. r. removed from chan. at Negro Head and Hen and Chickens; 28,622 t. r. removed from Flood Rock by contract, **86,** 676, 679, 688. Summary of work done, 1875-1886, **86,** 690.
1886-87. 34,956 c. y. r. removed in w. Newton Chan. and in cutting away the n. end of Flood Rock, **87,** 59, 691, 694. Details of cost of r. removal, **87,** 691, 692.
1887-88. 19,548 t. r. removed, **88,** 605.
1888-89. 1,410 t. r. removed by hired labor, **89,** 775.
1889-90. 47,398 t. r. removed, **90,** 716.
1890-91. Removal of r. at Flood Rock and Diamond Reef; 3,435 c. y. and 960 t. bowlders removed from Shell Reef; 24,040 t. r. removed from reef off Diamond Reef, **91,** 902, 904.
1891-92. 20,872 t. r. blasted and removed at Flood Rock; 52,803 c. y. dr. and 2,800 t. r. removed

at Shell Reef and Middle Ground; 1,763 t. r. removed at Ferry Reef; 1,211 t. r. removed from reef off Diamond Reef, **92,** 800, 803.

1892-93. 21,126 t. r. removed from Flood Rock; 48,853 c. y. fine material dr. from, and 313 t. bowlders removed from Shell Reef; 668 t. r. removed from Ferry Reef, 1,382 from Baretto Pt., and 764 from Sunken Meadow, **93,** 1038, 1039, 1040.

1893-94. 5,513 t. r. removed from Flood Rock, and 6,833 from Sunken Meadow, **94,** 754, 755.

1894-95. 681 t. r. removed from Sunken Meadow, **95,** 933.

1895-96. 4,673 t. r. removed from Sunken Meadow, **96,** 857.

1896-97. 2,175 t. r. removed from Sunken Meadow; 7,485 from Charlotte Rock, and 33,148 c. y. dr. from approaches to Davids Isld. and Willets Pt., **97,** 1029.

1897-98. 31 t. r. removed from Sunken Meadow, **98,** 1037.

1899-00. Removal of Man-o'-War Rock in progress, and 39 t. r. removed from Middle Reef, **00,** 1404.

1900-01. Removal of Man-o'-War Rock continued; removal of reefs off 3d and 26th Sts. begun; 68.9 c. y. removed from 26th St. reef; 19,743 t. removed from Battery and Shell Reefs, **01,** 1212.

1901-02. 11,710 c. y. r. removed from Man-o'-War Rock, 462 c. y. from 26th St. reef, and 3d St. reef drilled and blasted, **02,** 957.

1902-03. 3,663 c. y. r. removed from Man-o'-War Rock, 444 c. y. from reef off 26th St., and 95 c. y. from reef off 3d St., **03,** 871.

1903-04. 53,808 c. y. dr. and 102.2 t. ledge r. removed from Shell Reef, **04,** 1029.

1905-06. 35,901 c. y. dr. from Battery and South Ferry Reefs, **06,** 955.

1908-09. 231,169 sq. f. Middle Reef cleared to 26′, **09,** 1068.

1909-10. 187,761 sq. f. Middle Reef cleared to 26′, **10,** 1195.

1910-11. 393,756 sq. f. Middle Reef and 19,425 sq. f. in Pot Rock dr. to 26′ d., **11,** 161.

1911-12. Middle Reef, Frying Pan Reef, and Pot Rock completed to 26′, Apr. 12, 1912; work of drilling and blasting in Middle Reef, w. of completed area, in progress, **12,** 1474.

PHYSICAL DATA.

Formation of Battery Reef, **68,** 742. Area covered by, **68,** 744.

Area covered by Hell Gate Reefs, **68,** 739.

Formation of r. at Hallets Pt., **71,** 724. Leakage in tunnels at, **71,** 725.

Velocity of currents, Hell Gate, **68,** 736; **72,** 805; **75,** ii, 208.

Tides, rise and fall of, **75,** ii, 208.

Physical effect of Hallets Pt. blast, **77,** 233.

Observations on transmission of earth waves at explosion of Flood Rock, **86,** 691–717.

Description of obstructions, Hell Gate, **88,** 603.

Description of Diamond Reef and Coenties Reef, **00,** 1436.

Difficulties of navigation due to violent and irregular currents, narrow winding chan., and r. pts. and reefs, **10,** 1194.

Range of tides, depths, etc., **12,** 196.

E. R. is a tidal strait, 16 m. x 600–4,000′; separates N. Y. C. from Long Isld., extends from the Battery, N. Y. C., to Throgs Neck, at head of Long Isld. Sound, **12,** 192.

PLANS. (See Estimates and Projects.)

By Lt. Davis, U. S. N., 1848, removal of Pot Rock, Frying Pan, and Ways Reef, with the removal of rs. from the middle chan., i. e., Little Mill and Flood Rock, and the constr. of fender ps. on Hog's Back, Gridiron, and Bread and Cheese Rocks, **68,** 731.

By Lt. Porter, U. S. N., 1848, favors the above except the removal of rs. in middle chan.; suggests they be covered with fender docks; also removal of a part of Hallets Pt. and various small rs. below, **68,** 731.

By M. Maillfert, 1851–53, removal of r. in Hell Gate by surface blasts, **68,** 732, 733.

By advisory board, 1856. (See Board of Engineers.)

By Lt. Col. Newton, 1867, imp. of navigation through Hell Gate by 3 plans: 1st, removal to a m. l. w. d. of 25′ to 26′, Pot Rock, Frying Pan, Ways Reef, Shelldrake, and Heel Tap, with rs. off Negro Pt., Scaly Rock, and Hallets Pt.; with sea walls on Hen and Chickens, Flood Rock, Gridiron, and Hog Back, Holmes Rock, Great and Little Mill Rock, Bread and Cheese, and Rhinelander Reef. Time required, 6 years; est., chan., 25′, $5,008,580; 26′ chan., $5,723,129, **68,** 738, 741. Revised, 1870, to $4,100,000, **70,** 438. 2d (see Projects). 3d, removal of Pot Rock, Frying Pan, Way's Reef, Shelldrake, Heel Tap, Scaly Rock, and part of Hallets Pt., with sea walls along Hen and Chickens, Flood Rock, and Gridiron; est., to 25′, $2,674,930; to 26′, $2,877,000, **68,** 65, 730. This plan recom. by Chief of Engineers for commencement of work, but subsequently became expanded to 2d plan (see Projects), **68,** 730; **70,** 438; **72,** 803; **75,** ii, 202.

Plan for passing obstr. at Hell Gate by canal through Astoria, 1870. The proj. for removal of r. in chans., reported preferable, **70,** 436.

PRIVATE (CITY) WORK.

1861-63. Partial removal of Coenties Reef by N. Y. City, **68,** 744.

1870. Constr. of sea wall at head of Blackwell's Isld. by comrs. of pub. charities, **70,** 437.

Imp. of water front contemplated by local au. at, 1912, should result in considerable reduction of rates. Amount of this reduction dependent upon size of chans. au. by U. S., **12,** 197.

PROJECTS. (See Estimates and Plans.)

In 1851–52, under an app. of $20,000, effort made to imp. navigation through Hell Gate by removal of r. through the aid of surface blasting, **68,** 732. Proj. for imp. of Hell Gate proposed by Col. Newton, 1867, subsequently modified, 1868, 1874, 1880, and 1884, by extending it to embrace the removal of other reefs in East R. Later it included the removal to 26′ m. l. w. of all the dangerous reefs in Hell Gate, Diamond Reef, and North Brothers Isld. Reef, in East R., the removal of Coenties Reef to 25½′, and a number of small rs. in the shoaler parts of the chans.; also, constr. of sea walls on Great and Little Mill Rocks, Hog's Back, and Holmes Rock; est., $5,139,120, **68,** 741–745; **70,** 437; **71,** 725; **72,** 803; **74,** ii, 164; **76,** 243; **80,** 497; **84,** 690; **86,** 95.

By Lt. Col. Gillespie, 1895, expend. app. 1894 in continuation of work on Sunken Meadow and for repair of plant, **95,** 933.

By Lt. Col. Ludlow, 1896, expend. app. 1894 in continuation of work on Sunken Meadow, etc., and for increasing facilities and d. in approaches at Davids Isld. and Willets Pt., **97,** 1029.

Description of work done up to 1898, showing orig., existing, and proj. d., **98,** 1037.

By Lt. Col. Benyaurd, 1899, sur. and removal of Man-o'-War Rock to 26′ m. l. w.; est., $500,000, **99,** 1229.

By Maj. Ruffner, 1900, removal of reef off 26th St. to 26′ m. l. w., and reef off 3d St. to 19′ m. l. w., **00,** 1404.

Maj. Marshall, 1900, est. $1,897,500 to remove Diamond and Coenties Reefs to 32′ m. l. w., **00,** 1440.

Col. Knight recom., 1908, d. 18′ chan. between South Brother Isld. and Lawrence Pt., removing of Middle Ground to 26′, and d. 26′ chan. between North Brother and South Brother Islds., **08,** 1047–48.

Act June 25, 1910, au. removal of Middle Ground to 26′ m. l. w. and making chan. between North and South Brother Islds. Est. for completion, $8,757,183. Est. given by Col. Knight: 20′, 22′, 24′, resp., No. and So. Brother Islds., $216,100, $485,990, and $750,262, resp.; Middle Ground, 26′, $1,733,000. **09,** 158; **11,** 161; **12,** 194.

Col. Black recom. removal of reef e. of Oak Bluff Light; est., $19,000, **11,** 1263.

List of points of work under existing proj., **12,** 194.

SURVEYS.

At Hell Gate:
By Lt. Davis, U. S. N., 1848; **68,** 730.
By Maj. Fraser, 1853; **68,** 733.
By Lt. Craven, 1856; **68,** 729, 734.
By Lt. Col. Newton, 1866–79; **66,** iii, 29; **67,** 41; **69,** 55, 389; **72,** 803; **78,** 55.
By Lt. Col. Newton, 1867, of Diamond, Battery, and Coenties Reefs, **68,** 742, 745.
Sur. of Man-o'-War Rock made, 1889, by Lt. Col. Benyaurd, **99,** 1230.
Ex. Middle Reef made, 1899, by Maj. Ruffner, **00,** 1404.
Ex. Diamond Reef and Coenties Reef, au. act Mar. 3, 1899; made, 1899, by Maj. Adams (**R.** fav.), **00,** 1436.
Sur. Diamond Reef and Coenties Reef, au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (**R.** rendered by Maj. Marshall; **R.** fav.; see Projects), **00,** 1439.
Minor, 06, 955; **08,** 1047; **10,** 1195.

Between North and South Brother Islds., au. act Mar. 2, 1907; made, 1907–08, by Col. Knight,[1] **09,** 157.
Resur., incl. ledges near w. shore, au. act Mar. 2, 1907; made, 1908, by Col. Knight,[2] **09,** 158.
Incl. Little Hell Gate, au. act Mar. 3, 1909, **10,** 181.; **12,** 224. Difficulties encountered in sur. East **R.,** incl. Hell Gate, such as to delay final **R., 12,** 1475.
Cong. docs., etc., relating to exs., surs., plans, etc.. **12,** 195.

Maps:[1]
Sketch of plan of shaft and tunnels at Hallets Pt., **72,** 803; **73,** 936; **74,** ii, 163; **75,** ii, 201.
Sketch showing Way's Reef, **75,** ii, 210.
Hell Gate and vicinity, **79,** 376.
Progress sketch of Flood Rock, showing condition of the excavation, **79,** 378; **80,** 496; **81,** 622; **82,** 646; **83,** 533; **85,** 735.
Hell Gate and approaches, **85,** 735; **86,** 688.
Flood Rock, **86,** 688; **08,** 1046. Pot Rock, Frying Pan, and Middle Reef, **09,** 1068; **10,** 1194; **12,** 1474.

E-17(a) EAST RIVER, N. Y.—Broome, 23d, 10th, 11th Sts., New York, N. Y.

ENGINEERS.

Chief of Engineers. R., 87, 67; **89,** 83; **90,** 74; **91,** 86, 425.

In charge:
Lt. Col. W. McFarland. **R., 87,** 758.
Lt. Col. G. L. Gillespie, 1888. **R., 90,** 761; **91,** 899.

Assistant. G. W. Kuehnle. **R., 90,** 765.

PHYSICAL CHARACTERISTICS.

Least depth over ledge, 10th and 11th Sts., 10′, **87,** 758.

PLANS.

By Lt. Col. Gillespie, 1890, r. removal and dr. for 18′ chan., Broome to 23d Sts., East R.; est., $207,-996, **90,** 764.

SURVEYS.

Sur., foot of Broome St. to the foot of 23d St., New York City, au. act Aug. 11, 1888; made, 1890, by Lt. Col. Gillespie, **90,** 761.
Ex., ledge of r., foot of 10th and 11th Sts., New York City, au. act Aug. 5, 1886; made, 1887, by Lt. Col. W. McFarland (**R.** fav., but "cost too great"), **87,** 758.

E-19 WESTCHESTER CREEK, N. Y.

APPROPRIATIONS.

1910,	$10,000,	**10,** 1186.
1911,	32,780,	**11,** 1262.
Total,	42,780 (incl. misc., $42,786.45, **12,** 1473).	

COMMERCE.

Description of, **00,** 1432, 1435; **12,** 192.
1911, 148, 117 t., **12,** 192.

CONTRACTS.

1912. T. J. Dady, dr. (prices given), **12,** 1473.

ENGINEERS.

Chief of Engineers. R., 91, 94; **99,** 142; **1900,** 160; **10,** 147; **11,** 159; **12,** 191.

In charge:
Lt. Col. G. L. Gillespie, 1890. **R., 91,** 954, 955.
Lt. Col. W. H. H. Benyaurd, 1900. **R., 1900,** 1430, 1433.
Col. W. M. Black, 1910–. **R., 10,** 1186; **11,** 1262; **12,** 1473.

Assistant. G. W. Kuehnle. **R., 91,** 957.

OBSTRUCTION.

Drawless causeway br. an obstr., **1900,** 1431.

PHYSICAL CHARACTERISTICS.

Description of the locality, **91,** 954; **00,** 1431, 1434; **11,** 159; **12,** 191–92.

PLAN. (See Project.)

By Lt. Col. Gillespie, 1891, navigable chan. 8′ x 100′ m. l. w. across the estuary, thence 8′ x 80′ to 1,000′ above Scrivens Dock, and thence 8′ x 60′ to head of navigation; est., $27,500, **91,** 956.

PROJECT. (See Plan.)

Lt. Col. Benyaurd est., 1899, it would cost $42,780 to imp. creek, and $2,000 an. mainten., **00,** 1435.
Act June 25, 1910, au. chan. 8′ x 100′ across estuary, thence 80′ to about 1,000′ above Scrivens W harf, thence 60′ w. to head of navigation; est., $42,780, and $2,000 an. mainten., **10,** 147.

SURVEYS.

Au. act Sept. 19, 1890; made, 1891, by Lt. Col. Gillespie, **91,** 955.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (**R.** fav.; see Projects), **00,** 1431.
R. by BERH. on ex. and sur. of 1891 and 1899. Recom. exp. of $42,780.[3]
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 191.

[1] H. D. 1084, 60th, 2d. [2] H. D. 1187, 60th, 2d. [3] Comm. D. 7, 61st, 2d.

E-21 BRONX RIVER, N. Y.

APPROPRIATIONS.

1896, $10,000, **96,** 734.
1899, 20,000, **99,** 1218.
1902, *5,000, **03,** 863.
1905, *21,500, **05,** 959.
1907, *23,000, **07,** 988.
1910, 17,000, **10,** 1184.

Total, 96,500 (sales, addl., $7.70, **12,** 1470).

COMMERCE.

Rates probably reduced, **05,** 118.
Reduction of rates doubtful, but transportation facilitated, **08,** 127.
Extensive and growing, **09,** 130.
Increased C. causes highly congested conditions in R. traffic, **12,** 187, 1470.
Tonnage, 1911, 681,000 t., **12,** 187.
Diagram showing relation of C. to app., **12,** 1471.

CONTRACTS.

1896. F. Pidgeon, r. removal, $6.89 c. y. ($9,000), **97,** 1095.
1899. S. F. Randolph, r. removal, $3.78 c. y. ($16,000), **1900,** 1391.
1901. Edwin L. Smart, removing r., $16 c. y., **02,** 998.
1902. Anderson-Murphy Co., removing r., $12 c. y., **02,** 998.
1903. John & Joseph McSpirit, dr., 50¢ c. y., **04,** 1015, 1016.
1908. John & Joseph McSpirit, removing r. and overlying material, $8.50 c. y., p. m., **09,** 1060.
1909. Maritime Dredging Co., dr., 43¢ c. y., s. m.; removing bowlders and ledge r., $6 and $11 c. y., p. m., **10,** 1184.
1911. Maritime Dredging Co., dr. 20,000 c. y. soft material at 57¢ c. y., 185 c. y. ledge r. and 15 c. y. large bowlders at $8.85 c. y., and 30 c. y. small bowlders at $7 c. y., **12,** 1471.

ENGINEERS.

Chief of Engineers. **R., 80,** 85; **81,** 108; **91,** 94; **96,** 84; **97,** 118; **98,** 114; **99,** 128; **00,** 146; **01,** 201; **02,** 154; **03,** 126; **04,** 111; **05,** 117; **06,** 119; **07,** 122; **08,** 127; **09,** 129; **10,** 143; **11,** 155; **12,** 186.

In charge:
Col. J. Newton. **R., 81,** 665.
Lt. Col. G. L. Gillespie, 1891. **R., 91,** 949, 951.
Maj. H. M. Adams, 1896–98. **R., 96,** 733; **97,** 1093; **98,** 999.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1217.
Maj. E. H. Ruffner, 1900. **R., 00,** 1389.
Col. S. M. Mansfield, 1901. **R., 01,** 1203.
Capt. Spencer Cosby, 1902. **R., 02,** 998.
Col. Amos Stickney, 1903. **R., 03,** 862.
Capt. Edward H. Schulz, 1904. **R., 04,** 1015.
Col. W. R. Livermore, 1905–06. **R., 05,** 959; **06,** 945.
Col. John G. D. Knight, 1907–08. **R., 07,** 988; **08,** 1036.
Col. W. M. Black, 1909–. **R., 09,** 1059; **10,** 1183; **11,** 1258; **12,** 1469.

Assistants:
R. H. Talcot. **R., 81,** 666.
G. W. Kuehnle. **R., 91,** 953.
Capt. R. D. Black, **12,** 178.

OPERATIONS.

1896-97. About 1,100 c. y. r. removed, **97,** 1094.
1897-98. About 124 c. y. r. removed, **98,** 1000.
1899-00. 667 c. y. r. removed, **00,** 1390.
1900-01. 2,630 c. y. r. removed, **01,** 1204.
1901-02. 118 c. y. r. removed, **02,** 998.
1903-04. 12,000 c. y. dr., **04,** 1015.
1905-06. Dr. bids rejected as too high, **06,** 946.
1906-07. Dr. bids rejected as too high, **07,** 988.
1908-09. 2,577 c. y. r., gravel, sand, etc., removed, **09,** 1059.
1909-10. 18,402 c. y. dr. and about 12 c. y. bowlders removed, **10,** 1183.
1910-11. 1,100.1 c. y. sand and small st., and 2.87 c. y. bowlders removed; proj. 78% completed, **11,** 156, 1258.
1911-12. 3,780 c. y. dr., **12,** 1470.

PHYSICAL CHARACTERISTICS.

Described, **81,** 666; **91,** 949; **10,** 143; **11,** 156; **12,** 186, 187.
Navigation hampered by narrowness of chan., **09,** 130.
Nav. part, 50′ to 300′ w., wholly in limits of Greater New York, **12,** 186.

PLANS. (See Projects.)

By Col. Newton, 1881, imp. with dr. and dikes to obtain chan. 30′–50′ w. and from 4′–5′ m. l. w.; est. $136,275, **81,** 666, 667.

PROJECTS. (See Plans.)

By Lt. Col. Gillespie, 1890, w. and d. chan. to afford navigable chan. 4′ d. m. l. w. and 100′ w. from the head of the estuary at Strain Place to Barlow St., 60′ w. to Dongan St., and 50′ w. to West Farms, below The Bronx Co.'s Dye Works. L. of chan., 1¾ m., involving removing 54,880 c. y.; est., $85,985, **91,** 952.
By Lt. Col. Benyaurd, 1899, sur. and dr. or r. removal after sur. had been platted and the condition of the R. more fully understood, **99,** 1218.

SURVEYS.

Au. act June 14, 1880, **80,** 85.
Sur. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Gillespie, **91,** 951.
Sur. made, 1899, by Lt. Col. Benyaurd, **99,** 1218.
Minor, **08,** 1036.
Of entire R., **09,** 1059.
Ex. and sur. au. act June 25, 1910; Col. Black's **Rs.,** 1911, 1912, and Mar. 8, 1913; est., $93,000 for first constr., with $3,000 to $4,000 an. for maintan., subject to certain specified local cooperation, presented,[1] **12,** 224.
Maps.[1] **04,** 1016; **12,** 1470.
Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 186.

E-24 HARLEM RIVER, N. Y.

APPROPRIATIONS.[2]

1874, *$11,000, **12,** 1478.
1875, 10,000, **75,** i, 102, ii, 220; **77,** 248.
1878, [3] 300,000, **78,** 55, 414.
1879, [3] 100,000, **79,** 62, 385.
1888, 70,000, **88,** 601.
1890, 250,000, **90,** 712.
1892, 175,000, **92,** 786.
1894, 125,000, **95,** 927.
1896, 125,000, **96,** 850.
1899, 100,000, **99,** 1234.
1902, $75,000, **02,** 960.
1905, 75,000, **05,** 974.
1907, 150,000, **07,** 1002.
1909, *22,000, **09,** 1072.
1910, 150,000, **10,** 1197.
1911, 75,000, **11,** 1267.
1912, 25,000, **12,** 1479.

Total, 1,838,000 (incl. sales, $1,838,772.82, **12,** 1479).

*Allotment.
[1] H. D. 897, 62d, 2d.
[2] $10,000 allotted, 1874, from app. for East and Harlem Rs. near Hell Gate, **74,** ii, 165; **77,** 248.
[3] Proviso attached to each of these apps., rendering them unavailable until the right of way is secured to the U. S. free of cost, **78,** 55; **79,** 385. Secured, 1887, **87,** 671, 674.

COMMERCE.

Very large and steadily increasing, **01,** 207.

Would be between 300,000 t. and 450,000 t. an. if imp. be made, **04,** 1067.

Material saving in cost of transportation due to increased facilities for handling shipments, **10,** 161.

1911, 11,752,000± t., **12,** 1480.

"The tonnage and value of the commerce of this river, which is general in character, as obtained from the best available information, are as follows:

Year.	Short tons.	Value.
1895	7,533,594	$203,707,376
1903	6,910,386	282,186,100
1904	9,130,763	231,384,004
1905	9,998,021	270,210,309
1906	11,385,649	(?)104,359,757
1907	12,385,507	313,380,743
1909	12,822,885	369,099,686
1911	11,751,632	570,494,993

"The opening of the Harlem River to navigation has resulted in greatly increasing the areas of Manhattan and Bronx Boroughs, to which heavy freight can be brought by water with a marked saving in cost." **12,** 200.

CONTRACTS.

1888. J. Satterlee, excavation above and below m. l. w., 93¢ and $1.13 c. y., resp., **88,** 602. E. L. Richardson, timber, **88,** 602. J. Temines, drift bolts, **88,** 602.

1889. J. Satterlee, dr., 40¢ c. y., **89,** 772.

1891. L. McCallum, dr., 28¢ and 38¢ c. y.; crib and revet. work ($123,546). P. S. Ross, dr., 30¢ and 40¢ c. y.; crib and revet. work ($122,478), **91,** 896, 897; **93,** 1030.

1893. Open-market agreements, revet. work, **93,** 1031. Morris & Cumings, dr., 19¢, 22½¢, 28¢, and 30¢ c. y.; r. removal, $4.98 c. y.; cribwork, etc.; st. for crib and revet. work, 47½¢ and 49½¢ c. y. ($125,334.50), **94,** 749.

1894. R. R. Moore, dr., 18¢ and 20¢ c. y.; revet. work ($72,770), **95,** 927.

1896. R. R. Moore, dr., 14½¢ and 20¢ c. y.; revet. work ($80,022.50), **97,** 1023.

1897. U. Maurer Sons, st. retaining wall ($3.090), **98,** 1034.

1899. J. P. Conkling, purchase and removal of 235,000 c. y., more or less, broken st., owned by the U. S., at 22¢ c. y. (annulled), **99,** 1233; **00,** 1407. P. Sanford Ross (Inc.), dr., 10.4¢ c. y., s. m. ($15,600), **1900,** 1409.

1903. Morris & Cumings Dredging Co., dr., 32½¢ c. y., **03,** 873.

1904. R. G. Packard & Co., removing r., about 200 t., $489, **05,** 973.

1906. Seely-Taylor Co., dr., 25¢ c. y., s. m., **06,** 956.

1907. Taylor & Pearson (open-market agreement), removing material overlying ledge r. and blasted r., **07,** 1001.

1908. Columbia Dredging Co., dr., 28.85¢ c. y.; removing r., $4 c. y., **10,** 1197; annulled Sept. 27 1910, **11,** 1267.

1911. P. S. Ross (Inc.), dr. and removing broken r.; prices listed, **11,** 1267.

ENGINEERS.

Chief of Engineers. R., 73, 86; **74,** 95, 96; **75,** 101, 103; **76,** 55; **77,** 50; **78,** 55; **79,** 62; **80,** 82; **81,** 100, 108; **82,** 101; **83,** 96; **84,** 103; **85,** 93; **86,** 94; **87,** 58; **88,** 59; **89,** 74; **90,** 65; **91,** 84; **92,** 88; **93,** 95; **94,** 86; **95,** 98; **96,** 105; **97,** 110; **98,** 124; **99,** 135; **00,** 153; **01,** 206; **02,** 144; **03,** 132; **04,** 117, 127, 1064; **05,** 124; **06,** 129; **07,** 133; **08,** 139; **09,** 141; **10,** 159, 181; **11,** 164, 185; **12,** 198, 223.

BERH., **04,** 1067.

BERH. report on current through Harlem Kills; would not interfere with navigation.[1]

In charge:

Lt. Col. J. Newton, 1874–84. **R., 74,** ii, 166, 169; **75,** ii, 202, 219, 224; **76,** 244, 246; **78,** 414; **79,** 385; (Col.) **80,** 507; **81,** 631; **82,** 656; **83,** 543.

Capt. J. Mercur, 1877, in temporary charge; 1884–85. **R., 77,** 248; **84,** 704.

Lt. Col. W. McFarland, 1885–89. **R., 85,** 674; **86,** 672; **87,** 665; **88,** 598.

Lt. Col. G. L. Gillespie, 1889–96. **R., 89,** 767; **90,** 705; **91,** 886; **92,** 778; **93,** 1025; **94,** 741; **95** 917; (Col.) **96,** 840.

Lt. Col. W. Ludlow, 1897. **R., 97,** 1019.

Maj. H. M. Adams, 1898. **R., 98,** 1031.

Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1232.

Maj. E. H. Ruffner, 1900. **R., 00,** 1406.

Col. S. M. Mansfield, 1901–02. **R., 01,** 1214; **02,** 959.

Col. Amos Stickney, 1903. **R., 03,** 872.

Capt. E. H. Schulz, 1904. **R., 04,** 1031.

Col. W. R. Livermore, 1905–06. **R., 05,** 973; **06,** 956.

Col. J. G. D. Knight, 1907–08. **R., 07,** 1001; **08,** 1050.

Col. W. M. Black, 1909–. **R., 09,** 1070; **10,** 1196; **11,** 185, 1266; **12,** 1477.

Assistants:

J. H. Striedinger, **74,** ii, 173; **75,** ii, 236. **R., 76,** 244.

A. Doerflinger. **R.** on storage of unused st. of 1887, **99,** 1238.

Lt. R. D. Black, 1910–12; **11,** 149; (Capt.) **12,** 178.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Newton, 1874, removing br. ps., and r. to 12′ from Harlem R., near East R., $167,875.56, **74,** ii, 173; **75,** ii, 220; **76,** 245; **77,** 248. Chans. from Randalls Isld., by way of Spuyten Duyvil Creek to the Hudson R., 12′ x 350′, $2,270,825.18; 15′ x 350′, $2,277,571.44, **75,** ii, 237. Cut through Dykeman's Meadows, $1,963,000; through Spuyten Duyvil, by way of King's Br., $3,321,000, **76,** 246.

LEGAL PROCEEDINGS.

Rules and regulations for operation of all the brs. crossing the Harlem R. prescribed by Sec. of War on May 14, 1898 (see Obstructions), **98,** 1035.

Owners of land near Spuyten Duyvil, occupied by stored st., commenced proceedings, 1899, to dispossess the U. S. from occupancy of the land (see Contracts), **00,** 1407.

$75,000 paid to estate of I. M. Dyckman, releasing US. from all obligations to remove st. stored on land leased from said estate, **01,** 1215.

LEGISLATION.

Delay in securing right of way, **80,** 507; **86,** 674; **87,** 668.

Acts of State of New York relating to right of way, **87,** 677.

The department of public works, New York, in 1892, adopted a resolution closing the brs. across the R. at Madison and 3d Aves. between 6 and 10 in the forenoon and 4 and 7 in the afternoon, the periods of greatest daily traffic between the 2 shores, **93,** 1028.

New York State acts for constr. of brs. across the streams improved under the title of Harlem R. at 125th St., **95,** 928; at 145th St., **96,** 851; at junction of Harlem R. with Spuyten Duyvil Creek, **96,** 853.

OBSTRUCTIONS. (See Legal proceedings; Legislation.)

Brs. on Harlem R., **91,** 889; **92,** 780.

List of brs. crossing, **93,** 1028; **94,** 744; **95,** 920; **96,** 842; **97,** 1024; **98,** 1035; **99,** 1236.

List of brs. affected by State acts or by notices served by Sec. of War, **93,** 1028; **94,** 744; **95,** 921; **96,** 843; **97,** 1025.

Brs. having heavy traffic across R. interfere with work, **11,** 1266; in 1912, proj. work required dr. under 10 drawbr., and rock excavation beneath one of these br., **12,** 1478.

[1] Comm. D. 6, 61st, 2d.

OPERATIONS.

1874-75. Ps. and abutments of the old br., opposite 114th St., removed by dr., 1,260 c. y., **75,** ii, 202.

1875-76. Removal of 1,003 c. y. of r. from reef abreast of 125th St., **76,** 55, 244, 245.

1886-87. Right of way obtained May, 1887, **87,** 58, 674.

1887-88. 43,488 c. y. dr., **88,** 600. Experimental crib constr., **88,** 601.

1888-89. 152,973 c. y. dr.; 99′ cribwork built, and 1,929 c. y. st. filling placed, **89,** 769, 770.

1889-90. 264,512 c. y. dr., **90,** 707.

1890-91. 116,076 c. y. dr. and 2,487 c. y. r. excavated from the chan., **91,** 891.

1891-92. 40,063 c. y. r. excavated and 241,730 c. y. dr. from the chan.; 1,152 c. y. dry st. wall and 2,095 c. y. wall laid in mortar built; 100 l. f. cribwork revet. and 90′ of pilework revet. built, **92,** 784.

1892-93. 26,216 c. y. earth and r. excavated and removed; 384,276 c. y. dr.; 404 c. y. dry st. wall and 406 c. y. wall laid in mortar built, and 200 t. large bowlders removed, **93,** 1032, 1033.

1893-94. 4,380 c. y. r. excavated and removed; 155,520 c. y. dr.; 359 l. f. cribwork and 229 l. f. pile work constr.; wreck of canal barge removed, and 1,300 c. y. r. removed from Candle Factory Reef, **94,** 746, 747.

1894-95. 174 c. y. r. excavated; about 230,000 c. y. dr.; 384 l. f. timber revet. and 200 l. f. pilework constr., and over 4,000 c. y. r. removed from Candle Factory Reef, **95,** 924, 925.

1895-96. 317 c. y. r. excavated; about 242,000 c. y. dr.; over 500 l. f. cribwork completed; 6,136 t. st. removed from ps. of old br. which formerly spanned the R. near 114th St., and some bowlders removed, **96,** 845–847.

1896-97. 413,000 c. y. dr. and 1,552 t. r. removed from entrance to Mott Haven Canal, **97,** 1021.

1897-98. 320,688 c. y. dr.; 741 l. f. revet. work constr.; 1,602 t. r. removed from various parts of the R., and 41 l. f. st. retaining wall built, **98,** 1032, 1033.

1898-99. Repairs to plant and 396 c. y. st. removed from st. pile by contractor, **99,** 1233.

1899-00. 11,097 c. y. st. removed from st. pile and 132,174 c. y. dr. from mouth of Spuyten Duyvil Creek, **00,** 1407, 1408.

1900-01. 12,950 c. y. dr., **01,** 1215.

1902-03. 18,380 c. y. dr., **03,** 872.

1903-04. 199,675 c. y. dr., **04,** 1031.

1904-05. About 200 t. loose r. removed near 4th Ave Br., **05,** 973.

1905-06. Drilling for r. removal at McCombs Dam Br. by hired labor; drill boat damaged by fire, **06,** 956.

1906-07. 122,080 c. y. dr.; 2,061 c. y. r. and 17,209 c. y. overlying material removed: drilling and blasting ledge r. by hired labor continued, **07,** 1001.

1907-08. 338 c. y. ledge r., 27 pieces of piling, and other misc. obstr. removed by hired labor and U. S. plant; 3,389 c. y. r. and 504 c. y. overlying material removed, **08,** 1050.

1908-09. 215,802 c. y. dr., 205 c. y. broken r. removed (contractor suspended work, claiming material was too hard to dr.), **09,** 1070. 228 c. y. r. drilled, blasted, and removed by U. S. plant and hired labor, **09,** 1071.

1909-10. Claims of contractor shown to be not well founded; 108 c. y. r. removed by U. S. plant, **10,** 1196.

1910-11. 7.7 c. y. bowlders and 24,682 c. y., s. m., of other material removed, **11,** 1266; proj. about 58% completed; results of work, **11,** 165.

1911-12. 345 c. y. bowlders and 137,313 c. y. other material dr., **12,** 1478; results of dr. work, **12,** 200.

PHYSICAL CHARACTERISTICS.

Of Harlem R., near East R., **74,** ii, 169, 170; near Spuyten Duyvil Creek, **75,** ii, 224, 227, 228, 232–235; **76,** 246, 247.

Description of R., **88,** 598; **92,** 784, 785.

Water higher in 1893 than ever before noticed. Works for imp. of R. damaged, **93,** 1031.

Character of R. bed in vicinity of Candle Factory Reef, **95,** 924, 925.

Tidal observations to determine tidal changes following the opening of the new cut along Dyckman Creek, **96,** 847, 848.

Description of, **04,** 1067.

Available depths, **12,** 199.

PLANS. (See Estimates and Projects.)

By Comptroller Green, of New York, for bulkheads on both sides of the chan., backed with dr. material, **75,** ii, 227, 228.

By Lt. Col. Newton, chans. 12′ x 350′ and 15′x 350′ from Randalls Isld., via Harlem R. and Spuyten Duyvil Creek, to the Hudson R., **75,** ii, 235–237; **76,** 246.

By Col. Newton, 1882, chan. through Harlem Kills 300′ x 3,400′. Est., 18′ d., $3,488 400; 15′ d., $2,204,409; 12′ d., $1,161,225, **82,** 657.

By Col. Newton, 1884, chan. 15′ x 350′ from the Hudson to Harlem R. at Morris Dock, opposite Shermans Creek. Est., (1) via Dyckmans Creek, $2,091,684; (2) via Kings Br., $3,038,698; (3) via Shermans Creek, $3,026,078, **84,** 705.

PRIVATE (CITY) WORK.

The city of New York expended $3,900 in 1858 in removing old br. ps. between 114th St. and Wards Isld., **74,** ii, 171, 172.

PROJECTS.

By Lt. Col. Newton, removing old br. ps., drilling, blasting, and dr. r. at various places near East R.; est., $167,875.56, **74,** ii, 165, 172, 173; **76,** 245.

By Col. Newton, 1875, chan. 15′ d. at m. l. w. from Randalls Isld., by way of Spuyten Duyvil Creek, to the Hudson R., incl. the removal of r. obstr. around ps. of High Br., excavation of canal prism, dr., and revet., the w. of chan. to be 400′, except through Dyckmans Meadow, where it is reduced to 350′; est., $2,100,000, **75,** ii, 236, 237; **84,** 705; **85,** 676. Imp. of Harlem R. between this proposed chan. and its mouth, $600,000, **75,** ii, 237; **85,** 676. Aggregate est. cost of entire imp., $2,700,000, **75,** ii, 237; **85,** 676; **86,** 674; **87,** 668.

History of proj., **87,** 666.

By Lt. Col. Gillespie, 1893, removing Candle Factory Reef, **94,** 747; and other rocky obstrs. in the lower R., by hired labor and use of U. S. plant, **95,** 923.

By Lt. Col. Ludlow, 1897, expend. app. of 1896 in continuation of work of imp. by contract and hired labor, **97,** 1021.

Chief of Engineers recom., 1899, that the land on which the unused st. of 1887 was stored be purchased or that the st. be dumped into the Hudson R., **99,** 1238. (See Legal proceedings.)

By Col. Mansfield, 1903, 2 plans for imp. of Harlem Kills, from lower end Harlem R. to Long Isld. Sound: 1st, chan. 18′ x 300′; est., $1,899, 480. 2d, chan. 20′ x 300′; est., $2,514,600,[1] **04,** 1066.

SURVEYS.

Under direction of Lt. Col. Newton, by J. H. Striedinger, C. De Foresta, and V. M. Newton, 1873. **R.,** 74, ii, 169.

Under direction of Lt. Col. Newton, by J. H. Striedinger, De Foresta, Doerflinger, Geiseler, and Preuss, 1874, **75,** ii, 236. **R.,** **75,** ii, 224; **76,** 246.

Under direction of Lt. Col. Newton, 1878–79, **79,** 62, 385.

Au. act Mar. 3, 1881; made, 1881, by Col. Newton, **82,** 656.

Misc. surs., **93,** 1033.

H. lines of the R. and Spuyten Duyvil Creek modified in 1893, **94,** 743, and in 1897, **98,** 1032.

Ex. of Harlem Kills, from lower end Harlem R. to Long Isld. Sound, au. act June 13, 1902; made, 1902, by Col. Mansfield,[1] **04,** 1064.

Supp. report by BERH. on current observations Harlem Kills. (See BERH.)[2]

[1] H. D. 188, 58th, 2d.

[2] Comm. D. 6, 61st, 2d.

McCombs Dam Br. to Hudson R., **06,** 956.
Local exs., **10,** 1196.
Pre. ex. and sur. au. act Mar. 3, 1909, for straightening chan. at curve near Johnson Iron Works; **Rs.,** Col. Black, 1909 and 1910; est., $850,000, subject to certain specified conditions,[1] **10,** 181; **11,** 185; **12,** 223.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 199.
Maps.[1] **82,** 656.

E-28 HUDSON RIVER, N. J. and N. Y.[2]

Part.	Title.	Period.	Appropriations.
a	Hudson River	1831–1912	$7,566,524.56
b	At Jersey City	1875–1877	25,000.00
c	Ellis Island to Constable Hook; in front of Jersey City and Hoboken; Weehawken to Bergen Point, N. J.	1881–1885	.....
d	Troy to mouth of canal	1885	.....
e	New Baltimore to Coxsackie	1886–1888	.....
f	Jersey City to Ellis Island	1889	.....
	Total	.....	7,591,524.56

Part (a), E-28 Hudson River, N. J. and N. Y.

APPROPRIATIONS.

1834, $70,000.00, **66,** iii, 29, iv, 215.
1836, 100,000.00, **66,** iii, 29, iv, 215.
1837, 100,000.00, **66,** iii, 29, iv, 215.
1838, 100,000.00, **66,** iii, 29, iv, 215.
1852, 50,000.00, **66,** iii, 29, iv, 215.
1864, *[3] 33,000.00, **66,** iii, 20, 21, 29, iv, 215; **67,** 441.
1866, 50,000.00, **66,** iii, 21, 29, iv, 215; **67,** 442; **77,** 226.
1867, 305,188.00, **67,** 441.
1868, *85,000.00, **68,** 25, 64, 712; **69,** 55; **70,** 432.
1869, *[4] 89,100.00, **69,** 22, 55.
1870, 40,000.00, **70,** 73; **71,** 82.
1871, 40,000.00, **71,** 82.
1872, 40,000.00, **72,** 79, 801.
1873, 40,000.00, **73,** 84.
1874, 40,000.00, **74,** 94, ii, 159.
1875, 40,000.00, **75,** 100, ii, 199.
1876, 50,000.00, **76,** 54, 238; **77,** 49, 226.
1878, 70,000.00, **78,** 55, 412.
1879, 30,000.00, **79,** 60, 369.
1880, 20,000.00, **80,** 474.
1881, 15,000.00, **81,** 619.
1882, 10,000.00, **82,** 643.
1884, 30,000.00, **84,** 699.
1886, 26,250.00, **86,** 669.
1888, 75,000.00, **88,** 593.
1890, 150,000.00, **90,** 696.
1892, 187,500.00, **92,** 746.
1893, 500,000.00, **93,** 1016.
1894, 145,000.00, **95,** 909.
1895, 500,000.00, **95,** 909.
1896, 480,000.00, **96,** 836.
1897, 475,000.00, **97,** 1006.
1898, 160,406.56, **98,** 1054.
1899, 100,000.00, **99,** 1297.
1900, 400,000.00, **00,** 1492.
1901, 100,000.00, **01,** 1226.
1902, 225,000.00, **02,** 953.
1905, 203,300.00, **05,** 983.
1907, 250,000.00, **07,** 1011.
1909, *39,000.00, **09,** 1082.
1910 { *2,780.00, **10,** 1206; **11,** 1273.
1910 { 1,350,000.00, **10,** 1206.
1911, 750,000.00, **11,** 1273.

Total, 7,566,524.56 (incl. sales, $7,567,049.73, **12,** 1490).

COMMERCE.

Description of, **67,** 442; **68,** 711; **70,** 428; **71,** 723; **72,** 802; **73,** 934; **76,** 237; **77,** 226.
Opposition of Schuyler Steam Tow-Boat Line to plan of imp., **80,** 480, 486; **85,** 690.
Est. an. valuation of, **89,** 759.
Amount and value of the C. of the Hudson R. **90,** 698; **92,** 761.
Increased draft and saving of time permitted by imp., **06,** 134.
Rates probably reduced, **10,** 170; maintained within bounds by U. S. work, **12,** 212.
Diagram, showing relation of tonnage, valuation, and app., **11,** 1273.
"The commerce within the limits of the improvement, mainly in general merchandise, farm products, building material, fuel, and ice, as obtained from the best available information, is as follows:

Year.	Short tons.	Value.
1908	2,945,921	$120,421,651
1909	3,254,423	237,214,824
1910	5,033,360	109,941,000
1911	4,241,478	92,100,313

"During the season of navigation a large volume of traffic follows the railroad only because of lack of water transportation. The improvement accomplished so far has resulted in the establishment of an increasing passenger and freight packet business between the upper Hudson and New York. A direct result of the improvement has been to install in this service the largest river steamers to-day afloat in the United States, and in anticipation of benefits to be derived from the existing project two new steamboats, larger than their predecessors and stated to cost about $1,250,000 each, are under construction.
"The service of these steamers has resulted in strong competition with the railroads, by which freight rates are maintained within bounds. The status of water-borne freight traffic is at present unstable in view of the plans on foot for the development of traffic on the opening of the New

*Allotment.
[1] H. D. 557, 62d, 2d.
[2] Waterford to Schodac Isld. Sur.—R. 1831; est., $221,504.10. Above and below Albany. Sur.—R. Nov. 30, 1843. (H. D. 482, 55th, 2d.)
[3] Called $35,000, **66,** ii, 24, 28, iii, 29.
[4] Called $90,000, **69,** 385; **70,** 432; **77,** 226.

York State Barge Canals and the further improvement of the river contemplated in the present project." **12,** 212.

CONTRACTS.[1]

1866. E. R. Seward, st., **66,** iv, 216.

1867. E. R. Seward, st.; M. Lewis, materials, **67,** 444. E. R. Seward, materials and labor; R. N. Gere, materials and labor; William Fuller, materials; S. Cunliff, materials, **67,** 444; **68,** 720, 721. J. L. Powley, materials; Thomas Flood, materials and labor; J. Hutchinson, materials; M. O. Caldwell, materials; T. S. Van Hovenburgh, dr., **68,** 720, 721.

1868. E. R. Seward, materials and labor; R. N. Gere, materials and dr.; J. L. Powley, materials; D. Davis, materials; Templeton & Payne, labor; Plant's Manufac. Co., materials; C. B. Benson, labor; S. Strong, materials; White & Boynton, materials and labor, **68,** 720, 721.

1870. E. R. Seward, removing r., **71,** 720; **72,** 799, 800; **73,** 932; **74,** ii, 158.

1871. J. De Lacey, dike, **72,** 800.

1872. C. Johnson, dike, **75,** ii, 195.

1873. J. De Lacey, dike, **74,** ii, 159; **75,** ii, 195.

1874. J. De Lacey, repairing, **75,** ii, 195, 196. W. D Fuller, dike, **75,** ii, 195.

1875. J. H. Marshall, dike, **76,** 236, 238.

1876. W. D. Fuller, dike, **77,** 227.

1877. J. H. Marshall, dike, **78,** 412.

1878. J. H. Marshall, dike; W. D. Fuller, materials and labor, **79,** 370.

1881. Stanton & Doyle, r. removal, **82,** 642, 644. W. D. Fuller, dike constr., **82,** 642, 644.

1882. Luce & Hoskins, riprap st., **83,** 528.

1886. J. B. Marshall & Co. and W. D. Fuller, repair of dikes, **87,** 657.

1890. Wm. Fuller & Sons, pine piles, 11⅞¢ l. f.; round timber, 7⅞¢ l. f.; sq. timber, $39 M f. b. m.; spike and wire, 3⅞¢ lb.; rubblest., 94¢ c. y., and large st., $1.28 c. y., **90,** 698.

1891. Wm. Fuller & Sons, dike constr. and repair; total, $36,054, **91,** 876. P. W. Myers, dr., 14¾¢ c. y.; E. M. Payne, dr., 17⅝¢, 11⅝¢, and 21.9¢ c. y. **91,** 869.

1892. P. S. Ross, removing r. and sand covering in place, $5, and 50¢ s. t., resp. ($965,000); Edwards, Howlett & Thompson, dike constr. (timber, st., ironwork, etc.), aggregate, $231,302; dr. 4,620,000 c. y., 20.7¢ c. y. ($956,340), **93,** 1017.

1895. J. J. Cuddy, paving of dikes, 21¢ s. y. ($4,380), **95,** 909.

1896. W. Parrott, constr. and repair of dikes (piles, ironwork, st., etc.), aggregate, $22,777.50, **97,** 1007. Edwards, Howlett & Thompson, supp. to contract of 1892, dr. 700,000 c. y., 38¢ c. y., increased price, **97,** 999; **98,** 1048.

1897. W. D. Fuller, furnishing rubblest., 94¢ c. y.; paving st., $1.95 c. y. ($6,027), **98,** 1055.

1899. Kirk, Driscoll & Co., constr. and repair of dikes (piles, timber, ironwork, st., etc.), aggregate, $49,782, **99,** 1298.

1900. J. Du Bois, constr. and repair of dikes (piles, timber, ironwork, st., and dr.), aggregate, $121,007.50, **00,** 1453.

Open-market agreements for removal of wrecks, furnishing st., dr., etc., **93,** 1009, 1010; **94,** 727; **95,** 903; **96,** 829; **97,** 999.

1901. U. S. Fidelity & Guaranty Co., constr. and repair of dikes, unit prices, **02,** 953.

1902. Kirk, Driscol & Co., constr. and repairing dikes, unit prices; Dunbar & Sullivan, removing r., $3.35 c. y., **03,** 882.

1903. Newburgh Dredging Co., dr., 25¢ c. y., **04,** 1044.

1905. Newburgh Dredging Co., dr., 22½¢ c. y., **06,** 964.

1906. C. F. Suderley & Sons, 1,516 pieces round timber and piling, $2,764, **06,** 964. Sherman, Brown, Clements Co., rods, bolts, spikes, etc., 2.6¢ lb.; William D. Fuller, rubblest. and quarry spalls, $1.24 and $1.19, resp., c. y., **07,** 1011.

1907. C. F. Suderley & Son s, piling and roud timber, 12¢ l. f., **07,** 1011. G. Elias & Bro., sq. timber, $2,814.16; Flagler & Vedder, paving st., $2.20 c. y.; G. & W. Manufac. Co., rods, bolts, spikes, etc., $2,726.30; Welsh & Grey, sq. timber, $3,571.41, **07,** 1012. Newburgh Dredging Co., dr., 24.9¢ c. y., s. m., **08,** 1061.

1908. Hawley Miller, dr. mouth of Schodack Creek, 16¢ c. y., s. m.; Hirsch Lumber Co., lumber, $4,631.98; William D. Fuller, rubblest., quarry spalls and refuse, $1.39 c. y.; R. P. Clarke Co., piling and timber, $3,474.04; J. E. Ogden Co., bolts, spikes, etc. 2.49¢ lb., **08,** 1061. E. C. Sickles, rubblest., quarry spalls and refuse, $1.305 c. y. in place in dikes; Richard Parrott, jr., paving st., $2.53 c. y., **09,** 1082.

1909. E. C. Sickles, paving st., $2.55 c. y.; W. D. Fuller, rubblest. and quarry spalls, 97¢ c. y., **10,** 1206.

1910. Newburgh Dredging Co., dr. 19,326 c. y.; total cost, $2,538.38; Eugene S. Sickles, 895 c. y. rubblest. placed, $1,075.50, **11,** 1272.

1911. Michael J. Dady, removal of r. and overlying material, 86,705 c. y., at $3.21 c. y., and removal of shoals (10,000 c. y.), at 33¢ c. y., p. m., **11,** 1273. Eugene S. Sickles, furnishing 1,348 c. y. rubblest., $1,478.04, **11,** 1272.

1912. McHarg-Barton Co., constr. dikes, prices listed; Hirsch Lumber Co., sq. timber, $30.40 M f. b. m., **12,** 1490. Geo. R. Johnson, lumber, $23.75 M f., b. m.; Loren H. Elmendorf, round piling, 10¢ l. f., **12,** 1491. Purchases made under informal agreements, with list of companies, prices, etc., **12,** 1488.

ENGINEERS.

Chief of Engineers. R., 66, 3, ii, 24, 28, 41, iii, 20, 21, 29, iv, 205; **67,** 43, 444; **68,** 64; **69,** 54, 387; **70,** 72; **71,** 81, 82; **72,** 79; **73,** 84; **74,** 94; **75,** 100; **76,** 54; **77,** 48; **78,** 54, 411; **79,** 60, 367; **80,** 81, 479, 480; **81,** 97; **82,** 97; **83,** 93; **84,** 101; **85,** 94; **86,** 92; **87,** 56, 67; **88,** 57; **89,** 71; **90,** 63, 332; **91,** 81; **92,** 84, 751; **93,** 92; **94,** 83; **95,** 95; **96,** 103; **97,** 105; **98,** 131; **99,** 151; **00,** 171; **01,** 210; **02,** 140; **03,** 135; **04,** 120, 1082; **05,** 128; **06,** 133, 140; **07,** 138, 148; **08,** 144, 155; **09,** 148; **10,** 167, 181; **11,** 171; **12,** 209, 224.

Boards:

Convened, 1834; considered that an imp. chan. could only be maintained by floods; recom. lines of longitudinal dikes, Troy to New Baltimore, **66,** iii, 20, iv, 206, 207. (Col. Totten, Lt. Col. Thayer, and Capt. Talcott.)

Convened May 21, 1867, at Albany; recom. adoption of modified proj. for dikes; dr.; side reservoirs, and protection of banks by revet. **R., 67,** 445, 446. (Cols. Bache and Brewerton, Lt. Col. Newton, and Maj. Abbot.)

Convened, New York, Mar. 5, 1880, to **R.** upon Gen. Newton's plan for imp. at New Baltimore, which, in the opinion of the Schuyler Steam Tow-Boat Co., would result in injury to the navigation of the R., **80,** 480; **85,** 690. (Col. Tower and Maj. Abbot.)

H. line board convened Mar. 18, 1890, by S. O. No. 49, New York City, to ex. and **R.** upon location of H. lines in the R. from Troy to New Baltimore. **R., 90,** 770, 772. (Cols. Abbot, Craighill, and Comstock, and Lt. Col. Gillespie.)

Convened, New York, Oct. 1, 1891, by S. O. No. 66, to **R.** upon imp. of the R. **R., 92,** 752. (Lt. Col. Gillespie and Majs. Stickney and Raymond.)

(Col. S. M. Mansfield, Maj. W. L. Marshall, 1st Lt. E. H. Schulz) appointed by Sec. War under au. act 1902, to ex. and determine whether existing U. S. work in connection with the upper Hudson imp. causes gorges and freshets between Albany and Coxsackie, and what changes, if any, should be made. **R.** stated that U. S. imp. had not only not caused gorges and freshets, but had been an aid in diminishing them. The board recom. certain modifications of chan. imp.; est., $113,300, **04,** 1082.

In charge:

Capt. H. Brewerton, 1834; **66,** iii, 21, iv, 211, 212.

Capt. G. W. Hughes, 1843; **66,** iv, 212.

Maj. R. Delafield, 1852; **66,** iii, 20. **R., 66,** iv, 208.

[1] Bids thrown out for attempts to defraud the U. S., **74,** ii, 159; for informality, **75,** ii, 200.

Col. J. D. Graham, 1865. **R., 66,** 37, 40.
Lt. Col. J. Newton, 1866–84; **66,** ii, 28, 41, iii, 20. **R., 66,** iv, 202, 206–221; **67,** 441; **68,** 711; **69,** 381; **70,** 427; **71,** 719; **72,** 797; **73,** 930; **74,** ii, 154; **75,** ii, 195; **76,** 235; **78,** 411; **79,** 367; (Col.) **80,** 471, 488, 489; **81,** 617; **82,** 641; **83,** 529; **85,** 678.
Capt. J. Mercur, 1877, in temporary charge, 1884–85. **R., 77,** 223; **84,** 696.
Lt. Col. W. McFarland, 1885–89. **R., 85,** 677, 690; **86,** 665; **87,** 650; **88,** 588.
Lt. Col. G. L. Gillespie, 1889–96. **R., 89,** 756; **90,** 688, 766, 768; **91,** 864; **92,** 734; **93,** 1006; **94,** 723; **95,** 898; (Col.) **96,** 823.
Lt. Col. W. Ludlow, 1897. **R., 97,** 996.
Maj. A. M. Miller, 1898. **R., 98,** 1047.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1293; **00,** 1487.
Col. S. M. Mansfield, 1901–02. **R., 01,** 1222; **02,** 947.
Col. Amos Stickney, 1903. **R., 03,** 877
Capt. E. H. Schulz, 1904. **R., 04,** 1038.
Col. W. R. Livermore, 1905–06. **R., 05,** 978; **06,** 960.
Col. J. G. D. Knight, 1907–08. **R., 07,** 1006; **08,** 1056.
Col. W. M. Black, 1909–. **R., 09,** 1078; **10,** 1203; **11,** 1272; **12,** 1486.

Assistants:
Capt. J. M. Wilson, **66,** ii, 41, iii, 20, iv, 206; **67,** 43; **68,** 64, 72; **69,** 54, 384. **R., 70,** 430.
Capt. S. M. Mansfield, **71,** 81.
R. H. Talcott, **69,** 384; **76,** 236.
Lt. J. H. Willard, **72,** 798; **73,** 930. **R., 73,** 933, 934; **74,** ii, 156; **75,** ii, 195; **76,** 235; **77,** 223; **78,** 411; **79,** 370; **80,** 475; **85,** 696.

ESTIMATES. (See Projects.)

By BE., 1834, system of longitudinal dikes and occasional dams, $819,634.10, **66,** iv, 211, 212.
By Maj. Delafield, 1852, dr., etc., $50,000, **66,** 3, iii, 20, 21.
By Lt. Col. J. Newton, 1866, dikes, dr., revet., etc., $862,297.75, **66,** iii, 21, iv, 218, 219.
By Lt. Col. Newton, 1867, completion, $474,109.75, **67,** 442. Revised in 1868 to $511,116.47, **68,** 718, 719.
By Lt. Col. Newton, 1879, completion of existing proj., $65,016.47, **79,** 369.

LEGAL PROCEEDINGS.

Negotiations for acquiring land necessary for Troy l. and d., **12,** 1489.

LEGISLATION.

Act June 25, 1910, required extinguishment of existing water power (Troy) rights. Complied with by N. Y. Canal Board, Nov. 22, 1910. Detailed plans carried on. Prior compliance rescinded by N. Y. Canal Board, Apr. 28, 1911. Hence all work suspended, except contract for r. removal and necessary mainten., Sept. 15, 1911. Sec. of War au. resumption on such portion of proj. not dependent on l. and d. Feb. 17, 1912, all work under proj. resumed. Mar. 1, 1912, final location of dam approv. by Sec. of War, **12,** 211.

OBSTRUCTIONS.

Complaints by Albany State Board of Pilots as to illegal dumping in the R., **90,** 690, 770.
List of brs. across the Hudson R., **90,** 692; **91,** 867; **92,** 737; **95,** 902; **96,** 828; **97,** 1010.
List of brs. au. by State and U. S., **95,** 902; **96,** 828.

OPERATIONS.[1]

1834. Constr. of dikes, dams, and revet., **66,** iv, 212.
1854. Dr. at Ninemile Tree Bar and Mulls Plat Bar, **66,** iv, 212.
1866–67. Repairing dikes, **66,** iv, 212, 218. Dikes repaired, **67,** 43, 441.
1867–68. Constr. and repairs of dikes and revet.; paving shore line, and dr., **68,** 64, 65, 713–715.
1868–69. Constr. and repairs of dikes, and dr., **69,** 54, 381–384.
1869–70. Constr. and repairs of dikes; dr., and revet. built, **70,** 72, 427, 430.
1870–71. Constr. of dikes and revet.; dr.; removal of part of Overslaugh Rock and old State Dam; repairs, **71,** 82, 719–722.
1871–72. Constr. and repairs of dikes; dr., and removal of part of Overslaugh Rock by blasting, **72,** 798–801.
1872–73. Constr. of 3,047 l. f. of dike; repairs, **73,** 84, 930–934.
1873–74. 5,028 l. f. of dike nearly completed; repairs, **74,** 94, ii, 154, 155.
1874–75. Constr., raising, and repairing dikes, **75,** 100, ii, 195, 196.
1875–76. Constr. and repairs of dikes, and dr., **76,** 54, 236, 237.
1876–77. Constr. and repairs of dikes, and dr., **77,** 49, 224, 225.
1877–78. Constr. and repairs of dikes, and dr., under State app., **78,** 54, 411.
1878–79. Repairs; constr. of dikes and piling; wreck removal, and dr., **79,** 60, 367, 372.
1879–80. Dikes at Douws Pt. and Shad Isld. completed; e. and w. dikes at New Baltimore extended; upper section of dike between Barren Isld. and New Baltimore raised to h. w. level; beacon crib built; 17,000 l. f. single pile dke constr.; repairs to crib dike at Hillhouse Isld. to w. dike at Coeymans; 9,000 c. y. dr., **80,** 471, 472, 473, 477.
1880–81. Line of single piling at Staats extended 225′; repairs to dikes at Bath and Douws Pt.; 9,348 c. y. rubblest. placed; 1,170 l. f. piling restored, **81,** 618.
1881–82. Removal of Austins Rock commenced; dike constr. under contract of 1881 nearly finished; repairs and filling to existing works, **82,** 642.
1882–83. Removal of Austins Rock continued; 711 l. f. dike built; 115 l. f. cribwork built; repairs to high dike at Hillhouse, **83,** 529, 530.
1883–84. Removal of Austins Rock nearly finished; 119 760 c. y. dr. by State authorities, **84,** 696
1886–87. Repair of dikes at New Baltimore, Roah Hook, and Coeymans, **87,** 654.
1887–88. Repairs to w. dike, New Baltimore, and middle dike at Coeymans, **88,** 590.
1889–90. 23,582 c. y. st. used in repair of dikes, **90,** 694.
1890–91. 18,112 c. y. st. used in dike constr. and repair; 65,000 c. y. dr., **91,** 870, 871.
1891–92. Mulls Plaat Dike extended 800′; Mulls Dike extended 2,535′; Ninemile Tree Dike completed to 1,735′; 5,600 c. y. st., 5,213 l. f. pine piling, and 6,974′, b. m., of sq. timber used in repairs to existing dikes; 52,327 c. y. dr. at Mulls Cross Over, Kellogg, Weslington, Overslaugh, New Baltimore, and Stone Light Bars; 1,372 c. y. r. removed at Dettinger and Overslaugh Rocks, **92,** 739, 743.
1892–93. Two new dikes under constr., 8 dikes repaired, 54,458 c. y. dr., **93,** 1012; 3 wrecks removed, 2,340 c. y. r. blasted and removed, 109 t. r. removed, and also 14 t. sand covering, and model of the R. for World's Fair under constr., **93,** 1010–1015.
1893–94. 10,268 l. f. new dikes constr., 1,000 l. f. old dikes repaired, 544,520 c. y. dr., 13,092 t. r. and 2,259 t. sand removed, and 2 wrecks also removed, **94,** 729–731.
1894–95. 8,556 l. f. new dikes built, 10,020 l. f. old dikes repaired, 1,125,954 c. y. dr., 32,700 t. r. and 6,586 t. sand covering removed; 2,151 sq. y. dike paved, and 1 wreck removed, **95,** 904–906.
1895–96. 15,808 l. f. new dikes built, 4,086 l. f. old dikes repaired, 833,796 c. y. dr., 41,206 t. r. and 2,890 t. sand covering removed; 18,107 sq. y. dike paved, and 2 wrecks removed, **96,** 830–832.
1896–97. 1,285 l. f. new dikes built and materials for repair of old dikes supplied, 1,066,875 c. y. dr., 57,032 t. r. and 3,587 t. sand covering removed, and 3 wrecks removed, **97,** 1002–1003.
1897–98. 2,254 l. f. new dikes built, 2,094 l. f. old dikes repaired, 8,743 l. f. refilled with rubblest. and st. for paving 5,404 sq. y. of old dikes and revet.

[1] History of, from 1797 to 1866, **66,** iv, 211, 220.

furnished, 530,483 c. y. dr., 45,916 t. r. and 4,779 t. sand covering removed, and 3 wrecks also removed, **98,** 1049–1051.

1898-99. New dike under constr.; 1,261 c. y. rubblest, and 800 c. y. paving st. placed in repair of old dikes, **99,** 1294.

1899-00. New dike completed; 25 c. y. rubblest, and 651 c. y. paving st. placed in repair of old dikes; 177,718 c. y. dr. and several snags and a submerged pontoon removed from chan., **00,** 1488–1489.

1900-01. 394,203 c. y. dr. 13,575 c. y. r. removed, 2,500′ new dike built, 4,488′ dikes repaired, 4,533 c. y. rubblest. and 108 c. y. paving placed, **01,** 1222, 1223.

1901-02. 232,011 c. y. dr., 11,957 c. y. r. removed, dikes repaired, 7,583 c. y. st. used in filling 21,497′ dikes, **02,** 948, 949.

1902-03. 150,252 c. y. dr., 17,033 c. y. r. removed, work continued on constr. and repair of dikes, **03,** 877, 878.

1903-04. 142,075 c. y. dr., 22,801.7 c. y. r. removed, 3 new dikes under constr., and 25 dikes repaired during the year, **04,** 1038–40.

1904-05. 2,493 c. y. dr., dike constr. and repairs continued, **05,** 978.

1905-06. Dike constr. and repairs continued and 107,700 c. y. dr., **06,** 960, 961.

1906-07. 179,994 c. y. dr., **07,** 1006, 1007. Obstr. removed from chan. at Matthews Pt.; constr. of Bath Crossover Dike and repairs to Overslaugh Dike No. 2 continued, **07,** 1009.

1907-08. 61,205 c. y. dr. from Stonehouse Bar and 39,631 from other bars, 23,382 c. y. dr. from mouth of Schodack Creek, and dike work continued, **08,** 1056.

1908-09. 377,071 c. y. dr. and dike work continued, **09,** 1078.

1909-10. 13,242 c. y. dr. and dike work continued, **10,** 1203, 1204.

1910-11. 19,326 c. y. removed from shoal, and 2,441 c. y. rubblest. placed in revet. and dikes, **11,** 1272.

1911-12. Work in progress on removing r. (8,258 c. y.), constr. Van Wies and Willow Isld. Dikes, repairs to several dikes; plans and specifications prepared for work on Troy Lock and Dam; details of work given, **12,** 1486.

NOTE.—For details of locality, character, cost, etc., of work; also d. and w. of chan. at various points, see **Rs.** of E. in charge.

PHYSICAL CHARACTERISTICS.

Freshets and ice gorges, **66,** iv, 208.

Mean flow and fall of tides, **66,** iv, 207.

Velocity of currents at l. w., **66,** iv, 207.

General discussion, **66,** iv, 207, 208, 209, 213, 214.

Relative heights of tides and freshets, **68,** 716.

Effects of tides and freshets, **75,** ii, 196.

Tidal rise of the Hudson at various points, **86,** 667, 668; **87,** 652.

Drainage area of the Hudson R.; greatest, least, and average rainfall from 1827 to 1890; mean rise and fall of tides at various points along the R.; elevation of mean tide at Albany above that of the Atlantic Ocean; heights of greatest known freshets above plane of m. l. w. at Albany, **90,** 691; **91,** 866; **97,** 998.

Rainfall observations, **93,** 1008, 1009; **94,** 726; **95,** 900; **96,** 826; **97,** 999; **98,** 1052.

Navigation of the R. at low stages dependent in a large degree upon the tidal prism of the stream, **93,** 1008.

Tidal observations, **93,** 1009; **94,** 727; **95,** 901; **96,** 826; **97,** 998; **98,** 1052; **99,** 1295.

Effects of ice formation, **93,** 1015; **94,** 732; **95,** 907; **96,** 834.

Shoal formations, **93,** 1015; **94,** 732; **95,** 907, 908; **98,** 1052.

Chan. dimensions, **95,** 907; **96,** 834, 835; **97,** 1005; **98,** 1053; **99,** 1296.

Tide tables, **99,** 1295; **00;** 1490.

Sounding tables, **99,** 1296; **00,** 1491.

General description, and tables of freshets and ice gorges, 1818 to 1903, **04,** 1086, 1088; **12,** 212.

Depths at various localities, **11,** 173.

Max. draft at lowest l. w., 8.5′; range of tides, etc., **12,** 212.

Waterford head of navigation. Rises in Adirondacks, 300 m. from Battery, N. Y. C.; n. of Troy it is joined by Hoosick and Mohawk Rs. and many smaller streams. Proj. section, 39± m.; lower end of proj. section, 117 m. above Battery. At Waterford, R. connected by canal with Great Lakes and L. Champlain, **12,** 209, 212.

New planes of reference estab. for 12′ chan., **12,** 210.

PLANS.

By Mr. Genet, ship canal from Albany to d. w. below, **66,** iv, 211, 212.

PRIVATE (STATE) WORK.

The State of N. Y. expend. for imp. between Waterford and New Baltimore, as follows: 1797 to 1866, $600,030.84, **66,** iv, 211, 212, 220. 1870–71, repairs on dike, $716.84, **71,** 719. 1872, extension and repairs of dikes and dr., $50,000, **73,** 932. 1873, repairs of dike and dr., $50,000, **73,** 932. 1876, dr. 136,709 c. y., $40,000, **76,** 236; **77,** 49, 225. 1877, dr., $15,000, **77,** 225. 1878, dr., $30,000, **79,** 373. 1879, dr., $30,000, **79,** 373.

The State of N. Y. lost by injudicious application of app., $215,707, **66,** iv, 220.

Repairs to State dikes below Castleton and at Mulls Isld., by State au., also dr. at the above places, and between Troy and Albany, **83,** 530.

Dr. by State au., **84,** 696; **87,** 654.

Description of work done by the State of N. Y., **93,** 1008.

In 1895 the disposition of the N. Y. Legislature was to leave the imp. of the R. solely to the U. S., **95,** 900.

PROJECTS. (See Estimates.)

By De Witt Clinton, 1831, dikes and dams, **66,** iv, 211, 212.

By BE., 1834, system of longitudinal dikes and occasional dams; est., $819,634.10, **66,** iii, 20, iv, 206, 207, 212, 213.

By Maj. Delafield, 1852, dr. and closing isld. chutes, **66,** iii, 20, 21, iv, 208, 209.

The orig. and revised proj., under which the existing works for imp. are conducted, proposed by Col. Newton in 1866 and 1867, and provide for securing navigable chan. 11′ m. l. w. from New Baltimore up to Albany, and 9′ m. l. w. from Albany up to Troy. This proj. in detail is as follows: 1st, system of longitudinal dikes to confine the current sufficiently to allow the ebb and flow of the tidal current to keep the chan. clear, these dikes to be brought gradually nearer together from New Baltimore toward Troy; 2d, dr. where necessary; 3d, keeping the side reservoirs open to the passage of tidal currents, by gaps at their lower extremities, in order to increase the tidal flow; 4th, constr. dikes of timber and st. Orig. est. cost, $862,297.75; increased several times at later periods, to take account of expend. for repairs and for work done not included in previous est.; it was revised in 1867 to $984,304.47, **68,** 718, 719; **87,** 667. Increased in 1882, to cover repairs, by $78,000, **82,** 643; **86,** 667. For removal of r., 1884, by Capt. Mercur, $16,000, **84,** 696. Increasing the est. cost to $1,078,304.47, **86,** 667; **87,** 651, 656.

In 1887, Lt. Col. McFarland considered $255,000 would yet be required to complete the permanent works and make needed repairs to existing dikes, **87,** 653, 655, 656.

In 1889 this est. increased to $295,000 over and above prior app., **89,** 760.

By BE., 1891, for chan. 12′ x 400′, Coxsackie to the foot of Broadway, Troy, thence 12′ x 300′ to the State Dam at Troy; est., $2,447,906.56, **92,** 752, 759.

In 1898, Maj. Miller est. $2,246,769.80 additional to complete existing proj., and $100,000 an. maintenance, **98,** 1054. (1912 **R.** gives proj. of 1892, modified 1899, as follows: 12′ chan. m. l. w. 150′ w.; State Dam to foot of Jacob St., Troy; thence gradually increasing to 400′ at foot of Broadway, Troy; thence 400′ to Coxsackie; est., $4,343,863, **12,** 210.)

Act 1905 au. $85,000, or as much of it as necessary, be expend. (in discretion of Sec. of War) in removing Stonehouse Bar, opposite New Baltimore, **05,** 129.

By Col. Lockwood, 1906, alternative plans for extending imp. to Waterford; ests., $934,000 and $1,124,100,[1] **07,** 148.

[1] H. D. 539, 59th, 2d.

Act 1907 au. expend. of $5,000 in removing bar at mouth of Schodack Creek, **07,** 138.
See Boards.
Act June 25, 1910, au. Col. Black's proj. for new l. and d. to replace State Lock and Dam; construction of necessary works thereat to acquire power for sale; leasing of US. land; 12′ chan. at all stages, 200′ w. from above the dam to Waterford, general w. below the dam to be 400′, except in front of Troy (est., $420,559) and Albany (est., $105,000), where chan. is to widen to form a H. Below Congress St. Br. the chan. narrows again to 400′, with increased w. at bends, to be maintained to d. w. in R. Est., $5,186,064. Time for completion, 4 years, **10,** 168, 181; **12,** 210.
See Legislation.

SURVEYS.
1819–52. **67,** 446.
By De Witt Clinton, 1831, **66,** iv, 207, 211.
By Capt. Hughes, 1843, **66,** iv, 212.
By Maj. Delafield, 1852, **66,** iv, 208.
Under direction of Lt. Col. Newton, by R. H. Talcott, 1867–68–69, between Troy and New Baltimore, and from Troy to Albany, **67,** 441; **68,** 65, 711; **69,** 384.
Under direction of Lt. Col. Newton, by F. Von Egloffstein and R. H. Talcott, 1872, **72,** 801; **76,** 235, 236; **77,** 49, 223.
Under direction of Lt. Col. Newton, by Lt. Willard, 1878, from Troy to s. end of Houghtailing Isld., **78,** 54, 411.
Under direction of Lt. Col. Newton, by Lt. Willard, 1879, of various parts of the R., **79,** 60, 370.
Ex. of rs. at Van Wies Pt.; sur. and ex. at various pts., **80,** 475.
Between Troy and New Baltimore, by Lt. Col. McFarland, 1884, **85,** 695.
Between New Baltimore and Coxsackie, au. act Aug. 5, 1886, **87,** 97.
Misc. sur., ex., etc., **93,** 1015; **94,** 731, 732; **95,** 906; **96,** 833; **97,** 1004; **98,** 1052; **99,** 1295; **00,** 1491.
Ex. of st. p. at Piermont, N. Y., au. act Mar. 3, 1905, with view to removing it; made, 1906, by Col. Livermore (**R.** unfav.),[1] **06,** 140.
Ex. and sur. Troy to Waterford au. act Mar. 3, 1905; made, 1906, by Col. Livermore and Col. Lockwood, resp.,[2] **07,** 148.
For p. and bulkhead lines at Hastings on Hudson, **07,** 1009.
Ex. and sur. au. act Mar. 2, 1907; for 12′ from chan. to Upper Nyack, Nyack, South Nyack, Grand View, Piermont, and mouth of Sparkill R.; made, 1907–08, by Col. Knight (**R.** unfav.),[3] **08,** 155.
Ex. and sur. at Coeymans, Albany, Troy, and Waterford au. act Mar. 3, 1909; made, 1909–10, by Col. Black,[4] **10,** 181.
Ex. and sur. au. act June 25, 1910, Hudson R. at Ossining, N. Y., and Feb. 27, 1911, Hudson R. in front of Rensselaer, between Albany and Greenbush Br. and N. Y. C. & H. R. RR. br., for increased d., **12,** 224.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 210, 211.

Maps:[2 4]
Of a portion of the R. near Castleton, **66,** i. **80,** 484; **81,** 618; **85,** 692, 696; **11,** 1272.

Part (b), E-28 Hudson River (Jersey City), N. J.

APPROPRIATION.
1875, $25,000, **75,** 101, ii, 215; **77,** 245.

CONTRACT.
1875. Curtis, Fobes & Co., dr., 12¼¢ c. y., **76,** 243, 244.

ENGINEERS.
Chief of Engineers. R., **75,** 101; **76,** 55 **77,** 50.

In charge:
Lt. Col. John Newton, 1875–77. **R.,** **75,** ii, 215; **76,** 243; **77,** 245, 246.
Capt. J. Mercur, in temporary charge, 1877. **R.,** **77,** 245.

Assistant. J. H. Striedinger, **75,** ii, 219.

ESTIMATES. (See Projects.)
By Lt. Col. Newton, dr. in the vicinity of Pavonia Ferry and Cunard Docks, $101,807.20, **75,** ii, 219; **76,** 244; **77,** 245.

OPERATIONS.
1876. 163,639 c. y. removed; 105,924 c. y. dr. under contract, and 57,715 c. y. by hired labor from vicinity of Jersey Ferry slips and Cunard Docks, **76,** 55, 243.
1877. Dr. suspended, **77,** 247.

PHYSICAL CHARACTERISTICS.
Discussed, **75,** ii, 216–219; **77,** 246.

PRIVATE AND CORPORATE WORK.
Dr. by several RR. and SS. cos., 1874, at cost of $116,737.95, **75,** ii, 217.

PROJECTS. (See Estimates.)
By Lt. Col. Newton, 1875 dr. 221,300 c. y. from Pavonia Ferry to Cunard Docks, **75,** ii, 219. Dr. to amount of the app., **75,** ii, 215.

SECRETARY OF WAR.
Approves views of Chief of Engineers that dr. be suspended, **77,** 247.

SURVEYS.
Under direction of Lt. Col. Newton, by J. H. Striedinger, Preuss, and De Foresta, 1874. **R.,** **75,** ii, 215.
Resur. by Lt. Col. Newton, 1877, **77,** 246.
Maps. Of sur. by Maueer & Sylvester, **75,** ii, 219.

Part (c), E-28 Hudson River, N. J. and N. Y. (including Ellis Island to Constable Hook, N. J.; in front of Jersey City and Hoboken; and Weehawken to Bergen Point, N. J.).

COMMERCE.
Importance, **81,** 720; **84,** 776.

ENGINEERS.
Chief of Engineers. R., **82,** 116; **84,** 122; **85** 115.
In charge. Maj. G. L. Gillespie, 1882–85. **R.,** **82,** 719; **84,** 774; **85,** 790, 791.

Assistant. A. Doerflinger. **R.,** **82,** 722.

PHYSICAL CHARACTERISTICS.
Description of localities, **81,** 719.
Deposits from dumping on Jersey Flats, **82,** 720.
Comparison of surs. in front of Jersey City, **84,** 779.

PLANS.
By Maj. Gillespie, 1882, chan. 21′ x 300′ l. w. from the wharves of the Central RR. of New Jersey to

[1] H. D. 915, 59th, 1st. [2] H. D. 539, 59th, 2d. [3] H. D. 959, 60th, 1st. [4] H. D. 719, 61st, 2d.

d. w. in Kill von Kull, by r. removal and dr.; est., $7,134,980, **82,** 721, 724; **85,** 793.

By Maj. Gillespie, 1884, obtaining a d. w. front along Jersey City and Hoboken by the advance of the pier-head line from Castle Pt. to Communipaw, **84,** 777, 780. Extension of line farther upstream suggested, **85,** 793.

By Maj. Gillespie, 1885, imp. of Kill von Kull by the removal of the rocky ledges outside of the exterior wharf lines to d. of 10′ l. w.; est., $1,090,000, **85,** 795.

SURVEYS.

From Ellis Isld. to Constable Hook, au. act Mar. 3, 1881; made by Maj. Gillespie, **82,** 719.

Of North R. in front of New Jersey, au. act Aug. 2, 1882; made by Maj. Gillespie, **84,** 774.

From Weehawken to Bergen Pt., au. act July 5, 1884; made by Maj. Gillespie, 1884, **85,** 790.

Maps:

North R. from Ellis Isld. to Fort Washington Pt., **85,** 792.

Upper New York B. from Ellis Isld. to Bergen Pt., **85,** 792.

Part (d), E-28 Hudson River, N. Y. (Troy to mouth of canal).

ENGINEERS.

Chief of Engineers. **R.,** **85,** 96.
In charge. Capt. J. Mercur. **R.,** **85,** 71.
Assistant. F. P. Rogers. **R.,** **85,** 712.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Mercur (**R.** unfav.), **85,** 711, 712.

Part (e), E-28 Hudson River, N. Y. (Coxsackie to New Baltimore).

ENGINEERS.

Chief of Engineers. **R.,** **88,** 68.

In charge:
Lt. Col. W. McFarland, 1887. **R.,** **88,** 640.
Lt. Col. G. L. Gillespie, 1888. **R.,** **88,** 641; **91,** 864.

Assistant. M. Kingsley. **R.,** **88,** 642.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 640.

PROJECTS.

Inasmuch as a sufficient d. already exists between New Baltimore and Coxsackie, Lt. Col. Gillespie did not consider further imp. necessary, **88,** 642.

SURVEY.

Au. act Aug. 5, 1886; made, 1888, by Lt. Col. Gillespie (**R.** unfav.; see Projects), **88,** 641.

Maps. **88,** 642.

Part (f), E-28 Jersey City to Ellis Island (Ship Channel), N. Y.

COMMERCE.

Important, **89,** 804.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 83.
In charge. Lt. Col. G. L. Gillespie, 1888. **R.,** **89,** 801.

PLANS.

By Lt. Col. Gillespie, 1889, excavating ship chan. 2,375′ l. between Jersey City and Ellis Isld., 26′ x 300′ m. l. w.; est., $108,462; also basin with 26′ and an area of about 70 acres for anchorage purposes; est., $442,340, **89,** 803.

SURVEY.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Gillespie, **89,** 801.

Maps. **89,** 802.

E-30 TARRYTOWN HARBOR, N. Y.

APPROPRIATIONS.

1905,	$10,000,	**05,** 134.
1907,	16,000,	**07,** 1017.
1910,	10,000,	**10,** 1211.
Total,	36,000 (incl. misc., $36,003.25, **12,** 1498).	

COMMERCE.

Description of, **00,** 1521, 1524.

Imp. beneficial to C., but not known to have caused any reduction in rates, **08,** 152.

Slight reduction in rates reported, **09,** 155.

1911, 207,145 t., **12,** 222.

CONTRACTS.

1906. Columbia Dredging Co., dr. 54,150 c. y., 15.7¢ c. y., **06,** 967.

1907. Du Bois Bros. Dredging Co., dr. and removing bowlders to extent of $13,000; dr. 13.9¢ c. y., s. m.; bowlders, $4 c. y., s. m., **07,** 1018. Contract terminated under supp. agreement Aug. 21, 1908, **09,** 1087–88.

1911. Randerson & Miller, dr. 45,570 c. y., s. m., 19¾¢ c. y., **12,** 1495, 1498.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 83; **99,** 164; **1900,** 188; **05,** 133; **06,** 139; **07,** 143; **08,** 151; **09,** 154; **10,** 175; **11,** 181; **12,** 221.

In charge:
Lt. Col. G. L. Gillespie, 1888. **R.,** **89,** 800.
Col. J. W. Barlow, 1900. **R.,** **00,** 1520, 1522.
Col. W. R. Livermore, 1905–06. **R.,** **06,** 967.
Col. D. W. Lockwood, **07,** 118; **09,** 124.
Col. J. G. D. Knight, 1907–09. **R.,** **07,** 1017; **08,** 1067.
Col. W. M. Black, 1909–. **R.,** **09,** 1087; **10,** 1210; **11,** 1279; **12,** 1497.

Assistants:
H. C. Wilson. **R.,** **00,** 1523.
Lt. R. D. Black, **11,** 149; **12,** 178.

OPERATIONS.

1905–06. 45,060 c. y. dr. under contract, **06,** 967.

1906–07. 54,478 c. y. dr., **07,** 1017.

1907–08. 95,777.3 c. y. dr., **08,** 1067.

1910-11. Making sur. and map, and preparing specifications (see Peekskill H.), **11,** 178, 181, 1279.
1911-12. 42,439 c. y. dr., completing contract, **12,** 1498.

PHYSICAL CHARACTERISTICS.

Description of, **1900,** 1521, 1523; **06,** 139.
Condition of works and d., **06,** 139; **07,** 143–44; **08,** 151, 1067; **09,** 155; **10,** 176; **11,** 181–82; **12,** 222.

PROJECTS.

Col. Barlow est., 1899, $26,000 or $55,000 to imp. H., and $1,000 or $2,000 biennially for mainten., **00,** 1522, 1523.

Act Mar. 3, 1905, au. dr. chan. along wharf front 12′ x 150′, with connections n. and s. with d. w. in Hudson R., 100′ w.; est., $26,000, and $1,000 or $2,000 biennial mainten., **05,** 133. Est. increased to $35,491.68, **07,** 143, 144, 1017.
Proj. about 81% completed, **12,** 222.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Gillespie (**R.** unfav.), **89,** 800.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Col. Barlow (**R.** fav.; see Projects), **1900,** 1521, 1522.

E-35 PEEKSKILL HARBOR, N. Y.

APPROPRIATIONS.

1896,	$10,000,	**96,** 839
1899,	10,000,	**99,** 1302.
1902,	*3,000,	**03,** 956.
1905,	*2,500,	**05,** 987.
1907,	*3,000,	**07,** 1015.
1910,	*1,500,	**10,** 1209.
1911,	*2,000,	**11,** 1277.
Total,	32,000 (incl. misc., $32,001.90, **12,** 1495).	

COMMERCE.

Description of, **84,** 720; **95,** 1000.
Important and growing, **95,** 1000.
C. increased so much that chan. inadequate, **00,** 1499.
Rates reduced, **05,** 132; held reduced, **12,** 219.
Table, tonnages and values, 1904 to 1911, incl., **12,** 218.
1911, 291,000± t., **12,** 1496.

CONTRACTS.

1896. E. M. Payne, dr., 13.7¢ c. y. ($8,220), **97,** 1017.
1899. J. P. Randerson, dr., 8½¢ c. y. ($9,600), **99,** 1302.
1904. P. W. Myers & Son, dr., 13¢ c. y., **04,** 1050.
1907. Du Bois Bros. Dredging Co., dr., 20¢ c. y., s. m., **07,** 1015. The Newburgh Dredging Co., dr., 12¢ c. y., s. m., **08,** 1065.
1911. Randerson & Miller, dr. (5,060 c. y.), 19¾¢ c. y., s. m., **12,** 1495.

ENGINEERS.

Chief of Engineers. **R., 84,** 106; **95,** 120; **96,** 104; **97,** 109; **98,** 135; **99,** 154; **00,** 176; **01,** 213; **02,** 142; **03,** 137; **04,** 124; **05,** 132; **06,** 137; **07,** 141; **08,** 149; **09,** 152; **10,** 173; **11,** 178; **12,** 217.

In charge:
Col. J. Newton. **R., 84,** 718.
Lt. Col. G. L. Gillespie, 1895–96. **R., 95,** 999; **96,** 838.
Lt. Col. W. Ludlow, 1897. **R., 97,** 1016.
Maj. A. M. Miller, 1898. **R., 98,** 1058.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1301; **1900,** 1498.
Col. S. M. Mansfield, 1901–02. **R., 01,** 1230; **02,** 956.
Col. Amos Stickney, 1903. **R., 03,** 885.
Capt. E. H. Schulz, 1904. **R., 04,** 1049.
Col. W. R. Livermore, 1905–06. **R., 05,** 987; **06,** 966.
Col. J. G. D. Knight, 1907–08. **R., 07,** 1014; **08,** 1065.
Col. W. M. Black, 1909–. **R., 09,** 1085; **10,** 1208; **11,** 1277; **12,** 1495.

OPERATIONS.

1896-97. 64,620 c. y. dr., **97,** 1017.
1899-00. 102,344 c. y. dr., proj. completed, **00,** 1499.
1903-04. 25,393 c. y. dr. from chan. front of docks and at n. and s. turns, **04,** 1050.
1906-07. 7,812.8 c. y. dr., **07,** 1015.
1907-08. 18,272.8 c. y. dr., **08,** 1065.
1911-12. 5,812.4 c. y. dr., **12,** 1495.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1000.
A prominent indentation of Hudson R. at Peekskill, 1± sq. m. area. A narrow chan. at 1894 flowed n. and s. past the town docks. In the 35 years previous to 1889 no material change had occurred in the outlying shoals, **95,** 1000.
Chan. probably subject to shoaling, **98,** 1058.
Chan. shoaling, **03,** 885; **10,** 174.
Length of proj. portion, 1⅛ m., **12,** 218.

PLANS.

By Col. Newton, 1883, excavating chan. 8′ x 100′ x 10,000′ m. l. w.; est., $29,278, or one 10′ d., at $50,611; also for constr. of 1,400 l. f. of diking; cost, $137,000, **84,** 719.

PROJECTS.

By Lt. Col Gillespie, 1896, dr. turning-basins in front of the center and lower docks, and connection of these basins by a chan. 100′ x 600′; and for connecting the basin in front of the lower dock with d. w. of Hudson R. by a chan. 9′ x 75′ x 3,500′ m. l. w., **96,** 839. On application of the local authorities, chan. lines extended 600′ n. of the center wharf to the outer wharf, **97,** 1017.
As given at 1912, proj. of 1896: Chan. 10′ x 100′; est., $50,000; modification, 2 turning-basins, 10′ x 150′ x 200′. Proj. as modified completed 1899; cost, $19,400, **12,** 217.

SURVEYS.

Au. act Aug. 2, 1882; made, 1883, by Col. Newton, **84,** 718.
Ex. au. act Aug. 17, 1894; made by Lt. Col. Gillespie, 1894 (**R.** fav. to limited imp.; see Projects), **95,** 999.
Partial sur. of H., 1899, by Col. Barlow, **99,** 1301.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 218.
Maps. **03,** 885.

*Allotments.

E-40 WAPPINGERS CREEK, N. Y.

APPROPRIATIONS.

1890,	$13,000,	**91,** 886.
1902,	1,500,	**02,** 957.
1905,	3,000,	**05,** 989.
1907,	3,000,	**07,** 1016.
1910,	5,000,	**10,** 1210.
Total,	25,500	

COMMERCE.

In 1892 needs of C. were met by the completion of the proj. imp. of the creek, **93,** 1025.
C. interests benefited by imp., **09,** 154.
1911, 23,248 t., **12,** 221.

CONTRACTS.

1904. P. W. Myers & Son, dr. about 5,465 c. y., 21¢ c. y., **04,** 1051.
1906. A. C. Driscoll, dr. about 8,570 c. y., 28¢ c. y., **06,** 967.
1911. Randerson & Miller, dr. about 23,000 c. y., 19¾¢ c. y., **12,** 1495–96.

ENGINEERS.

Chief of Engineers. R., 89, 83; **90,** 74; **91,** 84; **92,** 88; **93,** 95; **94,** 85; **96,** 98; **02,** 143; **03,** 138; **04,** 124; **05,** 133; **06,** 138, 140; **07,** 142; **08,** 150; **09,** 153; **10,** 174; **11,** 180; **12,** 219.

In charge:
Lt. Col. G. L. Gillespie, 1888–95. **R., 90,** 758; **91,** 885; **92,** 776; **93,** 1024; **94,** 740; **95,** 916
Col. S. M. Mansfield, 1902–03. **R., 02,** 956.
Col. Amos Stickney, 1903–04. **R., 03,** 886.
Capt. E. H. Schulz, 1904–05. **R., 04,** 1051.
Col. W. R. Livermore, 1905–06. **R., 05,** 988; **06,** 966.
Col. D. W. Lockwood, **07,** 118; **09,** 124.
Col. J. G. D. Knight, 1907–09. **R., 07,** 1016; **08,** 1066.
Col. W. M. Black, 1909–. **R., 09,** 1086; **10,** 1209; **11,** 1278; **12,** 1496.

Assistants:
C. G. Weir. **R., 90,** 760.
Lt. J. R. Slattery, **03,** 123; **04,** 107.
1st Lt. E. I. Brown, **04,** 107.

OPERATIONS.

1891-92. 600 l. f. bulkhead built, and 50,000 c. y. dr. and placed behind same, **92,** 777.
1904-05. 5,463 c. y. dr., completing contract, **05,** 988.
1905-06. 7,903 c. y. dr., **06,** 966.
1911-12. 14,395 c. y. dr., **12,** 1496.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 758; **12,** 219.

PRIVATE WORK.

N. Y. C. & H. R. RR. Co. erected new draw, and dr. chan. to connect with new location, **09,** 1086.

PROJECTS.

By Lt. Col. Gillespie, 1889, excavation of a navigable chan. 8′ x 80′ m. l. w. from Wappingers Falls to the mouth of the creek; est., $13,000, **90,** 759.
Proj. completed, 1392, and no further app. recom., **92,** 777.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Gillespie, **90,** 759.
Pre. ex. au. Mar. 3, 1905, with view to r. removal. **R.** by Col. Livermore, Sept. 14, 1905 [1] (unfav.), **06,** 140.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 220.
Maps. **04,** 1051.

E-48(a) STUYVESANT HARBOR, HUDSON RIVER, N. Y.

ENGINEERS.

Chief of Engineers. R., 08, 155.
In charge. Col. J. G. D. Knight, **08,** 122.

SURVEY.

Pre. ex., with plan and est. of cost of imp., au. act Mar. 2, 1907. **R.** by Col. Knight, Sept. 24 and Oct. 25, 1907 [2] (unfav.), **08,** 155.
Map.[2]

E-54 MOHAWK RIVER, N. Y.

COMMERCE.

In 1897, none. Imp. of the stream between Rome and Schuyler would benefit only the city of Utica, **97,** 3305, 3306.

ENGINEERS.

Chief of Engineers. R., 97, 482.
In charge. Maj. W. S. Stanton, 1897. **R., 97,** 3304.

PHYSICAL CHARACTERISTICS.

Description of; R. ex., 1897, not navigable and also separated by falls at Little Falls and at Cohoes, and by dams both in the Mohawk and in the Hudson from the navigable waters of the latter R., **97,** 3305, 3306.

SURVEYS.

Ex. between Rome and Schuyler au. act June 3, 1896; made, 1896, by Maj. Stanton (**R.** unfav.), **97,** 3304.

E-61 CATSKILL CREEK, N. Y.

COMMERCE.

Description of; Catskill, at the mouth, has C. of 250,000 t. an., **97,** 1042; 251,000 t., 1896, **04,** 1056.

ENGINEERS.

Chief of Engineers. R., 97, 114; **04,** 126, 1054.

Boards. BERH. **R.** fav. (see Project and Survey, 1902), **04,** 1057.

In charge:
Lt. Col. W. Ludlow, 1897. **R., 97,** 1041.
Col. Amos Stickney, 1904. **R., 04,** 1058.

Assistants:
A. Doerflinger. **R., 97,** 1042.
R. H. Talcott. **R., 04,** 1059.

[1] H. D. 63, 59th, 1st.

[2] H. D. 491, 60th, 1st.

PHYSICAL CHARACTERISTICS.

Description of; creek a tributary of the Hudson R., entering it at Catskill, 10 m. below city of Hudson, **97,** 1041.

Description of, **04,** 1060.

PROJECT.

Col. Stickney presents 2 plans: (1) Chan. 10′ x 150′ m. l. w. to highway br., and 120′ above br.; est., $3,600; (2) chan. 12′ x 200′ m. l. w. to highway br., and 120′ above the br.; est., $74,111.75, **04,** 1059.

SURVEY.

Ex. au. act June 3, 1896; Col. Gillespie's **R.** partly fav., **97,** 1041.

Au. act June 13, 1902; made by Col. Stickney (see Projects),[1] **04,** 1054, 1058.

E-63 SAUGERTIES (Esopus Cr.) HARBOR, N. Y.

APPROPRIATIONS.

1884,	$5,000,	**85,** 700.
1886,	15,000,	**86,** 670.
1888,	12,000,	**88,** 595.
1890,	10,000,	**90,** 701.
1892,	5,000,	**92,** 772.
1894,	5,000,	**95,** 912.
1896,	2,500,	**96,** 766.
1899,	2,500,	**99,** 1300.
1902,	20,000,	**02,** 954.
1902,	*3,000,	**04,** 1047.
1905,	5,000,	**05,** 984.
1907,	20,000,	**07,** 1012.
1910,	12,500,	**10,** 1207.
1912,	2,500,	**12,** 1492.
Total,	120,000	(incl. misc., $120,004.60, **12,** 1492).

COMMERCE.

Description of, **00,** 1495, 1496, 1519, 1520.

A number of manuf. interests to locate here, which would add materially to C., **01,** 1227.

Imp. has effected reduction in rates, **07,** 140.

1911, 147,494 t.; table of tonnage for 11 years, **12,** 215.

CONTRACTS.

1888. H. Du Bois's Sons, pile dike constr., $6.79 l. f., **88,** 596.

1889. P. W. Meyers, dr., 15½¢ c. y.; Wm. Parrott, dike constr., $8.25 l. f., **89,** 762.

1890. Wm. Parrott, dike constr.; total, $7,746, **91,** 882.

1892. Wm. Parrott, repair of dike, **93,** 1020.

1895. W. D. Fuller, repair of n. dike, at a total cost of $1,134, **95,** 912. J. P. Randerson, dr. 13,969 c. y., at 16½¢ c. y., **96,** 765.

1896. F. Pidgeon, repair of s. dike; est., $1,721, **97,** 1012.

1901. Wm. Parrott, repairing dikes (prices given), **02,** 954.

1902. R. G. Packard Co., r. removal, $5,300, **03,** 884.

1903. Newburgh Dredging Co., dr., $6,000, **04,** 1048.

1906. Hawley Miller, dr. 27,120 c. y., 14¾¢ c. y., s. m., **06,** 1013.

1907. P. Sanford Ross (Inc.), removing 640 c. y. r. and 6,800 c. y. covering material, $2.12 c. y., **08,** 1063.

1910. Newburgh Dredging Co., dr. 30,000 c. y., 12¢ c. y., **11,** 1274.

1911. Randerson & Miller, dr. 65,000 c. y., 14¾¢ c. y., **11,** 1492.

ENGINEERS.

Chief of Engineers. R., 84, 105; **85,** 95; **86,** 93; **87,** 57; **88,** 58; **89,** 72; **90,** 64; **91,** 82; **92,** 86; **93,** 93; **94,** 84; **95,** 96; **96,** 93; **97,** 107; **98,** 134; **99,** 153, 164; **00,** 174, 188; **01,** 211; **02,** 141; **03,** 136; **04,** 122; **05,** 130; **06,** 135; **07,** 139; **08,** 146; **09,** 150; **10,** 171; **11,** 175; **12,** 213.

In charge:

Col. J. Newton, 1884. **R., 84,** 715.

Lt. Col. W. McFarland, 1885–89. **R., 85,** 699; **86,** 669; **87,** 660; **88,** 594.

Lt. Col. G. L. Gillespie, 1889–95. **R., 89,** 761; **90,** 699; **91,** 879; **92,** 771; **93,** 1019; **94,** 734; **95,** 910.

Maj. H. M. Adams, 1896. **R., 96,** 764.

Lt. Col. Wm. Ludlow, 1897. **R., 97,** 1010.

Maj. A. M. Miller, 1898. **R., 98,** 1056.

Col. J. W. Barlow, 1899. **R., 99,** 1299; **00,** 1494, 1518.

Col. S. M. Mansfield, 1901–02. **R., 01,** 1227; **02,** 954.

Col. Amos Stickney, 1903. **R., 03,** 883.

Capt. E. H. Schulz, 1904. **R., 04,** 1045.

Col. W. R. Livermore, 1905–06. **R., 05,** 984; **06,** 964.

Col. J. G. D. Knight, 1907–08. **R., 07,** 1012; **08,** 1062.

Col. W. M. Black, 1909–. **R., 09,** 1083; **10,** 1207; **11,** 1274; **12,** 1492.

OPERATIONS.

1885–86. 29,000 c. y. dr. from the bar at the mouth of the creek, **86,** 670.

1887–88. 2,363 l. f. of pile dike built, **88,** 595.

1888–89. 22,646 c. y. dr., **89,** 762.

1889–90. 28,746 c. y. dr.; work continued upon pile and crib dikes, **90,** 700.

1890–91. Extension of n. dike in progress, **91,** 880.

1891–92. Extension of n. dike completed, **92,** 772.

1892–93. Dikes repaired and bowlder removal in progress, **93,** 1020.

1893–94. Some bowlders removed, **94,** 735.

1895–96. N. dike repaired and 13,969 c. y. dr., **96,** 765.

1896–97. N. and s. dikes repaired, **97,** 1011.

1899–00. 392 c. y. rubblest. placed in repair of old dike, **00,** 1494.

1901–02. N. and s. dikes repaired, **02,** 954.

1902–03. Repairs to n. d., and 12,000 c. y. dr. from chan., **03,** 883.

1903–04. Portion of the reef of rs. at Barclays Pt. removed to 12′, 26,660 c. y. dr. from chan., and 1,833 l. f. n. d. repaired, **04,** 1045.

1904–05. 11,000 c. y. dr. from shoal, restoring 6′ d., **05,** 984.

1906–07. 25,545 c. y. dr., **07,** 1012.

1907–08. 1,968 c. y. r. and other material removed, securing 12′ d. over an area of 34,900 sq. f., **08,** 1062.

1908–09. 5,202 c. y. dr., resulting in removal of Powderhouse Reef to 12′ below m. l. w., **09,** 1083.

1910–11. 28,218 c. y. dr., **11,** 1275.

1911–12. 56,657 c. y. dr.; 80% of proj. completed, **12,** 1492.

PHYSICAL CHARACTERISTICS.

A large obstr. sandbar formed in the upper part of the creek by a freshet in the spring of 1895, **95,** 912.

Description of; at mouth of Esopus Cr., **88,** 594; **00,** 1519.

Considerable shoaling due to large amount of sand and silt brought into chan. by breaking of dam, **05,** 1046.

PLANS.

By Col. Newton, 1884, imp. by excavation of a chan. from 7′ x 100′ x 1,900′–2,500′ m. l. w.; also constr. of 2 parallel dikes; est., $41,000 to $46,000, **84,** 716; **85,** 699; **86,** 669; **87,** 662.

PRIVATE AND CORPORATE WORK.

Dr. by N. Y., **86,** 670; **87,** 661.

* Allotment.

[1] H. D. 59, 58th, 2d.

PROJECTS.

By Lt. Col. McFarland, 1887, chan. 300′ x 8′ m. l. w., with parallel dikes 2,300′ l., with dr. in the chan. between the dikes if necessary; est., $52,000, **87,** 662; **92,** 771.

By Congress, repair of dikes, and removal of rocky points near the shore end of the n. dike to the extent of $5,000, **93,** 1020.

In 1898 Maj. Miller est. $5,000 biennially for mainten., **98,** 1056.

Col. Barlow est., 1899, $7,465, with $2,000 an. for mainten., for further imp. from s. dike, and $44,685, with $2,500 an. mainten., for a 12′ chan. toward H. head (see Surveys), **00,** 1519.

Act June 25, 1902, au. chan. 12′ x 300′ from Hudson R. to the SS. landing at Saugerties, **02,** 141.

Act Mar. 3, 1905, au. Chief of Engineers, upon application, to permit extension of chan., provided no part of app. be expended therefor, **05,** 130.

SURVEYS.

Au. act Aug. 2, 1882; made, 1885, by Col. Newton, **85,** 699.

Ex. and sur. from s. dike to the "Point of Rocks" au. act Mar. 3, 1899; made, 1899, by Col. Barlow (**R.** fav.; see Projects), **00,** 1518.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 214.

Map. **04,** 1046.

E-64 RONDOUT HARBOR (Creek), HUDSON RIVER, N. Y.

APPROPRIATIONS.[1]

1872,	$10,000, **72,** 80, 806; **73,** 85.
1873.	20,000, **73,** 85.
1875,	*1,000, **76,** 56, 250; **77,** 251.
1876,	30,000, **76,** 56, 250; **77,** 251.
1878,	30,000, **78,** 56, 418.
1882,	2,000, **82,** 645.
1884,	1,000, **84,** 701.
1886,	2,500, **86,** 672.
1888,	5,000, **88,** 597.
1890,	5,000, **90,** 704.
1892,	5,000, **92,** 775.
1894,	5,000, **95,** 915.
1896,	2,500, **96,** 769.
1902,	*2,500, **02,** 955.
1902,	*3,800, **04,** 1049.
1905,	*15,000, **05,** 986.
1907,	*3,000, **07,** 1014.
1910,	*1,500, **10,** 1208.
1911,	*4,000, **11,** 1276.
1912,	11,000, **12,** 1494.
Total,	159,800

COMMERCE.

To value of $70,000,000 or $80,000,000, est. to be benefited by imp., **69,** 394.

Reduction in freight and towing rates since H. imp., **89,** 766; **08,** 148.

In 1900, 1,885,000 t., **01,** 213.

Table of tonnage, 1904 to 1911, incl., **12,** 216.

1911, 511,000± t., **12,** 1495.

CONTRACTS.

1872. Gage & Powley, pile dike, $9.89 l. f., **73,** 940, 941.

1873. J. D. Leary, pile dike, $10.29 l. f., **74,** 167 168.

1877. H. V. Sloat & Bro., pile dike, $5.97 l. f., **77,** 252. T. Sturgeon, sr., pile-dike, $4.79 l. f., **78,** 418.

1878. J. L. Powley, pile dike, $4.19 l. f., **79,** 375.

1888. J. L. Powley, piles, timber, iron, and st., **88,** 598.

1890. F. J. Kelly, dike repair, **90,** 705.

1892. W. Parrott, dike repairs at a total est. $3,159, **93,** 1024.

1894. R. Parrott, extension of s. dike—timber, iron, and st.—$2,212.20, **95,** 916. Annulled to apply the contract to repair of n. dike at actual cost of $2,128.03, **96,** 768.

1899. W. Parrott, repairing dikes (piling, timber, ironwork, and rubblest.); aggregate, $3,497, **1900,** 1498.

1904. P. W. Myers & Son, dr., 13½¢ c. y., **04,** 1049.

1906. P. W. Myers, dr., 15½¢ c. y., **06,** 965.

1908. Wm. Parrott, repairing dikes, $7,750.65, **08,** 1064.

1911. E. S. Sickles, repairs and extension to dikes; amount of material and prices listed, **12,** 1494.

ENGINEERS.

Chief of Engineers. **R.,** **69,** 56, 486; **71,** 83; **72,** 80; **73,** 85; **74,** 96; **75,** 102; **76,** 56; **77,** 51; **78,** 56; **79,** 60; **80,** 81; **81,** 98; **82,** 98; **83,** 94; **84,** 102; **85,** 94; **86,** 94; **87,** 57; **88,** 58; **89,** 73; **90,** 64; **91,** 83; **92,** 87; **93,** 94; **94,** 84; **95,** 97; **96,** 94; **97,** 108; **98,** 134; **99,** 154; **00,** 175; **01,** 213; **02,** 141; **03,** 137; **04,** 123; **05,** 131; **06,** 136; **07,** 140; **08,** 147; **09,** 151; **10,** 172; **11,** 177; **12,** 215.

In charge:

Lt. Col. J. Newton, 1869–84; **69,** 56. **R.,** **69,** 393; **72,** 806 (on sur.), 810; **73,** 940; **74,** ii, 167; **75,** ii 222; **76,** 250; **78,** 417; **79,** 374; (Col.) **80,** 494; **81,** 620; **82,** 645; **83,** 531.

Capt. J. Mercur, 1877; in temporary charge, 1884–85. **R.,** **77,** 251; **84,** 700.

Lt. Col. W. McFarland, 1885–89. **R.,** **85,** 697; **86,** 670; **87,** 663; **88,** 596.

Lt. Col. G. L. Gillespie, 1889–95. **R.,** **89,** 764; **90,** 701; **91,** 882; **92,** 773; **93,** 1021; **94,** 736; **95,** 913.

Maj. H. M. Adams, 1896. **96,** 767.

Lt. Col. W. Ludlow, 1897. **R.,** **97,** 1013.

Maj. A. M. Miller, 1898. **R.,** **98,** 1057.

Col. J. W. Barlow, 1899–1900. **R.,** **99,** 1300; **00,** 1496.

Col. S. M. Mansfield, 1901–02. **R.,** **01,** 1228; **02,** 955

Col. Amos Stickney, 1903. **R.,** **03,** 884

Capt. E. H. Schulz, 1904. **R.,** **04,** 1048.

Col. W. R. Livermore, 1905–06. **R.,** **05,** 985; **06,** 965.

Col. J. G. D. Knight, 1907–08. **R.,** **07,** 1014; **08,** 1063.

Col. W. M. Black, 1909–. **09,** 1084; **10,** 1208; **11,** 1275; **12,** 1493.

Assistants:

J. H. Striedinger, **72,** 812.

F. von Eglofstein, **72,** 812.

OPERATIONS.

1872-73. Completion of 570 l. f. of the n. pile dike, **73,** 85, 941.

1873-74. Extension of n. pile dike 1,282′ and a crib pierhead 20′ x 100′ at bottom and 16′ at top built; dike repaired, **74,** 96, ii, 167, 168.

1874-75. 25 spring pile fenders placed along the n. dike, **75,** ii, 222.

1875-76. Pile dike and crib repaired, **76,** 56, 250.

1876-77. Repairs to n. dike, **77,** 51, 251.

1877-78. Completion of branch dike 883′; completion of pile dike on s. side of chan. 893½′; repairs and spring and fender piles driven, **78,** 56, 417.

1878-79. Extension of s. dike 1,800′; repairs and dr.; chan. 12½′ d., **79,** 61, 374.

1882-83. Extensive repairs to dikes, **83,** 532.

1884-85. Repairs to diking; 923 c. y. dr., **85,** 698.

1885-86. Repairs to dikes and dr., **86,** 671.

1887-88. Repairs to dikes and protection of same by fender piling, **88,** 597.

1889-90. Ps. repaired under contract, **90,** 703.

1891-92. Repairs under contract to n. and branch dikes, **92,** 774.

1892-93. Repair of dikes in progress, **93,** 1023.

* Allotment.

[1] Importance of making app. to complete the work, **75,** ii, 223.

1893-94. Wreck of old canal boat removed and dikes repaired, **94,** 738.
1895-96. N. dike repaired, **96,** 768.
1899-00. Repairing dikes in progress, **00,** 1497.
1900-01. Repairs to dikes, **01,** 1228. Quantities of materials used, **01,** 1229.
1902-03. Repairs of spring and fender piles, **03,** 884.
1903-04. 11,577 c. y. dr. from shoal off e. end of s. dike, **04,** 1048.
1904-05. 23,718 c. y. dr., **05,** 986.
1905-06. 32,234 c. y. dr., **06,** 965.
1907-08. Repairs to dikes; work accomplished listed, **08,** 1063.
1908-09. Repairs to dikes completed; list of material delivered, **09,** 1084.
1911-12. 120′ of extension to s. dike completed and dike repaired, **12,** 1493.

PHYSICAL CHARACTERISTICS.

Description of, **69,** 393; **72,** 810, 811; **88,** 596.
In 1894 a narrow obstructing shoal, said by the State authorities to have been removed, still existed neat the lighthouse, **94,** 739.
Chan. subject to shoaling, **98,** 1057.
Damages to dikes by ice, **04,** 1048.
Condition of chan. and recom. for imp., **11,** 1275.
In mouth of Rondout Creek, on w. shore of Hudson R., 90 m. n. of Battery, N. Y. C.; is 300′–1,000′ x 3 m. Proj. portion extends between dikes ½ m. from entrance to creek, to Hudson chan., **12,** 215.

PRIVATE AND CORPORATE WORK.

Chan. 14′ d. dr. by Rondout Steamboat Co., 1870, **72,** 811.

PROJECTS.

By Lt. Col. Newton, 1869, dikes and probable dr. for d. of 13′ to 14′ at m. l. w.; est., $132,665.56, **69,** 56, 393.
By Lt. Col. Newton, 1871, chan. in prolongation of Rondout Creek, with a m. l. w. d. of from 10′ to 13½′ and a w. of from 100′ to 200′ by dr., and the constr. of parallel dikes and branch dikes; est., $172,500, **72,** 811, 812; **80,** 495. Proj. completed in 1880 at a cost of $90,000, **86,** 671.
By Capt. Mercur, 1884, w. the outlet between the dikes, $10,000, **84,** 700.
Est. for repair of ps. in 1888, $10,000, **88,** 597; increased in 1889 to $25,000, **89,** 765; **92,** 773.
Act of 1892 provided for repairs to the extent of $5,000, **93,** 1022.
In 1898 Maj. Miller est. $5,000 biennially for mainten., **98,** 1057.

SURVEYS.

1871. Under direction of Lt. Col. Newton, by F. von Eglofstein. **R.,** **72,** 810.
Of chan., **03,** 884.
Maps. **80,** 494; **85,** 698; **03,** 884.

E-70 MINISCEONGO RIVER, N. Y.

COMMERCE.

C. statistics, **84,** 715.
Mostly bricks, about 80,000,000 an., **04,** 1070.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 106; **04,** 127; **08,** 154.

Boards. BERH. recom. plan with cut-off; est., $26,279.62; no work to be done until necessary land is donated to U.S., and water pipe below br. removed to 12′, **04,** 1072.

In charge:
Col. J. Newton. **R.,** **84,** 714.
Col. S. M. Mansfield, 1904. **R.,** **04,** 1069.
Col. Amos Stickney, 1904. **R.,** **04,** 1072.

Assistant. 1st Lt. J. R. Slattery. **R.,** **04,** 1073.

PHYSICAL CHARACTERISTICS.

Chan. narrow and tortuous; d. about 5½′ m. l. w., **04,** 1070.

PLANS.

By Col. Newton, 1883, dr. and dike constr. for a chan. of 10′ at l. w., creek to the chan. of the Hudson R.; est., $93,400, **84,** 715.

SURVEYS.

Au. act Aug. 2, 1882; made by Col. Newton, **84,** 714.
Pre. ex. and sur. au. act June 13, 1902. **R.,** Col. Mansfield, 1902, and Col. Stickney, 1903; 2 plans and ests. submitted, $26,279.62 and $30,203.31,[1] **04,** 127, 1069.
Pre. ex., for 7′, au. act Mar. 2, 1907. **R.,** Col. Lockwood, Apr. 26 and May 21, 1907; est., $22,632,[2] **08,** 154.

E-70(a) NYACK HARBOR, N. Y. (28)

COMMERCE.

Description of, **97,** 1046.
Interests involved large, **97,** 1046.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 115.
In charge. Lt. Col. Wm. Ludlow, 1897. **R.,** **97,** 1044.
Assistant. A. Doerflinger. **R.,** **97,** 1044.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1044.
28 m. n. of New York City on the w. bank of the Hudson R., at the Tappan Zee, **98,** 1044.

SURVEYS.

Ex. au. act June 3, 1896; made, 1896, by Col. Gillespie (**R.** fav. to limited imp.), **97,** 1014.

E-74(a) LAKE CHAMPLAIN, N. Y. AND VT. (Breakwaters.)

ENGINEERS.

Chief of Engineers. **R.,** **93,** 419.

In charge. Maj. M. B. Adams, 1893. **R.,** **93,** 3202.
Remarks on this **R.**—Capt. W. L. Marshall, **93,** 3209; Maj. E. H. Ruffner, **93,** 3209; Maj. Wm. Ludlow, **93,** 3210.

SURVEY.

In 1892 the Chief of Engineers, on the recom. of the DE., called on Maj. Adams to prepare and submit a comprehensive **R.** of his method of constr. break'rs in Lake Champlain, which the DE. thought might be followed to advantage in the constr. of break'rs on the Great Lakes, **93,** 3202.
Maps. **93,** 3208.

[1] H. D. 300, 58th, 2d.
[2] H. D. 79, 60th, 1st.

E-76 GREAT CHAZY (Champlain) RIVER, N. Y.

APPROPRIATIONS.

1890, $10,000, **91,** 2929.
1892, 5,000, **92,** 2606.
1894, 3,000, **95,** 3234.

Total, 18,000

COMMERCE.

Description of, **84,** 2165.

CONTRACTS.

1892. L. Whitney, dr., 34¢ c. y. ($7,140), **93,** 3194.
1894. Lynch & Hannan, dr., 45¢ c. y. ($2,475), **95,** 3234.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 330; **89,** 344; **91,** 385; **92,** 363; **93,** 416; **94,** 390; **95,** 426.

In charge:

Maj. W. McFarland, 1884. **R.,** **84,** 2165.
Maj. M. B. Adams, 1888–92. **R.,** **89,** 2464; **91,** 2929; **92,** 2605.
Capt. S. S. Leach, 1893–95. **R.,** **93,** 3194; **94,** 2493; **95,** 3234.

Assistant:

J. A. Gillespie. **R.,** **84,** 2166.
F. M. Barstow. **R.,** **89,** 2464.

OPERATIONS.

1890-91. Chan. excavation under contract begun, **91,** 2929.
1891-92. 26,338 c. y. dr., **92,** 2606.
1893-94. Dr. 20,000 c. y. in progress, **94,** 2494.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 2166; **89,** 2466.

PLANS. (See Projects.)

By Maj. Adams, 1889, dr. chan. 6′ x 75′, 6′ curve in Lake Champlain to Champlain Village; est., $34,000, **89,** 2466.

PROJECTS. (See Plans.)

By Maj. Adams, 1891, chan. 5′ x 40′, 5′ curve in Lake Champlain to Champlain Village; est., $18,000, **91,** 2929; **92,** 2605.

SURVEYS.

Ex. Lake Champlain to Champlain Town au. act Aug. 2, 1882; made, 1882, by Maj. McFarland (fav.-but imp. not a necessity), **84,** 2165.

Au. act Aug. 11, 1888; made, 1889, by Maj. Adams, **89,** 2466.

E-77 ROUSE POINT, LAKE CHAMPLAIN, N. Y. (Breakwater).

APPROPRIATIONS.

1884, $35,000, **85,** 2298.
1886, 20,000, **86,** 1900.
1888, 13,500, **88,** 2094.
1890, 15,000, **90,** 2876.
1892, 15,000, **92,** 2604.

Total, 98,500

COMMERCE.

Necessity for H., **84,** 2172.

CONTRACTS.

1892. E. R. Goodsell, break'r constr.; rubblest., 90¢ c. y.; large st., $3.45 c. y.; and ring bolts, 10¢ lb. ($13,207.30), **93,** 3193.
1885. R. F. Hawkins, break'r constr., **86,** 1899.
1886. J. L. Johnson, break'r constr., **87,** 2397.
1889. W. Johnston, break'r extension, **89,** 2443.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 80; **73,** 50; **76,** 57; **84,** 330; **85,** 354, 2304; **86,** 348; **87,** 313; **88,** 448; **89,** 339; **90,** 306; **91,** 384; **92,** 363; **93,** 416; **94,** 390; **95,** 426.

Boards. Convened at New York, Jan., 1885, to consider site and form of break'r. **R.,** **85,** 2302. (Col. Duane, Lt. Cols. Abbot and Comstock.)

In charge:

Lt. Col. John Newton. **R.,** **73,** 403; **76,** 260.
Maj. W. McFarland. **R.,** **84,** 2172.
Lt. Col. H. M. Robert. **R.,** **84,** 2175; **85,** 2299.
Maj. M. B. Adams, 1885–92. **R.,** **85,** 2297; **86,** 1899; **87,** 2397; **88,** 2093; **89,** 2443; **90,** 2875; **91,** 2927; **92,** 2604.
Capt. S. S. Leach, 1892–95. **R.,** **93,** 3192; **94,** 2492; **95,** 3232.

Assistants:

D. White. **R.,** **73,** 403, 407; **76,** 260.
J. A. Gillespie. **R.,** **84,** 2173.
W. P. Judson. **R.,** **85,** 2300.

OPERATIONS.

1885-86. Constr. of break'r commenced, **86,** 1900.
1886-87. Constr. of break'r continued, **87,** 2397.
1887-88. 65 l. f. break'r completed, **88,** 2093.
1888-92. Break'r extension in progress, **89,** 2443; **90,** 2875; **91,** 2927; **92,** 2604.
1892-93. 135′ break'r in course of constr., **93,** 3192.
1893-94. Work in progress during the preceding year completed, **94,** 2493.

PHYSICAL CHARACTERISTICS.

Described, **73,** 404.
Character of lake bottom at proposed site of break'r, **85,** 2298.
Height of waves, **85,** 2300, 2302.

PLANS. (See Projects.)

By D. White, 1873, dr. Rouse Pt. Reef and 2 break'rs 1,200′ and 1,400′ l. between Windmill and Stony Pts.; est., $216,398, **73,** 404, 405.
By Lt. Col. Newton, 1873, 2 break'rs 1,900′ l. and 1,400′ l.; est., $336,001.25, **73,** 403.
By Lt. Col. Robert, 1884, crib-pier break'r 2,000′ l., extending from Stony Pt.; est., $140,000, **84,** 2175; **85,** 2299.

PROJECT. (See Plans.)

By BE., 1885, break'r of random st. about 2,000′ l., extending from Stony Pt. toward Windmill Pt. until the 18′ curve in the lake be reached; est. $110,000, **85,** 2303. Proj. approv. by Sec. of War **85,** 2304; **92,** 2604.

SURVEYS.

Under direction of Lt. Col. Newton, by D. White. **R.,** **73,** 403; **76,** 260.
Ex. au. act Aug. 2, 1882; made by Maj. McFarland, **84,** 2172.
Sur. made, 1884, by Lt. Col. Robert, **85,** 2298.
Maps. Rouse's Pt., **85,** 2300; **87,** 2398.

E-79 LAKE CHAMPLAIN, VT. (Channel between North and South Hero Islands.)[1]

APPROPRIATIONS.

1836,	$15,000,	act July 4.
1837,	6,000,	act Mar. 3.
1888,	10,000,	**89,** 2445.
Total,	31,000	

COMMERCE.

In 1897 2 SS. carrying freight and passengers each passed through the chan. daily during the season of navigation, **97,** 3299.

Chan. is main water connection between C. chan. and Swanton H. and St. Albans B.; used twice daily by 2 SS. carrying freight and passengers, **09,** 75.

ENGINEERS.

Chief of Engineers. R., 81, 115; **82,** 116; **87,** 317; **88,** 287; **89,** 340; **90,** 307; **97,** 480; **98,** 128; **01,** 146; **03,** 69; **04,** 65; **05,** 69; **06,** 68; **07,** 71; **08,** 73; **09,** 74, 78.

In charge:
Maj. G. L. Gillespie. **R., 82,** 717.
Maj. M. B. Adams, 1887–89. **R., 97,** 2412; **89,** 2444; **90,** 2876.
Maj. W. S. Stanton, 1897. **R., 97,** 3299.
Capt. H. Taylor, 1901–03. **01,** 133; **03,** 54.
Col. W. S. Stanton, 1904–05. **04,** 35; **05,** 42.
Maj. Edw. Burr, 1906–09. **06,** 41; **07,** 44; (Lt. Col.) **08,** 74; **09,** 78.

Assistants:
D. White. **R., 82,** 718.
J. C. Churchill. **R., 87,** 2413.

OBSTRUCTIONS.

Complaint against br. of Rutland RR. Co., **06,** 68; required by Sec. of War to restore and maintain chan. in lieu of altering its br., **12,** 75.

OPERATIONS.

1889–90. 17,326 c. y. dr., **90,** 2877.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 717; **87,** 2413; **97,** 3299; **04,** 65.
Shoaling, **12,** 74.

PRIVATE WORK.

Chan. restored by Rutland RR. Co., under order of Sec. of War., **08,** 73.

PROJECTS.

By Maj. Gillespie, to w. the existing chan. to 250′ by dr.; est., $8,000, **82,** 718, 719.
By Maj. Adams, 1886, dr. chan. 10′ x 150′; est., $14,300, **87,** 2413; **97,** 3299.
Maj. Burr est., 1906, it would cost $4,850 to restore chan., **06,** 69.

SURVEYS.

Au. act Mar. 3, 1881, and Senate res. of Jan. 13, 1887; made by Maj. Gillespie, **82,** 717; also Maj. Adams, **87,** 2412.
Ex. to ascertain character of obstr. said to exist. made, 1897, by Maj. Stanton, **97,** 3299.
Of chan., **06,** 68.
Ex. au. act Mar. 2, 1907, of chan. known as the "Gut," and break'r at Burlington, by Lt. Col; Burr, 1907 (unfav.),[1] **09,** 78.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 75.[2]
Maps:

E-80 NORTH HERO HARBOR, LAKE CHAMPLAIN, VT.

COMMERCE.

In 1892 C. provided for fairly well, **93,** 3214.

ENGINEERS.

Chief of Engineers. R., 93, 419.
In charge. Maj. M. B. Adams, 1892–93. **R., 93,** 3213.

PHYSICAL CHARACTERISTICS.

H. on the n. side of Hero Isld.; affords a well-sheltered H. of limited area, where most of the farming products of the isld. find shipment by water, **93,** 3214. See **08,** 74.

SURVEYS.

Ex. au. act July 13, 1892; made, 1892, by Maj. Adams (**R.** unfav.), **93,** 3214.

E-81 GORDONS LANDING, LAKE CHAMPLAIN, VT. (Breakwater).

APPROPRIATIONS.

1886,	$18,750,	**87,** 314.
1888,	10,000,	**88,** 2096.
1890,	6,000,	**90,** 2878.
Total,	34,750	

CONTRACTS.

1888. W. J. Daly, break'r constr., **88,** 2096.

ENGINEERS.

Chief of Engineers. R., 87, 314; **88,** 287; **89,** 340; **90,** 307; **91,** 385; **92,** 363.

In charge. Maj. M. B. Adams, 1886–92. **R., 87,** 2400; **88,** 2095; **89,** 2445; **90,** 2877; **91,** 2930; **92,** 2606.

OPERATIONS.

1887–88. 4,711 c. y. rubblest. placed in break'r, **88,** 2096.
1888–89. 3,570 c. y. rubblest. placed in break'r, **89,** 2446.
1889–90. Break'r constr. continued, **90,** 2877.
1890–91. 3 cribs built and sunk in extension of break'r, and reconstr. of old superstr. begun, **91,** 2931.

PROJECTS.

By Maj. Adams, 1887, rubblest. break'r extending from a point 250′ s. of landing to a point on the 18′ curve 100′ n. of a line drawn from the dock to Cumberland Head; est., $38,158, **87,** 2400; **92,** 2607.

SURVEYS.

Maps. **87,** 2400.

E-82 ADAMS (Tobias) LANDING, GRAND ISLE, VT.

COMMERCE.

About 2,000 t. an., and from 3,000 to 5,000 pass., **93,** 3216.

ENGINEERS.

Chief of Engineers. R., 93, 419.
In charge. Maj. M. B. Adams, 1892. **R., 93,** 3215.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3216.
On the w. shore of Grand Isle, about 4 m. n. of Gordons Landing, **93,** 3216.

SURVEYS.

Ex. au. act July 13, 1892; made by Maj. Adams (**R.** unfav.), **93,** 3215.

[1] Sometimes called the "Gut."

[2] H. D. 1109, 60th, 2d.

E-86 PLATTSBURG HARBOR, N. Y.[1]

APPROPRIATIONS.

1836,	$10,000.00,	**66,** iii, 29.
1837,	10,000.00,	**66,** iii, 29.
1838,	27,500.00,	**66,** iii, 29.
1843,	2,680.01,	Treas. Doc. No. 373, 1882.
1844,	10,000.00,	**66,** iii, 29.
1864,	*2,000.00,	**66,** 57, iii, 29.
1867,	26,000.00,	**67,** 234.
1870,	10,000.00,	**70,** 55, 222, 224.
1871,	15,000.00,	**71,** 53.
1872,	10,000.00,	**72,** 48, 271.
1873,	10,000.00,	**73,** 49.
1874,	5,000.00,	**74,** 56, 274.
1879,	2,000.00,	**79,** 65, 395.
1880,	1,000.00,	**80,** 557.
1886,	5,000.00,	**86,** 1902.
1888,	7,000.00,	**88,** 2097.
1890,	32,500.00,	**90,** 2879.
1902,	5,000.00,	**02,** 864.
1910,	25,500.00,	**10,** 1120.
Total,	216,180.01 (incl. misc., $216,180.51, **12,** 1481).	

COMMERCE.

In 1911, 262,075 t.; probably only 20% of this should be credited to H., **12,** 204, 1482.

Estab. competition with RR., but privately owned terminals hamper effect of imp. on rates, **12,** 204.

On opening of new Champlain Canal, H. should be imp., **12,** 202.

CONTRACTS.

1867. L. Whitney, repairs of break'r, **67,** 242.

1868. E. R. Seward, dr., 35¢ c. y., **68,** 295; **69,** 182, 184.

1872. J. D. Leary, break'r, $91.86 l. f., **73,** 393; **74,** 274.

1873. L. Whitney, break'r, $94 l. f., **73,** 394; **75,** 352.

1903. Daly & Hannan Dredging Co., dr., 25.5¢ c. y., **04,** 868.

1911. G. W. Beeman, dr. about 35,000 c. y., 25½¢ c. y., s. m., and bowlders at $4 c. y., s. m., **12,** 1482.

ENGINEERS.

Chief of Engineers. **R., 66,** 2, iii, 17, 29; **67,** 17, 34; **68,** 48; **69,** 42; **70,** 55; **71,** 52; **72,** 48; **73,** 49; **74,** 56; **75,** 60; **76,** 57; **77,** 51; **78,** 57; **79,** 65; **80,** 89; **81,** 113; **82,** 114; **83,** 324; **84,** 327; **85,** 355; 357; **86,** 348; **87,** 314; **88,** 288; **89,** 341, 343; **90,** 307; **91,** 385; **92,** 364; **93,** 417; **94,** 390; **95,** 426; **02,** 93; **03,** 72; **04,** 67; **05,** 72; **10,** 87, 89; **11,** 167; **12,** 202, 203.

In charge:

Maj. C. E. Blunt, 1864; **66,** 56, 57.

Capt. C. B. Reese, 1865; **66,** 57, iii, 17. **R., 66,** iv, 181; **67,** 249.

Lt. Col. C. E. Blunt, 1867. **R., 67,** 234, 242.

Capt. J. W. Barlow, 1868–69; **68,** 48. **R., 68,** 293; **69,** 181.

Lt. Col. J. Newton, 1870–79; **70,** 55. **R., 70,** 222, 224; **71,** 254; **72,** 271; **73,** 393; **74,** 274; **75,** 352; **78,** 420; **79,** 395.

Capt. J. Mercur, in temporary charge, 1877. **R., 77,** 252.

Lt. Col. N. Michler, 1880–82. **R., 80,** 556; **81,** 722.

Maj. G. L. Gillespie, 1882–83. **R., 82,** 708.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1956; **84,** 2155; **85,** 2318.

Maj. M. B. Adams, 1885–92. **R., 85,** 2306; **86,** 1902; **87,** 2405; **88,** 2097; **89,** 2447, 2458; **90,** 2878; **91,** 2931; **92,** 2607.

Capt. S. S. Leach, 1893–95. **R., 93,** 3195; **94,** 2495; **95,** 3235.

Capt. H. Taylor, 1902–03. **R., 02,** 863; **03,** 751.

Lt. Col. W. S. Stanton, 1904–05. **04,** 867; (Col.) **05,** 834.

Lt. Col. Edw. Burr, **10,** 59.

Col. F. V. Abbot, 1910. **R., 10,** 1120.

Col. W. M. Black, 1911–. **R., 11,** 1268; **12,** 1481.

Assistants:

Lt. C. J. Allen. **R., 67,** 249.

D. White. **R., 77,** 252.

W. P. Judson. **R., 83,** 1956.

L. Y. Schermerhorn. **R., 85,** 2320.

ESTIMATES. (See Projects.)

By Capt. Reese, 1866, repairs to break'r, $25,512.20, **66,** iii, 17, iv, 181; entire permanent completion, $26,500, **66,** iii, 29; in 1867, dr. to 9′, $12,500, **67,** 249.

By Lt. Allen, 1867, dr. to 13′, $82,326.50, **67,** 234, 250.

By Col. Blunt, 1867, dr., $22,000 to $23,000, **67,** 34, 234.

By Capt. Barlow, 1868, revet., extension of break'r, and dr., $50,000, **68,** 294.

By Lt. Col. Newton, 1870, extension of break'r, revet., and dr., $65,000, **70,** 224. In 1872, repairs and extension of break'r, $15,000, **72,** 271. In 1879, to complete required dr., $3,000, **79,** 395.

OPERATIONS.[2]

1865. Repairs to break'r, **66,** 56, 57.

1866-67. Repairs under contract, **67,** 34, 234.

1867-68. Repairs to break'r completed, **68,** 48, 293.

1868-69. Dr. to attain 7′, **69,** 42, 182.

1870-71. Crib 94′, in extension of break'r, sunk, **71,** 52, 254.

1871-72. Crib 150′ sunk and 94′ superstr. built, **72,** 48, 271.

1872-73. Crib 100′ sunk, 150′ superstr. built, **73,** 393, 394.

1873-74. Crib 56′ sunk, 100′ superstr. built, **74,** 56, 274.

1874-75. 56′ superstr. built, repairs to old break'r, **75,** 60, 352.

1877-78. Repairs to break'r and dr., **78,** 57, 420.

1880-81. Dr. upon shoals between mouth of R. and s. wharves, **81,** 722.

1887-88. 25,000 c. y. dr., **88,** 2097.

1889-90. 3,000 c. y. dr., **90,** 2878.

1890-91. Extension of break'r and renewal of timber superstr. in progress, **91,** 2931.

1891-92. Break'r extension completed and superstr. in progress, **92,** 2608.

1892-93. Rebuilding of superstr. of break'r completed, **93,** 3195.

1903-04. Timber crib pierhead at s. end of break'r rebuilt, break'r repaired, 9,500 c. y. dr.; proj. completed, **04,** 867.

1911-12. Work under contract begun June 21, 1911, and at close of year 1,486 c. y. had been dr. Proposals for constr. rubble mound in front of break'r opened July 25, 1912, **12,** 1481.

PHYSICAL CHARACTERISTICS.

Description of, **67,** 235, 249; **68,** 293; **78,** 421; **89,** 2458.

H. on w. shore of Cumberland B., 30 m. s. from lower end of Lake Champlain, at the international boundary, near Rouse Pt., N. Y. Burlington H., N. Y., 20 m. se., **12,** 202.

PLANS.

By Lt. Col. Robert, 1884, dr. basin at the mouth of the Saranac R.; est., $60,000, **85,** 2319.

By Maj. Adams, 1888, repair of 1,250 l. f. of existing superstr. and constr. of 300′ of additional break'r; est., $32,500, **89,** 344, 2459.

*Allotment.

[1] Sur.—**R.,** Feb. 7, 1834; est., $24,003.16. (H. D. 482, 55th, 2d.)

[2] Early history of operations, **67,** 235; results to 1865, a break'r 854′ l. of timber cribs 39′ w. on top, with batter on shore side of 2 upon 1, **66,** iii, 17, iv, 181.

PRIVATE (CORPORATE) WORK.

Severnal hundred f. of wooden revet. built by New York & Canada RR. Co.; a benefit to the H., **77,** 253.

PROJECTS. (See Estimates.)

The earliest app. made 1836; between this date and 1844, under app. aggregating $57,500, 854 l. f. of break'r, covering the city wharves, built, **66,** iii, 17,; iv, 1881.

By Capt. Reese, 1866, repairs of break'r; est., $25,512.21, **66,** iv, 181; **67,** 235.

By Capt. Barlow, 1868, dr., revet., and extension of break'r 300′; est., $50,000, **68,** 294; **69,** 182.

Between 1864 and 1869 $28,000 was expended in repairs, **66,** 56; **67,** 234; **68,** 293; **69,** 182.

By Lt. Col. Newton, 1870, change in direction of, and extension of break'r 400′; est., $65,000, **70,** 222, 224; in 1877, dr. shoal, **77,** 253; **79,** 395.

Total app. from 1836 to 1886, incl., $146,180.

Act June 25, 1910, au. dr. to 9′, at low lake level, the shoal between break'r and wharves, redr. chan. in front of wharves, and repairing break'r, incl. rebuilding superstr. of timber ps. with st.,[1] **10,** 87; **12,** 203.

SURVEYS.

Under direction of Capt. Reese, by Lt. Allen, 1867. **R., 67,** 249.

By Lt. Col. Newton, 1870, **70,** 222, 224.

Of H. in vicinity of city front and break'r, **83,** 1956.

At mouth of Saranac R., **85,** 2318, au. act July 5, 1884; made by Lt. Col. Robert, **85,** 2318.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Adams, **89,** 2458.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Lt. Col. Burr, July 7, 1909, and Jan. 12, 1910; est., $25,500,[1] **10,** 89.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 203.

Maps:

Of Northern and Northwestern Lakes, showing location of H., **66,** i.

85, 2320; **87,** 2405.

E-88 SARANAC RIVER, N. Y. (Harbor of Refuge, inner bay.)

ENGINEERS.

Chief of Engineers. **R., 91,** 388, 2938.

In charge. Maj. M. B. Adams, 1890. **R., 91,** 2939.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Adams (**R.** unfav.), **91,** 2939.

E-90 PORT KENT HARBOR, N. Y.[2]

E-93 BOUQUET RIVER, N. Y.

ENGINEERS.

Chief of Engineers. **R., 84,** 330; **91,** 388.

In charge:

Maj. W. McFarland, 1884. **R., 84,** 2162.

Maj. M. B. Adams, 1891. **R., 91,** 2940.

Assistant. J. A. Gillespie. **R., 84,** 2163.

PHYSICAL CHARACTERISTICS.

Description, **91,** 2940.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Maj. McFarland (**R.** unfav.), **84,** 2162.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Adams (**R.** unfav.), **91,** 2940.

E-97 PORT HENRY HARBOR, LAKE CHAMPLAIN, N. Y.

ENGINEERS.

Chief of Engineers. **R., 76,** 57; **81,** 115; **84,** 330; **12,** 224.

In charge:

Lt. Col. J. Newton, 1875–76. **R., 76,** 261.

Maj. G. L. Gillespie. **R., 82,** 715.

Lt. Col. W. McFarland. **R., 84,** 2168.

Col. W. M. Black, **12,** 178.

Assistants:

D. White. **R., 76,** 262.

J. A. Gillespie. **R., 84,** 2169.

PHYSICAL CHARACTERISTICS.

Described, **76,** 262; **82,** 715.

PLANS.

By D. White, 1876, concurred in by Lt. Col. Newton, break'r of cribwork, 30′ x 3,500′, to protect from n. and w. winds; est., $559,030, **76,** 261, 262.

In 1881 Maj. Gillespie refers to previous sur., 1875, **82,** 717.

SURVEYS.

Under direction of Lt. Col. Newton, by D. White, 1875. **R., 76,** 261, 262.

Ex. au. acts Mar. 3, 1881, and Aug. 2, 1882; made by Majs. Gillespie, **82,** 715, and McFarland (**R.** unfav.), **84,** 2168.

Pre. ex. and sur. au. act Mar. 3, 1909 (**R.** to come), **12,** 224.

E-99 TICONDEROGA RIVER, N. Y.

APPROPRIATIONS.

1881,	$5,000,	**81,** 726.
1882,	5,000,	**82,** 714.
1886,	2,000,	**86,** 350.
1888,	2,500,	**88,** 2102.
1890,	2,000,	**90,** 2883.
Total,	16,500	

COMMERCE.

About 12,000 t. an., **04,** 891.

CONTRACTS.

1882. L. Whitney, dr., 22¢ c. y., **82,** 714.

1884. C. H. De Lano, dr., 20¢ c. y., **84,** 2160.

[1] H. D. 759, 61st, 2d.

[2] Sur.—**R.,** Feb. 7, 1834; est., $43,876.27. (H. D. 482, 55th, 2d.)

ENGINEERS.

Chief of Engineers. **R., 80,** 90; **81,** 114; **82,** 115; **83,** 325; **84,** 329; **85,** 356; **86,** 350; **87,** 316; **88,** 289; **89,** 342; **90,** 309; **91,** 387; **92,** 365; **93,** 418; **94,** 391; **95,** 428; **04,** 70, 886.

Boards. BERH. **R., 04,** 888.

In charge:
Lt. Col. N. Michler, 1880–82. **R., 81,** 726.
Maj. G. L. Gillespie, 1882–83. **R., 82,** 713.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1960; **84,** 2160.
Maj. M. B. Adams, 1885–92. **R., 85,** 2310; **86,** 1905; **87,** 2410; **88,** 2101; **89,** 2451; **90,** 2882; **91,** 2936; **92,** 2613.
Capt. S. S. Leach, 1893–95. **R., 93,** 3200; **94,** 2498; **95,** 3240.
Capt. H. Taylor, 1904. **R., 04,** 887, 888, 889.

Assistant. D. White. **R., 81,** 727.

OPERATIONS.

1881-82. Chan. 42′ x 6′ dr. from the lake to Casseys Wharf, **82,** 713.
1882-83. 14,981 c. y. dr. from chan., **83,** 1960.
1887-88. 10,870 c. y. dr., **88,** 2101.
1888-89. 15,418 c. y. dr., **89,** 2451.
1891-92. 8,132 c. y. dr., **92,** 2613.

PROJECTS.

By Lt. Col. Michler, 1880, imp. of Ticonderoga R. by excavating a chan. 8′ x 100′ from the 8′ curve in Lake Champlain to the RR. br., thence 60′ to the foot of the falls at Ticonderoga; also to w. the chan. in front of Cassey and Bishops Docks to 100′ and to extend a cut 100′ w. diagonally across the basin; est., $42,516, **81,** 728, 729; **92,** 2613.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Lt. Col. Michler, **81,** 726.
Pre. ex. au. act June 13, 1902. **R.** by Capt. Taylor (unfav.), **04,** 70, 889.
Maps. **87,** 2411.

E-100 LAKE GEORGE, N. Y.

ENGINEERS.

Chief of Engineers. **R., 89,** 343.

In charge. Maj. M. B. Adams, 1888. **R., 89,** 2454.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Adams (**R.** unfav.). **89,** 2454.

E-101 PORT MARSHALL HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. **R., 84,** 330.

In charge. Lt. Col. W. McFarland. **R., 84** 2161.

Assistant. J. A. Gillespie. **R., 84,** 2161.

PHYSICAL DATA.

Name formerly given to a fishing station, where a few canal boats were occasionally built, on narrow part of Lake Champlain, just below mouth of Ticonderoga R., **84,** 2161.

SURVEY.

Ex. au. act Aug. 2, 1882; made, 1883, by Lt. Col. McFarland (**R.** unfav.), **84,** 2161.

E-105 LAKE CHAMPLAIN, N. Y. AND VT. (Narrows.)

APPROPRIATIONS.

1886,	$30,000,	**87,** 2412.
1888,	[1] 15,000,	**88,** 2103.
1892,	18,500,	**92,** 2615.
1899,	5,000,	**99,** 1292.
1900,	1,500,	**01,** 1056.
1902,	17,500,	**02,** 865.
1905,	2,500,	**05,** 835.
1907,	2,500,	**07,** 927.
1912,	6,000,	**12,** 1485.
Total,	98,500 (incl r. sales, etc., $98,501.50, **12,** 1485).	

COMMERCE.

Description of, **85,** 2310.
Imp. has reduced operating cost of navigation, resulting in reduced freight rates and increased business, **12,** 208.
1906, 676,000± t.; 1911, 826,000± t., **12,** 208.

CONTRACTS.

1886. L. Whitney, r. removal at the Elbow, **87,** 2412. J. L. Johnson, dr., Kinyons B., **87,** 2412.
1892. Lynch & Hannan, dr., 15¢ c. y. ($13,800), **93,** 3201.
1896. Lynch & Hannan, removal of sunken logs and stumps, at 50¢ c. y.; dr., 19½¢ c. y. ($4,500), **96,** 3171.
1899. W. J. Daly, dr., 20¢ c. y., **00,** 1486.
1903. Daly & Hannan Dredging Co., dr., 22.5¢ c. y., **04,** 869.
1905. E. R. Goodsell, 450 l. f. timber fenders or booms in place, $1,100, **06,** 894.
1911. Geo. W. Beeman, dr., prices listed, **12,** 1485.

ENGINEERS.

Chief of Engineers. **R., 85,** 357; **87,** 316; **88,** 289; **89,** 343; **90,** 309; **91,** 387; **92,** 365; **93,** 418; **94,** 392; **95,** 428; **96,** 384; **97,** 481; **98,** 130; **99,** 150; **00,** 170; **01,** 148; **02,** 94; **03,** 72; **04,** 68; **05,** 73; **06,** 71; **07,** 73; **08,** 75; **09,** 76; **10,** 88; **11,** 170; **12,** 207, 224.

In charge:
Lt. Col. H. M. Robert. **R., 85,** 2310, 2314.
Maj. M. B. Adams, 1887–92. **R., 87,** 2411; **88,** 2102; **89,** 2452; **90,** 2883; **91,** 2937; **92,** 2614.
Capt. S. S. Leach, 1893–96. **R., 93,** 3201; **94,** 2499; **95,** 3241; **96,** 3170.
Maj. W. S. Stanton, 1897. **R., 97,** 3302.
Maj. A. M. Miller, 1898. **R., 98,** 1046.
Col. J. W. Barlow, 1899. **R., 99,** 1292; **00,** 1485.
Capt. H. Taylor, 1901–03. **R., 01,** 1055; **02,** 864; **03,** 752.
Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 868; (Col.) **05,** 835.
Maj. Edw. Burr, 1906–09. **R., 06,** 894; **07,** 926; (Lt. Col.) **08,** 968; **09,** 1002.
Col. F. V. Abbot, 1910. **R., 10,** 1120.
Col. W. M. Black, 1911–. **R., 11,** 1271; **12,** 1484.

Assistants:
W. P. Judson. **R., 85,** 2312, 2315.
Capt. R. D. Black, 1911–12. **11,** 149; **12,** 178.

OPERATIONS.

1886-87. R. removal at the Elbow and dr. in Kinyons B. in progress, **87,** 2412.
1887-88. Dr. under contract continued, **88,** 2102.

[1] From Benson to Whitehall.

1888-89. Dr. continued, **89,** 2453.
1889-90. Dr. continued, **90,** 2883.
1893-94. 89,818 c. y. dr., **94,** 2499.
1896-97. 22,681 c. y. dr., and 48 c. y. logs removed, **97,** 3302.
1899-00. 40,020 c. y. dr., **00,** 1485.
1900-01. 2,910 c. y. dr. from shoal in Whitehall H., **01,** 1055.
1903-04. 62,480 c. y. dr., **04,** 868.
1905-06. 450 l. f. timber fenders built along rocky bank, **06,** 894.

PHYSICAL CHARACTERISITCS.

Description of, **85,** 2312, 2315; **97,** 3302; **10,** 88.
Chan. subject to shoaling, **98,** 1046.
Narrows that portion of Lake Champlain at upper end of lake included between Whitehall and Crown Pt. Proj. portion is s. 15 m. of waterway from Whitehall to Bensons Landing, Vt. Chan. tortuous and orig., 9½–10′ x 75′ or 200′, low lake level, **12,** 207.

PROJECTS.

By Lt. Col. Robert, 1885, chan. 12′ x 150′ from the Elbow to Whitehall, by dr. and r. removal; est., $30,000, **85,** 2312, 2313. Also, dr. chan. 12′ x 200′ Four Channels to Bensons Landing; est., $50,000, **85,** 2315, 2318; **91,** 2937; **92,** 2614.
Maj. Miller est., 1898, cost of completing imp. $22,500, and $5,000 every 2 years for mainten., **98,** 1046.

SURVEYS.

Au. act July 5, 1884; made by Lt. Col. Robert, **85,** 2310, 2314.
Minor ex., **96,** 3171; **97,** 3302; **09,** 1002.
Ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 224.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 207.

Maps:
Vicinity of Whitehall, **85,** 2312; **87,** 2411.
Vicinity of Four Channels, **85,** 2316.

E-105(a) WHITEHALL HARBOR, N. Y.

APPROPRIATIONS.

1836,	$8,000
1837,	10,000
1838,	15,000
Total,	33,000

SURVEYS.

Rs., Aug. 24, 1836, est. $76,993, and Feb. 29, 1840, est. $22,142.28. (H. D. 482, 55th, 2d.)
App. 1836 was for imp. entrance, and the app. of 1837 and 1838 were for continuing imp. (Tr. D. 373, 1882; H. R. D. 482, 1898.)

E-110 OTTER CREEK, VT.

APPROPRIATIONS.

1872,	$10,000,	**72,** 49, 272.
1875,	5,000,	**75,** 61, 355.
1878,	8,000,	**78,** 58, 424.
1879,	5,000,	**79,** 66, 399.
1880,	2,000,	**80,** 560.
1881,	2,000,	**81,** 726.
1882,	2,000,	**82,** 712.
1888,	2,500,	**88,** 2100.
1890,	5,000,	**90,** 2881.
1892,	10,000,	**92,** 2612.
1894,	5,000,	**95,** 3239.
1896,	5,000,	**96,** 3169.
1899,	1,000,	**99,** 1291.
Total,	62,500	

COMMERCE.

Important, **72,** 278; **79,** 398.

CONTRACTS.

1872. E. R. Seward, dr., **72,** 272; **73,** 402; **74,** 276.
1873. J. D. Hancock, dr., 40¢ c. y., **74,** 276.
1875. J. D. Hancock, dr., 34¢ c. y., **76,** 259.
1878. Bigelow & Adsit, dr., 32½¢ c. y., **73,** 399.
1881. L. Whitney, dr., 30¢ c. y., **82,** 712.
1884. L. Whitney, dr., 25¢ c. y., **84,** 2158.
1889. L. Whitney, dr., **89,** 2450.
1893. R. H. Rogers and J. J. Fitzpatrick, r. excavation, $4.44 c. y., p. m. ($8,880), **93,** 3199.
1894. Lynch & Hannan, r. excavation, 1,600 c. y., $4 and $5 c. y., p. m., **95,** 3240; **97,** 3300.
1899. W. J. Daly, dr., 25¢ c. y.; removing loose r., $1 short t., and fixed r., $6 c. y. ($1,000), **00,** 1485.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 49; **73,** 50; **74,** 57; **75,** 61; **76,** 57; **77,** 52; **80,** 90; **81,** 114; **82,** 115; **83,** 325; **84,** 329; **85,** 356; **86,** 350; **87,** 315; **88,** 289; **89,** 342; **90,** 308; **91,** 386; **92,** 365; **93,** 417; **94,** 391; **95,** 427; **96,** 383; **97,** 481; **98,** 130; **99,** 149; **00,** 169; **01,** 148; **02,** 93; **03,** 71; **04,** 66; **05,** 71; **06,** 70; **10,** 89; **11,** 91.

In charge:
Lt. Col. J. Newton, 1872–77. **R.,** **72,** 272; **73,** 402; **74,** 276; **75,** 355; **76,** 259; **78,** 423; **79,** 398; (Col.) **80,** 90.
Capt. J. Mercur, 1877, in temporary charge, **77,** 48. **R.,** **77,** 254.
Lt. Col. N. Michler, 1880–82. **R.,** **80,** 559; **81,** 725.
Maj. G. L. Gillespie, 1882–83. **R.,** **82,** 711.
Lt. Col. H. M. Robert, 1883–85. **R.,** **83,** 1960; **84,** 2158.
Maj. M. B. Adams, 1885–91. **R.,** **85,** 2309; **86,** 1905; **87,** 2410; **88,** 2100; **89,** 2450; **90,** 2881; **91,** 2935.
Capt. S. S. Leach, 1893–96. **R.,** **93,** 3198; **94,** 2497; **95,** 3239; **96,** 3169.
Maj. W. S. Stanton, 1897. **R.,** **97,** 3299.
Maj. A. M. Miller, 1898. **R.,** **98,** 1045.
Col. J. W. Barlow, 1899–1900. **R.,** **99,** 1291; **00,** 1484.
Capt. H. Taylor, 1901–03. **R.,** **01,** 1054; **02,** 867; **03,** 750.
Lt. Col. W. S. Stanton, 1904–05. **R.,** **04,** 867; (Col.) **05,** 833.
Maj. Edw. Burr, 1906. **R.,** **06,** 893.
Col. F. V. Abbot, **11,** 62.

Assistants:
D. White, **74,** 276. **R.,** **72,** 273; **77,** 254.
J. A. Gillespie. **R.,** **82,** 712.

ESTIMATES. (See Projects.)

By D. White, 1872, dr., $51,000, **72,** 272, 276, 277.
By Lt. Col. Newton, 1872, 3 projs., $51,000, $106,842, and $58,146, **72,** 49, 273, 277; **74,** 276; **75,** 355; **76,** 260; **77,** 254.
By Lt. Col. Newton, 1879, completion of existing proj., $30,146, **79,** 399.

OPERATIONS.

1873-74. 19,712 c. y. dr., **74,** 57, 276.
1875-76. 13,000 c. y. dr. from various places, **76,** 57, 260.
1878-79. Dr. 15,667 c. y. by contract, and 432 leaning trees removed from banks by hired labor, **79,** 65, 398.
1881-82. 6,219 c. y. dr. from bars at Vergennes Basin and mouth of the creek, **82,** 711.
1882-83. 10,791 c. y. dr. from Vergennes Basin, Bull Brook, Smiths and Gages Bends, **83,** 1960.
1884-85. 11,773 c. y. dr. from Bull Brook Bend, **85,** 2309.
1889-90. 21,000 c. y. dr., **90,** 2881.
1891-92. 20,995 c. y. dr., **92,** 2612.

1893-94. 2,000 c. y. r., p. m., excavated, **94,** 2497.
1895-97. 2,170 c. y. r., p. m., excavated, and 4,526 c. y. dr., **96,** 3169; **97,** 3301.
1899-00. 421 t. loose r. removed, and 1,915 c. y. dr., **00,** 1484.

PHYSICAL CHARACTERISTICS.
Described, **72,** 273, 274.

PROJECTS. (See Estimates.)
Col. Newton, 1872, proposed chan., Lake Champlain to Vergennes Basin, 8′ x 100′, with basin at Vergennes; est., $58,148, **72,** 273; **81,** 725.
In 1882 proj. modified to provide for r. removal at SS. landing near Vergennes, increasing the est. to $73,748.40, **82,** 712.
In 1884 further modified to provide for a change in the hitherto proposed chan. at Bull Brook Bend to escape removal of r., **84,** 2159.

SURVEYS.
Under direction of Lt. Col. Newton, by D. White, 1871. **R., 72,** 273.
Ex., 1881, **81,** 725.
Ex. of bars and special sur. SS. landing, **82,** 711.
Sur. of Vergennes Reef, 1882, **82,** 712.
Sur. at Bull Brook Bend, 1884, **84,** 2158.
Pre. ex. au. act Mar. 3, 1909, of Otter Creek, Vt., Lake Champlain to Vergennes. **R.** by Col. Abbot, May 23, 1910[1] (unfav.), **10,** 89; **11,** 91.

E-115 BURLINGTON HARBOR, VT.[2]

APPROPRIATIONS.

1836,	$10,000.00,	**66,** iii, 28.
1837,	10,000.00,	**66,** iii, 28.
1838,	50,000.00,	**66,** iii, 28.
1844,	10,000.00,	**66,** iii, 28.
1852,	10,000.00,	**66,** iii, 28.
1864,	308.00	(H. Doc. 373, 1882).
1864,	13,500.00,	**66,** iii, 28.
1866,	27,672.20,	**66,** iii, 28.
1867,	80,000.00,	**67,** 234.
1870,	25,000.00,	**70,** 56, 223.
1871,	30,000.00,	**71,** 53.
1872,	30,000.00,	**72,** 49, 272.
1873,	25,000.00,	**73,** 49.
1874,	25,000.00,	**74,** 56, 275.
1875,	25,000.00,	**75,** 61, 353.
1876,	20,000.00,	**76,** 57, 258; **77,** 52, 253.
1878,	20,000.00,	**78,** 57, 422.
1879,	15,000.00,	**79,** 65, 396.
1880,	10,000.00,	**80,** 558.
1881,	10,000.00,	**81,** 724.
1882,	12,000.00,	**82,** 709.
1884,	50,000.00,	**84,** 2157.
1886,	18,750.00,	**86,** 1904.
1888,	35,000.00,	**88,** 2099.
1890,	20,000.00,	**90,** 2880.
1894,	10,000.00,	**95,** 3237.
1896,	10,000.00,	**96,** 3168.
1899,	15,000.00,	**99,** 1290.
1900,	*5,000.00,	**01,** 1053.
1902,	57,750.00,	**02,** 861.
1905,	20,000.00,	**05,** 832.
1907,	35,000.00,	**07,** 925.
1908,	16,855.00,	**08,** 967.
1910,	52,000.00,	**10,** 1118.
1911,	2,500.00,	**11,** 1270.
1912,	2,000.00,	**12,** 1483.
Total,	808,335.20	(not incl. sales, $147.45, **12,** 1483).

COMMERCE.
Freight, 1911–1912, increased about 10,000 t., **12,** 1484.
Traffic, 1911, 100,000 t. C. dependent on break'r in storms, **12,** 206.

CONTRACTS.[3]
1867. C. J. De Graw, timber, **67,** 245. R. N. Gere, iron, **67,** 245. Luther Whitney, st., **67,** 245. Jennings & Hart, labor, **67,** 245. Hart & Jennings, timber and plank, **68,** 295, 299.
1873. Luther Whitney, cribwork, **73,** 395. Charles DeGraw,[4] cribwork, **73,** 395. Luther Whitney, cribwork, **74,** 274; **75,** 353.
1874. Luther Whitney, 1 crib, **75,** 354; **76,** 258.
1875. James D. Hancock, cribs, **75,** 354; **76,** 258; **77,** 253.
1878. Luther Whitney, break'r extension, **79,** 396.
1882. Dillabeck & Murphy, rubblest., 70¢ c. y., **82,** 709.
1884. L. Whitney, break'r extension, **85,** 2307.
1894. L. Whitney, break'r repairs, $21,948.30, **95,** 3238.
1897. E. S. Fleury, break'r superstr. constr., $31.50 l. f.; furnishing and setting quarry-faced stones, $6 c. y.; filling space between cribs, 50¢ c. y., **97,** 3298.
1899. W. J. Daly, repairing break'r, $14,870 or $15,500, **00,** 1483.
1901. Daly & Hannan Dredging Co., repairing break'r, unit prices given, **02,** 861. W. J. Daly (supple.), repairing break'r, unit prices given, **02,** 862.
1903. John Cashman, repairs to break'r, unit prices given, **03,** 749.
1905. James E. Cashman, sheathing with oak plank 242 l. f. break'r, $575, **06,** 892.
1906. James E. Cashman, repairs to break'r, unit prices given, **07,** 925.
1911. E. C. Sickles, about 50,000 s. t. rubblest., at $1.05 t., and 2,000 t. large st. at $1.50 t., **12,** 1483.

ENGINEERS.
Chief of Engineers. R., 66, 2, 3, ii, 41, iii, 17, 28; **67,** 34; **68,** 48; **69,** 42; **70,** 56; **71,** 53; **72,** 49; **73,** 49, 50; **74,** 56; **75,** 61; **76,** 57; **77,** 52; **78,** 57; **79,** 65; **80,** 89; **81,** 113; **82,** 114; **83,** 325; **84,** 328; **85,** 355; **86,** 349; **87,** 315; **88,** 288; **89,** 341; **90,** 308; **91,** 386; **92,** 364; **93,** 417; **94,** 390; **95,** 427; **96,** 382; **97,** 480; **98,** 129; **99,** 148; **00,** 168; **01,** 146, 150; **02,** 91; **03,** 69; **04,** 65; **05,** 70; **06,** 69; **07,** 72; **08,** 74; **09,** 75, 78; **10,** 85; **11,** 168; **12,** 204.

Boards:
Convened, June 6, 1867, to consider location and constr. of break'r. Recom. the extension of old break'r about 1,500′ to the n., and constr. of cribs of rectangular cross section 30′ at base and 40′ high, **67,** 34, 234, 251. (Col. Bache and Lt. Cols. Thom and Blunt.)

In charge:
Col. Turnbull. (S. D. 42, 35th, 1st.)
Maj. J. D. Graham, 1857. **R.,** S. Doc. 42, 35th Cong., 1st sess.
Maj. C. E. Blunt, 1865–67. **R., 66,** 56, 57; (Lt. Col.) **67,** 234, 245, 246, 251.
Capt. C. B. Reese, 1866. **R., 66,** iv, 179, 180.
Capt. J. W. Barlow, 1867–69. **R., 68,** 295; **69,** 184.
Lt. Col. John Newton, 1870–79. **R., 70,** 223; **71,** 255; **72,** 272; **73,** 394; **74,** 274; **75,** 353; **76,** 258; **78,** 422; **79,** 395.
Capt. James Mercur, in temporary charge, **77,** 253.
Lt. Col. N. Michler, 1880–81. **R., 80,** 557; **81,** 723.
Maj. G. L. Gillespie, 1881–82. **R., 82,** 708.
Maj. W. McFarland, 1882–83. **R., 83,** 1931.

*Allotment.
[1] H. D. 1085, 61st, 3d.
[2] Sur.—**R.,** Feb. 7, 1834; est., $28,727.18. (H. D. 482, 55th, 2d.)
[3] Failing bidders, Wells DeGraw, Antoin Poupor, L. B. Platt, and L. T. Richardson, **68,** 296, 299.
[4] Annulled and awarded to Luther Whitney, **74,** 274; **75,** 353.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1959; **84,** 2157.
Maj. M. B. Adams, 1885–92. **R., 85,** 2307; **86,** 1903; **87,** 2406; **88,** 2098; **89,** 2448; **90,** 2879; **91,** 2933; **92,** 2609.
Capt. S. S. Leach, 1893–96. **R., 93,** 3196; **94,** 2496; **95,** 3236; **96,** 3167.
Maj. W. S. Stanton, 1897. **R., 97,** 3296.
Maj. A. M. Miller, 1898. **R., 98,** 1043.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1289; **00,** 1482.
Capt. Harry Taylor, 1901–03. **R., 01,** 1052; **02,** 860; **03,** 748.
Lt. Col. W. S. Stanton, 1904–05. **R., 04,** 865; (Col.) **05,** 832.
Maj. Edw. Burr, 1906–09. **R., 06,** 891; **07,** 924; (Lt. Col.) **08,** 966; **09,** 1000.
Col. Frederic V. Abbot, 1910. **R., 10,** 1118.
Col. W. M. Black, 1911–. **R., 11,** 1269; **12,** 1482

Assistants:
Lt. C. J. Allen, **66,** ii, 41, iv, 178; **67,** 34.
D. White, **74,** 275; **76,** 253.
Capt. R. D. Black, **12,** 178.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Graham, extension and repairs, $21,286.31, S. Doc. 42, 35th Cong., 1st sess.; $27,672.20, **66,** 3.
By Capt. Reese, 1,500′ new break'r, $333,442, **66,** iv, 180; **67,** 234; **68,** 49; **69,** 42.
By D. White and Lt. Col. Newton, 2,000′ break'r, $340,000, **74,** 275; **75,** 353; **76,** 258.
By Lt. Col. Newton, completion of proj., $260,000, **79,** 396.

OPERATIONS.[1]
1844. Constr. of break'r, **66,** iii, 17, iv, 179.
1857. Break'r 1,069′ l., S. D. 42, 35th, 1st.
1868. 2 cribs well under way, **68,** 298.
1868–69. 6 cribs, 500′ of break'r built, **69,** 42.
1869–70. Constr. of 2 cribs, 160 l. f., **70,** 56, 223.
1870–71. Constr. of 2 cribs, 171 l. f., **71,** 53, 255.
1871–72. 2 cribs, 217 l. f., placed in position for s. extension; completion of superstr. over extension, **72,** 48, 272.
1872–73. Constr. of 2 cribs, 180 l. f., **73,** 49, 395.
1873–74. Constr. of 2 cribs, 220 l. f., and 180′ of superstr., **74,** 56, 274.
1874–75. Constr f crib, 145′ and 220′ of superstr., **75,** 61, 353.
1875–76. Constr. o 160′ n. extension and 145′ of superstr., **76,** 57, 258.
1876–77. Completion of 160′ of superstr., repairs, **77,** 52, 253.
1877–78. Repairs and extension of break'r, **78,** 57, 422.
1878–79. Riprapping and extension of break'r, **79,** 65, 395.
1879–80. Break'r extended n. 111 l. f.; repairs to break'r, **80,** 557.
1880–81. Break'r extended n. 70 l. f.; repairs to break'r, **81,** 723.
1881–82. Break'r extension in progress, **82,** 709.
1882–83. Break'r extended n. 50 l. f., **83,** 1959.
1883–84. Break'r extended n. 50 l. f., **84,** 2157.
1884–85. Break'r extended s. 200 l. f.; 1,175 l. f. of old break'r repaired by hired labor, **85,** 2307.
1885–86. Repairs to break'r by hired labor, **86,** 1903.
1886–87. Slight repairs to n. end of break'r, **87,** 2409. Discussion of most economical height of st. foundations for break'r, **87,** 2407.
1887–88. 4,209 c. y. rubblest. placed in break'r foundation, **88,** 2099.
1888–89. 780 c. y. rubblest. placed in break'r foundation, **89,** 2449.
1890–91. Repairs to break'r, **91,** 2934.
1891–92. Repairs to 1,000 l. f. of superstr., **92,** 2611.
1895–96. 683 l. f. break'r repaired, **96,** 3167.
1896–97. Break'r repairs in progress, **97,** 3297.
1897–98. 235 l. f. of st. superstr. completed, **98,** 1044.
1900–01. Old timber and st. superstr. replaced for 140′ with concrete superstr.; repairs to superstr., **01,** 1052.
1901–02. 237′ of old superstr. removed and replaced with concrete, 180′ repaired and faced with concrete blocks, **02,** 860.
1903–04. 332.75 l. f. wooden superstr. replaced with concrete or st., 426½ l. f. concrete footing blocks placed, and 487½ l. f. st. coping placed, **04,** 865.
1904–05. 641 l. f. decayed superstr. removed, 609 l. f. concrete parapet erected, and 20 l. f. concrete decking laid, **05,** 832.
1905–06. Repairs to break'r, and 242 l. f. lake slope sheathed with planking, **06,** 892.
1906–07. 560 l. f. superstr. removed, 559 l. f. parapet built, paving laid, st. coping set, etc., **07,** 924.
1907–08. 240 l. f. concrete superstr. completed, 60 l. f. parapet built, and 348 l. f. superstr. repaired, **08,** 966.
1908–09. 327 l. f. concrete superstr. built, and 124 l. f. foundation repaired, **09,** 1000.
1910–11. No work done during year; proj. 68% completed, **11,** 169.
1911–12. Minor repairs made to break'r, **12,** 205, 1483.

PHYSICAL CHARACTERISTICS.
66, iii, 17; **11,** 169; **12,** 206.
H. 5½ m. of shore line, along e. shore of Lake Champlain, protected by break'r 4,157′ l., at average distance of about 1,000′ from shore.
Deterioration of timber cribs serious, **12,** 205.
Plane of reference for H. is low lake level; variation of level, 4–6½′, **12,** 206.

PLANS. (See Estimates; Projects.)

By Capt. C. B. Reese, new break'r n. and w. of old work, 1,500′ l, **67,** 179, 180.

PROJECTS.

Between 1836 and 1857, 1,069 l. f. of break'r had been built. In 1867 a BE. recom. a further extension n. of 1,500 l. f. In 1871, 831 l. f. of this extension had been made, **67,** 34, 234, 251.
Between 1871 and 1874, 617 l. f. were added in a s. extension, making a total extension of 2,517 l. f., **74,** 274.
In 1874 an additional extension of 2,000 l. f. was adopted; est., $340,000, **74,** 275.
In 1884, under an app. of $25,000, extensive repairs were undertaken over the part of the break'r built between 1836 and 1857. In 1886 Maj. Adams proposed a further extension of the break'r, both to the n. and s., with the gradual withdrawal of the work as prolonged into water 32′ d., **87,** 315, 2406.
From 1836 to 1886, incl., $526,922.20 was app., completing proj.; est., 1887, $184,250, **87,** 2409.
1894 and 1902, repairs au. and replacing crib superstr. (3,833′) with one of st. or concrete; est., $173,750 (total of $323,750), **94,** 2496; **02,** 860; **10,** 1118; **12,** 205.
Col. Barlow, 1901, est. $129,605 for proper repair and completion, in compliance with concurrent resolution of Congress, **01,** 1072. Act June 13, 1902, app. $57,750 for repair and mainten. of break'r, thus further enlarging proj. of 1886, **02,** 92.

SURVEYS.

By Lt. Allen, under direction of Capt. Reese, **66,** iv, 180; **67,** 251; **69,** 185.
Concurrent resol. of Cong. (1900–01) asked for report on condition of break'r, with est. of cost of repair and completion, **01,** 1072. (See Projects.)
Ex. of Lake Champlain, with view to imp. in several localities, au. act Mar. 2, 1907; made, 1907–08, by Col. Burr; further imp. at Burlington H. not considered advisable,[2] **09,** 78.
Cong. Doc. etc., relating to exs. surs., plans, etc., **12,** 205.

Maps:
Of Northern and Northwestern Lakes, showing location of imp., **66.**
Of vicinity, showing break'r and part of city, **66. 97,** 3298.

[1] History, **74,** 274.
[2] H. D. 1109, 60th, 2d.

E-118 LA MOEILLE CANAL, VT.

SURVEYS.

Rs., Feb. 18, 1829, and Jan. 27, 1829. (H. D. 482, 55th, 2d.)

E-120 ST. ALBANS HARBOR, LAKE CHAMPLAIN, VT.

APPROPRIATIONS.

1910, $5,000, **10,** 1119.

COMMERCE.

1909, 174 t., **10,** 1119; 1911, 250 t., **12,** 1481; 2 SS. employed, **12,** 1481.

CONTRACTS.

1911. G. W. Beeman, removing 150 c. y. bowlders and other obstr., $19.90 c. y., s. m., **12,** 1480.

ENGINEERS.

Chief of Engineers. **R., 08,** 77; **09,** 78; **10,** 86; **11,** 166; **12,** 201.

In charge:
Lt. Col. Edw. Burr, **08,** 44; **09,** 48.
Col. F. V. Abbot, 1910. **R., 10,** 1119.
Col. W. M. Black, 1911–. **R., 11,** 1267; **12,** 1480.

OPERATIONS.

1911-12. 9.82 c. y. bowlders removed, **12,** 1480.

PHYSICAL CHARACTERISTICS.

In its orig. condition this H. had sufficient d., being restricted to such C. as could pass through "The Gut" (between N. and S. Hero Islds.) where proj. d. is 10′ at l. l. l. Obstr. bowlders in H. rendered navigation difficult, **10,** 86.

H. is the port for the town of St. Albans, and is the name applied to the upper end of St. Albans B. on n. shore of Lake Champlain, **12,** 201.

Navigation closed by ice, **12,** 1480.

PROJECTS.

Act June 25, 1910, au. removal, to the level of the surrounding bottom, of all bowlders or other obstr. in vicinity of old wharves having d. over them of less than 6½′ at l. l. l., and also off the SS. wharf; est., $5,000,[1] **10,** 86.

SURVEYS.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Lt. Col. Burr, Nov. 25, 1907, and July 28, 1908; est., $5,000,[1] **08,** 77; **09,** 78.

Maps.[1]

E-123 SWANTON HARBOR, VT.

APPROPRIATIONS.

1873,	$15,000,	**73,** 50; **74,** 57.
1874,	8,000,	**74,** 57, 275.
1875,	10,000,	**75,** 61, 354.
1876,	2,000,	**76,** 57, 259.
1878,	20,000,	**78,** 58, 423.
1879,	6,000,	**79,** 65, 397.
1880,	2,500,	**80,** 559.
1881,	2,500,	**81,** 725.
1882,	4,500,	**82,** 710.
Total,	70,500	

CONTRACTS.

1873. L. Whitney, break'r, $109 l. f., **73,** 396.
1874. L. Whitney, break'r, $119 l. f., **75,** 355; **76,** 258.
1875. J. Hancock, break'r, $106 l. f., **76,** 259; **77,** 254.
1878. L. Whitney, repairing break'r, $78 l. f., **79,** 397.
1882. N. W. Fisk, rubblest., 83¢ c. y., **82,** 711.

ENGINEERS.

Chief of Engineers. **R., 72,** 80; **73,** 50; **74,** 57; **75,** 61; **76,** 57; **77,** 52; **78,** 58; **79,** 65; **80,** 89; **81,** 114; **82,** 115; **83,** 324; **84,** 328; **85,** 355, 357; **86,** 348; **87,** 314; **88,** 287; **89,** 343.

In charge:
Lt. Col. J. Newton, 1872–79. **R., 73,** 396; **74,** 275; **75,** 354; **76,** 258; **78,** 423; **79,** 396.
Capt. J. Mercur, in temporary charge, 1877, **77,** 48. **R., 77,** 254.
Lt. Col. N. Michler, 1880–81. **R., 80,** 558; **81,** 724.
Col. J. Newton, 1881, **82,** 683.
Lt. Col. G. L. Gillespie, 1881–83. **R., 82,** 710.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1958; **84,** 2156; **85,** 2321, 2324.
Maj. M. B. Adams, 1885–89. **R., 85,** 2305; **86,** 1901; **87,** 2399; **88,** 2094; **89,** 2455.

Assistants:
D. White. **R., 73,** 397; **77,** 254; **78,** 423.
L. Y. Schermerhorn. **R., 85,** 2325.

ESTIMATES. (See Plans and Projects.)

By D. White, 1873, adopted by Lt. Col. Newton, 1,900 l. f. of break'r, $272,160, **73,** 397, 398; **74,** 275; **78,** 423.

By Lt. Col. Newton, 1879, completing proj., $179,000, **79,** 65, 397.

OPERATIONS.

1873. Constr. of crib; 115 l. f. of break'r under contract, **73,** 396.
1873-74. 1 crib, 110′, placed, **74,** 57, 275.
1874-75. 1 crib, 70′, placed; 110′ of superstr. built, **75,** 61, 354.
1875-76. 1 crib, 69′, placed; 70′ of superstr. built, and damages to cribs repaired, **76,** 57, 258.
1876-77. 69′ of superstr. completed, **77,** 52, 254.
1878-79. Extension of break'r 189′; repairs, **79,** 65, 396.
1879-80. Repairing break'r, **80,** 558.
1880-81. W. foundation of break'r, **81,** 724.
1881-82. 1 78′ crib sunk in repair of breach in break'r and 687 c. y. filling placed in same, **82,** 710.
1882-83. St. filling of crib sunk in 1881 completed, and an additional crib commenced, **83,** 1958.
1883-84. 50 l. f. of crib substr. and 78 l. f. of superstr. built, **84,** 2156.

PHYSICAL CHARACTERISTICS.

Described, **73,** 397.
H. is on e. shore of Maquam B., **85,** 2325.

PLANS. (See Estimates and Projects.)

By Lt. Col. Robert, 1885, constr. break'r directly in front of existing and proposed wharves; est., $140,000, **85,** 2324.

[1] H. D. 1109, 60th, 2d.

PROJECT. (See Estimates and Plans.)

By Lt. Col. Newton, 1873, constr. of a break'r of cribwork filled with st., for protection of docks and wharves at Swanton; est., $272,600, **73,** 397, 398; **74,** 275. Reduced to $240,000, **79,** 397; **82,** 710.

In 1888 Maj. Adams recom. no further app. be made until development of the shipping interests indicated in what direction imp. was desired, **88,** 2095.

In 1889, after ex., Maj. Adams reported the locality unworthy of further imp., **89,** 2458.

SURVEYS.

Under direction of Lt. Col. Newton, by D. White, 1872. **R., 73,** 396, 397.

Au. act July 5, 1884; made by Lt. Col. Robert, **85,** 2324.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj Adams, **88,** 2095.

Maps. Of Maquam B., **85,** 2324.

E-126 MISSISQUOI RIVER, VT.

COMMERCE.

Description of, **95,** 3244; **97,** 3321.

1894, 70,000 t.; in that year it was believed that the imp. of the R. to Swanton would result in largely increasing the C., the cost of the imp. being considered relatively small compared with the probable benefits to be derived, **97,** 3244, 3245.

In 1897 it was est. at 87,000 t., but after a sur. Maj. Stanton considered that the cost of imp. necessary, together with the cost of mainten., would be greater than would be justified by the C. interests involved, **97,** 3320.

ENGINEERS.

Chief of Engineers. R., 95, 429; **97,** 483.
In charge:
Capt. S. S. Leach, 1894–95. **R., 95,** 3243.
Maj. W. S. Stanton, 1896–97. **R., 97,** 3319.
Assistant. F. M. Barstow. **R., 97,** 3322.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3244; **97,** 3320.

R. rises in the Green Mountains near the Canadian line and flows into the Missisquoi B. by 3 branches, **95,** 3244; and so near the n. boundary of the US. that the middle and eastern mouths can be entered only from Canadian water, **97,** 3322.

PROJECTS.

In 1897 Maj. Stanton est. $43,000 to obtain 4′, $78,000, 5′; and $122,000, 6′, **97,** 3321.

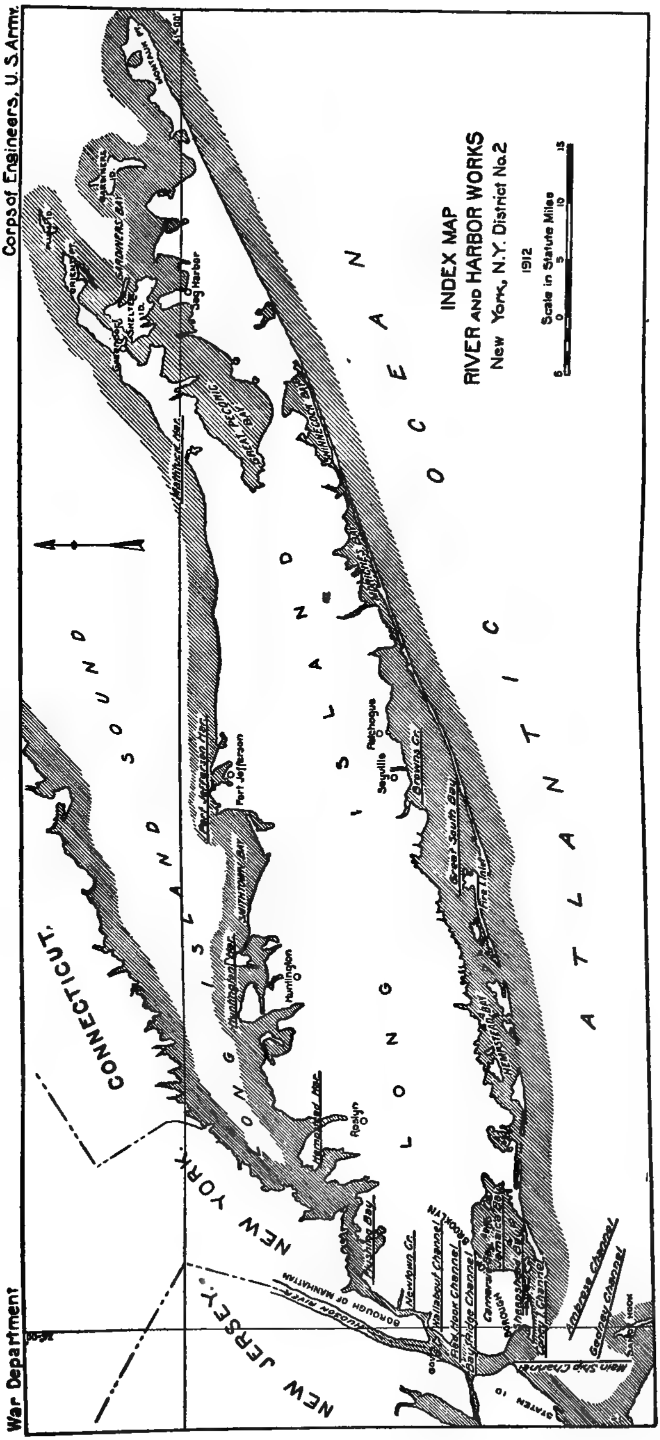
SURVEYS.

Ex., particularly between Swanton and Lake Champlain, au. act Aug. 17, 1894; made, 1894, by Capt. Leach (**R.** fav. for sur.), **95,** 3243.

Sur. au. act June 3, 1896; made, 1897, by Maj. Stanton (**R.** unfav.; see Projects), **97,** 3319.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

F.—NEW YORK, N. Y., DISTRICT No. 2.


Corps of Engineers, U.S. Army.
War Department
INDEX MAP
RIVER AND HARBOR WORKS
New York, N.Y. District No.2
1912
Scale in Statute Miles
CONNECTICUT
NEW YORK
NEW JERSEY
LONG ISLAND SOUND
LONG ISLAND
ATLANTIC OCEAN
Great Peconic Bay
Shinnecock Bay
Great South Bay
Sag Harbor
Port Jefferson
Huntington
Roslyn
Sayville
Patchogue
Browns Cr.
Fire Island
Flushing Bay
Newtown Cr.
Wallabout Channel
Red Hook Channel
Bay Ridge Channel
Main Ship Channel
Gedney Channel
Ambrose Channel

F.—NEW YORK, N. Y., DISTRICT—NO. 2.

In charge of U. S. Engineer Office,
Army Building, New York, N. Y.

NOTE.—The following list of waterways of this district begins at the end of a line drawn from the mainland to Long Island, in the vicinity of the Bronx-Manhattan Borough line, New York City—moving thence toward Long Island Sound to Montauk Point, thence toward Jamaica Bay, New York Harbor, and the starting point in East River.

F 1 Atlantic Ocean.
F 2 Long Isld. Sound, N. Y., and Conn. (1)
F 3 East R., N. Y. (2, 105)
F 4 Berrians Cr., N. Y. (3)
F 5 Flushing B., N. Y. (3)
F 6 Flushing Cr., N. Y. (5)
F 7 Little Neck B., N. Y. (2)
F 8 Manhasset H. and B., N. Y. (2)
F 9 Hempstead H., N. Y. (2)
F 10 Roslyn H., N. Y. (9)
F 11 Glen Cove, N. Y. (9)
F 12 Oyster H. and B., N. Y. (2)
F 13 Cold Spring H., N. Y. (2)
F 14 Huntington B., N. Y. (2)
F 15 Lloyds H., N. Y. (14)
F 16 Huntington H., N. Y. (14)
F 17 Northport H. and B., N. Y. (2)
F 18 Smithtown H. and B., N. Y. (2)
F 19 Nissequogue R., N. Y. (18)
F 20 Stony Brook H. (including Porpoise Chan.), N. Y. (18)
F 21 Port Jefferson H., N. Y. (2)
F 22 Conscience B., N. Y. (21)
F 23 Setauket H., N. Y. (21)
F 24 Mt. Sinai H., N. Y. (2)
F 25 Wading R., N. Y. (2)
F 26 Mattituck H. and B., N. Y. (2)
F 27 Hortons Pt., N. Y. (2)
F 28 Plum Gut, N. Y. (2), (29)
F 29 Block Isld. Sound, N. Y. and Conn. (2), (30)
F 30 Gardiners B., N. Y. (29)
F 31 Orient H., N. Y. (30)
F 32 Peters Neck (Long Beach) B., N. Y. (31)
F 33 Greenport H. and B., N. Y. (30)
F 34 Shelter Isld. Sound, N. Y. (30)
F 35 Southold H., N. Y. (34)
F 36 Little Peconic B., N. Y. (34)
F 37 Great Peconic B., N. Y. (36)
F 38 Peconic R., N. Y. (37)
F 39 Shinnecock Canal, N. Y. (37)
F 40 Noyack B., N. Y. (34)
F 41 Sag H., N. Y. (34)
F 42 Threemile R. and H., N. Y. (30)
F 43 Napeague B., N. Y. (29)
F 44 Fort Pond B., N. Y. (29)
F 45 Great Pond, N. Y. (29)
F 46 Montauk Pt., N. Y. (29) (1)
F 47 Fire Isld. Inlet, N. Y. (1) (48)
F 48 Great South B., N. Y. (47) (*)
F 49 West Hampton Cr., N. Y. (50)
F 50 Quogue Ditch, N. Y. (49)
F 51 Shinnecock B., N. Y. (50)
F 52 Moriches B., N. Y. (49)
F 53 Speonk R., N. Y. (52)
F 54 Forge R., N. Y. (52)
F 55 Bellport B., N. Y. (48)
F 56 Carmans R., N. Y. (55)
F 57 Patchogue R., N. Y. (48)
F 58 Browns Cr., N. Y. (48)
F 59 Great R., N. Y. (48)
F 60 Champlins Cr., N. Y. (48)
F 61 Islip Cr., N. Y. (48)
F 62 Bay Shore, N. Y. (48)
F 63 Sumpawanus Inlet, N. Y. (48)
F 64 Carris R., N. Y. (48)
F 65 Amityville, N. Y. (48)
F 66 South Oyster B., N. Y. (48)
F 67 Seaford R. and B., N. Y. (48)
F 68 Baldwin R. (Parsonage Cr.), N. Y. (48)
F 69 Jones Inlet, N. Y. (1, 71)
F 70 Debs Inlet (East Rockaway Inlet), N. Y. (1, 71)
F 71 Hempstead B., N. Y. (69, 70)
F 72 Broad Chan., Hempstead B., N. Y. (71, 74, 75)
F 73 East Rockaway Cr., N. Y. (71)
F 74 Hewlett B., N. Y. (72)
F 75 Woodmere B., N. Y. (72)
F 76 Woodsburg Chan., Hempstead B., N. Y. (71)
F 77 Bannister Cr., N. Y. (71)
F 78 Rockaway Inlet, N. Y. (1, 79)
F 79 Jamaica B., N. Y. (78) (*)
F 80 Beach Chan., N. Y. (79)
F 81 Broad Chan., N. Y. (79)

* There are almost 50 tributaries other than those named flowing into this waterway, concerning which bridge complaints might arise.

F 82 The Raunt, N. Y. (79)
F 83 Conch Hole Cr., N. Y. (79)
F 84 Bass Chan., N. Y. (79)
F 85 Norton Cr., N. Y. (79)
F 86 Far Rockaway and Inwood, N. Y. (79)
F 87 Nigger Bar Chan., N. Y. (79)
F 88 Jamaica-Rockaway Chan., N. Y. (79)
F 89 Hook Cr., N. Y. (79)
F 90 Hassock Cr., N. Y. (79)
F 91 Cornells Cr., N. Y. (79)
F 92 Spring Cr., N. Y. (79)
F 93 Mill Cr., N. Y. (79)
F 94 Fresh Cr., N. Y. (79)
F 95 Canarsie B., N. Y. (79)
F 96 Indian Cr., N. Y. (79)
F 97 Island Chan., N. Y. (79)
F 98 Irish Chan., N. Y. (79)
F 99 Garritson Cr., N. Y. (79)
F 100 Dead Horse Inlet, N. Y. (79)
F 101 Plum Beach Chan., N. Y. (79)
F 102 Sheepshead B., N. Y. (79)
F 103 Coney Island Cr., N. Y. (102, 104)
F 104 Gravesend B., N. Y. (103, 105)
F 105 New York H., N. Y. (1) (Hudson R.; see Dist. E.)**
F 106 Gowanus Cr., N. Y. (105)
F 107 Gowanus Canal, N. Y. (106)
F 108 Bushwick Cr., N. Y. (3)
F 109 Newtown Cr., N. Y. (3)
F 110 Whale Cr., N. Y. (109)
F 111 English Kills, N. Y. (109)
F 112 Maspeth Cr., N. Y. (109)
F 113 Dutch Kills, N. Y. (109)

F-4 BERRIANS CREEK, LONG ISLAND, N. Y.

COMMERCE.

Description of. 16,000 t. an. C. would probably be doubled by an imp. of the stream, **93,** 994.

ENGINEERS.

Chief of Engineers. R., 93, 92.
In charge. Lt. Col. H. M. Robert, 1893. **R., 93,** 993.

PHYSICAL CHARACTERISTICS.

Description of. A small tidal branch of East R. on n. shore of Long Isld., 3 m. n. and e. from Hell Gate by chan.

At ordinary l. t. the bed of the creek is nearly bare everywhere, **93,** 994.

SURVEYS.

Ex. au. act July 13, 1892; made by Col. Houston, 1892 (**R.** unfav.), **93,** 993.

F-5 FLUSHING BAY, N. Y.

APPROPRIATIONS.

1879,	$20,000,	**79,** 62.
1880,	15,000,	**80,** 509.
1881,	10,000,	**81,** 633.
1882,	5,000,	**82,** 659.
1884,	10,000,	**84,** 725.
1886,	10,000,	**86,** 662.
1888,	15,000,	**88,** 582.
1890,	20,000,	**90,** 666.
1892,	10,000,	**92,** 724.
1894,	4,000,	**95,** 843.
1896,	4,000,	**96,** 744.
1902,	*2,000,	**03,** 869.
1905,	*10,000,	**05,** 967.
1907,	*27,000,	**07,** 996.
1910,	*12,900,	**10,** 1192.
1912,	4,000,	**12,** 1516.
Total,	178,900 (incl. sales, $178,905.75, **12,** 1516).	

COMMERCE.

Benefit of imp. to C., **78,** 430; **79,** 387.

Opposition of Newtown citizens to dike constr., **80,** 508.

No local C. to be benefited by a chan. between the B. and Newtown Creek, and the use of the chan. by other C. uncertain, **97,** 1160.

Description of, **05,** 993.

Demand for water front, **05,** 999.

Transportation facilitated, but no effect on freight rates, **10,** 153.

1897, $163,000; 1903, $110,000; 1909, $277,000; 1911, $394,000, **12,** 239.

CONTRACTS.

1879. H. Du Bois & Sons, pile-dike constr., **80,** 509.
1880. W. Flannery, dr., 17¢ c. y., **81,** 633.
1881. C. M. Pratt, dr., 24¢ c. y., **82,** 659.
1882. H. N. & A. J. Beardsley, dr., 19½¢ c. y., **83,** 560.
1884. H. Du Bois's Sons, dr., 18¢ c. y., **85,** 667.
1886. P. S. Ross, dr., 17.7¢ c. y., **87,** 636.
1889. J. & A. Du Bois, pile-dike constr., at $45.09½ per 10 l. f.; dr., 20¢ c. y., **89,** 732.
1891. C. & H. E. Du Bois, dr., 17.9¢ c. y., **91,** 823.
1892. C. & H. E. Du Bois, dr., 28¢ c. y., s. m. ($11,200), **93,** 983.
1895. J. H. Fenner, dr., 18¢ c. y., s. m. ($3,500), **95,** 844.
1897. W. W. Du Bois, dr. 20,588 c. y., 17¢ c. y., s. m., **97,** 1107.
1905. International Contracting Co., dr., 25¢ c. y., s. m., **06,** 952.
1907. Maritime Dredging Co., dr., 19⅝¢ c. y., s. m., **08,** 1044.
1911. R. G. Packard Co., dr., 22¢ c. y., s. m., and removing bowlders over ½ c. y., $8 c. y., **11,** 1304.

ENGINEERS.

Chief of Engineers. R., 78, 58; **79,** 62, 66; **80,** 82; **81,** 100; **82,** 101; **83,** 101; **84,** 106; **85,** 90; **86,** 91; **87,** 55; **88,** 56; **89,** 69; **90,** 62; **91,** 77; **92,** 82; **93,** 89; **94,** 80; **95,** 91; **96,** 87; **97,** 123, 139; **98,** 118; **99,** 133; **00,** 151; **01,** 204; **02,** 158; **03,** 129; **04,** 114; **05,** 121, 134, 990; **06,** 125; **07,** 128; **08,** 134; **09,** 136; **10,** 152, 181; **11,** 184, 197; **12,** 238.

Boards. BERH. **R., 05,** 994, 995.

In charge:

Lt. Col. J. Newton, 1878–83. **R., 78,** 430; **79,** 385, 386; (Col.) **80,** 508; **81,** 631; **82,** 657.

Lt. Col. G. L. Gillespie, 1883–85. **R., 83,** 559; **84,** 724.

Lt. Col. W. McFarland, 1885–86. **R., 85,** 666.

Lt. Col. D. C. Houston, 1886–92. **R., 86,** 661; **87,** 634; (Col.) **88,** 581; **89,** 730; **90,** 664; **91,** 822; **92** 722.

Lt. Col. H. M. Robert, 1893–95. **R., 93,** 980; **94,** 703; (Col.) **95,** 842.

* Allotment.

** For list of channels, see p. 233.

Maj. H. M. Adams, 1896–98. **R., 96,** 742; **97,** 1106, 1159; **98,** 1008.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1227.
Maj. E. H. Ruffner, 1900. **R., 00,** 1401.
Col. S. M. Mansfield, 1901. **R., 01,** 1210; **05,** 991.
Capt. Spencer Cosby, 1902. **R., 02,** 1005.
Col. Amos Stickney, 1903. **R., 03,** 868; **05,** 996.
Capt. E. H. Schulz, 1904. **R., 04,** 1025.
Col. W. R. Livermore, 1905–06. **R., 05,** 967; **06,** 951.
Col. J. G. D. Knight, 1907–08. **R., 07,** 995; **08,** 1043.
Col. W. M. Black, 1909–10. **R., 09,** 1066; **10,** 1192.
Col. S. W. Roessler, 1911–. **R., 11,** 1303; **12,** 1516.

Assistants:
R. H. Talcott, **79,** 386. **R, 79,** 387.
Lt. J. R. Slattery. **R., 05,** 1000.

OPERATIONS.

1879-80. 3,057 l. f. pile dike built, **80,** 508.
1880-81. Chan. x 65′ 6,000′ dr. from 6′ d. on East R. side to corresponding d. at Flushing, **81,** 632.
1881-82. 36,000 c. y. dr., **82,** 657.
1882-83. 31,959 c. y. dr., **83,** 560.
1884-85. 44,633 c. y. dr., **85,** 667.
1886-87. 26,630 c. y. dr. from chan. leading up the bay and creek to Flushing; history of past operations, **87,** 635.
1887-88. 23,630 c. y. dr. from chan. and shoals, **88,** 581.
1888-89. 375 piles driven, **89,** 731.
1889-90. 1,606 l. f. of dike built, and 15,063 c. y. dr., **90,** 665.
1890-91. 4,515 c. y. riprap st. placed upon dike, **91,** 823.
1891-92. 73,849 c. y. dr., **92,** 723.
1892-93. 31,378 c. y., s. m., dr., **93,** 981.
1895-96. 19,435 c. y., s. m., dr., **96,** 743.
1896-97. 20,494 c. y., s. m., dr., **97,** 1106.
1905-06. 35,451 c. y. dr., **06,** 951.
1907-08. 130,825 c. y. dr., **08,** 1043.
1908-09. 873 c. y. dr., **09,** 1066.
1910-11. 1,434 c. y. dr., **11,** 1303.
1911-12. 43,891 c. y. soft material and 12 c. y. bowlders dr., **12,** 1516.

PHYSICAL CHARACTERISTICS.

Description of, **78,** 430; **79,** 387; **97,** 1159; **05** 991.
Description of the B.; rise of tide, **88,** 581.
Flushing B. and Newtown Creeks separated by 4 m. of upland, **97,** 1159.
Dike nearly destroyed by storms and ice, **01,** 1210.
Effect of dike on chan., **05,** 998; shoaling, **12,** 239.
Max. draft, range of tides, etc., **12,** 239.
On n. shore of Long Isld., 14 m. from Battery, N. Y. C., **12,** 238.

PLANS. (See Projects.)

By Lt. Col. Newton, 1878, dr. chan. 1′ x 3′ x 100′ m.; est., $15,000; should be determined by sur., **78,** 430.

PROJECTS. (See Plans.)

By Lt. Col. Newton, 1879, tidal basin by dr., and an inclosing pile dike with an opening near the head of the B., which, by filling and discharging through the main chan., would maintain a d. of 6′ m. l. w.; est., $173,500, **79,** 62, 385, 387; **86,** 661; **87,** 634; **92,** 722.
Col. Mansfield, 1903, recom. removal of dike, **05,** 993.
By Col. Stickney, 1904, repairing and extend. dike shoreward and dr. chan. 10′ x 100′ up to Broadway Br., and 8′ d. on up to main St. Br.; est., $87,308.83,[1] **05,** 1000.

SURVEYS.

Pre. ex., **78,** 58, 430.
By R. H. Talcott, **78,** 58; **79,** 66, 387.
Surs., **85,** 666; **89,** 732.
Ex. with a view to connecting Flushing B. with Newtown Creek, N. Y., au. act June 3, 1896; made by Maj. Adams in the same year (**R.** unfav.), **97,** 1159.
Ex. and sur. au. act June 13, 1902; made, 1903–04 by Cols. Mansfield and Stickney, resp.,[1] **05,** 990.
Of dike, **07,** 995.
Minor, **09,** 1066.
Pre. ex. and sur. au. act Mar. 3, 1909; **Rs.,** Col. Black, 1909 and 1910; est., $235,700, and $5,500 an. mainten.,[2] **10,** 181; **11,** 184.
Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 240.
Maps.[1] **85,** 666; **89,** 732; **03,** 868.

F-7 LITTLE NECK BAY, N. Y.

ENGINEERS.

Chief of Engineers. R., 12, 254.
In charge. Col. S. W. Roessler, **12,** 224.

SURVEY.

Pre. ex. au. act June 25, 1910; **R.,** Col. Roessler, June 22, 1911 (unfav.),[3] **12,** 254.

F-8 MANHASSET HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. R., 12, 254.
In charge. Col. S. W. Roessler, **12,** 224.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 254.

F-9 HEMPSTEAD HARBOR, N. Y.

APPROPRIATIONS.

1910, $23,500, **10,** 1194.
1911, 23,500, **11,** 1305.

Total, 47,000 (incl. sales, etc., $47,003.52, **12,** 1519).

COMMERCE.

Small, **84,** 764.
1911, 844,480 t., **12,** 243.

CONTRACTS.

1911. P. S. Ross (Inc.), dr., 21¢ c. y., **11,** 1305.
1912. Coastwise Dredging Co., dr., 18¾¢ c. y., **12,** 1519.

ENGINEERS.

Chief of Engineers. R., 80, 85; **81,** 108; **84,** 122; **08,** 155; **10,** 155; **11,** 200; **12,** 242.

[1] H. D. 98, 58th, 3d. [2] H. D. 1333, 61st, 3d. [3] H. D. 427, 62d, 2d.

In charge:
Col. J. Newton. **R., 81,** 668.
Maj. G. L. Gillespie. **R., 84,** 764.
Col. J. G. D. Knight, **08,** 122.
Col. W. M. Black, 1909–10. **R., 10,** 1193.
Col. S. W. Roessler, 1910–. **R., 11,** 1305; **12,** 1518.

Assistants:
R. H. Talcott. **R., 81,** 669.
Capt. H. L. Wigmore, **11,** 105.

OPERATIONS.

1910–11. 9,555 c. y. dr., **11,** 201.
1911–12. 87,187 c. y. dr., **12,** 1518.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 156, 157; excessive refill, **12,** 242.
H. on n. shore of Long Isld., about 29 m. e. of Battery, N. Y. C.

PLANS.

By Col. Newton, 1881, separating inner from the outer B. by a dam, and regulating ingress and egress by means of a lock; est., $440,000, **81,** 668.
Constr. dike 7,500′ l. from "Bar Beach" in a s. direction to Hick's Wharf and dr.; est., $163,200, **81,** 668.
Constr. 2,500 l. f. diking from B. entrance to SS. dock, and dr.; est., $83,375, **81,** 671.

PROJECT.

Au. act June 25, 1910, 6′ x 100′ chan. entrance to opp. Ward's Wharf; thence 80′ w. to Roslyn; thence to head of navigation 50′–70′ w.; est., $47,000, and $3,000 an. mainten., **10,** 155; **12,** 242.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Newton (**R.** unfav.), **81,** 668.
Of Hempstead B., au. act Aug. 2, 1882; made by Maj. Gillespie (**R.** unfav.), **84,** 764.
Pre. ex. au. act Mar. 2, 1907; made by Col. J. G. D. Knight; **R.,** Sept. 4, 1907 (unfav.),[1] **08,** 155.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 242.
Supp. report on sur. Col. Black recom. chan. 6′ x 80′ to town wharf at Roslyn, cost $25,000, and a chan. same depth and 50′–70′ w. from said wharf to head of navigation, cost $22,000; making a total of $47,000. Concurred by BERH.[2]

F-10 ROSLYN HARBOR, N. Y.

COMMERCE.

Est. at 21,400 t. an., **97,** 1162, 1163.

ENGINEERS.

Chief of Engineers. **R., 97,** 139.
In charge. Maj. H. M. Adams, 1896–97. **R., 97,** 1161.

PHYSICAL CHARACTERISTICS.

Description of. At s. end of Hempstead H., about 27 m. from the Battery, New York H., **97,** 1161.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Adams, 1897 (**R.** unfav.), **97,** 1161.

F-11 GLEN COVE HARBOR, N. Y.

APPROPRIATIONS.

1888,	$20,000,	**88,** 56.
1890,	15,000,	**90,** 663.
1892,	10,000,	**92,** 721.
1894,	10,000,	**95,** 840.
1896,	8,000,	**96,** 741.
1902,	*6,000,	**03,** 868.
1905,	*3,000,	**05,** 966.
Total,	72,000	

COMMERCE.

Present and prospective, **87,** 646.
No immediate effect on freight rates, **10,** 152.
Chiefly coal; 7,062 t. in 1906, **11,** 197.

CONTRACTS.

1889. Brown & Fleming, gneiss riprap, 83¢ t., **89,** 729.
1890. J. A. Bouker, break'r extension, 80¢ c. y. for st., **91,** 822.
1892. Brown & Fleming, break'r constr., st., 69¢ t. ($5,520), **93,** 980.
1894. J. A. Bouker, break'r constr., st., 65¢ t. ($9,000), **95,** 840.
1896. J. F. Quinn, extension and repair of break'r, st., 59¢ t. ($7,000), **97,** 1105.
1903. Smith & Robinson, repairing break'r, riprap, 78½¢ t., **03,** 868.
1906. Bouker Contracting Co., repairing and enlarging break'r, st., 99¢ t., **06,** 951.

ENGINEERS.

Chief of Engineers. **R., 87,** 56; **88,** 56; **89,** 69; **90,** 61; **91,** 77; **92,** 82; **93,** 89; **94,** 79; **95,** 90, 94; **96,** 87; **97,** 122; **98,** 117; **99,** 132; **00,** 150; **01,** 204; **02,** 157; **03,** 129; **04,** 114; **05,** 121; **06,** 124; **07,** 128; **08,** 133; **09,** 135; **10,** 151; **11,** 197.

In charge:
Lt. Col. D. C. Houston, 1886–92. **R., 87,** 645; (Col.) **89,** 728; **90,** 662; **91,** 820; **92,** 720.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 978; **94,** 700; (Col.) **95,** 838, 877.
Maj. H. M. Adams, 1896–98. **R., 96,** 740; **97,** 1103; **98,** 1007.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1225.
Maj. E. H. Ruffner, 1900. **R., 00,** 1399.
Col. S. M. Mansfield, 1901. **R., 01,** 1209.
Capt. Spencer Cosby, 1902. **R., 02,** 1004.
Col. Amos Stickney, 1903. **R., 03,** 867.
Capt. E. H. Schulz, 1904. **R., 04,** 1024.
Col. W. R. Livermore, 1905–06. **R., 05,** 966; **06,** 950.
Col. J. G. D. Knight, 1907–08. **R., 07,** 994; **08,** 1042.
Col. W. M. Black, 1909–10. **R., 09,** 1065; **10** 1191.
Col. S. W. Roessler, 1911. **R., 11,** 1303.

Assistant. Lt. J. C. Sanford. **R., 87,** 645.

OPERATIONS.

1888–89. 4,216 t. st. placed in 220 l. f. of break'r, **89,** 728.
1889–90. 8,284 t. st. placed in 350 l. f. of break'r **90,** 663.
1890–91. 3,024 c. y. st. delivered in break'r, **91,** 821.
1891–92. 13,220 c. y. riprap gneiss placed in break'r extension, **92,** 721.
1892–93. 8,250 t. st. deposited in break'r, **93,** 979.
1893–94. 3,300 t. st. deposited, **94,** 701.
1894–95. 12,983 t. st. deposited, **95,** 839.
1896–97. 11,845 t. st. deposited, **97,** 1104.
1902–03. 1799 t. riprap placed in break'r, **03,** 867.
1903–04. 4,824 t. riprap placed in break'r, **04,** 1024.
1905–06. 2,547 t. st. placed in break'r, **06,** 950.

*Allotment. [1] H. D. 463, 60th, 1st. [2] Comm. D. 1, 61st, 2d.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 645; **89,** 728; **10,** 151.
Hempstead H. the same as Glen Cove H., **95,** 878.
1,564′ of break'r built to full proj. section; no further work necessary, **11,** 197.
Depths, tides, shoaling, **11,** 197.
Small tidal inlet on e. side Hempstead H., Long Isld., 1¾± m. from Long Isld. Sound, and 27± m. from Battery, N. Y. C., **11,** 197.

PROJECTS.

By Col. Houston, 1886, 2,500 l. f. of riprap break'r extending from Mosquito Pt. in a w. direction; est., $201,960, **87,** 646; **89,** 728; **92,** 720.

By Col. Robert, 1895, modifying the proj. to provide for a break'r 2,000′ l., extending w. from the nw. cor. of Glen Cove Dock, the top to be 5′ w. and 3′ above h. w., with slopes of 1 on 1; est., from the beginning, $135,000, **95,** 839, 841.
No further work being necessary under proj. of June, 1895, it may be considered completed, **11,** 197.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Houston, **87,** 645.
Sur. Hempstead H. (see Physical data) au. act Aug. 17, 1894; made by Lt. Col. Robert, 1894 (**R.** unfav. to further imp.), **95,** 877.
Maps. **89,** 728.

F-12 OYSTER BAY HARBOR, N. Y.

COMMERCE.

An. value, $1,053,000, **97,** 1164.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 139.
In charge. Maj. H. M. Adams, 1896–97. **R.,** **97,** 1163.

PHYSICAL CHARACTERISTICS.

Description of; a village, with a population of about 3,000, situated about 35 m. from the Battery, New York H., **97,** 1164.

SURVEY.

Ex. au. act June 3, 1896; made, 1897, by Maj. Adams (**R.** unfav.), **97,** 1163.

F-13 COLD SPRING HARBOR, N. Y.

COMMERCE.

Description of; limited, **95,** 875.

ENGINEERS.

Chief of Engineers. **R.,** **95,** 94.
In charge. Lt. Col. H. M. Robert, 1895. **R.,** **95,** 874.
Assistant. Lt. W. E. Craighill. **R.,** **95,** 875.

PHYSICAL CHARACTERISTICS.

Description of. Situated at the head of Oyster B., Long Isld., and about 35 m. from New York. A biological laboratory of the Brooklyn Institute and a building of the N. Y. Fish Commission are shut off from communication with the outer H., where most of the shipping of the district is done, by a shoal inner H., **95,** 875.

SURVEY.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert, 1894 (**R.** unfav.), **95,** 874.

F-15(a) LLOYDS HARBOR AND COLD SPRING BAY, N. Y. (Channel between).

COMMERCE.

Important, **81,** 615.
Description of, **97,** 1166.
1897, value est. at $2,600,000, **97,** 1166.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 80; **81,** 96; **97,** 139; **06,** 140.
In charge:
Maj. J. W. Barlow, 1881. **R.,** **81,** 613.
Maj. H. M. Adams, 1896–97. **R.,** **97,** 1165.
Col. W. R. Livermore, **06,** 115.
Assistant. W. W. Starr. **R.,** **81,** 614.

PHYSICAL CHARACTERISTICS.

Description of. A shallow inlet 2½ m. l. on the n. shore of Long Isld. Sound, situated about 40 m. by water from New York City, **97,** 1165.

PLANS.

By Maj. Barlow, 1890, dr. chan. 10′ x 200′ m. l. w., with js. at Cold Spring; est., $287,534.40, **81,** 615.

SURVEYS.

Au. act June 14, 1880; made by Maj. Barlow, 1880, **81,** 613.
Ex. for connection with Cold Spring B. au. act June 3, 1896; made, 1896, by Maj. Adams (**R.** unfav.), **97,** 1165.
Pre. ex. au. act Mar. 3, 1905, for imp. chan. between Huntingdon B. and Cold Spring H.; **R.,** Col. Livermore, d. Sept. 19, 1905 (unfav.),[1] **06,** 140.

F-16 HUNTINGTON HARBOR, LONG ISLAND, N. Y.

APPROPRIATIONS.

1872,	$22,500,	**72,** 84.
1890,	10,000,	**91,** 819.
1892,	5,000,	**92,** 719.
1894,	2,000,	**95,** 837.
1896,	5,000,	**96,** 740.
1899,	7,500,	**99,** 1223.
1902,	*2,500,	**03,** 867.
1905,	*2,500,	**05,** 965.
1907,	*$3,500,	**07,** 994.
1910,	*2,500,	**10,** 1190.
Total,	63,000 (incl. sales, $63,002.30,	**12,** 1515).

COMMERCE.

Important, **72,** 907; **85,** 706.
Material reduction in rates, **10,** 151; **12,** 238.
In 1911, 50,542 t., **12,** 238.

*Allotment.

[1] H. D. 151, 59th, 1st.

CONTRACTS.

1872. S. F. Shelbourne, dr., 30¢ and 14.98¢ c. y., **72,** 905.
1891. C. & H. E. Du Bois, dr., 15.9¢ c. y., **91,** 819.
1892. E. Brainard, dr., 19¾¢ c. y. ($4,937.50), **93,** 977.
1894. J. H. Fenner, dr., 12¢ c. y. ($1,700), **95,** 837.
1897. E. Brainard, dr. 47,368 c. y., 9½¢ c. y., s. m., **97,** 1102.
1899. Du Bois Bros. Dredging Co., dr., 13.9¢ c. y. ($6,741.50), **99,** 1224.
1903. John & Joseph McSpirit, dr., 24¢ c. y., s. m., **04,** 1023.
1906. Seely-Taylor Co., dr., 32½¢ c. y., s. m., **06,** 950.
1907. John P. Randerson, dr., 26¢ c. y., s. m., **08,** 1042.
1911. Maritime Dredging Co., dr. about 7,500 c. y., at 28⅝¢ c. y.; removing bowlders exceeding ½ c. y., $8 c. y., **11,** 1302.

ENGINEERS.

Chief of Engineers. R., 71, 87; **72,** 84; **73,** 92; **85,** 96; **91,** 76; **92,** 81; **93,** 88; **94,** 79; **95,** 89; **96,** 86; **97,** 121; **98,** 116; **99,** 131; **00,** 149; **01,** 203; **02,** 157; **03,** 128; **04,** 113; **05,** 120; **06,** 123; **07,** 127; **08,** 132; **09,** 134; **10,** 150, 181; **11,** 195; **12,** 237.

In charge:
Maj. G. K. Warren, 1871–85. **R., 72,** 905; **73,** 1027; (Lt. Col.) **85,** 703, 704.
Col. D. C. Houston, 1890–92. **R., 91,** 817; **92,** 717.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 975; **94,** 698; (Col.) **95,** 835.
Maj. H. M. Adams, 1896–98. **R., 96,** 738; **97,** 1100; **98,** 1005.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1223.
Maj. E. H. Ruffner, 1900. **R., 00,** 1397.
Col. S. M. Mansfield, 1901. **R., 01,** 1208.
Capt. Spencer Cosby, 1902. **R., 02,** 1003.
Col. Amos Stickney, 1903. **R., 03,** 866.
Capt. E. H. Schulz, 1904. **R., 04,** 1023.
Col. W. R. Livermore, 1905–06. **R., 05,** 965; **06,** 949.
Col. J. G. D. Knight, 1907–08. **R., 07,** 993; **08,** 1041.
Col. W. M. Black, 1909–10. **R., 09,** 1064; **10,** 1190.
Col. S. W. Roessler, 1911. **R., 11,** 1302; **12,** 1515.

Assistants:
W. S. Edwards. **R., 72,** 908.
J. H. Dager. **R., 73,** 1027.

OPERATIONS.

1872–73. 91,786 c. y. dr., **73,** 1027.
1891–92. 55,137 c. y. dr., **92,** 718.
1892–93. 22,034 c. y. dr., **93,** 977.
1895–96. 13,994 c. y., s. m., dr., **96,** 739.
1896–97. 47,050 c. y., s. m., dr., **97,** 1101.
1899–00. 48,478 c. y. dr., **00,** 1398.
1903–04. 9,518 c. y. dr., **04,** 1023.
1905–06. 6,154 c. y. dr., **06,** 949.
1907–08. 11,538 c. y. dr., **08,** 1041.
1911–12. 7,500 c. y. dr., **12,** 1515.

PHYSICAL CHARACTERISTICS.

Character of bed, **72,** 907; **73,** 1027.
Tides, **72,** 907; **73,** 1029.
Description of, **05,** 120; **10,** 151.
Landlocked arm 2 m. x ½ m. on n. shore of Long Isld., about 40 m. e. of N. Y. C., **12,** 237.
Dr. chan. deteriorating, **12,** 237.

PROJECTS.

By Maj. Warren, dr. chan. at entrance, 8′ x 200′ m. l. w., and in inner H., the chan. to be 8′ x 150′ m. l. w.; est., $22,780, **72,** 905, 907, 909.
By Col. McFarland, 1885, dr. chan. 8′ x 100′ l. w. on the bar, the w. of the chan. near the wharves, and the protection of the chan. by a pile revet. 1,400′ l.; est., $32,000, **85,** 705; **91,** 817; **92,** 718.

SURVEYS.

Included in Coast Sur., 1836, **72,** 907.
By W. S. Edwards, 1871. **R., 72,** 908.
Au. act July 5, 1884; made by Col. McFarland, **85,** 704.
Au. act Mar. 3, 1909; made, 1909–10, by Col. Black (**R.** unfav.),[1] **10,** 181.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 238.
Maps.[1] **93,** 976; **04,** 1023.

F-17 NORTHPORT HARBOR, N. Y.

COMMERCE.

Description of. Estimated an. value, 1895, $1,400,000, **97,** 1167.

ENGINEERS.

Chief of Engineers. R., 97, 139.
In charge. Maj. H. M. Adams, 1896–97. **R., 97,** 1167.

PHYSICAL CHARACTERISTICS.

Description of. Situated about 42 m. by water from New York City, **97,** 1167.

SURVEY.

Ex. au. act June 3, 1896; made by Maj. Adams, 1896 (**R.** fav.), **97,** 1167.

F-18(a) SMITHTOWN HARBOR, N. Y.

COMMERCE.

Description of. Est. $30,000 an. Community engaged mostly in farming, **97,** 1169.

ENGINEERS.

Chief of Engineers. R., 97, 140.
In charge. Maj. H. M. Adams, 1896–97. **R., 97,** 1168.

PHYSICAL CHARACTERISTICS.

Description of. Situated on the n. shore of Long Isld. about 50 m. by water from New York City, **97,** 1169.

SURVEY.

Ex. au. act June 3, 1896; made, 1896, by Maj. Adams (**R.** unfav.), **97,** 1168.

[1] H. D. 827, 61st, 2d.

F-20 STONY BROOK HARBOR, INCLUDING PORPOISE CHANNEL, N. Y.

COMMERCE.

Small, **84,** 665.

ENGINEERS.

Chief of Engineers. R., 84, 99; **10,** 181.
In charge:
Maj. J. W. Barlow. **R., 84,** 664.
Col. W. M. Black, **10,** 138.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 664. On n. shore of Long Isld., about 50 m. e. of N. Y. C. Lies behind a low sand beach stretching out from Rassepeague Pt.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Barlow (**R.** unfav.), **84,** 664.
Pre. ex. au. act Mar. 3, 1909. **R.** by Col. Black, July 8, 1909[1] (unfav.), **10,** 181.

F-21 PORT JEFFERSON HARBOR, N. Y.[2]

APPROPRIATIONS.

1852,	$1,200.00 (sur.), act Aug. 30.	
1871,	15,000.00,	**71,** 86, 804.
1872,	15,000.00,	**72,** 85, 910.
1875,	15,000.00,	**75,** 106, ii, 266.
1876,	6,000.00,	**76,** 53, 233; **77,** 221.
1878,	8,000.00,	**78,** 53, 408.
1879,	5,000.00,	**79.** 59, 361.
1880,	3,000.00,	**80,** 468.
1881,	4,000.00,	**81,** 612.
1882,	8,000.00,	**82,** 625.
1890,	25,000.00,	**91,** 816.
1892,	10,000.00,	**92,** 81.
1894,	7,500.00,	**95,** 834.
1896,	7,500.00,	**96,** 737.
1899,	7,500.00,	**99,** 1221.
1902,	*10,500.00,	**05,** 963.
1904,	*1,956.35,	**05,** 963.
1905,	*8,500.00,	**05,** 963.
1907,	*21,100.00,	**07,** 991.
1910,	1,600.00,	**11,** 1299.
1912,	5,000.00,	**12,** 1512.
Total,	186,356.35 (less $1,200 allotted for sur. in 1852, $185,156.35, **12,** 1512).	

COMMERCE.

Requirements, **71,** 807; **73,** 1030, 1035.
1900, 40,380 t., **01,** 1208; 1906, 113,705 t., **07,** 992; 1910 and 1911, about equal, 56,935 t., **12,** 234.
Rates probably reduced by imp., **12,** 234.

CONTRACTS.

1871. C. C. Campbell, sea wall. W. H. Beard, dr., **71,** 805.
1872. J. Beattie, granite, $2.67 t., **72,** 911.
1875. S. F. Shelbourne,[3] dr., 27¢ c. y., **75,** ii, 265; **76,** 232. F. H. Smith, st., $1.44 t., **75,** ii, 265; **76,** 232.
1877. Ingerson & Molthorp, granite, $1.33 t., **77,** 220; **78,** 408.
1878. M. F. Brainerd, dr., $6.50 per hour, **78,** 408; **79,** 360. J. Beattie, granite, $1.05 t., **79,** 358.
1879. J. M. Seward, dr., 55¢ c. y., **80,** 469.
1880. J. Scully, riprap granite, $1.69 t., **81,** 613.
1881. C. F. Stoll, riprap granite, $2.10 t., **82,** 626.
1883. J. Beattie, riprap st., $1.54 t., **83,** 527.
1891. H. Toomey, granite riprap, $1.50 t., **91,** 817.
1892. R. Parrott, dr., 21½¢ c. y., **92,** 717.
Contract with R. Parrott for dr. allowed to expire by limitation in Dec., 1892, **93,** 972.
1893. J. H. Fenner, dr., 32½¢ c. y., s. m. ($16,-250), **93,** 974.
1895. Hartford Dredging Co., dr., 26¢ c. y., s. m. ($7,000), **95,** 834.
1897. Newburgh Dredging Co., dr. 28,482 c. y., 23⅞¢ c. y., s. m., **97,** 1099.
1899. Hudson Contracting Co., 7,865 t. riprap st., 89¢ t., **00,** 1396.
1903. J. P. Randerson, dr. about 28,500 c. y., 28¢ c. y., **03,** 866.
1905. The International Contracting Co., dr. about 20,000 c. y., 25¢ c. y., **06,** 948.
1906. E. S. Belden & Sons, repairing and enlarging break'r, delivering about 4,510 t. st., $1.33 t., **06,** 948.
1907. E. S. Belden & Sons, extending e. j. by delivering 13,800 t. st., $1.25 t., **08,** 1039.

DOCUMENTS. (Not published in **Rs.**)

R. of Lt. M. Harrison, on sur., 1853, **70,** 454; **71,** 805.

ENGINEERS.

Chief of Engineers. R., 70, 32, 76; **71,** 86; **72,** 84; **73,** 93; **74,** 103; **75,** 105; **76,** 53; **77,** 48; **78,** 53; **79,** 59; **80,** 80; **81,** 96; **82,** 93; **83,** 92; **84,** 98; **85,** 90; **86,** 90; **87,** 54; **89,** 70; **91,** 76; **92,** 80; **93,** 87; **94,** 78; **95,** 89; **96,** 85; **97,** 120; **98,** 115; **99,** 130; **00,** 148; **01,** 202; **02,** 156; **03,** 127; **04,** 112; **05,** 118; **06,** 121; **07,** 124; **08,** 129; **09,** 132; **10,** 148; **11,** 193; **12,** 233.

In charge:
Lt. M. Harrison, 1853; **70,** 454; **71,** 805; **79,** 359.
Lt. Col. J. D. Graham, 1865. **R., 66,** 37.
Maj. G. K. Warren, 1870–75. **R., 70,** 454; **71,** 804, 805; **72,** 910; **73,** 1029; **74,** ii, 270.
Maj. J. W. Barlow, 1875–83. **R., 75,** ii, 265; **76,** 232; **77,** 220; **78,** 407; **79,** 358; **80,** 467; **81,** 611; **82,** 624.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 526; **84,** 656; **85,** 665.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 660; **87,** 632; (Col.) **88,** 578; **89,** 751; **91,** 814; **92,** 713.
Lt. Col. H. M. Robert, 1893–96. **R., 93,** 971; **94,** 694; (Col.) **95,** 831; **96,** 735.
Maj. H. M. Adams, 1897–98. **R., 97,** 1097; **98,** 1002.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1220.
Maj. E. H. Ruffner, 1900. **R., 00,** 1393.
Col. S. M. Mansfield, 1901. **R., 01,** 1206.
Capt. Spencer Cosby, 1902. **R., 02,** 1002.
Col. Amos Stickney, 1903. **R., 03,** 865.
Capt. E. H. Schulz, 1904. **R., 04,** 1021.
Col. W. R. Livermore, 1905–06. **R., 05,** 962; **06,** 947.
Col. J. G. D. Knight, 1907–08. **R., 07,** 990; **08,** 1038.
Col. W. M. Black, 1909–10. **R., 09,** 1061; **10,** 1186
Col. S. W. Roessler, 1911–. **R., 11,** 1298; **12,** 512.

Assistants:
W. S. Edwards. **R., 72,** 911.
J. H. Dager. **R., 73,** 1030.
H. N. Babcock, **74,** ii, 270; **79,** 360.
G. A. Weaver. **R., 76,** 232.
F. N. Owen. **R., 79,** 361.

ESTIMATES. (See Projects.)

By Maj. Barlow, 1879, completion of existing proj., $15,000, **79,** 361.

OPERATIONS.

1871–72. 360 l. f. of e. j., or break'r, built, **72,** 85, 910.

* Allotments.
[1] H. D. 300, 61st, 2d.
[2] Sur.—**R.,** Oct., 1853. (H. D. 482, 55th, 2d.)
[3] Failed to compete, **76,** 232; **77,** 220; **79,** 360.

1872-73. Extension of j. 422′., **73,** 93, 1029.
1875-76. 165 c. y. dr. and 475 l. f. w. j. built, **76,** 232.
1876-77. 741 t. of riprap added, **77,** 220.
1877-78. Repairs to e. j. and dr., **78,** 53, 407.
1878-79. Extension of w. j. 450′; of e. j., 70′; repairs to e. j., **79,** 59, 358.
1879-80. 5,421 c. y. dr. from chan., **80,** 468.
1880-81. 2,579 c. y. dr. from chan., and 1,400 t. granite placed in js., **81,** 611.
1881-82. 2,020 t. granite placed in e. j., **82,** 625.
1882-83. 3,413 t. granite riprap placed in 150 l. f. of j. extension, **83,** 526.
1883-84. 575 t. granite riprap added to j., extending same 35′, **84,** 657.
1890-91. 1,464 t. st. delivered upon e. j., **91,** 815.
1891-92. 7,520 t. riprap delivered in e. and w. js.; 2,285 c. y. dr., **92,** 715.
1892-93. 16,084 c. y., s. m., dr., **93,** 973.
1893-94. 36,868 c. y., s. m., dr., **94,** 696.
1895-96. 26,308 c. y., s. m., dr., **96,** 736.
1896-97. 27,282 c. y., s. m., dr., **97,** 1098.
1897-98. 1,138 c. y., s. m., dr., **98,** 1003.
1899-00. 7,253 t. st. deposited, **00,** 1395.
1900-01. 538.1 t. riprap placed in outer end of e. j. for protection of lighthouse foundation which had been damaged by settlement in j., **01,** 1206.
1902-03. 6,583 c. y. dr. under contract, removing shoal parts, **03,** 865.
1903-04. 18,728 c. y. dr. under contract which was completed July 17, 1903, **04,** 1021.
1904-05. Specifications prepared and proposals invited; 2 bids received and rejected as excessive, **05,** 962.
1905-06. 16,451 c. y. dr., restoring chan. to proj. d. and w.; 2,910 t. st. placed in break'r, completing 260′ of break'r to proj. dimensions, **06,** 947.
1906-07. 2,034 t. st. placed in break'r, completing 1,380 l. f. of it to proj. cross-section, except where covered by sand, **07,** 990.
1907-08. 8,292 t. st. delivered in extension of e. j., completing 90 l. f. to proj. dimensions, **08,** 1038.
1908-09. 5,663 t. st. placed in extension of e. j. completing 80 l. f.; contract work completed Sept. 18, 1908, **09,** 1061.

PHYSICAL CHARACTERISTICS.

Description, **71,** 86, 806; **72,** 912; **73,** 1034; **77,** 222; **79,** 361; **88,** 578; **89,** 751.
The rapidity of the tidal current a cause for the comparatively high prices for dr., **96,** 738.
Before imp. chan. d. outside entrance was 4′, m. l. w.; d. in H. was 12′ and more up, to within 300′ of wharves at Port Jefferson, **03,** 127; 2 js. built to shelter inlet chan. A chan. 8′ x 100′ m. l. w. dr. through inlet and shoal outside, **03,** 128.
Max. draft carried, 1903, over shoalest part of chan., 12′ m. l. w.; mean range of tide at entrance 7′, and at wharves 6.2′; chan. through H. entrance 12′ x 200′, **03,** 128.
Description of, **12,** 233, 234.
Inland B., 2 m. long by ¾ m., n. shore Long Isld., 50 m. e. of N. Y. C.; connected with Long Isld. Sound by narrow entrance, **12,** 233.

PROJECTS. (See Estimates.)

By Maj. Warren, 1871, dr. chan. of entrance 7′ x 200′, protected by a break'r 800′ l.; est., $175,000, **71,** 86, 804, 808. Modified in 1875 by the addition of an e. j., **75,** 105; ii, 265.
By Maj. Barlow, 1877, completion of imp. by extension of js. to 9′ curve and excavation of chan. between them to 8′ l. w.; est., $34,000, **78,** 407; **79,** 359; **80,** 468. Operations under this proj. were completed in 1883, **89,** 752.
In 1889 Col. Houston proposed to make and maintain a 10′ chan. through the inlet by dr. and the repair and enlargement of the e. and w. js.; est., $90,000, **89,** 754; **91,** 815; **92,** 714.
Existing proj. about 67% completed, **12,** 234.

SURVEYS. (See Documents.)

By Lt. M. Harrison, 1853, **70,** 454; **71,** 805; **79,** 359.
By Maj. Warren, ex., 1870. **R.,** **71,** 805.
By W. S. Edwards, 1871, under direction of Maj. Warren. **R.,** **71,** 805; **72,** 911.
By J. H. Dager, 1872–73. **R.,** **73,** 1030.
By H. N. Babcock, 1874, **74,** ii, 270; **79,** 360.
R. by Col. Stickney, 1903, **03,** 865.
Minor, **05,** 962.
Maps. Of the H., **79,** 360; **82,** 626; **84,** 656; **86,** 660; **03,** 866.

F-24 MT. SINAI HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. **R.,** **12,** 253.
In charge. Col. S. W. Roessler, **12,** 224.

SURVEYS.

Pre. ex. au. act June 25, 1910. **R.,** Col. Roessler, Aug. 18, 1911 [1] (unfav.), **12,** 253.

F-26 MATTITUCK BAY AND HARBOR, N. Y.

APPROPRIATIONS.

1896,	$10,000,	**96,** 735.
1899,	5,000,	**99,** 1220.
1905,	*20,000,	**05,** 964.
1907,	*40,000,	**07,** 993.
1909,	*6,000,	**09,** 1064.
1910,	*23,750,	**10,** 1189.
1912,	*10,000,	**12,** 1514.
Total,	114,750 (incl. mise., $114,759.45,	**12,** 1514).

COMMERCE.

Not unimportant, **91,** 846.
Development of oyster industry as result of imp., **09,** 1063.
Necessity of completing proj. in spite of small C., **10,** 1189.

Only H. in 48 m. of coast, n. shore of Long Isld. that can be entered safely by fishing vessels, **11,** 195.

CONTRACTS.

1900. E. S. Belden, j., st. $1.47 t., **01,** 1206.
1906. Peter Beattie and John Beattie, jr., executors, building break'r, st., $1.55 t., **06,** 949, J. P. Randerson, dr., 33¢ c. y., s. m., **07,** 993.
1907. Maritime Dredging Co., dr., 23⅝¢ c. y., s. m., **08,** 1041.
1910. Romano V. Perini, repairing js., st., $2.09 t.; building dike, $4 l. f.; erecting 2 chan. marks, $300, **10,** 1189.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 80; **96,** 85; **97,** 119; **98,** 115; **99,** 129; **00,** 147; **01,** 201; **02,** 155;

* Allotment.

[1] H. D. 426, 62d, 2d.

05, 119; **06,** 122; **07,** 126; **08,** 131; **09,** 133; **10,** 149; **11,** 194; **12,** 235.

In charge:
Col. D. C. Houston. **R., 91,** 843.
Maj. H. M. Adams, 1896–98. **R., 96,** 734; **97,** 1095; **98,** 1001.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1219.
Maj. E. H. Ruffner, 1900. **R., 00,** 1392.
Col. S. M. Mansfield, 1901. **R., 01,** 1205.
Capt. Spencer Cosby, 1902. **R., 02,** 1000.
Col. W. R. Livermore, 1905–06. **R., 05,** 964; **06,** 949.
Col. J. G. D. Knight, 1907–08. **R., 07,** 992; **08,** 1039.
Col. W. M. Black, 1909–10. **R., 09,** 1063; **10,** 1188.
Col. S. W. Roessler, 1911–. **R., 11,** 1300; **12,** 1513.

OBSTRUCTIONS.

Work above dam and br. prevented by lack of draw, **08,** 1040.
Fixed br. replaced by drawbr., **10,** 1188.

OPERATIONS.

1900–01. 8,781 t. st. deposited, completing w. j. to the 10′ contour, **01,** 1205.
1901–02. 268 t. st. placed on w. j., **02,** 1001.
1905–06. 7,222 t. st. placed in e. j., **06,** 949.
1906–07. 15,736 c. y. dr., **07,** 992.
1907–08. 7,356 c. y. dr., **08,** 1039.
1908–09. 84,514 c. y. dr., **09,** 1063.
1909–10. 43,416 c. y. dr.; 371′ dike built; 2,211 t. st. placed in js., **10,** 1188.
1910–11. Js. built higher and tighter, and slightly l., **11,** 1300.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 843; **08,** 131.
Rapid shoaling following imp., **08,** 1040.
Damages to fence dike of w. j. by storms, **11,** 194; **12,** 235.
Tidal inlet on n. side of Long Isld., 70 m. e. of N. Y. C. (see Obstructions), **12,** 235.

PRIVATE WORK.

Local authorities constructed drawbr.; old dam emoved, **11,** 195.

PROJECTS.

By Col. Houston, 1891, chan. 7′ l. t., Long Isld. Sound up to the tide mill at Mattituck, 100′ w. at the entrance, thence to the mill to be 80′ w., the entrance chan. to be secured with parallel js. extending from the shore out to the 9′ curve in Long Isld. Sound; est., $83,000, **91,** 845; **96,** 734.
By Maj. Adams, 1897, retaining funds intact until a large enough sum had been app. to complete at least 1 of the js., **97,** 1096.
Col. Black proposed, 1909, extending e. j. to 1,000′ and w. j. to 800′, dr. up to milldam, and omitting work above milldam until fixed br. be replaced by drawbr. (see Obstructions); (detrimental to upstream waterway); est. increased to $176,700, **09,** 1063; (est. to milldam, $134,200), **10,** 1189; **12,** 235.
Col. Roessler, 1912, of opinion w. j. should be extended shoreward, and e. j. raised, and wing extension built; effort made to acquire needed easement, pending which work apparently unwise to dr. entrance again, **12,** 1513.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Col. Houston, **91,** 843.
Minor, and exs., **08,** 1040; **09,** 1063; **10,** 1188; **12,** 237.

F-27 HORTON POINT, N. Y. (Breakwater.)

COMMERCE.

Necessity for Hs. of refuge on Long Isld. Sound, **85,** 701.

ENGINEERS.

Chief of Engineers. R., 85, 95.
In charge. Lt. Col. W. McFarland. **R., 85,** 701.

PHYSICAL DATA.

Description of. On n. shore of Long Isld., 13 m. w. of Plum Gut, and 50 m. e. of Huntington, **85,** 701.

PLANS.

H. of refuge would cost not less than $1,000,000; selection of site should be made only after careful study of the whole coast line, **85,** 702.

SURVEY.

Ex. au. act July 5, 1884; made by Col. McFarland (see Plans), **85,** 701.

F-32 PETERS NECK (Long Beach) BAY, N. Y.

COMMERCE.

Existing and prospective C. unimportant, **87,** 638.

ENGINEERS.

Chief of Engineers. R., 87, 55; **08,** 155.
In charge:
Lt. Col. D. C. Houston, 1886. **R., 87,** 637.
Col. J. G. D. Knight, **08,** 122.

PHYSICAL CHARACTERISTICS.

Description, **87,** 638.
Landlocked B. indenting s. shore of ne. fork of Long Isld., 2 m. from Oyster Pond Pt., **87,** 638.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Houston (**R.** unfav.), **87,** 637.
Pre. ex., Peters Neck Pt. through Long Beach B. to Horn R., N. Y., au. act Mar. 2, 1907. **R.** by Col. Knight, Aug. 30, 1907[1] (unfav.), **08,** 155.
Supple. **R.** by BERH. on above ex. Concur in former unfav. opinion.[2]

[1] H. D. 447, 60th, 1st.

[2] Comm. D. 23, 61st, 2d.

F-33 GREENPORT HARBOR, N. Y.

APPROPRIATIONS.

1882,	$10,000,	**83,** 528.
1884,	10,000,	**84,** 658.
1886,	5,000,	**86,** 659.
1888,	5,000,	**88,** 578.
1890,	5,000,	**90,** 661.
1892,	11,000,	**92,** 713.
Total,	46,000	

COMMERCE.

Increased by imp., **82,** 636.
Description of; increasing, 1894; good business done in repairing and fitting out of pleasure craft and small steamers, **95,** 871, 872.

CONTRACTS.

1883. Luce & Hoskins, st., $1.59 t., **83,** 528.
1884. C. H. Edwards, st., $1.38 t., **85,** 664.
1886. J. V. Luce, st., $1.17 t., **87,** 632.
1889. Wm. Molthrop & Co., riprap granite, $1.23 t., **89,** 727.
1891. Brown & Fleming, st., $1.29 t., **91,** 813. Hartford Dredging Co., dr., 18¢ c. y., **91,** 813.
1892. P. J. Brummelkamp, dr., 20¢ c. y., s. m. ($9,000), **93,** 970.

ENGINEERS.

Chief of Engineers. R., 81, 97; **82,** 97; **83,** 92; **84,** 99; **85,** 89; **86,** 90; **87,** 54; **88,** 55; **89,** 68; **90,** 61; **91,** 75; **92,** 80; **93,** 87; **94,** 78; **95,** 88, 94; **10,** 181.

In charge:
Maj. J. W. Barlow, 1881–83. **R., 82,** 635.
Lt. Col. W. McFarland, 1883–86. **R., 83,** 527; **84,** 658; **85,** 664.
Lt. Col. D. C. Houston, 1886–92. **R., 86,** 659; **87,** 630; (Col.) **88,** 577; **89,** 725; **90,** 660; **91,** 811; **92,** 711.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 969; **94,** 692; (Col.) **95,** 829, 870.
Col. W. M. Black, **10,** 138.

Assistant. H. N. Babcock. **R., 82,** 635.

OPERATIONS.

1882–83. 939 t. st. delivered and 45 t. placed in position, completing 25 l. f. of dike, **83,** 528.
1883–84. 4,047 t. st. delivered in break'r, completing same to 805′, **84,** 658.
1884–85. 6,387 t. st. placed in the work, increasing its l. 428 l. f., **85,** 664.
1886–87. 1,596 t. st. placed in work, extending its l. 92′, **87,** 631.
1887–88. 13,000 t. riprap granite used in break'r, **88,** 577.
1888–89. 2,410 t. riprap granite delivered in break'r, **89,** 726
1889–90. 1,011 t. riprap granite delivered in break'r, **90,** 661.
1890–91. 520 t. st. placed in break'r, **91,** 812.
1891–92. 12,037 c. y. dr.; 594 t. st. delivered and placed in break'r, **92,** 712.
1892–93. 10,404 c. y. dr., **93,** 969.
1893–94. 32,820 c. y. dr.; proj. completed, **94,** 692.

PHYSICAL CHARACTERISTICS.

Mean rise and fall of tide, Greenport, **82,** 636.
Description of, **88,** 577; **95,** 871.
Small anchorage ground on the se. side of the n. fork of Long Isld. near its e. end, sheltered by a break'r, **95,** 871.

PROJECT.

By Maj. Barlow, 1882, rubblest. break'r, Joshua Pt. Shoal, off Joshua Pt., to cover Greenport H. anchorage from e. and ne. storms, and to prevent further shoaling of the H. by transfer of material from pt. and shoal above mentioned; est., break'r, extending to 18′ curve, $46,000, **82,** 635; **87,** 630; **92,** 712.

SURVEYS.

Au. act Mar. 3, 1881; made, 1882, by Maj. Barlow, **82,** 635.
Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Robert (**R.** fav.), **95,** 871.
H. lines estab. by the Sec. of War, 1894, **95,** 829
Pre. ex. and sur., Sterling Basin, Greenport H., au. act Mar. 3, 1909; made by Col. Black; **Rs.** July 9 and Dec. 29, 1909, resp.; plan for imp.; est. $22,500,[1] **10,** 181.
Maps.[1] **83,** 528; **85,** 664; **93,** 970.

F-35 SOUTHOLD HARBOR, LONG ISLAND, N. Y.

COMMERCE.

A place for the shipment of farm products and receipt of supplies, **93,** 996.

ENGINEERS.

Chief of Engineers. R., 84, 100; **93,** 92.
In charge:
Maj. J. W. Barlow, 1882. **R., 84,** 686.
Lt. Col. H. M. Robert, 1893. **R., 93,** 996.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 686.
Private landing wharf, **93,** 996.

PLANS.

By Maj. Barlow, 1884, excavating chan. 100′x 10′ landing to d. w., 500′; est., $4,000, **84,** 686.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1884, by Maj. Barlow, **84,** 686.
Ex. au. act July 13, 1892; made by Col. Houston, 1892 (**R.** unfav.), **93,** 996.

F-38 PECONIC RIVER, N. Y.

APPROPRIATIONS.

1871,	$5,000,	**71,** 86, 811.
1872,	10,000,	**72,** 85, 915.
1873,	10,000,	**73,** 93, 1041.
Total,	25,000	

COMMERCE.

Benefits of imp. to, **71,** 815, 817, 818; **84,** 682.

CONTRACTS.

1871–73. M. F. Brainard, dr., **71,** 812; **72,** 915; **73,** 1041.

[1] H. D. 874, 61st, 2d.

ENGINEERS.

Chief of Engineers. R., 70, 32, 76; **71,** 86; **72,** 85; **73,** 93; **74,** 103; **75,** 106; **76,** 53; **84,** 99; **91,** 81.

In charge:
Maj. D. C. Houston, 1870; **70,** 74.
Maj. G. K. Warren, 1870–76. **R., 70,** 454; **71,** 811, 814; **72,** 914; **73,** 1041; **74,** ii, 272.
Maj. J. W. Barlow, 1876–84. **R., 76,** 233; **84** 681, 682.
Col. D. C. Houston, 1890–91. **R., 91,** 855.

Assistants:
N. E. Russell. **R., 72,** 915.
H. S. Van Ingen. **R., 72,** 915.
J. H. Dager. **R., 74,** ii, 272.
H. N. Babcock. **R., 84,** 683.

ESTIMATES. (See Plans and Projects.)

By Maj. Warren, dr., Indian Isld. to Terry & Wells's Dock, $32,818.50, **71,** 86, 811, 817.
By N. E. Russell, dr., Terry & Wells's Dock to br., $5,720, **71,** 817.
By H. S. Van Ingen, C. E., completion, $27,717.30, **72,** 916.

OPERATIONS.

1871-72. Dr. at the "crook" in chan. near the mouth, above Colonels Isld., and from B. up to Riverhead, **72,** 916.
1872-73. Dr. 60,045 c. y., **73,** 1041.

PHYSICAL CHARACTERISTICS.

Described, **71,** 815; **91,** 855.

PLANS. (See Estimates and Projects.)

By Maj. Barlow, 1883, chan. 4′ d. m. l. w., mouth of Mud Creek to Riverhead; est., $29,000, **84,** 682.
By Col. Houston, 1891, chan. 6′ x 75′ m. l. w., head of Merritt B. to Peconic B.; turning basin in Merritt B. 6′, x 250′ x 400′ and extension of chan. to 2,000′ above Merritt B.; est., $44,000, **91,** 858.

PRIVATE (PRIVATE, STATE, AND CORPORATE) WORK.

A stock co. chartered by New York for imp. R. with dams, canals, and locks. No work done. Charter annulled, **71,** 815. Dr. by private parties, with dr. machinery run by horsepower, **71,** 815. $5,000 app. by State of New York for imp., **73,** 93; 74, ii, 271. Expended in dr., **74,** ii, 271, 273. Dr. by citizens of Riverhead, **72,** 916.

PROJECTS. (See Estimates.)

By Maj. Warren, chan. 6′ x 75′, **71,** 86, 811, 814; **72,** 916.

SURVEYS.

Au. act July 11, 1870, **70,** 76; assigned to Maj. Warren and made under his direction by N. Russell. **R., 71,** 815.
Au. act Aug. 2, 1882; made by Maj. Barlow, **84,** 682.
Sur. au. act Sept. 19, 1890; made, 1891, by Col. Houston, **91,** 857.

F-41 SAG HARBOR, N. Y.[1]

APPROPRIATIONS.

Mar. 2, 1829, $150 (sur.), Treas. Doc. 373, 1882.
1902, *10,000, **03,** 870.
1902, *3,500, **05,** 971.
1905, *16,000, **05,** 971.
1907 { *26,500, **07,** 998.
[2] 2,900 } **08,** 1046.
[3] 750 }
Total, 59,800 (incl. misc., and less $150 allotted for sur., 1829, $61,946, **08,** 1046).

COMMERCE.

Description of, **1900,** 1453.

CONTRACTS.

1902. Peter Lynam, placing riprap st. in break'r, $1.37 t., **03,** 871. (Annulled June 16, 1904, **04,** 1028.)
1904. E. S. Belden & Sons, 4,900 t. riprap in break'r, $1.67 t., **05,** 971.
1906. E. S. Belden & Sons, placing 9,500 t. st. in break'r, $1.57 t., **06,** 954.
1907. E. S. Belden & Sons, extending break'r by placing 15,096 t. st., $1.67 t., and suppl. contract for 2,104 t., **07,** 1046.

ENGINEERS.

Chief of Engineers. R., 91, 81; **99,** 142; **00,** 161; **02,** 159; **03,** 130; **04,** 115; **05,** 122; **06,** 127; **07,** 130; **08,** 136; **12,** 224.

In charge:
Col. D. C. Houston, 1891. **R., 91,** 859.
Maj. H. M. Adams, 1900. **R., 1900,** 1451.
Col. Amos Stickney, 1903. **R., 03,** 870.
Capt. E. H. Schulz, 1904. **R., 04,** 1027.
Col. W. R. Livermore, 1905–06. **R., 05,** 969; **06,** 953.
Col. J. G. D. Knight, 1907–08. **R., 07,** 998; **08,** 1045.

LEGAL PROCEEDINGS.

Suit against Peter Lynam for extra expense incurred by U. S. on account of failure to do work contracted for; $2,296 received and placed to credit of app., **05,** 970.

OPERATIONS.

1902-03. 1,015 t. st. placed in break'r, **03,** 870.
1903-04. 693 t. st. placed in break'r; work suspended July 22, 1903, **04,** 1028.
1904-05. 5,920 t. st. placed in break'r, completing 610 l. f., **05,** 970.
1905-06. Placing st. in break'r, **06,** 953.
1906-07. 280 t. st. placed in break'r; total of 2,050 l. f. completed to full cross-section, **07,** 998.
1907-08. 17,079 t. st. placed in break'r, **08** 1046.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1452.

PLANS.

By Col. Houston, 1891, protection of wharves from ne. storms by riprap break'r of 3,180′, and extending to 8′ above m. l. w.; est., $71,000, **91,** 861.

PROJECTS.

Maj. Adams est., 1899, $71,000 to constr. break'r, **00,** 1452.
Act June 13, 1902, au. proj. which contemplates protecting H. and landings by a break'r; est., $71,000,[4] **02,** 159. Break'r to be of riprap and to extend from Conklin Pt. in a n. by w. direction about 1,330′, thence in a nearly nw. direction 1,850′ to the 9′ curve, making a total l. of 3,180′; top to be 8′ above m. l. w. and 5′ w.; side slopes 1 on 1, **03,** 870.

* Allotments.
[1] **Sur.—R.,** Apr. 30, 1830; est., $31,087.65. (H. D. 482, 55th, 2d.)
[2] Trans. from allot. for Port Jefferson, N. Y.
[3] Trans. from allot. for Canarsie B., N. Y.
[4] H. D. 77, 56th, 1st.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Col. Houston, **91,** 860.

Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Adams (**R.** fav.; see Projects), **00,** 1453.

Pre. ex. and sur. au. act June 25, 1910, with view to securing increased anchorage area and protecting chan. between said H. and Gardiners B. from the erosion of Cedar Pt.; **R.** to come, **12,** 224.

Map. **03,** 870.

F-42 THREEMILE HARBOR, LONG ISLAND, N. Y.

COMMERCE.

Description of, **00,** 1454.

ENGINEERS.

Chief of Engineers. **R., 99,** 142; **00,** 161. **08,** 155.

In charge. Maj. H. M. Adams, 1900. **R., 00,** 1454.

Col. J. G. D. Knight, **08,** 122.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1454.

H. on n. shore of s. fork of Long Isld., 18 m. w. from Montauk Pt. Lighthouse and 5 m. e. from Sag H.

SURVEY.

Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Adams (**R.** unfav.), **00,** 1455.

Pre. ex. au. act Mar. 2, 1907. **R.** by Col. Knight, Aug. 8, 1907 [1] (unfav.), **08,** 155.

Supple. **R.** by BERH. on ex. Concur in previous opinion that C. benefits does not justify expend. required to imp.[2]

F-44 FORT POND BAY AND HARBOR, MONTAUK, N. Y.

COMMERCE.

Description of, **93,** 1078, 1080.

ENGINEERS.

Chief of Engineers. **R., 89,** 70; **93,** 105; **12,** 254.

In charge:

Lt. Col. D. C. Houston, 1888. **R., 89,** 733.

Lt. Col. G. L. Gillespie, 1893. **R., 93,** 1077.

Col. S. W. Roessler, **12,** 224.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 733; **93,** 1078, 1080.

H. is small and comparatively deep, situated on n. side of Long Isld., 6 m. approx. from Montauk Pt. and 124 m. from Long Isld. City, **93,** 1078.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Houston (**R.** unfav.), **89,** 733.

Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Gillespie (**R.** unfav.), **93,** 1077.

Pre. ex. and sur. au. act Feb. 27, 1911, **12,** 254.

F-47 FIRE ISLAND INLET, N. Y.

ENGINEERS.

Chief of Engineers. **R., 06,** 140.

In charge. Col. W. R. Livermore, **06,** 115.

SURVEY.

Pre. ex. au. act Mar. 3, 1905, for break'r; **R.,** Col. Livermore, 1906 (unfav.),[3] **06,** 140.

F-48 GREAT SOUTH BAY, N. Y.

APPROPRIATIONS.

1890,	$15,000,	**91,** 827.
1892,	8,000,	**92,** 726.
1894,	4,000,	**95,** 847.
1896,	13,000,	**96,** 747.
1902,	66,000,	**02,** 1010.
1905,	2,000,	**05,** 977.
1907,	2,000,	**07,** 1005.
1909,	3,000,	**09,** 1077.
1910,	50,000,	**10,** 1202.
Total,	163,000 (incl. sales, $163,007.37, **12,** 1524).	

COMMERCE.

C. and navigation to be benefited by imp., **81,** 674.

Description of, **1900,** 1444–1450.

56,000 t., 1890; 266,800 t., 1899; general description and character; list of vessels, **01,** 1250, 1256, 1257.

Rates, reduced, **05,** 977.

As result of work navigation aided and C. benefited, **11,** 207; **12,** 249.

1903, 259,000± t.; 1908, 195,000 t.; 1911, 181,000± t., **12,** 249.

CONTRACTS.

1891. E. Bailey & Sons, j. constr., riprap, $2.80 t., **91,** 828.

1892. A. E. Smith, dr., 20¢ c. y., **92,** 726.

1893. A. E. Smith, dr., 34¢ c. y., p. m. ($8,500), **93,** 986.

1895. F. S. Whitman, dr., 14¢ c. y., p. m. ($3,500), **96,** 747.

1896. K. Simon, dr., 23¢ c. y., p. m.; st. for $2.60 t. ($5,190), **97,** 1110.

1901. Frank Perkinson, dr., 19¢ c. y., **02,** 1009.

1902. Kirk, Driscoll & Co., dr., Great South B., 23½¢ c. y., and in Patchogue R., 23¢ c. y., **03,** 876.

1906. J. M. Briggs, dr., 35¢ c. y., s. m., **06,** 960.

1911. Coastwise Dredging Co., dr., 37.9¢ c. y., **12,** 1525.

ENGINEERS.

Chief of Engineers. **R., 80,** 85; **81,** 108; **87** 67; **91,** 78; **92,** 83; **93,** 90; **94,** 81; **95,** 91; **96,** 88 **97,** 123; **98,** 119; **99,** 140, 142; **00,** 158, 160–161; **01,** 210, 223, 1249; **02,** 160; **03,** 134; **04,** 120; **05,** 127; **06,** 132; **07,** 136; **08,** 143; **09,** 146; **10,** 166; **11,** 205; **12,** 247.

In charge:

Col. J. Newton. **R., 81,** 674.

Lt. Col. McFarland, 1887. **R., 87,** 759.

Col. D. C. Houston, 1890–92. **R., 91,** 825; **92,** 724.

Lt. Col. H. M. Robert, 1892–95. **R., 93,** 983; **94,** 705; (Col.) **95,** 844.

Maj. H. M. Adams, 1896–98. **R., 96,** 745; **97,** 1108; **98,** 1010.

Lt. Col. W. H. H. Benyaurd, 1899–1900. **R., 99,** 1249; **00,** 1443, 1446, 1450.

Maj. E. H. Ruffner, 1900. **R., 00,** 1419.

Col. S. M. Mansfield, 1901. **R., 01,** 1220.

Capt. Spencer Cosby, 1902. **R., 02,** 1009.

Col. Amos Stickney, 1903. **R., 03,** 875.

Capt. E. H. Schulz, 1904–05. **R., 04,** 1036.

[1] H. D. 503, 60th, 1st. [2] Comm. D. 22, 61st, 2d. [3] H. D. 909, 59th, 1st.

Col. W. R. Livermore, 1905-06. **R., 05,** 976; **06,** 959.
Col. J. G. D. Knight, 1907-08. **R., 07,** 1005; **08,** 1054.
Col. W. M. Black, 1909-10. **R., 09,** 1076; **10,** 1202.
Col. S. W. Roessler, 1911-. **R., 11,** 1311; **12,** 1524.

Assistants:
R. H. Talcott. **R., 81,** 674.
M. Kingsley. **R., 87,** 760.

LEGAL PROCEEDINGS.

Injunction served on contractor for dr. by parties interested in oyster beds, causing dr. to stop, **04,** 1036; **07,** 1005; injunction dismissed, **08,** 1054.

OBSTRUCTIONS.

Complaints regarding fish pounds obstr. navigation, **05,** 977; public hearing; regulations estab. by Chief of Engineers, **06,** 959.

OPERATIONS.

1890-91. 450 t. st. placed in riprap j., completing 150 l. f., **91,** 827.
1891-92. 2,552 t. riprap delivered in j., completing 900 l. f.; 16,265 c. y. dr., **92,** 725.
1892-93. 20,000 c. y. dr., **93,** 985.
1895-96. 24,140 c. y. dr., **96,** 746.
1896-97. 2,266 c. y. st. placed in j. and 10,098 c. y., p. m., dr., **97,** 1110.
1897-98. 10,713 c. y., p. m., dr.; proj. completed, **98,** 1011.
1901-02. 2,956 c. y. dr., **02,** 1009.
1902-03. 46,119 c. y. dr., **03,** 875.
1903-04. 164,369 c. y. dr. from Patchogue R. and 8,756 c. y. from Great South B., **04,** 1036.
1906-07. 15,705 c. y. dr.; work stopped by injunction, **07,** 1005.
1911-12. 68,097 c. y. dr., **12,** 1524.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 825; **00,** 1443, 1446; **01,** 1252.
Max. draft, tides, etc., **12,** 248.

PLANS. (See Projects.)

By Col. Newton, 1880, 6′ l.-w. chan. head of navigation to 6′ curve, Great South B., by dr. and constr. at mouth of R. 2 parallel timber dikes, aggregating 2,400 l. f.; est., $42,320, **81,** 674, 675.
By Lt. Col. McFarland, 1886, 6′ l.-w. chan. within the above limits, by dr. and the protection of the cut by a dike on the w. side; est., $40,000, **87,** 760.

PROJECTS. (See Plans.)

By Lt. Col. McFarland, 1886, excavating chan. 60′ w. from the highway br. at Patchogue to the 6′ contour in Great South B., 1 m.; also for protection of the chan. in the B. by riprap j. along the w. side 1,700′ l.; est., $40,000, **87,** 760; **91,** 826; au. 1890, **12,** 247.
Lt. Col. Benyaurd est., 1899, $19,550 to further imp. the R., and $2,000 an. mainten., **00,** 1450.
By Maj. Ruffner, chan. 10′ x 200′ m. l. w., Fire Isld. Inlet to central basin in Great South B., at the mouth of Patchogue R.; est., $66,000, and $2,000 an. mainten., **01,** 1256; au. act June 13, 1902,[1] **02,** 160.
Col. Black recom., 1909, extension of existing j., building of j. on e. side of chan., and restoring chan. to proj. d.; est., $75,000, **09,** 1076.
Act June 25, 1910, au. redr. chan. and constr. of js.; est. for completion increased to $141,000, **10,** 166.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Newton, **81,** 674.
Ex. mouth of Patchogue R. au. act Aug. 5, 1886; made, 1886, by Lt. Col. McFarland, **87,** 759.
Ex., 1893-94, by Lt. Col. Robert, **94,** 707.
Ex., for 8′ chan., Fire Isld. Inlet to Patchogue, au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (depth existing; **R.** unfav.), **00,** 1445.
Ex. of R. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (**R.** fav.; see Projects), **00,** 1446.
Ex. and sur. au. act June 6, 1900, Fire Isld. Inlet, Great South B. to Patchogue R., for chan. not less than 10′ x 200′ m. l. w. (see Projects);[1] made by Maj. Ruffner, **01,** 223, 1249, 1255.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 249.
Maps, **93,** 984; **03,** 876.

F-48(a) FREEPORT, CHANNEL CONNECTING, WITH GREAT SOUTH BAY, N. Y.

COMMERCE.

Chiefly in oysters, **93,** 1137.

ENGINEERS.

Chief of Engineers. **R., 93,** 118.
In charge. Capt. T. L. Casey, 1893. **R., 93,** 1136.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1136.

SURVEY.

Ex. au. act July 13, 1892; made by Capt. Casey, 1892 (**R.** unfav.), **93,** 1136.

F-48(b) JAMAICA BAY, GREAT SOUTH BAY, AND PECONIC BAY, N. Y. (Waterway connecting.).

ENGINEERS.

Chief of Engineers. **R., 08.** 155.

In charge. Col. J. G. D. Knight. **R., 08,** 122.

SURVEYS.

Pré. ex. au. act Mar. 2, 1907, for chan. 6′ x 100′ to and through Great South B. to Peconic B., incl. chans. to Parsonage and Sumpawams Rs. and Freeport and Massapequa Creeks; **R.,** Col. Knight, July 17, 1907 (unfav.),[2] **08,** 155.

F-58 BROWNS CREEK, SAYVILLE, LONG ISLAND, N. Y.

APPROPRIATIONS.

1890,	$12,000,	**91,** 830.
1892,	5 000,	**92,** 729.
1894,	4,000,	**95,** 849.
1896,	4,000,	**96,** 750.
1899,	3,000,	**99,** 1248.
1905,	3,000,	**05,** 976.
1907,	5,000,	**07,** 1004.
1910,	3,000,	**10,** 1201.
Total,	39,000 (add'l, $1.38, sales),	**12,** 1523.

[1] H. D. 103, 56th, 2d.
[2] H. D. 449, 60th, 1st.

COMMERCE.

Present and prospective C. of the locality, **90,** 670.
Benefit of imp. to fishing industry as H. of refuge; no effect on rates, **10,** 165.
Description of, **11,** 205.
Tonnage, 1911–12, 7,950 t., **12,** 1524.

CONTRACTS.

1891. E. Bailey & Sons, riprap j. constr., $2.80 t., **91,** 830.
1892. A. E. Smith, drg., 34¢ c. y., p. m. ($5,100), **93,** 989.
1895. A. E. Smith, drg., 15¢ c. y., p. m. ($3,500), **96,** 750.
1896. K. Simon, drg., 15¢ c. y., s. m. ($3,500), **97,** 1113.
1899. C. Vivian, drg., 13¾¢ c. y., p. m. ($2,500) **1900,** 1418.
1905. Leek & Field, drg., 20¢ c. y., **06,** 959.
1910. Advertisement of work delayed in attempt to procure consent of abutting property owners for disposal of material on adjacent uplands; attempt successful; proposed to combine work with Great South B. and invite proposals, **11,** 1310.
1911. Maritime Dredging Co., dr., 41¢ c. y., **12,** 1523.

ENGINEERS.

Chief of Engineers. R., 89, 71; **90,** 63; **91,** 79; **92,** 83; **93,** 91; **94,** 81; **95,** 92; **96,** 89; **97,** 124; **98,** 119; **99,** 140; **00,** 157; **01,** 209; **02,** 159; **03,** 133; **04,** 119; **05,** 126; **06,** 131; **07,** 135; **08,** 141; **09,** 145; **10,** 164; **11,** 204; **12,** 246.

In charge:
Col. D. C. Houston, 1888–92. **R., 90,** 669; **91,** 828; **92,** 727.
Lt. Col. H. M. Robert, 1893–95. **R., 93,** 986; **94,** 708; (Col.) **95,** 847.
Maj. H. M. Adams, 1896–98. **R., 96,** 748; **97,** 1111; **98,** 1012.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1247.
Maj. E. H. Ruffner, 1900. **R., 00,** 1417.
Col. S. M. Mansfield, 1901. **R., 01,** 1219.
Capt. Spencer Cosby, 1902. **R., 02,** 1008.
Col. Amos Stickney, 1903. **R., 03,** 874.
Capt. Edward H. Schulz, 1904. **R., 04,** 1035.
Col. W. R. Livermore, 1905–06. **R., 05,** 975; **06,** 958.
Col. John G. D. Knight, 1907–08. **R., 07,** 1004; **08,** 1053.
Col. W. M. Black, 1909–10. **R., 09,** 1075; **10,** 1201.
Col. S. W. Roessler, 1911–. **R., 11,** 1310; **12,** 1522.

Assistant. Lt. J. C. Sanford. **R., 90,** 669.

OPERATIONS.

1891–92. 492 l. f. w. j. and 275 l. f. e. j. completed, **92,** 728.
1892–93. 273 t. st. deposited in e. j. and 12,000 c. y., p. m., dr., **93,** 988.
1895–96. 17,903 c. y., p. m., dr., **96,** 749.
1896–98. In connection with previous year, 24,279 c. y., p. m., dr., **97,** 1112; **98,** 1013.
1899–00. 15,727 c. y. dr., **00,** 1417.
1905–06. 1,200′ chan. restored to proj. d. and w., **06,** 958.
1908–09. Dr. bids advertised for and none received, **09,** 1075.
1909–10. Dr. bids advertised for and none received, **10,** 1201.
1911–12. 15,000 c. y. dr., **12,** 1523.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 669; **06,** 131; **11,** 205.
Rapid shoaling, due to inflow of mud from marshes, **07,** 136.
Narrow stream emptying into Great South B. Long Isld., near Browns Pt., **12,** 246.

PROJECTS.

By Col. Houston, 1889, chan. 6′ x 100′ m. l. w. from the 6′ curve in the B. up to the first bend in the creek, 1,850′; est., $46,000, **90,** 673; **92,** 728.
Recom., 1907, that work, except for mainten., be suspended, **07,** 136. Rapid deterioration of work, due mainly to inflow of mud from marshes, **12,** 246.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Col. Houston, **90,** 673.
Of chan., **08,** 1053; **11,** 204.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 247.
Maps. **94,** 710.

F-60 CHAMPLIN (Champlins) CREEK, N. Y.

COMMERCE.

None, **91,** 943.

ENGINEERS.

Chief of Engineers. R., 91, 943.
In charge. Lt. Col. G. L. Gillespie. **R., 91,** 943.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 943. At e. end of Islip, on s. shore of Long Isld., and is trib. to Great South B., which it enters about opposite Fire Isld. Light.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Gillespie (**R.** unfav.), **91,** 943.

F-62 BAY SHORE, LONG ISLAND, N. Y.

COMMERCE.

Description of, **00,** 1442.

ENGINEERS.

Chief of Engineers. R., 99, 142; **00,** 160.
In charge. Lt. Col. W. H. H. Benyaurd, 1900. **R., 00,** 1441.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1441.

SURVEY.

Ex. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Benyaurd (**R.** unfav.), **00,** 1442.

F-63 SUMPAWANUS (Babylon Creek) INLET, N. Y.

APPROPRIATIONS.

1881	$5,000,	**81,** 653.
1882	2,000,	**82,** 673.
Total,	7,000	

COMMERCE.

Est. an. C. of 3,000 t., would probably be increased to 18,000 t. after imp. of the stream, **97,** 1173.
In 1893, imp. appeared to be more of local than of U. S. interest, **93,** 1100.

CONTRACTS.

1883. J. McDermott, dr., 69¢ c. y., **83,** 569.

ENGINEERS.

Chief of Engineers. R., 80, 85; **81,** 105; **82,** 107; **83,** 104; **84,** 110; **85,** 100; **86,** 102; **87,** 65; **88,** 66; **89,** 85; **90,** 75; **91,** 94; **92,** 98; **93,** 106; **94,** 95; **95,** 107; **97,** 140.

In charge:
Col. J. Newton, 1880–83. **R., 81,** 652; **82,** 672.

Lt. Col. G. L. Gillespie, 1883–85. **R., 83,** 568, **84,** 734; **85,** 742.
Lt. Col. W. McFarland, 1885–89. **R., 86,** 748; **87,** 740; **88,** 629.
Capt. T. L. Casey, 1889–94. **R., 89,** 817; **90,** 841; **91,** 978; **92,** 863; **93,** 1100; **94,** 794.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 965.
Maj. H. M. Adams, 1896–97. **R. 97,** 1172.

Assistant. R. H. Talcott. **R., 81,** 654.

OPERATIONS.

1882–83. 9,481 c. y. dr. from chan., **83,** 568.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 629; **97,** 1173.

PLANS.

Lt. Col. McFarland reported, 1888, that the limited C. of the inlet did not warrant formation of more than 5′ chan., **88,** 630.

PROJECTS.

By Col. J. Newton, 1880, imp. of the inlet by excavation of a 5′ m. l. w. chan. from head of tide water to the B.; w. in inlet, 100′, and at mouth, 150′; est., $23,115, **81,** 655; **92,** 864.

SURVEY.

Au. act June 14, 1880; made, 1880, by Col. Newton, **81,** 653.
Ex. au. act June 3, 1896; made by Maj. Adams, 1897 (**R.** unfav.), **97,** 1173.

F-64 CARRLS RIVER, N. Y.

COMMERCE.

None, and none expected, **95,** 1004.

ENGINEERS.

Chief of Engineers. **R., 95,** 121.
In charge. Capt. T. L. Casey, 1895. **R., 95,** 1003.

PHYSICAL CHARACTERISTICS.

One of the many creeks draining the uplands down into Great South B., Long Isld., **95,** 1003.

PRIVATE WORK.

Est., 1895, that about $5,000 had been spent by private enterprise in the imp. of the stream, **95,** 1004.

SURVEY.

Ex. au. act Aug. 17, 1894; made by Capt. Casey 1894 (**R.** unfav.), **95,** 1003.

F-67 SEAFORD CREEK, L. I., N. Y.

COMMERCE.

Description of, **93,** 1135.
Not probable that imp. of creek would withdraw traffic from the railroads, **93,** 1135.

ENGINEERS.

Chief of Engineers. **R., 93,** 118.
In charge. Capt. T. L. Casey, 1893. **R., 93,** 1134.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1134.

SURVEY.

Ex. au. act July 13, 1892; made by Capt. Casey 1892 (**R.** unfav.), **93,** 1134.

F-68 BALDWIN RIVER (Parsonage Cr.), N. Y.

COMMERCE.

None, and none looked for, **85,** 789.

ENGINEERS.

Chief of Engineers. **R., 85,** 114.
In charge. Maj. G. L. Gillespie, 1885. **R., 85,** 781.

PHYSICAL CHARACTERISTICS.

Locality described, **85,** 789.

On the w. side of village of Baldwin, 21½ m. e. of Long Isld. City.

PLANS.

In 1884 Maj. Gillespie reported that desired imp. would cost $20,000, **85,** 789.

SURVEYS.

Ex. au. act July 5, 1884; made by Maj. Gillespie (**R.** unfav.), **85,** 789.

F-73 EAST ROCKAWAY CREEK, N. Y.

ENGINEERS.

Chief of Engineers. **R., 89,** 93.
In charge. Capt. T. L. Casey, 1888. **R., 89,** 840.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 841.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. McC. Derby (**R.** unfav.), **89,** 840.

F-76 WOODSBURG CHANNEL, HEMPSTEAD BAY, N. Y.

COMMERCE.

Description of, **95,** 880.
Limited, **95,** 880.

ENGINEERS.

Chief of Engineers. **R., 95,** 94.
In charge. Lt. Col. H. M. Robert, 1895. **R., 95,** 879.
Assistant. Lt. W. E. Craighill. **R., 95,** 879.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 879.
Chan. in w. part of Hempstead B., a mass of small, irregular, and shallow chans. extending from South Oyster B. on the e. to Jamaica B. on the w., **95,** 879.

SURVEY.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Robert, 1894 (**R.** unfav.), **95,** 879.

F-78(a) ROCKAWAY INLET, CANARSIE AND SHEEPSHEAD BAYS, N. Y.

COMMERCE.

Important, **78,** 426; **79,** 400, 401.

ENGINEERS.

Chief of Engineers. **R., 78,** 58; **79,** 66.
In charge. Lt. Col. Newton. **R., 78,** 424; **79,** 399.
Assistant. R. H. Talcott. **R., 79,** 401.

PHYSICAL CHARACTERISTICS.

Description, **78,** 425; **79,** 399–402.

PLANS.

Discussion of plans by Lt. Col. Newton, 1878, for break'r and imp. inlets, **78,** 425–427; **79,** 400.

No permanent imp. possible for Rockaway Inlet, 1879. The imp. of Canarsie B. by means of dikes, inclosing a tidal basin; est., $88,000; recom. Similar imp. for Sheepshead B.; est., $10,000, **79,** 400.

SURVEYS.

By R. H. Talcott, 1878, between Rockaway Inlet and Coney Isl., inc. Canarsie and Sheepshead Bs., **78,** 58; **79,** 66, 399, 401.

F-78(b) JAMAICA BAY TO ROCKAWAY INLET, N. Y. (Channel.)

COMMERCE.

Value of oyster trade, **87,** 755.

ENGINEERS.

Chief of Engineers. **R., 87,** 67.
In charge. Lt. Col. W. McFarland, 1886. **R., 87,** 754.
Assistant. M. Kingsley. **R., 87,** 756.

PHYSICAL CHARACTERISTICS.

Description, **87,** 754.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. McFarland (**R.** unfav.—cost too great), **87,** 754.

F-79 JAMAICA BAY, N. Y.

APPROPRIATIONS.

1910,	$250,500,	**10,** 1212.
1912,	300,000,	**12,** 1526.
Total,	550,500 (incl. sales, etc., $550,539.11, **12,** 1526).	

COMMERCE.

1910, 1,786,000± t.; 1911, 957,000± t., **12,** 251.

ENGINEERS.

Chief of Engineers. **R., 08,** 155; **09,** 158; **10,** 178; **11,** 208; **12,** 249.

In charge:
Col. J. G. D. Knight, 1908–09. **08,** 122; **09,** 124.
Col. W. M. Black, 1910. **R., 10,** 1212.
Col. S. W. Roessler, 1911–. **R., 11,** 1312; **12,** 1525.

OPERATIONS.

1911-12. Location made of 18′ x 500′ chan., **12,** 1526.

PHYSICAL CHARACTERISTICS.

Details; draft, tides, etc., **10,** 179; shifting of chan., **12,** 251.

Lies wholly in limits of N. Y. C. on s. shore of Long Isld.; 4 m. x 8 m.; connected to ocean at Rockaway Inlet by shifting chan.; low-lying hummocks reduce area of w. surface, **12,** 249.

PRIVATE WORK.

City of New York app. $1,000,000 as its part of proposed work—bulkhead work, $50,000; dr. main chan. Jamaica B., $150,000 (to be reimbursed by U. S.); for gaining fill lands, $750,000; misc., $59,000—approv. by Sec. of War, **11,** 208; **12,** 250.

PROJECTS.

Act June 25, 1910, au. dr. to obtain entrance chan. 18′ x 500′, entrance to be later 30′ x 1,500′, and mainten. of entrance; dr. of interior chans. by city of New York to be reimbursed by U. S. and bulkheading of shores of the B. and filling behind bulkheads by city of New York,[1] the ultimate cost to US. should not exceed $7,430,050 plus cost of mainten. of entrance, **10,** 178; **12,** 1525, 250.

Act July 25, 1912, app. $300,000, from which amount city of New York to be reimbursed for dr. at not to exceed 8¢ c. y., etc., **12,** 251.

SURVEYS.

Pre. ex. au. act Mar. 2, 1907, for chan. 6′ x 100′ to and through Great South B. to Peconic B., incl. chans. to Parsonage and Sumpawams Rs. and Freeport and Massapequa Creeks; **R.,** Col. Knight, July 17, 1907 (unfav.),[2] **08,** 155.

Pre. ex. and sur. au. act Mar. 2, 1907, incl. entrance to B. at Rockaway Inlet, and waters having outlet in Dead Horse Inlet; **Rs.,** Col. Knight, 1907 and 1909; est., $7,430,000,[1] **09,** 158.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 251.

F-80 JAMAICA BAY TO LONG BEACH INLET, N. Y.

APPROPRIATION.

1892, $9,460, **93,** 1070.

CONTRACT.

1892. E. Brainard, dr., 25½¢ c. y. ($8,542.50), **93,** 1070.

ENGINEERS.

Chief of Engineers. **R., 92,** 97; **93,** 103; **94,** 93; **95,** 106.

In charge. Lt. Col. G. L. Gillespie, 1892–95. **R., 92,** 840, 845; **93,** 1069; **94,** 779; **95,** 958.
Assistant. G. W. Kuehnle. **R., 92,** 847.

OPERATIONS.

1892-93. 13,845 c. y. dr., **93,** 1069.
1893-94. 20,174 c. y. dr., **94,** 780.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 841.

PROJECTS.

By Lt. Col. Gillespie, 1891, dr. navigable waterway 5′ x 60′ m. l. w., from Beach Chan. to some pt.

[1] H. D. 1488, 1506, 60th, 2d.

[2] H. D. 449, 60th, 1st.

on the e. shore of Jamaica B.; 3 routes submitted; cost, resp., $21,406, $18,920, and $9,460, **92,** 846, 847; **93,** 1069.

SURVEY.

Sur. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Gillespie, **92,** 845.

F-86 FAR ROCKAWAY AND INWOOD, N. Y.

COMMERCE.

Description of; $402,000 an., **97,** 1171.

ENGINEERS.

Chief of Engineers. **R., 97,** 140.
In charge. Maj. H. M. Adams, 1896–97. **R., 97,** 1170.

PHYSICAL CHARACTERISTICS.

Description of; Far Rockaway and Inwood and adjoining villages on the e. end of Jamaica B., **97,** 1171.

SURVEYS.

Ex. chan. at Far Rockaway and Inwood au. act June 3, 1896; made, 1897, by Maj. Adams (**R.** unfav.), **97,** 1171.

F-91 CORNELLS CREEK AND LANDING, TO JAMAICA BAY, N. Y. (Water connection.)

ENGINEERS.

Chief of Engineers. **R., 80,** 85; **81,** 108.
In charge. Col. J. Newton. **R., 81,** 671.
Assistant. R. H. Talcott. **R., 81,** 672.

PLANS.

By Col. Newton, 1880, dr. chan. 60′–70′ w., with a d. of 2′ m. l. w., Jamaica B. to Cornells Landing; est., $29,900, **81,** 673.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Col. Newton, **81,** 671.

F-92 SPRING CREEK, N. Y.

COMMERCE.

None, **88,** 639.

ENGINEERS.

Chief of Engineers. **R., 88,** 67, 638.
In charge. Lt. Col. W. McFarland, 1888. **R., 88,** 638.
Assistant. G. W. Kuehnle. **R., 88,** 639.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 638, 639.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1887, by Lt. Col. McFarland (**R.** unfav.), **87,** 317; **88,** 638.

F-95 CANARSIE BAY, N. Y.

APPROPRIATIONS.

1880,	$10,000,	**80,** 515.
1881,	5,000,	**81,** 650.
1882,	*3,000,	**82,** 670.
1884,	5,000,	**84,** 732.
1886,	10,000,	**86,** 748.
1888,	10,000,	**88,** 628.
1890,	5,000,	**90,** 841.
1892,	5,000,	**92,** 867.
1894,	2,000,	**95,** 967.
1896,	10,000,	**96,** 753.
1902,	*5,000,	**03,** 870.
1905,	*2,500,	**05,** 969.
1907,	[1]3,250,	**07,** 997; **12,** 1518.
Total,	75,750,	**12,** 1518.[1]

COMMERCE.

Increased business through restoration of chan., **81,** 651.
Benefit of imp., **83,** 565.
Fishing industry of the B., **88,** 628; large, **94,** 795.
Transportation developed, but no reduction in rates, **10,** 154; **12,** 241.
Greatly benefited by imp., **11,** 200.
1901, 450,000 t.; 1908, 240,075 t.; 1910, 44,800 t., **12,** 241.

CONTRACTS.

1880. Henry Du Bois & Sons, pile dike, **81,** 650; completed, **81,** 651.

1881. E. Brainard, dr., 48¢ c. y., **83,** 565; completed, **83,** 564.

1884. Henry Du Bois & Sons, dr. and diking, 35¢ c. y., and $29.37 l. f., respy., **85,** 740; completed, **85,** 739.

1888. S. A. Kelly, pile dike constr., $9.87 l. f. **88,** 629.

1891. E. Brainard, dr., 24½¢ c. y., **91,** 980.

1893. J. H. Fenner, dr., 24¢ and 40¢ c. y. ($4,000), **93,** 1102.

1896. E. Brainard, dr., 28¢ c. y., s. m. ($10,000) **97,** 1116.

1904. Kirk, Driscol & Co., dr., 35¢ c. y., s. m., **05,** 969.

1906. J. M. Briggs, dr., 39¢ c. y., s. m., **06,** 953.

ENGINEERS.

Chief of Engineers. **R., 80,** 84; **81,** 104; **82,** 105; **83,** 103; **84,** 108; **85,** 98; **86,** 101; **87,** 64; **88,** 65; **89,** 84; **90,** 75; **91,** 95; **92,** 98; **93,** 106; **94,** 96; **95,** 108; **96,** 89; **97,** 125; **98,** 120; **99,** 139; **00,** 156; **01,** 208; **02,** 159; **03,** 130; **04,** 115; **05,** 122; **06,** 126; **07,** 129; **08,** 135; **09,** 137; **10,** 154; **11,** 199; **12,** 240.

In charge:

Col. J. Newton, 1878–83. **R., 80,** 514; **81,** 649; **82,** 669.
Lt. Col. G. L. Gillespie, 1883–86. **R., 83,** 564; **84,** 731; **85,** 739.
Lt. Col. W. McFarland, 1886–89. **R., 86,** 746; **87,** 737; **88,** 627.
Capt. T. L. Casey, 1889–94. **R., 89,** 816; **90,** 839; **91,** 980; **92,** 866; **93,** 1101; **94,** 795.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 966.
Maj. H. M. Adams, 1896–98. **R., 96,** 751; **97,** 1114; **98,** 1014.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1245.
Maj. E. H. Ruffner, 1900. **R., 00,** 1415.
Col. S. M. Mansfield, 1901. **R., 01,** 1218.
Capt. Spencer Cosby, 1902. **R., 02,** 1007.
Col. A. Stickney, 1903. **R., 03,** 869.
Capt. E. H. Schulz, 1904. **R., 04,** 1026.

*Allotments.

[1] $750 transferred to allotment for H. at Sag H., N. Y., **08,** 1045.

Col. W. R. Livermore, 1905–06. **R., 05,** 968; **06,** 952.
Col. J. G. D. Knight, 1907–08. **R., 07,** 996; **08,** 1044.
Col. W. M. Black, 1909–10. **R., 09,** 1067; **10,** 1192.
Col. S. W. Roessler, 1911–. **R., 11,** 1304; **12,** 1517.

OPERATIONS.

1880–81. 1,000 l. f. of timber dike built, **81,** 649.
1882–83. 9,726 c. y. dr., **83,** 564.
1884–85. 7,535 c. y. dr. and 50′ added to e. end of dike, **85,** 739.
1887–88. 2,946 c. y. dr., 590 l. f. of piling driven, and 30′ of dike timbered and prepared for st. filling, **88,** 626.
1888–89. 33,320 c. y. dr., 820′ of dike built, **89,** 817.
1891–92. 12,760 c. y. dr.; repairs to n. dike, **92,** 866.
1892–93. 7,867 c. y. dr., **93,** 1101.
1893–94. About 3,000 c. y. dr., **94,** 795.
1895–96. N. dike slightly repaired, **96,** 752.
1896–97. 35,714 c. y. dr., **97,** 1115.
1904–05. 13,589 c. y. dr., **05,** 968.
1906–07. 5,131 c. y. dr., **07,** 996.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 627; **96,** 751; **10,** 154.

B. is the nw. part of Jamaica B. at and in front of Canarsie Landing. Jamaica B. is about 6 m. e. and w. by 4 m. n. and s., connecting with Atlantic Ocean through Rockaway Inlet, in the s. part of Long Isld., and is 7 m. from the Narrows, New York H., **96,** 751.

Chan. has deteriorated; dikes in poor condition, **11,** 199.

Max. draft 6′ in main chan., 2½′ in W. Branch, and 3′ in E. Branch, **12,** 241.

Range of tides, 4.7′, **12,** 241.

PRIVATE WORK. (See Projects, 1912.)

PROJECTS.

By Col. Newton, 1879, chan. of entrance into Canarsie B., of navigable w. and not less than 6′ d., through the aid of dikes inclosing a tidal basin; est., $88,000, **79,** 400; **80,** 84; **82,** 670; **91,** 981; **92,** 866.

City of New York has determined to carry out this imp.; it is not believed U. S. should expend any more money on the proj., **12,** 241.

SURVEYS.

Canarsie B.
Maps. **82,** 670; **04,** 1026.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 241.

F-96 INDIAN CREEK (Jamaica Bay), N. Y.

ENGINEERS.

Chief of Engineers. **R., 10,** 180.
In charge. Col. W. M. Black, **10,** 138.

SURVEY.

Ex. au. act Mar. 3, 1909, for d. of 6′; **R.,** Col. Black, Aug. 11, 1909 (unfav.),[1] **10,** 180.

F-102 SHEEPSHEAD BAY, N. Y.

APPROPRIATIONS.

1880,	$3,000,	**80,** 515.
1881,	5,000,	**81,** 652.
1882,	3,000,	**82,** 672.
1884,	5,000,	**84,** 734.
1886,	5,000,	**86,** 745.
1888,	5,000,	**88,** 626.
1912,	13,600,	**12,** 1527.
Total,	39,600 (see H. D. 421, 57th, 2d).	

COMMERCE.

1892, valued at $3,598,000; increasing, **93,** 1103.

1894, the H. of minor importance; it would continue to be so until the entrance would be imp. by an extensive system of js., **93,** 1103.

Est. at 11,000 t. per year. Probable C. were imp. made, est. at 100,000 t., **04,** 1080.

1911, 28,700 t., **12,** 252.

CONTRACTS.

1882. H. N. & A. J. Beardsley, dr., 45¢ c. y. **83,** 567.
1884. Atlantic Dredging Co., dr., 13½¢ c. y., **85,** 742.
1889. M. H. Flannery, dr., 25¢ c. y., **89,** 814.

ENGINEERS.

Chief of Engineers. **R., 80,** 84; **81,** 105; **82,** 106; **83,** 103; **84,** 109; **85,** 99; **86,** 100; **87,** 64; **88,** 64; **89,** 83; **90,** 74; **91,** 96; **92,** 99; **93,** 107; **94,** 96; **95,** 109; **04,** 127, 1074, 1077; **10,** 181; **12,** 252.

Boards. BERH. considers it not advisable to undertake imp. at "present" time, **04,** 1076, 1077, 1078.

In charge:
Col. J. Newton, 1878–83. **R., 80,** 515; **81,** 651; **82,** 670.
Lt. Col. G. L. Gillespie, 1883–86. **R., 83,** 566; **84,** 732; **85,** 740.
Lt. Col. W. McFarland, 1886–89. **R., 86,** 743; **87,** 734; **88,** 624.
Capt. T. L. Casey, 1888–94. **R., 89,** 814; **90,** 837; **91,** 982; **92,** 868; **93,** 1103; **94,** 796.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 968.
Col. Amos Stickney, 1904. **R., 04,** 1078.
Col. W. M. Black, **10,** 138.
Col. S. W. Roessler, 1912–. **R., 12,** 1527.

Assistant. 1st Lt. J. R. Slattery. **R., 04,** 1079.

OPERATIONS.

1883–84. 20,000 c. y. dr. from chan., **84,** 733.
1885–86. 21,256 c. y. dr. from cut at Dead Horse Inlet, **86,** 744.
1889–90. 27,025 c. y. dr., **90,** 838.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 624; **04,** 1079, 1080; **12,** 252.

PLANS. (See Projects.)

In 1888, in view of the small C. need for imp., Lt. Col. McFarland did not consider further app. necessary, **88,** 626.

PROJECTS. (See Plans.)

By Lt. Col. Newton, 1879, imp. of Sheepshead B. by diking and dr.; est., $100,000, **79,** 400; **86,** 743, 745.

In 1882, proj. changed to one for the excavation of a crib 6′ x 100′ m. l. w., to connect Sheepshead B. with Dead Horse Inlet; also for dr. within chan.; est., $34,200, **82,** 671; **86,** 744; **87,** 735; **92,** 868.

By Col. Stickney, dr. out the old chan. and closing the cut-off chan. with a sheet-pile dike; est., $104,620.16; or dr. the cut-off chan. and protecting it with a riprap dike; est., $71,786,[2] **04,** 1079–80.

Act July 25, 1912, au. chan. 6′ x 100′ from 6′ contour in ocean, to corresponding contour in B., crossing bar about 500′ e. of existing bulkhead of Manhattan Beach Estates, and swinging w., entering B. near its n. side; l. about 2,200′; est., $13,600, **12,** 252.

SURVEYS.

Au. act June 18, 1878; made by Col. Newton, 1878, **79,** 399.

Pre. ex. and sur. au. act June 13, 1902. **R.** by Col. Mansfield, Jan. 16, 1903, and by Col. Stickney, Dec. 10, 1903,[2] **04,** 1075, 1078.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to securing increased d. at mouth. **R.** by Col. Black, 1909 and 1910; est., $13,600,[3] **10,** 181.

Maps. **82,** 670; **84,** 732.

[1] H. D. 207, 61st, 2d. [2] H. D. 427, 58th, 2d. [3] H. D. 959, 61st, 2d.

F-103 CONEY ISLAND CREEK, N. Y.

COMMERCE.

Unimportant, **97,** 1051.

ENGINEERS.

Chief of Engineers. R., 97, 115.
In charge. Lt. Col. G. L. Gillespie, 1897. **R., 97,** 1050.
Assistant. A. Doerflinger. **R., 97,** 1051.

PHYSICAL CHARACTERISTICS.

Description of: Small creek, tidal, 200–50′ w., 2¼ m. l., crossed by many brs., connecting Gravesend B. with Sheepshead B., N. Y., and separating Coney Isld. from the mainland of Long Isld., **97,** 1050.

SURVEY.

Ex. au. act June 3, 1896; made, 1896, by Lt. Col. Gillespie (**R.** unfav.), **97,** 1050.

F-104 GRAVESEND BAY, N. Y.

COMMERCE.

Limited, **95,** 1006.

ENGINEERS.

Chief of Engineers. R., 95, 121.
In charge. Lt. Col. G. L. Gillespie, 1895. **R., 95,** 1005.

PHYSICAL CHARACTERISTICS.

Description of; place used chiefly as an anchorage for small craft during storms coming from the n. round by e. to the s., **95,** 1005.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Gillespie (**R.** unfav.) **95,** 1006

F-105 NEW YORK HARBOR., N. Y. AND N. J.

(See Works of District E and G.)

The H. of New York, as a Federal R. and H. work, embraces the following main channels, beginning at the sea entrance:

Channels.	Period of improvement.
Entrance channels.	
Via Gedney Channel	1868–1912
Via Bayside Channel	1868–1912
Via Main Ship Channel	1868–1912
Via South Channel	.....
Via Swash Channel	.....
Via Coney Island Channel	1906–1912
Via Ambrose (or East) Channel	1898–1912
Interior main channels.	
Bay Ridge Channel	1880–1912
Red Hook Channel	1880–1912
(These last two have, since 1904, been grouped as Gowanus Bay Channel.)	
Buttermilk Channel	1880–1905
Between Governors Island and Battery.	1897
East River and Hell Gate	(See Dist. E.)
Hudson or North River.	(See Dist. E.)
Harlem River	(See Dist. E.)
There are also various interior branch channels, such as—	
Gowanus Creek	1896–1904
Gowanus Canal	1896
Wallabout Channel	1897–1912
Newtown Creek	1880–1912
Etc., etc. (see District Map).	

List of Abstracts.

Part.	Title.	Period.
a	List of Appropriations, etc	1836–1912
b	Sandy Hook, N. J	1868–1873
c	Gedney Chan. (Gedney and Main Ship Chans.)	1868–1912
d	Ambrose Chan	(See "c" above.)
e	Coney Isld. Chan	1906–1912
f	Main Ship Chan	(See "b" above.)
g	Bay Ridge Chan. ("Gowanus B.")	1880–1895
h	Gowanus B. Chans	1896–1912
i	Gowanus Cr. Chan	1896–1904
j	Red Hook Chan	(See "f" and "g.")
k	Buttermilk Chan	1880–1905
l	Between Governors Isld. and Battery	1897
m	Wallabout Chan	1897–1912
n	East R	(See Dist. E.)
o	Hudson or North R	(See Dist. E.)
p	Staten Isld. Ice Breaker	1836

Part (a), F-105 New York Harbor—Appropriations, Commerce, etc.[1]

Staten Island Ice Breaker, N. Y.:

July 4, 1836, H. D. 482, 55th, 2d, $19,500.

Sandy Hook Entrance—wreck removed:

1868,	$100,000, **69,** 56, 406.	
1873,	15,000, **73,** 86, 941.	
		$115,000

Removal of sunken rock:

1868,	$1,530, act July 25.	
		1,530

Buttermilk Channel:

1880,	$60,000, **80,** 506.	
1881,	60,000, **81,** 630.	
1882,	60,000, **82,** 655.	
1884,	10,000, **84,** 704.	
1886,	56,250, **86,** 722.	
1888,	100,000, **88,** 612.	
1892,	100,000, **92,** 816.	
1894,	50,000, **95,** 942.	
1902,	90,000, **02,** 977.	
		586,250

Gedney Channel:

1884,	$200,000, **85,** 770.	
		200,000

New York Harbor:

1886,	$750,000, **86,** 743.	
1888,	380,000, **88,** 623.	
1890,	160,000, **90,** 739.	
1892,	170,000, **92,** 832.	
1894,	75,000, **95,** 957.	
1896,	60,000, **96,** 868.	
1899,	1,000,000, **99,** 1264.	
1899,	100,000, **99,** 1264.	
		2,695,000

Gowanus Bay, N. Y.:

1881,	$40,000, **81,** 635.	
1882,	20,000, **82,** 661.	
1883,	5,000, **84,** 708.	
1886,	7,500, **86,** 725.	
1888,	60,000, **88,** 617.	
1890,	60,000, **90,** 731.	
1892,	100,000, **92,** 823.	
1894,	150,000, **95,** 947.	
		442,500

Bay Ridge Channel:

1890,	$100,000, **90,** 731.	
1892,	98,600, **92,** 823.	
		198,000

Ambrose Channel:

1901,	$130,000, **01,** 1290.	
1902,	150,000, **02,** 972.	
1903,	708,000, **03,** 913.	
1904,	50,000, **04,** 1116.	
1905,	695,510, **05,** 1014.	
1906,	265,000, **06,** 985.	
1907,	470,000, **07,** 1032.	
1908,	683,490, **08,** 1080.	
1909,	627,000, **09,** 1094.	
1910,	324,510, **10,** 1218.	
		4,103,510

General improvements:

1902,	$50,000, **02,** 972.	
1904,	*1,500, **04,** 1116.	
1904,	*15,000, **04,** 1116.	
1905,	75,000, **05,** 1013.	
1907,	125,000, **07,** 1031.	
1909,	100,000, **09,** 1094.	
		366,500

Gowanus Creek Channel:

1896,	$25,000, **96,** 759.	
1899,	25,000, **99,** 1275.	
1902,	20,000, **02,** 977.	
		70,000

Gowanus Bay Channels:

1896,	$200,000, **96,** 757.	
1897,	350,000, **97,** 1120.	
1898,	130,000, **98,** 1018.	
1899,	100,000, **99,** 1270.	
1900,	262,000, **00,** 1467.	
1901,	140,000, **01,** 1294.	
1902,	100,000, **02,** 976.	
1903,	272,000, **03,** 916.	
1904,	175,000, **04,** 1120.	
1905,	200,000, **05,** 1018.	
1906,	250,000, **06,** 988.	
1907,	200,000, **07,** 1036.	
1909,	310,000, **09,** 1096.	
1910,	250,000, **10,** 1220.	
1911,	241,000, **11,** 1294.	
		$3,180,000

Wallabout Channel:

1899,	$40,000, **99,** 1244.	
		40,000

North River—removing obstructions:

1903,	$25,000, **03,** 913.	
1905,	20,000, **05,** 1014.	
		45,000

General improvement and Coney Island Channel:

1905,	$15,000, **05,** 1013.	
		15,000

Coney Island Channel:

1907,	$188,300, **07,** 1018; **08,** 1069.	
		188,300

Maintenance—Ambrose Channel:

1910,	$200,000, **10,** 1218.	
1911,	100,000, **11,** 1291.	
1912,	200,000, **12,** 1505.	
		500,000

Total.....12,746,590

In connection with the total, the various waterways tributary to N. Y. H. should be kept in mind—East R., Hudson R., etc. (See District map.)

COMMERCE.

The following description of the foreign commerce of N. Y. H. for 1911–12 shows its importance:

"No comprehensive record of the commerce of the port of New York is kept, and its magnitude and diversity preclude the possibility of preparing such for this report.

"The Chamber of Commerce of the State of New York in its annual report prepares with care a statement of imports from and exports to foreign countries, but not including domestic, coastwise, and local traffic. This is the most accurate statement available for the items which it covers, and from the report for the year ending June 30, 1911, the following data are compiled:

"'The leading articles of import into the U. S. at New York for year ending June 30, 1911, were sugar, tea, coffee, wool, cloths, and dress goods, hides, leather and leather goods, furs, copper, tin, rubber, and tobacco, which, with other misc. imports, aggregated about 5,128,000 t.; value, $917,121,800. The value of such imports for all other ports of the U. S. for the same period was $729,648,567.

"'The leading articles of export were cotton, breadstuffs, and other provisions, oils, tobacco, metals, and manufactures, which, with other items, amounted to about 8,453,215 t.; value, $827,755,334. The value of such exports for all other ports of the U. S. for same period, $1,308,991,273.

"'Vessels trading with domestic ports are not required to take out clearance papers, and most of them do not; no statistics of their carrying trade are accessible.'"

*Allotment.

[1] Many changes in the following list of appropriations might be made, showing in more detail the purposes to which funds were applied specifically. For instance, "New York H., 1899, $1,000,000" was designed for East Channel, since named Ambrose Channel, and was so expended.

Statement of the number and tonnage of vessels belonging to the port of New York, June 30, 1911.

	Number.	Tonnage.
Sailing vessels	486	219,762
Steam vessels	1,537	976,677
Canal boats	30	4,429
Barges	1,545	440,909
Total	3,598	1,641,777

From the records of the New York and New Jersey pilot commissioners' offices the following data concerning deep-draft ships crossing the outer bar have been compiled for the calendar year 1911:

Draft.	Outward.		Inward.	
	No. of vessels.	No. of trips.	No. of vessels.	No. of trips.
36 ft. draft and under 37	1	2	.....	.....
35 ft. draft and under 36	2	29	.....	.....
34 ft. draft and under 35	3	8	2	5
33 ft. draft and under 34	11	21	3	21
32 ft. draft and under 33	16	50	2	8
31 ft. draft and under 32	32	93	3	3
30 ft. draft and under 31	33	88	2	2
29 ft. draft and under 30	45	116	12	18
28 ft. draft and under 29	66	168	25	76
27 ft. draft and under 28	102	200	37	115
Total	.....	773	.....	248

"The max. draft of ships leaving the harbor, 1911, was 36.2′; the max. draft entering, 34.2′." **12,** 1507.

"The entire cost of this improvement to 1912 is about seven-eighths of 1% of the increase in valuation of annual foreign commerce alone, and is less than one-half of 1% of the annual value of foreign commerce.

Recent compilations from reliable sources indicate an approximate annual tonnage for the port of New York of somewhat over 90,000,000 tons.

"It is impossible to estimate the effect of the imp. upon freight rates. During 1911, 167 different ships with drafts of 27 feet or more, made 773 trips outward and 248 trips inward. Prior to the imp. none of these ships could have crossed the bar to enter or leave the harbor except at extreme high tide or after lightering." **12,** 228.

GOWANUS BAY CHANNELS.

"Statistics for the calendar year 1908 were collected in detail from the several wharves along the channel. They have been modified from year to year according to reports received from principal terminals, and the resultant commerce of 1911 is, approximately:

Number of sailings	1,100
Tonnage of cargo, t.	4,502,000
Estimated value	$232,562,000

"In addition to the above about 3,215,000 t. of domestic freight passed through these channels to and from Gowanus Creek, of value estimated at $33,000,000.

"The amount and importance of commerce in this part of New York Harbor is increasing with the increased channel facilities. This section is now the terminal of steamship lines making regular trips to Central America, Brazil, Nova Scotia, Italy, Australia, and Sweden, and of more or less regular sailings to China, East Africa, India, etc.

"During 1910 two foreign steamship lines located themselves at piers at the upper end of Bay Ridge Channel, one running to Russian ports and one to France." **12,** 1509.

"The effect of the imp. projected is undoubtedly to lower freight rates; these rates depend so largely upon the amount of business in hand and upon competition that it is impracticable to separate the effect of the imp. upon rates. A notable effect has been the growth of foreign commerce and the class of ships which carry it, many of which could not have entered Bay Ridge Channel before its improvement." **12,** 230.

CONEY ISLAND CHANNEL.

Practically all the commerce of Jamaica Bay and its interior landings, Canarsie, Far Rockaway, etc., passes through this channel. Its amount, 1911, about 957,000 t.

"Besides this, the chan. is always used by garbage scows carrying refuse to the Barren Isld. disposal works; it is frequently used by tows of scows returning from sea after dumping dredgings. The amount of this navigation can not be accurately ascertained; it is quite large in tonnage, and without value.

"Should the development of Jamaica Bay progress as expected, for many years its commerce will be almost wholly with New York direct, and will be carried through Coney Isld. Chan." **12,** 1510.

Part (b), F-105 New York Harbor, N. Y.—Sandy Hook Entrance (removal of wrecks).

APPROPRIATIONS. (See Part a.)

CONTRACTS.

1868. Neptune Submarine Co., removal of wreck, $63,300, **69,** 406; **70,** 44.

ENGINEERS.

Chief of Engineers. **R.,** **69,** 56; **70,** 74; **73,** 86.
In charge. Lt. Col. J. Newton, 1869–73. **R.,** **69,** 405, 407; **73,** 941.
Assistant. J. H. Striedinger, **73,** 941.

OPERATIONS.

1868. The first section, one-third of the wreck SS. *Scotland,* removed soon after the close of the fiscal year, **69,** 56, 406. Work completed Aug. 6, 1870; **70,** 74.

For removal of wreck to 22½′ m. l. w., by exploding gunpowder confined in strong kegs, **69,** 406.

1873. Removal of wreck of schooner *Chas. H. Moller;* 25.5′ obtained; rifle powder principally used, 28 charges, work done by hired labor, **73,** 86, 941.

SURVEY.

By Lt. Col. Newton, 1869, **69,** 406.

Part (c, d, f), F-105 New York Harbor.—Gedney and Main Ship Channels.

APPROPRIATION. (See Part a.)

COMMERCE.

Important, **85,** 770, 780; **86,** 728; **87,** 728, 729.

Tonnage and draft of largest steamers entering port of New York, **85,** 778; **86,** 728.

Draft of vessels using the chan., **88,** 619.

Gross export and import of N. Y. C., **90,** 732. Imports and exports of N. Y. H. for 1891, **91,** 930; for 1892, **92,** 832.

List of trans-Atlantic steamships plying between N. Y. C. and foreign ports, giving tonnage, dimensions, and draft for 1885, and from Apr., 1889, to Apr., 1890, **90,** 742.

Report upon height of masts of vessels of the largest class which enter the port, **90,** 749.

List of vessels over 800 t. which entered and cleared at the customhouse, port of New York, Jan., 1890, **90,** 752.

Description of, **97,** 1057; **99,** 1284.

Size and draft of steamers engaged in it constantly increasing, **97,** 1036; **99,** 1281.

Lusitania and other large ships pass through Ambrose Chan., **08,** 1076.

Diagram showing relation of app., tonnage, and values, **11,** 1292.

1911. 14,000,000± t. foreign. Valuation, $1,745,000±, "increase of $905,000± over 1886." Cost of imp. less than ½ of 1% of an. value of foreign C. alone. No detailed statistics available for local and domestic C.—90,000,000± t. an. Impossible to est effect of U. S. works on rates, but in 1911 "167 different ships with draft of 27′ or over made 773 trips out and 248 trips in," and none of these trips could have been made over the bar prior to work of U. S., except at extreme h. t., **12,** 228.

CONTRACTS.

1885. R. Stone, formation of chan. by hydraulic dr., **85,** 767, 771. Failure of method employed, **85,** 768, 769; **86,** 731. E. Brainard, dr. at Gedney Chan., 54¢ c. y., **85,** 772; **86,** 731.

1887. Joseph Edwards Dredging Co., dr. in Gedney and Main Chans., 28½¢ c. y., **87,** 722, 728, 733.

1889. Brainard Dredging Co., dr., 16⅞¢ c. y., **91,** 925. Contract annulled, **91,** 926.

1890. Joseph Edwards Dredging Co., dr., 23½¢ c. y., **91,** 925. Joseph Edwards Dredging Co., dr., 22.6¢ c. y., **91,** 926. J. S. Howell, broken st., 90¢ t., **91,** 927.

1891. Joseph Edwards Dredging Co., dr., 23.9¢ c. y., **91,** 926. J. Satterlee, broken st., 79¢ t., **91,** 927.

Open-market agreements, dr., etc., **93,** 1066.

1892. J. Edwards, hydraulic dr. purchased, steamer, $72,500, **93,** 1067.

1897. H. Ramsay, repair of dr. hull, $6,124, **97,** 1037. Harlan & Hollingsworth, 2 new Scotch boilers for dr., $12,270, **97,** 1037.

1899. A. Onderdonk, dr., 9¢ c. y., s. m., $3,825,000, **99,** 1265. Annulled Dec. 3, 1906, **07,** 1026.

1905. J. D. Miller, r. removal in North R., $40,000; W. H. Beard, dr. Coney Isld. Chan., 36¢ c. y., **05,** 1015.

1907. Hite & Rafetto, coal, $2.89 t., **08,** 1080.

1908. R. G. Packard Co., removing st. dumps in Ambrose Chan., prices given, **08,** 1080.

1909. R. G. Packard Co., removing r. in North R., $37,450, **09,** 1094. W. K. Niver Coal Co., 36,000 t. coal, $2,82 t., **10,** 1218.

1911. W. P. W. Haff, 20,000 t. coal, $3.08 t., **12,** 1506.

ENCROACHMENTS.

Illegal dumping of dr. material and garbage, **86,** 728, 739; **87,** 724. (See Legislation.)

ENGINEERS.

Chief of Engineers. R., 85, 113, 773; **86,** 98; **87,** 62; **88,** 63; **89,** 80, 368; **90,** 71, 332; **91,** 90, 424; **92,** 95, 398; **93,** 102; **94,** 92; **95,** 105; **96,** 108; **97** 113, 115; **98,** 127; **99,** 142, 147; **00,** 161; **01,** 224; **02,** 146; **03,** 139; **04,** 127; **05,** 134; **06,** 141; **07,** 148 **08,** 155; **09,** 158; **10,** 181; **11,** 185; **12,** 224, 225, 254, 279.

Boards:

Convened, New York, Nov., 1880, to consider plan of Mr. H. Knapp for creating permanent chan. through Sandy Hook Bar. **R., 81,** 675. (Cols. Tower and Newton and Lt. Col. Abbot.)

BE. of 1884 convened to consider the imp. of chans. of entrance to N. Y. H. over the shoal areas across lower B. (See Plans and Proj.) **R., 85,** 783. (Col. Duane, Lt. Cols. Abbot and Comstock.)

BE. of 1886 convened to consider the communication of the committee of the N. Y. Chamber of Commerce upon permanent imp. of the sea entrance to the H. of New York. **R., 87,** 731. (Cols. Casey and Abbot, Lt. Cols. Comstock, Houston, and McFarland.)

Convened, New York City, Mar. 26 and June 4, 1889, by S. O. No. 49, to estab. H. lines (a) on East R. between 59th and 64th Sts., N. Y. C.; (b) for the n. and e. shores of Staten Isld. from New Brighton to Fort Wadsworth. **R., 89,** 807, 809. (Cols. Abbot and Comstock and Lt. Cols. Houston and Gillespie.)

Convened, New York, Dec. 18, 1889, by S. O. No. 11, to ex. and **R.** upon the estab. of H. lines in N. Y. H. and adjacent waters. **R., 90,** 786; **92,** 849. (Cols. Abbot, Craighill, Comstock, and Houston, and Lt. Col. Gillespie.)

Convened, New York, Sept. 17, 1890, by S. O. No. 49, to estab. H. lines in N. Y. H. and its adjacent waters. H. lines as estab. for e. side of Manhattan Isld., **91,** 958; Raritan R., **91,** 960; Newtown Creek, **91,** 961; East R., **91,** 963; Jersey Flats, **91,** 965. Modification of p. and bulkhead lines on n. shore of Staten Isld. **91,** 973. (Cols. Abbot, Craighill, Comstock, Houston, and Lt. Col. Gillespie.)

Convened, New York, Dec. 16, 1898, by S. O. No. 22, Sept. 12, 1898, for consideration of securing chan. of adequate w. and d. to accommodate the C. interests centering at the port of N. Y. **R., 99,** 1280. (Col. H. M. Robert, Lt. Col. C. W. Raymond, and Maj. H. M. Adams.)

In charge:

Lt. Col. G. L. Gillespie, 1884–85. **R., 85,** 766.

Lt. Col. W. McFarland, 1885–89. **R., 86,** 724; **87,** 717; **88,** 617.

Lt. Col. G. L. Gillespie, 1889–96. **R., 89,** 788; **90,** 732, 786; **91,** 922; **92,** 824; **93,** 1060; **94,** 770 **95,** 950; (Col.) **96,** 861.

Lt. Col. W. Ludlow, 1897–99. **R., 97,** 1031, 1053; **99,** 1281.

Maj. H. M. Adams, 1898–99. **R., 98,** 1038; **99,** 1261.

Maj. W. L. Marshall, 1900–. **R., 00,** 1459; **01,** 1285; **02,** 969; **03,** 909; (Lt. Col.) **04,** 1113; **05,** 1009; **06,** 969; **07,** 1025; (Col.) **08,** 1073.

Col. S. W. Roessler, 1908–. **R., 09,** 1091; **10,** 1215, 1219; **11,** 1289; **12,** 1503.

Assistants:

A. Doerflinger. **R., 97,** 1057.

A. Stierle. **R., 99,** 1286.

Lt. J. A. Woodruff, **00,** 224.

Capt. J. F. McIndoe, **01,** 224.

Lt. W. L. Guthrie, **02,** 146; **03,** 139.

H. N. Babcock. **R.** on operating drs., **06,** 972.

Capt. H. L. Wigmore, **09,** 158; **10,** 181; **11,** 185.

REGULATION, LEGAL PROCEDURES, ETC.

Ambrose Chan. first buoyed for navigation 1907 and regul. made restricting its use to ships, in daytime, of 29′ dr. or over, or of 600′ l. or over; 1909, regul. amended, permitting use day and night by all SS. not having tows, regardless of size. Recom. that such regulation be continued, **12,** 226.

LEGISLATION.

Provisions, act Aug. 6, 1886, relating to unlawful disposal of garbage and dr. material, **87,** 725.

Act to prevent deposits within N. Y. H. and adjacent waters, **88,** 623.

OBSTRUCTIONS.

R. in North R. off Pier A, **03,** 911.

OPERATIONS.

1884-85. Efforts to d. Gedney Chan. by hydraulic dr., **85,** 768, 769; **86,** 731.

1885-86. 86,708 c. y. removed from Gedney Chan., **86,** 100, 734; **87,** 719.

1886-87. 217,161 c. y. removed from Gedney Chan., **87,** 719.

1887-88. 580,405 c. y. dr. from the bars, **88,** 619.

1888-89. 1,394,777 c. y. dr., **89,** 792.

1889-90. 1,318,178 c. y. dr., **90,** 739.

1890-91. 1,008,097 c. y. dr., **91,** 928.

1891-92. 213,268 c. y. dr.; 3,110 t. st. placed in sea wall on n. shore of Sandy Hook, **92,** 829, 831.

1892-93. Dr. in progress in Main Ship Chan., Swash Chan., and at Forts Hamilton and Wadsworth, **93,** 1066.

1893-94. 348,963 c. y. dr., beach front at Sandy Hook strengthened, and SS. *A. A. Humphreys*, sunk during a storm, repaired, **94,** 777.

1894-95. 126,486 c. y. dr., **95,** 956.

1895-96. 142,613 c. y. dr., **96,** 866, 867.

1896-97. 79,369 c. y. dr., **97,** 1035.

1897-98. 180,111 c. y. dr., **98,** 1039.

1898-99. 199,837 c. y. dr., **99,** 1263.

1899-00. 176,451 c. y. dr., **00,** 1461.

1900-01. 219,880 c. y. dr. from Bayside and Main Ship Chan.; dr. in progress at Coney Isld. Chan. (38,460 c. y.); Fort Hamilton (10,978 c. y.); Fort Hancock (5,266 c. y.); 423,209 c. y. dr. from Ambrose Chan. outside of bar, **01,** 1287, 1288.

1901-02. 87,658 c. y. dr. from Bayside and Main Ship Chan., **02,** 970.; 5,015,568 c. y. dr. (new) from Ambrose Chan. outside of bar, **02,** 971.

1902-03. 85,795 c. y. dr.[1] from Gedney and Main Ship Chan., and 111,589 c. y. from Ambrose Chan., **03,** 910; 3,754,227 c. y. dr. (new) from Ambrose Chan. outside of bar, **03,** 911.

1903-04. 128,626 c. y. dr.[1] from Main Ship and Gedney Chan., **04,** 1114; 2,948,511 c. y. dr. (new) from Ambrose Chan. outside of bar, and 77,374 c. y. from inside of bar, **04,** 1114–15.

1904-05. 315,418 c. y. dr.[1] by U. S. dr. *Gedney* from Gedney, Bayside, and Main Ship Chan.; 2,914,440 c. y. dr. under contract, **05,** 1010. 499,375 c. y. dr. from Ambrose Chan. by U. S. drs. *Manhattan* and *Atlantic*, **05,** 1011.

1905-06. 294,362 c. y. dr. by U. S. dr. *Gedney* from Bayside, Gedney, and Main Ship Chans., and 21,649 c. y. dr. by contractor from Coney Isld. Chan., **06,** 970. 2,364,889 c. y. dr. by contractor, and 3,794,399 c. y. dr. by U. S. dr. from Ambrose Chan., **06,** 971. Removal of r. off Pier A, North R., in progress, **06,** 983.

1906-07. 93,643 c. y. dr.[1] from Main Ship Chan., **07,** 1026. 613,078 c. y. dr. by contractor, and 4,021,564 c. y. dr. by U. S. from Ambrose Chan.; repairs made to U. S. dr. *Gedney*, **07,** 1026, 1029. R. removal in progress, **07,** 1030.

1907-08. 351,139 c. y. dr.[1] from Main Ship Chan.; 5,799,230 c. y. dr. from Ambrose Chan. by U. S., **08,** 1074. Under contract, 33 st. dumps (10,134 c. y.) removed from Ambrose Chan.; Ambrose Chan. opened for navigation, **08,** 1075. Work on r. removal in North R. in progress; expense of operating U. S. drs., **08,** 1077.

1908-09. 73,681 c. y. dr. from Main Ship Chan.;[1] 10,786,638 c. y. dr. from Ambrose Chan. by U. S., and 6,889 c. y. st. removed under contract, **09,** 1092. R. removal off Pier A, North R., in progress, **09,** 1093.

1909-10. 459,993 c. y. dr. from Main Ship Chan., and 9,246,401 c. y. sand and 17 st. piles dr. from Ambrose Chan. by U. S. drs.; R. removal off Pier A, North R., completed, 2,741 c. y. removed, **10,** 1216–17.

1910-11. 2,368 c. y. dr. from Main Ship Chan.; 5,710,739 c. y. dr. from Ambrose Chan. by U. S. drs., **11,** 1290.

1911-12. Several st. dumps removed, and 3,717,742 c. y. dr. from Ambrose Chan., **12,** 1504.

PHYSICAL CHARACTERISTICS.

Description of the lower B., **86,** 724; **87,** 717.

Changes in lower B. as determined by comparative surs., **85,** 775, 784; **86,** 726, 729.

Tidal observations, **85,** 777, 784; **86,** 727, 740.

Character of bottom, **86,** 837, 739.

Wave action, **86,** 741.

Description of the H., **88,** 617.

Description of vicinity of Sandy Hook, **94,** 774.

Chans. possessing a tendency to d., **94,** 776.

Description of, Narrows to the sea, **97,** 1054.

Description of, Coney Isld., East, Swash, and Bayside Chans., **99,** 1282.

Condition of work, w. d., **01,** 1288; **06,** 983.

R. in North R., to be removed, **03,** 911.

At 1912, 2 chans. of approach to N. Y. H.—Main Ship, Bayside, Gedney, and Ambrose Chans. Completion of Ambrose Chan. rendered it less necessary, 1912, to maintain Gedney Chan. to full w. and d., **12,** 226.

PLANS.

By H. Knapp, creating a deep and permanent chan. through Sandy Hook Bar by artificial bar of st. located outside the natural bar, **81,** 679–685.

Plan considered by BE., 1880, which concluded that the proposed wall would not imp. navigation over the bar, **81,** 679.

By Lt. Col. Gillespie, 1884, dr. chan. through main chan., w. of Flynns Knoll, 30′ x 1,000′ m. l. w.; est., $620,000, **85,** 779, 786.

By BE., 1884, to give 30′ m. l. w. from New York to the ocean by a st. dike running about s.-se. from Coney Isld. probably about 4 m., the protection of the head of Sandy Hook, and the dr. of a chan. 30′ d. from the d. w. near Sandy Hook to d. w. below the Narrows; also the dr. of a chan. 28′ x 1,000′ through the shoal w. of Flynns Knoll, **85,** 787; **86,** 730.

PROJECTS.

By Lt. Col. Gillespie, 1884, dr. chan. through the shoal in the w. end of Gedney Chan. 30′ x 1,000′ x 4,000′ m. l. w., **85,** 777. Recom. for approval by board after reducing proposed d. to 28′, **85,** 773, 787; **86,** 730. Approv. by Sec. of War, **85,** 774.

Successful results from dr. chan., **87,** 63, 720.

Act Aug. 5, 1886, provided for chans. 30′ d. m. l. w., **87,** 63, 718.

The BE. of 1886 recom. app. of $750,000, made in 1886, be applied wholly in Gedney and the Main Ship Chans., **87,** 720–733.

The modified proj. of Lt. Col. Gillespie involved the removal of 4,300,000 c. y. of material; est. $1,490,000, **88,** 618; **91,** 925.

By Lt. Col. Gillespie, 1892, purchase of steam dr. vessel for mainten. of d., etc., at cost of $72,500, and using this vessel for w. the s. entrance of Main Ship Chan., Swash Chan., and removal of Craven Shoal to 26′ m. l. w., **93,** 1065.

By Lt. Col. Gillespie, 1893, connecting Main Ship Chan. with the US. wharves at Fort Hamilton and Fort Wadsworth by chans. 10′ x 100′ m. l. w., **93,** 1066.

By Lt. Col. Gillespie, 1894, protection of beach in front of pneumatic-gun site at Sandy Hook; cost, $2,000, **94,** 777.

By Lt. Col. Gillespie, 1896, w. and d. the imp. chans. near the termini of lighthouse ranges and removal of material at any point where shoaling would be found to have occurred in Main Ship Chan., **97,** 1035.

In 1897 Col. Gillespie est. that, using the U. S. plant, it would cost $1,740,000 to obtain 35′ x 1,000′, $2,772,000 for 1,500′ w., and $4,180,000 for 2,000′ w., from the Narrows to the sea; and if done by contract 20% should be added, **97,** 1055. Lt. Col. Ludlow's est. for 35′ chan. from Narrows to sea, $3,200,750, **99,** 1284.

[1] Maintenance.

By BE., 1898, connecting d. w. in the lower B. with the ocean by chan. 40′ x 2,000′ by way of East Chan. (Ambrose Chan.), 7 m. l.; est., $6,688,000. Limit of cost set by Congress, $4,000,000, **99,** 1280; **00,** 1460. 1903, U. S. built 2 dr. to supple. work of contractor; contractor abandoned work 1906; act 1907 au. 2 more dr., changing limit of expend. to $5,148,510, "sufficient," 1912, to complete chan. Chan., 1912, navigable for 37′ dr. boats at moderate speed, with max. h. w. capacity of 44′. Proj. 96%± done. (See Legal proceedings.) **12,** 226.

Resolution July 1, 1902, provides for removing r. or obstr. in North R., near Pier No. 1, and au. diversion of sum not to exceed $25,000 from amounts app. for Ambrose Chan., **03,** 911; act Mar. 3, 1905, diverted addl. $20,000 from app. for Ambrose Chan. for such removal, **05,** 1012. Removed to 40′, 1909, **12,** 226.

Allt., Apr. 28, 1904, for restoring 14′ in Coney Isld. Chan., **05,** 136.

Act June 25, 1910, au. mainten. of Ambrose Chan. as part of mainten. of N. Y. H.; est., $200,000 an., **10,** 182; **12,** 226.

Gedney Chan. mainten. 20 yrs. prior to 1912–13, $815,898.64; cost increasing an.; 1,000′ w. maintained, except at Main Ship Chan., where w. varies 600–800′.

L. of N. Y. H. included in principal projs.—from Atlantic Ocean to Battery—22½ m. Dr. extended over 15 m., including Ambrose Chan., **12,** 226.

Two plans considered for enlarging anchorage grounds, **11,** 187. Grounds laid out au. act 1888; amended and extended au. act 1899. They include shoal-water areas for l. dr. vessels, and d. w. areas for seagoing ships; latter on w. side of chan. from s. point of Staten Isld. to mouth of Hudson R. in upper B. Crowding toward shoal area 1912. Complaint taken up with Dept. Commerce and Labor. Temporary relief by discontinuing portion of area, pending app. of proj. for imp. upper B. area; 2 plans proposed, one for transfer of anchorage to shoal on opp. side of natural chan., dredging, the other to retain old anchorage and dr. chan. e. of them 40′ x 2,000′; est., $740,000; latter plan favored by SS. companies, DO., DE., BEHR., and by Chief of Engineers, being best for needs of the growing H., **12,** 227.

SURVEYS.

Of part of lower B., N. Y. H., by Lt. Col. Gillespie, 1884, **85,** 766, 778.

Comparison with previous surs., **85,** 775.

Minor surs., **93,** 1065; **94,** 776; **95,** 956; **96,** 866.

Sur., Narrows to the sea, for 35′ m. l. w., au. act June 3, 1896; made in 1897 by Col. Gillespie (**R.** fav.), **97,** 1053. Sur. of a different chan. route made, 1898, by Lt. Col. Ludlow (see Projects), **98,** 1039; **99,** 1281.

Ex. and sur. au. act June 25, 1910, to determine whether addl. chan. w. and d. necessary in North or Hudson R.; made, 1911, by Col. Black; est., $1,570,000 for 1st constr.,[1] **12,** 224.

Ex. and sur. au. act June 25, 1910, for suitable d. of chan. to navy yard. **R.** to come, **12,** 254.

Ex. and sur. au. acts 1910 and 1911, for increased w. and d. from near Southwest Spit, through lower New York B., Raritan B., and the chan. between N. J. and Staten Isld., to chan. in upper New York B. **R.** to come, **12,** 279.

Maps:[1]
Of lower B., **85,** 778; **86,** 742.
Of Gedney Chan., **86,** 742.
92, Atlas, 4.
Showing progress of dr., **03,** 914.
Details of drag, **06,** 978.
Showing condt. of imp., **07,** 1032.
Showing area dr. to 40′ or more, **09,** 1092.
Showing Ambrose Chan., **11,** 1290.

Part (e), F-105 New York Harbor.—Coney Island Channel, N. Y.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Chan. much used by small sailing vessels, steamers, and by scows loaded with refuse of New York City, **97,** 1049; **12,** 232.

CONTRACTS.

1907. Morris & Cummings Dredging Co., drg. 529,000 c. y., at 27.4¢ c. y., s. m., **08,** 1069; terminated under supple. agreement Aug. 27, 1908, **09,** 1088. (Further drg. deferred until some US. seagoing dr. could be assigned to do work, **09,** 156.)

ENGINEERS.

Chief of Engineers. **R., 97,** 115; **06,** 141; **07,** 144; **08,** 152; **09,** 155; **10,** 177; **11,** 190; **12,** 231.

In charge:
Lt. Col. Wm. Ludlow, 1897. **R., 97,** 1048.
Col. W. R. Livermore, 1906–07. **R., 06,** 115; **07,** 1018.
Col. J. G. D. Knight, 1908. **R., 08,** 1068.
Col. W. M. Black, 1909–10. **R., 09,** 1088; **10,** 1211.
Col. S. W. Roessler, 1911–. **R., 11,** 1295; **12,** 1509.

OPERATIONS.

1907-08. 114,978 c. y. removed under contract, **08,** 1068.

1908-09. 33,233.6 c. y. removed under contract, **09,** 1088.

1910-11. 123,117 c. y. sand removed by U. S. dr., at a cost of 5.83¢ c. y., **11,** 1295.

1911-12. Drs. *Raritan* and *Navesink* dr. 418,793 c. y. sand; dr. suspended Apr. 30, 1912, **12,** 1509.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1049; **07,** 144; **08,** 152.

Chan. imm. south of Coney Isld.; one of 5 chans. which cross bar separating New York lower B. from ocean, **12,** 231.

Shoaling occurs so as to reduce d. to practically d. before dr.; impossible to maintain chan. at reasonable cost, **09,** 1088.

Max dr., 1912, 18′ m. l. w.; 20′ in w. part. Total l. of proj. chan., 1½ m., **12,** 232.

PROJECT.

Au. act Mar. 2, 1907, dr. chan. 20′ d. m. l. w., and 600′ w., with side slopes of 1 on 3, from d. w. in lower B. to d. w. in Atlantic Ocean; est., $168,300 and $20,000 an. for mainten.,[2] **07,**145; mainten., $20,000 to $54,000, **12,** 232.

SURVEYS.

Ex. from Norton Pt. to bell buoy with a view to 16′ d. au. act June 3, 1896; made, 1896, by Col. Gillespie (**R.** fav.), **97,** 1049.

Ex. and sur. au. act June 28, 1906, with view to est. cost of chan. 20′ x 600′ l. w., from d. w. sw. of Nortons Pt. e. to d. w. off Rockaway Inlet, and across bar w. of inlet to d. w. in Jamaica B.; made, and **R.** submitted by Col. Livermore; est., $168,300, and $20,000 an. for mainten.,[2] **06,** 141; **07,** 148.

Sur. indicates mainten. of chan. will be problematical, **08,** 1068.

Sur. made in June, 1908, showed that considerable shoaling had occurred, **09,** 1088.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 232.

[1] H. D. 719, 62d, 2d.

[2] H. D. 442, 59th, 2d.

Part (g), F-105 New York Harbor.—Bay Ridge Channel (Gowanus Bay), N. Y.

APPROPRIATIONS. (See Part a.)

COMMERCE.

C. statement, 1880 to 1884, **84,** 707.
Necessity for enlarged chans., **87,** 712, 714.

CONTRACTS.

1881. J. W. Ambrose, dr., 17¢ c. y., **82,** 661.
1883. E. Brainard, dr., 18¢ c. y., **84,** 708.
1884. H. Dubois's Sons, dr., 19.9¢ c. y., **85,** 673.
1886. E. Brainard, dr., 32¢ c. y., **87,** 711.
1889. J. A. Simmons, dr., 18¾¢ c. y., **89,** 787.
1891. W. H. Beard, dr., 21¢ c. y., **91,** 917. W. H. Beard, dr., 21¢ c. y., **91,** 918.
1893. International Dredging Co., dr., 13.7¢ c. y. ($124,670), **93,** 1058. J. D. Leary, dr., 13⅝¢ c. y., **94,** 767.
1894. W. H. Beard Dredging Co., dr., 15¢ c. y. ($135,000), **95,** 948.

ENGINEERS.

Chief of Engineers. R., 80, 85; **81,** 101; **82** 102; **83,** 97; **84,** 103; **85,** 93; **86,** 98; **87,** 61; **88,** 62 **89,** 78; **90,** 70; **91,** 89; **92,** 93; **93,** 101; **94,** 91; **95** 103.

In charge:
Col. J. Newton, 1880-84. **R., 81,** 634, 635; **82,** 659; **83,** 544.
Capt. J. Mercur, 1884-86. **R., 84,** 706; **85,** 672.
Lt. Col. W. McFarland, 1886-89. **R., 86,** 722; **87,** 709; **88,** 613.
Lt. Col. G. L. Gillespie, 1889-95. **R., 89,** 784; **90,** 727; **91,** 914; **92,** 817; **93,** 1053; **94,** 764; **95** 943.

Assistant. R. H. Talcott. **R., 81,** 636.

LAW PROCEDURES.

Operations under app. of 1882 prevented by legal formalities for securing right of way, **83,** 544; **87,** 710.

OPERATIONS.

1881-82. 158,458 c. y. dr., **82,** 659.
1882-83. 60,708 c. y. dr., **83,** 544.
1883-84. 91,609 c. y. dr., **84,** 706.
1884-85. 22,996 c. y. dr., **85,** 673.
1886-87. 21,497 c. y. dr. from chan. below Hamilton St. Br., **87,** 711.
1888-89. 38,938 c. y. dr.; 2 canal-boat wrecks removed, **89,** 787.
1889-90. 135,967 c. y. dr., **90,** 730.
1890-91. 268,000 c. y. dr., **91,** 917.
1891-92. 520,000 c. y. dr. from Red Hook Gowanus Creek, and Bay Ridge Chan., **92,** 820.
1892-93. 20,297 c. y. dr., **93,** 1057.
1893-94. 852,137 c. y. dr., **94,** 767, 768.
1894-95. 757,006 c. y. dr., **95,** 946, 947.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 613.

PROJECTS.

By Col. Newton, 1881, dr. chan. 200′ x 18′ m. l. w. from 18′ contour outside the B. to Hamilton Ave. drawbr., the last 400′ narrowing down to a w. of 100′; est., $182,850, **81,** 636.

Revised proj. for dr. the natural chan. from Hamilton Ave. drawbr. to sw. corner of Erie Basin, and thence 2 chans., one running n. along the w. side of Erie Basin to d. w. near Red Hook, the other running s. along the wharves on the s. side of the B.; est., $192,564, **81,** 634, 635; **87,** 712.

In 1887 Lt. Col. McFarland considered that the Red Hook, Bay Ridge, and Gowanus Creek Chans. should be w. to 400′, with a l.-w. d. of 21′; est., $403,500, **87,** 712.

By Lt. Col. Gillespie, 1889, increasing the d. of Gowanus B. Chans. to 21′ m. l. w. and increasing their w. to 400′; also removal of angle on s. side of Gowanus Creek near its mouth; est., $600,000, **89,** 785, 786; **91,** 916.

By Lt. Col. Gillespie, 1892, expend. of app. of 1892 as follows: $58,000 on Red Hook Chan. and $42,000 on Gowanus Creek Chan., **93,** 1056.

The existing proj. in 1894 amended by Congress providing for 26′ x 800′ for Bay Ridge Chan., 26′ x 400′ for Red Hook Chan., and 21′ x 250′ for Gowanus Creek Chan.; est. $483,300, **95,** 946.

In 1895 Lt. Col. Gillespie est. either $2,391,814 or $2,929,114 to complete imp. properly, **95,** 948.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Col. Newton, **81,** 635.
Maps. **81,** 636; **85,** 672.

Part (h), F-105 New York Harbor.—Gowanus Bay Channels, N. Y.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Description of, **97,** 1179.

Large and important, and would probably be still further enlarged by constr. of deeper chans., **97,** 1179.

Rates reduced; growth of foreign C., **10,** 186; **12,** 1509.

Traffic, 1911-12, 8,000,000 t. Importance of this section of N. Y. H. increasing, with U. S. imp. Section terminal of large foreign steamship lines, **12,** 1509.

CONTRACTS.

1896. W. H. Beard Dredging Co., dr., 14¢ and 21¢ c. y., s. m. ($630,000), **97,** 1121.
1899. Hughes Bros. & Bangs, dr. Bay Ridge and Red Hook Chans., 10¢ c. y., s. m. ($2,040,540), **1900,** 1468.
1907. Contract with Hughes Bros. & Bangs, dated July 31, 1899, annulled Feb. 21, 1907, **07,** 1036. Morris & Cumings Dredging Co., dr., 18.4¢ c. y., **08,** 1083.
1909. Morris & Cumings Dredging Co., dr., 16.85¢ c. y., **10,** 1221.
1911. Coastwise Dredging Co., dr. 2,400,000 c. y., at 15.89¢ c. y., **11,** 1294.

ENGINEERS.

Chief of Engineers. R., 91, 94; **96,** 90; **97** 125, 140; **98,** 121; **99,** 144; **00,** 163; **01,** 226; **02,** 148; **03,** 142; **04,** 130; **05,** 137; **06,** 144, 147; **07,** 151; **08,** 159; **09,** 162; **10,** 185, 188; **11,** 189; **12,** 229.

In charge:
Lt. Col. G. L. Gillespie, 1890-91. **R., 91,** 940.
Maj. H. M. Adams, 1896-99. **R., 96,** 753; **97,** 1117, 1177: **98,** 1016; **99,** 1266.
Maj. W. L. Marshall, 1900-1908. **R., 00,** 1464; **01,** 1291; **02,** 974; **03,** 915; (Lt. Col.) **04,** 1118; **05,** 1016; **06,** 986; **07,** 1034; (Col.) **08,** 1081.
Col. S. W. Roessler, 1909-. **R., 09,** 1095; **10,** 1219; **11,** 1293; **12,** 1507.

Assistant. Capt. H. L. Wigmore, 1911. **11,** 185.

OPERATIONS.

1895-96. 718,487 c. y. dr., **96,** 755.
1896-97. 872,617 c. y. dr., **97,** 1119.
1897-98. 1,499,462 c. y. dr., **98,** 1018.
1898-99. 1,844,410 c. y. dr., **99,** 1268.
1900-01. 284,501 c. y. dr., **01,** 1292.
1901-02. 2,238,023 c. y. dr., **02,** 974.
1902-03. 2,354,555 c. y. dr., **03,** 915.

1903-04. 2,002,337 c. y. dr., **04,** 1119.
1904-05. 2,038,227 c. y. dr., **05,** 1017.
1905-06. 2,164,560 c. y. dr., **06,** 987.
1906-07. 1,204,001 c. y. dr., **07,** 1034.
1907-08. 1,363,185 c. y. dr., **08,** 1081.
1908-09. 799,727 c. y. dr., **09,** 1095.
1909-10. 1,767,792 c. y. dr., **10,** 1220.
1910-11. 302,714 c. y. dr., **11,** 1293.
1911-12. 1,027,596 c. y. dr. (255,245 c. y. deducted for overdepth and 3,411 c. y. for illegal dumping), **12,** 1507.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1179; **10,** 185.

The chans. included in this work form an e. water route between the Narrows and East R., New York H., running close to the water front of Brooklyn and Governors Isld., **97,** 1178.

PROJECTS.

By act of 1896, Bay Ridge and Red Hook Chans., the triangular area between them, and Buttermilk Chan. were consolidated into one work, incl. limited imp. of Gowanus Canal, **96,** 755.

By Maj. Adams, under act 1896, dr. chans., with w. of 800′ in Bay Ridge Chan., 900′ in the triangular area, 400′ in Red Hook Chan., 1,000′ in Buttermilk Chan., and all with a d. of 26′; dr. also provided for in Gowanus Canal to the extent of $5,000; total est., $837,000, **96,** 755.

In 1897 Maj. Adams est. $2,000,000 to obtain 30′ chans., and $5,300,000 to obtain 35′ chans., both amounts in addition to the est. of proj. of 1896, **97,** 1179.

By Maj. Adams, 1899, making Bay Ridge and Red Hook Chans. 40′ x 1,200′ m. l. w., at a limit of cost of $2,500,000, and continuing contract for whole work au., **99,** 1267.

Proj. modified, 1907, to permit completing 35′ chan. first, **07,** 152; **12,** 229.

(See sur. made 1909, under Surveys.)

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Gillespie (**R.** unfav.), **91,** 940.

Sur. with a view to one continuous chan. 30′ d. m. l. w., w. of 1,000′, and d. of 35′ m. l. w., with w. of 1,200′, au. act June 3, 1896; made, 1897, by Maj. Adams (see Projects), **97,** 1177. Ex. and sur. of Buttermilk Chan. (See Buttermilk Chan.)

Pre. ex. au. act Mar. 3, 1905, with view to break'r opposite the wharves; made, 1905, by Lt. Col. Marshall (**R.** unfav.),[1] **06,** 147.

Made, 1909; new est. of completion ($1,450,000) submitted, making entire est. for 1899 proj. $3,459,000, **10,** 186.

Ex. with view to dr. between chans. and d. w. of B., and constr. break'r along Red Hook Pt., au. act Mar. 3, 1909; made, 1909, by Col. Roessler (**R.** unfav.),[2] **10,** 188.

List of Cong. docs., etc., covering ex., surs., plans, etc., **12,** 231.

Maps. **96,** 756; progress, **03,** 916.

Part (i), F-105 New York Harbor.—Gowanus Creek Channel, N. Y.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Description of; of the total freight carried in 1896, 2,164,654 t., nine-tenths of this was carried in boats drawing less than 12′, **97,** 1181.

Total amount expend. on imp. to 1904 about $\frac{8}{10}$ of 1% of an. value of C., **04,** 132.

CONTRACTS.

1897. H. S. Beard, dr., 24¢ c. y., s. m.; bowlder removal, $12 c. y. ($22,000), **97,** 1123, 1124.
1899. H. S. Beard, dr., 14½¢ c. y., s. m. ($23,000), **99,** 1276.
1903. Wm. H. Taylor, dr. 91,139 c. y., 19.75¢ c. y., **03,** 919.

ENGINEERS.

Chief of Engineers. **R.,** **96,** 92; **97,** 127, 141; **98,** 122; **99,** 146; **00,** 165; **01,** 227; **02,** 150; **03,** 143; **04,** 132.

In charge:
Maj. H. M. Adams, 1896–99. **R.,** **96,** 758; **97,** 1122, 1180; **98,** 1020; **99,** 1274.
Maj. W. L. Marshall, 1900–1904. **R.,** **00,** 1469; **01,** 1296; **02,** 977; **03,** 919; (Lt. Col.) **04,** 1123.

Assistants:
Capt. J. F. McIndoe, 1901. **01,** 224.
Lt. J. A. Woodruff, 1900–01. **01,** 224.
Lt. W. L. Guthrie, 1902–03. **02,** 146; **03,** 139.

OPERATIONS.

1896-97. 75,417 c. y. dr., **97,** 1123.
1897-98. 16,073 c. y. dr., **98,** 1021.
1899-00. 156,204 c. y. dr., **00,** 1470.
1900-01. 1,740 c. y. dr., **01,** 1296.
1903-04. 94,381 c. y. dr., completing proj., **04,** 1123.

PHYSICAL CHARACTERISTICS.

Description of; originally a tidal inlet in the s. part of the city of Brooklyn, emptying into Gowanus B., **97,** 1181.

Chan. defined as extending from the junction of Bay Ridge and Red Hook Chans. opposite Henry St., Brooklyn, and 28th St., Brooklyn, e. to the foot of Percival St., the part e. of Percival St. being called Gowanus Canal, **96,** 758.

Shoaling of chan., **01,** 1297.

Chan. from foot of Henry St. to Percival St., 26′ d., **04,** 1123.

PROJECTS.

About $75,000 had been spent on this chan. up to 1892 (see Gowanus Bay, N. Y.), **00,** 1471.

Under act of 1896 a proj. adopted by Maj. Adams for dr. chan. 26′ between the foot of Percival St., Brooklyn, and Red Hook Chan.; est., $70,000, **96,** 758.

In 1897 Maj. Adams est. that to obtain 30′ would cost $58,000 in addition to the est. cost of the 26′ chan. in process of constr., **97,** 1181.

SURVEYS.

H. lines slightly modified by act June 3, 1896, **96,** 755.

Sur. for chan. 30′ d. au. act June 3, 1896; made by Maj. Adams, 1897 (see Proj.) **97,** 1180.

Maps. **03,** 919.

Part (k), F-105 New York Harbor.—Buttermilk Channel.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Important, **84,** 702; **86,** 721; **87,** 707.
Traffic, 1905, about 17,000,000 t., **05,** 139.

CONTRACTS.

1880. H. E. Du Bois, dr., 35¢ c. y., **81,** 631.
1881. H. E. Du Bois, dr., 22¢ c. y., **82,** 655.
1882. H. E. Du Bois, dr., 22¢ c. y., **83,** 543.
1884. H. E. Du Bois, dr., 33¢ c. y., **85,** 671.

[1] H. D. 65, 59th, 1st.

[2] H. D. 205, 61st, 2d.

1688. United States Dredging Co., dr., 23½¢ c. y.; contract annulled and work prosecuted by H. E. Du Bois's Sons, 25¢ c. y., **87,** 705.
1889. J. A. Simmons, dr., 18½¢ c. y., **89,** 782.
1892. International Dredging Co., dr., 32.7¢ c. y. ($111,180), **93,** 1052.
1894. R. R. Moore, dr., 25¢ c. y. ($42,500), **95,** 943.
1903. Wm. H. Taylor, dr. 300,000 c. y., at 26¢ c. y., **03,** 919.

ENGINEERS.

Chief of Engineers. R., 80, 82; **81,** 99; **82,** 100; **83,** 96; **84,** 102; **85,** 92; **86,** 97; **87,** 60; **88,** 61; **89,** 78; **90,** 69; **91,** 88, 93; **92,** 92; **93,** 100; **94,** 90; **95,** 102; **01,** 229; **02,** 149; **03,** 143; **04,** 131; **05,** 139.

In charge:
Col. J. Newton, 1880–84. **R., 80,** 505; **81,** 629; **82,** 654; **83,** 542.
Capt. J. Mercur, 1884. **R., 84,** 701.
Lt. Col. W. McFarland, 1884–89. **R., 85,** 670; **86,** 720; **87,** 703; **88,** 610.
L. Col. G. L. Gillespie, 1889–95. **R., 89,** 780; **90,**t724; **91,** 911, 937; **92,** 814; **93,** 1050; **94,** 761; **95,** 940.
M aj. W. L. Marshall, 1901–05. **R., 01,** 1301, 1303; **02,** 976; **03,** 917; (Lt. Col.) **04,** 1121; **05,** 1019.

Assistant. Henry N. Babcock. **R., 01,** 1204.

OPERATIONS.

1880–81. 80,000 c. y. dr., **81,** 100.
1881–82. 137,545 c. y. dr., **82,** 654.
1882–83. 232,375 c. y. dr., **83,** 542.
1883–84. 207,090 c. y. dr., **84,** 701.
1884–85. 30,097 c. y. dr., **85,** 671.
1886–87. 89,625 c. y. dr., **87,** 705.
1889–90. 206,199 c. y. dr., **90,** 726.
1890–91. 190,000 c. y. dr., **91,** 913.
1891–92. Chan. completed through shoal at s. entrance, **92,** 815.
1892–93. 32,308 c. y. dr., **93,** 1051.
1893–94. 345,090 c. y. dr., **94,** 762.
1894–95. 52,602 c. y. dr., **95,** 942.
1902–03. Contract entered into; fire destroys part of contractor's plant, **03,** 918.
1903–04. 117,588 c. y. dr., **04,** 1122.
1904–05. 192,412 c. y. dr., completing proj., **05,** 1019.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 610.
Condition of imp., giving depths, etc., **05,** 1020.
Chan. lies between Governors Isld. and Brooklyn shore, **05,** 139.

PLANS.

In 1890 Lt. Col. Gillespie reported Buttermilk and Gowanus B. Chans. worthy of 26′., **91,** 938.

PRIVATE WORK.

New York Tunnel Co. constr. tunnel under East R.; e. end crosses Buttermilk Chan., **05,** 1020.

PROJECTS. (See Plans.)

By Col. Newton, 1880, removal of shoal between Long Isld. and Governors Isld. to 26′ x 850′ from the Brooklyn wharves; est., $210,000, **80,** 506; **81,** 629; **86,** 721. In 1887, after an aggregate app. of $190,000, Lt. Col. McFarland est. $95,000 would be required to complete proj., **87,** 705. Existing proj., to 1899, completed at total of $650,000, **05,** 139.
Act June 13, 1902, au. proj. for chan. 30′ x 400′[1] (see Survey, 1900), **02,** 149, or such w. as $90,000 would provide for, **05,** 139.

SURVEYS.

Pre. ex. and sur. au. act June 6, 1900, for chan. 40′ x 1,200′ w. m. l. w.; **Rs.** by Maj. Marshall, June 25 and Nov. 28, 1900; est., $1,900,000,[1] **01,** 229, 1299.
Maps. **80,** 506; **84,** 702; **85,** 670; **03,** 918.

Part (l), F-105 New York Harbor.—Battery and Governors Island, N. Y. (Channel between.)

COMMERCE.

In 1897 an average of 125 boats passing every hour, **97,** 1184.

ENGINEERS.

Chief of Engineers. R., 97, 141.
In charge. Maj. H. M. Adams, 1897. **R., 97,** 1182.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1183.

PROJECTS.

In 1897 Maj. Adams est. $2,210,000 to imp. chan., **97,** 1184.

SURVEYS.

Sur. of chan. between Battery and Governors Isld., N. Y. H., for chan. continuous with Buttermilk Chan. 30′ x 1,200′ au. act June 3, 1896; **R.** by Maj. Adams, 1897 (see Projects), **97,** 1182.

Part (m), F-105 New York Harbor.—Wallabout Channel, N.Y.

APPROPRIATIONS.[2] (See Part a.)

COMMERCE.

Description of, **97,** 1048; **99,** 1253.
This waterway important for the handling of an extensive C., **97,** 1048.
Table of tonnage, 1897 to 1911, incl., **12,** 245.
Part of N. Y. H.; 1911, 1,137,000± t., **12,** 1522.

CONTRACTS.

1899. J. H. Fenner, dr., 9⅜ c. y., s. m. ($17,156.25), **99,** 1244.
1910. Morris & Cumings Dredging Co., dr., prices listed, **11,** 1309.

ENGINEERS.

Chief of Engineers. R., 97, 115; **98,** 124; **99,** 138, 141; **00,** 156; **01,** 208; **09,** 144; **10,** 163; **11,** 203; **12,** 245.

In charge:
Lt. Col. Wm. Ludlow, 1897. **R., 97,** 1047.
Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1242, 1251.
Maj. H. M. Adams, 1899. **R., 99,** 1252.
Maj. E. H. Ruffner, 1900. **R., 00,** 1413.
Col. S. M. Mansfield, 1901. **R., 01,** 1218.
Col. W. M. Black, 1909–10. **R., 09,** 1074; **10,** 1200.
Col. S. W. Roessler, 1911–. **R., 11,** 1308; **12,** 1521.

OPERATIONS.

1898–99. 31,809 c. y. dr., **99,** 1244.
1899–00. 122,308 c. y. dr. and 50 t. bowlders removed, **00,** 1414.
1910–11. 78,981.1 c. y. dr., restoring chan. to proj. w. and d., **11,** 1309.

[1] H. D. 122, 56th, 2d.
[2] $21,826.31 returned to Treas., **01,** 1218; $10,000 was later reallotted, **10,** 1200.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1047.

Cob Dock Isld. belongs to the U.S. Part of it is occupied for the storage of ordnance. Chan. on the s. side leads to the Brooklyn Navy Yard and the chan. on the other side to Brooklyn wharves, **97,** 1047.

Ex. showed shoaling had occurred along entire length of Cob Dock and causeway, **09,** 1074.

Waterway extending in a half circle around inside of isld. known as Cob Dock, in Wallabout B., a slight indentation of East R., off U.S. Navy Yard, Brooklyn, and is part of U. S. property, **12,** 245.

PROJECTS.

By Maj. Adams, 1898, chan. with 20′ x 250-350′ from entrance to vicinity of new masonry causeway; est., $40,000, **99,** 1252.

SURVEYS.

Ex. for imp. by cutting off a portion of an isld. known as Cob Dock Isld. and securing 20′ x 300′ au. act June 3, 1896; made, 1896, by Lt. Col. Gillespie (**R.** fav.), **97,** 1047.

Sur. au. joint res. of Congress, 1898; made by Maj. Adams, 1898 (see Projects), **99,** 1252.

Sur. of chan. au., and completed, **09,** 1074.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 245.

Part (p), F-105 New York Harbor—Staten Island Ice Breaker, N. Y.

APPROPRIATION.

(July 4, 1836, $19,500. H. D. 482, 55th, 2d.)
(Repeated in app. preceding Part b.)

F-106 GOWANUS CREEK, N. Y.

ENGINEERS.

Chief of Engineers. R., 84, 105.
In charge. Col. J. Newton. **R., 84,** 713.

PLANS.

In 1882 a line of canal having taken the place of the creek, Col. Newton reported the creek unworthy of imp., **84,** 714.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Col. Newton, **84,** 713.

F-109 NEWTOWN CREEK, N. Y.

APPROPRIATIONS.

1880,	$10,000,	**80,** 510.
1882,	15,000,	**82,** 663.
1884,	20,000,	**84,** 727.
1886,	37,500,	**86,** 719.
1888,	25,000,	**88,** 609.
1890,	35,000,	**90,** 723.
1892,	35,000,	**92,** 813.
1894,	20,000,	**95,** 939.
1896,	30,000,	**96,** 762.
1897,	183,000,	**97,** 1127.
1902,	*400,	**04,** 1034.
1905,	5,000,	**05,** 975.
1907	5,000 / 15,000	**07,** 1003.
1910,	10,000,	**10,** 1199.
1911,	20,000,	**11,** 1307.
1912,	15,000,	**12,** 1520.
Total,	480,900	(incl. misc., $481,218.48, **12.** 1520).

COMMERCE.

Important, **78,** 427, 428.
Large trade in oil, **80,** 510.
Value of, **83,** 562.
Description of West Branch, **95,** 1008.
Connection with Flushing B.: Description of probable C., **97,** 1159.
Rates greatly reduced as result of imp., **05,** 126.
1911, 5,435,016 t., **12,** 1521.

CONTRACTS.

1880. W. Flannery, dr., 43¢ c. y., **81,** 640.
1883. H. N. & A. J. Beardsley, dr., 27¢ c. y., **83,** 563.
1884. Atlantic Dredging Co., dr., 23½¢ c. y., **85,** 669.
1887. Morris & Cumings Dredging Co., dr., 32¢ and 34½¢ c. y., **87,** 702.
1889. J. A. Simmons, dr., 18½¢ c. y., **89,** 779.
1890. Atlantic Dredging Co., dr., 26¢ and 40¢ c. y., **91,** 910.
1892. T. Potter, dr., 26¢, 29¢, 40¢, and 70¢ c. y. ($32,533.30), **93,** 1049.
1894. T. Potter, dr., 24¢ and 27¢ c. y. ($18,900), **95,** 939.
1896. J. H. Fenner, dr., 17⅜¢ c. y.; removal of bowlders, $8 c. y. ($193,268.75), **97,** 1127.
1903. R. G. Packard Co., dr., 21⅝¢ c. y., **04,** 1034.
1904. Merritt & Chapman Derrick & Wrecking Co., removal of obstr. at mouth of creek, lump sum of $558, **04,** 1033.
1907. Seely-Taylor Co., dr. 11,290 c. y., 31¢ c. y., s. m., **07,** 1003.
1910. Morris & Cumings Dredging Co., dr., etc., prices listed, **11,** 1307.
1912. Morris & Cumings Dredging Co., dr., about 84,210 c. y., 28½¢ c. y., **12,** 1520.

ENGINEERS.

Chief of Engineers. R., 78, 58; **79,** 66; **80,** 83; **81,** 102; **82,** 103; **83,** 101; **84,** 107, 122; **85,** 91; **86,** 96; **87,** 60; **88,** 61; **89,** 76; **90,** 68; **91,** 87; **92** 91; **93,** 99; **94,** 89; **95,** 102, 121; **96,** 92; **97,** 128, 139; **98,** 123; **99,** 137; **00,** 155; **01,** 207; **02,** 145; **03,** 133; **04,** 118; **05,** 125; **06,** 130; **07,** 134; **08,** 140; **09,** 143; **10,** 161; **11,** 202; **12,** 243.

In charge:

Lt. Col. J. Newton, 1879–83. **R., 78,** 427; (Col.) **80,** 509; **81,** 638; **82,** 661.

Lt. Col. G. L. Gillespie, 1883–85. **R., 83,** 561; **84,** 726, 765.

Lt. Col. W. McFarland, 1885–89. **R., 85,** 668; **86,** 717; **87,** 699; **88,** 606.

Lt. Col. G. L. Gillespie, 1889–95. **R., 89,** 777; **90,** 720; **91,** 906; **92,** 810; **93,** 1044; **94,** 757; **95** 935, 1006.

Maj. H. M. Adams, 1896–98. **R., 96,** 759; **97,** 1125, 1159; **98,** 1022.

*Allotment.

Lt. Col. W. H. H. Benyaurd, 1899. **R., 99,** 1239.
Maj. E. H. Ruffner, 1900. **R., 00,** 1411.
Col. S. M. Mansfield, 1901–02. **R., 01,** 1216; **02,** 960.
Col. Amos Stickney, 1903. **R., 03,** 873.
Capt. E. H. Schulz, 1904. **R., 04,** 1033.
Col. W. R. Livermore, 1905–06. **R., 05,** 974; **06,** 957.
Col. J. G. D. Knight, 1907–08. **R., 07,** 1002; **08,** 1052.
Col. W. M. Black, 1909–10. **R., 09,** 1073; **10,** 1198.
Col. S. W. Roessler, 1911–. **R., 11,** 1306; **12,** 1520.

Assistant. A. Doerflinger. **R., 84,** 767.

OBSTRUCTIONS.

In 1892 the Sec. of War directed that the Meeker Ave. Br. should be altered to conform to the bulkhead line, and should be provided with draw opening on either side of the pivot pier 65′ w. in the clear, **93,** 1047. Alterations completed, **94,** 759.

In 1893 the Vernon Ave. Br. considered an obstr., **93,** 1047. Repair and mainten. of the br., and its operation by a modern motor attachment was ordered by the Sec. of War in 1893, **94,** 759. Plans for a lift br., and for a temporary br. during the constr. of the former, approved by the Sec. of War, **95,** 939.

List of brs. crossing the creek, **94,** 759.

Complaint of obstr. near mouth of creek, **04,** 1033.

OPERATIONS.

1880–81. Chan. 18 x′ 60′ dr. from mouth of creek to Vernon Ave., **81,** 638.

1882–83. 52,005 c. y. dr. from chan. at br., **83,** 561.

1884–85. 51,468 c. y. dr. from chan., **85,** 669.

1886–87. 24,675 c. y. dr., **87,** 700.

1887–88. 50,248 c. y. dr., **88,** 608.

1888–89. 7,738 c. y. dr., **89,** 779.

1889–90. 83,850 c. y. dr., **90,** 722.

1890–91. 78,520 c. y. dr., **92,** 909.

1891–92. 15,648 c. y. dr., **92,** 812.

1892–93. 91,981 c. y. dr., **93,** 1047.

1894–95. 72,394 c. y. dr. and about 150 t. bowlders removed, **95,** 937.

1896–97. 136,158 c. y. dr. and 99 c. y. bowlders removed, **97,** 1126.

1897–98. 423,587 c. y. dr. and 95 c. y. bowlders removed, **98,** 1023.

1898–99. 456,637 c. y. dr. and 268 c. y. bowlders removed, **99,** 1240.

1903–04. 65,519 c. y. dr. and 2 large bowlders removed; obstr. at mouth of creek removed, consisting of 2 large bowlders, **04,** 1033.

1906–07. 11,116.8 c. y. dr., restoring 1,700′ l. of chan. just below Greenpoint Ave. Br. to proj. d. of 8′ x 90′ m. l. w., **07,** 1003.

1908–09. A large bowlder and several obstr. endangering navigation in vicinity of Meeker Ave. Br. removed and disposed of, **09,** 1073.

1910–11. 47,322 c. y. material other than ledge, bowlders, broken st., etc., and 66.16 c. y. of the latter, over ½ c. y. in size, excavated, restoring 1,700 l. f. of chan. below Greenpoint Ave. Br. to proj. l. of 18′ and w. of 90′, **11,** 1307.

1911–12. 5,666 c. y. material dr., restoring 8′ x 90′ x 500′ of chan. in immediate vicinity of Meeker Ave. Br., **12,** 1520.

PHYSICAL CHARACTERISTICS.

Description, **78,** 427, 428; **88,** 606.

Description of, W. Branch, **95,** 1007.

Description of, proposed connection with Flushing B., **97,** 1159.

A portion of the W. Branch a canal built by private enterprise for the reclamation of land for profit, **95,** 1008.

In 1896 there was no connecting chan. between Flushing B. and the creek. The two waters were separated by 4 m. of land. Connection was sought as a means of freeing the creek from sewage, etc., **97,** 1159, 1160.

Max. draft 18′ m. l. w.; total l. of navigablo chan. about 4 m., w. 125′. Head of navigation in each branch is at the Metropolitan Ave. Br., **05,** 126.

An inlet of East R., between Brooklyn and Queens Boroughs, N. Y. C., for 4 m., **12,** 243.

PLANS.

By Lt. Col. Newton, 1878, removing deposits to 14′ in d.; est., $2,000. Repeated dr. would be required to maintain, **78,** 428, 429.

PRIVATE WORK.

Much of the W. Branch dr., rectified, and d. by private enterprise, the excavated material being used to reclaim land from the neighboring marshes before 1895, **95,** 1007.

PROJECTS.

By Col. Newton, 1880, imp. of the creek by d. chan. from 18′ to 21′ l. w. and 200′ w. from mouth to Vernon Ave.; est., $44,050, **80,** 511; **81,** 636; **82** 662; **86,** 96.

By Lt. Col. Gillespie, 1884, imp. of creek from Vernon Ave. Br. to head of navigation by excavation of a chan. from 125′–150′ w., and with a d. of 18′ to the Central Oil Works, 15′ to Queens Co. Oil Works, 12′ to Nichol's Chemical Works, and 10′ thence to the head of navigation; est., $255,569, **84,** 766; **86,** 718; **87,** 699; **92,** 810.

In 1896 Maj. Adams est. $450,000 additional to obtain 18′ x 125′, and the constr. of such a chan. was au. by Congress, 1896, **96,** 761, 762. Est reduced later to $213,000; increased to $228,000, 1912, **12,** 243.

SURVEYS.

Ex. at junction with East R. made, 1878, by Lt. Col. Newton, **78,** 427.

Au. act Mar. 3, 1879; made, 1880, by Col. Newton, **79,** 66; **80,** 510.

From mouth to Metropolitan Ave. au. act Aug. 21, 1882; made, 1882, by Maj. Gillespie, **84,** 765.

Ex. of W. Branch from Metropolitan Ave. Br. to the head of navigation, au. act Aug. 17, 1894; made by Lt. Col. Gillespie in 1894. **R.** unfav., **95,** 1006.

Est. of the cost of securing an 18′ chan. d. with w. of 125′ called for by joint resol. of Congress, Mar. 11, 1896, submitted by Maj. Adams in 1896 (see Projects), **96,** 759, 763.

Ex. with a view to the constr. of a chan. connecting Flushing B. with the creek, au. act June 3, 1896; made, 1896, by Maj. Adams. **R.** unfav., **97,** 1159.

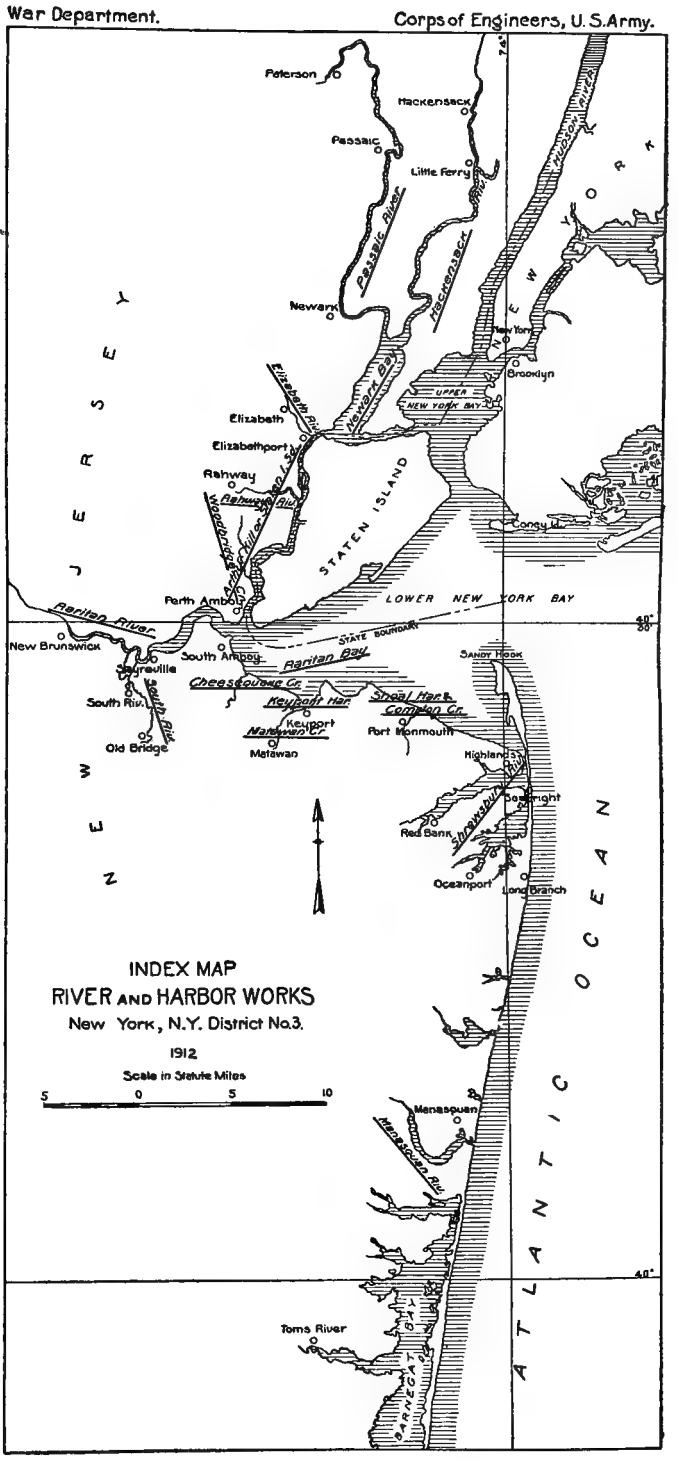
Minor, to determine where shoaling had taken place, **07,** 1002.

Cong. docs., etc., relating to ex., sur., plans, etc., **12,** 244.

Maps. **85,** 668; **04,** 1034.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

G.—NEW YORK, N. Y., DISTRICT No. 3.


War Department.
Corps of Engineers, U.S.Army.
INDEX MAP
RIVER AND HARBOR WORKS
New York, N.Y. District No.3.
1912
Scale in Statute Miles
5 0 5 10
Peterson
Hackensack
Passaic
Little Ferry
Passaic River
Hackensack Riv.
Newark
New York
Brooklyn
UPPER NEW YORK BAY
Newark Bay
Elizabeth Riv.
Elizabeth
Elizabethport
Rahway
Rahway Riv.
Woodbridge
Arthur Kill or Sen. I. Sd.
STATEN ISLAND
Coney Id.
Perth Amboy
LOWER NEW YORK BAY
Raritan River
New Brunswick
South Amboy
STATE BOUNDARY
Raritan Bay
Sandy Hook
Sayreville
South Riv.
South Riv.
Cheesequake Cr.
Keyport Har.
Shoal Har. & Compton Cr.
Keyport
Matawan Cr.
Port Monmouth
Old Bridge
Matawan
Highlands
Shrewsbury Riv.
Seabright
Red Bank
Oceanport
Long Branch
Manasquan
Manasquan Riv.
Toms River
BARNEGAT BAY
NEW JERSEY
NEW YORK
ATLANTIC OCEAN
HUDSON RIVER
74°
40° 50'
40°

G.—NEW YORK, N. Y., DISTRICT—NO. 3.

In charge of U. S. Engineer Office,
Army Building, New York City.

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1 Atlantic Ocean.
2 New York H. & Bay, N. Y. and N. J. (1)
3 Kill Van Kull, N. Y. and N. J. (2)
4 Newark B., N. J. and N. Y. (3)
5 Bergen Neck, N. J. (Ship Canal) (4)
6 Hackensack R., N. J. (4)
7 Penhorn Cr., N. J. (6)
8 Division Cr., N. J. (6)
9 Mill Cr., N. J. (6)
10 Croma Kill, N. J. (6)
11 Bellmans Cr., N. J. (6)
12 Overpeck Cr., N. J. (6)
13 Berrys Cr., N. J. (6)
14 Kingsland Cr., N. J. (6)
15 Saw Mill Cr., N. J. (6)
16 Passaic R., N. J. (4)
17 Saddle R., N. J. (16)
18 Weasel Brook, N. J. (16)
19 Third R., N. J. (16)
20 Second R., N. J. (16)
21 Arthur Kill, N. Y. and N. J. (4) (23)
22 Shooters Isld. Chan., N. Y. and N. J. (4)
23 Raritan B., N. Y. and N. J. (2)
24 Great Kills, N. Y. (23)
25 Lemon Cr., N. Y. (23)
26 Princess Bay, Staten Island, N. Y. (23)
27 Arthur Kill, N. Y. and N. J. (4) (23)
28 Fresh Kills, N. Y. (27)
29 Old Place Cr., N. Y. (27)
30 Elizabeth R., N. J. (27)
31 Morse Cr., N. J. (27)
32 Piles Cr., N. J. (27)
G 33 Rahway R., N. J. (27)
G 34 Smiths Cr., N. J. (27)
G 35 Woodbridge Cr., N. J. (27)
G 36 Raritan R., N. J. (23)
G 37 Red Root Cr., N. J. (36)
G 38 Lawrence Brook, N. J. (36)
G 39 South R., N. J. (36)
G 40 Cheesequake Cr., N. J. (23)
G 41 Stump Cr., N. J. (40)
G 42 Whale Cr., N. J. (23)
G 43 Keyport H., N. J. (23)
G 44 Matawan Cr., N. J. (43)
G 45 Waackaack Cr., N. J. (23)
G 46 Shoal H., N. J. (Sandy Hook Bay) (2)
G 47 Compton Cr., N. J. (46)
G 48 Shrewsbury R., N. J. (Sandy Hook Bay) (2)
G 49 Navesink R., N. J. (48)
G 50 Atlantic Highlands, N. J. (Sandy Hook Bay (2)
G 51 Clay Pit Cr., N. J. (49)
G 52 Swimming R., N. J. (49)
G 53 South Branch, Shrewsbury R., N. J. (48)
G 54 Little Silver Cr., N. J. (53)
G 55 Parkers Cr., N. J. (53)
G 56 Pleasure B., N. J. (53)
G 57 Solomons Cr., N. J. (53)
G 58 Long Branch, N. J. (1)
G 59 Shark R., N. J. (1)
G 60 Manasquan R., N. J. (1)

-3 KILL VAN KULL, N. J.

NGINEERS.

Chief of Engineers. **R., 06,** 167; **07,** 175.
In charge:
Col. W. R. Livermore, **06,** 147; 154.
Col. D. W. Lockwood, **07,** 154.

URVEY.

Ex. and sur. au. act Mar. 3, 1905, from n. of ooters Isld. to existing chan. near Corner Stake Light, incl. reef at Bergen Pt. Light, for 16′; **Rs.** by Col. Livermore, 1906, and by Col. Lockwood, 1906; est., $280,115, with $5,000 an. mainten.,[1] **06,** 167, 168; **07,** 175.

Pre. ex. from Kill von Kull to a point in vicinity of Bedloe (Liberty) Isld., w. of Robbins Reef lighthouse, with view to 21′ chan. of sufficient w., au. act. Mar. 3, 1905. **R.,** Col. W. R. Livermore, Dec. 5, 1906 (unfav.), **07,** 175 (H. R. 59, 2nd, 273).
Map.[1]

-4 NEWARK BAY, N. J.

PROPRIATIONS.

Aug. 30, 1852, sur., $2,000; imp., $10,000; total $12,000. Sur.—**R.,** Jan. 27, 1853; est., $25,000. (H. Doc. No. 482, 55th Cong., 2d sess.)

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[1] H. D. 337, 59, 2.

G-5 BERGEN NECK, N. J.—SHIP CANAL ACROSS.

COMMERCE.

Important, **80,** 533.

ENGINEERS.

Chief of Engineers. **R., 80,** 85.
In charge. Lt. Col. J. Newton, 1880. **R., 80,** 529.
Assistant. R. H. Talcott. **R., 80,** 530.

PHYSICAL CHARACTERISTICS.

Described, **80,** 531. Tidal obstructions, **80,** 531.

PLANS.

By Lt. Col. Newton, 1880, connecting Newark B. with upper New York B. by a canal 4,500′ x 12′ m. l. w., 200′ w. at bottom; est., exclusive of land damages, $3,332,426.88, **80,** 530, 532.

PRIVATE, STATE, AND CORPORATE WORK.

Morris Canal crosses Bergen Neck at site proposed for ship canal, **80,** 531.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 66, 1879; made by Col. Newton, 1880, **80,** 530.
Maps. **80,** 530.

G-6 HACKENSACK RIVER, N. J.

APPROPRIATIONS.

1912, $50,000, **12,** 1536.

COMMERCE.

1911, 314,200± t., **12,** 1537.

ENGINEERS.

Chief of Engineers. **R., 89,** 93; **91,** 108; **10,** 212; **12,** 257, 279.

In charge:
Capt. G. McC. Derby, 1888. **R., 89,** 841.
Capt. T. L. Casey, 1888–91. **R., 89,** 842; **91,** 1016, 1018.
Col. D. W. Lockwood, **10,** 189.
Col. W. T. Rossell, 1910–. **10,** 189; **R., 12,** 1536.

Assistant. C. S. Kelsey. **R., 89,** 844; **91,** 1019.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 842; **91,** 1017; **12,** 257.
Rises in N. Y.; flows s. and empties into head of Newark B., about 34 m. in a direct line from source. R. is navigable to New Milford, about 20 m. from mouth, where navigation is cut off by low dams of Hackensack Water Co.; distances of various points on R., **12,** 257.

PLANS.

By Capt. Casey, 1889, providing and maintaining chan. 10′ d. m. l. w., and 200–150′ w. from mouth to Turnpike Br. at Hackensack; est., $60,114; or, for a modified imp., dr. a chan. 8′ m. l. w., and from 200′ w., the mouth to Turnpike Br.; est., $22,308, **89,** 845.

PROJECT.

Act July 25, 1912, provides for making and maintaining chan. 12′ x 200′ m. l. w., Newark B. to Little Ferry, thence 150′ w. to the New York, Susquehanna & Western RR. br.; est., $171,018.10, and $6,000 an. mainten.,[1] **12,** 258.

SURVEYS.

Sur. au. act Aug. 11, 1888; made, 1889, by Capt. Casey (**R.** fav.), **89,** 842; **91,** 1018.
R. by BERH., Sept. 8, 1908, reviewing ex. 1888 and 1899. Recom. imp. to extent of $60,000.[2]
Pre. ex. and sur. au. act Mar. 3, 1909, for chan. 16′, Newark B. to Little Ferry; 12′, Little Ferry to Hackensack; **Rs.,** Col. Lockwood, 1909, and by Col. Rossell, 1910; est., $171,018.10 presented,[1] **10,** 212.
Pre. ex. of Newark B., Passaic and Hackensack Rs., N. J., au. act June 25, 1910; **Rs.,** 1911 and 1912, by Col. Rossell; est., $1,064,800, with $20,000 an. mainten.[3] **12,** 279.
Maps.[1] **89,** 844.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 258.

G-16 PASSAIC RIVER, N. J.

Part.	Title.	Period.	Appropriations.
a	Passaic River—above Newark	1872–1879	$112,000
b	.....do	1880–1892	26,850
c	Below Newark	1880–1892	239,500
d	Passaic River	1892–1912	1,222,000
	Total		1,600,350

Part (a), G-16 Passaic River, N. J. (above Newark).[4]

APPROPRIATIONS.

1872,	$25,000, **72,** 80, 805.
1873,	25,000, **73,** 85.
1874,	20,000, **74,** 95, ii, 166.
1875,	20,000, **75,** 102, ii, 221.
1876,	10,000, **76,** 56, 249; **77,** 50, 249.
1878,	10,000, **78,** 56, 415.
1879,	2,000, **79,** 64, 392.
Total,	112,000

CONTRACTS.

1872. Morris & Cumings, dr. st., $1.10 c. y.; sand, gravel, etc., 90¢ c. y., **73,** 938; **74,** ii, 165; **75,** ii 220.
1873. J. Caler, dr., **74,** ii, 166; **75,** ii, 220.

ENGINEERS.

Chief of Engineers. **R., 71,** 83; **72,** 80; **73,** 85; **74,** 95; **75,** 102; **76,** 55; **77,** 50; **78,** 55; **79,** 391.

[1] H. D. 643, 61st, 2d.
[2] Comm. D. 21, 61st, 2d.
[3] H. D. 707, 62d, 2d.
[4] As stated in appropriation acts

In charge:
Lt. Col. J. Newton, 1872–79. **R., 72,** 805, 807, 808; '3, 938; **74,** ii, 165; **75,** ii, 220; **76,** 248; **78,** 415; '9, 391.
Capt. J. Mercur, 1877. **R., 77,** 248.

Assistant. Capt. J. Mercur, **78,** 415.

ESTIMATES. (See Projects.)
By Lt. Col. Newton, 1872, thorough imp., $251,-49; partial, $123,924, **72,** 807, 809.
By Lt. Col. Newton, 1879, completion of existing roj., $11,924, **79,** 392.

OPERATIONS.
Belleville Bar:
1872–73. Removal of 4,719 c. y. by dr.; 750′ of mbankment built, **73,** 85, 938.
1873–74. Removal of 5,820 c. y. of st. and 3,807 . y. of sand, etc.; blasting bed r., by hired labor, o prepare for dr., **74,** ii, 165, 166.
1874–75. Completion of cut, 2,300′ x 75′ x7½′, nd dike 1,800′ l. Total amount of sand, etc., removed, 6,524 c. y.; of st., etc., 9,828 c. y., **75,** 102, ii, 20.
1875–76. Removal of loose st., a point of solid ., and a shoal at upper end of dike, **76,** 55, 248.
1876–77. 75′ of chan. cleared of loose st., **77,** 48.

Rutherford Park Bar:
1873–74. Cut 50′ x 2,900′ nearly completed, '4, ii, 166.
1874–75. Completion of cut, 6′ d., **75,** 102.
1875–76. Straightening the cut by drilling, blasting, and grappling, **76,** 248.
1876–77. Removal of 395 c. y. loose st. and bowlders from sides of the cut; 685′ of chan. cleared, **77,** 50.

Holsman's Bar, and other bars:
1874–75. Removal of r. and bowlders from opposite Passaic, by hired labor, **75,** 102.
1875–76. Drilling, blasting, and dr. a cut 40 x 1,300′, or 6′ x 50′; a small bar above removed by dr. a cut 300′ l., **76,** 248.

From Newark to Passaic:
1877–78. Work of clearing chan. of loose st. continued, shoal dr. near Erie RR. br., **78,** 55, 415.
1878–79. Dr., removal of bowlders, etc. Results, the R. in good condition from Montclair and Greenwood Lake RR. br. to Passaic for vessels drawing 6′, regardless of tides, **79,** 63, 391.

PHYSICAL CHARACTERISTICS.
Description, **72,** 807, 808; **73,** 939; **74,** ii, 166.

PROJECTS. (See Plans.)
By Lt. Col. Newton, 1872, thorough imp. of R.; est., $251,349; partial, $123,924, dr. and diking; the latter proj. adopted, **72,** 805, 807.

SURVEY.
By Lt. Col. Newton, 1871, **71,** 83. **R., 72,** 807.

Part (b), G-16 Passaic River, N. J., above Newark.

APPROPRIATIONS.

1880,	$2,000,	**80,** 536.
1882,	7,000,	**82,** 684.
1884,	3,000,	**84,** 739.
1886,	2,250,	**86,** 797.
1888,	7,500,	**88,** 646.
1890,	5,100,	**90,** 849.
Total,	26,850	

COMMERCE.
C. interests of R., **88,** 646.

CONTRACTS.
1883. F. Pidgeon, dr., 38¾¢ c. y., **84,** 739.
1884. R. Parrott, dr., 49¢ c. y., **85,** 746.
1891. R. Parrott, drg., 35¢ c. y., **91,** 992.

ENGINEERS.
Chief of Engineers. **R., 80,** 86; **81,** 108; **82,** 09; **83,** 105; **84,** 111, 122; **85,** 102; **86,** 111; **87,** 68; 8, 68; **89,** 87; **90,** 78; **91,** 100; **92,** 102.

In charge:
Lt. Col. N. Michler, 1880–82. **R., 80,** 535; **81,** 87.
Lt. Col. G. L. Gillespie, 1882–85. **R., 82,** 684; 3, 571; **84,** 737, 780, 782; **85,** 744.
Lt. Col. W. McFarland, 1886. **R., 86,** 792.
Lt. G. McC. Derby, 1887–89. **R., 87,** 763; (Capt.) 8, 645.
Capt. T. L. Casey, 1889–92. **R., 89,** 824; **90,** 848; 1, 990; **92,** 876.

Assistant. A. R. Doerflinger. **R., 84,** 784.

OPERATIONS.
1879–80. 328 c. y. st. removed from chan., **80,** 35.
1880–81. St. abutment removed at expense of New York Lake Erie & Western RR., **81,** 687.
1883–84. 19,190 c. y. sand and gravel removed from shoals between Erie and Montclair & Greenwood RR. brs., **84,** 738.
1884–85. 1,945 c. y. dr. from Lime Kiln and Middle bars, **85,** 744.
1891–92. 10,718 c. y. dr. under contract and 2,333 c. y. by hired labor, **92,** 877.

PHYSICAL CHARACTERISTICS.
Description of R., **84,** 780.

PLANS. (See Projects.)
By Maj. G. L. Gillespie, 1884, extension of imp. from Passaic to Paterson; est., $380,000 to $611,000, **84,** 782, 784.

PRIVATE (CORPORATE) WORK. (See Operations.)
Occupation of R. between Passaic and Paterson by a corporate company, **84,** 780, 782, 784.

PROJECTS. (See Plans.)
By Lt. Col. Newton, 1872, partial imp. of R. above Newark, to afford chan. 6′ d. l. w. to the head of navigation at Passaic, by means of drg. and dike constr.; est., $123,924, **72,** 805, 807; **80,** 536; **86,** 793.
In 1885 proj. amended to provide for chan. 7½′ d. from the Erie to the Montclair & Greenwood RR. br., **87,** 764.
1886, est. $7,512 would be required for completion of proj., **86,** 796, 797; increased, 1890, to $8,199.79, to include plant purchased, **90,** 849.
By Capt. Casey, 1890, chan. 6′ x 100′ for 1,600′ through Third R. Bar; also for removal of bowlders at various points in the R., increasing the total est. to $193,822, **91,** 991, 992.

SURVEYS.
Between Passaic and Paterson au. act Aug. 2, 1882; made, 1884, by Maj. Gillespie, **84,** 780, 782.
Of R. above Newark; made, 1889, by Capt. Casey, **90,** 848.
Maps. **81,** 688; **87,** 766.

Part (c), G-16 Passaic River, N. J., below Newark.[1]

APPROPRIATIONS.

1880,	$30,000,	**80,** 536.
1881,	50,000,	**81,** 689.
1882,	43,000,	**82,** 686.
1884,	25,000,	**84,** 741.
1886,	24,000,	**86,** 800.
1888,	27,500,	**88,** 648.
1890,	40,000,	**90,** 851.
Total,	239,500	

COMMERCE.

Necessity for completion of imp., **83,** 574.
C. interests of R., **88,** 647, 648.

CONTRACTS.

1880. H. Du Bois & Sons, pile-dike constr., **81,** 690.
1881. E. M. Payn, drg. 13.9¢ c. y., **81,** 690. H. Du Bois & Sons, pile-dike constr., **81,** 690. E. Brainard, jr., drg., 10⅞¢ c. y., **82,** 686.
1882. Morris & Cumings, drg., 22½¢ c. y., **83,** 574.
1884. H. Du Bois & Sons, drg., 10¢ c. y., **85,** 748.
1886. P. S. Ross, pile-dike constr., $11.50 l. f., **87,** 767.
1889. R. G. Packard, drg., 22¢ c. y., **90,** 850.
1891. R. G. Packard, drg., 30¢ c. y., **91,** 990.

ENGINEERS.

Chief of Engineers. **R., 80,** 86; **81,** 109; **82,** 110; **83,** 106; **84,** 112; **85,** 103; **86,** 112; **87,** 68; **88,** 69; **89,** 88; **90,** 79; **91,** 99; **92,** 102.

In charge:
Col. J. Newton, 1880. **R., 80,** 537.
Lt. Col. N. Michler, 1880–82. **R., 80,** 536; **81,** 688.
Lt. Col. G. L. Gillespie, 1882–85. **R., 82,** 684; **83,** 572; **84,** 740; **85,** 746.
Lt. Col. W. McFarland, 1885–86. **R., 86,** 792.
Lt. G. McC. Derby, 1886–89. **R., 87,** 764; (Capt.) **88,** 646.
Capt. T. L. Casey, 1889–92. **R., 89,** 825; **90,** 849; **91,** 988; **92,** 873.

OPERATIONS.

1880–81. 2,000 l. f. of diking built at mouth of R.; 19,263 c. y. dr. from chan., **81,** 689.
1881–82. 134,589 c. y. dr. from chan.; 2,003 l. f. of pile diking built, **82,** 685.
1882–83. 228,993 c. y. dr. from chan., **83,** 572.
1883–84. 110,221 c. y. dr. from chan., **84,** 740.
1884–85. 699 l. f. of diking built; 34,509 c. y. dr., **85,** 747.
1885–86. 110,221 c. y. dr.; repairs to dike, **86,** 799.
1886–87. 1,000 l. f. of pile dike built, **87,** 765.
1887–88. 500 l. f. of dike built, **88,** 647.
1888–89. Dike extension under contract continued, **89,** 826.
1889–90. 66,008 c. y. dr., **90,** 850.
1891–92. 100,692 c. y. dr., **92,** 873.

PROJECTS.

By Col. Newton, 1880, chan. 10′ x 200′ m. l. w. from Pennsylvania RR. br. at Newark to Newark B., by dr. and constr. of 15,800 l. f. of pile dike; est., $232,875, **80,** 537; **84,** 741.

By Lt. Col. Gillespie, 1884, extension of chan. through shoals in Newark B. by dr., and the extension of the dike at the mouth of the R. about 8,000′; est., $121,000, increasing orig. est. to $353,875, **84,** 741; **87,** 765, 766.

SURVEYS.

Maps. **81,** 688; **82,** 686; **87,** 766.

Part (d), G-16 Passaic River, N. J.[2]

APPROPRIATIONS.

1892,	$45,000,	**92,** 875.
1894,	15,000,	**95,** 976.
1896,	15,000,	**96,** 774.
1899,	15,000,	**99,** 1303.
1901,	*1,000,	**02,** 1011.
1902,	75,000,	**02,** 1011.
1903,	*10,000,	**03,** 931.
1903,	100,000,	**03,** 931.
1904,	*10,000,	**04,** 1134.
1905	75,000 / 40,000	**05,** 1030.
1906,	46,000,	**06,** 996.
1907,	253,000,	**07,** 1045.
1908,	65,000,	**08,** 1091.
1909,	200,000,	**09,** 1105.
1910,	150,000,	**10,** 1228.
1911,	65,000,	**11,** 1318.
1912	38,000 / 5,000	**12,** 1532.
Total,	1,223,000	(incl. misc. rects., and less $1,000 returned to Treas., 1902, $1,222,186.38, **12,** 1532).

COMMERCE.

Description of, **1900,** 1533, 1544.

"The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 2,037,363 tons in 1900; to 2,009,356 tons in 1901; to 2 494,312 tons in 1902; to 2,356,511 tons in 1903; to 2,567,942 tons in 1904; to 2,567,000 tons in 1905; to 2,577,188 tons in 1906 and 1907, valued at $167,113,305; in 1908 to 2,110,959 tons, valued at $171,612,700; in 1909 to 2,650,809 short tons, valued at $164,800,203; and in 1910 to 2,266,291 short tons, valued at $62,216,587, including the commerce of Hackensack River which passes through Newark Bay. Tonnage reported before 1908 in long tons since reported in short tons.

"This improvement is necessary to the great industrial interests and has reduced freight rates $1 a ton on coal and building materials, and its continuance is necessary to the successful carrying on of the business of this locality." **03,** 931; **05,** 142; **12,** 1534.

CONTRACTS.

1892. J. McSpirit, dr., 75¢ c. y.; removal of bowlders, $5 c. y. ($8,000), **93,** 1112.
1893. P. S. Ross, dr., 33¢ c. y. ($20,000), **93,** 1112.
1895. A. E. Smith, dr., 28.9¢ and 95¢ c. y.; bowlder removal, $4.50 c. y. ($15,835), **95,** 977.
1899. P. Sanford Ross (Inc.), dr., 17½¢ c. y. J. O. Stokes, r. removal, $16.20 and $17.33 c. y.; dr., 27¢ and 36¢ c. y. ($6,183.50), **00,** 1501.
1903. R. B. Rodermond, removal of bowlders, $8 c. y., s. m., **04,** 1134.
1904. Kirk, Driscoll & Co., dr. 500,000 c. y., 15¢ c. y., **04,** 1135. P. Sanford Ross, dr. about 707,000 c. y. from chan. from center of Newark B. to w. shore of same, 19.8¢ c. y., **05,** 1031.
1906. John & Joseph McSpirit, dr. to amount of $18,000, at 75¢ c. y., s. m., and for bowlders over ½ c. y. size, $7.50 c. y. The International Contracting Co., dr. 157,600 c. y., 25¢ c. y., s. m., **07,** 1046.
1907. Midland Land & Improvement Co., dr. about 4,177,110 c. y., 16½¢ c. y., **08,** 1091.
1910. International Contracting Co., dr. 39,000 c. y., 50¢ c. y., s. m.; and for dr. 16,000 c. y. above Montclair & Greenwood Lake RR. br., 75¢ c. y., s. m., **10,** 1228.

*Allotment. [1] Sur.—**R.,** Jan. 23, 1837; est., $40,000. (H. D. 482, 55th, 2d.) [2] Consolidated project.

1911. Midland Land & Improvement Co., pple., dr. bends in R. below Montclair & Greenwood Lake RR. br., 16½¢ c. y., s. m., material to be moved not to exceed the quantity stated in orig. ntract (4,177,110 c. y.) by more than 10%, **12,** 33.

NGINEERS.

Chief of Engineers. R., 93, 109; **94,** 99; **95,** 1; **96,** 95; **97,** 129; **98,** 135; **99,** 155, 164; **00,** 7, 188; **01,** 214; **02,** 161; **03,** 145; **04,** 134; **05,** 1; **06,** 147, 168; **07,** 154, 175; **08,** 162; **09,** 165, 187; 0, 189; **11,** 210, 233; **12,** 254, 278, 279.

In charge:
Capt. T. L. Casey, 1889–94. **R., 93,** 1108; **94,** 801.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 973.
Maj. H. M. Adams, 1896–97. **R., 96,** 770; **97,** 28.
Maj. A. M. Miller, 1898. **R., 98,** 1059.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1303; 0, 1500, 1530, 1536, 1543, 1547.
Col. S. M. Mansfield, 1901. **R., 01,** 1231.
Capt. Spencer Cosby, 1902. **R., 02,** 1010.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 927.
Col. W. R. Livermore, 1904–06. **R., 04,** 1132; 5, 1028; **06,** 993.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1042; 8, 1087; **09,** 1101.
Col. W. T. Rossell, 1910–. **R., 10,** 1225; **11,** 1315; 2, 1529.

Assistant. C. S. Kelsey. **R., 00,** 1546, 1550.

BSTRUCTIONS.

Passaic County brs. (3 above Dundee Dam and 1 elow it), **00,** 1552.

PERATIONS.

1892–93. 16,494 c. y. dr., **93,** 1109, 1111.
1893–94. 63,561 c. y. dr., and dike repaired, 4, 801, 803.
1894–95. 39,161 c. y. dr., and dike repaired, 5, 974, 976.
1895–96. 21,841 c. y. dr., **96,** 773.
1896–97. 77,977 c. y. dr., **97,** 1129.
1899–00. 28,422 c. y. dr. and some bowlders removed, **00,** 1500.
1900–01. 7,267 c. y. gravel, 45.6 c. y. bowlders, nd 292.93 c. y. ledge r. removed from bars at Belleelle, Rutherford Park, and Passaic City, **01,** 1231.
1903–04. 124,357 c. y. dr., and material deosited on e. side of R. between Newark Plank oad br. and Pennsylvania RR. freight br., and as pumped ashore on marsh between Passaic and ackensack Rs., **04,** 1132–33.
1904–05. 2,896 c. y. dr. and bowlders removed, xtending one cut on Lime Kiln Bar 8½′ x 25′ x 825′ . l. w.; total of 222,100 c. y. dr. under new proj., 5, 1028. 9,247 c. y. dr. from Newark B. and assaic R., **05,** 1029–30.
1905–06. 535,370 c. y. dr.; details given, **06,** 4.
1906–07. 194,665 c. y. soft material and 21.19 y. bowlders dr., **07,** 1042.
1907–08. 1,017,985 c. y. dr., **08,** 1087.
1908–09. 1,158,963 c. y. dr., **09,** 1102–03.
1909–10. 761,500 c. y. dr., **10,** 1229.
1910–11. 235,078 c. y. dr. for proj. of 1907; ,357 c. y. mud, sand, and gravel, and 19.8 c. y. owlders dr. for proj. of 1902; 14,040 c. y. dr. above ontclair & Greenwood Lake RR. br., **11,** 1317.
1911–12. 278,965 c. y. dr. for proj. of 1907, **12,** 30.

HYSICAL CHARACTERISTICS.

Table of distances by course of chan. below the ghway br. at Passaic City showing the relative sition of the several bars, brs., etc., **96,** 771.

Description of, **00,** 1533, 1543.
Complaints received that shoals had formed in R. at Newark, Rutherford, and Belleville, **03,** 930.
Areas dr. on various bars, **08,** 1089.
Rises n. N. J., flows e. and s. into Newark B.; navig. to Passaic, 16 m.; power dam cuts off navig. here, **12,** 254.

PROJECTS.

R. imp. under one head began again 1892, **93,** 109, 1108.
Col. Barlow est., 1899, $273,000 for 8′ and 12′ chan. 200′ w. from d. w. in Newark B. to Montclair RR. br., and $860,563 for 8′ chan. from Montclair RR. br. to Dundee Dam, **00,** 1545, 1546, 1550.
Act June 13, 1902, au. new proj. for imp. lower part of R., from Staten Isld. Sound through Newark B. and said R. to Montclair & Greenwood Lake RR. br., with chan. 12′ d. to Nairn Linoleum Works, and 10′ from that point to RR. br.; est., $296,000, and $5,000 an. mainten.,[1] **02,** 162. Est. increased to $323,274.60, **07,** 155.
Bids for dr. excessive; letter of Compt. of Treas. to Sec. of War of May 14, 1903, states that no money can be expend. from existing apps. except under a contract limiting cost of entire work within amount fixed by law, **03,** 929–30.
Cost of proj. au. 1902 increased by act Mar. 3, 1905, to $323,274; work to be done under continuing contract, **07,** 155.
Act Mar. 2, 1907, au. new proj. pr. chan. 16′ x 300′ m. l. w., d. w. in Newark B. to the Nairn Linoleum Works, 9.7 m., thence 200′ w. to the Montclair & Greenwood Lake RR. br., 1.1 m.; est., $1,216,775,[2] **07,** 155; mod. by act Feb. 27, 1911, to allow, in discretion of Sec. of War, w. of chan. at bends, **12,** 255.
The former projs. of 1902 and 1907 practically covered by a new proj., 1912, for increasing d. in Newark B. and Passaic R., to Montclair & Greenwood Lake RR. br. to 20′ m. l. w.,[3] **12,** 255.

SURVEYS.

Sur. of Newark B. in the vicinity of R. made in 1892 by Capt. Casey, **93,** 1109.
Ex. and sur. of Passaic R., Center St. Br. to Montclair RR. br., thence to Paterson, au. act Mar. 3, 1899; made, 1899, by Col. Barlow (**R.** fav.; see Projects), **00,** 1532, 1536, 1543, 1547.
Pre. ex. and sur. au. act Mar. 3, 1905, of Newark B. and Passaic R., from Staten Isld. Sound to Montclair & Greenwood Lake RR. br., with view to providing increased d. and w. **R.** by Col. Livermore, Jan. 18, and Col. Lockwood, Dec. 28, 1906, on pre. ex. and sur., resp.; est., $1,216,775,[2] **06,** 168; **07,** 175.
R. by BERH., reviewing former ex. and sur. reports. Recom. fav.; sur. necessary to determine.[4]
Pre. ex. and sur. au. act Mar. 3, 1909, of Newark B., with view to securing chan. along e. shore. **R.** by Col. Lockwood, Apr. 23, 1909[5] (unfav.), **09,** 187.
Pre. ex. and sur. au. act Mar. 3, 1909, of R. with view of extending continuous navigation from Montclair & Greenwood Lake RR. br. o the city of Paterson. **R.** by Col. Rossell, 1909 and 1910[6] (unfav.), **12,** 278.
Pre. ex. with plan and est. of cost of imp. of Newark B. and Passaic and Hackensack Rs., au. act June 25, 1910. **R.** by Col. Rossell, 1911 and 1912; plan of imp. est. to cost $1,064,800, and $20,000 an. mainten.,[2] **12,** 279.
Cong. docs., etc. relating to ex. surs. plans, etc., **12,** 256.

Maps.[6]
05, 1030.

[1] H. D. 401, 56th, 1st.
[2] H. D. 441, 59th, 2d.
[3] H. D. 707, 62d, 2d.
[4] Comm. D. 4, 59th, 2d.
[5] H. D. 80, 61st, 1st.
[6] H. D. 722, 62d, 2d.

G-23 RARITAN BAY, N. J.

APPROPRIATIONS.

1881, $50,000, **81,** 715.
1882, 50,000, **82,** 704.
1884, 20,000, **84,** 753.
1886, 37,500, **86,** 769.
888, 25,000, **88,** 636.
1890, 40,000, **90,** 756.
1892, 40,000, **92,** 836.
1894, 40,000, **95,** 963.
1896, 75,000, **96,** 790.
1899, 65,000, **99,** 1308.
1902, 45,000, **02,** 1014.
1905, 50,000, **05,** 1039.
1907, 25,000, **07,** 1055.
1909, 20,000, **09,** 1114.
1910, 20,000, **10,** 1238.
1911, 20,000, **11,** 1331.
1912, 10,000, **12,** 1543.

Total, 632,500 (incl. misc., $632,511.36, **12,** 1543).

COMMERCE.

Benefited by imp. made in B., **94,** 783.
Description of **99,** 1309; **00,** 1509.
Reduction in rates have resulted from imp., **05,** 147; **12,** 265.
Almost doubled in 1911 since 1901, **11,** 220.
Diagram of freight, value, and apps., **11,** 1336; **12,** 1544.
In 1911, 10,078,774 t., **12,** 265.

CONTRACTS.

1881. Atlantic Dredging Co., dr. 28¢ c. y., **81,** 716.
1882. Atlantic Dredging Co., dr., 22¢ c. y., **83,** 586.
1884. Atlantic Dredging Co., dr., 16¢ c. y., **85,** 759.
1888. Atlantic Dredging Co., dr., 23¾¢ c. y. **88,** 637.
1889. J. A. Simmons, dr., 18½¢ c. y., **89,** 796.
1891. T. Potter, dr., 16¾¢ and 18¾¢ c. y., **91,** 934.
1892. T. Potter, dr., 17½¢ and 21¢ c. y. ($35,805), **93,** 1074.
1894. Same firm, dr., 14.9¢ and 17¾¢ c. y. ($34,920), **95,** 963.
1896. R. G. & J. S. Packard, dr., 19¾¢ and 16¢ c. y., s. m. ($66,000), **97,** 1144.
1899. T. Potter, dr. 348,427 c. y., South Amboy Chan., 12.4¢ c. y.; International Contracting Co., dr. 194,172 c. y., Seguine Pt. Chan., 9.8¢ c. y., **00,** 1509.
1902. R. G. Packard & Co., dr. (250,000 c. y.), 16¢ c. y., s. m., **03,** 938.
1905. P. Sanford Ross, dr. (252,366 c. y.), 15.85¢ c. y., **06,** 1002.
1908. P. Sanford Ross (Inc.), dr. (105,263 c. y.), 20.9¢ c. y., **08,** 1100.
1909. R. G. Packard & Co., dr. (109,091 c. y.), 16½¢ c. y., **10,** 1238.
1910. Morris & Cumings Dredging Co., dr. (129,412 c. y.), 12¼¢ c. y., **11,** 1332.
1911. P. Sanford Ross, dr. (86,956 c. y.), 20.7¢ c. y., **12,** 1544.

ENGINEERS.

Chief of Engineers. **R., 81,** 112, 115; **82,** 113; **83,** 110; **84,** 117; **85,** 108; **86,** 106; **87,** 66; **88,** 67; **89,** 81; **90,** 72; **91,** 92; **92,** 96; **93,** 104; **94,** 94; **95,** 106, 121; **96,** 98; **97,** 133; **98,** 139; **99,** 159; **00,** 181; **01,** 218; **02,** 164; **03,** 150; **04,** 139, 148; **05,** 147; **06,** 154; **07,** 162; **08,** 169; **09,** 173; **10,** 197; **11,** 219; **12,** 264.

Boards. BERH. **R.,** Feb. 17, 1903, concurring in Lt. Col. Raymond's views for w. So. Amboy Chan., maintaining 21′ d., **04,** 1161.

In charge:
Lt. Col. N. Michler, 1880–82. **R., 81,** 715, 717.
Lt. Col. G. L. Gillespie, 1882–86. **R., 82,** 703; **83,** 585; **84,** 752; **85,** 757.
Lt. Col. W. McFarland, 1886–89. **R., 86,** 765; **87,** 749; **88,** 633.
Lt. Col. G. L. Gillespie, 1889–95. **R., 89,** 794; **90,** 753; **91,** 931; **92,** 833; **93,** 1070; **94,** 780; **95,** 959, 1014.
Maj. H. M. Adams, 1896–97. **R., 96,** 787; **97,** 1142.
Maj. A. M. Miller, 1898. **R., 98,** 1065.
Col. J. W. Barlow, 1899–1901. **R., 99,** 1308; **00,** 1508.
Maj. E. H. Ruffner, **01,** 198.
Col. S. M. Mansfield, 1901–02. **R., 01,** 1238.
Capt. Spencer Cosby, 1902. **R., 02,** 1013.
Lt. Col. C. W. Raymond, 1902–04. **R., 03,** 937; **04,** 1159.
Col. W. R. Livermore, 1904–06. **R., 04,** 1141; **05,** 1038; **06,** 1003.
Col. D. W. Lockwood, 1906–09. **R., 07,** 1054; **08,** 1099; **09,** 1113.
Col. S. W. Roessler, **09,** 188.
Col. W. T. Rossell, 1909–. **R., 10,** 1237; **11,** 1330; **12,** 1543.

Assistants:
A. Doerflinger. **R., 81,** 718.
G. W. Kuehnle. **R., 95,** 1016.

OBSTRUCTIONS.

Illegal dumping of material, **88,** 636.

OPERATIONS.

1881-82. 166,346 c. y. dr. from chan. across shoal, **82,** 704.
1882-83. 56,200 c. y. dr. from n. side of chan., **83,** 586.
1883-84. 146,026 c. y. dr. from chan., **84,** 752.
1884-85. 112,657 c. y. dr. from w. end of chan., across the shoal, **85,** 757.
1887-88. 163,756 c. y. dr., **88,** 635.
1889-90. 200,000 c. y. dr., **90,** 755.
1890-91. 82,035 c. y. dr., **91,** 934.
1891-92. 114,290 c. y. dr., **92,** 836.
1892-93. 170,081 c. y. dr., **93,** 1073.
1893-94. 18,686 c. y. dr., **94,** 783.
1894-95. 219,706 c. y. dr., **95,** 962.
1896-97. 359,345 c. y. dr., **97,** 1143.
1899-00. 197,398 c. y. dr. from Seguine Pt. Chan., and 350,818 c. y. dr. from So. Amboy Chan., **00,** 1508.
1902-03. 95,544 c. y. dr. from So. Amboy Chan., **03,** 938.
1903-04. 110,546 c. y. dr. from Wards Pt. Chan., 43,885 c. y. from So. Amboy Chan., completing contract for dr. about 250,000 c. y., **04,** 1141.
1905-06. 150,161 c. y. dr., **06,** 1002.
1906-07. 101,561 c. y. net dr. (67,804 c. y. deducted for overd.), **07,** 1055.
1907-08. 26,974 c. y. dr. from Seguine Pt. Chan., and 30,080 c. y. from So. Amboy Chan., **08,** 1099.
1908-09. 48,936 c. y. dr. from So. Amboy Chan., **09,** 1113.
1909-10. 78,543 c. y. dr. from Seguine Pt. Chan., **10,** 1237.
1910-11. 27,529 c. y. dr. under one contract, completing a total of 106,072 c. y. net (9,268 c. y. deducted for overd.). Under another contract, 51,782 c. y. dr. from Seguine Pt., 80,061 c. y. from So. Amboy Chan. (3,573 c. y. deducted for illegal dumping, and 16,681 c. y. for overd.), **11,** 1330.
1911-12. 86,000 c. y. dr., **12,** 1543.

PHYSICAL CHARACTERISTICS.

Description of the B., **88,** 633; **95,** 1015.
Chans. subject to deterioration by deposits, **94,** 783; **96,** 789; **98,** 1065.
B. bet. s. end of Staten Isld. and N. J. and lower N. Y. B., and is about 5 m. n. and s. x 7 m. e. and w. Raritan R. empties into it at its w. end, bet. Perth Amboy and So. Amboy, and the Arthur Kill and Staten Isld. Sound extends n. from its w. end, connecting it with Newark B., **12,** 264.

PROJECTS.

By Lt. Col. Michler, 1880, chan. 21′ x 300′ m. l. w. through shoal off Seguine Pt.; est., $126,500, **81,** 715, 717, 719; **87,** 750.

By Lt. Col. Gillespie, 1884–85, chan. 21′ x 300′, Great Beds Light to wharves at Perth Amboy, and a 15′ chan. from outside of Great Beds Light to So. Amboy; est., $114,000, **84,** 753; **85,** 758; **87,** 751.

Revised proj., 1889, by Lt. Col. Gillespie, chan. 300′ x 21′ m. l. w., New York Lower B. to Perth Amboy; also chan. 15′ x 300′, Great Beds Light to So. Amboy; est., $175,375, **91,** 932, 933.

Proj. modified act 1896 to make So. Amboy Chan. 21′ x 300′ at an est. additional cost of $150,000, making the total cost of the proj. $507,875, **96,** 789.

At 1900, est. $20,000 would be required each year, after the completion of the proj., for mainten., **00,** 1508.

SURVEYS.

From Perth Amboy and So. Amboy to main ship chan. off Great Kills, Raritan B., au. act June 14, 1880; made, 1880, by Lt. Col. Michler, **81,** 717, 718.

Sur. of the chan. between So. Amboy and Great Beds Light with a view to d. it to 21′ m. l. w., au. act Aug. 17, 1894; made by Lt. Col. Gillespie, 1895 (see Projects), **95,** 1015.

Sur. of B. in vicinity of So. Amboy and Seguine Pt.; made, 1899, by Col. Barlow, **99,** 1308.

Pre. ex. au. act June 13, 1902, from So. Amboy to tail of Great Beds, to obtain 22′ x 400′ m. l. t. **R.** by Lt. Col. Raymond, Oct. 14, 1902. Submits plan for increasing w. to 400′ x 21′; no additional funds required,[1] **04,** 148, 1158.

Maps. **92,** Atlas, 5, 6; **05,** 1038; **11,** 1330; **12,** 1543.

G-24 GREAT KILLS HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. **R., 11,** 209
In charge. Col. S. W. Roessler, **11,** 185.
Assistant. Capt. H. L. Wigmore, **11,** 185.

SURVEY.

Pre. ex. au. act June 25, 1910, for increased anchorage area; **R.,** Col. Roessler, Sept. 19, 1910 (unfav.),[2] **11,** 209.

G-25 LEMON CREEK, N. Y.

ENGINEERS.

Chief of Engineers. **R., 12,** 279.
In charge. Col. W. T. Rossell, **12,** 254.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910 (**R.** by "Col. Rossell Dec. 17, 1910—unfav."), **12,** 279.

G-26 PRINCESS BAY, STATEN ISLAND, N. Y. (Breakwater.)

COMMERCE.

Small, **91,** 1014.

ENGINEERS.

Chief of Engineers. **R., 91,** 107.
In charge. Capt. T. L. Casey, 1890. **R., 91,** 1013.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Casey (**R.** unfav.), **91,** 1013.

G-27 ARTHUR KILL, STATEN ISLAND SOUND, AND CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY, INCLUDING CHANNEL NORTH OF SHOOTERS ISLAND.

Part.	Title.	Period.	Appropriations.
a	Appropriations	1874–1912	See below.
b	Arthur Kill, N. Y. and N. J.	1889–1912	do.
c	Staten Isld. and N. J. (chan. between)	1872–1912	do.
d	Shooters Isld. (chan. north of)	1910–1912	do.

Part (a), G-27 Appropriations.

Staten Isld. and N. J. (chan. between):

1874,	$50,000,	**74,** 96, ii, 169.
1876,	10,000,	**76,** 56, 251; **77,** 51, 252.
1878,	15,000,	**78,** 419.
1880,	29,000,	**80,** 540.
1882,	40,000,	**82,** 689.
1884,	10,000,	**84,** 744.
1886,	15,000,	**86,** 792.
1888,	15 000,	**88,** 633.
1890,	15,000,	**90,** 847.
1892,	15,000,	**92,** 872.
1894,	6,000,	**95,** 972.
1896,	13,000,	**96,** 777.
1899,	32,000	**99,** 1304.
1902,	[3] 10,000,	**02,** 1012
1905,	10,000,	**05,** 1035.
1910,	10,000,	**10,** 1234.
1911,	10,000,	**11,** 1326.
Total,	305,000	

[1] H. D. 184, 8th, 2d. [2] H. D. 18, 62d, 1st. [3] Including $5,000 for Lemon Creek.

Arthur Kill, N. Y. and N. J.:

1888, $10,000, **89,** 820.
1890, 7,000, **90,** 845.
1892, 5,000, **92,** 870.
1894, 4,500, **95,** 970.
1902, 100,000, **02,** 1012.
1903, 150,000, **03,** 933.
1905, 70,000, **05,** 1034.
1906, 50,000, **06,** 998.
1907, 85,000, **07,** 1050.
1909, 150,000, **09,** 1109.
1910, 30,000, **10,** 1233
1911, 61,000, **11,** 1324.
1912, 20,000, **12,** 1538.

Total, 742,500

Shooters Isld. (chan. n. of):

1910, $100,000, **10,** 1235.
1911, 90,000, **11,** 1327.
1912, 30,000, **12,** 1541.

Total, 220,000, **12,** 1541.
Grand total, $1,267,500 ($1,267,635.11, including sales, **12,** 1538, 1539, 1541).

Part (b), G-27 Arthur Kill, N. Y. and N. J.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Details of, **93,** 1084; **00,** 1526; **11,** 214; **12,** 260.
Local rates reduced, effect on others unknown, **10,** 193; **12,** 260.
Traffic, 1911–12, 17,000,000± t., **12,** 1540.

CONTRACTS.

1890. R. G. Packhard, dr., 23½¢ c. y., **90,** 844.
1891. Atlantic Dredging Co., dr., 24½¢ c. y., **91,** 985.
1892. Atlantic Dredging Co., dr., 24¢ c. y., s. m. ($4,000), **93,** 1106.
1903. William H. Taylor, dr., 14.8¢ c. y., **04,** 1137.
1910. John & Joseph McSpirit, r. removal, $3.25 c. y., s. m., **11,** 1324.
1911. P. Sanford Ross (Inc.), removing about 12,000 c. y. r., hard pan, gravel, and bowlders, $2.84 c. y., s. m.; amount may be increased 100%, **12,** 1539.

ENGINEERS.

Chief of Engineers. **R., 89,** 86; **90,** 76; **91,** 97; **92,** 100, 398; **93,** 105, 108; **94,** 97; **95,** 109; **99,** 164; **1900,** 188; **02,** 162; **03,** 147; **04,** 136; **05,** 143; **06,** 149; **07,** 157; **08,** 164; **09,** 168; **10,** 191; **11,** 213; **12,** 258.

Boards:
Convened, New York City, May 20, 1892, by S. O. No. 49, to consider the modification of the pier-head line established Mar. 4, 1890, on Arthur Kill, in front of Perth Amboy. **R., 92,** 861.
(Cols. Abbot, Craighill, and Houston, and Lt. Col. Gillespie.)

In charge:
Capt. T. L. Casey, 1889–94. **R., 89,** 819; **90,** 843; **91,** 983; **92,** 869; **93,** 1104; **94,** 798.
Lt. Col. G. L. Gillespie, 1895 (see Surveys). **R., 95,** 969.
Col. J. W. Barlow, 1899–1900. **R., 00,** 1525, 1527.
Capt. Spencer Cosby, 1902. **R., 02,** 1012.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 932.
Col. W. R. Livermore, 1904–06. **R., 04,** 1135; **05,** 1033; **06,** 997.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1048; **08,** 1093; **09,** 1108.
Col. Wm. T. Rossell, 1910–. **R., 10,** 1231; **11,** 1323; **12,** 1537.

Assistant: C. S. Kelsey. **R., 00,** 1529.

OPERATIONS.

1889-90. 29,000 c. y. dr., **90,** 844.
1890-91. 22,000 c. y. dr., **91,** 984.
1892-93. 16,500 c. y. dr., **93,** 1105.
1894-95. 7,738 c. y. dr.; proj. completed, **95,** 969.
1903-04. 98,529 c. y. dr., **04,** 1136.
1904-05. 560,888 c. y. dr., **05,** 1033.
1905-06. 689,866 c. y. dr., **06,** 998.
1906-07. 274,653 c. y. dr., **07,** 1048.
1907-08. 749,686 c. y. dr., **08,** 1094.
1908-09. 593,926 c. y. dr., **09,** 1108.
1909-10. 389,245 c. y. dr., **10,** 1231.
1910-11. 40,283 c. y. dr.; imp. completed except r. removal; certain amounts deducted from total dr. for overd., determined by final ex., **11,** 1322; 13,990.62 c. y. r. removed, **11,** 1323.
1911-12. 21,865 c. y. removed from vicinity of Baltimore & Ohio RR. br., near lower part of Elizabethport, and towed to sea and dumped, **12,** 1537, 1538. (For tables showing progress of dr., see **Rs.** of Engineers in charge, 1907–11.)

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1083; **00,** 1530; **10,** 191; **11,** 214; **12,** 258, 259, 260.

PROJECTS.

By Capt. Casey, 1888, removal of a pt. of land near the Staten Isld. Br., to straighten the chan., and facilitate the passage of long tows through the drawspan of the br.; est., $26,500, **89,** 86, 820.
Col. Barlow est., 1899, $696,000 for a 21′ chan., 300′–400′ w., from Kill van Kull to Raritan B., with $5,000 an. mainten., **00,** 1529. Au. by act June 13, 1902, **02,** 163.[1] Experience had shown, 1902, mainten. required $25,000 an., **12,** 259.

SURVEYS.

Ex. for chan. w. of Robbins Reef Lighthouse au. act July 13, 1892; made, 1892, by Lt. Col. Gillespie (**R.** unfav.), **93,** 1083.
Ex. and sur. of Arthur Kill, from Kill van Kull to Raritan B., au. act Mar. 3, 1899; made, 1899–1900, by Col. Barlow (**R.** fav.; see Projects), **00,** 1525, 1527.
Pre. ex., by Col. Livermore, on w. side of Arthur Kill from opposite n. end of Pralls Isld. to about 2,000′ n. of Piles Creek, au. act 1905 (**R.** unfav.[3]). **06,** 167.
Pre. ex. w. side of Buckwheat Isld,, au. act 1907 (**R.** unfav.[3]), **08,** 184.
Ex. and sur. au. act Feb. 27, 1911; completed, and **R.** and map nearly ready at close of year, **12,** 1538.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 260.
Maps. **89,** 820; **90,** 844; **05,** 1034; **11,** 1322.

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[1] H. D. 393, 56th, 1st. [2] H. D. 591, 59th, 1st. [3] H. D. 533, 60th, 1st.

Part (c), G-27 Staten Island, N. Y., and State of N. J. (channel between).

APPROPRIATIONS. (See Part a.)

COMMERCE. (See Part a.)

Changes in and requirements of, **76,** 251, 255–257.
Cause of falling off, **77,** 252.
Est. t., 10,800,000 t., **73,** 945.
Advantages resulting from imp., **82,** 690.
Importance of imp., **85,** 750; **96,** 775.
Value of C. passing Stake Light, **88,** 632.
Diagram showing relation of app., tonnage, and value, **11,** 1326.

CONTRACTS.

1874. J. D. Leary, pile dike, $18.94 l. f., **75,** ii, 223, 224.
1880. Morris & Cumings Dredging Co., dr., 19½¢ c. y., **81,** 692. Completed, **82,** 687.
1883. Morris & Cumings Dredging Co., dr., 23¾¢ c. y., **83,** 576. Completed, **83,** 575.
1885. E. Brainard & T. H. Benton, dr., 20¢ c. y., **85,** 750. Completed, **85,** 749.
1887. T. H. Benton, dr., 28¼¢ c. y., **87,** 748.
1889. T. H. Benton, dr., 27¢ c. y., **90,** 846.
1891. T. H. Benton, dr., 26¢ c. y., **91,** 987.
1896–97. A. E. Smith, dr. 17,316 c. y. 25¢ c. y., p. m., **97,** 1132.
1899. Morris & Cumings Dredging Co., dr., 10¾¢ c. y. **00,** 1503.
1901. Kirk, Driscoll & Co., dr., 18¢ c. y., **01,** 1233.
1902. Duncan J. Currie, dr. 23,000 c. y. in Lemon Creek, 19¢ c. y., p. m., **03,** 935.
1905. P. S. Ross, dr. about 94,637 c. y., 15.85¢ c. y., s. m., **06,** 999.
1910. Columbia Dredging Co., dr. about 66,000 c. y., 13½¢ c. y., **11,** 1326.

ENGINEERS.

Chief of Engineers. R., 72, 80; **73,** 86; **74,** 96; **75,** 103; **76,** 56, 251; **77,** 51; **78,** 56; **79,** 64; **80,** 86; **81,** 109, 693; **82,** 110; **83,** 106; **84,** 113; **85,** 104; **86,** 110; **87,** 65; **88,** 66; **89,** 86; **90,** 77; **91,** 98; **92,** 101; **93,** 108; **94,** 98; **95,** 110; **96,** 96; **97,** 130; **98,** 136; **99,** 156; **00,** 178; **01,** 215; **02,** 162; **03,** 148; **04,** 137; **05,** 144; **06,** 150; **07,** 158; **08,** 166; **09,** 169; **10,** 193; **11,** 215; **12,** 258.

Boards:
Convened, New York, May 12, 1875; recom. dr. to 11′. **R., 76,** 252. (Col. Tower and Lt. Cols. Wright, Kurtz, and Newton.)
For R. and H. imp. **R., 81,** 694.

In charge:
Lt. Col. John Newton, 1873–80. **R., 73,** 943; **74,** ii, 168; **75,** ii, 223; **76,** 250, 257; **78,** 418; **79,** 392; (Col.) **80,** 540.
Capt. J. Mercur, in temporary charge, **77,** 223 **R., 77,** 252.
Lt. Col. N. Michler, 1880–81. **R., 80,** 540; **81,** 691.
Lt. G. L. Gillespie, 1881–86. **R., 82,** 687; **83,** 575; **84,** 742; **85,** 749.
Lt. Col. W. McFarland, 1886–89. **R., 86,** 788; **87,** 743; **88,** 631.
Capt. T. L. Casey, 1889–94. **R., 89,** 821; **90,** 846. **91,** 986; **92,** 871; **93,** 1106; **94,** 799.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 970.
Maj. H. M. Adams, 1896–97. **R., 96,** 775; **97,** 1130.
Maj. A. M. Miller, 1898. **R., 98,** 1060.
Col. J. W. Barlow, 1899. **R., 99,** 1304; **00,** 1502.
Col. S. M. Mansfield, 1901. **R., 01,** 1233.
Capt. Spencer Cosby, 1902. **R., 02,** 1012.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 933.
Col. W. R. Livermore, 1904–06. **R., 04,** 1137; **05,** 1035; **06,** 998.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1050; **08,** 1096; **09,** 1111.
Col. W. T. Rossell, 1910–11. **R., 10,** 1234; **11,** 1325.

Assistant. J. H. Striedinger, **73,** 943.

ESTIMATES. (See Projects.)

By Lt. Col. Newton, 1873, temporary imp., $192,491.60; permanent imp., $443,210, **73,** 945.
By BE., 1875, dr. to 11′, $40,480, **76,** 56, 250, 256; **77,** 252; **79,** 392.
By Lt. Col. Newton, 1879, to complete existing proj., $15,480, **79,** 64.

OPERATIONS.

1874–75. 2,237 l. f. of s. pile dike built by contract, **75,** ii, 223.
1879–80. 101,368 c. y. dr., **81,** 691.
1881–82. 116,931 c. y. dr., **82,** 687.
1882–83. 158,637 c. y. dr., **83,** 575.
1884–85. 44,953 c. y. dr., **85,** 749.
1886–87. 31,261 c. y. dr. from chan., **87,** 747.
1887–88. 15,000 c. y. dr., **88,** 632.
1889–90. 44,041 c. y. dr., **90,** 846.
1890–91. 44,820 c. y. dr., **91,** 986.
1894–95. 86,667 c. y. dr., **95,** 971.
1896–97. 47,906 c. y. dr., of which 17,316 c. y. were dr. from Lemon Creek, **97,** 1132.
1899–00. 103,663 c. y. dr., **00,** 1502.
1900–01. 97,193 c. y. dr., **01,** 1233.
1902–03. 2,575 c. y. dr. in Lemon Creek, **03,** 934.
1903–04. 12,170 c. y. dr.; result of work given, **04,** 1138.
1905–06. 81,781 c. y. dr., **06,** 999.
1906–07. 14,758 c. y. dr.; chan. now restored to proj. dimensions, **07,** 1051.
1910–11. 68,479 c. y. dr. for mainten., **11,** 1326.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 943, 944; **76,** 253, 254; **86,** 788; **87,** 743.
Chan. subject to shoaling, **94,** 799.
Washing in of adjacent flats, 1898, had reduced chan. w., **98,** 1060.
Lemon Creek is a small creek entering the chan. from Staten Isld., **97,** 1131.
Max. draft in Staten Isld. and New Jersey Chan., 14′; in Lemon Creek, 5′, **11,** 215.

PROJECTS. (See Estimates.)

By Lt. Col. Newton, 1873, temporary imp. by dr.; for permanent imp., diking, and dr., **73,** 944, 945; **76,** 251.
By BE., 1875, dr.; est., $40,480, **76,** 256.
By BE., 1880 (in extension of previous projs. of 1873 and 1875), formation of a chan. between Staten Isld. and New Jersey, e. from Elizabethport to the d. w. of the Kill Von Kull, 400′ w., the middle 200′ to be 13′ and the remainder of the chan. 12′ d. m. l. w.; in addition, if found necessary, parallel dikes to be built on opposite sides of the chan. at 2 places; est., $185,705, **81,** 109, 692, 695; **86,** 790. (Cols. Tower and Newton and Lt. Col. Abbot.) Est. increased to $210,000, **87,** 745.
In 1890 proj. modified to meet the increased demands of C., and now calls for a uniform d. of 14′ over the entire w. of 400′; est. for completion in 1891, $61,000, **91,** 987.
By Capt. Casey, 1892, expend. of app. of 1892 in w. and d. the chan. at such points as an ex. would show to be most deficient, **93,** 1107.
By Maj. Adams, 1896, dr. chan. 8′ d. h. w. and 50′ w., in Lemon Creek, Staten Isld. to drawbr. at the mouth, and 35′ w. above the br. as far as funds would permit, **97,** 1131.
Act June 13, 1902, au. mainten. of imp., **02,** 163.
Proj. completed, **08,** 1096.

SURVEYS.

Under direction of Lt. Col. Newton, by J. H. Striedinger, E. Gieseler, and M. Lacy. **R., 73,** 943.
Sur. in the vicinity of Corner Stake Light made, 1893, by Capt. Casey, **94,** 799.
H. lines modified in 1892 by Sec. of War, **96,** 777.
Maps. **81,** 696; **89,** 822; **05,** 1036; **11,** 1326.

Part(d), G-27 Shooters Island (channel north of).

APPROPRIATIONS. (See Part a.)

CONTRACTS.

1910. Wm. Beard & Co., dr. about 979,000 c. y., 13½¢ c. y., **11,** 1328.

ENGINEERS.

Chief of Engineers. R., 10, 195; **11,** 216; **12,** 261.

In charge. Col. W. T. Rossell, 1910–. **R., 10,** 1235; **11,** 1327; **12,** 1541.

OPERATIONS.

1910-11. 380,094 c. y. dr., **11,** 1327.
1911-12. 418,617 c. y. dr., **12,** 1540.

PHYSICAL CHARACTERISTICS.

Before imp. there was no chan. within the limits of the proj., it being part of the flats at lower end of Newark B. Object of new chan. to relieve congestion of main chan. s. of Shooters Isld., **12,** 261.

PROJECTS.

Act June 25, 1910, au. chan. 16′ x 300′ x 1 m., and removal of a middle ground in main chan. of Newark B., removal of a part of Bergen Pt. reef and middle ground at Corner Stake Light[1] (see Surveys), **10,** 195.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, in Newark B., N. J., and Kill van Kull, n. of Shooters Isld., for 16′; **Rs.** by Col. Livermore, Jan. 26, 1906, and by Col. Lockwood, Dec. 6, 1906; est., $280,115, with $5,000 ann. mainten.,[1] **07,** 175.

G-30 ELIZABETH RIVER, N. J.

APPROPRIATIONS.

1879,	$7,500.00,	**80,** 545.
1880,	7,500.00,	**80,** 545.
1881,	4,000.00,	**81,** 707.
1882,	8,000.00,	**82,** 698.
1890,	5,000.00,	**90,** 853.
1892,	5,000.00,	**92,** 879.
1894,	3,000.00,	**95,** 979.
1896,	3,160.00,	**96,** 780.
1902,	*2,000.00,	**03,** 947.
1905,	*5,000.00,	**05,** 1049.
1907,	*9,784.45,	**07,** 1068.
Total,	59,944.45,	**11,** 1341.

COMMERCE.

Important, **79,** 481, 483; **82,** 698.
Prospective benefit to C. from imp., **88,** 649.
Description of, **97,** 1186.
Freight rates reduced, **10,** 205.
Increasing on lower part of R., **10,** 1248.
51,000, 1911, **11,** 1341.

CONTRACTS.

1879. E. G. Brown, dr., 37¢ c. y., **80,** 545.
1880. T. H. Benton, dr., $1.05 c. y., **81,** 707.
1881. T. H. Benton, dr., $1.05 c. y., **82,** 698.
1882. F. C. Somers, dr., 63¢ c. y., **83,** 581.
1891. R. Parrott, dr., 55¢ c. y., **91,** 994.
1894. W. H. Taylor, dr., 76½¢ c. y., **94,** 805.
1895. J. McSpirit & Sons., dr., 68¢ c. y., p. m.; ledge removal, $2 c. y., p. m., **96,** 779.
1897. J. McSpirit, dr., 34¢ c. y., p. m. ($2,800) **97,** 1135.
1902. Kirk, Driscoll & Co., dr., 35¢ c. y., s. m., **03,** 948.
1905. John & Joseph McSpirit, dr., 44¢ c. y., s. m., **06,** 1010.
1907. Morrison Dredging Co., dr., 39¢ c. y., **07,** 1068.
1908. U. S. Fidelity & Guaranty Co., dr., 39¢ c. y., **08,** 1110.

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 67, 75; **80,** 88; **81,** 111; **82,** 112; **83,** 108; **84,** 115; **85,** 106; **86,** 110; **87,** 69; **88,** 69; **89,** 89; **90,** 79; **91,** 100; **92,** 103; **93,** 111; **94,** 100; **95,** 112, 121; **96,** 96; **97,** 131, 141; **98,** 137; **99,** 157; **00,** 179; **01,** 216; **02,** 168; **03,** 154; **04,** 143; **05,** 151; **06,** 159; **07,** 168; **08,** 176; **09,** 180; **10,** 205; **11,** 227; **12,** 279.

In charge:

Col. J. N. Macomb, 1878–79; **78,** 63; **79,** 66, 74. **R., 79,** 481.
Lt. Col. N. Michler, 1880–83. **R., 80,** 545; **81,** 706.
Lt. Col. G. L. Gillespie, 1883–86. **R., 83,** 581; **84,** 748; **85,** 754.
Lt. Col. W. McFarland, 1886. **R., 86,** 785.
Lt. G. McC. Derby, 1886–89. **R., 87,** 768; (Capt.) **88,** 648.
Capt. T. L. Casey, 1889–94. **R., 89,** 827; **90,** 852; **91,** 993; **92,** 878; **93,** 1113; **94,** 804.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 978, 1011.
Maj. H. M. Adams, 1896–97. **R., 96,** 778; **97,** 1134, 1185.
Maj. A. M. Miller, 1898. **R., 98,** 1061.
Col. J. W. Barlow, 1899. **R., 99,** 1305; **00,** 1503.
Col. S. M. Mansfield, 1901. **R., 01,** 1235.
Capt. Spencer Cosby, 1902. **R., 02,** 1020.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 947.
Col. W. R. Livermore, 1904–06. **R., 04,** 1150; **05,** 1048; **06,** 1009.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1067; **08,** 1108; **09,** 1123.
Col. W. T. Rossell, 1910. **R., 10,** 1247; **11,** 1340; **12,** 254.

Assistant. A. Doerflinger, **79,** 481. **R., 79,** 481.

OBSTRUCTIONS. (See Physical data.)

Shoaling mostly due to deposits from sewers of city of Elizabeth; removal of such deposits hindered by city not permitting deposit of dr. material on R. banks (the only available dumping place) during summer months, **08,** 1109.

OPERATIONS.

1879-80. 7′ chan., 60′ x 4,110′, excavated, **80,** 545.
1880-81. 9,200 c. y. dr., **81,** 706.
1881-82. 3,335 c. y. dr., **82,** 697.
1882-83. 4,142 c. y. dr., **83,** 581.
1883-84. 6,952 c. y. dr., **84,** 748.
1884-85. Proj. completed according to requirements of C., **85,** 754.
1890-91. Excavation of chan. begun, **91,** 993.
1891-92. 6,917 c. y. dr., **92,** 879.
1893-94. 5,200 c. y. dr., **94,** 805.
1895-96. 2,211 c. y. dr. and 394 c. y. shale r. removed, **96,** 779.
1897-98. 7,669 c. y., p. m., dr., **98,** 1061.
1903-04. 5,466 c. y. dr., **04,** 1150.
1905-06. 9,088 c. y. dr., **06,** 1009.
1907-08. 9,794 c. y. dr., **08,** 1108.
1908-09. 10,723 c. y. dr., **09,** 1123.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 481, 482; **95,** 1012; **97,** 1185; **10,** 205.
Difference in tides, **79,** 482.
Description of the R.; deterioration since suspension of work, **88,** 648, 649.
During the progress of dr. in 1894 fixed red shale was uncovered in the chan. bed, **94,** 805.
Tidal observations, **95,** 1012.

*Allotment.

[1] H. D. 337, 59th, 2d.

Distances above the R. mouth of the several brs. and other points, **96,** 778. Stream subject to shoaling, **98,** 1061.

The stream enters the Arthur Kill, in e. New Jersey, about 11 m. from New York City; flows along the so. part of the city of Elizabeth for about 2 m. The sewage from the latter city a cause of the decrease in the natural depth of the stream, **97,** 1185, 1186.

PROJECTS.

By Col. Macomb, 1879, dr. chan. 7′ x 60′ m. h. w., mouth to Broad St. Br., 2.7 m., removing 44,000 c. y.; est. cost, $25,530, **79,** 67, 482, 483.

Est. increased, 1881, by Lt. Col. Michler, to $43,160 from increased cost of dr., **81,** 707; **87,** 768; **92,** 879.

In 1892, by Capt. Casey, expend. app. 1892, dr. between the brs. at South St. and Bridge St. to d. of 7′ x 40′–50′ m. h. w., **93,** 1113.

In 1897 Maj. Adams est. $12,000 for further imp., with $6,000 for an. mainte., **97,** 1187.

Col. Lockwood, 1909, recom. no further app. be made, under existing circumstances (see Obstructions), **08,** 176, 1109.

Work ordered dropped June 30, 1911, upon recom. of Col. Rossell, **11,** 1341.

SURVEYS.

Ordered and in progress, **78,** 63.

Completed by A. Doerflinger, **79,** 67, 75, 481.

Sur. by Capt. Casey, 1892, **93,** 1113.

Ex. for locks at the mouth of the R. au. act Aug. 17, 1894; made by Lt. Col. Ludlow, 1894 (**R.** unfav.), **95,** 1011.

Sur. au. act June 3, 1896; made by Maj. Adams, 1897 (**R.** unfav.), **97,** 1185.

Ex. and sur. au. act June 25, 1910, for chan., Broad St. Br. to Staten Isld. Sound Chan.; **R.,** Col. Rossell, 1911 and 1912; est., $15,443.50, subject to certain specified conditions,[1] **12,** 279.

Maps. **05,** 1048.

G-33 RAHWAY RIVER, N. J.

APPROPRIATIONS.

1879,	$10,000,	**79,** 67.
1880,	10,000,	**80,** 544.
1881,	10,000,	**81,** 705.
1882,	7,000,	**82,** 696.
Total,	37,000	

COMMERCE.

Not unimportant, **79,** 483, 485.

Imp. beneficial to shippers, but C. not increased, **86,** 784.

Decrease in, since suspension of work of imp., **88,** 650.

Reduction in rates consequent upon imp., **89,** 828.

But slightly increased by the works of imp. done, **97,** 1189.

CONTRACTS.

1879. E. G. Brown, dr., 37¢ c. y., **80,** 544.

1880. J. Van Patten, sand, gravel, mud, and st. removal, 85¼¢ c. y., **81,** 705.

1881. W. Chamberlain, gravel and r. removal, 63¢, $2, and $3 c. y., **82,** 696.

1882. W. Chamberlain, dr., 78¢ c. y., **83,** 579.

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 67, 74; **80,** 87; **81,** 110; **82,** 111; **83,** 108; **84,** 115; **85,** 106; **86,** 109; **87,** 70; **88,** 70; **89,** 89; **90,** 80; **91,** 101; **92,** 104; **93,** 112; **94,** 101; **95,** 113, 121; **97,** 142; **08,** 184.

In charge:

Col. J. N. Macomb, 1879–80. **R., 79,** 483.

Lt. Col. N. Michler, 1880–82. **R., 80,** 544; **81,** 704.

Lt. Col. G. L. Gillespie, 1882–86. **R., 82,** 695; **83,** 579; **84,** 747; **85,** 753.

Lt. Col. W. McFarland, 1886. **R., 86,** 783.

Lt. G. McC. Derby, 1886–89. **R., 87,** 769; (Capt.) **88,** 649.

Capt. T. L. Casey, 1889–94. **R., 89,** 828; **90,** 853; **91,** 995; **92,** 880; **93,** 1115; **94,** 807.

Lt. Col. G. L. Gillespie, 1895. **R., 95,** 980, 1009.

Maj. H. M. Adams, 1897. **R., 97,** 1187.

Col. D. W. Lockwood, **08,** 162.

Assistant. A. Doerflinger. **R., 79,** 484.

OPERATIONS.

1879–80. 2,733 c. y. dr. from chan., **80,** 544.

1880–81. Dr. recommenced under 1881 contract, **81,** 705.

1881–82. 16,978 c. y. dr. from chan., **82,** 695.

1882–83. 18,108 c. y. dr. from chan., **83,** 579.

1883–84. 4,144 c. y. dr. from chan., **84,** 747

PHYSICAL CHARACTERISTICS.

Description of, **79,** 484.

Obstrs., **79,** 484; **97,** 1188.

A small R. flowing into the Arthur Kill about 3½ m. s. of Elizabethport, **97,** 1188.

A dam constr. at the mouth would collect and hold behind it material brought down by the stream, menacing the health of the neighboring locality, and finally closing the R. to navigation if not dr., **95,** 1010.

PROJECTS.

By Col. Macomb, 1878, chan. 8′ at m. h. w., and 125′ w. from Bricktown to Main St. Br. in Rahway; est., $36,653, **79,** 485; **80,** 87. Increased in 1882 on account of extra cost for dr. to $66,250, **82,** 696; **87,** 769; **91,** 995.

Maj. Adams, 1897, est. $108,000 to further imp. the R., **97,** 1189.

SURVEYS.

By A. Doerflinger, under direction of Col. Macomb, **78,** 63; **79,** 67, 75, 484.

Ex. to ascertain desirability of placing locks at the mouth of the R. au. act Aug. 17, 1894; **R.** (unfav.) submitted by Lt. Col. Gillespie in same year, **95,** 1009.

Sur. from its mouth to Rahway au. act June 3, 1896; made by Maj. Adams, 1897 (**R.** unfav.); **97,** 1187.

Pre. ex. au. act Mar. 2, 1907. **R.** by Col. Lockwood, Aug. 20, 1907[2] (unfav.), **08,** 184.

G-35 WOODBRIDGE CREEK, N. J.

APPROPRIATIONS.

1879,	$4,000,	**79,** 68.
1880,	5,000,	**80,** 546.
1881,	5,000,	**81,** 709.
1882,	5,000,	**82,** 700.
1902,	10,000,	**03,** 935.
1904	*250 / *7,500	**05,** 1038.
1905,	6,000,	**05,** 1038.
1907,	19,000,	**07,** 1053.
1909,	*6,000,	**09,** 1112.
1910,	3,000,	**10,** 1236.
1911,	3,000,	**11,** 1329.
1912,	6,000,	**12,** 1542.
Total,	79,750	

*Allotment.

[1] H. D. 750, 62d, 2.

[2] H. D. 350, 60th, 1st.

COMMERCE.

Important, **79,** 478.
Creek an outlet for products of fireclay works, **82,** 700.
Description of, **00,** 1553; **04,** 1140; **12,** 1542.
1903, 155,751 t., **04,** 1140; 1911, 128,560 t., **12,** 1542.
Rates reduced as a result of imp., **08,** 169.

CONTRACTS.

1880. E. Brainard, dr., 58¾¢ c. y., **81,** 709.
1881. J. Van Patten, dr., 65¢ c. y., **81,** 710.
1882. E. Brainard and T. H. Benton, dr., 65¢ c. y., **83,** 583.
1902. The Newburgh Dredging Co., dr. 45,000 c. y., 20¢ c. y., **03,** 937.
1905. P. S. Ross (Inc.), dr. 29,500 c. y., 22¢ c. y., **05,** 1038.
1906. A. C. Driscoll, dr. 16,129 c. y., 31¢ c. y., **06,** 1001.
1907. J. M. Briggs, dr. about 55,555 c. y., 28.8¢ c. y., **08,** 1098.
1909. John & Joseph McSpirit, dr. about 17,857 c. y., 26¢ c. y., **10,** 1236.
1910. John & Joseph McSpirit, dr. about 10,000 c. y., 30¢ c. y., **11,** 1329.
1911. John & Joseph McSpirit, dr. about 8,333 c. y., 30¢ c. y., **11,** 1329.

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 67, 75; **80,** 88; **81,** 111; **82,** 112; **83,** 109; **84,** 116; **85,** 107; **86,** 109; **87,** 71; **88,** 71; **99,** 164; **00,** 188; **02,** 164; **03,** 149; **04,** 138; **05,** 145; **06,** 153; **07,** 160; **08,** 168; **09,** 171; **10,** 196; **11,** 218; **12,** 263.

In charge:
Col. J. N. Macomb. **R., 79,** 478.
Lt. Col. N. Michler, 1880–82. **R., 80,** 546; **81,** 708.
Lt. Col. G. L. Gillespie, 1882–85. **R., 82,** 699; **83,** 582; **84,** 749; **85,** 754.
Lt. Col. W. McFarland, 1885–86. **R., 86,** 781.
Lt. G. McC. Derby, 1886–88. **R., 87,** 770; **88,** 650.
Col. J. W. Barlow, 1900. **R., 00,** 1552, 1554.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 935.
Col. W. R. Livermore, 1904–06. **R., 04,** 1139; **05,** 1036; **06,** 1000.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1052; **08,** 1097; **09,** 1112.
Col. W. T. Rossell, 1910–. **R., 10,** 1235; **11,** 1328; **12,** 1541.

Assistants:
A. Doerflinger. **R., 79,** 479.
C. S. Kelsey. **R., 00,** 1555.

OPERATIONS.

1879–80. Cut 80′ x 9′ dr. through shoal above Valentine's Dock, **80,** 546.
1880–81. 12,554 c. y. dr., **81,** 709.
1881–82. 7,324 c. y. dr., **82,** 700.
1882–83. 6,880 c. y. dr., **83,** 582.
1902–03. 45,066 c. y. dr., and pumped ashore, **03,** 936.
1904–05. 21,799 c. y. dr., restoring chan. to proj. dimensions for 3,000′, **05,** 1037.
1905–06. 7,509 c. y. dr., in vicinity of Berrys and Salamander Docks, restoring chan. to 9′ x 50′ x 300′ m. l. w., **06,** 1000.
1906–07. 16,389 c. y. dr., incl. 850 c. y. overd., **07,** 1052.
1907–08. 54,814 c. y. excavated and pumped ashore, **08,** 1097.
1909–10. 18,620 c. y. redr., restoring chan. for 50′ x 3,100′ from town dock to Salamander Dock, and 25′ x 650′ and 25′ x 100′ just below Vulcan Dock; d. from 8′ to 9′ m. l. w., **10,** 1236.
1910–11. 10,597 c. y. dr. near mouth of creek and between mouth and town dock; work completed. 8,348 c. y. dr. for mainten., **11,** 1328.

PHYSICAL CHARACTERISTICS.

Described, **79,** 479; **00,** 1553; **07,** 161.
Max. draft June 30, 1903, through Wards Pt. Chan., 19.5′, and through Seguine Pt. and So. Amboy Chans. 19′ m. l. w., **03,** 151.
Max. draft over shoalest part of creek, June 30, 1908, 7′ to 8′ m. l. w.; mean range of tide, 5′, **08,** 169.
Max. m. l. w. d. June 30, 1912, throughout imp., 8′ for nine-tenths and 6′ for one-tenth of length, **12,** 263.

PROJECTS.

By Col. Macomb, 1879, to w. stream near Salamander Dock, dr. through shoal near Valentine's Dock, and constr. a pile revet. to straighten and strengthen banks in that vicinity to procure a uniform d. of 12′ m. h. w., w. of chan. to be 80′ from mouth to Salamander Dock; est., $13,800, **79,** 67, 478–480; **86,** 781. Revised, 1884, to $29,000, **84** 750; **86,** 782; **87,** 770.
Col. Barlow est., 1899, $35,000 for further imp., with $3,000 an. mainten., **00,** 1554.
Act June 13, 1902, au. chan. 8′ d. m. l. w., with bottom w. of 50′, by dr., from Arthur Kill to Salamander Dock; est., $35,000, with $3,000 an. mainten.,[1] **02,** 164.

SURVEYS.

Au., 1878, and in progress, **78,** 63.
Completed, 1879, by A. Doerflinger, **79,** 75, 479.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Col. Barlow (**R.** fav.; see Projects), **00,** 1552, 1554.
Maps. **05,** 1036.

G-36 RARITAN RIVER, N. J.[2]

APPROPRIATIONS.

1836,	$7,000.00,	act July 4.
1837,	6,963.00,	act Mar. 3.
1878,	200,000.00,	**78,** 57, 420.
1879,	60,000.00,	**79,** 64, 394.
1880,	100,000.00,	**80,** 518.
1881,	25,000.00,	**81,** 659.
1882,	25,000.00,	**82,** 676.
1884,	35,000.00,	**84,** 755.
1886,	26,250.00,	**86,** 776.
1888,	50,000.00,	**88,** 655.
1890,	50,000.00,	**90,** 858.
1892,	40,000.00,	**92,** 884.
1894,	20,000.00,	**95,** 983.
1896,	20,000.00,	**96,** 783.
1899,	20,000.00,	**99,** 1306.
1902,	*20,000.00,	**02,** 944.
1905,	*22,000.00,	**05,** 1045.
1907,	*16,975.42,	**07,** 1062.
1909,	*10,000.00,	**09,** 1120.
1910,	*21,994.39,	**10,** 1244.
1911,	*10,000.00,	**11,** 1337.
1912,	*5,000.00,	**12,** 1549.
Total,	791,182.81 (incl. misc., $791,185.18, **12,** 1549).	

COMMERCE.

Benefit of imp. to navigation, **85,** 761.
Exports and imports of the region, **88,** 656.
Description, **94,** 808; **95,** 981.
Proj. has caused material reduction in rates, **07,** 166.
1911, 1,100,851 t., **12,** 268.

CONTRACTS.

1878. Henry Dubois & Sons, dikes, **79,** 394.
1879. W. H. Wood, dike constr., **80,** 516.
1880. J. Van Patten, dr., 24¼¢ c. y., **81,** 659.
1882. J. D. Leary, dr., 13¢ c. y., **83,** 552.

*Allotment.
[1] H. D. 282, 56th, 1st.
[2] New Brunswick H.: Sur.—**R.,** June 20, 1832; est., $13,963.40. (H. D. 482, 55th, 2d.)

1888. M. H. Flannery, dr., 40¢ c. y., **88,** 653.
1889. M. H. Flannery, dr., 15¢ c. y., **89,** 830.
J. D. Leary, 3 dump scows, $5,490 per scow, **89,** 833.
1894. P. S. Ross, hire of r.-chiseling machine, $1.25 per t. of r. broken, **94,** 809.
1895. Hingston & Woods, breaking r., 74¢ short t. ($7,400), **95,** 983.
1897. P. S. Ross, breaking r., 59¢ short t. ($7,500), **97,** 1138.
1899. J. McSpirit & Sons, dr., 90¢ c. y.; r. removal, $1.09 to $2.72 c. y. ($12,092.80), **00,** 1506.
1903. Rogers & O'Brien, dr., 25¢ c. y., **03,** 944.
1906. National Contracting Co., dr., 25¢ c. y., **06,** 1007.
1907. J. M. Briggs, dr., 40¢ c. y., **07,** 1062.
1909. P. Sanford Ross, dr., 30¢ c. y., **10,** 1244.
1910. U. S. Dredging & Contracting Co., dr., 17½¢ c. y. (annulled), **11,** 1337.
1911. John H. Gerrish, dr., 38½¢ c. y., **12,** 1549.

ENGINEERS.

Chief of Engineers. R., 73, 86; **74,** 96; **78,** 57; **79,** 64; **80,** 84; **81,** 106; **82,** 107; **83,** 99; **84,** 118; **85,** 109; **86,** 107; **87,** 71; **88,** 71; **89,** 90; **90,** 81; **91,** 102; **92,** 104; **93,** 112; **94,** 102; **95,** 114; **96,** 97; **97,** 132; **98,** 137; **99,** 157; **00,** 179; **01,** 217; **02,** 167; **03,** 152; **04,** 142; **05,** 149; **06,** 157; **07,** 165; **08,** 173; **09,** 177; **10,** 221; **11,** 223; **12,** 268, 279.

In charge:
Lt. Col. J. Newton, 1874–84. **R., 74,** ii, 173; **78,** 419; **79,** 392; (Col.) **80,** 516; **81,** 655; **82,** 673; **83,** 549.
Lt. Col. G. L. Gillespie, 1884–86. **R., 84,** 754; **85,** 759.
Lt. Col. W. McFarland, 1886. **R., 86,** 769.
Lt. G. McC. Derby, 1886–89. **R., 87,** 771; (Capt.) **88,** 652.
Capt. T. L. Casey, 1889–94. **R., 89,** 829; **90,** 855; **91,** 996; **92,** 881; **93,** 1116; **94,** 808.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 981.
Maj. H. M. Adams, 1896–97. **R., 96,** 780; **97,** 1136.
Maj. A. M. Miller, 1898. **R., 98,** 1062.
Col. J. W. Barlow, 1899–1901. **R., 99,** 1306; **00,** 1504.
Maj. E. H. Ruffner, **01,** 198.
Col. S. M. Mansfield, 1901–02. **R., 01,** 1236.
Capt. Spencer Cosby, 1902. **R., 02,** 1017.
Lt. Col. C. W. Raymond, 1902–04. **R., 03,** 943.
Col. W. R. Livermore, 1904–06. **R., 04,** 1147; **05,** 1044; **06,** 1006.
Col. D. W. Lockwood, 1906–09. **R., 07,** 1060; **08,** 1104; **09,** 1119.
Col. S. W. Roessler, **09,** 188.
Col. W. T. Rossell, 1909–. **R., 10,** 1243; **11,** 1336; **12,** 1548.

Assistants:
J. H. Striedinger, **74,** ii, 177.
A. Zoller, **74,** ii, 177.
E. A. Giesler, **74,** ii, 177.
C. S. Kelsey. **R., 92,** 884; **93,** 1118; **94,** 811.

ESTIMATE. (See Projects.)

By Lt. Col. Newton, 1879, completion of existing proj., $1,833,662.05, **79,** 394.

OPERATIONS.

1878-79. Dr., and constr. of Dikes Nos. 2 and 3 in progress, **79,** 64, 393.
1879-80. 2,600 l. f. pile dike completed; 241,121 c. y. dr. at "the Stakes," the "Middle Ground," and at Whitehead's sand dock, **80,** 516.
1880-81. Diking at "the Stakes" completed; dr. and r. blasting at Whitehead's and dr. in the "Middle Ground" in progress, **81,** 658.
1881-82. 57,700 c. y. dr. from chan. at "Middle-Ground"; 24,337 c. y. r. blasted and removed from Whitehead's sand dock, **82,** 674.
1882-83. 46,740 c. y. dr. from cut in s. chan., **83,** 550.
1883-84. 6,929 c. y. dr. from s. chan.; 3,173 c. y. st. drilled, blasted, and removed at Whitehead's, **84,** 755.
1884-85. S. chan. dr. to 4,000′, 47,234 c. y. broken st., small fragments and sand removed at Rocky Reach, **85,** 760.
1885-86. 6,392 c. y. r. blasted and removed, **86,** 774.
1887-88. 7,630 c. y. dr.; repairs to launch and drill scow, **88,** 654.
1888-89. 29,376 c. y. dr.; 840 c. y. riprap used in revetting face and top of Dike C, **89,** 830.
1889-90. 20,569 c. y. dr., **90,** 856.
1890-91. 62,934 c. y. sand and gravel and 7,206 c. y. r. removed, **91,** 997.
1891-92. 6,209 c. y. sand and gravel and 6,475 c. y. r. removed, **92,** 883.
1892-93. 11,675 c. y. dr., r. removal in progress, and dikes repaired, **93,** 1117.
1893-94. 10,876 c. y. dr., over 12,000 t. r. blasted and removed in connection with preceding year; US. plant repaired, **94,** 810, 812.
1894-95. 2,955 t. r. chisled and removed, 195 t. gravel removed, and 7,442 t. r. broken and removed, **95,** 981, 982.
1895-96. 3,454 t. r. broken and removed, 985 t. gravel removed, and dikes extended, **96,** 782.
1896-97. 8,694 t. r. broken and much of it removed, **97,** 1137.
1897-98. 3,625 t. r. broken and much of it removed, 2,017 t. gravel removed; U. S. plant sold to highest bidder, **98,** 1062.
1899-00. 8,092 c. y. p. m. r. and gravel removed, (less than 1,745 c. y. deducted for overdepth) **00,** 1504.
1902-03. 2,408 c. y. dr., **03,** 943.
1903-04. 66,843 c. y. dr., **04,** 1146.
1904-05. 720 c. y. dr., completing contract, **05,** 1044.
1905-06. 67,498 c. y. dr., **06,** 1006.
1906-07. 2,918 c. y. dr., completing contract (12,131 c. y. deducted for overd.); large tree trunk removed, **07,** 1061.
1907-08. 39,607 c. y. dr., **08,** 1105.
1909-10. 26,971 c. y. dr., **10,** 1243.

PHYSICAL CHARACTERISTICS.

Description, **74,** ii, 174–176; **86,** 769; **88,** 652.
Distances of the several brs. and other points of the R. above its mouth, **96,** 781.
Flows through N. J. to Raritan B. at Perth Amboy; navig. to New Brunswick, 12 m., where it is e. terminus of Del. and Raritan Canal, **12,** 268.

PROJECTS. (See Estimates.)

By Maj. H. Bache (sur. June 20, 1832; est., $13,963.40), 1836, New Brunswick H., details unknown; act July 4.
By Lt. Col. Newton, 1872, 10′ chan. below New Brunswick by dr., removal of r., and building dikes, **78,** 419; **79,** 393.
By Lt. Col. Newton, 1874, permanent imp., 10′ m. l. w. chan. 200′ w., mouth to New Brunswick, 12½ m., and excavation of tidal basin above New Brunswick locks by dr., r. removal, and diking; est., $2,093,662, **74,** ii, 179; **82,** 675; **86,** 770.
Modified in 1881 to provide for dr. s. chan. to form chan. 5½′ x 100′ m. l. w., **87,** 771; **92,** 882.
By Capt. Casey, 1892, expend. of app. of 1892 in excavation of chan. 10′ x 100′ m. l. w. through the r. shoals along the line of the bulkhead extending toward the canal lock at New Brunswick; in dr. the s. chan. to the required w. and d.; and in repairing dikes, **93,** 780, 1116.

SURVEYS.

1832. By Maj. H. Bache, June 20, 1832; est., $13,963.40.[1]
1873–74. By J. H. Striedinger, A. Zoller, and E. A. Giesler, under direction of Lt. Col. Newton, of the R. below New Brunswick, incl. shoals called the "middle ground." **R., 74,** ii, 173.
Ex. and sur. au. act June 25, 1910, with view to w. chan. from Martins Creek to Martins Dock, **12,** 279.

Maps:
Raritan R., from mouth to New Brunswick, **85,** 760.
93, 1118; **94,** 810; **05,** 1044.

[1] New Brunswick H. (H. D. 306, 22d, 1st.)

G-36(a) DELAWARE AND RARITAN CANAL, N. J.

Ex.—**R.** (indefinite), Feb. 2, 1825. (H. D. 482, 55th, 2d.)

G-39 SOUTH RIVER, N. J.

APPROPRIATIONS.

1871,	$15,000.00,	**71,** 80, 697.
1873,	5,000.00,	**73,** 81, 869; **74,** ii, 144.
1880,	40,000.00,	**80,** 519.
1881,	6,000.00,	**81,** 662.
1882.	10,000.00,	**82,** 679.
1886,	5,000.00,	**86,** 780.
1888,	5,000.00,	**88,** 660.
1890,	5,000.00,	**90,** 860.
1892,	7,000.00,	**92,** 888.
1894,	5,000.00,	**95,** 986.
1896,	5,000.00,	**96,** 786.
1899,	5,000.00,	**99,** 1307.
1902,	*5,000.00,	**03,** 946.
1905,	*5,000.00,	**05,** 1047.
1907,	*13,178.63,	**07,** 1064.
1909,	*5,000.00,	**09,** 1122.
1910,	*19,380.63,	**10,** 1246.
1911,	*5,000.00,	**11,** 1339.
1912,	87,000.00,	**12,** 1552.

Total, 252,559.26 (incl. miscl., $252,560.26, **12,** 1552).

COMMERCE.

Increase of, **88,** 659, 661.

1895, C. carried through a chan. in the R. not included in the proj. for the imp., **95,** 985.

1901, large temporary brickyards along banks, **01,** 218.

1900, 414,288 t., **01,** 218; 1907, 226,227 t., **07,** 1065, 1911, 127,024 t., **12,** 271.

At 1909 imp. had caused a great reduction in rates, **09,** 179.

CONTRACTS.

1873. P. W. Myers & Co., dr., 38¢ c. y., **73,** 869.

1882. H. Du Bois & Sons, wharf removal and reconstr., dike constr., and dr., **83,** 554.

1891. E. M. Payn, dr., 38⅞¢ c. y., **91,** 1001.

1892. W. H. Taylor, dr., 29½¢ c. y., s. m. ($5,605), **93,** 1122.

1895. E. Brainard, dr., 25¢ c. y. ($3,750), **95,** 986.

1896. Newburgh Dredging Co., dr., 24½¢ c. y., s. m. ($4,500), **97,** 1141.

1899. E. M. Payn, dr., 27¾¢ c. y., **1900,** 1507.

1903. Rogers & O'Brien, dr. 18,000 c. y., 25¢ c. y., s. m., **03,** 946.

1907. Hawley Miller, dr. 43,750 c. y., 32¢ c. y., s. m., **07,** 1064–65.

1909. P. Sanford Ross (Inc.), dr. 13,333 c. y., 30¢ c. y., s. m. (contract includes dr. in Raritan R., N. J.), **10,** 1246.

1910. U. S. Dredging & Contracting Co., dr. 53,512 c. y., 29.9¢ c. y., s. m., **11,** 1340.

1912. John H. Gerrish, dr. 13,924 c. y., 39½¢ c. y. s. m., **12,** 1552.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 72; **71,** 80; **72,** 77; **73,** 81; **74,** 93; **79,** 66; **80,** 84, 85; **81,** 106; **82,** 108; **83,** 100; **84,** 120; **85,** 112; **86,** 108; **87,** 72; **88,** 72; **89,** 91; **90,** 82; **91,** 103; **92,** 105; **93,** 113; **94,** 103; **95,** 115; **96,** 98; **97,** 133; **98,** 138; **99,** 158; **00,** 180; **01,** 217; **02,** 167; **03,** 153; **04,** 142; **05,** 150; **06,** 158, 168; **07,** 166; **08,** 174; **09,** 178; **10,** 203; **11,** 225; **12,** 270, 279.

In charge:

Lt. Col. J. D. Kurtz, 1871–74. **R., 71,** 697–701; **72,** 781; **73,** 869; **74,** ii, 144.

Col. J. Newton, 1879–84. **R., 80,** 519; **81,** 660; **82,** 677; **83,** 553.

Lt. Col. G. L. Gillespie, 1884–86. **R., 84,** 760; **85,** 764.

Lt. Col. W. McFarland, 1886. **R., 86,** 777.

Lt. G. McC. Derby, 1886–89. **R., 87,** 773; (Capt.) **88,** 657.

Capt. T. L. Casey, 1889–94. **R., 89,** 834; **90,** 858; **91,** 999; **92,** 887; **93,** 1120; **94,** 813.

Lt. Col. G. L. Gillespie, 1895. **R., 95,** 984.

Maj. H. M. Adams, 1896–97. **R., 96,** 784; **97,** 1139.

Maj. A. M. Miller, 1898. **R., 98,** 1064.

Col. J. W. Barlow, 1899–1900. **R., 99,** 1307; **00,** 1506.

Col. S. M. Mansfield, 1901. **R., 01,** 1237.

Capt. Spencer Cosby, 1902. **R., 02,** 1019.

Lt. Col. C. W. Raymond, 1903. **R., 03,** 945.

Col. W. R. Livermore, 1904–06. **R., 04,** 1148; **05,** 1046; **06,** 1008.

Col. D. W. Lockwood, 1907–09. **R., 07,** 1063; **08,** 1106; **09,** 1121.

Col. W. T. Rossell, 1910–. **R., 10,** 1245; **11,** 1339; **12,** 1553.

Assistants:

G. E. Brown. **R., 71,** 699.

R. H. Talcott. **R., 80,** 520.

OPERATIONS.

1870-71. Delayed by failure to enter into contract, **71,** 697.

1871-72. Dr. in progress, **72,** 77, 781.

1872-73. Dr. in progress, **73,** 869.

1873-74. Results, a chan. 6′ d. joining the South and Raritan Rs., **74,** 93, ii, 144.

1882-83. Wharf at Raritan and South R. Canal junction rebuilt; 1,779 l. f. of dike built, **83,** 554.

1883-84. 3,117 l. f. of diking built; 2,222 c. y. dr. from shoal; 3,173 c. y. r. blasted from shoal at Whitehead's sand dock, **84,** 760, 761.

1884-85. 1,200 c. y. broken st. placed in dike at mouth of canal, **85,** 765.

1887-88. 16,815 c. y. dr. from chan. between Dikes D and E, and from shoal at Dike F, **88,** 659.

1891-92. 10,551 c. y. dr., **92,** 887.

1892-93. 18,028 c. y. dr., **93,** 1121.

1894-95. 16,069 c. y. dr., **95,** 984, 985.

1896-97. 17,988 c. y. dr., **97,** 1140.

1899-00. 18,024 c. y. dr., **00,** 1506.

1903-04. 18,000 c. y. dr., completing contract; three-eighths of proj. completed, **04,** 1149.

1907-08. 46,477 c. y. dr. and pumped ashore on w. bank of R. between highway br. and Raritan R. RR. br., **08,** 1106–07.

1909-10. 13,470 c. y. dr. and dumped at sea, and contract completed, **10,** 1245.

1910-11. 13,589 c. y. dr., **11,** 1339.

1911-12. Contractor abandoned work Sept. 30, 1911; contract annulled Dec. 8, 1911; 22,115 c. y. had been dr., **12,** 1551.

PHYSICAL CHARACTERISTICS.

Described, **71,** 698–701; **88,** 657.

Distances of the various points along the R. from its junction with the Raritan R. at Sayreville, **96,** 784.

South R. a small stream in central part of New Jersey, discharging into Raritan R. 8 m. above its mouth, **12,** 270.

Max. draft to South R. or Washington, June 30, 1912, about 8′, thence to Bissetts 5′–6′ m. l. w., **12,** 270.

PLAN. (See Projects.)

By Lt. Col. Kurtz, 1872, short wing dam and pile protection; may be necessary; est., $5,000, **72,** 781.

*Allotment.

PRIVATE (CORPORATE) WORK.

New Jersey Transportation Co. made a cut about 80′ w. between South and Raritan Rs. about 1831, **71,** 698.

Private canal about ¾ m. l. had been dr. from near Washington, on South R., to Sayreville, on the Raritan R., shortening the sailing course about 2 m., **01,** 218.

PROJECTS. (See Plans.)

By Lt. Col. Kurtz, 1870, 6′ chan. through the canal made by New Jersey Transportation Co., and through the shoals between the canal and Washington, and at the confluence of the South and Raritan Rs. by dr.; est., $13,653.50, **71,** 698.

By Col. J. Newton, 1879, imp. of South R. by rectification of the entrance to the artificial chan. or canal into the Raritan R.; closing the South R. below Petit's brickyard, increasing, by means of dikes and dr., the d. to 8′ m. l. w. up to Washington, 6′ to Bissetts, and 4′ to old br., involving const. of 14,800 l. f. of dike and 3,200′ of half dike, and dr.; est., $194,695, **80,** 522, 523; **87,** 773.

Proj. of 1880 modified in 1892 by omitting the proposed dr. of the cut above Washington and in front of the brickyards, the const. of Dikes H, I, J, K, and L, and substituting therefor dr. of the chan. between Washington and the Raritan R. RR. br., reducing the orig. est. to $176,975, **93,** 1121.

By Capt. Casey, 1892, expend. of the app. of 1892 in dr. the R. between the turnpike br. and Bissetts, **93,** 1121.

Act July 25, 1912, au. chan. between Bissetts and Old Br. 6′ x 100′; est., $87,000, and $8,000 an. mainten.,[1] **12,** 271.

SURVEYS.

By Lt. Col. Kurtz, 1870. **R., 71,** 698–701.

By Lt. Col. Newton, 1879, **79,** 66.

Ex. au. act Mar. 3, 1879; made, 1880, by Col. Newton, **80,** 519.

Ex. of a bar which had formed around an old wreck made, 1894, by Lt. Col. Gillespie, **95,** 984.

Ex., 1899, by Col. Barlow, **99,** 1307.

Pre. ex. au. act Mar. 3, 1905. **R.** by Col. Livermore, June 27, 1906, and Col. Lockwood, Dec. 6, 1906; est., $20,908.80,[2] **07,** 175.

Pre. ex. and sur. au. act June 25, 1910, between Bissetts and Old Br., with view to d. chan. to 6′. **R.** by Col. Rossell, 1910 and 1911; est., $87,000, and $3,000 an. mainten.,[1] **12,** 279.

Maps. **82,** 678; **85,** 764; **05,** 1046.

G-40 CHEESEQUAKE CREEK, N. J.

APPROPRIATIONS.

1880,	$20,000.00,	**80,** 524.
1881,	5,000.00,	**81,** 664.
1882,	15,000.00,	**82,** 681.
1905	*5,000.00,	**05,** 1051.
	*1,000.00,	**06,** 1013.
1907,	*3,604.96,	**07,** 1072.
1910,	5,000.00,	**10,** 1250.
1911,	*2,500.00,	**11,** 1344.
1912,	*2,500.00,	**12,** 1556.
Total,	59,604.96	(less $252.68 returned to Treas., and incl. sales, $59,353.53, **12,** 1556).

COMMERCE.

Since impr. freight increased over 200%, **06,** 1014. 1911, 36,500 t., **12,** 1556.

CONTRACTS.

1882. S. R. Cumming, revet., **83,** 570.

1906. A. C. Driscoll, dr., 40¢ c. y.; Bouker Contracting Co., 714 t. riprap st. in place, $1.40 t., **06,** 1013.

1907. Hawley Miller, dr., 42½¢ c. y., **07,** 1072.

1910. John H. Gerrish, dr. about 9,091 c. y., at 44¢ c. y., s. m.; completed June 3, 1911, **11,** 1344.

1912. John H. Gerrish, dr. about 10,101 c. y., s. m., at 49½¢ c. y.; contract completed July 28, 1912, **12,** 1554.

ENGINEERS.

Chief of Engineers. R., 80, 85; **81,** 107; **82,** 108; **83,** 104; **84,** 110; **85,** 101; **86,** 106; **87,** 73; **88,** 73; **05,** 152; **06,** 162; **07,** 170; **08,** 178; **09,** 182; **10,** 207; **11,** 229; **12,** 274.

In charge:

Col. J. Newton, 1879–82. **R., 80,** 524; **81,** 663; **82,** 679.

Lt. Col. G. L. Gillespie, 1882–86. **R., 83,** 569; **84,** 735; **85,** 743.

Lt. Col. W. McFarland, 1886. **R., 86,** 763.

Lt. G. McC. Derby, 1886–88. **R., 87,** 775; (Capt.) **88,** 661.

Col. W. R. Livermore, 1905–06. **R., 05,** 1051; **06,** 1012.

Col. D. W. Lockwood, 1907–09. **R., 07,** 1070; **08,** 1112; **09,** 1126.

Col. W. T. Rossell, 1910–. **R., 10,** 1250; **11,** 1343; **12,** 1555.

Assistant. R. H. Talcott. **R., 80,** 525.

OPERATIONS.

1882–83. 2,000 l. f. of st. j. constr.; chan. dr., **83,** 569.

1883–84. Rubble js. raised by adding 750 c. y. st., chan. w. to 100′; 532′ of sheet pile revet. built, **84,** 736.

1905–06. 714 t. st. placed in 250′ break in w. j., and 7,206 c. y. dr., restoring chan. for l. of 5′–6′ x 50′ x 1,200′ m. l. w., **06,** 1013.

1906–07. 1,868 c. y. dr., restoring chan. for w. of 50′–90′ x 800′, **07,** 1071.

1907–08. 8,236 c. y. dr., restoring chan. 100′ x 5′ highway br. to Raritan B., **08,** 1112.

1910–11. 5,641 c. y. dr., restoring the entrance chan. to 5′, **11,** 1343.

1911–12. 3,266 c. y. removed from mouth of creek during July, 1912, restoring the entrance chan. to w. of 125′–150′, for its entire l. of 1,800′ contract completed July 28, 1912, **12,** 274, 1555.

PHYSICAL CHARACTERISTICS.

Described, **80,** 526; **12,** 274.

Max. draft, 5′; mean range of tides, 5′, **11,** 229.

Discharges into Raritan B., about 2 m. e. of So. Amboy, **12,** 274.

PROJECTS.

By Col. Newton, 1879, to change the outlet into a direction at a right angle to the beach and to sustain this direction by parallel js. to strengthen the course of the stream and increase the d. to 4′ at m. l. w.; est., $75,279, **80,** 525, 527; **82,** 680. Est. revised in 1885 to $90,000, **85,** 743; **87,** 775.

By Col. Lockwood, for expending $315,04, unexpended balance, and allotment of $3,604.96, act Mar. 2, 1907, to restore chan. 100′ w. by dr., B. to the highway br., **07,** 1071.

SURVEY.

Au. act Mar. 3, 1879; made, 1880, by Col. Newton, **79,** 66; **80,** 525.

Maps. **82,** 680; **05,** 1051.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 275.

* Allotment. [1] H. D. 520, 62d, 2d. [2] H. D. 335, 59th, 2d.

G-42 WHALE CREEK, N. J.

COMMERCE.

Large shipments of brick, **93,** 1139.

ENGINEERS.

Chief of Engineers. **R., 93,** 118.
In charge. Capt. T. L. Casey, 1893. **R., 93,** 1138.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1139.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Capt. Casey (**R.** unfav.), **93,** 1138.

G-43 KEYPORT HARBOR, N. J.

APPROPRIATIONS.

1882,	$30,475.00,	**83,** 589.
1892,	5,000.00,	**92,** 890.
1894,	5,000.00,	**95,** 988.
1896,	2,500.00,	**96,** 794.
1899,	2,500.00,	**99,** 1311.
1902,	5,000.00,	**03,** 940.
1904,	*5,000.00,	**04,** 1143, 1144.
1905,	*5,000.00,	**05,** 1041.
1907,	8,705.97,	**07,** 1057.
1909,	5,000.00,	**09,** 1116.
1910,	18,872.74,	**10,** 1240.
1911,	5,000.00,	**11,** 1333.
1912,	5,000.00,	**12,** 1546.

Total, 103,053.71 (incl. sales, $103,054.71, **12,** 1546).

COMMERCE.

Increase in C. consequent upon imp., **88,** 662.
Had increased up to 1892, to $6,562,200, **93,** 1124.
Rates greatly reduced, **10,** 200; **12,** 266.
Increasing in 1911, 96,477 t., **12,** 266.

CONTRACTS.

1882-83. Atlantic Dredging Co., dr., 24¢ c. y., **83,** 589.
1893. R. G. Packard, dr., 28¢ c. y., s. m. ($4,000), **93,** 1125.
1895. A. E. Smith, dr., 20¢ c. y., **95,** 987.
1897. W. H. Taylor, jr., dr., 18¢ c. y., s. m. ($2,200), **97,** 1149.
1899. W. H. Taylor, jr., dr., 15½¢ c. y., s. m. ($2,250), **99,** 1311.
1902. International Contracting Co., dr., 23½¢ c. y., s. m., **03,** 940.
1904. International Contracting Co., dr., 19¢ c. y., s. m., **05,** 1042.
1905. Atlantic Dredging Co., dr., 29¢ c. y., s. m., **06,** 1003.
1907. J. M. Briggs, dr., 40¢ c. y., s. m., **07,** 1058.
1909. John & Joseph McSpirit, dr., 28¢ c. y., s. m., **10,** 1240.
1910. John H. Gerrish, dr., 17.9¢ c. y., **11,** 1334.

ENGINEERS.

Chief of Engineers. **R., 72,** 80; **73,** 86; **83,** 111; **84,** 120; **85,** 111; **86,** 105; **87,** 73; **88,** 73; **89,** 93; **90,** 83; **91,** 104; **92,** 106; **93,** 114; **94,** 104; **95,** 116; **96,** 100; **97,** 135; **98,** 141; **99,** 160; **00,** 183; **01,** 220; **02,** 165; **03,** 151; **04,** 141; **05,** 148; **06,** 155; **07,** 163; **08,** 171; **09,** 174; **10,** 199; **11,** 221; **12,** 266.

In charge:
Lt. Col. J. Newton, 1872. **R., 73,** 941.
Lt. Col. G. L. Gillespie, 1883–86. **R., 83,** 588; **84,** 758; **85,** 763.
Lt. Col. W. McFarland, 1886. **R., 86,** 760.
Lt. G. McC. Derby, 1886–89. **R., 87,** 776; (Capt.) **88,** 662.
Capt. T. L. Casey, 1889–94. **R., 89,** 839; **90,** 863; **91,** 1001; **92,** 889; **93,** 1123; **94,** 815.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 987.
Maj. H. M. Adams, 1896–97. **R., 96,** 793; **97,** 1147.
Maj. A. M. Miller, 1898. **R., 98,** 1067.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1310; **00,** 1511.
Col. S. M. Mansfield, 1901. **R., 01,** 1241.
Capt. Spencer Cosby, 1902. **R., 02,** 1015.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 939.
Col. W. R. Livermore, 1904–06. **R., 04,** 1143; **05,** 1040; **06,** 1003.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1056; **08,** 1101; **09,** 1115.
Col. W. T. Rossell, 1910–. **R., 10,** 1239; **11,** 1333; **12,** 1545.

Assistants:
J. H. Striedinger, **73,** 942.
A. Zoller, **73,** 942.
A. Doerflinger, **73,** 942.

OPERATIONS.

1882-83. 1,863 c. y. dr. from chan., **83,** 589.
1883-84. 112,299 c. y. dr. from chan., **84,** 758.
1892-93. 14,999 c. y. dr., **93,** 1124.
1895-96. 20,339 c. y. dr., **96,** 794.
1896-97. 12,222 c. y. dr., **97,** 1148.
1899-00. 14,500 c. y. dr., **00,** 1511.
1902-03. 18,700 c. y. dr., **03,** 940.
1904-05. 23,968 c. y. dr., **05,** 1041.
1905-06. 11,959 c. y. dr., **06,** 1003.
1908-09. 19,878 c. y. dr., **09,** 1116.
1909-10. 14,388 c. y. dr., **10,** 1239.
1910-11. 20,263 c. y. dr., **11,** 1333.
1911-12. 65,655 c. y. dr., **12,** 1545.

PHYSICAL CHARACTERISTICS.

The bed of the H. clay and fine sand. Max. velocity of tidal current 0.50 knot per hour. Exposed to the waves during n. gales, **73,** 941, 942.
Description of, **88,** 662.
Tidal observations, **93,** 1123.
Chan. subject to shoaling, **95,** 988; **97,** 1148; **98,** 1067.
Max. drafts, tides, etc., **12,** 266.
H. at mouth of Matawan Creek, on s. side of Raritan B., 5 m. e. of Raritan R.; is a B. 1 ± m. broad, **12,** 266.

PROJECTS.

By Lt. Col. Newton, 1873, chan. 8′ x 200′ x 4,700′ m. l. w.; est., $30,475, **73,** 942. Revised, 1884, to $40,475, **84,** 759; **87,** 776; **91,** 1002.

SURVEYS.

Under direction of Lt. Col. Newton, 1872–73, by J. H. Striedinger, A. Zoller, and A. Doerflinger. **R., 73,** 941.
Sur. by Capt. Casey, 1892, **93,** 1123.
Maps. **05,** 1040.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 266.

*Allotment.

G-44 MATAWAN CREEK, N. J.

APPROPRIATIONS.

1881, $15,000, **81,** 720.
1882, 6,000, **82,** 707.
1890, 2,500, **91,** 1003.
1892, 9,620, **92,** 891.
1894, 3,000, **95,** 990.
1896, 3,000, **96,** 792.
1899, 3,000, **99,** 1309.
1902, *3,000, **03,** 942.
1904, *3,000, **04,** 1145.
1905, *3,000, **05,** 1043.
1907, *6,000, **07,** 1059.
1909, *3,000, **09,** 1118.
1910, *6,000, **10,** 1242.
1911, *3,000, **11,** 1335.
1912, *6,000, **12,** 1547.

Total, 75,120 (incl. misc., less $315.61 returned to Treas., $74,805.89, **12,** 1547).

COMMERCE.

Rates greatly reduced, especially in marketing season, **10,** 201; **12,** 268.
1907, 41,000 ± t.; 1908, 10,100 ± t.; 1909, 17,000 ± t.; 1910, 41,000 ± t.; 1911, 48,745 t., **12,** 268.

CONTRACTS.

1881. J. Van Patton, dr., 48¢ c. y., **81,** 720.
1882. F. Pidgeon, jr., dr., 59¢ c. y., **83,** 588.
1891. Atlantic Dredging Co., dr., 37½¢ c. y., **91,** 1003.
1893. A. E. Smith, dr., 30¢ c. y., s. m. ($7,600), **93,** 1127.
1895. A. E. Smith, dr., 20¢ c. y., **95,** 989.
1896. J. McSpirit & Sons, dr. 7,600 c. y., 19½¢ c. y., b. m., **96,** 791.
1897. J. McSpirit, dr., 18¾¢ c. y., p. m. ($2,700), **97,** 1147.
1899. W. H. Taylor, jr., dr., 26¢ c. y., s. m. ($2,700), **99,** 1310.
1902. International Contracting Co., dr., 23½¢ c. y., s. m., **03,** 942.
1904. T. G. Smith & Co. (Inc.), dr., 24.9¢ c. y., **05,** 1044.
1905. John & Joseph McSpirit, dr., 28¢ c. y., s. m., **06,** 1005.
1907. J. M. Briggs, dr., 60¢ c. y., s. m., **07,** 1060.
1909. John & Joseph McSpirit, dr., 28¢ c. y., s. m., **10,** 1242.
1910. J. H. Gerrish, dr., 36¢ c. y., **11,** 1336.
1912. J. H. Gerrish, dr., 53¢ c. y., **12,** 1547.

ENGINEERS.

Chief of Engineers. R., 80, 90; **81,** 113, 115; **82,** 113; **83,** 110; **84,** 119; **85,** 111; **86,** 105; **87,** 74; **88,** 74; **91,** 104; **92,** 107; **93,** 115; **94,** 104; **95,** 117; **96,** 99; **97,** 135; **98,** 140; **99,** 160; **00,** 183; **01,** 219; **02,** 166; **03,** 152; **04,** 141; **05,** 148; **06,** 156; **07,** 164; **08,** 172; **09,** 176; **10,** 200; **11,** 222; **12,** 267.

In charge:
Lt. Col. N. Michler, 1880–81. **R., 81,** 720.
Col. J. Newton, 1881. **R., 82,** 683.
Lt. Col. G. L. Gillespie, 1881–85. **R., 82,** 706; **83,** 587; **84,** 756; **85,** 763.
Lt. Col. W. McFarland, 1885. **R., 86,** 761.
Lt. G. McC. Derby, 1887–90. **R., 87,** 777; (Capt.) **88,** 663.
Capt. T. L. Casey, 1890–94. **R., 91,** 1003; **92,** 890; **93,** 1125; **94,** 816.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 988.
Maj. H. M. Adams, 1896–97. **R., 96,** 790; **97,** 1145.
Maj. A. M. Miller. **R., 98,** 1066.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1309; **00,** 1510.
Col. S. M. Mansfield, 1901. **R., 01,** 1240.
Capt. Spencer Cosby, 1902. **R., 02,** 1016.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 941.
Col. W. R. Livermore, 1904–06. **R., 04,** 1144; **05,** 1042; **06,** 1004.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1059; **08,** 1103; **09,** 1117.
Col. W. T. Rossell, 1910–. **R., 10,** 1241; **11,** 1334; **12,** 1547.

Assistant. A. Doerflinger. **R., 81,** 721.

OPERATIONS.

1881-82. 25,630 c. y. dr., **82,** 706.
1882-83. 8,897 c. y. dr., **83,** 587.
1891-92. 5,028 c. y. dr., **92,** 891.
1892-93. 2,617 c. y. dr., **93,** 1126.
1893-94. 22,285 c. y. dr., **94,** 816.
1895-96. 12,404 c. y. dr., **96,** 791.
1897-98. 13,508 c. y. dr., **98,** 1066.
1899-00. 10,400 c. y. dr., **00,** 1510.
1902-03. 11,968 c. y. dr., **03,** 941.
1904-05. 9,050 c. y. dr., **05,** 1043.
1905-06. 8,908 c. y. dr., **06,** 1004.
1907-08. 1,258 c. y. dr., **08,** 1103.
1908-09. 7,036 c. y. dr., **09,** 1118.
1909-10. 9,297 c. y. dr., **10,** 1241.
1910-11. 14 310 c y. dr. **11,** 1335.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 663; **10,** 200.
Small tidal stream in e. N. J., flowing into Raritan B. through Keyport H. It is navigable up to br. of N. Y. & L. B. RR., 2 m. above mouth, **12,** 267.

PROJECTS.

By Lt. Col. Michler, 1880, chan. 4′ x 100′ m. l. w., mouth up to Winkson Creek, 1 m., thence to head of navigation at the Long Branch RR. br., 4′ x 75′ m. l. w.; est., $33,120, **81,** 722; **86,** 762; **91,** 1003.
In 1892 Capt. Casey reported that the est. should be increased by $10,000, **93,** 1126.
In 1898 Maj. Miller est. $3,000 an. for mainten., **98,** 1066.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Lt. Col. Michler, **81,** 720.
Sur. by Capt. Casey, 1892, **93,** 1126.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 268.
Maps. **05,** 1042.

G-46 SHOAL HARBOR, AND COMPTON CREEK, N. J.

APPROPRIATIONS.

1890, $5,000.00, **91,** 1006.
1892, 3,000.00, **92,** 893.
1894, 3,000.00, **95,** 992.
1896, 5,000.00, **96,** 796.
1899, 8,000.00, **99,** 1312.
1902, *8,000.00, **03,** 949.
1905, *5,000.00, **05,** 1050.
1907, *9,750.57, **07,** 1069.
1910, *8,752.24, **10,** 1249.
1911, *5,000.00, **11,** 1342.
1912, 5,000.00, **12,** 1554.

Total, 65,502.81

COMMERCE.

1900, 179,500 t., **01,** 221; 1905, 34,340 t., **06,** 161; 1911, 61,702 t., **12,** 273.
Rates reduced from 40 to 50% as result of imp., **06,** 161.

CONTRACTS.

1891. E. Brainard dr., 24¾¢ c. y., **91,** 1006.
1894. W. H. Taylor, dr., 54¢ c. y. ($2,376), **94,** 818; 64¢ c. y. ($2,400), **95,** 992.
1896. Newburgh Dredging Co., dr., 60¢ c. y., s. m. ($4,500), **97,** 1151.
1899. International Dredging Co., dr., 45¢ c. y., s. m. ($7,450), **99,** 1312.

*Allotment.

1903. Kirk, Driscoll & Co., dr. 24,000 c. y., 30¢ c. y., **03,** 949.
1906. A. C. Driscoll, dr. 6,666 c. y., 60¢ c. y., **06,** 1011.
1907. J. M. Briggs, dr. 13,333 c. y., 60¢ c. y., **07,** 1070.
1910. J. H. Gerrish, dr. 18,182 c. y., 44¢ c. y., **11,** 1342.
1912. J. H. Gerrish, dr. 10,101 c. y., 49½¢ c. y., **12,** 1554.

ENGINEERS.

Chief of Engineers. R., 84, 122; **91,** 105; **92,** 108; **93,** 116; **94,** 105; **95,** 118; **96,** 100; **97,** 136; **98,** 141; **99,** 161; **00,** 184; **01,** 220; **02,** 168; **03,** 154; **04,** 144; **05,** 151; **06,** 160; **07,** 168; **08,** 177; **09,** 181; **10,** 206; **11,** 228; **12,** 272.

In charge:
Maj. G. L. Gillespie. **R., 84,** 770.
Capt. T. L. Casey, 1890–94. **R., 91,** 1004; **92,** 892; **93,** 1128; **94,** 818.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 991.
Maj. H. M. Adams, 1896–97. **R., 96,** 795; **97,** 1150.
Maj. A. M. Miller, 1898. **R., 98,** 1068.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1312; **00,** 1512.
Col. S. M. Mansfield, 1901. **R., 01,** 1242.
Capt. Spencer Cosby, 1902. **R., 02,** 1021.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 948.
Col. W. R. Livermore, 1904–06. **R., 04,** 1152; **05,** 1050; **06,** 1011.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1069; **08,** 1110; **09,** 1124.
Col. W. T. Rossell, 1910–12. **R., 10,** 1248; **11,** 1342; **12,** 1553.

Assistant. A. Doerflinger. **R., 84,** 771.

OPERATIONS.

1890-91. 10,808 c. y. dr., **91,** 1005.
1891-92. 4,921 c. y. dr., **92,** 893.
1894-95. 8,150 c. y. dr., **95,** 992.
1896-97. 7,500 c. y. dr., **97,** 1151.
1899-00. 16,300 c. y. dr., **00,** 1512.
1902-03. 24,020 c. y. dr., **03,** 949.
1905-06. 6,659 c. y. dr. from chan. in creek and B., **06,** 1011.
1907-08. 13,064 c. y. dr., restoring chan. for 5′-6′ x 60′ x 2,400′ m. l. w., **08,** 1111.
1911-12. 14,442 c. y. dr. for mainten., **12,** 1553.

PHYSICAL CHARACTERISTICS.

Description of locality, **84,** 770.
Max. draft June 30, 1912, in imp. chan. to drawbr. 4′ m. l. w. Mean range of tide, 4.5′, **12,** 273.

PROJECTS.

By Maj. Gillespie, 1884, chan. in the creek, by dr., 5′ x 150′ l. w. bet. H. and the B.; est., $64,130, **84,** 771, 773; **91,** 1005.
By Capt. Casey, 1892, expend. of app. of 1892, $3,000, in extending dr. chan. toward d. w. in Raritan B. as far as the funds would permit, **93,** 1128.

SURVEYS.

Au. act Aug. 2, 1882; made by Maj. Gillespie, **84,** 770.
Sur. by Capt. Casey, 1892, **93,** 1128.
Map. **05,** 1050.

G-48 SHREWSBURY RIVER, N. J.[1]

APPROPRIATIONS.

1852,	$1,500 (sur.), act Aug. 30.	
1871,	14,000,	**71,** 80, 701; **72,** 782.
1873,	5,000,	**73,** 81, 869.
1878,	18,000,	**78,** 62, 441.
1879,	10,000,	**79,** 66, 404.
1880,	30,000,	**80,** 543.
1881,	86,000,	**81,** 699.
1882,	30,000,	**82,** 693.
1886,	10,000,	**86,** 760.
1888,	10,000,	**88,** 667.
1890,	10,000,	**90,** 862.
1892,	10,000,	**92,** 896.
1894,	5,000,	**95,** 996.
1896,	15,000,	**96,** 800.
1899,	10,000,	**99,** 1313.
1900,	*10,000,	**00,** 1513
1902,	75,000,	**02,** 1023.
1905,	20,000,	**05,** 1054.
1907,	10,000,	**07,** 1074.
1909,	*20,000,	**09,** 1128.
1910,	10,000,	**10,** 1252.
1911,	10,000	**11,** 1346.
1912,	10,000,	**12,** 1557.
Total,	429,500	(incl. misc., $429,520.62, **12,** 1557).

COMMERCE.

Increase in C. consequent upon imp., **84,** 745.
Importance of the river's C., **88,** 666.
1900, 804,000 t., **01,** 1245.
R. used mostly as a means of transportation for persons patronizing summer resorts. Rates of fare generally ½ less than charged by RR., **04,** 1165.
1903, 761,000 t., **04,** 1156; 1906, 1,668,500 t., **07,** 173; 1911, 1,608,600 t., **12,** 1557.
Rates lowered and maintained; C. increasing, **10,** 210; **12,** 277.
Passengers, 150,000, 1910, **12,** 277.

CONTRACTS.

1873. P. W. Myers & Co., dr., 29¢ c. y., **73,** 870.
1880. J. A. Bouker, crib and training-dike constr, **80,** 542. J. Kelley, pile-dike constr., **81,** 700.
1881. W. H. Wood, pile-dike constr., **81,** 700. E. Brainard, jr., dr., 34¢ c. y., **82,** 693. W. H. Wood, pile-dike constr., **82,** 693. W. H. Wood, dr., 44¢ c. y., **82,** 694. E. Brainard, jr., dr., 41¾¢ c. y., **82,** 694.
1882. E. Brainard, jr., dr., 35¾¢ c. y.; diking, $5.50 l. f., **83,** 578.
1888. A. J. Howell, st. delivered in place, $1.45 c. y., **88,** 667.
1891. P. S. Ross, dr., 35¢ c. y.; G. Humphreys, timber dike constr., $7.75 l. f., **91,** 1009.
1893. E. M. Payn, dr., 37⅜¢ c. y., s. m., subsequently reduced to 25¢ by suppl. agreement ($5,000), **93,** 1131, 1133.
1897. F. H. Brainard, dr., 28¢ and 35¢ c. y., s. m. ($10,500), **97,** 1156. J. McSpirit, dr. 18,000 c. y., at 25¢ c. y., **97,** 1154.
1899. R. G. Packard Co., dr., 27½¢ c. y., s. m. ($8,500), **99,** 1314.
1900. Shrewsbury Dredging Co., dr. 30,000 c. y., 24.6¢ c. y.; removing 85 piles, at $2 each, and 13.7 c. y. st., $8 c. y., **01,** 1245.
1902. The Newburgh Dredging Co., dr. 16,000 c. y., 28¢ c. y., **03,** 953.
1903. The Newburgh Dredging Co., dr. 50,000 c. y., 26½¢ c. y., **03,** 953.
1904. W. H. Gahagan, dr. 60,000 c. y., 23¢ c. y.; The Newburgh Dredging Co., dr. 100,000 c. y., 23¢ c. y., **05,** 1055.
1905. M. H. Flannery, dr. 57,142 c. y., 28¢ c. y., **06,** 1016.
1906. The John L. Mills Co., dr. 33,000 c. y., 28¢ c. y., **07,** 1075.
1908. John & Joseph McSpirit, dr. 44,285 c. y., 28¢ c. y., **08,** 1116.

*Allotment.

[1] Sur.—**R.,** Oct. 1853; est., $10,000. (H. D. 482, 55th, 2d.)

1909. The Newburgh Dredging Co., dr. 56,075 c. y., 26¾¢ c. y., **10,** 1253.
1910. The Newburgh Dredging Co., dr. 15,384 c. y., 25¢ c. y., **10,** 1253; also dr. 32,000 c. y., 25¢ c. y., **11,** 1346.

ENGINEERS.

Chief of Engineers. R., 70, 32, 72; **71,** 80; **72,** 77; **73,** 81; **74,** 93; **75,** 99; **76,** 61; **77,** 56; **78,** 62; **79,** 66, 405; **80,** 87; **81,** 110; **82,** 111; **83,** 107; **84,** 114; **85,** 105; **86,** 103; **87,** 74; **88,** 74; **89,** 92; **90,** 83; **91,** 106; **92,** 108; **93,** 117; **94,** 106; **95,** 119; **96,** 101; **97,** 137; **98,** 142; **99,** 162; **00,** 185; **01,** 221; **02,** 169; **03,** 155; **04,** 145, 149; **05,** 153; **06,** 163; **07,** 171; **08,** 180; **09,** 184; **10,** 208; **11,** 231; **12,** 276.

Boards:
To consider proj. by Capt. Ludlow, 1879; imp., as follows: (1) So. Shrewsbury, by dr. and dikes; (2) Navesink R., by dr., dikes, and a crib; (3) the flood or ebb chans. of the main stem by the same methods. B. adopted proj. with certain modifications, favoring the imp. of the flood chan. Modified est., $142,086. **R., 79,** 411. (Cols. Macomb and Tower and Lt. Col. Newton.)
BE., 1880, concurred with Lt. Col. Michler in proposed change of chan. from the w. to the e. side of Isld. A, **81,** 704.

In charge:
Lt. Col. J. D. Kurtz, 1871–78. **R., 71,** 701–704; **72,** 782; **73,** 869; **74,** ii, 144; **75,** ii, 194; **76,** 276, 278; **77,** 268.
Capt. W. Ludlow, 1877, in temporary charge. **R., 79,** 405.
Col. J. N. Macomb, 1878–79. **R., 78,** 441; **79,** 403.
Lt. Col. N. Michler, 1878–82. **R., 80,** 542; **81,** 697, 701.
Lt. Col. G. L. Gillespie, 1882–86. **R., 82,** 690; **83,** 576; **84,** 745; **85,** 751.
Lt. Col. W. McFarland, 1886. **R., 86,** 756.
Lt. G. McC. Derby, 1887–89. **R., 87,** 778; (Capt.) **88,** 665.
Capt. T. L. Casey, 1889–94. **R., 89,** 836; **90,** 860; **91,** 1007; **92,** 894; **93,** 1130; **94,** 819.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 993.
Maj. H. M. Adams, 1896–97. **R., 96,** 797; **97,** 1152.
Maj. A. M. Miller, 1898. **R., 98,** 1069.
Col. J. W. Barlow, 1899–1900. **R., 99,** 1313; **00,** 1513.
Col. S. M. Mansfield, 1901. **R., 01,** 1243.
Capt. Spencer Cosby, 1902. **R., 02,** 1022.
Lt. Col. C. W. Raymond, 1903. **R., 03,** 950.
Col. W. R. Livermore, 1904–06. **R., 04,** 1153; **05,** 1052; **06,** 1014.
Col. D. W. Lockwood, 1907–09. **R., 07,** 1073; **08,** 1114; **09,** 1127.
Col. W. T. Rossell, 1909–. **R., 10,** 1251; **11,** 1345; **12,** 1556.

Assistants:
Capt. W. Ludlow. **R., 79,** 405.
H. N. Babcock. **R., 04,** 1167, 1171.

ESTIMATES. (See Projects.)

By Lt. Col. Kurtz, dr. at Rocky Pt., Port Washington, near Ocean House, Jumping Pt., and Bulkhead, $14,000, **71,** 703. Increased for continuing dr., $5,000, **72,** 77, 782. For pile work and dr., additional, details, $18,000, **76,** 277, 281; **77,** 268.
By Capt. Ludlow, 1878, dr. and dikes on So. Shrewsbury and Navesink Rs., and the ebb chan. of the main stem. Total, $134,686, **79,** 411. Modified by BE. Total, $142,086, **79,** 412.
By Col. Macomb, 1879, complete existing proj., $116,000, **79,** 67, 404.

OPERATIONS.

1871-72. Dr. by contract; details, **72,** 77, 782.
1872-74. Dr. continued, **73,** 81, 869; **74,** 93, ii, 144.
1879-80. 1,830′ of w. dike completed, **80,** 542.
1880-81. 24,017 c. y. sand dr. from flat at So. Branch entrance, **81,** 698.
1881-82. 89,566 c. y. dr. from No. and So. Branches and main stem; 4,021 l. f. pile dike built, **82,** 690, 691, 692.
1882-83. 94,311 c. y. dr. from No. and So. Branches and main stem; 503 l. f. diking built, **83,** 577.
1883-84. 31,415 c. y. dr. from So. Branch Chan., **84,** 745.
1886-87. 1,357 l. f. of Dike B riprapped, **87,** 778.
1887-88. 1,000 l. f. st. dike built; guide piles driven, **88,** 666.
1888-89. 11,945 c. y. dr., **89,** 837.
1889-90. 12,215 c. y. dr., **90,** 862.
1890-91. 11,045 c. y. dr., **91,** 1008.
1891-92. Repairs to dike at mouth of R.; 1,956 c. y. dr., **92,** 895.
1892-93. 18,565 c. y. dr., **93,** 1131.
1893-94. 4,200 c. y. dr., and dike at mouth of R. repaired, **94,** 820.
1894-95. Outer bar dike repaired, and 3,875 c. y. dr., **95,** 994.
1895-96. 6,857 t. r. deposited in repair of dikes, **96,** 799.
1896-97. 2,145 c. y. dr. from 2 sand bars, 29,978 c. y. dr. from chan. w. of Island Beach, and 7,609 c. y. dr. from No. and So. Branches, **97,** 1154.
1897-98. 1,040 c. y. dr. from So. Branch, and dikes repaired, **98,** 1069.
1899-00. 32,378 c. y. dr., **00,** 1513.
1900-01. 19,250 c. y. sand dr., and 13.7 c. y. st. and 85 piles removed, **01,** 1243.
1901-02. 12,595 c. y. sand dr., and 3.42 c. y. st. and 1 pile removed, **02,** 1022.
1902-03. 16,010 c. y. dr. and pumped inside of Dike B, and 52,262 c. y. dr. and deposited behind Dikes B, C, and K, **03,** 951.
1903-04. 59,958 c. y. dr., **04,** 1154.
1904-05. 164,889 c. y. dr., **05,** 1053.
1905-06. 8,813 c. y. dr., **06,** 1015.
1906-07. 25,623 c. y. dr., **07,** 1074.
1907-08. 26,235 c. y. dr., **08,** 1114.
1908-09. 36,404 c. y. dr., **09,** 1127.
1909-10. 71,222 c. y. dr., **10,** 1252.
1910-11. 31,614 c. y. dr., **11,** 1345.

PHYSICAL CHARACTERISTICS.

Described, **71,** 702, 703; **76,** 279, 280; **79,** 406 **86,** 756; **90,** 861.
Tidal observations, **86,** 666.
Description of, No. Branch to vicinity of Oceanic, **93,** 1130.
Tendency to bar formation, **94,** 820; **95,** 994; **97,** 1153, 1154.
Description of, Sandy Hook Peninsula, particularly that part bought by the US., 1893, **95,** 994; **97,** 1154.
Distances to principal points along the R. from the outer end of Dike B at outlet into Sandy Hook B., **96,** 797.
Mean rise of tide, **96,** 798.
Tide observations, and levels, **04,** 1172.
Max. draft, June 30, 1907, throughout limit of imp., 5′ m. l. w., **07,** 173. Max. draft, June 30, 1912, 5′–6′ at various parts of R., **12,** 277.

PRIVATE AND CORPORATE WORK.

Town authorities expend. about $2,000 in dr., **71,** 703.

PROJECTS. (See Estimates.)

Proj. of 1870 proposed dr. chans. through shoals in both branches of R.; est., $14,000, **71,** 703. This amount was app. 1871, with an additional $5,000 in 1873, but imp. was not permanent, **86,** 104.
Existing proj., 1879, was for securing, by dr. and contracting the w. portions of R. by dikes, chans. 6′ x 200′–300′, extending from 6′ curve at mouth in Sandy Hook B. up to 6′ curves on both branches of R. in Bs. above; est., as modified by BE., $142,086, **79,** 408, 411; **86,** 757.
In 1880 Col. Michler proposed change of proposed chan. from w. to e. side of the Island A in So. Branch, **81,** 701. Concurred in by BE., 1880, **81,** 704.
In 1887, total est. cost revised to $254,562, **87,** 781.

By Capt. Casey, 1892, expend. of app. of 1892 in making dike repairs, dr. chans. of No. Branch, between Oceanic and Barley Pt., and So. Branch, near lower Rocky Pt., **93,** 1130; and in 1894 for expend. of about $1,400 in reopening chans. filled with sand, **94,** 820.

In 1894 Capt. Casey est. $34,000 to protect beach of the US. land purchased at Sandy Hook, **95,** 995; and, 1895, Lt. Col. Gillespie est. that foregoing est. should be increased on account of changed conditions, **95,** 996.

By Lt. Col. Gillespie, 1894, application of 1894 app. to preservation of existing dikes and chans., employing hired labor and plant, **95,** 994.

By Maj. Adams, 1897, modification of proj., because of opening by the sea of an outlet between Island Beach and Sandy Hook Peninsula, to provide for imp. of chan. w. of Island Beach until such time as it should be desirable to continue work on the e. chan., **97,** 1154.

SURVEYS.

Ex., 1853, by Lt. Harrison; mentioned, **71,** 702.

Au. act July 11, 1870; assigned to Lt. Col. Kurtz. **R., 71,** 702. Again ordered by act Mar. 3, 1875, **75,** 99, ii, 194; assigned to Lt. Col. Kurtz, **76,** 61. **R., 76,** 278; **77,** 268.

By Capt. Ludlow, 1878, under direction of Col. J. N. Macomb. **R., 79,** 405.

Miscellaneous surs., **97,** 1153.

Sur. of No. Branch from junction with So. Branch to vicinity of Oceanic; made, 1892, by Capt. Casey, **93,** 1130.

Bar and bulkhead lines vicinity of Sandy Hook fixed by Sec. of War, Feb. 5, 1894, **94,** 820.

Harbor lines in vicinity of Seabright estab. by Sec. of War, Feb. 5, 1894, **96,** 799.

Sur. below Highlands Br.; made, 1898, by Col. Barlow, **99,** 1313.

Pre. ex. and sur. au. act June 13, 1902, of R., from mouth to Redbank on No. Branch, and to Branchport on So. Branch, with view to 8′ chan. **R.** by Maj. Marshall, Aug. 15, 1902, and Oct. 7, 1903; est., $364,000, and $20,000 an. mainten. for 8′ chan., or $83,000, and $10,000 an. mainten. for 6′ chan.,[1] **04,** 149. BERH. concurs in recom. of district officer. **R., 04,** 1165, 1167.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 276.

Maps.[1] Of the R., **79,** 404; **81,** 698; **82,** 694; **87,** 780; **90,** 862; **92,** Atlas, 7; **93,** 1130; **05,** 1054.

G-50 ATLANTIC HIGHLANDS, N. J.

COMMERCE.

In years recent to 1906, 50 vessels destroyed in vicinity by storms, etc., valued at $1,000,000. Com. of Raritan R. and B., and vicinity of Staten Isld. Sound,[2] should have protection of break'r.[2]

ENGINEERS.

Chief of Engineers. R., 07, 175.

In charge. Col. W. R. Livermore, 1906. **07,** 154.

SURVEY.

Ex., with view to location of break'r, au. act Mar. 3, 1905; made by Col. Livermore (est., $1,000,000); **R.,** Apr. 13, 1906, unfav.,[2] **07,** 175.

G-58 LONG BRANCH, N. J. (Breakwater.)

COMMERCE.

No requirement for H. of refuge, **84,** 764.

ENGINEERS.

Chief of Engineers. R., 84, 122.

In charge. Lt. Col. G. L. Gillespie. **R., 84,** 763.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Lt. Col. Gillespie (**R.** unfav.), **84,** 123.

G-59 SHARK RIVER, N. J.

COMMERCE.

Description of, **95,** 1013.

ENGINEERS.

Chief of Engineers. R., 80, 90; **81,** 115; **91,** 118; **95,** 121.

In charge:
Lt. Col. N. Michler, 1880. **R., 81,** 730.
Maj. C. W. Raymond, 1890. **R., 91,** 1092.
Lt. Col. G. L. Gillespie, 1895. **R., 95,** 1013.
Assistant. A. Doerflinger. **R., 81,** 730.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 731; **91,** 1092; **95,** 1013.

R. discharges into the Atlantic Ocean through an inlet in the beach about 20 m. s. of Sandy Hook, **95,** 1013.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Lt. Col. Michler (**R.** unfav.), **81,** 730.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1092.

Ex. for H. of refuge, au. act Aug. 17, 1894; made, 1894, by Capt. Casey (**R.** unfav.), **95,** 1013.

G-60 MANASQUAN (Squan) RIVER, N. J.

APPROPRIATIONS.

1879,	$12,000, **79,** 68.
1880,	20,000, **80,** 548.
1882,	7,000, **82,** 703.
1890,	2,000, **91,** 1012.
1899,	5,000, **99,** 1315.
Total,	46,000[3]

COMMERCE.

Not unimportant, **79,** 465.

H. available as a H. of refuge, **79,** 465; **80,** 552; **81,** 713; **82,** 702.

Uncertainty of condition of H. entrance an effectual bar to growth of C. **81,** 711.

Small, principally fishing craft and pleasure boats, **09,** 187.

[1] H. D. 123, 58th, 2d.
[2] H. D. 85, 59th, 2d.
[3] $4,945.89 of this amount carried to surplus fund, **09,** 187.

CONTRACTS.

1879. C. F. Drake, js., annulled for failure to commence, **80,** 547; **81,** 710.

1880. H. Du Bois & Sons, timber j. constr., **81,** 712.

1882. S. A. Kelly, timber j. constr., **83,** 585.

1899. R. Parrott, repairing n. dike (timber and iron work), aggregate, $653.50, **00,** 1515.

1905. Joseph Stillwell, repairing n. dike, $56 per M f. lumber in place, **06,** 1017.

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 68, 74; **80,** 88; **81,** 112; **82,** 112; **83,** 109; **84,**;116; **85,** 107; **86,** 102; **87,** 75; **88,** 75; **91,** 106; **92,** 109; **93,** 118; **94,** 107; **95,** 119; **98,** 143; **99,** 162; **00,** 186; **01,** 222; **02,** 171; **03,** 157; **04,** 147; **05,** 155; **06,** 166; **07,** 173; **08,** 182; **09,** 186.

Boards. Convened, New York, Apr. 6, 1880, to consider the proj. of Col. Macomb for imp. of the Manasquan R., **80,** 548. (Cols. Macomb, Tower, and Newton and Maj. Abbot.)

In charge:

Col. J. N. Macomb, 1878–80. **R., 78,** 63; **79,** 66, 74, 463; **80,** 553.

Lt. Col. N. Michler, 1880–82. **R., 80,** 547; **81,** 710, 712.

Lt. Col. G. L. Gillespie, 1882–86. **R., 82,** 701; **83,** 583; **84,** 751; **85,** 756.

Lt. Col. W. McFarland, 1886. **R., 86,** 751.

Lt. G. McC. Derby, 1887–88. **R., 87,** 782; (Capt.) **88,** 667.

Capt. T. L. Casey, 1891–94. **R., 91,** 1010; **92,** 897; **93,** 1133; **94,** 822.

Lt. Col. G. L. Gillespie, 1895. **R., 95,** 997.

Maj. A. M. Miller, 1898. **R., 98,** 1070.

Col. J. W. Barlow, 1899–1900. **R., 99,** 1314; **00,** 1514.

Col. S. M. Mansfield, 1901. **R., 01,** 1245.

Capt. Spencer Cosby, 1902. **R., 02,** 1024.

Lt. Col. C. W. Raymond, 1903. **R., 03,** 953.

Col. W. R. Livermore, 1904–06. **R., 04,** 1156; **05,** 1055; **06,** 1017.

Col. D. W. Lockwood, 1907–09. **R., 07,** 1076; **08,** 1116; **09,** 1129.

Assistants:

Capt. W. Ludlow. **R., 79,** 463.

E. Mahlo. **R., 79,** 466.

C. S. Kelsey. **R., 91,** 1011.

OPERATIONS.

1881–82. 1,515 l. f. timber j. constr., **82,** 702.

1882–83. 475 l. f. s. j. built, **83,** 584.

1899–00. N. dike repaired, **00,** 1515.

1905–06. 8,074′ lumber placed in repairs to n. dike, **06,** 1017.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 463, 464, 466; **88,** 667; **09,** 186.

Table of tides, **79,** 466.

Description of changes since 1883. In 1898 the condition of the R. worse than when work of imp. was commenced, **98,** 1071.

Small stream in e. N. J.; empties into Atlantic 26± m. s. of Sandy Hook, **09,** 186.

PLANS. (See Projects.)

For canal from Barnegat B. to Manasquan R., 1839; work never begun; funds insufficient; discussion of plan by Col. Macomb, **79,** 464.

PROJECTS. (See Plans.)

By Col. Macomb, 1879, js. at the inlet to control and concentrate the scouring action of ebb tides; imp. of upper R. by drg. and removal of wrecks, logs, and snags; est., $52,120, **79,** 68, 463, 464; **86,** 751.

BE. of 1880 **R.** that the js. proposed would be insufficient to maintain the desired imp., **80,** 552; **86,** 752. Conclusions of Board justified by subsequent experience, **86,** 754.

In 1882 Col. Gillespie proposed extension of n. j. seaward 255′, and constr. of 905′ of j. on s. side; est., $40,000, **82,** 702; **86,** 753.

In 1897 Maj. Miller est. $20,000 to complete imp., **98,** 1071.

Existing proj. on basis of proj. au. 1899, embracing 6′ outlet and d. of R. above mouth to 6′; total est., $59,300, and $1,075 for mainten. au., **04,** 147; **09,** 186.

By Col. Livermore, 1904, expend. of available funds by ex. and removal of ruins of s. dike, **04,** 1156.

Col. Lockwood reported, 1908, that cost of imp. would be out of proportion to benefits, **08,** 1117.

By Col. Livermore, 1904, for expend. of $1,000 in repair of n. dike, **05,** 1056.

SURVEYS.

Au. and in progress, **78,** 63. Completed by E. Mahlo, **79,** 68, 74, 463, 466.

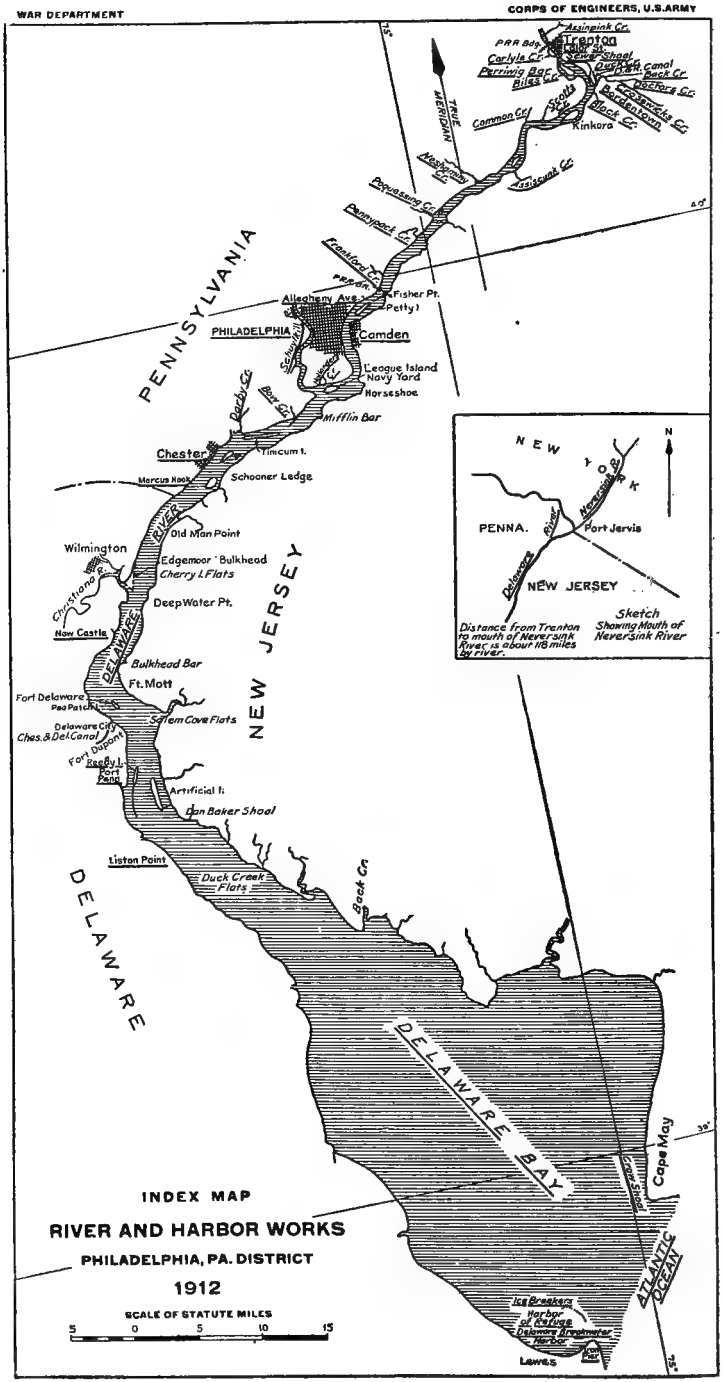
Sur. au. by Chief of Engineers; made by Maj. Miller, 1897, **98,** 1070.

Ex. of mouth and s. dike, **04,** 1156.

Maps. **79,** 464; **80,** 550; **82,** 702; **87,** 782; **98,** 1070; **05,** 1056.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

H.—PHILADELPHIA, PA., DISTRICT.


WAR DEPARTMENT
CORPS OF ENGINEERS, U.S.ARMY
Assinpink Cr.
Trenton
PRR Bdg.
Carlyle Cr.
Perriwig Bar
Biles Cr.
Sewer Shoal
Duck Cr.
Canal
Back Cr.
Doctors Cr.
Crosswicks Cr.
Bordentown
Black Cr.
Scotts Cr.
Common Cr.
Kinkora
TRUE MERIDIAN
Neshaminy Cr.
Assiscunk Cr.
Poquessing Cr.
Pennypack Cr.
Frankford Cr.
PRR Br.
Allegheny Ave.
Fisher Pt.
Petty I.
PHILADELPHIA
Camden
Schuylkill
League Island
Navy Yard
Horseshoe
Darby Cr.
Bow Cr.
Mifflin Bar
PENNSYLVANIA
Chester
Tinicum I.
Marcus Hook
Schooner Ledge
Old Man Point
Wilmington
Edgemoor
Bulkhead
Cherry I. Flats
Christiana R.
Deep Water Pt.
New Castle
DELAWARE RIVER
Bulkhead Bar
Ft. Mott
Fort Delaware
Pea Patch I.
Delaware City
Ches. & Del. Canal
Fort Dupont
Salem Cove Flats
Reedy I.
Port Penn
Artificial I.
Dan Baker Shoal
Liston Point
Duck Creek Flats
Back Cr.
NEW JERSEY
DELAWARE
DELAWARE BAY
Cape May
Crow Shoal
ATLANTIC OCEAN
Ice Breakers
Harbor of Refuge
Delaware Breakwater Harbor
Lewes
NEW YORK
Neversink R.
PENNA.
Port Jervis
Delaware River
NEW JERSEY
Distance from Trenton to mouth of Neversink River is about 118 miles by river.
Sketch Showing Mouth of Neversink River
INDEX MAP
RIVER AND HARBOR WORKS
PHILADELPHIA, PA. DISTRICT
1912
SCALE OF STATUTE MILES
5 0 5 10 15

H.—PHILADELPHIA, PA., DISTRICT.*

In charge of U. S. Engineer Office,
Witherspoon Building, Philadelphia, Pa.

NOTE.—A number of waterways on the New Jersey Coast, etc., geographically precede the group which follows here. They are listed with those of Group I, which they also precede, in view of the fact that, with the other waterways of Group I, they are under the supervision of the Wilmington, Del., office.

H 1 Atlantic Ocean.
H 2 Delaware B., N. J. and Del. (1)
H 3 Delaware R., Pa. and N. J. (2)
(The list of tributaries, beginning with N. J., considered in the Phila., Pa., District, begins on east side at Burlington, N. J., continuing northward to Trenton, N. J., thence southward to Darby Creek, Pa. Included also in the term "Delaware River" are a number of harbors—for example, Phila., Pa., and Camden, N. J.)
H 4 Assiscunk Cr., N. J. (3)
H 5 Black Cr., N. J. (3)
H 6 Crosswick Cr., N. J. (3)
H 7 Doctors Cr., N. J. (3)
H 8 Back Cr., N. J. (3)
H 9 Duck Cr., N. J. (3)
H 10 Assinpink Cr., N. J.* (3)
(This is last tributary going upstream without going beyond Trenton, N. J.)
H 11 Carlyle Cr., Pa.* (3)
(This is first tributary going downstream from Trenton on Pa. side.)
H 12 Biles Cr., Pa. (3)
H 13 Scotts Cr., Pa. (3)
H 14 Common Cr., Pa. (3)
H 15 Neshaminy Cr., Pa. (3)
H 16 Poquessing Cr., Pa. (3)
H 17 Pennypack Cr., Pa. (3)
H 18 Frankford Cr., Pa. (3)
H 19 Hollanders Cr., Pa. (3)
H 20 Schuylkill R., Pa. (3)
(There are a number of minor tributaries of this stream, but they are above a dam at Phila., Pa., built and owned by a private concern.)
H 21 Bow Cr., Pa. (3)
H 22 Darby Cr., Pa. (see District I) (3)
H 23 Delaware Break'r, Del. (2)
H 24 Iron Pier, Lewes, Del. (2)

H-3. DELAWARE RIVER, N. J., N. Y., PA., AND DEL.[1]

NOTE.—River rises in New York, is 315 m. long, flows into Delaware Bay. Navigation is from Trenton, N. J., which point is about 86 miles from mouth. Philadelphia, Pa., is about 56 miles from the seawater; to Harbor of Refuge (q. v.), about 100 miles.

The river has been improved from precolonial times. The early works were mainly of the nature of ice piers, etc.

Its principal tributaries are the Schuylkill and the Christiana. (See list of tributaries under District I and immediately before and after this abstract in District H.)

In its relation to commerce, the river, besides admitting ocean carriers as far as Philadelphia Harbor, forms an important link in a proposed chain of North Atlantic coast backwaterways, to connect New York Harbor with southern points as far as Albemarle Sound. The League Island Navy Yard is at Philadelphia, and nearby are one or two of the notable shipyards of the Atlantic coast.

Part.	Title.	Period.
a	Appropriations, etc.	
b	Trenton to mouth[1] (see also e to l, below)	1832–1900
c	Philadelphia to the sea (see l, below)	1901–1912
d	Philadelphia to Trenton (see also m, n, o, p, below)	1910–1912
	Special points reported on (arranged from mouth upstream).	
e	Wreck removal at mouth, and elsewhere	1868–1882
f	Delaware B. (mouth)—ice Hs	1880–1896
g	Listons Tree Pt., Del	1867–1868
h	Reedy Isld., Del.[1]	1827–1879
i	New Castle, Del	1826–1898
j	Marcus Hook, Pa.[1]	1829–1900
k	Chester, Pa.[1]	1826–1884
l	Philadelphia H., Pa. and N. J	1888–1907
m	Bordentown, N. J	1908–1910
n	Perriwig Bar, N. J	1907–1910
o	Sewer Shoal, N. J	1909–1910
p	Trenton, N. J. (Lalor St., etc.)	1910–1912
q	Neversink R., Pa. and N. Y	1908–1912

*This district has had charge of work at junction of Neversink R., Pa. and N. Y., a considerable distance beyond Trenton. (See p. 287.)

[1] Delaware R.: Sur.—**R.**, June 20, 1832; est., $25,715.80. Chester ps.: Sur.—**R.**, Nov. 20, 1826; papers not on file. Ps. at Port Penn, Marcushook, and Fort Miffin: Ex.—**R.**, May 31, 1827; unknown, papers not on file. (H. D. 482, 55th, 2d.)

Part (a), H-3. Delaware River—Appropriations, Commerce.

APPROPRIATIONS. (Arranged according to earliest date.)

Allegheny Ave., Phila., to the sea:

1802,	[1] $30,000.00, act Apr. 6.	
1806,	[1] 448.71, act Apr. 18.	
1884,	200,000.00, **85,** 799.	
1886,	210,000.00, **86,** 808.	
1888,	250,000.00, **88,** 675.	
1890,	[2] 240,000.00, **90,** 875.	
1892,	50,000.00, **92,** 904.	
1894,	170,000.00, **95,** 1027.	
1896,	500,000.00, **96,** 887.	
1899,	300,000.00, **99,** 1322.	
1900,	270,500.00, **00,** 1561.	
1901,	61,500.00, **01,** 1313.	
1902,	600,000.00, **02,** 1028.	
1903,	1,400,000.00, **03,** 961.	
1904,	1,000,000.00, **04,** 1188.	
1905,	500,000.00, **05,** 1075.	
1906,	1,000,000.00, **06,** 1030.	
1907,	895,000.00, **07,** 1088.	
1908,	375,000.00, **08,** 1132.	
1909	125,000.00; 390,000.00	**09,** 1141.
1910,	800,000.00, **10,** 1262.	
1911,	800,000.00, **11,** 1354.	
1912	1,300,000.00; 450,000.00	**12,** 1567.
		$11,917,448.71

Chester Harbor, Pa.:

1826,	$100.00, act May 20 (sur.).	
1827,	5,383.40	
1836,	3,000.00	**66,** iii, 31.
1837,	2,000.00	
1852,	5,000.00, **66,** 7, iii, 31.	
1867,	11,000.00, act Mar. 2.	
1873,	550.00, **73,** 864 (alt.).	
1876,	2,600.00, **76,** 59; **77,** 54, 262.	
1878,	3,400.00, **78,** 60, 437.	
		33,033.40

New Castle, Pa.:

1826,	$25,000.00, act May 20.	
1836,	25,000.00, act July 2.	
1837,	10,000.00, act Mar. 3.	
1838,	11,573.00, act July 7.	
1852,	15,000.00, act Aug. 30.	
1870,	2,500.00, **70,** 71; **71,** 79, 690.	
1872,	27,000.00, **72,** 76, 779, 780.	
1873,	20,000.00, **73,** 80.	
1874,	10,000.00, **74,** 90, ii, 135.	
1875,	20,000.00, **75,** 96, ii, 178.	
1876,	12,000.00, **76,** 58, 269; **77,** 53, 258.	
1878,	10,000.00, **78,** 359, 435.	
1879,	5,500.00, **79,** 72, 440.	
1880,	3,000.00, **80,** 585.	
1881,	20,000.00, **81,** 768.	
1884,	2,000.00, **84,** 816.	
1886,	5,000.00, **86,** 859.	
1888,	7,500.00, **88,** 741.	
1890,	8,100.00, **90,** 922.	
		239,173.00

Reedy Island, Del.:

1827,	[3] $100.00, act Mar. 2.	
1828,	[3] 4,413.00, act May 23.	
1830,	[4] 10,000.00, act Apr. 23.	
1831,	[4] 4,000.00, act Mar. 2.	
1832,	[4] 10,000.00, act July 3.	
1833,	[4] 4,000.00, act Mar. 2.	
1834,	[4] 6,133.00, act June 28.	
1835,	[4] 6,000.00, act Mar. 3.	
1852,	[4] 51,090.00, act Aug. 30.	
		95,736.00

Marcus Hook, Pa.:

1829,	$5,000.00, **66,** iii, 31.	
1866,	5,000.00, **66,** iii, 31.	
1867,	94,000.00, **71,** 686.	
1880,	35,000.00, **80,** 583.	
1881,	30,000.00, **81,** 766.	
1882,	15,000.00, **82,** 751.	
1886,	15,000.00, **86,** 833.	
1888,	15,000.00, **88,** 704.	
1890,	5,000.00, **90,** 887.	
1910,	600.00, **10,** 221, 1272.	
		219,600.00

Fort Mifflin Bar: (See Petty Island to mouth, below.)

1836,	$15,000.00, act July 4.	
1873,	50,000.00, **73,** 82.	
1874,	50,000.00, **74,** 92.	
1875,	20,000.00, **75,** ii, 190.	
		135,000.00

Bordentown to Trenton:

1872,	$10,000.00, **72,** 77.	
1873,	15,000.00, **73,** 82.	
1874,	10,000.00, **74,** 92.	
		35,000.00

Trenton to Whitehill:

1875,	$10,000.00, **75,** ii, 193.	
1878,	10,000.00, **78,** 61.	
1879,	6,000.00, **79,** 70.	
1880,	10,000.00, **80,** 562.	
		36,000.00

Horseshoe Shoals:

1873,	[5] $50,000.00, **73,** 82.	
		50,000.00

Pettys Island to mouth:

1876,	[6] $40,000.00, **76,** 60, 275.	
		40,000.00

Below Bridesburg:

1878,	$100,000.00, **78,** 61.	
1879,	45,000.00, **79,** 71.	
1880,	85,000.00, **80,** 569.	
1881,	100,000.00, **81,** 745.	
1882,	136,000.00, **82,** 737.	
		466,000.00

Schooner Ledge:

1879,	$50,000.00, **79,** 71.	
1880,	40,000.00, **80,** 578.	
1881,	40,000.00, **81,** 755.	
1882,	40,000.00, **82,** 742.	
		170,000.00

Cherry Island Flats:

1879,	$100,000.00, **79,** 71.	
1880,	100,000.00, **80,** 580.	
1881,	100,000.00, **81,** 760.	
1882,	100,000.00, **82,** 745.	
		400,000.00

River and bay (wreck removal):

1880,	$25,000.00, **80,** 607.	
		25,000.00

Trenton to Bridesburg:

1881,	$10,000.00, **81,** 735.	
1882,	10,000.00, **82,** 727.	
		20,000.00

Ice harbor, mouth of river:

1882,	$25,000.00, **82,** 787.	
		25,000.00

[1] Piers.
[2] Part of $250,000, of which $10,000 was for Rancocas R.
[3] Piers at Port Penn, Marcus Hook, Ft. Mifflin.
[4] Port Penn, New Castle, Marcus Hook, and Chester Harbors.
[5] Transferred by act of Mar. 3, 1875, to the impt. of the R., Pettys Isld. to mouth, **75,** ii, 191.
[6] Of which $35,000 was allotted to Fort Mifflin Bar, **77,** 265.

Philadelphia Harbor, Pa. and N. J.:

1888,	$5,000.00 (sur.), **88,** 678.	
	[1] 500,000.00, **89,** 863.	
1890,	200,000.00, **90,** 884.	
1891,	300,000.00, **92,** 911.	
1892,	41,000.00, **92,** 839.	
1893,	500,000.00, **94,** 839.	
1894,	250,000.00, **95,** 1035.	
1895,	850,000.00, **95,** 1035.	
1896,	600,000.00, **96,** 901.	
1897,	694,000.00, **97,** 1207.	
1906,	*10,000.00, **06,** 172, 1038.	
		[3] 3,950,000.00

Perriwig Bar:

1907,	$50,000.00, **07,** 1100.	
1909,	1,500.00, **09,** 1148.	
		51,500.00

Near Bordentown, N. J.:

1908,	*$10,000.00, **08,** 1138.	
		10,000.00

At Sewer Shoal:

1909,	*$15,000.00, **09,** 1150.	
		15,000.00

At and near Neversink River, N. Y.:

1910,	$6,612.50, **10,** 1256.	
		6,612.50

Allegheny Ave. to Trenton:

1910,	$100,000.00, **10,** 1270.	
1911,	160,000.00, **11,** 1350.	
1912,	70,000.00, **12,** 1563.	
		330,000.00

Lalor St., Trenton, to upper RR. bridge:

1912,	$50,000.00, **12,** 281, 1562.	
		50,000.00

Grand total.....[3] 18,320,103.61

COMMERCE.

The following shows the condition of the commerce of the Delaware at 1912—Philadelphia to the sea:

"The gradual and systematic improvement of this section of the river and the increase in terminal facilities at the port of Philadelphia have led to the establishment during the year (1911–12) of three new steamship lines trading with foreign ports, and several of the old established lines have added larger and deeper-draft boats to their fleet, while the number of deep-draft vessels having no regular port of call has increased. The owners of barges and canal boats trading on the river also report an increase in their fleets. The principal commodities of commerce carried on the river during the year consisted of coal, lumber, ores, iron and steel products, oils, sugar, grain, foodstuffs, and general merchandise. *No change in the nature of the commerce has resulted from existing improvements.* The following tabular statement shows the amount and value of commerce carried during the past 10 years:

Calendar years.	Short tons.	Value.
1902	21,843,209	$1,621,239,450
1903	22,827,926	1,289,965,088
1904	23,372,036	1,579,060,906
1905	24,383,571	1,612,847,499
1906	26,111,047	1,472,540,364
1907	27,283,529	1,538,385,389
1908	24,023,895	1,249,175,518
1909	24,677,671	1,327,869,862
1910	25,496,213	1,340,391,894
1911	25,786,180	1,209,879,741

"*The improvement has had no appreciable effect on foreign and coastwise freight rates,* except that which is brought about through competition between larger and deeper-draft vessels. The deeper-draft vessels trading at this port are generally engaged in foreign commerce, and rates on the class of freight usually carried are largely regulated by supply and demand. Freight rates by regular steamship lines plying between points located on the section of the river under improvement average about 23 per cent lower than railroad rates between like points Rates on freight carried by small craft on this section of the river average about 50 per cent of railroad rates. The owners of barges engaged in transshipping report a slight decrease in freight rates owing to the increased amount of commerce moved." **12,** 285.

Philadelphia to Trenton:

"The work of improvement has not advanced sufficiently to cause any increase in commerce or to have any effect on freight rates." **12,** 283.

At mouth of Neversink R.:

"The commerce on this section of the river is confined to the rafting of lumber, railroad ties, and building stone. A committee of citizens of Port Jervis, N. Y., under date of April 11, 1907, reported that the rafting commerce passing that point annually consisted of about 6,000,000 feet of lumber and, in addition, a considerable amount of structural stone and thousands of railroad ties, the approximate value of which was $100,000. It was also estimated that this amount of commerce would continue for many years to come. The main object of the proposed improvement is to furnish relief from the effects of floods due to ice gorges at Port Jervis. It is not probable that the proposed improvement will have any effect upon commerce or freight rates." **12,** 280.

Part (b), H-3 Delaware River, N. J., Pa., Del.—Trenton to Mouth.

APPROPRIATIONS. (See Part (a).)

COMMERCE.

Of Trenton, **71,** 708.
Lumber business of the upper R., **73,** 902, 922.
Losses annually to lumbermen, **73,** 916.
C., Phila., **79,** 423, 428–431.
List of vessels sunk in Delaware R. and B., **81,** 746.
Draft of vessels seeking Phila., **85,** 804.
C. requirements, Phila. to Trenton, **90,** 880.

CONTRACTS.

At Fort Mifflin Bar:

1873. Albany Dredging Co., dr. 140,000 c. y., at 21.9¢ c. y., **73,** 872.
1874. American Dredging Co., dr., 19¢ c. y., **75,** ii, 141.
1875. American Dredging Co., dr., 22½¢ c. y., **75,** ii, 190.
1876. American Dredging Co., dr., 16¢ c. y., **77,** 267.
1878. Morris & Cummings, dr., 15¢ c. y., **79,** 428.

Between Trenton and Bordentown and Whitehill:

1873. E. M. Payne, dr. 60,000 c. y., 28½¢ c. y., **73,** 873.
1874. American Dredging Co., dr., 16¢ c. y., **75,** ii, 141.
1875. William H. Beard, dr., 18¢ c. y., **75,** ii, 194.
1878. American Dredging Co., dr., 14⅜¢ c. y., **79,** 423.

*Allotment.
[1] Not to exceed $300,000 of the amount to be applied to purchase of islands, provided that no part thereof be expended until title to the lands be acquired and vested in the U. S. without charge to the latter beyond said $300,000.
[2] $4,559.58 unused balance to Treas.
[3] From this might be deducted various sums transferred from one sectional appropriation to another, for example, see footnotes 5 and 6, p. 272.

Between Trenton and Bridesburg:

1879. J. V. Patten, dr., 55¢ c. y., **80,** 563.
1880. M. Herron, dr., 22¢ c. y., **81,** 735.
1881. M. Herron, dr., 22¢ and 50¢ c. y., **82,** 728.
1882. M. Herron, dr., 40¢ and 50¢ c. y., **83,** 574.

Below Bridesburg:

1879. G. F. Ferris, dr., 26¾¢ c. y., **80,** 570. F. B. Colton, dr., 27.4¢ c. y., **80,** 570.
1880. G. F. Ferris, dr., 35¢ c. y., **80,** 570. American Dredging Co., dr., 39¢ and 46¢ c. y., **81,** 747. F. Pidgeon, dr., 33¢ and 39¢ c. y., **81,** 747.
1881. American Dredging Co., dr., 39¢, 41¢, and 58¢ c. y., **82,** 738. National Dredging Co., dr., 34½¢, 37¢, and 40¢ c. y., **82,** 738.
1882. National Dredging Co., dr., 40¢ c. y., **82,** 738. Delaware & Chesapeake Improvement Co., dr., 37¢ c. y., **83,** 605. New York Steam Dredging Co., 54½¢ c. y., **83,** 605. American Dredging Co., dr., 35¢ c. y., **83,** 605. New York Steam Dredging Co., dr., 38¢ c. y., **83,** 605.
1884. Delaware & Chesapeake Improvement Co., dr., 23½¢ c. y., **84,** 804.

At Schooner Ledge:

1880. Townsend & Trumbull, r. removal, $21 c. y., **80,** 578. American Dredging Co., r. removal, $17 c. y., **81,** 755.
1881. American Dredging Co., r. removal, $24 c. y., **82,** 742.
1882. American Dredging Co., r. removal, $21 c. y., **83,** 608.

At Cherry Island Flats:

1879. F. B. Colton, dr., 23¢ c. y., **80,** 580.
1880. National Dredging Co., dr., 21.7¢ c. y., **81,** 760.
1881. National Dredging Co., dr., 21¢ c. y., **82,** 745.
1882. National Dredging Co., dr., 23¢ c. y., **83,** 609.

Between Trenton, N. J., and the mouth:

1885. American Dredging Co., dr. w. of Pettys Isld., 19½¢ c. y., **86,** 812. American Dredging Co., dr. Mifflin Bar, 9½¢ c. y., **86,** 812. E. D. Register, dike constr., Mifflin Bar, **86,** 812. Failure to complete contract and its annulment, **86,** 804. J. A. Bouker, dike constr. at Fishers Pt. and Mifflin Bar, **86,** 812. R. Patterson & Sons, dike constr. at Mifflin Bar, **86,** 812.
1886. R. W. Gibson, constr. of Smiths Isld. revet., **87,** 797. American Dredging Co., dr. at Smiths Isld. Bar, 18¢ c. y., **87,** 797. J. A. Bouker, furnishing st. for Smiths Isld. revet., $1.83 c. y., **87,** 797. American Dredging Co., dr. w. of Pettys Isld., 32¢ c. y., **87,** 797. J. H. Ward, st. at Mifflin Bar dike, $1.09 c. y., **87,** 797.
1887. M. W. Locke, dike constr., Reedy Isld., **87,** 797. Comparison of cost of dr. by contract and hired labor, **81,** 757; **82,** 734.
1888. J. H. Ward, furnishing and placing st. in Mifflin Bar dike, $1.19 c. y., **88,** 676. J. A. Bouker, furnishing and placing st. in Fishers Pt. dike, $1.49 c. y., **89,** 860. American Dredging Co., dr. Mifflin Bar, 18¢ c. y., **89,** 859. Atlas Dredging Co., dr. Bulkhead Shoal, 24¢ c. y., **89,** 859. Davis & Irwin, 500 l. f. pile and st. dike at Fishers Pt. $8,521.63, **89,** 860. Davis & Irwin, 500 l. f. pile dike, Fishers Pt., $5,379.75, **89,** 861. Brandywine Granite Co., brush and st. dike constr., Reedy Isld.; brush mattress, $1.55 c. y., and st., $1.45 c. y., **88,** 676. E. H. Gaynor, brush and st. dike constr., Reedy Isld.; brush mattress, $1.25 c. y., and st. $1.30 c. y., **89,** 860.
1890. W. T. Gaynor, 600 l. f. pile and st. dike constr., Kinkora Bar, $9,003, **90,** 876. F. C. Somers, dr., Kinkora Bar, 7.9¢ c. y., **91,** 1026. C. McLean, dike constr., Bulkhead Bar, **92,** 902.
1891. I. H. Hathaway, pile and st. dike constr., Bulkhead Bar, $49,919, **91,** 1027.
1892. American Dredging Co., dr., 9.7¢ c. y. ($71,295), **93,** 1147.
1894. Brandywine Granite Co., dike repairing, $31,355, **94,** 829, 832. Morris & Cumings Dredging Co., dr., 11.9¢ c. y., s. m. ($30,416.40), **95,** 1028. Brandywine Granite Co., dike repairing; timber at $75 M f., ironwork at 7¢. lb., and st. at $1.19 c. y. ($9,598), **95,** 1028.
1895. American Dredging Co., dr., 14¢ c. y. ($2,800), **95,** 1028. Delaware Construction Co., dike constr.; mattresses at $1.45 c. y., st. at $1.35 and $1.05 c. y. ($128,150). (Contract annulled 1896.) (Contractors given $54,350.35 by act June 3, 1896.) **97,** 1193.
1896. Morris & Cumings Dredging Co., dr., 7.9¢ c. y. ($31,600), **97,** 1195.
1897. Morris & Cumings Dredging Co., dr., 8.8¢ c. y. ($264,545.45), **97,** 1195.
1898. P. H. Wilson, dr., 30¢ c. y. ($4,500), **98,** 1079.
1899. River & Harbor Improvement Co., dr., 6¾¢ c. y. ($72,187.50), **99,** 1323. P. S. Ross. (Inc.), r. removal opposite Petty Isld., $6.85 c. y. ($44,518.15), **00,** 1562.
00. Virginia Dredging Co., dr., 5½¢ and 6¢ c. y. ($194,830); bulkhead constr. (piles, timber, and iron), $180,450. **00,** 1562.

ENGINEERS.

Chief of Engineers. R., 70, 32, 71; **71,** 81; **72,** 77, 79; **73,** 82; **74,** 92; **75,** 98, 99; **76,** 60; **77,** 55; **78,** 61; **79,** 69–71; **80,** 91, 92, 93; **81,** 116, 117, 118, 119; **82,** 116, 117, 118, 119; **83,** 112, 113, 114, 115, 116; **84,** 122, 123, 124, 125, 126; **85,** 115, 116, 117, 118, 119, 811; **86,** 113, 114, 115, 825; **87,** 76; **88,** 76; **89,** 94; **90,** 84; **91,** 108; **92,** 110; **93,** 119; **94,** 108; **95,** 122, 132; **96,** 110; **97,** 142; **98,** 144, 156; **99,** 164; **00,** 189, 207.

Boards:

Convened, Philadelphia, Apr. 23, 1873, to consider Lt. Col. Kurtz's plan for prevention and removal of ice obstr., Horseshoe Shoals. Considered that ice boats afford the most effective means of overcoming the difficulties of winter navigation; that the expedient of a ship canal is one that belongs rather to the shipping interests and property owners than to U. S.; and recom. 2 lines of ice barriers, proposed by Col. Kurtz, made of timber instead of iron, **73,** 875–878. (Col. Woodruff, Lt. Cols. Wright, Newton, and Kurtz, and Maj. Craighill.)

Constituted by S. O. No. 79, C. of E., 1879, to consider impt. in progress at Bulkhead Shoals and Cherry Isld. Flats. **R., 80,** 575. The Board approve of plans in progress, and recom. dredged material be placed on the submerged lands adjacent to the chan. dr., **80,** 567, 576. (Col. Macomb, Lt. Cols. Raynolds and Michler, and Capt. Ludlow.)

The Board of 1885, constituted by S. O. No. 117, C. of E., 1884, to ex. and **R.** on the permanent impt. of the Delaware R. and B., recom. ship chan. Philadelphia to d. w. in the B. not less than 26′ x 600′ m. l. w., **85,** 822, 830. (Lt. Cols. Craighill and McFarland, and Majs. Gillespie and Heuer.)

Board reconvened Oct., 1885, to consider objections made by citizens of Camden to the constr. of Fishers Pt. dike. **R., 86,** 822.

Convened, Philadelphia, Apr. 18, 1896, under instructions from Chief of Engineers, dated Apr. 15, 1896, to consider the probable effects of dikes under constr. at Liston Pt. and Reedy Isld. on navigation of Appoquinimink R. and Blackbird Creek, and on the navigability and sanitary condition of the Delaware R. between the dikes and the Del. shore. **R., 96,** 887. (Col. H. M. Robert, Col. P. C. Hains, and Maj. C. W. Raymond.)

Convened, Philadelphia, Aug. 10, 1896, by S. O. No. 19, dated July 28, 1896, to report on the proj. for dike between Reedy Isld. and Liston Pt. **R., 97,** 1199. (Col. H. M. Robert, Col. P. C. Hains, and Maj. C. W. Raymond.)

Convened, Philadelphia, Apr. 10, 1899, by S. O. No. 16, dated Mar. 20, 1899, to make a further ex. of the proj. for imp. Delaware R., Trenton to its mouth, and **R.** such modifications as might be deemed desirable. **R., 00,** 1617. (Lt. Col. G. J. Lydecker, Lt. Col. C. W. Raymond, and Maj. W. H. Bixby.)

In charge:

Lt. Col. J. D. Kurtz, 1870–77; **71,** 77. **R., 71,** 704, 707; **72,** 783; **73,** 872, 899–929; **74,** ii, 140; **75,** ii, 189–193; **76,** 274; **77,** 265.

Col. J. N. Macomb, 1877–1881; **78,** 59. **R., 78,** 439; **79,** 420, 485; **80,** 561, 563, 577, 579; **81,** 733, 736, 752, 756.

Capt. W. Ludlow, 1881–82. **R., 82,** 725, 728, 740, 743.

Lt. Col. G. Weitzel, 1882–84. **R., 83,** 594, 596, 607, 609.

Lt. T. L. Casey, Mar. 19 to Apr. 19, 1884, **84,** 792.

Maj. W. H. Heuer, 1884–85. **R., 84,** 792, 794, 808, 809; **85,** 802.

Lt. Col. H. M. Robert, 1885–90. **R., 85,** 798, 833, 834, 835, 836; **86,** 801, 820, 826, 828, 829; **87,** 786–799; **88,** 669; **89,** 847; **90,** 878.

Maj. C. W. Raymond, 1890–. **R., 90,** 866; **91,** 1022; **92,** 900; **93,** 1142; **94,** 827; **95,** 1021, 1080; **96,** 877; **97,** 1192; (Lt. Col.) **98,** 1075, 1105; **99,** 1317; **00,** 1557, 1615.

Assistants:

M. Merriam. **R., 73,** 900.

F. F. Weld, **73,** 900.

Capt. W. Ludlow, **78,** 59. **R., 79,** 434.

Thomas Valentine. **R., 78,** 439, 440; **83,** 601; **84,** 802, 803, 809, 810; **85,** 811.

A. H. Fisher, **79,** 421.

A. Stierle. **R., 83,** 595, 598, 599; **84,** 792, 797, 800; **85,** 813.

J. J. Lee. **R., 83,** 601, 602.

T. G. Locke. **R., 83,** 608.

J. H. Dager. **R., 83,** 610.

Lt. T. L. Casey. **R., 85,** 815.

E. A. Giesler. **R., 85,** 817.

ESTIMATES. (See Plans and Projects.)

By M. Merriam, asst. eng., for imp. between Trenton and Easton, $23,110.54, **73,** 917–921. By Lt. Col. Kurtz, for the same, $25,922.33, **73,** 929.

By Lt. Col. Kurtz, for imp. Trenton to Bordentown, at Periwig Isld., $65,000 and $75,000, **71,** 81, 708; **74,** ii, 142; **76,** 276; **77,** 268.

By Lt. Col. Kurtz, for imp. at Horseshoe Shoals, for ice boats, $1,000,000, **72,** 78, 787; for ice barriers, $1,062,000, **72,** 78, 790, 791; for open cut or ship canal, $1,300,000, **72,** 78, 787, 788.

By BE., for wooden ice barriers 8,000′ in length, $211,435.18, **73,** 878.

By Lt. Col. Kurtz, for imp. at Bulkhead Shoals, $275,000, **75,** ii, 192.

By Col. Macomb, for various imp. Trenton to Philadelphia, **79,** 422.

By Capt. Ludlow, for removal of Schooner Ledge to 24′, $226,940, **79,** 435.

By Col. Macomb, for dr. Cherry Isld. Flats, $304,000, **79,** 438.

LEGAL PROCEEDINGS.

Injunction granted by New Jersey against constr. of Fishers Pt. dike, **86,** 804, 806, 813, 815. Injunction removed by U.S. circuit court, **86,** 807.

LEGISLATION.

By Pennsylvania, for imp. of the R. Trenton to Easton, **73,** 909, 927. By New Jersey, for the same, **73,** 928.

OPERATIONS.

Between Trenton and Bordentown and Whitehill:

1873-74. Dr. 60,000 c. y. from Periwig Isld. Shoal, giving a cut 6′ x 75′, **74,** ii, 142; **75,** ii, 193.

1874-75. Width of chan. increased to 125′, **75,** ii, 193; **77,** 267.

1878-79. A chan. cut at Bordentown 7′ x 200′ **79,** 69, 421.

At Fort Mifflin Bar:

1873-74. Dr. 140,000 c. y., **74,** ii, 140.

1874-75. Dr. 265,000 c. y., **75,** ii, 189.

1875-76. Dr. 125,016 c. y., **76,** 60. Work ceased Apr. 5, 1876, under the above title, and was continued under the app. for the Del. R. "between Pettys Isld. and its mouth," **76,** 60, 274; and "below Bridesburg," **78,** 61, 440.

1875-76. Dr. 96,221 c. y., **76,** 60, 274.

1876-77. Dr. 100,000 c. y., **77,** 55.

1877-78. Dr. 62,000 c. y., **78,** 61, 440.

1878-79. Dr. 98,000 c. y., **79,** 70, 426.

At Horseshoe Shoals:

No operations, the experience during the winter of 1874–75 showing that the ice boats were amply sufficient to keep the navigation open. The unexpend. balance ($49,500) to be used on the R., Pettys Isld. to mouth, **75,** ii, 191; **76,** 274.

Pettys Island to mouth. (See also at Fort Mifflin Bar, ante.)

Work ordered by the Chief of Engineers, **75,** ii, 191.

1875-76. Dr. 98,000 c. y. at Bulkhead Shoals, and a sunken wreck removed from below Reedys Isld. at cost of $900, **76,** 60, 274.

1876-77. Wreck removed below Horseshoe Buoy, **77,** 55.

Below Bridesburg. (See also Mifflin Bar, ante.)

1877-78. A wreck removed from the chan., Pea Patch Isld., **78,** 61, 440.

1878-79. A gravel shoal off Christian St., Phila., removed to 25′, **79,** 70, 426.

At Schooner Ledge:

1878-79. Borings made, **79,** 433.

Between Trenton and Bordentown and Whitehill:

1879-80. Closing of Duck and Long Isld. Bar back chan. with timber dikes filled with gravel, **80,** 561; **81,** 734. 12,760 c. y. dr. from chan. at Bordentown and Periwig Isld., **80,** 562.

1880-81. 47,645 c. y. dr. from chan. at Bordentown; Duck and Long Isld. Bar dikes repaired, **81.** 734.

1881-82. 21,085 c. y. dr. from chan. at Bordentown, **82,** 726.

1882-83. Repairs to Duck and Long Isld. Bar dikes; 11,428 c. y. dr. from chan. at Bordentown, **83,** 595.

1883-84. 6,120 c. y. dr. from chan. at Bordentown **84,** 123, 793.

Below Bridesburg:

1879-80. 48,132 c. y. dr. from chan. w. of Pettys Isld., opposite Port Richmond, **80,** 564. 71,000 c. y. dr., Mifflin Bar, **80,** 564. 5,000 c. y. dr., Bulkhead Shoals, **80,** 565, 577.

1880-81. Chan. 9′ x 75′ dr. across upper end of Fivemile Bar, **81,** 736. 72,198 c. y. dr. from chan. w. of Pettys Isld., **81,** 737. 10,000 c. y. dr. chan. across upper end of Smiths Isld. Bar, **81,** 737. 13,252 c. y. dr., Mifflin Bar, **81,** 739.

1881-82. 6,500 c. y. dr., chan. at upper end Pettys Isld., **82,** 729. 38,869 c. y. dr. chan., Port Richmond, **82,** 730. 13,000 c. y. dr., chan. across upper end of Smiths Isld. Bar, **82,** 731. 22,000 c. y. removed, Mifflin Bar, **82,** 732. 40,000 c. y. removed, Bulkhead Shoal, **82,** 733.

1882-83. 7,516 c. y. removed, chan. Port Richmond, **83,** 597, 598. 11,566 c. y. removed, bar at upper end of Pettys Isld., **83,** 598. 135,194 c. y. removed, Mifflin Bar, **83,** 600. 67,119 c. y. removed, Bulkhead Shoal, **83,** 601.

1883-84. 29,446 c. y. removed, chan. Port Richmond, **84,** 795. Aggregate of material removed at this point, 200,412 c. y., **84,** 798. 23,394 c. y. removed, Smiths Isld. Bar at upper end of isld., **84,** 801. 80,154 c. y. removed, Mifflin Bar, **84,** 802. 111,281 c. y. removed, Bulkhead Shoal, **84,** 803.

1884-85. 16,372 c. y. removed, Smiths Isld. Bar, **85,** 834.

At Schooner Ledge:

1879-80. 1,386 c. y. r. and bowlders, and 2,309 c. y. sand and gravel removed, **80,** 577.

1880-81. 476 c. y. r. and bowlders, and 1,740 c. y. sand and gravel removed, **81,** 753. Cost r. removed, $25.11 c. y., **81,** 754.

1881-82. 1,886 c. y. r., 834 c. y. bowlders, and 3,867 c. y. sand and gravel removed, **82,** 741.

1882-83. 1,481 c. y. r., 643 c. y. bowlders, and 3,566 c. y. sand and gravel removed, **83,** 608.

1883-84. 288 c. y. r. removed, **84,** 809.

At Cherry Island Flats:

1879-80. Commencement of operations; 300,000 c. y. dr. from chan., **80,** 579.
1880-81. 405,374 c. y. dr. from chan., **81,** 757.
1881-82. 409,342 c. y. dr. from chan., **82,** 743.
1882-83. 338, 423 c. y. dr. from chan., **83,** 610.
1883-84. 141,601 c. y. dr. from chan., **84,** 810.

From Trenton, N. J., to the mouth:

1885-86. Constr. of gravel dike between Long Bar and Emily Islds., **86,** 803. Constr. of 3,500 l. f. of brush and st. dike at Fishers Pt., **86,** 803. 91,194 c. y. dr. chan. across upper end of Fivemile Bar, **86,** 805. 105,331 c. y. dr. main ship chan. w. of Pettys Isld., **86,** 805. 98,145 c. y. dr. from chan. across Mifflin Bar, **86,** 806. Partial constr. of 1,800 l. f. of dike at Mifflin Bar, **86,** 804. Sur. and tidal observations in progress, **86,** 802.

1886-87. 33,806 c. y. dr. chan. across upper end of Fivemile Bar, **87,** 789. 60,019 c. y. dr. main ship chan. w. of Pettys Isld., **87,** 789. Constr. of 1,100 l. f. of revet., and the removal, by dr., of 58,125 c. y. in the formation of a chan. across Smiths Isld. Bar, **87,** 790. Partial constr. of 7,200 l. f. of dike at Mifflin Bar, **87,** 788. Commencement of dike from lower end of Reedy Isld., **87,** 789. Sur. between Bridesburg and Trenton, and tidal observations at points below Phila. in progress, **87,** 786, 787.

1887-88. 23,107 c. y. st. placed in Mifflin Bar Dike, **88,** 672. 20,000 c. y. dr. chan. across Smiths Isld. Bar; 2,200 c. y. brush mattress and 18,300 c. y. st. placed in Reedy Isld. Dike, extending the same 2,000′, **88,** 673, 674.

1888-89. 6,141 c. y. st. placed in Fishers Pt. Dike, **89,** 851. 1,000 l. f. of pile dike built at Fishers Pt., **89,** 852. 52,471 c. y. dr. from main ship chan. near Port Richmond, **89,** 852. 6,380 c. y. st. placed in Mifflin Bar Dike, **89,** 854. 62,221 c. y. dr. chan., Bulkhead Shoal; 3,673 c. y. of brush and 20,267 c. y. st. placed in Reedy Isld. Dike; 250 c. y. r. removed at Schooner Ledge, **89,** 856, 857.

1889-90. 600 l. f. of pile and st. dike built, Kinkora Bar, **90,** 869. 10,773 c. y. st. placed in 3,500 l. f. of dike, Fivemile Bar, **90,** 870. 89,790 c. y. dr. main ship chan., Port Richmond, **90,** 871. 1,178 c. y. r. removed chan. near the foot of Otis St., Phila.; 20,452 c. y. brush mattress and 10,397 c. y. st. placed, Reedy Isld. Dike, **90,** 872, 874.

1890-91. 600 l. f. of pile and st. dike and 200 l. f. of earthen embankment completed, Kinkora Bar, **91,** 1023. 1,300 l. f. of e. dike completed, Bulkhead Bar, **91,** 1024.

1891-92. Dike completed and chan. 12′ x 175′ dr. across Kinkora Bar; 2,650 l. f. of e. dike built, and 51,810 c. y. dr., Bulkhead Bar, **92,** 903.

1892-93. 669,630 c. y. dr., Cherry Isld. Flats, **93,** 1145. 532 t. st. deposited, Bulkhead Bar Dike, and some repairs made, **93,** 1145.

1893-94. Repairs made to Mifflin Bar Dike, **94,** 829. 290,832 c. y. dr., Cherry Isld. Flats, **94,** 830. Dike, Bulkhead Bar, strengthened and repaired, **94,** 831.

1894-95. 19,826 c. y. dr., Perriwig Bar, **95,** 1024. Dike at Mifflin Bar repaired and raised to a height of 8′ m. l. w., **95,** 1024. Bulkhead Bar Dike strengthened and repaired; and 165,865 c. y. dr. chan. in the vicinity, **95,** 1026. Portion of old wreck removed from R. near Ship John Light, **95,** 1027.

1895-96. 7,331 c. y. dr., Perriwig Bar, dipper measurement, **96,** 883. 170 t. st. deposited in repair of Mifflin Bar Dike, **96,** 884. 137,202 c. y. dr., Bulkhead Bar, **96,** 884. 3,151 c. y. of mattresses and 6,682 t. st. placed in dike, Reedy Isld., **96,** 885.

1896-97. 169,235 c. y. dr., Cherry Isld. Flats, **97,** 1193. 756,316 c. y. dr. vicinity of Dan Baker Shoal, **97,** 1193. Enlargement and repair of dike, Fort Mifflin, in progress, **97,** 1193. In 1896 simultaneous tidal observations taken at 27 stations, Delaware Break'r to Trenton, N. J., **97,** 1192.

1897-98. 14,500 c. y. dr., Perriwig Bar, **98,** 1076. 344,208 c. y. dr., Cherry Isld. Flats, **98,** 1077. 3,069,334 c. y. dr. vicinity of Dan Baker Shoal, **98,** 1078. Enlargement and repair of dike, Fort Mifflin, completed, **98,** 1078.

1898-99. 539,991 c. y. dr. vicinity of Holly Oak Reach; 513,435 c. y., Cherry Isld. Flats, and 129,127 c. y., shoal below Christiana R., **99,** 1319. 253,581 c. y. dr. between Pennsville and Bulkhead Bar, 3,186,270 c. y. vicinity of Dan Baker Shoal, and Bulkhead Bar Dike repaired, **99,** 1320, 1321.

1899-00. 832 c. y., s. m., r. removed, opposite Pettys Isld., **00,** 1559. 2,500 l. f. of bulkhead partly constr. for the 30′ chan. imp., **00,** 1560.

PHYSCIAL CHARACTERISTICS.

Between Trenton and Easton, **73,** 900, et seq.
Ice floods, upper R., **73,** 904.
Rainfall, discharge, velocity, etc., **73,** 905.
Falls and rifts, **73,** 908.
Stages of water, **73,** 923.
Heights along R., **73,** 923.
Bridges, Trenton to Easton, **73,** 925.
History, Scudders Falls, **73,** 929.
Proposed line of navigation from the Delaware R. to the N. Y. State line, **73,** 926.
Trenton to Bordentown, **71,** 81, 707.
Horseshoe Shoals, **71,** 705, 783; **79,** 423.
Schooner Ledge and Cherry Isld. Flats, **79,** 71, 433–436.
Mifflin Bar, **79,** 424, 425.
Bulkhead Shoals, **79,** 427.
R. in general, **79,** 423; **98,** 1106; **00,** 1619.
Ice Hs., **79,** 424.
Average winter temperature, **72,** 784.
Law of increase of cross-sectional areas, **85,** 817, 819.
Current observations at 8 cross sections, Fishers Pt. to Bombay Hook, **89,** 848.
Tidal observations, Bridesburg to Trenton, **90,** 878, 879.
Condition, R. chan. Philadelphia to Trenton, **90,** 880.
Causes that complicate the constr. of a l.-w. chan. of proper w. and d., Delaware R., **95,** 1081.
Tidal observations, 1896, **97,** 1192.

PLANS. (See Estimates and Projects.)

Trenton to Easton:

By M. Merriam, imp. by wing-dams, dr., or scraping, and removal of rs. by drilling and blasting, at Ground Hog, Blackguard Isld., and other places; est., $23,110.54, **73,** 921. Increased, Lt. Col. Kurtz, to $25,922.33, **73,** 929.

Horseshoe Shoals:

By Lt. Col. Kurtz, for: (1) breaking up the ice by ice boats and removing it; (2) for imp. of the waterway; (3) for unencumbered chan., **72,** 786. Discussion—the first requiring 3 ice boats at an average yearly expense of $83,400, equivalent to a permanent sinking of $1,000,000, **72,** 78, 786. Est., 2d plan, $1,062,788.62, **72,** 791; 3d plan, $1,300,000 to $1,700,000, **72,** 787, 788. The 2d plan recom., **72,** 78. (See Projects.)

By Col. Weitzel, 1883, w. Penn. chan. opposite Pettys Isld., by removal of a part of the w. side of isld. near its lower end, **84,** 795. In 1884 Maj. Heuer submitted est. of $1,010,460, **84,** 796.

Lt. Col. Robert, 1890, considered any valuable and permanent imp. Bordentown to Trenton would require the expend. of a much larger sum than would be justified, **90,** 882.

PRIVATE (STATE, CITY, AND CORPORATE) WORK.

Trenton to Easton:

In 1771 Penn. appointed 26 commissioners to receive subscriptions for imp. the R., and subsequently made app. as follows: 1817, $10,000; 1866, $10,000, **73,** 927. Large amount expend. by canal companies and private parties in building wing dams and in removal of r. and other obstr., **73,** 909, 915.

1896-97. 86,625 c. y. r. and other materials removed by Phila. from Schooner Ledge, **97,** 1194.

1897-98. 28,615 c. y. r. and other materials removed from Schooner Ledge, and 1,017,780 c. y. dr. from chan., vicinity of Mifflin Bar, by Phila., **98,** 1078.

1898-99. 534,226 c. y. r. and other material removed from Greenwich Pt., Mifflin Bar, and below Schooner Ledge by Phila., **99,** 1321.

PROJECTS. (See Estimates and Plans.)

Trenton to Easton:

By Lt. Col. Kurtz, imp. at various points; est., $25,922.33, **73,** 929.

Trenton to Bordentown:

By Lt. Col. Kurtz, cut 200′ x 6′ l. w. at e. end of Perriwig Isld. and below Newbolds Isld.; est., $75,000. Chan. on w. side of Perriwig Isld.; est., $65,000. The former recom. as most advisable, **71,** 81, 707; **74,** ii, 142.

Horseshoe Shoals:

By Lt. Col. Kurtz, open ice barriers; cost, $1,062,778, **72,** 78, 786, 788. Approv. by BE., **73,** 877; imp. to be deferred until experience proved that ice boats could keep the chan. open, **74,** 92.

Fort Mifflin Bar:

By Lt. Col. Kurtz, cut 22′ x 1,500′ l. w.; est., $150,000, **73,** 872.

Cherry Island Flats:

By Col. Macomb, imp. w. chan. by removing 1,520,000 c. y. by dr.; est., $304,000, **79,** 438.

Bulkhead Shoals:

By Lt. Col. Kurtz, removal of 900,000 c. y., to straighten chan.; est., $275,000, **75,** ii, 192.

Schooner Ledge:

By Capt. Ludlow, removal of r. to 24′; est., $226,940, **79,** 435.

Trenton to Bridesburg:

Efforts of the past, directed toward the imp., Trenton to Whitehill, by dr. through the bar in vicinity of Bordentown and Perriwig Shoal, to furnish navigable chan. carrying 6′–8′ at m. l. w., **84,** 122; **85,** 115, 803; **86,** 113.

Plans for the comprehensive imp. not yet considered, **86,** 113.

Below Bridesburg:

By Col. Weitzel, 1884, dr. chan. across Smiths Isld. Bar, just above the isld., 10′ x 350′ m. l. w., for the accommodation of the cross-river traffic, **84,** 124, 800; **85,** 805, 813, 814.

In 1885 Lt. Col. Robert proposed chan. 10′ x 200′ across Smiths Isld. Bar in the vicinity of that executed under the previous proj. To provide as far as possible against the refilling of the chan., it was proposed to give it protection by a line of revet. placed on each side of the dr. chan. and also oblique to the axis of the bar, to direct into it a part of the ebb tide; est., $40,000, **86,** 806, 826; **87,** 793, 794.

The projs. prior to 1885 for imp. of the R., Phila. to B., have been directed toward chans. 24′ m. l. w. across bars below Phila. by means of dr., except at Schooner Ledge, where solid r. was to be removed, **85,** 115, 804; **86,** 113.

The BE., 1885, recom. ship chan. from a point opposite the upper end of Pettys Isld. to d. w. in Del. B., having a least w. of 26′ x 600′ m. l. w. Such a chan. to be obtained, except at Schooner Ledge, where r. would require to be removed, by regulating the tidal flow with dikes, with recourse to dr. where necessary as an aid to such contracting and regulating works; est., $2,425,000, **85,** 802, 822, 830. The proj. for the imp., Trenton to Phila., to be submitted after completion of detailed sur., **85,** 799, 822; **86,** 113.

By Lt. Col. Robert, 1888, removal of 1,200 c. y. ledge r. in chan. near the foot of Otis St., Phila.; est., $3,800, **90,** 871.

By Lt. Col. Robert, 1890, imp., Phila. & Trenton, by the formation of a 12′ l.-w. chan. across Kinkora Bar with pile and st. dike partly closing the slough s. of Newbolds Isld., supple. by dr. on the line of the proposed chan.; est., $15,000, **90,** 869.

By Maj. Raymond, 1890, imp. of Bulkhead Shoal by a modification of the proj. of 1885, whereby the imp. of the locality is to be accomplished with 2 pile and st. h.-w. dikes; the e. dike, 4,200′, starting from the N. J. shore and passing obliquely across the e. ebb chan., and the w. dike, 6,800′, situated upon the opposite side of the bar; est., both dikes, $280,000, **90,** 873, 874.

By Maj. Raymond, 1892, 26′ x 500′ chan., Cherry Isld. Flats, by dr.; est., $100,000, **93,** 1145.

By Maj. Raymond, 1895, 6′ x 200′ chan., Perriwig Bar, by dr.; est., $4,543.93, **95,** 1024.

By Maj. Raymond, 1894, 26′ x 600′ chan., vicinity of Bulkhead Bar, by dr.; est., $56,232; repairing e. dike, est. $13,300, and repair of Mifflin Bar Dike, est. $1,000, **95,** 1025, 1026.

By Maj. Raymond, 1895, repair of Reedy Isld. Dike, with sufficient st. to raise it 1′ above m. l. w., and for constr. of another portion of the proj. dike commencing at the Del. shore and extending up stream for about 11,600′; est., $120,000, **95,** 1027.

Act June 3, 1896, required expend. of $3,000 in rebuilding and enlarging dike on U. S. reservation at the junction of Schuylkill and Del. Rs. at Ft. Mifflin, **96,** 884; **97,** 1193.

In 1896 the adopted proj. for the imp. of R. modified on the recom. of BE. to provide for enlargement of chan., head of B. to d. w. above Dan Baker Shoal, by dr. instead of by the action of dikes, **97,** 1193.

Act June 3, 1896, required expend. $5,000 from app. for the R. on Perriwig Bar. Maj. Raymond proposed, 1897, to w. the chan. to 200′ over the l. of the bar, **98,** 1076.

By Lt. Col. Raymond, 1899, dr. and blasting a 30′ x 600′ chan., Christian St., Phila., to d. w. in Del. B., along the axis of the main ship chan., and for r. removal, Pettys Isld.; total est., $5,935,000, if completed within 6 years of commencement, **99,** 1321. Board of 1899 provided for constr. of bulkhead basin, Dan Baker Shoal, in which would be deposited dr. material from the 30′ chan., forming an isld. that would probably help to maintain chan. in that vicinity; est., according to Board, of 30′ chan., $5,810,000 (map), **99,** 1321; **00,** 1623.

By Lt. Col. Raymond, 1899, expend. of $125,000, app. act Mar. 3, 1899, for removal of r. near Pettys Isld., **99,** 1322.

By Lt. Col. Raymond, 1899, reservation of $18,400 from app. June 3, 1896, for repair and mainten. of dikes, **00,** 1561.

SURVEYS.

Trenton to Easton, in progress, **72,** 79. **R.** on, **73,** 899, 900. Cost of sur., $2,738.24, **73,** 900.

Trenton to Bordentown, au. act July 11, 1870, in progress, **70,** 71. **R.** on, **71,** 707.

Whitehill, to above Bordentown, **79,** 70, 421.

Horseshoe Shoals, au. act Mar. 3, 1871, **71,** 81, 704; **72,** 77. **R.,** **72,** 783.

Below League Isld., au. act June 18, 1878, **78,** 63; **79,** 75. **R.,** **79,** 485.

Cherry Isld. Flats, 1842, by U. S. Coast Sur., **79,** 434. By Capt. William Ludlow, 1878. **R.,** **79,** 434.

Chester and Marcus Hook, **79,** 75. Sundry ex., **79,** 70, 426, 427.

Au. act June 14, 1880, **80,** 98; made by Col. Macomb, **79,** 485; **81,** 743.

Trenton to Bordentown, **83,** 112.

Front of Phila., **83,** 599; **84,** 799.

Above Bridesburg, **85,** 799; **86,** 802; **87,** 786.

Ex. Fivemile Bar, 1887 and 1888, to determine extent of dike's action in imp. bar, **88,** 670.

Sur., Reedy Isld.; made, 1887, by Lt. Col. Robert, **88,** 674.

Ex. Kinkora Bar; made, 1889, by Lt. Col. Robert, **89,** 849.

Ex. of Smiths Isld. Bar; made, 1889, by Lt. Col. Robert, **89,** 853.

Sur. Mifflin Bar; made, 1888, by Lt. Col. Robert, **89,** 855.

Ex. Smiths Isld. Bar and Shoal, Greenwich Shoal, Mifflin Bar, and sur. of Schooner Ledge; made, 1890, by Maj. Raymond, **90,** 867, 868.

Minor sur. and ex. (See **R.** for each year.)

Ex., Trenton to Burlington, N. J., for imp. R. and protecting its banks, au. act Aug. 17, 1894; made, 1894, by Maj. Raymond (**R.** fav. from Burlington to Whitehill, and unfav. thence to Trenton), **95,** 1080.

Sur. for chan. 30′ d. au. act June 3, 1896; made, 1898, by Maj. Raymond (see Boards of Engineers, **R.** fav.), **98,** 1105.
Sur. R., vicinity of Reedy and Pea Patch Islds.; made, 1899–1900, au. of BE. of 1899, **00,** 1559.

Maps:
Referred to. Sur. Horseshoe Shoals, by David McClure, 1819, by Phila., 1854–56 and 1864–66, **72,** 784.
Chart, Del. near Bordentown, **79,** 422.
Fort Mifflin Bar, **79,** 426.
Bulkhead Shoals, **79,** 428.
Schooner Ledge, **79,** 434.
Cherry Isld. Flats, **79,** 436.
Pettys Isld., **80,** 564.
Schooner Ledge, **80,** 578.
30′ chan., **99,** 1321.
88, 670, 672, 682; **90,** 869, 870, 872; **92.** Atlas, 8; **00,** 1618.

Part (c), H-3 Delaware River, N. J., Pa. & Del.—Philadelphia to the Sea.

APPROPRIATIONS. (See Part (a).)

COMMERCE.

In 1906, 26,111,047 t., **07,** 179.
Regulations, use of main ship chan., below Phila., prescribed by Sec. of War, **01,** 1312.
C. advantages from deepening chan. below Phila., and its mainten., to sea; details, **09,** 191.
Diagram showing app., tonnage, and value, 1890 to 1910, **11,** 1354; **12,** 1568–73.
Freight rates lowered on raw materials, between foreign and domestic ports, in bulk quantities, **11,** 238.

CONTRACTS.

1901. Hughes Bros. & Bangs, furnishing and placing st.; American Dredging Co., dr., **02,** 1027.
1902. American Dredging Co., dr., 13$\frac{7}{10}$¢ c. y., s. m.; American Dredging Co., retaining banks, 48¢ c. y., **03,** 961. Sanford & Brooks Co., 19,768 l. f. timber bulkhead, Baker and Stony Pt. Shoals, round piles, 17¾¢ l. f.; yellow pine timber, $37.50 M f. b. m.; ironwork, 4¢ lb., **03,** 959, 962. Hughes Bros. & Bangs, st., $1.20 t., **03,** 962.
1903. American Dredging Co., timber and st. bulkhead, Baker Shoal, prices listed, **03,** 962. F. K. Wills Construction Co., 9,979 l. f. timber bulkhead at Edgemoor, Del., prices listed, **03,** 959, 962. Hughes Bros. & Bangs, supple., contract of 1902, increase in quantity of st.; last agreement, $1.35 t., **04,** 1184. Richardson & Ward, st., $1.09 t., **04,** 1189. Baltimore Construction Co., 3,000 l. f. bulkhead, Edgemoor, Del., prices listed (annulled Mar. 10, 1904), **04,** 1185, 1186.
1904. Maryland Steel Co., self-propelling hopper dredge, $358,400, **04,** 1189. Centrifugal pump dr. *Uncle Sam* purchased, $18,855.94, **04,** 1187.
1905. Sanford & Brooks Co., timber revet., wiers, sluices, trestle, and raising and repairing retaining banks, Fort Du Pont; raising and repairing retaining banks, Fort Delaware; to be paid by QM. Dept., **05,** 1069. F. K. Wills Construction Co., bulkhead, Edgemoor, not to exceed 5,800 l. f., with rows of 3 piles instead of 5 as in orig. contract, **05,** 1070. Sanford & Brooks Co., dr. sec. 3, subsec. A, 15.45¢ c. y., s. m.; Maryland Dredging & Contracting Co., dr. sec. 3, subsec. B, 15.4¢ c. y., s. m.; American Dredging Co., dr. sec. 4, subsec. A, 14¢ c. y., s. m.; sec. 4, subsec. B, 14½¢ c. y., s. m.; and sec. 5, subsec. A, 15½¢ c. y., s. m., **06,** 1031.
1906. Ellicott Machine Co., rehandling machine *Cataract*, $80,600, **06,** 1027, 1028. Removal of datum point, Del. R., near Salem Creek, $425, **06,** 1029.
1907. American Dredging Co., dr. (2 contracts); sec. 5, subsec. A, 16¢ c. y., s. m.; and sec. 5, subsec. B, 17½¢ c. y., s. m., **08,** 1132, 1133. Sanford & Brooks Co., pumping dr. material into basin, Fort Du Pont, 7¢ c. y., s. m., deposited, **08,** 1129.
1908. American Dredging Co., dr. sec. 1, 13⅝¢ c. y., s. m.; sec. 3, 16¢ c. y., s. m.; sec. 5, subsec. A, 15.8¢ c. y., s. m., **09,** 1133.
1909. American Dredging Co., dr. sec. 1, 1,000,000 c. y., 12.3¢ c. y., s. m., **09,** 1133, 1134.
1910. American Dredging Co., dr. 5 localities; yardage and prices listed, **11,** 1354.
1911. American Dredging Co., dr. about 1,617,000 c. y., 15$\frac{3}{10}$¢ c. y.; American Contracting Co., dr. about 500,000 c. y., 16$\frac{1}{10}$¢ c. y., **12,** 1568.
1912. The Breakwater Co., dike constr.; locations, quantities, and prices listed, **12,** 1568.

ENGINEERS.

Chief of Engineers. **R., 01,** 230; **02,** 172; **03,** 159; **04,** 149; **05,** 156; **06,** 168, 177; **07,** 176; **08,** 184; **09,** 188; **10,** 213; **11,** 236; **12,** 283.

In charge:
Lt. Col. C. W. Raymond, 1901–02. **R., 01,** 1310.
Lt. Col. J. A. Smith, 1902. **02,** 151.
Capt. Spencer Cosby, 1902–03. **R., 02,** 1025.
Lt. Col. C. W. Raymond, 1903. **03,** 159.
Capt. J. C. Sanford, 1903–08. **R., 03,** 957; (Maj.) **04,** 1181; **05,** 1065; **06,** 1021; **07,** 1079.
Maj. Herbert Deakyne, 1908–12. **R., 08,** 1121; **09,** 1131; **10,** 1256; **11,** 1351; **12,** 1564.

Assistants:
Capt. J. B. Cavanaugh, 1901. **01,** 229.
Capt. Spencer Cosby, 1901–02. **01,** 229; **02,** 151.

LEGAL PROCEEDINGS.

Libel filed, U. S. district court for N. J. against coal barge *Alaska*, owned by Phila. & Reading Ry. Co., to recover damages for sinking scow belonging to U. S.; and judgment for U. S., $1,400 and costs amounting to $100.80; $1,400 credited to app. for imp. Del. R., Pa. and N. J., **09,** 1140.

LEGISLATION. (See Commerce.)

By States of Del. and N. J., to cede certain land to U. S., **07,** 1087, 1095, 1096.

OBSTRUCTIONS.

Navigation usually greatly handicapped by ice in winter; kept open by ice boats, **12,** 1566.

OPERATIONS.

1900–01. 18,063 c. y., s. m., r. and overlying material removed from opposite Pettys Isld., **01,** 1311. 8,140 l. f. bulkhead completed and accepted and 2,200 l. f. partly constr. for the 30′ chan., Dan Baker Shoal, **01,** 1311, 1312. 1,004,338 c. y., s. m., removed, chan. through part of Dan Baker Shoal, and 85,650 c. y., dipper meas., addl., cast over against inner face of completed bulkhead to form backing, **01,** 1312.
1901–02. 3,135 c. y., s. m., r. and overlying material removed opposite Pettys Isld.; work completed, **02,** 1026. 3,557 l. f. bulkhead completed; 1,263,212 c. y., s. m., removed from chan., Dan Baker Shoal, and contract completed; 32,830 t. st. deposited at bulkhead, **02,** 1027.
1902–03. 919,729 c. y., s. m., dr. chan., Baker Shoal, **03,** 958. 2,790,006 c. y., s. m., dr., Salem Cove, Duck Creek Flats, and Baker Shoal, and 24,829 c. y. heavy material deposited in retaining bank within bulkhead; 2,500 l. f. bulkhead completed and 800 l. f. partly constr.; 87,002 t. st. deposited to raise bank across Basin A within bulkhead, Baker Shoal, **03,** 959. 600 l. f. bulkhead, Edgemoor, partly constr., **03,** 960. Mainten. and repair of dikes, **03,** 959, 960.
1903–04. 4,679,379 c. y., s. m., dr. chan. at Salem Cove, Duck Creek Flats, and Baker Shoal; 815,050 c. y. deposited on Pea Patch Isld. since commencement of dr.; timber bulkhead, 1,893 l. f., riprapped with st. across end of Basin B, Baker Shoal, completed; old wreck removed from Duck Creek Flats; 14,000 l. f. bulkhead completed, **04,** 1183. 4,930 l. f. 1-row bulkhead completed; total length

constr., 18,930 l. f.; 375 l. f. 1-row constr. carried away replaced, **04,** 1183, 1184. Total of 188,333 t. st. deposited for buttresses, and contract completed; 61,491 t. st. deposited for buttresses, **04,** 1184. 1,500 l. f. bulkhead, Edgemoor, constr., and 600′ addl. partly constr., **04,** 1185. Piling for only 380 l. f. bulkhead driven by Baltimore Construction Co.; 103,635 c. y. drd. by U. S. dr. *Cape Fear* from chan., Cherry Isld. Flats, **04,** 1186. 105,340 c. y. drd. by U. S. dr. *Cumberland* from chan., Cherry Isld. Flats, and 28,084 c. y. from Deep Water Pt.; 376 c. y. r. and 11,954 c. y. mud, sand, and gravel drd., Schooner Ledge, **04,** 1186, 1187. 22 holes drilled, 10 holes blasted, and 262 lbs. dynamite used by U. S. plant, Schooner Ledge, **04,** 1187.

1904-05. 2,827,106 c. y. drd., Baker, Salem Cove, and Duck Creek Flats, 24,829 c. y. of which placed in retaining banks; 83,764 t. st. deposited in buttresses; timber work of Baker Shoal bulkhead completed; 199,471 c. y. deposited at Fort Du Pont retaining banks, and 373,697 c. y. at Fort Delaware banks; 31,784 c. y. drd. material deposited within marsh land at Crum Creek; 3,035 l. f. bulkhead constr., Cherry Isld. Flats; U. S. dr. *Cumberland* removed 155,659 c. y. and U. S. dr. *Burton* 85,722 c. y. from chan., Cherry Isld. Flats, and U. S. dr. *Gen. Gillespie* removed 135,147 c. y. from chan. at Cherry Isld. Flats and Deep Water Pt. Range; 64,946 c. y. overlying material and 2,080 c. y. r. removed from Schooner Ledge; dr. *Cumberland* removed 638 c. y. and dr. *Gen. Gillespie* 108,813 c. y. from Deep Water Pt. Range; U. S. dr. *Burton* removed 21,165 c. y., Tinicum Isld. Flats, **05,** 1066–74.

1905-06. 213,002 c. y., s. m., drd., chan. in sec. 3, subsec. A, **06,** 1022. 346,472 c. y., s. m., drd., chan. in sec. 3, subsec. B; 2,213,671 c. y., s. m., drd., chan. in sec. 4, subsecs. A and B, and sec. 5, subsec. A, **06,** 1023. Retaining banks at Forts Du Pont and Delaware raised and repaired and subsequent breaks repaired and paid for by QM. Dept., **06,** 1024, 1025. 663,360 c. y. deposited behind retaining banks at Fort Du Pont and 11,782 c. y. at Fort Delaware, **06,** 1025. 27,785 c. y. overlying material and 6,746 c. y. ledge r. removed, and 15,139 c. y. (est.) r. blasted; material removed deposited at Edgemoor, Crum Creek, and Salem Light, **06,** 1025, 1026. 129,870 c. y. removed by U. S. dr. *Hell Gate* and 200,133 c. y. by U. S. dr. *Delaware* from Tinicum Isld. Flats, **06,** 1026. 232,924 c. y. removed by U. S. dr. *Delaware* at Mifflin Bar, **06,** 1026. 686,533 c. y., s. m., deducted from 10,296,491 c. y., s. m., removed under contract Sept. 9, 1902, 9,609,958 c. y. paid for, **06,** 1028. About 63% of approv. proj. done, **06,** 1030. H. lines front of city of Chester estab. by Sec. of War, **06,** 1030. Repairs to U. S. plant, **06,** 1026. U. S. suction dr. *Delaware* placed in commission, **06,** 1027. Rehandling machine *Cataract* placed at work, **06,** 1028.

1906-07. Up to June 30, 1907, 690,000 c. y., s. m., removed, chan. in sec. 3, subsec. A, and deposited at Fort Du Pont, Fort Delaware, and on Scott property; U. S. dr. *Delaware* removed 60,852 c. y. of this, **07,** 1080, 1081. Up to June 30, 1907, 1,180,000 c. y., s. m., removed from chan. in sec. 3, subsec. B, and deposited at Forts Du Pont and Delaware, on Scott property and above mouth of Christiana R., **07,** 1081. Total of 4,382,223 c. y., s. m., removed from chan. in subsec. 4A, subsec. 4B, and subsec. 5A; contract completed; material pumped ashore at Pidgeon Pt., Edgemoor, and Repaupo Pt.; dimensions of chan. made, **07,** 1081. Total removed by U. S. under general proj. to June 30, 1907, under contracts, and by U. S. plant, exclusive of r. area at Schooner Ledge and drg. paid for by Penn. and city of Phila., 20,590,000 c. y., s. m., **07,** 1082. 12,821 c. y. overlying material, 2,784 c. y. ledge r. removed, and 15,665 c. y. (est.) r. blasted, Schooner Ledge, and deposited at Edgemoor, Crum Creek, and Salem Light; 60,852 c. y. removed by U. S. dr. *Delaware*, Deep Water Pt. Range, and deposited at Fort Delaware and Mifflin Bar Dike; 69,542 c. y. removed by U. S. dr. *Delaware*, Mifflin Bar; 43,343 c. y. removed by U. S. dr. *Delaware* from Tinicum Isld. Shoal; 8,896 c. y. removed in mainten. drg. on Liston Range, and deposited in d. w. in Del. B.; dr. *Delaware* worked in N. Y. dis. Feb. 5 to Apr. 4, 1907, **07,** 1083. 79,150 c. y. removed from Liston Range and deposited in d. w., Del. B., **07,** 1083, 1084. Quarters built and imp. made in machinery of *Cataract;* ponton pipe line built and extended as orig. pipe wore out; dr. *Uncle Sam* supple. work of *Cataract*, **07,** 1084. To June 30, 1907, total of 1,784,056 c. y. pumped ashore at Fort Delaware, and 945,293 c. y. at Fort Du Pont, **07,** 1086.

1907-08. Under decision Comp. Treas., Sanford & Brooks Co. allowed and paid for 227,068 c. y., s. m., forming part of total quantity deducted in the account as overdepth dr. This quantity is included in total amount dr. (1,492,693 c. y.) in sec. 3, subsec. A, under contract, **08,** 1123. Total of 1,615,210 c. y., s. m., removed by Maryland Dredging & Contracting Co. in sec. 3, subsec. B, completing contract; material pumped ashore at Fort Du Pont, Fort Delaware, on Scott property, above mouth of Christiana R., Repauno Pt., N. J., and Eagle Pt., N. J.; final payment not made, as it is proposed to pay for material removed between depths of 31′ and 32′ m. l. w., which had previously been deducted and not paid for; computation not completed, **08,** 1123. 813,847 c. y., s. m., removed in sec. 4; work completed, **08,** 1124. 496,416 c. y., s. m., removed in sec. 5A, and 241,169 c. y., s. m., in sec. 5B, and pumped ashore at Edgemoor, mouth of Christiana R., in Ridley Creek Basin, and in basins provided by contractor, **08,** 1124. Total removed from chan. under contracts and by U. S. plant, exclusive of r. area at Schooner Ledge and dr. by Penn. and city of Phila., 23,334,000 c. y., s. m., to June 30, 1908, **08,** 1124. At Schooner Ledge, main work of blasting completed June 15, 1908, **08,** 1124. 79,883 c. y. overlying material, 8,261 c. y. ledge r. and 23,497 c. y. (est.) r. blasted, and deposited at Edgemoor bulkhead, Ridley Creek, and Blacks farm, **08,** 1125. Night work begun Sept. 5, 1907, by all the Schooner Ledge plant, **08,** 1125. To June 30, 1908, total of 2,008,177 c. y., s. m., pumped ashore at Fort Delaware and 1,432,945 c. y. at Fort Du Pont, **08,** 1128. 192,546 c. y., s. m., pumped into basin at Fort Du Pont under emergency contract of Nov. 7, 1907, and 79,460 c. y. pumped into basin by Sanford & Brooks Co. after contract was completed, making total of 272,006 c. y. pumped into basin, **08,** 1129. 30% of work on banks about depositing basin at Pea Patch Isld. completed at end of year, **08,** 1129, 1130. $2,000 allotted, Acting Sec. of War, from app. for Army transportation, 1908, under the QM. Dept., for mainten. of banks during year ending June 30, 1908, and further sum of $1,113 from the same app., the work to be done by Eng. Dept., and paid for by QM. Dept.; $2,335.75 expended on banks up to close of year; expend. made from app. for imp. Del. R., **08,** 1128. $21,500 allotted from app. for Army transportation, 1908, for filling marsh lands on flank of 12-inch rifle battery and adjoining s. basin, Fort Du Pont, $7,500 to be used for constr. retaining banks and $14,000 for pumping material into basin, work to be done by Eng. Dept.; up to close of last fiscal year $20,700.76 expend. for retaining banks and filling, **08,** 1128, 1129. Sur. of proposed basin and work of constr. banks at Fort Du Pont by hired labor completed, **08,** 1129.

1908-09. Total net amount removed under the contracts, in subsec. 5A, 739,884 c. y., s. m., and in subsec. 5B, 714,029 c. y., s. m., and contracts completed; (243,468 c. y. from 5A and 472,860 c. y. from 5B during fiscal year 1909) material pumped ashore between Edgemoor and mouth of Christiana R., Ridley Creek Basin, and in basins provided by contractor, **09,** 1133. 822,636 c. y., s. m., removed from sec. 1, 488,623 c. y., s. m., from sec. 3, and 231,165 c. y., s. m., from sec. 5, subsec. A, and deposited at Repauno Basin, e. of Chester Isld., at Kelly Pt., N. J., and in Basin B, Artificial Isld., **09,** 1133. 297,000 c. y. removed from sec. 1 (Baker Shoal); contracts for orig. dr. have provided a chan. 30′ x 600′ m. l. w., Finns Pt. to s. line of Pa., completing chan. from d. w. in Del. B. to s. line of Pa.; work for mainten. provided chan. 30′ x 600′ in sec. 5, and chan. 30′ x 400′–450′ through Baker

Shoal, **09,** 1134. Total amount of material removed from chan. to June 30, 1909, by the U. S. under contracts and by U. S. plant, exclusive of r. area at Schooner Ledge and dr. by Pa. and city of Phila., 24,744,000 c. y., s. m., **09,** 1134. 2,608,000 c. y. removed by mainten. dr. during fiscal year 1909; 174,171 c. y. overdepth dr. by Maryland Dredging Co. allowed and paid for under decision of Comp. Treas., **09,** 1134. Dredges leased from American Dredging Co., used from time to time at Schooner Ledge; 288,467 c. y. sand, mud, and blasted r. removed from Schooner Ledge by dr. *Delaware;* drill scow *Newton* and derrick scow *Rattler* sweeping and blasting points of r. projecting above plane of 30′ m. l. w.; night work continued by U. S. plant and leased drs.; 354,956 c. y. overlying material and 15,498 c. y. r. removed from Schooner Ledge and deposited behind Edgemoor bulkhead and in basin at Blacks farm near Fort Mifflin, **09,** 1135. 120,397 c. y. dr., Tinicum Range, 1,250,500 c. y., Duck Creek Flats, and 16,198 c. y., New Castle Range, by U. S. dr. *Delaware*, **09,** 1136. 73,979 c. y. dr., Tinicum Range, and 7,116 c. y. from Cherry Isld. Range by U. S. dr. *Clatsop*, **09,** 1137. Banks inclosing depositing basin at Pea Patch Isld. completed, forming basin of 157 acres with capacity of 2,230,000 c. y.; repair made to banks during May and June, **09,** 1139.

1909-10. 652,720 c. y., s. m., removed, Baker Shoal; total amount removed under general proj. to June 30, 1910, under contract and by U. S. plant, exclusive of r. area at Schooner Ledge and dr. by State of Pa. and city of Phila., 24,744,000 c. y., s. m.; total amount removed from dr. chan. by mainten. dr. by U. S. plant and contract work during fiscal year 1910, 4,795,395 c. y., **10,** 1257. Leased dr. used July to Dec., 1909, at Schooner Ledge, night work continued by dr. *Hell Gate*, 1,197 c. y. overlying material and 5,368 c. y. r. removed; 553,542 c. y. overlying material and 41,113 c. y. r. removed since commencement of operations, **10,** 1257, 1258. 1,146,162 c. y. dr. and deposited and 2,696,513 c. y. dr. and pumped overboard by dr. *Delaware*, Phila. to Del. B., in mainten. work of 30′ chan., **10,** 1258. Repairs made to banks of depositing basin at Pea Patch Isld., **10,** 1260. Wharf at Fort Mifflin, Pa., placed in good condition, **10,** 1261.

1910-11. Schooner Ledge under 30′ proj.; total removed during year by U. S. drs., 48,355 c. y. overlying material and bowlders and 1,729 c. y. ledge lock, completing work on 30′ proj., **11,** 1351. Mainten. 30′ chan. by U. S. dr. plant, U. S. drs. *Manhattan* and *Delaware* dr. 9,500,050 c. y. during year; U. S. rehandling machine *Cataract*, Deep Water Pt., rehandled material dr. by U. S. drs.; U. S. rehandling machine *Uncle Sam* rehandled at Artificial Isld. material dr. by S. drs., **11,** 1352. Work under 35′ proj. Contract for drng. made with the American Dredging Co., under which they removed 2,344,818 c. y. of material, **11,** 1353.

1911-12. Work of imp.: 869,780 c. y. dr., and contract 91% completed; 2,327,554 c. y. drd., and contract 97% completed; 43,740 c. y. drd., contract suspended Sept. 21, 1911, resumed June 22, 1912. 40,234 t. riprap st. placed in dikes, **12,** 1564, 1565.

Mainten.: U. S. drs. *Delaware* and *Manhattan* removed 5,362,089 and 4,439,107 c. y. material, resp., over entire sec. of R. under imp., **12,** 1566.

PHYSICAL CHARACTERISTICS.

Greatest d. at m. l. w., 21′, Cherry Isld. Flats; least l.-w. d., 19½′, but soft, **01,** 231.

Owing to soft nature of material dumped behind bulkhead at Dan Baker Shoal, the backing had a tendency to slide, **01,** 1312.

Description of bulkhead built on lower end of Baker and Stony Pt. Shoals, **02,** 1033.

Greatest draft at m. l. w., 22′ at lower end of Schooner Ledge Range, **05,** 159.

Shoaling, Billingsport Ferry dock, from operations of U. S. plant (drd. out by dr. *Hell Gate*), **09,** 1135.

Max. draft through shallowest sec., 30′ m. l. w., **12,** 285.

PRIVATE WORK.

Imp. by city of Phila., **01,** 1317; **04,** 1193; **05,** 1079; **06,** 1102. 386,009 c. y. removed from Tinicum Range, **02,** 1032. 538,937 c. y. removed from Tinicum Range, by city of Phila., **03,** 966. Oct. 23, 1905, Sec. of War au. city of Phila. to dr. for 30′ chan., **06,** 1036.

$750,000 app., State of Pa. and city of Phila., to be expend. under direction of city, in accordance with the general proj.; agreement made with city to place U. S. plant in secs. 7 and 8; operated under direction of Eng. Dept.; all costs to be paid by city. Dr. *Delaware*, rehandling machines *Cataract* and *Uncle Sam*, and drs. *Hell Gate* and *Key West* placed on the work. Material removed by U. S. drs. under agreement with the city, as follows:

Tinicum Isld. Shoal..	301,927 c. y.
Mifflin Bar.....	407,277 c. y.
Shoal opposite League Isld.....	21,458 c. y.
Total.....	730,662 c. y., **07,** 1084, 1085.

City of Phila. entered into contract with American Dredging Co. for dr. to full w. and d. of 30′ chan. in secs. 6A, 6B, and 9 for a lump sum in each case. These secs., with secs. 7 and 8, cover entire length of chan., s. line of Pa. to Christian St., Phila.; dr. done to secure d. of 30′ m. l. w., **07,** 1085.

U. S. drs. removed, for city of Phila., 778,075 c. y., and American Dredging Co. from subsec. 6A, 722,870 c. y. and from subsec. 6B, 139,783 c. y.; all pumped ashore, **07,** 1095.

U. S. drs. removed, for city of Phila., 1,573,766 c. y. from Tinicum Isld. Shoal, Mifflin Bar, and shoal opposite League Isld., **08,** 1125, 1126, 1127.

2,881,979 c. y. removed by American Dredging Co. for city of Phila., in subsecs. 6A and 6B and in sec. 9, at lump sum of $430,000, or about 14$\frac{3}{10}$¢ c. y., completing contract, **08,** 1127.

Total amount removed, by city of Phila., s. line of Pa. to Christian St., Phila., 5,186,407 c. y.; this includes amounts dr. under contract, and removed by U. S. plant and paid for by city of Phila. under agreement of July 27, 1906, **08,** 1128.

156,346 c. y. removed, for city of Phila., Tinicum Isld. Shoal; total material removed by city of Phila., s. line of Pa. to Christian St., Phila., including amount dr. by contract and by U. S. drs. under agreement with the city, 5,300, 230 c. y., s. m., **09,** 1138.

Imp. by State of Pa. and city of Phila., **10,** 1259, 1260.

Work, by city of Phila.; details, **11,** 1359; **12,** 1573.

PROJECTS.

By Lt. Col. Raymond, buttresses of rough riprap st. at intervals along outer face of bulkhead, Dan Baker Shoal, to give stability to structure; est., $50,000, **01,** 1312.

By Capt. Cosby, w. chan. already dr. through Baker Shoal to full dimen. of 30′ x 600′; est., $100,000, **02,** 1027.

By Maj. Sanford, work on bulkhead, Baker Shoal, modified by changing 4,000 l. f. of bulkhead from 2-row to 1-row constr., to be strengthened by st. along inner and outer faces under another contract, **04,** 1183.

By Maj. Sanford, expend. $1,000,000 for continuing imp., **04,** 1187.

By Maj. Sanford, expend. $1,500,000 for continuing work under existing proj., partly by contract and partly by hired labor, using U. S. plant, **05,** 1073.

By Maj. Sanford, rehandling machine for Del. R.; est., $40,000, **05,** 1073.

R., Dec. 8, 1906, by BERH. requested by R. & H. Comm., reviewing proj., 1899. Recom. no change in d.; est. cost of mainten. present proj. at $130,000 and not over $250,000 per annum.[1]

By Maj. Sanford, expend. $895,000, completing imp. under general proj. for a 30′ chan., and an addl. amount not exceeding $500,000 for mainten. of dr. chan., and $200,000 of amounts app. and au-

[1] Comm. D. 7, 59th, 2d.

in w. bends below Phila.; it being understood that these funds are also available for mainten. of the dr. chan. along the Phila. water front above Christian St., **07,** 1086, 1087.

By Maj. Sanford, constr. of depositing basin at Pea Patch Isld. for dr. material; est., $23,000, **08,** 1129.

By Maj. Deakyne, expend. $375,000, imp. of chan. and mainten. of imp., **09,** 1133.

By Maj. Deakyne, expend. $390,000, mainten. of dr. chan., and $125,000 for completing imp. of chan., w. bends, and mainten. of dr. chan., **09,** 1133.

By Maj. Deakyne, 35′ chan., Allegheny Ave., Phila., to the sea; est., $10,920,000, with $300,000 an. mainten., **10,** 224; au. act June 25, 1910, **11,** 237.

Work in Phila. H. combined with work under the general proj. below Christian St., Phila., **10,** 1261.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909, Allegheny Ave., Phila., to the sea, for 35′ chan.; **Rs.,** Maj. Deakyne, 1909 and 1910; est., $10,920,000 and $300,000 an. mainten.,[1] **10,** 224. (See projects)

Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 238.

Maps. Pile-bulkhead, Dan Baker and Stony Pt. Shoals, **02,** 1034.

Part (d), H-3 Delaware River, N. J. and Pa.—Philadelphia to Trenton.

APPROPRIATIONS. (See Part (a).)

CONTRACTS.

1910. Atlantic, Gulf & Pacific Co., drg. and dike constr., prices listed, **11,** 1351.

ENGINEERS.

Chief of Engineers. **R., 10,** 218, 224; **11,** 234; **12,** 281, 290.

In Charge. Maj. Herbert Deakyne, 1908–. **R., 10,** 1270; **11,** 1350; **12,** 1562.

OPERATIONS.

1910–11. 56,080 c. y. dr. under contract from Kinkora sec., and 59,200 c. y. from Duck Isld. sec.; work on Bordentown Dike continued; 3,152 l. f. timber work and 272 l. f. embankment completed; 5,760 c. y. dr. by U. S. dr. *Hell Gate,* making chan. 12′ x 300′ m. l. w. upper end of Pettys Isld. to Fishers Pt. Dike, **11,** 1350.

1911–12. 472,527 c. y. dr., 4,949 l. f. of Bordentown Dike built, and about 25% of Biles Isld. Dike constr.; U. S. dr. *Uncle Sam* removed 62,334 c. y. from shoal, lower end of Burlington Isld., **12,** 1562, 1563.

PHYSICAL CHARACTERISTICS.

Details, **12,** 281, 282.

Chan. has d. of 12′ x 200′ x 28 m., m. l. w., **12,** 283.

PROJECTS.

By Maj. Deakyne, chan. 12′ x 200′ m. l. w.; est., $360,000, with $20,000 an. mainten.;[2] au. act June 25, 1910, **10,** 219, 224.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909; made by Maj. Deakyne; **Rs.,** 1909 and 1910; est., $360,000, with $20,000 an. mainten.,[2] **10,** 219, 224.

Pre. ex. au. act June 25, 1910, for connecting landing at Bordentown with main chan.; **R.,** Maj. Deakyne, Nov. 5, 1910 (unfav.), [3]**12,** 290.

Pre. ex. and sur. au. act Feb. 27, 1911, at Morrisville, Pa. (**R.** to come), **12,** 290.

Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 235.

Maps. **11,** 1350.

Part (e), H-3 Delaware Breakwater Harbor, and Delaware Bay and River, N. J. and Del. -(Wrecks, removal of).

APPROPRIATION. (See Part (a).)

CONTRACTS.

1880. G. W. Townsend, $12,200 (annulled), **81,** 822.

1881. McDonald & Cuming, $17,250, **81,** 823.

ENGINEERS.

Chief of Engineers. **R., 68,** 64, 710; **80,** 97; **81,** 128; **82,** 125.

In charge:

Lt. Col. C. S. Stewart. **R., 68,** 710.

Col. J. N. Macomb. **R., 80,** 607; **81,** 822.

Capt. Wm. Ludlow. **R., 82,** 797.

ESTIMATES.

By Lt. Col. Stewart, removing wreck of brig in vicinity of Listons Tree and Duck R. Light, $6,000 or $7,000, **68,** 711.

PROJECTS.

Ten vessels foundered at their moorings in the overcrowded break'r H. during a storm in 1877. Their hulls began aiding shoaling, and Congress was appealed to for funds. Removal of wreck (not found) from Crossover Ledge Light was included, **80,** 607.

Removal of other wrecks in parts of the B. and R. done in subsequent years with the balance of the money.

SURVEYS.

Ex. by Lt. Col. Stewart, based upon the petitions of pilots and the board of underwriters of the city of Phila. to the Sec. of the Treas., and referred by him to the Sec. of War, **68,** 710.

Part (f), H-3 Delaware Bay, N. J. and Del.—(Ice harbor at head of).

APPROPRIATION. (See Part (a).)

CONTRACT.

1883. American Dredging Co., removing ice ps. at Reedy Isld., **83,** 619.

ENGINEERS.

Chief of Engineers. **R., 80,** 93, 98; **81,** 129; **82,** 125; **83,** 119; **84,** 129; **85,** 121; **86,** 118; **87,** 80; **88,** 80; **89,** 98; **90,** 89; **91,** 113; **92,** 115; **93,** 123; **94,** 112; **95,** 126; **96,** 115.

In charge:

Col. J. N. Macomb, 1880–82. **R., 80,** 611.

Capt. W. Ludlow, 1882–83. **R., 82,** 784.

Lt. Col. G. Weitzel, 1883–84. **R., 83,** 618.

Maj. W. H. Heuer, 1884–85. **R., 84,** 817; **85,** 841.

Lt. Col. H. M. Robert, 1885–90. **R., 85,** 840; **86,** 834; **87,** 804; **88,** 704; **89,** 868.

Maj. C. W. Raymond, 1890–. **R., 90,** 887; **91,** 1072; **92,** 930; **93,** 1169; **94,** 849; **95,** 1062; **96,** 919.

Assistant. A. Stierle. **R., 83,** 619; **84,** 817; **85,** 842.

[1] H. D. 733, 61st, 2d. [2] H. D. 702, 61st, 2d. [3] H. D. 262, 62d, 2d.

PHYSICAL CHARACTERISTICS.

Tide-gauge observations at Port Penn and Listons Pt., from Aug. 25 to Oct. 19, 1883, **84,** 823.

Borings, 1883, **84,** 824.

Flood and ebb current surface velocities, 1883, **84,** 825.

PLANS.

By Capt. Ludlow, 1880, ice H., protecting about 9 acres, near Listons B.; to consist of an iron substr. of screw piles carrying a wooden superstr.; est., $200,000 to $250,000, **80,** 613; **81,** 847.

Plan modified in 1882; est., $406,090.47, **82,** 785, 787.

Consideration of plan of ice H. near Listons Pt., **84,** 817–822; **85,** 841–845; est., $308,800, **85,** 845.

In 1885 Lt. Col. Robert considered plans hitherto proposed defective, and recom. that the matter remain for the present in abeyance, **85,** 841; **86,** 836. Suggesting a consideration of the use of an ice breaker of floating pontoons heavily anchored in place of the previously proposed structures, **86,** 836; **87,** 804.

Maj. Raymond reports, 1890, the constr. of an ice H. at the head of Del. B. should be deferred to await the completion of the imp. ship chan., Phila. to the sea; est., $400,000 to $600,000, **90,** 887; **91,** 1073; **92,** 931.

SURVEY.

Au. act June 14, 1880, **81,** 846; **83,** 619; **84,** 817; **85,** 842.

Part (g), H-3 Delaware River, Del.—Listons Tree Point.

ENGINEERS.

Chief of Engineers. **R., 67,** 43; **68,** 63.

In charge. Lt. Col. C. S. Stewart. **R., 67,** 440; **68,** 703, 706.

Assistant. R. M. Bache, **68,** 703, 706.

ESTIMATES. (See Plans.)

By Lt. Col. Stewart, sur., $1,000; ice H., $480,000, **68,** 708.

EXPENDITURES.

For sur., $1,277.01 **68** 707.

PLANS. (See Estimates.)

By Lt. Col. Stewart, ice H. of 21 large and 2 small ps., **68,** 706, 708.

SURVEY.

Under direction of Lt. Col. Stewart, by R. M. Bache, U. S. C. S., 1867. **R., 67,** 440; **68,** 703, 706, 708.

Part (h), H-3 Delaware River, Del.—Reedy Island Harbor (Port Penn).

COMMERCE.

Importance of Reedy Isld. as an ice H., **71,** 693; **79,** 73.

DEFENSE.

Fort Delaware, in vicinity, **71,** 694; **79,** 445.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **67,** 43; **68,** 63; **71,** 79; **79,** 73.

In charge:

Col. J. D. Graham, 1865. **R., 66,** 37.

Lt. Col. C. S. Stewart, 1867–71. **R., 67,** 440; **68,** 703.

Lt. Col. J. D. Kurtz, 1871. **R., 71,** 693.

Col. J. N. Macomb, 1879. **R., 79,** 444.

Assistant. R. M. Bache, **67,** 440; **68,** 703.

LEGISLATION.

50 acres on the n. end of Reedy Isld. and the ice H. itself ceded to the U. S. by Delaware, 1873, **79,** 445.

OPERATIONS.

1853. Ps. constr. to serve as a H. of refuge from floating ice, **68,** 703; condition of the work in 1871, **71,** 693; in 1879, **79,** 73.

PLANS.

By Lt. Col. Stewart, p. extension and repairs; est., $132,000, **68,** 705.

By Lt. Col. Kurtz, p.-work, forming an ice H.; est., $190,000, **79,** 445.

PROJECT.

Ps., 1853, to form a H. of refuge from floating ice, **68,** 703.

SURVEY.

By R. M. Bache, under direction of Lt. Col. Stewart, **67,** 42, 440; **68,** 703.

Part (i), H-3 Delaware River, Del.—New Castle Harbor.

COMMERCE.

The general interests require that this H. be re-established and maintained, **71,** 690.

Importance of New Castle as a H. of refuge, **88,** 741.

CONTRACTS.

1873. J. E. Simpson & Co., completing p., $6,685; American Dredging Co., removal of old p., $2,150; Giles, Lambson & Co., work on ice p., $695.50; Bellevue Quarry Co., st. superstr., $12,760, **73,** 864.

1875. Peirce, Rowe & Co., ice p., $21,409, **75,** ii, 178. Pierce, Rowe & Co., wooden crib in place, **77,** 260.

1877. American Dredging Co., removal of 110′ of coal wharf, $4,000, **77,** 260.

1878. Leiper & Lewis, materials and labor **79,** 440.

1879. American Dredging Co., dr., 15¢ c. y., **80,** 585.

1881. F. Pidgeon, jr., ice p. constr., **81,** 769, **82,** 756.

1887. National Dredging Co., dr., 12¢ c. y., **87,** 829.

1891. Delaware Construction Co., removal of old p. and constr. of new ice p., $9,500, **92,** 950.

1893. Atlas Dredging Co., dr., 9.4¢ c. y., p. m., **94,** 873.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **70,** 71; **71,** 79; **72,** 76; **73,** 80; **74,** 90; **75,** 96; **76,** 58; **77,** 53; **78,** 59; **79,** 71; **80,** 94; **81,** 121; **82,** 120; **83,** 119; **84,**

[1] History of, **79,** 439.

128; **85,** 128; **86,** 125; **87,** 88; **88,** 88; **89,** 103; **90,** 94; **91,** 120; **92,** 121; **93,** 130; **94,** 119; **95,** 135; **96,** 123; **98,** 160.

Boards. Maj. Smith, U. S. agt., recom. that H. lines be estab. upon the lines adopted in 1873 by the commissioners of the legislature of Delaware, with certain modifications. Approv. by Sec. of War, **91,** 1225.

In charge:
Lt. Col. J. D. Kurtz, 1870–77. **R., 71,** 689; **72,** 779; **73,** 863; **74,** ii, 134; **75,** ii, 177; **76,** 268; **77,** 258.
Col. J. N. Macomb, 1877–82. **R., 78,** 434; **79,** 439; **80,** 584; **81,** 768.
Capt. W. Ludlow, 1882–83. **R., 82,** 755.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 617.
Maj. W. H. Heuer, 1884–85. **R., 84,** 816.
W. F. Smith, U. S. agt., 1885–98. **R., 85,** 872; **86,** 858; **87,** 829; **88,** 740; (Maj.) **89,** 883; **90,** 921; **91,** 1160, 1225; **92,** 948; **93,** 1196; **94,** 873; **95,** 1113; **96,** 945; **98,** 1149.

Assistants:
Lt. M. R. Brown, **71,** 77; **72,** 74; **73,** 79; **74,** 90; **75,** 95.
Capt. Wm. Ludlow, **77,** 52.
J. J. Lee. **R., 78,** 434; **79,** 440.
W. P. Smith. **R., 85,** 874.

ESTIMATES. (See Projects.)
By Lt. Col. Kurtz, 3 ps., each $20,000, $60,000, and for completing repairs, $7,000; total, $67,000, **71,** 690; **74,** ii, 135; **75,** ii, 177. Increased to $100,000, **74,** ii, 135; **75,** 177. Increased to $120,000, **77,** 258.
By Col. Macomb, 1879, to complete existing proj., $3,000, and for a proposed addl. p., $20,000, **79,** 72, 440.

OBSTRUCTIONS. (See Private (corporate) work.)

OPERATIONS.[1]
1870–71. Removal of decayed and broken woodwork commenced Apr. 19 and rebuilding the superstr. with st. by hired labor was continued until the app. was exhausted, **71,** 79, 689.
1872–73. The st. superstr. on old crib completed, the unfinished p. in the middle of the H. has been removed, and a crib foundation for new p. commenced, **73,** 80, 863.
1873–74. Obstr. of st. and timber removed, woodwork of old p. on lower line of H. sheathed with oak and corners protected with iron, and a new p. consisting of crib substr., and st. superstr. completed, **74,** 90, ii, 135.
1874–75. The constr. of a new p. in progress, **75,** 96.
1875–76. A new ice p. completed and 108′ of coal wharf removed, **76,** 58, 268.
1876–77. Removal by contract of 110′ addl. of the coal wharf in progress and contract awarded for building foundation for a new ice p., **77,** 53, 258.
1878. 110′ of coal wharf removed and a p. head built; the crib foundation for the new ice p. completed, **78,** 59, 434.
1878–79. The new ice p. with st. superstr. completed, **79,** 71.
1879–80. 17,000 c. y. dr.; old wreck near Pier H removed; 100 c. y. riprap placed along outer face of outer p.; repairs to ps., **80,** 584.
1881–82. Cribwork constr. under contract nearly completed, **82,** 756.
1882–83. Work in accordance with proj. completed, **83,** 618.
1886–87. 30,015 c. y. dr. and ps. repaired and riprapped, **87,** 829.
1887–88. 252 c. y. riprap placed around Piers K and M; Pier N. repaired; work done by hired labor, **88,** 740, 741.
1891–92. Old p. renewed and ice p. constr., **92,** 948.
1893–94. 31,000 c. y., p. m., dr., **94,** 873.
1897–98. 3 ps. repaired, **98,** 1149.

PHYSICAL CHARACTERISTICS.
Described, **71,** 79, 690.

PRIVATE (CORPORATE) WORK.
Wharf built about 1836 by RR. obstructed H. **75,** ii, 177.

PROJECTS.
One of a series of ice Hs. estab. in colonial days, **71,** 690.
By Lt. Col. Kurtz, 1871, repairs to existing ps., removal of an unfinished p., and the constr. of 3 addl. ps.; cost, $67,000, **71,** 690.
By Col. Macomb, 1879, addl. p. required to perfect H.; cost, $20,000, **79,** 439, 440.
By Col. Macomb, 1881, constr. of 1 addl. p., and dr.; est., $23,000, **81,** 768.
By W. F. Smith, U. S. agt., 1884, removal and reconstr. of Pier H, repairs to Pier K, and dr.; est., $20,600, **85,** 875, 876; **86,** 126.

SURVEYS.
Maps. **79,** 440; **87,** 830; **94,** 874.

Part (j), H-3 Delaware River—Marcus Hook Harbor, Pa.

APPROPRIATIONS. (See Part (a).)

COMMERCE.
Rules for use of landing ps. approv. by Sec. of War Apr. 29, 1904, **04,** 1196, 1197.

CONTRACTS.
1867. W. H. Rotan, materials and labor. A. P. Eyre, materials and labor. J. C. Leiper, materials. Crane & Keaveny, labor. J. R. Grant, materials. **67,** 435, 436.
Mismanagement and bad faith of A. P. Eyre, **69,** 380. Difficulties and delays caused by the system of letting of, **67,** 431; **71,** 687.
1880. Mount Waldo Granite Co., 2 ps., **81,** 767.
1882. Leiper & Lewis, p. constr., **83,** 617.
1884. Leiper & Lewis, p. constr., **84,** 814.
1885. American Dredging Co., dr., 20¢ c. y., **86,** 832. Davis, Irvin & Sanville, driving mooring piles, **86,** 833.
1887. I. Lunt, ice p., **87,** 803.
1888. F. C. Somers, dr., 14¢ c. y. H. H. Dambly, repairs to ps. and placing mooring piles, $1,557.50. **89,** 868.
1892. Davis & Irvin, repairs to landing ps. and placing 7 groups of mooring piles, $1,014, **92,** 930.
Misc. contracts for repairs, etc., **93,** 1168; **94,** 848.
1903. Henhoeffer & Vaughn, repairing 2 landing ps., **04,** 1196.

ENCROACHMENTS.
Improper use of ps. by vessel owners, **87,** 802.

ENGINEERS.
Chief of Engineers. R., 66, ii, 41, iii, 21, 31; **67,** 43; **68,** 63; **69,** 53; **70,** 71; **71,** 78; **72,** 75; **73,** 80; **74,** 91; **75,** 97; **76,** 59; **77,** 54; **80,** 93; **81,** 120; **82,** 120; **83,** 118; **84,** 128; **85,** 120; **86,** 117; **87,** 79; **88,** 79; **89,** 98; **90,** 88; **91,** 113; **92,** 114; **93,** 123; **94,** 112; **95,** 126; **96,** 114; **97,** 146; **98,** 149; **99,** 171; **00,** 195; **01,** 235; **02,** 178; **03,** 166; **04,** 153; **05,** 160; **06,** 173; **07,** 182; **08,** 190; **09,** 195; **10,** 221; **11,** 239.

In charge:
Lt. Col. C. S. Stewart, assigned charge July 21, 1866, **66,** ii, 41, iii, 21. **R., 66,** iv, 221; **67,** 431, 434; **68,** 697; **69,** 380.
Lt. Col. J. D. Kurtz, 1870–77. **R., 70,** 424; **71,** 686; **72,** 778; **73,** 865; **74,** ii, 135; **75,** ii, 181; **76,** 270; **77,** 262.
Col. J. N. Macomb, 1877–82. **R., 78,** 436; **79,** 444; **80,** 583; **81,** 764.
Capt. W. Ludlow, 1882–83. **R., 82,** 750.

[1] History of, **79,** 439.

Lt. Col. G. Weitzel, 1883–84. **R., 83,** 616.
Maj. W. H. Heuer, 1884–85. **R., 84,** 814.
Lt. Col. H. M. Robert, 1885–90. **R., 85,** 839; **86,** 832; **87,** 802; **88,** 701; **89,** 866.
Maj. C. W. Raymond, 1890–. **R., 90,** 886; **91,** 1072; **92,** 929; **93,** 1168; **94,** 848; **95,** 1061; **96,** 918; **97,** 1213; (Lt. Col.) **98,** 1093; **99,** 1344; **00,** 1574; **01,** 1322.
Col. Jared A. Smith, 1901–02. **R., 02,** 1045.
Capt. J. C. Sanford, 1903–08. **R., 03,** 984; (Maj.) **04,** 1196; **05,** 1081; **06,** 1038; **07,** 1101.
Maj. Herbert Deakyne, 1908–. **R., 08,** 1139; **09,** 1150; **10,** 1272; **11,** 1362.

Assistants:
T. Valentine. **R., 75,** ii, 182; **78,** 436; **79,** 444.
Lt. A. M. D'Armit. **R., 93,** 1169.

ESTIMATES. (See Plans and Projects.)

By Maj. Stewart, completion, $94,000, **66,** iii, 22, 31, iv, 222, 223.

OPERATIONS.

1867-68. 2 brs. connecting p. heads and wharves built, 2 cribs sunk, and 2 more nearly ready. Wharves and p. head reconstr. **68,** 63, 697, 698.

1868-69. Progress slow account of the inefficiency of one of the contractors. Two cribs sunk and the woodwork of those sunk last year completed. **69,** 53, 380.

1869-70. 297 c. y. of hammered face st. and 895 perches rubble backing received and placed in position, **70,** 71, 424.

1870-71. Closed by completion of the ice ps.; description of the work, **71,** 78, 687.

1871-72. Iron ladders attached to each p., **72,** 778.

1872-73. Heavier ladders substituted and placed in recesses cut in the ps., **73,** 80, 865.

1874-75. Repairs to ps. and brs., **75,** 97, ii, 181.

1875-76. Repairs to the lower outer ice p., **76,** 59, 270. History of operations since, 1867, **79,** 444.

1877-78. Minor repairs only, **78,** 60, 436.

1878-79. Thorough repairs to the ps.; connecting brs. rebuilt and drg. to 18′, **79,** 73, 444.

1880-81. 7 clusters of mooring piles driven along inner line of H., **81,** 765.

1881-82. Repairs to landing ps., **82,** 750.

1882-83. Crib substr. for p. No. 7 sunk, **83,** 616.

1883-84. Pier No. 7 completed and reconstr. of p. No. 5 commenced, **84,** 814.

1884-85. Pier No. 5 reconstr., **85,** 839.

1885-86. 34,000 c. y. dr. and 2 groups of mooring piles placed, **86,** 832, 833.

1886-87. Constr. of crib substr. for p. No. 6, **87,** 802.

1887-88. 58,000 c. y. dr. from shoal area at lower end of H.; proposed new p. completed; pile foundations of p. No. 6 removed, and 2 groups of mooring piles placed between existing ps., **88,** 702.

1888-89. 100,000 c. y. dr. and landing ps. repaired, **89,** 867.

1892-93. 7 mooring piles were replaced and 1 repaired, and repairs were made to 2 ps., **93,** 1168.

1893-94. 2 landing ps. repaired and 1 group of mooring piles placed in H., **94,** 849.

1895-96. 3 groups of mooring piles driven and 1 group repaired, **96,** 919.

1897-98. 2 landing ps. repaired, **98,** 1093.

1903-04. 2 landing ps. repaired; cost, $1,637.94, **04,** 1196.

1908-09. Repairs to ice ps. by replacing st moved out of place; cost, $37.54, **09,** 1150.

1910-11. Repairs to ps., **11,** 1362.

PHYSICAL CHARACTERISTICS.

66, iv, 221; **75,** ii, 182.

PLANS. (See Estimates and Projects.)

To extend a branch of the Chester & Delaware RR. on to the ps. **R.** of DO., asst. eng., and letter of Wm. Ward, **75,** ii, 181, 182, 183.

PRIVATE WORK.

In 1785 Pa. built 2 wharves upon crib piers for commerce. In 1829 Congress repaired piers and imp. harbor, **10,** 221.

The citizens repaired p. and wharf to prevent their entire destruction, **66,** iv, 221.

Revocable license granted by Sec. of War to Joseph N. Pew to erect and maintain a p., **02,** 1046; modified to permit extension of p. 175′ farther, **03,** 984; **04,** 1196.

PROJECTS. (See Estimates and Plans.)

Original, a h. of refuge from running ice, **68,** 699; **70,** 425.

By Maj. Stewart, repairs and imp., consisting of new br. and ps., **66,** iv, 221, 223. Description of, as completed, **71,** 78, 687.

The orig. proj. of 1866, with the amendments thereto, proposed a h. for the protection of vessels against moving ice by the constr. of st. ps. behind which vessels could anchor, and the building of a bulkhead about 1,800′, parallel with the shore line and about 150′ outside of h.-w. line, together with the 'd., by dr., of the area behind the ps. and in front of the bulkhead, **86,** 117. Total amount app., 1829 to 1886, inclusive, $199,000; amount required to complete proj., $35,000, **86,** 833.

By Lt. Col. Robert, 1888, excavation of h. to 24′ m. l. w. outside the line running midway between each pair of ice ps.; from this line gradually diminishing to 18′ along the line running midway between the inner ice ps. and the landing ps., gradually diminishing to 12′ on the line joining the head of the landing ps., from which latter line the bottom would take a gentle slope of about 1 on 6 until it reached natural bottom. Amount of dr. required, 100,000± c. y. The proj. provided for the reconstr. of the upper courses upon 2 of the U.S. landing ps.; est., $20,000, **89,** 867.

SURVEYS.

By Col. Macomb, **79,** 444.
Ex. by Maj. Raymond, 1895–96, **95,** 1061; **96,** 919.
Maps. Plan of ice h., **79,** 444; **88,** 702; **02,** 1046.

Part (k), H-3 Delaware River—Chester Harbor, Pa.

CONTRACTS.

1867. B. Booth, materials, **67,** 439. J. R. Grant, materials, **67,** 439. J. Nelson, labor, **67,** 439.

1868. J. E. Neall, materials, **68,** 702. P. McAdams, materials, **68,** 702. H. Bitting, labor, **68,** 702.

ENGINEERS.

Chief of Engineers. R., 66, 7, ii, 41, iii, 22; **67,** 43; **68,** 63; **70,** 32; **71,** 81; **73,** 80; **75,** 97, 169; **76,** 59; **77,** 54; **78,** 60; **79,** 72; **80,** 94; **81,** 121; **82,** 120; **83,** 119; **84,** 128.

In charge:
Lt. Col. C. S. Stewart, 1866–68; **66,** ii, 41, iii, 22 **R., 66,** iv, 224; **67,** 437; **68,** 700.
Lt. Col. J. D. Kurtz, 1870–77; **70,** 71. **R., 71,** 705; **73,** 864; **75,** ii, 183; **76,** 271; **77,** 262.
Col. J. N. Macomb, 1877–82. **R., 78,** 437; **79,** 443; **80,** 584, 611; **81,** 767.
Capt. W. Ludlow, 1882–83. **R., 82,** 755.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 617.
Maj. W. H. Heuer, 1884. **R., 84,** 816.

Assistants:
E. Hergesheimer, **66,** iv, 224.
T. Valentine. **R., 75,** ii, 185; **78,** 437; **79,** 443.
Capt. W. Ludlow. **R., 80,** 612.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Stewart, entire completion of repairs, $11,000, **66,** iii, 22. In detail, **66,** iv, 225, 226. For renewal and general repairs in 10 years, $7,000, **68,** 701.

By Lt. Col. Kurtz, aggregate for a new h., $123,000, **71,** 706. Repairs, $6,000, **75,** ii, 183; **76,** 271.
By T. Valentine, repairs, $3,153.60, **75,** ii, 186.

LEGISLATION.

Recom. by Lt. Col. Stewart that the US. might retrocede the ps. to the State, **67,** 438.

OPERATIONS.

1866-67. Repairs in progress, **67,** 43.
1867-68. Repairs completed, details, **68,** 63, 700.
1872-73. Repairs to ps. and brs. to the amount of $550, **73,** 864.
1876-77. Repairs to ps. and brs. by hired labor to the amount of $2,600, **77,** 54, 262.
1878-79. Repairs, and constr. of a new connecting br.; **79,** 72, 443.

PHYSICAL CHARACTERISTICS.

Description, **66,** iv, 224; **68,** 701; **71,** 706; **75,** ii, 184.

PLANS. (See Estimates and Projects.)

By Lt. Col. Kurtz, to abandon the old h. and estab. one above the city, composed of 6 ps., **71,** 706.

PRIVATE, CORPORATE, AND STATE WORK.

The orig. ps. and wharves were ceded to the U. S. by Pa., **75,** ii, 186.
Private wharves built between the U. S. ps., **67,** 438.
Proposed occupancy of lower p. by the Chester & Delaware R. RR. Co., **75,** ii, 184, 186.

PROJECTS. (See Estimates and Plans.)

Orig., for H. of refuge against floating ice, **66,** iv 224, 226.
By Maj. Stewart, repairs, details, **66,** iv, 225, 226.
By Lt. Col. Kurtz, repairs to ps. and bulkhead, and reconstr. of brs., **77,** 262.

SURVEYS.

Assigned to Maj. Stewart, **66,** ii, 41. Made in Sept. and Oct., 1865, **66,** iii, 22, by E. Hergesheimer. **R., 66,** iv, 224.
An act July 11, 1870, **70,** 31, 32; ex. by Lt. Col. Kurtz. **R., 71,** 705.
Ex. or sur. an act Mar. 3, 1875, of lower p., **75,** 169; made by Lt. Col. Kurtz. **R., 75,** ii, 184, 185.
An act Mar. 3, 1879; assigned to Col. Macomb, **79,** 72, 443.
Ex. for ice H., Marcus Hook and Chester, an act Mar. 3, 1879; made, 1880, by Col. Macomb, **80,** 611.
Maps. Plan, ice H., **79,** 443.

Part (1), H-3 Delaware River—Philadelphia, Pa., and Camden, N. J. (Harbor between.)[1]

APPROPRIATIONS. (See Part (a).)

COMMERCE.

Existing C. and necessity for increased chan. facilities, **88,** 684, 687.

CONTRACTS.

1892. Jas. A. Mundy & Co., dr., 10⅞¢ c. y.; depositing and spreading material on League Isld., 9½¢ c. y., **92,** 907. Time for completion of contract extended, **92,** 911.
In 1892 contract of J. A. Mundy & Co. annulled, **93,** 1154.
1893. American Dredging Co., dr., 14.2¢ c. y.; removal of revet., $1.90 l. f.; depositing and spreading dr. material on League Isld., 16¢c. y. ($3,403,780), **93,** 1155.

ENGINEERS.

Chief of Engineers. R., 88, 78, 86; **89,** 96; **90,** 86; **91,** 110; **92,** 112; **93,** 121; **94,** 108, 110; **95,** 124; **96,** 112; **97,** 144; **98,** 147; **99,** 168; **00,** 193; **01,** 230; **02,** 172; **03,** 159; **04,** 149; **05,** 157; **06,** 172, 177; **07,** 181.

Boards:

Convened, Phila., 1888, to report upon a plan for the removal of Smith, Windmill, and Pettys Islds., in the Del. R. between Phila. and Camden. **R., 88,** 679. (Col. Craighill and Lt. Cols. Comstock and Robert.)
US. Commission advisory to the board of H. commissioners of the port of Phila. **R., 88,** 718, 720. (Capt. White, U. S. N.; H. Mitchell, U. S. C. & G. S.; and Lt. Col. Robert.)
Convened, Phila., Oct. 10, 1890, by S. O. No. 20, to **R.** on the estab. of H. lines, port of Phila. **R., 91,** 1122. (Cols. Craighill and Comstock, and Maj Raymond.)

In charge:

Lt. Col. H. M. Robert, 1888–90. **R., 88,** 678, 722; **89,** 863.
Maj. C. W. Raymond, 1890–. **R., 90,** 882; **91,** 1029; **92,** 906, 913, 914; **93,** 1152; **94,** 836; **95,** 1032; **96,** 897; **97,** 1205; (Lt. Col.) **98,** 1085; **99,** 1328, (final **R.**) 1330; **00,** 1566; **01,** 1310, 1317.
Capt. Spencer Cosby, 1902. **R., 02,** 1025, 1027, 1032, 1041.
Maj. J. C. Sanford, 1903–08. **R., 03,** 958, 960; **04,** 1182, 1187, 1193; **05,** 1073, 1079; **06,** 1038; **07,** 1100.

LEGISLATION.

Legal proceedings for the condemnation of Smith and Windmill Islds., **89,** 863; **90,** 883.
Pa. and the city of Phila. enacted laws to facilitate the reconstr. of the Phila. water front in accordance with the proj. of the U. S., **93,** 1154.
Resolution passed by the legislature of N. J. asking for a modification of the proj. for the constr. of a dike at Fishers Pt., N. J., **95,** 1036.
Pa. passed a law providing for at least 150′ distance between wharves, **97,** 1208.

OBSTRUCTIONS.

In 1894 the Pa. quarantine commission complained that the dr. material deposited back of Tinicum Isld. was obstr. the chan., **95,** 1041.
In 1894 the Navy Dept. complained that the deposit of dr. material in the vicinity of League Isld. was causing shoaling in front of its docks, **95,** 1044.

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[1](ESTABLISHMENT AND REGULATION OF THE PORT WARDEN'S LINE.)

ENGINEERS.

Chief of Engineers. R., 73, 83, 886; **74,** 93.
Boards:
Convened, Apr., 1873. Considered the subject of "the imperfect and uncertain condition of the port warden's line of Philadelphia and adjacent waters." Recom. that the subject be referred to the municipal authorities of Phila., **73,** 887. (Col. Woodruff, Lt. Cols. Wright, Newton, and Kurtz, and Maj. Craighill.)

In charge:

Lt. Col. J. D. Kurtz. **R., 74,** ii, 145, 146; **77,** 270.
Capt. W. Ludlow, in temporary charge, 1877, **78,** 431.
Col. J. N. Macomb. **R., 78,** 443; **79,** 462.

SURVEY.

By U. S. Coast Sur., 1878, **78,** 443.

In 1896 the citizens of Gloucester and Salem Counties, N. J., protested against the dumping of dr. material in Hog Neck Chan., **96,** 904.

OPERATIONS.

1890-91. 10,318 c. y. dr., **92,** 908.

1891-92. 312,111 c. y. dr. and 2,330 l. f. of revet. removed, **92,** 908, 910.

1892-93. 5,495 l. f. of revet. removed, 596,108 c. y. dr. from Windmill Isld., and 327,228 c. y. deposited on League Isld., **93,** 1154.

1893-94. 14,839 l. f. of revet. removed, 4,924,390 c. y. dr. from Windmill, Smith, and Pettys Islds., and 1,021,123 c. y. deposited on League Isld., **94,** 838.

1894-95. 2,184 l. f. of revet. removed, 4,597,365 c. y. dr. from Smith and Pettys Islds., and 719,526 c. y. deposited on League Isld., **95,** 1033.

1895-96. 4,488,837 c. y. dr., and 634,245 c. y. deposited on League Isld., **96,** 899.

1896-97. 3,956,027 c. y. dr. from H., and the deposit of material at League Isld. completed by the addition of 594,766 c. y., **97,** 1205.

1897-98. 2,978,295 c. y. dr., **98,** 1085.

1898-99. Removal of projecting points of r. opposite Rush St. and below Cramp's shipyard, **99,** 1329.

1905-06. 98,432 c. y. removed by U. S. dr. *Delaware,* **06,** 1038.

1906-07. 10,968 c. y. removed by U. S. dr. *Delaware,* making total of 109,400 c. y., **07,** 1100.

PHYSICAL CHARACTERISTICS.

Description of, Smith, Windmill, and Pettys Islds., **88,** 680.

Physical results of the work, **99,** 1335.

PRIVATE (CITY) WORK.

Reconstr. of water fronts, **99,** 1336.

Pier extensions, **94,** 838; **95,** 1034, 1051; **96,** 900, **97,** 1206; **98,** 1086.

Bulkhead constr., **01,** 1312; **09,** 1140; **10,** 1267.

Pier extensions, **01,** 1312; **02,** 1027, 1028; **03,** 960; **04,** 1187; **05,** 1074; **06,** 1030; **07,** 1087.

PROJECTS.

By joint resolution Feb. 17, 1888, $5,000 was app. for sur. of R. between Phila. and Camden, and the Sec. of War au. to appoint BE. to ex. and **R.** upon this part of the R.

By BE., 1888, imp. of Del. R. between Phila., Pa., and Camden, N. J., by the removal of Smith, Windmill, and a portion of Pettys Islds. and adjacent shoals, securing a chan. from Kaighns Pt. to Fishers Pt. 2,000′ w. The d. on the Pa. side, commencing about 300′ from the existing wharf line, to admit of wharf extension, to be 26′ x 1,000′ m. l. w.; the d. across the remaining half of the chan. to decrease from 26′ to 12′ on the N. J. side; est., $3,500,000, **88,** 682, 684. (Col. Craighill and Lt. Cols. Comstock and Robert.)

The proj. for the imp. of the H. modified act Mar. 3, 1891, to provide for the deposit of material on League Isld., and the cost of dr. under this addl. condition est. at $3,053,000, **93,** 1153. Act July 13, 1892, modified the act of 1891 so as to provide for the deposit of material at other places as well as at League Isld., **93,** 1153.

H. lines estab. by Sec. of War, 1894, **94,** 864.

In 1895 Maj. Raymond est. that the total amount of material required to be removed during the entire work would amount to 21,046,000 c. y., **96,** 900.

By Maj. Raymond, 1898, sur. to include gaugings of the flow and determinations of the velocities of the current in the H., etc.; cost, $11,200, **98,** 1086.

Under proj. for expend. of $390,000, work in H. is combined with work under the general proj. below Christian St., Phila., **09,** 1139.

SURVEYS.

Minor sur. and ex., **95,** 1034; **96,** 899; **97,** 1206; **98,** 1085; **99,** 1329.

Gloucester to Fishers Pt., to locate new system of triangulation stations, and the shore lines of Phila. and Camden, and at s. end of Pettys Isld., **01,** 1310.

West of Pettys Isld., to determine changes, **02,** 1025.

Greenwich ps., to determine extent of shoaling in chan. in front of, **03,** 958.

Pre. ex. au. Mar. 3, 1905, Del. R., at Phila., for removal o f shoal opposite Greenwich coal ps.; **R.,** Maj. Sanford, 1905 (unfav.), **06,** 177.[1]

Ex. of part of H., and sur. of water front, and all new ps. and extensions located, **08,** 1130.

Maps. **88,** 682; **95,** 1034; **98,** 1086; **99,** 1338.

Part (m), H-3 Delaware River—Near Bordentown, N. J.

APPROPRIATIONS. (See Part (a).)

COMMERCE.

Necessity for greater d., **08,** 1138.

CONTRACT.

1908. American Dredging Co., dr., 14½¢ c. y., p. m., **08,** 1139.

ENGINEERS.

Chief of Engineers. **R., 08,** 190; **09,** 194; **10,** 220.

In charge. Maj. Herbert Deakyne, 1908–. **R., 08,** 1138; **09,** 1148; **10,** 1270.

OPERATIONS.

1908. Work about 60% completed, **08,** 1139.

1908-09. Total of 64,221 c. y., p. m., removed and placed on shore; work completed, **09,** 1148.

Operations to be merged hereafter into general imp. of Del. R., from Allegheny Ave., Phila., to Trenton, N. J., **10,** 220.

PROJECT.

By Maj. Herbert Deakyne, dr. chan. 7′ x 200′ x 3,800′ m. l. w. through bar, **08,** 1138, 1139.

SURVEYS.

Between Bordentown and Trenton, made in Aug., 1900, by Lt. Col. Raymond, to determine condition of R. to the head of tide at Trenton, **01,** 1311.

Sur. by Maj. Deakyne, to determine means of relief for C., **08,** 1138.

Part (n), H-3 Delaware River, N. J. and Pa.—at Perriwig Bar.

APPROPRIATIONS. (See Part (a).)

CONTRACTS.

1907. American Dredging Co., dr., 33¢ c. y., p. m., **08,** 1137.

ENGINEERS.

Chief of Engineers. **R., 06,** 177; **07,** 181; **08,** 189; **09,** 193; **10,** 219.

In charge:

Maj. J. C. Sanford, 1903–08. **R., 07,** 1100.

Maj. Herbert Deakyne, 1908–. **R., 08,** 1137; **09,** 1147; **10,** 1270.

OPERATIONS.

1907-08. 140,801 c. y., p. m., removed; work completed. Part pumped into old chan. and part deposited on N. J. shore, **08,** 1137, 1138.

[1] H. D. 230, 59th, 1st.

Operations to be merged hereafter into general imp. of Del. R. Allegheny Ave., Phila., Pa., to Trenton, N. J., **10,** 219.

PROJECT.

By Maj. Sanford, dr. 7′ x 200′ m. l. w. in 3 straight reaches; est., $50,000, **06,** 177; **07,** 1100.

SURVEYS.

Pre. ex. and sur.,[1] **06,** 177.

Sur. to determine changes, **07,** 1100; **08,** 1138; **09,** 1147.

Pre. ex. and sur. au. act Mar. 3, 1905, Perriwig Bar. **Rs.,** Maj. Sanford, 1905, 1906; est., $50,000 and $1,500 au. mainten.,[1] **06,** 177.

Maps.[1]

Part (o), H-3 Delaware River—at Sewer Shoal, N. J. and Pa.

APPROPRIATIONS. (See Part (a).)

CONTRACTS.

1909. American Dredging Co., dr., 35¢ c. y., p. m., **09,** 1150.

ENGINEERS.

Chief of Engineers. R., 09, 194; **10,** 220.

In charge. Maj. Herbert Deakyne, 1908–. **R., 09,** 1149; **10,** 1271.

OPERATIONS.

1909-10. 32,657 c. y., p. m., removed and deposited on the N. J. shore; work completed, **09,** 1150; **10,** 220, 1271.

Operations to be merged hereafter into general imp. of Del. R., Allegheny Ave., Phila., Pa., to Trenton, N. J., **10,** 220.

PROJECT.

By Maj. Deakyne, straight chan. through bar 7′ x 200′ x 1,800′ m. l. w., **09,** 1149.

Part (p), H-3 Delaware River—Lalor Street, Trenton, to Upper Railroad Bridge, N. J.

APPROPRIATIONS. (See Part (a).)

ENGINEERS.

Chief of Engineers. R., 10, 224; **12,** 281.

In charge. Maj. Herbert Deakyne, 1910–. **R., 12,** 1562.

OPERATIONS.

1911-12. No work done, pending condemnation proceedings by city of Trenton for securing water-front property necessary for substantial terminal facilities, **12,** 1562.

PHYSICAL CHARACTERISTICS.

Details, **12,** 281.

PROJECT.

Proj. au. act July 25, 1912, provides for dr. chan. 12′ x 200′ m. l. w., with turning basin at its upper end, of same d., 300′ x 400′, along N. J. side of R., Lalor St. to upper RR. br., Trenton; est., $164,000,[2] **10,** 224; **12,** 281.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, for greater d.; **Rs.,** Maj. Deakyne, 1909 and 1910; est., $164,000,[2] **10,** 224.

Map.[2]

Part (q), H-3 Delaware River, N. Y., N. J., and Pa.—at or Near the Mouth of Neversink River.

APPROPRIATIONS. (See Part (a).)

COMMERCE.

R. at this point not navigable for C. purposes other than rafting of lumber, etc.; main object sought is relief from floods due to ice gorges, **10,** 212, 213.

ENGINEERS.

Chief of Engineers. R., 08, 193; **09,** 198, 199; **10,** 212; **11,** 233; **12,** 279.

Boards. BERH. recom. plan of Maj. Sanford, 1909.

In charge. Maj. Herbert Deakyne, 1908–. **R., 10,** 1255; **11,** 1349; **12,** 1561.

LEGISLATION.

Sec. Port Jervis Board of Trade reports no final action had been taken by State legislatures toward providing their share of the money necessary (see Projects), **11,** 1349; **12,** 1561.

PROJECTS.

By Maj. Sanford, removal of r. ledge known as Sims Clip to 3′ below m. summer stage, removal of portion of Storms Isld. to m. summer stage, constr. of dike across the head of Bendkill, behind Storms Isld., and another dike across the subsidiary chan. which separates the two parts of Storms Isld.; est., $61,392.50; States of New York, New Jersey, and Pennsylvania, or other local interests, to supply $54,780 before U. S. app. of 1910 to be available, **10,** 1255, 1256.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.,** Maj. Sanford, 1907 and 1908, for removal of bars and other obstr. at and near mouth of Neversink R., and of Del. R. at and near mouth of Neversink R.; est., $61,392.50, of which $6,612.50 for removal of r. ledge known as Sims Clipp should be borne by U. S. and balance ($54,780) provided for by State and local interests,[3] **08,** 193; **09,** 198–199.

Map.[3]

[1] H. D. 852, 59th, 1st. [2] H. D. 839, 61st, 2d. [3] H. D. 1164, 60th, 2d.

H-18 FRANKFORD CREEK, PA.

APPROPRIATIONS.

1882, $10,000, **83,** 612.
1894, 2,000, **95,** 1076.

Total, 12,000

COMMERCE.

Statement of manufacturing industries concerned. Value and capacity of the Frankford Arsenal, **82,** 826, 827.

C. interests of the creek did not warrant further app., **88,** 698, 699.

CONTRACTS.

1883. American Dredging Co., dr., 23¢ c. y., **83,** 612.

ENGINEERS.

Chief of Engineers. **R., 81,** 129; **82,** 127; **83,** 117; **84,** 127; **85,** 119; **86,** 116; **87,** 78; **88,** 77; **95,** 131; **96,** 121; **12,** 290.

In charge:
Capt. W. Ludlow, 1881–83. **R., 82,** 822.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 611.
Maj. W. H. Heuer, 1884–85. **R., 84,** 810.
Lt. Col. H. M. Robert, 1885–88. **R., 85,** 836; **86,** 829; **87,** 799; **88,** 698.
Maj. C. W. Raymond, 1890–96. **R., 95,** 1075; **96,** 935.
Maj. H. Deakyne, **12,** 279.

Assistants:
E. A. Giesler. **R., 82,** 824.
A. Stierle. **R., 83,** 612; **84,** 811.
E. D. Thompson. **R., 96,** 937.

OPERATIONS.

1882–83. 35,178 c. y. dr., **83,** 612.

PHYSICAL CHARACTERISTICS.

Description of creek and its obstr., **82,** 823.

PRIVATE (CORPORATE) WORK.

The Penn. RR. Co. straightened the chan. between Tulip and Roxborough Sts. in 1896, **96,** 936.

PROJECTS.

By Capt. W. Ludlow, 1882, chan., mouth to Frankford Ave. Br., l.-w. d. of 7′ at the mouth, decreasing to 3′ at the br., with a bottom w. of 50′, est., $40,000, **82,** 823. No further operations recom.; **84,** 811; **87,** 799.

Congress, 1894, app. for the straightening of the creek between Tulip and Roxborough Sts., Phila., **95,** 1075. The Penn. RR. given permission to do the work under certain conditions, **96,** 937.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. W. Ludlow, **82,** 822.

Sur. by Maj. Raymond, 1896, **96,** 936.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 290.

Maps. **95,** 1076.

H-20 SCHUYLKILL RIVER, PA.

APPROPRIATIONS.

1870, $15,000, **70,** 71; **71,** 79.
1871, 10,000, **71,** 79, 692; **72,** 780.
1872, 40,000, **72,** 76, 77, 780, 781.
1873, 40,000, **73,** 81, 867.
1874, 20,000, **74,** 91, ii, 139.
1875, 20,000, **75,** 98, ii, 187, 188.
1876, 20,000, **76,** 60, 273; **77,** 55, 263.
1878, 30,000, **78,** 61, 439.
1879, 25,000, **79,** 69, 418.
1880, 40,000, **80,** 581.
1881, 40,000, **81,** 762.
1882, 25,000, **82,** 747.
1884, 25,000, **84,** 812.
1886, 18,750, **86,** 831.
1888, 25,000, **88,** 701.
1890, 45,000, **90,** 886.
1892, 46,250, **92,** 925.
1894, 20,000, **95,** 1059.
1896, 20,000, **96,** 917.

Total, 525,000

COMMERCE.

Rapidly increasing, **71,** 79, 692.

Extensive arrangements for shipment of grain at Girard Pt., **82,** 749.

C. interests and requirements, **88,** 700; **90,** 885.

Description of, **93,** 1165; **94,** 847; **95,** 1059.

Imp. already completed of great benefit, **98,** 1116.

C. interests of great and increasing value and importance, **01,** 235.

CONTRACTS.[1]

1870. American Dredging Co., dr., 30, 40, and 60¢ c. y., **71,** 693.

1872. American Dredging Co., removal of r., $17 c. y., **73,** 868. W. H. Beard, dr., 32¢, **73,** 868.

1873. American Dredging Co., removal of r., $25.50 c. y., **74,** ii, 139.

1874. American Dredging Co., dr., 18¢ c. y., **75,** ii, 188.

1876. M. F. Brainard, dr., 11½¢ c. y., **77,** 265.

1877. M. F. Brainard, dr., 18¢ c. y., **77,** 265.

1878. American Dredging Co., dr., 10, 21½, and 28¢ c. y., **79,** 419. T. Cuning, removal of r., $23.50 c. y., **79,** 419.

1879. F. Pidgeon, removal of material, **80,** 582.

1880. F. Pidgeon, dr., **81,** 763.

1882. American Dredging Co., dr., 25 to 45¢ c. y., **82,** 748. National Dredging Co., dr., 25¢ c. y., **83,** 615.

1884. National Dredging Co., dr., 28¢ c. y., **85,** 838.

1886. American Dredging Co., dr., 19¢ c. y., **87,** 801.

1888. American Dredging Co., dr., 19¢ c. y., **89,** 866.

1891. F. C. Somers, dr., 18.9¢ c. y., **91,** 1071.

1892. F. C. Somers, earth-dike constr., 7.4¢ c. y., **92,** 925. B. G. Bailey, pile-dike constr., $15.87 l. f., and earth filling, 10¢ c. y., **92,** 925. American Dredging Co., dr., 19½¢ c. y. ($33,150), **93,** 1166.

1894. Delaware Construction Co., pile dike: Timber work, at $17.50 l. f.; filling dike, at 40¢ c. y. ($19,750), **95,** 1060.

1896. Virginia Dredging Co., dr., 13.4¢ c. y. ($7,638), **97,** 1212.

1900. River & Harbor Improvement Co., dr. required by proj., **01,** 1320.

ENGINEERS.

Chief of Engineers. **R., 70,** 71; **71,** 79; **72,** 76; **73,** 81; **74,** 91; **75,** 98; **76,** 59; **77,** 54; **78,** 61; **79,** 69; **80,** 93; **81,** 120; **82,** 119; **83,** 117; **84,** 127; **85,** 119; **86,** 116; **87,** 78; **88,** 78; **89,** 97; **90,** 87; **91,** 112; **92,** 113; **93,** 122; **94,** 111; **95,** 125; **96,** 113; **97,** 145; **98,** 148, 157; **99,** 169; **00,** 193; **01,** 233.

In charge:
Lt. Col. J. D. Kurtz, 1871–77. **R., 71,** 692; **72,** 780; **73,** 867; **74,** ii, 138; **75,** ii, 187; **76,** 271; **77,** 263.

[1] Various open-market agreements, **93,** 1163; **94,** 846; **96,** 916; **98,** 1089.

Capt. W. Ludlow, in temporary charge, 1877; **78,** 431.
Col. J. N. Macomb, 1877–82. **R., 78,** 439; **79,** 416; **80,** 580; **81,** 761.
Capt. W. Ludlow, 1882–83. **R., 82,** 746.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 613.
Maj. W. H. Heuer, 1884–85. **R., 84,** 811.
Lt. Col. H. M. Robert, 1885–89. **R., 85,** 837; **86,** 830; **87,** 800; **88,** 699; **89,** 864.
Maj. C. W. Raymond, 1889–1901. **R., 90,** 884; **91,** 1069; **92,** 923; **93,** 1164; **94,** 846; **95,** 1057; **96,** 915; **97,** 1211; (Lt. Col.) **98,** 1089, 1114; **99,** 1339; **00,** 1570; **01,** 1319.
Col. J. A. Smith, 1902. **R., 02,** 1063.
Maj. J. C. Sanford, 1903–06. **R., 03,** 1024; **04,** 1201; **05,** 1085; **06,** 1040.
Maj. H. Deakyne, 1909–. **R., 09,** 1147; **10,** 1268 **11,** 1360; **12,** 1576, 1578.

Assistants:
Capt. M. R. Brown, **71,** 77; **72,** 74; **73,** 79; **74,** 90; **75,** 95; **76,** 58.
Capt. W. Ludlow, **77,** 52; **78,** 431; **79,** 403.
T. Valentine. **R., 79,** 417, 439; **82,** 748.
R. G. Pearson. **R., 98,** 1119.

ESTIMATES. (See Projects.)

By Lt. Col. Kurtz, 1870, dr. and removing r. by blasting, $257,700, **74,** ii, 139, 140. Increased, 1874, by $42,000, **74,** ii, 140. Increased again, 1875, $75,000, **76,** 273; **77,** 264; **79,** 417.

OPERATIONS.

1870–71. Dr. by contract at entrance into the Delaware R. and other places, **71,** 79, 692.
1871–72. Dr. at various places, **72,** 76, 780.
1872–73. 68,404 c. y. sand, etc., dr.; 300 c. y. r. removed by blasting at various places, **73,** 81, 867.
1873–74. 104,993 c. y. sand, etc., dr., and 606 c. y. r. removed by blasting, **74,** 91, ii, 138.
1874–75. Dr. by contract, **75,** 97, ii, 187.
1875–76. 46,257 c. y. sand dr., **76,** 59, 271, 272.
1876–77. About 50,000 c. y. dr., **77,** 54, 264.
1877–78. About 67,000 c. y. dr., **78,** 61, 437, 438.
1878–79. About 188,000 c. y. clay, gravel, etc., dr.; 100 c. y. r. removed, **79,** 69, 417.
1879–80. 61,073 c. y. dr. from chan., **80,** 580.
1880–81. 8,500 c. y. dr., **81,** 761.
1881–82. 62,573 c. y. dr., **82,** 748.
1882–83. 166,911 c. y. dr. from various points in the R., **83,** 614.
1883–84. 90,864 c. y. dr. from chan. between the mouth and Girard Pt., **84,** 812.
1884–85. 52,730 c. y. dr. from chan. between Pt. Breeze and Girard Pt. p., **85,** 837.
1885–86. 36,004 c. y. dr. from chan. between Pt. Breeze and Girard Pt. p., **86,** 830.
1886–87. 90,581 c. y. dr. from chan. at Pt. Breeze, Yankee Pt., and Penrose Reach, **87,** 800.
1888–89. 111,354 c. y. dr., **89,** 864.
1890–91. 95,890 c. y. dr., **91,** 1069.
1891–92. 400 c. y. dr., **92,** 923.
1892–93. 2,797′ of earthen and 800′ of pile dike constr.; 98,148 c. y. dr.; dikes repaired, **93,** 1165.
1893–94. 90,218 c. y. dr.; dikes damaged by storms repaired; 300 willows planted to protect earthen dike, **94,** 846.
1894–95. Extension of pile dike in progress, **95,** 1058.
1895–96. Extension of pile dike 900′ completed; earthen dike repaired and 161 t. st. deposited to protect chan. slope, **96,** 916.
1896–97. 62,983 c. y. dr., **97,** 1211.
1897–98. Pile dike at mouth of the R. raised about 2′ for 1,734 l. f., and earthen dike repaired, **98,** 1089.
1898–99. Repairs of pile dike completed, **99,** 1340.
1900–01. 55,068 c. y., s. m., removed from chan. across bar at mouth, completing operations under existing proj., **01,** 1320.

PHYSICAL CHARACTERISTICS.

Described, **71,** 692; **72,** 780; **73,** 867.
Tidal observations and description of the stream and the locality, **98,** 1119.

PRIVATE (CITY) WORK.

Up to 1897 total amount dr. by the city of Phila., 91,830 c. y., **97,** 1211. 1897–98, city dr. also 171,540 c. y., **98,** 1090.
During the 5 years preceding 1900 the city dr. 615,377 c. y. from the chan., **00,** 1570.
1901–02. 219,066 c. y. removed from below Penrose Ferry Br. and 30,647 c. y. from above it and deposited on site of League Isld. Park, **02,** 1032, 1033.
1902–03. 296,670 c. y. removed from below Penrose Ferry Br. and 68,654 c. y. from above it; also 17 c. y. bowlders, completing contract, **03,** 966, 967.
1903–04. 448,500 c. y. in all dr. at Grays Ferry and between Penrose Ferry br., and oil wharves at Pt. Breeze, **04,** 1195.
1904–05. Total amount removed during 1903, 1904, and 1905, 731,747 c. y. soft material and 62.5 c. y. r., **05,** 1080.
Description of, **06,** 1037.
Sur., mouth to South St. Br., **09,** 1147.
Dr., **10,** 1268; **11,** 1360.
Reconstr. and repair of bulkheads, **12,** 1574.

PROJECTS. (See Estimates.)

By Col. Kurtz, 1870, dr. chan. 20′ x 100′ mouth to Gibsons Pt.; thence 18′ to Chestnut St. Br.; est., $257,700, **74,** ii, 139, 140. Modified, 1875, to provide chan. 24′ x 300′ bet. mouth and Girard Pt., **75,** ii, 187; **76,** 272; **79,** 417.
Further modification, 1883, to increase w. bet. mouth and Girard Pt. to 400′, with d. of 24′, and from Girard and Gibsons Pts. 20′ x 250′ m. l. w., **83,** 614; **87,** 78.
1870 to 1886, incl., $368,750 app., when it was est. $116,250 required to complete proj., **87,** 801.
Existing proj. proposes chan. 24′ x 400′ m. l. w. mouth to Girard Pt., about 1 m.; thence to Gibsons Pt., 3 m., chan. 20′ x 250′, except at Yankees Pt., where the chan. w. to be increased to 300′; thence to Chestnut St. Br., 3 m., chan. of navigable w. and 18′ d. m. l. w.; proposed chans. to be obtained by dr.; est., $485,000, of which amount $438,750 already app., **91,** 1069.
By Maj. Raymond, 1892, preservation of chan. at mouth with 2,910 l. f. of earthen and 1,800 l. f. of pile dike; est., $44,209, **92,** 929.
By Maj. Raymond, 1894, extension of pile dike, and repair of the earthen dike with st. and planted willows, **95,** 1058.
Sec. of War gave city of Phila. permission, 1895 and 1896, to dr. R. to aid in its imp., **96,** 916.
Maj. Raymond est., 1898, cost of proposed works of imp. would be $3,153,000, **98,** 1118.
By Lt. Col. Raymond, expend. of available balance on redr. chan. across bar at mouth to 26′ m. l. w., over a w. not exceeding 150′, **01,** 1319. Proj. completed, **01,** 1320.

SURVEYS. (See Private work.)

By Col. J. N. Macomb, 1879, **79,** 417.
Ex. by Maj. Raymond, 1896, **96,** 916.
Sur. au. act June 3, 1896; made by Maj. Raymond, 1898 (**R.** fav.), **98,** 1115.

Maps:
Charts of R. from mouth to Girards Pt., from Penrose Ferry Br. to Yankee Pt., and from Pt. Breeze to Gibsons Wharf, **79,** 418.
88, 700; **92,** Atlas, 10.

H-23 DELAWARE BREAKWATER, DEL.

Part.	Title.	Period.	Appropriation.
a	Delaware Breakwater, Del	1822–1912	$3,008,353.70
b	Delaware Bay, Del.—Iron Pier, Lewes, Del	1870–1912	388,660.00
c	Crow Shoals, N. J	1873–1874	
d	Delaware Bay, Del.—Harbor of Refuge	1891–1912	2,255,334.00
	Total		† 5,652,347.70

Part (a), H-23 Delaware Breakwater, Del.[1]

APPROPRIATIONS.

1822,	$22,700.00, act May 7.
1828,	250,000.00, **66,** iii, 31.
1830,	162,000.00, **66,** iii, 31.
1831,	208,000.00, **66,** iii, 31.
1832,	270,000.00, **66,** iii, 31.
1833,	270,000.00, **66,** iii, 31.
1834,	270,000.00, **66,** iii, 31.
1835,	100,000.00, **66,** iii, 31.
1836,	[2] 1,000.00, act July 2 (sur.).
1836,	100,000.00, **66,** iii, 31.
1837,	141,000.00, **66,** iii, 31.
1838,	150,000.00, **66,** iii, 31.
1852,	30,000.00, **66,** iii, 31.
1863,	100,000.00, act Feb. 20.
1864,	100,000.00, act July 2.
1866,	107,910.00, **66,** iii, 31.
1867,	109,493.70, act Mar. 2.
1882,	125,000.00, **82,** 792.
1884,	75,000.00, **84,** 845.
1886,	56,250.00, **86,** 840.
1888,	100,000.00, **88,** 708.
1890,	80,000.00, **90,** 891.
1892,	50,000.00, **92,** 935.
1894,	50,000.00, **95,** 1066.
1896,	80,000.00, **96,** 923.
Total,	3,008,353.70

COMMERCE. (See Harbor of refuge.)

The shelter afforded inadequate to the requirements of C., **74,** ii, 146; **79,** 453.

Necessity for increased H. area, **82,** 792.

Importance of the work, **88,** 707.

CONTRACTS.

1867. Barker & Bodwell, st., $4.73 t. Wm. H. Miller, labor, annulled, **67,** 433.

1868. A. O. & J. O. Deshong, jr., st., $2.89 and $3.89 t., **69,** 377, 380. J. C. Leiper, st., $3.10 perch, **69,** 377, 380.

1882. Eppinger & Russel, timber, **83,** 658. Finley, Garret & Wilson, iron, **83,** 658. P. G. Field, iron, **83,** 658.

1883. S. R. Cummings, creosoted timber, **83,** 658. W. H. Brown, granite, $3.23 t., **83,** 659. H. L. Fearing, rope and cordage, **84,** 845.

1884. A. J. Howell, st., $2.99 and $2.77½ c. y., **84,** 846. C. A. Brown, st., $1.74 t., declined to enter into contract, **85,** 847, 848. Andrews & Locke, st., $1.99 t., **85,** 848.

1886. W. M. Field, st., $2.24 t., **86,** 841. W. M. Field, st., $2.10 t., **87,** 807.

1888. Brandywine Granite Co., furnishing and placing random st., $2.23 t., **89,** 873.

1891. Brandywine Granite Co., furnishing and placing random st., $2.17 t., **91,** 1077.

1892. Brandywine Granite Co., st., $2.17 and $3.20 t. ($48,552.92), **93,** 1172.

1894. G. W. Andrews, st., $2.62 t. ($29,475), **95,** 1066.

1896. Open-market agreements, **96,** 922. J. F. Donovan, st., $2.33 t. ($55,920), **97,** 1215.

1903. Horace Brown, sale and removal of old building belonging to the U. S., **$1, 05,** 1083.

DOCUMENTS. (Not printed in **Rs.**)

H. Doc. 1, 33d Cong., 1st sess., **66,** 3; and all detailed **Rs.** prior to Maj. J. G. Barnard's, dated Oct. 8, 1853.

ENGINEERS.

Chief of Engineers. R., 66, 3, ii, 30, 41, iii, 21, 22, 31, iv, 227; **67,** 42; **68,** 62; **69,** 53; **70,** 70; **71,** 77; **72,** 74, 777; **73,** 83; **76,** 61; **77,** 56; **78,** 62; **79,** 74, 455; **80,** 97; **81,** 127; **82,** 125; **83,** 129; **84,** 137; **85,** 122; **86,** 119; **87,** 81; **88,** 81; **89,** 100; **90,** 90; **91,** 115; **92,** 116; **93,** 125; **94,** 114; **95,** 127; **96,** 116; **97,** 148; **98,** 151; **99,** 172; **00,** 196; **01,** 237; **02,** 176; **03,** 163; **04,** 154; **05,** 161; **06,** 174; **07,** 183; **08,** 191; **09,** 196; **10,** 222; **11,** 240.

Boards:

1834. Board of sur. consider the subject of the formation of shoals and modification of proj.; recom. numerous careful and systematic observations of the force and direction of the currents, and no change in proj., **66,** iv, 228, 229.

1871. Convened, Philadelphia, and recom. further surs.

1872. Reassembled May 12, and recom. closing gap between the break'r and ice breaker; est., $1,314,200. **R., 72,** 755. Lt. Col. Kurtz dissented. **R., 72,** 757; **71,** 672, 678. (Col. Woodruff, Lt. Cols. Wright and Newton, and Maj. Craighill.)

In charge:

Maj. R. Delafield, 1836, **73,** 883.

Lt. T. B. Linnard, 1839, **73,** 883.

Maj. H. Bache, 1839–53, **66,** iv, 227, 229; **72,** 777, 778; **73,** 83.

Maj. J. G. Barnard, 1853, **66,** iv, 227. **R., 73,** 878.

Col. J. D. Graham, 1864–66. **R., 66,** 37, 40.

Maj. C. S. Stewart, 1866–70, **66,** ii, 41. **R., 66,** iv, 226; **67,** 430, 432; **68,** 694; **69,** 377.

Lt. Col. J. D. Kurtz, 1870, **70,** 70. **R., 70,** 422; **71,** 663; **72,** 753; **76,** 278; **77,** 269.

Capt. Wm. Ludlow, in temporary charge, 1877, **78,** 431. **R., 79,** 457.

Col. J. N. Macomb, 1877–81. **R., 78,** 443; **79,** 453; **80,** 610; **81,** 820.

Capt. W. Ludlow, 1881–82. **R., 82,** 791.

Lt. Col. G. Weitzel, 1882–84. **R., 83,** 656.

Maj. W. H. Heuer, 1884–85. **R., 84,** 845.

Lt. Col. H. M. Robert, 1885–90. **R., 85,** 846; **86,** 839; **87,** 805; **88,** 707; **89,** 871; **90,** 891.

Maj. C. W. Raymond, 1890–1901. **R., 90,** 889; **91,** 1075, 1078; **92,** 933; **93,** 1172; **94,** 852; **95,** 1064; **96,** 922; **97,** 1214; (Lt. Col.) **98,** 1094; **99,** 1345; (final **R.,** 1346); **00,** 1575; **01,** 1323.

Capt. Spencer Cosby, 1902. **R., 02,** 1035.

† To which might be added the total on p. 304, "Cold Spring Inlet," $961,200.

[1] Delaware Break'r H. Del.: Sur.—**R.,** Oct. 8, 1853; est., $750,000. Crow Shoal, N. J., for break'r: Sur.—**R.,** Dec. 1,1837; est., $1,590,843.30. Break'r at the Shears near Cape Henlopen, Del.: Sur.—**R.,** July 14, 1823; ests. $222,508.98 and $2,326,627.17; **R.,** Feb. 2,1829; est., $2,216,950.46. (H. D. 482, 55th, 2d.)

[2] Crab Shoal.

Capt. J. C. Sanford, 1903–08. **R., 03,** 969; (Maj.) **04,** 1197; **05,** 1083; **06,** 1039; **07,** 1102.
Maj. Herbert Deakyne, 1908–11. **R., 08,** 1140; **09,** 1151; **10,** 1273; **11,** 1363.

Assistants:
Capt. M. R. Brown, **71,** 77; **72,** 74, 757; **73,** 79; **76,** 58.
Capt. Wm. Ludlow, **77,** 52. **R., 79,** 457.
A. Stierle. **R., 81,** 821.
J. M. Stewart. **R., 83,** 659; **84,** 846.
L. Y. Schermerhorn. **R., 90,** 894.

ESTIMATES. (See Plans and Projects.)

For closing the gap by extending the ice breaker:
By Maj. Bache, 1843, $815,341, **66,** iv, 229; **73,** 883.
By Maj. Stewart, 1866, $1,502,645.61, **66,** iii, 23, iv, 230.
By Lt. Col. Kurtz, 1871, $1,944,950, **71,** 664.
To close the gap by extending the break'r proper, connecting the ice breaker, **71,** 664.
By Maj. Bache, 1843, $551,635.10, **66,** iv, 229; **73** 883.
By. Maj. Stewart, 1866, $1,018,820.85, **66,** iii, 23, iv, 230.
By BE., 1872, $1,314,200, **72,** 74, 756.
By Lt. Col. Kurtz, 1871, $1,314,200, **71,** 664.
By Maj. Barnard, 1853, for this plan modified and completion of existing work, $500,000, **73,** 884.
To cover the gap by a detached work:
By Maj. Bache, 1843, $959,664.39, **66,** iv, 229; **73,** 883.
By Maj. Stewart, 1866, $1,762,078.07, **66,** iii, 23, iv, 230.
By Lt. Col. Kurtz, 1871, $2,278,000, **71,** 665.
By Maj. Barnard, 1853 for this plan modified and completion of the existing works, $750,000, **73,** 885.
By Maj. Bache, 1843, to complete existing work on present basis, $138,921, **73,** 884.
By Maj. Stewart, 1866, $109,493.79, **66,** iii, 23; **66,** iv, 230.
By Capt. William Ludlow, forming a basin by closing the gap, and a j. to connect with the shore, $2,000,000, **79,** 461.
By BE., closure of the gap, $600,000, **79,** 456.
By Col. Macomb, removal of 8 wrecks, $28,000, **79,** 74, 454.

OPERATIONS.

1866–67. About 1,200 t. st. placed, completing 115 l. f. of break'r superstr. Total length completed about 2,000′, **67,** 42, 432.

1867–68. 8,100 t. st. put in position, 1,129 t. old st. removed and relaid, a gap of 210′ closed in break'r proper, and 228′ of old work relaid and raised to proper level, **68,** 62, 63, 694, 695.

1868–69. 9,040 t. large st. for superstr. of break'r and ice breaker placed in position, completing 217 l. f. of the former and 281 l. f. of the latter; 9,271 perches of st. applied to riprapping. Completion of break'r and 646′ of ice breaker, **69,** 53, 377, 378.

1869–70. 10,698 t. large st. placed in superstr., completing 120′ break'r and 715′ of ice breaker; 122 t. st. of old superstr. reset and 2,192 perches riprap deposited. Total length of break'r on top, 2,558′; of ice breaker, 1,353′, **70,** 70, 422, 423.

1882–83. Constr. derrick, scows, and delivery of brush and creosoted piles, **83,** 659.

1883–84. Constr. mattress foundation in progress; 7,500 t. granite received, **84,** 846.

1884–85. 258 mattresses, 1,813 c. y. small and 1, 198 t. large st. placed in foundation of work, and 3,000 t. st. delivered in gap, **85,** 846.

1885–86. 30,339 t. st. placed in gap, **86,** 839.

1886–87. 24,025 t. st. placed in gap, **87,** 805.

1888–89. 23,195 t. random st. placed in Delaware Break'r Gap, **89,** 871.

1889–90. 17,755 t. random st. placed in break'r gap, **90,** 889.

1890–91. Quarrying of st. begun under contract, **91,** 1076.

1891–92. 34,022 t. granite placed in break'r gap **92,** 933.

1892–93. 18,746 t. st. deposited, **93,** 1172.

1894–95. 602 t. st. deposited, **95,** 1065.

1895–96. 8,016 t. st. deposited and a portion of an old wreck removed, **96,** 922.

1896–97. 17,078 t. st. deposited, **97,** 1214.

1897–98. 26,926 t. st. deposited and proj. completed, **98,** 1095.

1904–05. Old building belonging to the U. S. removed, **05,** 1083. Maritime Exchange permitted to occupy old lighthouse for reporting station, **04,** 1198.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 77, 664, 670, 671, 683, 685, 686; **74,** ii, 147, 148; **99,** 1347.
Table of current velocities, **79,** 454.
General discussion, **79,** 458.
Ice formation in H., **81,** 821.
Changes of depth in H., **82,** 791.
Slopes of the break'r, **86,** 840.
Break'r at mouth of Delaware B., midway between New York and Chesapeake Capes.

PLANS. (See also Estimates and Projects.)

Lt. Col. Kurtz suggested removal of break'r and ice breaker to the "Shears," **74,** ii, 148.
By Maj. Barnard, 1853, reducing the width of the top to 12′, **73,** 884.
By Capt. William Ludlow, pile j. from high-water mark to the 15′ curve, and a number of small is. perpendicular to the shore to arrest the movement of the cape, **79,** 460, 461.

PRIVATE (CORPORATE) WORK.

The Western Union Telegraph Co. laid a cable to and opened an office on the break'r in 1876, **76,** 278.

PROJECTS. (See Estimates and Plans.)

Original proj. submitted in 1828 by a board of commissioners appointed by Cong.; proposed constr., in the concavity of the B. just inside of Cape Henlopen, of 2 massive works on the pierres perdues or riprap system, separated by an interval of 1,390′; the larger work, called the break'r, to afford a safe anchorage during gales from the n. and e., and the lesser, called the ice breaker, to protect shipping against nw. gales and the heavy drifting ice in the B., **66,** iv, 229; **73,** 881, 884; **79,** 453; **86,** 119.

Proj. completed, 1869, under aggregate app. of $2,192,103.70, and resulted in the constr. of a break'r 2,558′ long, and an ice breaker 1,359′ long on top, **79,** 453; **86,** 119, 840.

BE., 1871 and 1879, recom. the closure of the interval between the break'r and ice breaker by a work similar to those already built; est., $600,000 to $1,314,200, **72,** 756; **79,** 456.

By Capt. Ludlow, 1882, closing the gap between the break'r and ice breaker, by a random-stone foundation carrying a concrete superstr.; the foundation to be brought to a height of 12′ below m. l. w., with a top width of 48′; the concrete superstr. to have a bottom width of 24′, a top width of 12′, and to rise 12′ above m. l. w.; est., $675,000, **82,** 792; **86,** 119.

In 1883 a brush-mattress foundation under the random-stone superstr. was adopted, **83,** 130, 659; **84,** 845.

In 1884 the pile br. forming a part of the proj. of 1882 was abolished, **84,** 846; **85,** 122, 847; **87,** 81.

Causes for probable increase in cost as originally est., **87,** 806.

By Lt. Col. Robert, 1890, completing Delaware Break'r by a substr. of rubblest. and a superstr. of concrete; the rubble mound to have side slopes of 1 vertical to 2 horizontal on the sea face, and 1 vertical to 1½ horizontal on the H. face; its top to be 62′ wide and 15′ below m. l. w.; the superstr. to have a cross section of 27′ height and 27′ width, its base being 15′ below m. l. w., and its top 7½′ above m. l. w.; the material to be concrete blocks up to about 2′ above h. w., the topping, after the blocks had settled, to be a mass of concrete; the foot of the superstr. to be protected on the sea face by 4-ton blocks of st.; est., $500,000, **90,** 893.

In 1891 the revised proj. of Maj. Raymond provided for a rubble mound, to be raised to the level of m. l. w., with a width of 40′ at that level, and a superstr. above l. w., 14′ high and 20′ wide on top, to be formed by heavy st. laid in position, the interior spaces to be filled with rubble; est., $400,000, **91,** 1083.

Detailed description of completed work, **99,** 1346.

SURVEYS.

Numerous early, **73,** 882.

Conclusions of board of sur., 1834, **73,** 881, 883; **66,** iv, 228. Under direction of Lt. Col. Kurtz, by Lt. M. R. Brown, 1871–72, **72,** 75, 756. By Capt. W. Ludlow. **R., 79,** 457.

Au. act Mar. 3, 1881, **83,** 130; made by Capt. Ludlow, **82,** 792.

Ex. made by Maj. Raymond, 1894, **94,** 852.

Sur. made, 1897 and 1898, by Maj. Raymond, **98,** 1095.

Ex. made, 1899, by Lt. Col. Raymond, **99,** 1345.

Sur. made, 1901, by Lt. Col. Raymond, **01,** 1324.

Sur. made, 1902, by Lt. Col. Raymond, as part of the sur. of the H. of refuge, **02,** 1035; completed in 1903, **03,** 163.

Maps:

List, relating to the work and of the vicinity, **72,** 757.

Of break'r and B., **66,** i.

Of the H. showing location of current observations and proposed imp., **79,** 454. (See also sur. of Crow Shoals, Delaware B., 1873, under direction of Lt. Col. Kurtz, by F. M. Eppley. **R., 74,** ii, 146–154.) **91,** 1080.

99, 1352.

Part (b), H-23 Delaware Bay, Del. (Pier in, near Lewes, Del.)

APPROPRIATIONS.

1870,	$225,000,	**70,** 72; **71,** 78, 665, 666.
1874,	10,000,	**74,** 90, ii, 130, 131.
1875,	40,000,	**75,** 96, ii, 173.
1876,	30,000,	**76,** 58, 267; **77,** 53, 257.
1878,	20,000,	**78,** 59, 434.
1879,	10,500,	**79,** 74, 450.
1880,	10,000,	**80,** 607.
1881,	10,000,	**81,** 816.
1882,	13,000,	**82,** 782.
1890,	10,000,	**90,** 889.
1896,	7,660,	**96,** 922.
1910,	1,500,	**10,** 222, 1272.
1911,	1,000,	**11,** 1363.
Total,	388,660	

COMMERCE.

Would probably be benefited by this work, **71,** 669, 672.

Pier of great value to vessels frequenting the break'r H. in winter, when H. is packed with floating ice, **01,** 236.

CONTRACTS.

1872. Paulding, Kemble & Co., ironwork, **73,** 862.

1873. Macpherson, Willard & Co., ironwork, **73,** 862.

1875. Macpherson, Willard & Co., ironwork, **75,** ii, 177.

1877. Paulding, Kemble & Co., ironwork, **77,** 257.

1878. Patterson Iron Co., iron, **79,** 452.

1880. Eppinger & Russell, pine timber and creosoted piles, **81,** 818.

1882. Eppinger & Russell, pine timber, $27.25 and $31 per M, **82,** 782; **83,** 655.

Open-market agreements, **96,** 921.

1897. W. H. Virden, repairs, $6,722.39, **98,** 1094.

ENGINEERS.

Chief of Engineers. R., 70, 72; **71,** 77, 677, 678; **72,** 75, 761; **73,** 79; **74,** 90; **75,** 95; **76,** 58; **77,** 52; **78,** 59; **79,** 73; **80,** 96; **81,** 127; **82,** 124; **83,** 128; **84,** 137; **85,** 121; **86,** 118; **87,** 80; **88,** 81; **89,** 99; **90,** 89; **91,** 114; **92,** 115; **93,** 124; **94,** 113; **95,** 127; **96,** 115; **97,** 147; **98,** 150; **99,** 171; **00,** 196; **01,** 236; **02,** 175; **03,** 163; **04,** 153; **05,** 161; **06,** 174; **07,** 183; **08,** 191; **09,** 195; **10,** 221; **11,** 240; **12,** 286.

Boards. Convened, Philadelphia, Apr. 10, 1871, to consider Lt. Col. Kurtz's plan for p. Approv. plan. Reconvened July 5; recom. approx. location. **R., 71,** 681–686. (Lt. Cols. Woodruff, Newton, and Kurtz.)

In charge:

Lt. Col. C. S. Stewart, 1870; **70,** 70, 72.

Lt. Col. J. D. Kurtz, 1870–77; **70,** 70; **71,** 77. **R., 71,** 662, 665, 667–676; **72,** 758; **73,** 859; **74,** ii, 130; **75,** ii, 173; **76,** 267; **77,** 255.

Col. J. N. Macomb, 1877–81. **R., 78,** 431; **79,** 445; **80,** 605; **81,** 815.

Capt. W. Ludlow, 1881–82. **R., 82,** 781.

Lt. Col. G. Weitzel, 1882–84. **R., 83,** 654.

Lt. T. L. Casey, jr., Mar. 19 to Apr. 19, 1884; **84,** 792.

Maj. W. H. Heuer, 1884–85. **R., 84,** 843.

Lt. Col. H. M. Robert, 1888–90. **R., 85,** 845; **86,** 836; **87,** 804; **88,** 705; **89,** 869.

Maj. C. W. Raymond, 1890. **R., 90,** 888; **91,** 1073; **92,** 931; **93,** 1170; **94,** 850; **95,** 1062; **96,** 920; **97,** 1213; (Lt. Col.) **98,** 1093; **99,** 1344; **00,** 1574; **01,** 1323.

Col. Jared A. Smith, 1901–02; **02,** 172.

Capt. Spencer Cosby, 1902. **R., 02,** 1035.

Capt. J. C. Sanford, 1903–08. **R., 03,** 968; (Maj.) **04,** 1197; **05,** 1082; **06,** 1039; **07,** 1102.

Maj. Herbert Deakyne, 1908–. **R., 08,** 1140; **09,** 1151; **10,** 1272; **11,** 1363; **12,** 1575.

Assistants:

Capt. M. R. Brown, **71,** 77. **R., 72,** 760; **73,** 860; **74,** ii, 131; **75,** ii, 173; **76,** 267.

Capt. W. Ludlow. **R., 81,** 818.

A. Stierle. **R., 82,** 782.

J. M. Stewart. **R., 83,** 655; **84,** 844.

ESTIMATES. (See Projects.)

By Lt. Col. Kurtz, p., with wooden superstr., $278,423.78; with iron superstr., $328,227.38, **71,** 675, 676. Increased to $387,419.67; reasons for increase by $24,000, **74,** ii, 133, 134. Reasons for reducing $36,419.67, **75,** ii, 173; **76,** 267. For completion of work, $50,600, **71,** 53, 257.

By Col. Macomb, 1879, completion of existing proj., $24,500, **79,** 450.

LEGISLATION.

Del. gave site for shore end of p. to U.S., **72,** 75, 759.

Senate res. of Mar. 12, 1886, directing an est. be made as to probable cost of an iron superstr., **86,** 837.

By act of Mar. 3, 1891, Sec. of War directed to assign to the Sec. of the Treas. a portion of the iron p. at Lewes, Del., for Marine-Hospital Service, "whenever convenient" to the War Dept., **92,** 932.

OPERATIONS.

History of plans and operations, **71,** 667, 668, 672, 673; **79,** 445.

1871–72. Completion of 231 l. f. of p., **72,** 75, 759.

1872–73. Constr. of 924′ of p. and 1,050′ of superstr., **73,** 79, 860.

1873–74. Extension of superstr. 105′; total l. of p., 1,281′, **74,** 90, ii, 130.

1874–75. Extension of superstr. 147′; repairs, **75,** 96, 175.

1875–76. Extension of p. 126′; total l., 1,533′, **76,** 58, 267.

1876–77. Extension of superstr. 42′; total l., 1,460′, **77,** 255.

1877–78. Extension of p. 126′; total l., 1,659′, **78,** 59, 433.

1878–79. Extension of superstr. to the designed l., 1,701′; the 57th row of piles taken up to l. them, **79,** 73, 448.

1879–80. Redriving iron piles in 57th row and placing of 52 sets of horizontal braces; superstr. replaced on part of p., **80,** 605.

1880–81. 78 fender piles placed at p. head and timber superstr. partly renewed, **81,** 815.

1881–82. 107 fender piles placed and timber superstr. partly renewed, **82,** 783.

1882-83. Timber superstr. replaced over 500 l. f. of p.; iron rails purchased for RR. track for full l. of p., **83,** 655.

1883-84. Replacing timber superstr. in progress; RR. track laid for full l. of p., **84,** 844.

1889-90. Minor repairs made, **90,** 888.

1895-96. Pier repaired; cost, $689.95, **96,** 921.

1897-98. Repairs costing $6,722.39 made, **98,** 1004.

1898-99. Storage platform built near head of p., **99,** 1345.

1899-00. Slight repairs made to p., **00,** 1575.

1910-11. Minor repairs to deck and other woodwork of p., and 2 panels destroyed by fire were rebuilt, by hired labor, **11,** 1363.

1911-12. Minor repairs to broken fender piles, fender logs, chocks, cap logs, etc., by hired labor, **12,** 1575.

PHYSICAL CHARACTERISTICS.

Description, **72,** 75, 758, 762–777; **74,** ii, 131; **75,** ii, 175.

PLANS.

History of plans and operations prior to the present work, **71,** 667, 668.

By Lt. Col. Robert, 1886, iron superstr. suitable for the requirements of the p. if subjected to RR. traffic; est., $93,000 to $115,000, **86,** 838; **87,** 805.

PRIVATE (CORPORATE) WORK.

Wooden pile p. 1,600′ l. constr. by the Junction Break'r RR. Co.; cost, $37,000, **71,** 669.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Kurtz, 1871, landing-p. in Del. B., near Lewes, Del., about 1,800′ l., with floor 13′ above m. l. w. From the shore end outward for a distance of 1,200′ the p. to be 22′ w., thence to the outer end 43′ w.; the superstr. to consist of iron screw piles from 22′ to 45′ l. and 5½ to 8 in. in dia.; the superstr. carrying the floor to be of wood. Est., $278,423.78, **71,** 670–680. Increased to $387,419.67, **74,** ii, 133, 134.

The substr. completed in 1880, **80,** 606.

The total amount app., $368,500, **86,** 837.

By Lt. Col. Robert, 1889, for repairing a 100′ breach in the p.; est., $10,000, **90,** 888.

Employment of harbormaster and estab. of regulations governing use of the p. recom., **94,** 851.

By Maj. Raymond, 1896, repair of the fender system and the substr., **97,** 1213.

SURVEYS.

By Lt. Col. Kurtz, 1871, **72,** 75.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 287.

Maps. Sketch showing soundings, **72,** 774. Sketch showing the method of driving screw piles, **79,** 448.

Part (c), H-23 Crow Shoals, Delaware Bay, N. J.

PLANS.

Proposed by Lt. Col. Kurtz, to estab. a H. of refuge with the following works: 1st, a solid break'r along the shoal; 2d, opening the chan. of approach by dr.; 3d, ice ps. across the upper end of the H., $10,477,520, **74,** ii, 147.

SURVEYS.

For an artificial H. or break'r au. act approv. Mar. 3, 1873, assigned to Lt. Col. Kurtz, **74,** 93; and made under his direction by F. M. Eppley in Aug., 1873. **R., 74,** ii, 146–154.

Part (d), H-23 Delaware Bay, Del. (Harbor of refuge in.[1])

APPROPRIATIONS.

1896,	$5,000,	**96,** 924.
1897,	394,334,	**97,** 1217.
1898,	800,000,	**98,** 1096.
1899,	377,000,	**99,** 1355.
1900,	450,000,	**00,** 1577.
1901,	213,000,	**01,** 1326.
1910,	8,000,	**10,** 223, 1273.
1911,	8,000,	**11,** 1364.
Total,	2,255,334	

COMMERCE.

C. that would use the H. important, **97,** 1217.

Value of this H. to C. due to its location about equidistant from New York, Philadelphia, and the capes of Chesapeake B., **04,** 1218.

CONTRACTS.

1897. Hughes Bros. & Bangs, break'r constr., st. $1.18⅜ t. ($1,638,795.33), **97,** 1218.

1900. Hughes Bros. & Bangs, constr. st. ice ps., $2.25 t. ($145,125), **00,** 1578.

1900. Hughes Bros. & Bangs, placing 64,500 t. st. $2.25 t., for complete constr. of ice ps., **01,** 1325, 1326.

1902. Hughes Bros. & Bangs, addl. st. ice ps., $2.89 t., **03,** 970.

1910. The Breakwater Co., for relaying ashlar and rubblest. and placing about 4,000 t. riprap around p.; prices listed, **11,** 1364.

ENGINEERS.

Chief of Engineers. R., 91, 119; **92,** 119; **96,** 118; **97,** 149; **98,** 152; **99,** 173; **00,** 197; **01,** 237; **02,** 176; **03,** 164; **04,** 154, 157, 1215; **05,** 162; **06,** 174; **07,** 184; **08,** 192; **09,** 196; **10,** 222; **11,** 241; **12,** 288.

Boards. Convened, Philadelphia, Pa., Dec. 11, 1890, by S. O. No. 66, to ex. and report upon a proposed national H. of refuge for deep-draft vessels near the mouth of Delaware B. **R., 91,** 1120; **92,** 941. (Col. Craighill, Maj. Raymond, and Capt. Bixby.)

BERH. **R., 04,** 1219, 1222.

In charge:

Maj. C. W. Raymond, 1890–1901. **R., 96,** 924; **97,** 1216; (Lt. Col.) **98,** 1096; **99,** 1354; **00,** 1576; **01,** 1325.

Col. Jared A. Smith, 1901–02. (No **R.**), **02,** 172.

Capt. Spencer Cosby, 1902. **R., 02,** 1036.

Capt. J. C. Sanford, 1903–08. **R., 03,** 970; (Maj.) **04,** 1199, 1223; **05,** 1084; **06,** 1039; **07,** 1103.

Maj. Herbert Deakyne, 1908–. **R., 08,** 1141; **09,** 1151; **10,** 1273; **11,** 1364; **12,** 1576.

OPERATIONS.

1896-97. Soundings made to ascertain the exact character of the bottom; 9,035 t. st. deposited, **97,** 1216, 1217.

1897-98. 289,709 t. st. deposited, **98,** 1096.

1898-99. 450,460 t. st. placed, **99,** 1354.

1899-00. 345,895 t. st. placed, **00,** 1576.

1900-01. 277,517 t. st. placed in break'r, and 39,562 t. placed in ice ps., **01,** 1325, 1326.

1901-02. 102,660 t. st. deposited in break'r, completing the work Dec. 11, 1901; total quantity of st. deposited under the contract, 1,475,276 t., **02,** 1036. The superstr. is 7,960 l. f. and the substr. 8,040 l. f., measured on l.-w. line, **02,** 1037. 25,607 t. st. deposited in ice ps., **02,** 1037.

1902-03. 10 ice ps. completed; total amount of st. placed in them, 71,300 t.; 5 addl. ice ps. constr. by the deposit of 37,673 t. of st., **03,** 970.

1910-11. 1,665 t. riprap placed around base of 15 ice ps., and superstr. removed and rebuilt, **11,** 1364.

1911-12. Contract entered into for furnishing riprap st., etc.; not yet approved, **12,** 1576.

[1] See p. 304, "Cold Spring Inlet, N. J."

PROJECTS.

By BE., 1892, national H. of refuge for deep-draft vessels, by constr. st. break'r 1½ m. l. off Cape Henlopen, Del., and ice ps. to protect the H. from ice flowing down the R.; est., $4,665,000, **92,** 942, 943; **96,** 924.

By Maj. Raymond, 1896, constr. ps. after a part of the break'r had been built, **97,** 1216.

By Lt. Col. Raymond, 1900, row of 10 ice ps. across the upper end of the H. to protect it from ice descending the B., **00,** 1577.

By Capt. Spencer Cosby, expend. $100,000 in constr. of addl. ice ps.; au. June 30, 1902, **03,** 970.

By Maj. Sanford, detailed proj. and est., proposed extension of break'r, **04,** 1223.

SURVEYS. (See Board of Engineers.)

Of the H., by Capt. Cosby in progress, **02,** 1037; completed, **03,** 970.

Ex. au. act June 13, 1902, to ascertain what further protection needed; made by Lt. Col. Raymond; Rs. by Lt. Col. Raymond, 1902, and Capt. Sanford, 1903; est., $2,117,500;[1] modified by BERH., $1,600,000, **04,** 157, 1215, 1216, 1219.

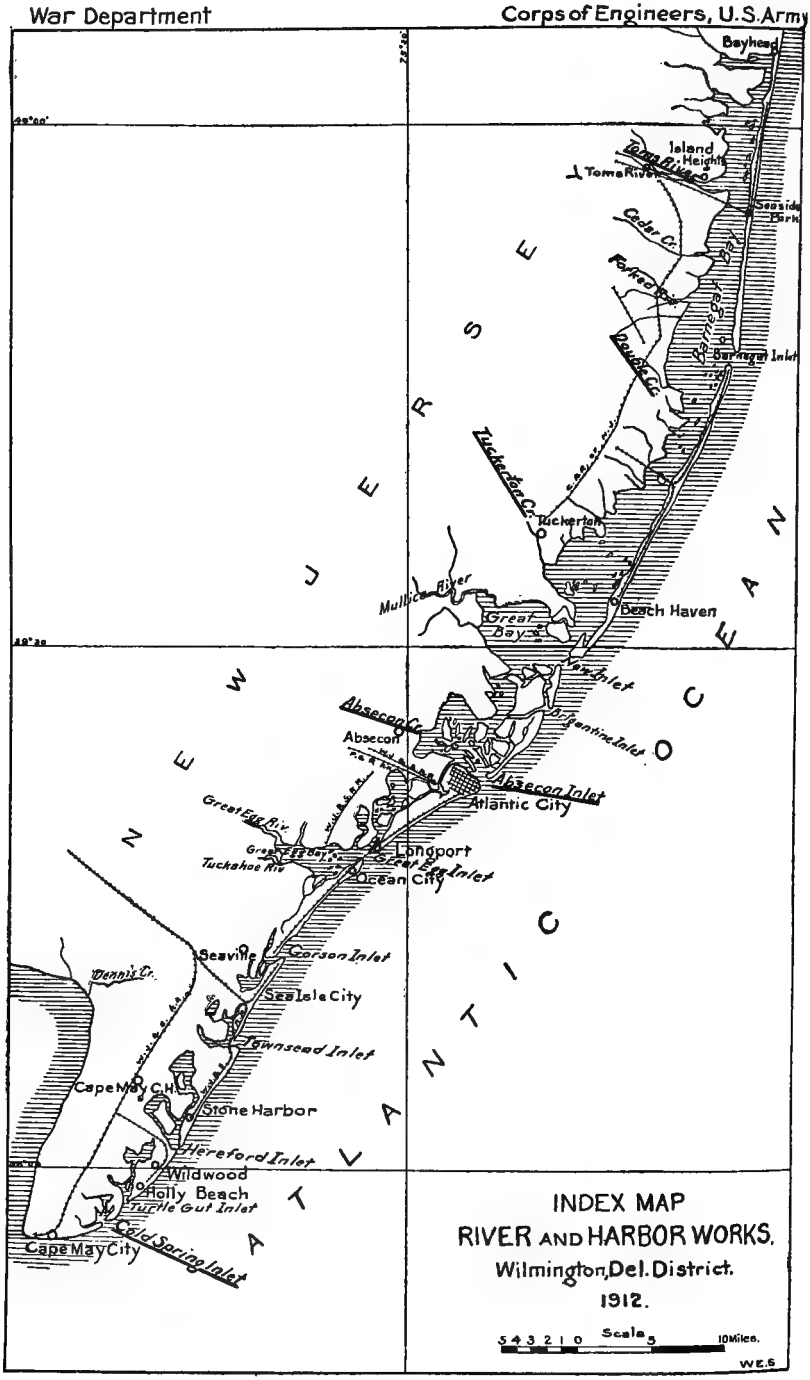
Ex. to ascertain extent of repairs necessary to ice ps., **12,** 1576.

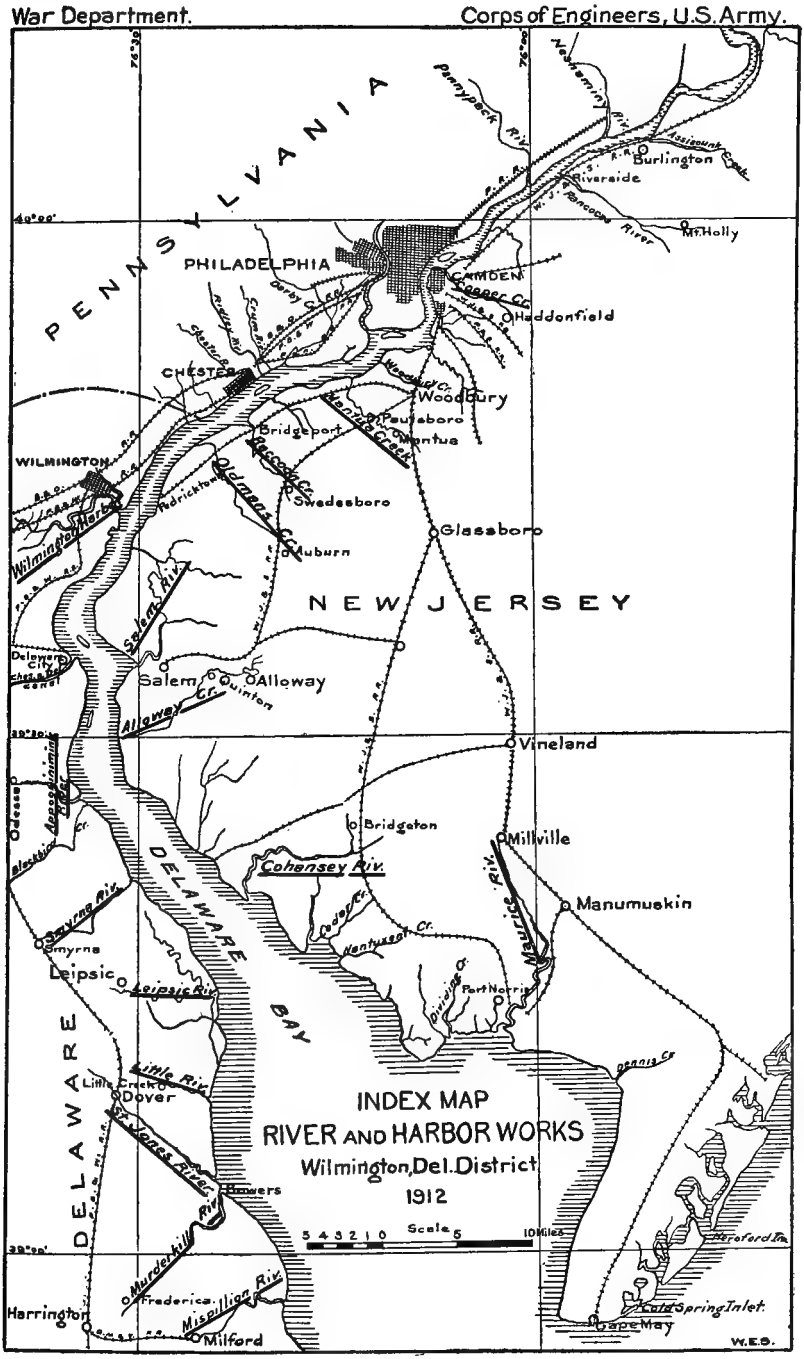
Maps. **99,** 1354.

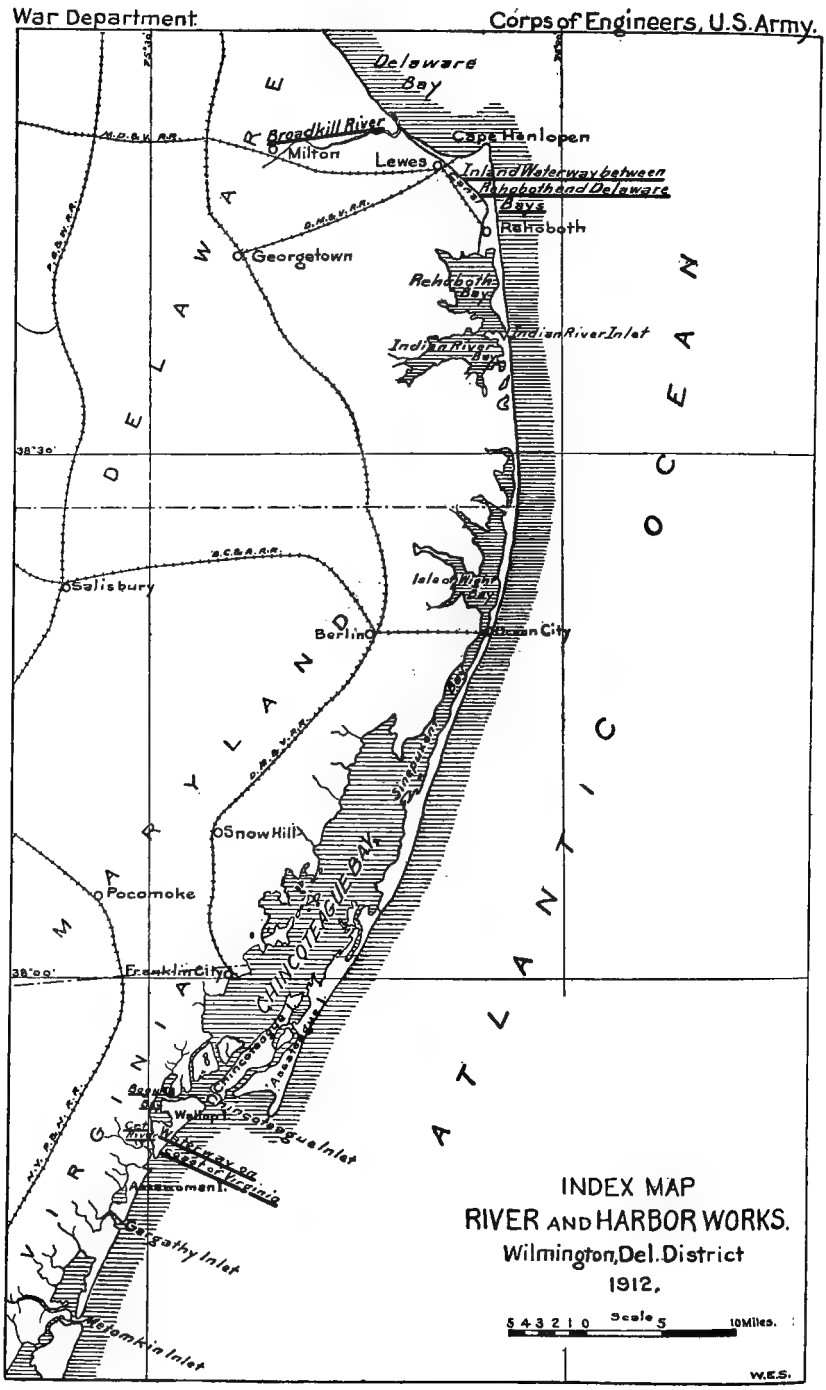
[1] H. D. 548, 58th, 2d.

RIVER AND HARBOR WORKS—NORTH ATLANTIC.

I.—WILMINGTON, DEL., DISTRICT.


War Department
Corps of Engineers, U.S.Army
Bayhead
Island Heights
Toms River
Toms River
Seaside Park
Cedar Cr.
Forked Riv.
Barnegat Bay
Barnegat Inlet
Double Cr.
Tuckerton Cr.
Tuckerton
Mullica River
Great Bay
Beach Haven
Brigantine Inlet
Absecon Cr.
Absecon
Absecon Inlet
Atlantic City
Great Egg Riv.
Great Egg Bay
Tuckahoe Riv.
Longport
Great Egg Inlet
Ocean City
Seaville
Corson Inlet
Dennis Cr.
Sea Isle City
Townsend Inlet
Cape May C.H.
Stone Harbor
Hereford Inlet
Wildwood
Holly Beach
Turtle Gut Inlet
Cape May City
Cold Spring Inlet
NEW JERSEY
ATLANTIC OCEAN
INDEX MAP
RIVER AND HARBOR WORKS.
Wilmington, Del. District.
1912.
Scale
5 4 3 2 1 0 5 10 Miles.
W.E.S.


War Department.
Corps of Engineers, U.S. Army.
PENNSYLVANIA
PHILADELPHIA
CAMDEN
Burlington
Riverside
Mt. Holly
Haddonfield
CHESTER
Woodbury
Paulsboro
Mantua
Bridgeport
WILMINGTON
Pedricktown
Swedesboro
Glassboro
Auburn
NEW JERSEY
Salem
Alloway
Quinton
Vineland
Bridgeton
Millville
Cohansey Riv.
Manumuskin
Smyrna
Leipsic
DELAWARE BAY
Port Norris
Dover
INDEX MAP
RIVER AND HARBOR WORKS
Wilmington, Del. District
1912
Scale
10 Miles
Harrington
Frederica
Milford
Cape May
Cold Spring Inlet
W.E.S.


War Department.
Corps of Engineers, U.S. Army.
Delaware Bay
Broadkill River
Milton
Cape Henlopen
Lewes
Inland Waterway between Rehoboth and Delaware Bays
Rehoboth
Georgetown
Rehoboth Bay
Indian River Inlet
Indian River Bay
DELAWARE
ATLANTIC OCEAN
38°30'
Salisbury
Isle of Wight Bay
Berlin
Ocean City
MARYLAND
Snow Hill
Pocomoke
CHINCOTEAGUE BAY
38°00'
Franklin City
Chincoteague I.
Assateague I.
Wallop I.
Chincoteague Inlet
Waterway on Coast of Virginia
Assawoman I.
Gargathy Inlet
Metomkin Inlet
VIRGINIA
INDEX MAP
RIVER AND HARBOR WORKS.
Wilmington, Del. District
1912.
Scale
5 4 3 2 1 0 5 10 Miles.
W.E.S.

I.—WILMINGTON, DEL., DISTRICT.

In charge of U. S. Engineer Office,
Wilmington, Del.

NOTE.—A number of waterways on the New Jersey coast, etc., geographically precede the waterways of H list, but they are listed here, with those of I group, which they also precede or connect with, in view of the fact that, with the other waterways of Group I, they are under the supervision of the Wilmington (Del.) office.

I 1 Atlantic Ocean.
I 2 Barnegat Inlet and Bay, N. J. (1)
I 3 Cranberry Inlet, N. J. (2)
I 4 Metedeconk R., N. J. (2)
I 5 Toms R., N. J. (2)
I 6 Cedar Cr., N. J. (2)
I 7 Forked R., N. J. (2)
I 8 Double Cr., N. J. (2)
I 9 Little Egg H. Inlet; N. J. (2)
I 10 Tuckerton Cr., N. J. (9)
I 11 New Inlet, N. J. (1)
I 12 Flatbeach, or Tuckers Isld., N. J. (1)
I 13 Great R., N. J. (11)
I 14 Mullica R., N. J. (13)
I 15 Wading R., N. J. (14)
I 16 Brigantine Inlet, N. J. (1)
I 17 Absecon Inlet, N. J. (1) (Atlantic City, N. J.)
I 18 Absecon Cr., N. J. (17)
I 19 Egg Harbor Inlet, N. J. (1)
I 20 Beach Thoroughfare, N. J. (19, 21)
I 21 Great Egg H., N. J. (19)
I 22 Tuckahoe R., N. J. (21)
I 23 Corsons Inlet, N. J. (1)
I 24 Townsend Inlet, N. J. (1)
I 25 Hereford Inlet, N. J. (1)
I 26 Turtle Gut Inlet, N. J. (1)
I 27 Cold Spring Inlet, N. J. (1)
I 28 Cape May, N. J. (29)
I 29 Delaware B. (see Dist. H) (1)
I 30 Goshen Cr., N. J. (29)
I 31 Dennis Cr., N. J. (29)
I 32 Maurice R., N. J. (29)
I 33 Buckshutem Cr., N. J. (32)
I 34 Dividing Cr., N. J. (29)
I 35 Nantuxent Cr., N. J. (29)
I 36 Cedar Cr., N. J. (29)
I 37 Back Cr., N. J. (29)
I 38 Cohansey R., N. J. (29)
I 39 Stow Cr., N. J. (29)
I 40 Mad Horse Cr., N. J. (29)
I 41 Delaware R., N. J. and Del. (See Dist. H) (29)
I 42 Alloway Cr., N. J. (41)
I 43 Salem R., N. J. (41)
I 44 Little Salem Cr., N. J. (43)
I 45 Oldmans Cr., N. J. (41)
I 46 Raccoon Cr., N. J. (41)
I 47 Mantua Cr., N. J. (41)
I 48 Woodbury Cr., N. J. (41)
I 49 Big Timber Cr., N. J. (41)
I 50 Newton Cr., N. J. (41)
I 51 Cooper R., N. J. (41)
I 52 Pensauken Cr., N. J. (41)
I 53 Rancocas R., N. J. (41)
See p. 271 for other tributaries of Delaware R.
I 54 Darby R., Pa. (41)
I 55 Crum R., Pa. (41)
I 56 Ridley R., Pa. (41)
I 57 Chester R., Pa. (41)
I 58 Christiana R. (Wilmington H.), Del. (41)
I 59 Brandywine R., Del. (58)
I 60 Chesapeake and Delaware Canal, Del. (41)
I 61 Appoquinimink R., Del. (41)
I 62 Blackbird Cr., Del. (41)
I 63 Smyrna R., Del. (29)
I 64 Leipsic R., Del. (29)
I 65 Duck Cr., Del. (29)
I 66 Mahon R., Del. (29)
I 67 Little R., Del. (29)
I 68 St. Jones R., Del. (29)
I 69 Murderkill R., Del. (29)
I 70 Mispillion R., Del. (29)
I 71 Cedar Cr., Del. (29)
I 72 Prime Hook Cr., Del. (29)
I 73 Broadkill R., Del. (29)
I 74 Lewes, Del. (Delaware Break'r; see Dist. H) (29)
I 75 Indian R. Inlet, Del. (1)
I 76 Rehoboth Bay, Del. (75)
I 77 Indian R., Del. (76)
I 78 Chincoteague Inlet, Va. (1)
I 79 Chincoteague Bay, Md., Va. (78) (80)
I 80 Sinepuxent Bay, Va. (81)
I 81 Isle of Wight Bay, Del. and Md. (80, 82)
I 82 Assawoman Bay, Del. and Md. (81)
I 83 St. Martins R., Va. (81)
I 84 Newport Cr., Va. (79)
I 85 Bogus Bay, Va. (78)
I 86 Cat R., Va. (85)
I 87 Gargathy Inlet, Va. (1)

I-2 BARNEGAT INLET, N. J.

COMMERCE.
C. local and unimportant, **93,** 1186.

ENGINEERS.
Chief of Engineers. R., 93, 129.
In charge. Maj. C. W. Raymond, 1892–93. **R., 93,** 1185.

PHYSICAL CHARACTERISTICS.
Description of, **93,** 1186.

SURVEYS.
Ex. au. act July 13, 1892; made by Maj. Raymond, 1892 (**R.** unfav.), **93,** 1185.

I-2(a) BARNEGAT AND GREAT EGG HARBOR BAYS, N. J. (Sound between.)

ENGINEERS.
Chief of Engineers. R., 91, 118.
In charge. Maj. C. W. Raymond. **R., 91,** 1094.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 1094.

SURVEYS.
Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1094.

I-2(b) BARNEGAT BAY, N. J.

COMMERCE.
Description of, **97,** 1230.

ENGINEERS.
Chief of Engineers. R., 97, 154.
In charge. Maj. C. W. Raymond, 1897. **R., 97,** 1229.
Assistant. Lt. S. Cosby. **R., 97,** 1229.

PHYSICAL CHARACTERISTICS.
Description of the B. and the locality, **97,** 1229.

SURVEYS.
Ex. by Lt. Col. C. S. Stewart, in 1868, to determine the necessity of opening an inlet from the Atlantic Ocean at a pt. near the head of Barnegat B. **R., 68,** 64, 708, 710.
Ex. au. act June 3, 1896; made by Maj. Raymond, 1896 (**R.** unfav.), **97,** 1229.

I-3 CRANBERRY INLET, N. J.[1]

APPROPRIATIONS. (See Surveys.)

ENGINEERS.
In charge. Col. J. D. Graham, 1865. **R., 66,** 37.

SURVEY.
$1,000 app. for sur. by act approv. Aug. 30, 1852,

I-5 TOMS RIVER, N. J.

APPROPRIATIONS.

1910,	$10,050,	**10,** 1288.
1912,	1,000,	**12,** 1595.
Total,	11,050	

COMMERCE.
Little during 1911, **12,** 303.

CONTRACTS.
1910. Pennsylvania Dredging Co., dr., 24¢ c. y., p. m., **11,** 1377.

ENGINEERS.
Chief of Engineers. R., 91, 119; **08,** 217; **10,** 235; **11,** 255; **12,** 303.

In charge:
Maj. C. W. Raymond, 1890. **R., 91,** 1114, 1115.
Maj. C. A. F. Flagler, **08,** 194.
Maj. R. R. Raymond, 1910–. **R., 10,** 1287; **11,** 1377; **12,** 1594.

OPERATIONS.
1910–11. 22,103 c. y. dr., **11,** 1377.
1911–12. 5,165 c. y. dr., completing contract, **12,** 1595.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 1114; **12,** 303.

PLANS.
By Maj. Raymond, 1891, excavating chan. 6′ x 75′ m. l. w. from the br. at the village of Toms R. to the 6′ curve below, 3,500′; est., $10,000, **91,** 1115, 1116.

PROJECTS.
Act June 25, 1910, au. 5′, m. l. w., near Toms R. village, and chan. 5′ x 100′ below; est., $10,050, and $1,000 an. mainten.,[2] **10,** 235.

SURVEY.
Sur. au. act Sept. 19, 1890; made by Maj. Raymond, **91,** 1115.
Pre. ex. and sur. au. act Mar. 2, 1907, with view to 5′ m. l. w. on shoals near village of Toms R. **R.** by Maj. Flagler, May 6, and Oct. 16, 1907; est., $10,050,[2] **08,** 217.

[1] Sur.—**R.,** Oct. —, 1853; est., $50,000. (H. D. 482, 55th, 2d.)

[2] H. D. 346, 60th, 1st.

I-7 FORKED RIVER, N. J.

ENGINEERS.

Chief of Engineers. R., 08, 217.
In charge. Maj. C. A. F. Flagler, **08,** 194.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907, for 5′, mouth to town of Forked R.; **Rs.,** Apr. 24 and Oct. 16, 1907, by Maj. Flagler (unfav.),[1] **08,** 217.

I-8 DOUBLE CREEK, N. J.

APPROPRIATIONS.

1910, $7,800, **10,** 1288.

COMMERCE.

In 1911, 26,280 t., **12,** 1596.

CONTRACTS.

1911. Van Note & Conrad, dike, Hollingsworth Pt., $3.90 l. f., **12,** 1595. Pennsylvania Dredging Co., dr., 15.9¢ c. y., p. m., **12,** 1596.

ENGINEERS.

Chief of Engineers. R., 10, 235, 256; **11,** 256; **12,** 304.

In charge:
Capt. L. H. Rand, **10,** 224.
Maj. R. R. Raymond, 1910–. **R., 10,** 1288; **11,** 1378; **12,** 1595.

OPERATIONS.

1911-12. Conditions of proj. (q. v.) having been fulfilled, proposals were duly invited and contract made; 501½′ j. completed and 31,710 c. y. mud dr. under contract; proj. completed, **12,** 1595, 1596.

PHYSICAL CHARACTERISTICS.

An arm of Barnegat B., N. J.; extends 3 m. above mouth.
Max. draft available June 30, 1912, m. l. w. over shoalest part of imp., 6′, **12,** 304.

PROJECT.

Act June 25, 1910, au. dr. 5′ x 40′, and fence or dike 550′ l.; est., $7,800,[2] **10,** 236; Union Township, N. J., to accept au. of State of N. J. to maintain imp., and made provision for mainten., satisfactory to Sec. of War, and all rights of way, etc., to be free to U. S., etc., **12,** 304.

SURVEY.

Ex. and sur. au. act Mar. 3, 1909; **Rs.,** Capt. L. H. Rand, June 17 and Nov. 30, 1909; est., $7,800; imp. contingent,[2] **10,** 256.
Maps.[2]

I-9 LITTLE EGG HARBOR INLET, N. J.

APPROPRIATIONS.

1836,	$5,000,	act July 4.
1838,	10,000,	act July 7.
1852,	8,500,	act Aug. 30.
Total,	23,500	

ENGINEERS.

Chief of Engineers. R., 66, 37.
In charge. Col. J. D. Graham, **66,** 37.

PROJECT.

For repairing the public works at Little Egg H. **66,** 37.

I-9(a) LITTLE EGG HARBOR BAY AND INLET, INCLUDING GREAT BAY, N. J. (Harbor of refuge.)

ENGINEERS.

Chief of Engineers. R., 91, 118.
In charge. Maj. C. W. Raymond, 1890. **R., 91,** 1095.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1095.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1096.

I-10 TUCKERTON CREEK, N. J.

APPROPRIATIONS.

1902,	$12,000,	**02,** 1053.
1905,	12,000,	**05,** 1103.
1907,	12,000,	**07,** 1117.
1909,	*2,000,	**09,** 1166.
1910,	12,000,	**10,** 1289.
1911,	23,380,	**11,** 1380.
Total,	73,380	

COMMERCE.

Would probably justify an imp. of the creek, **97,** 1233.
Description of, **00,** 1613.
1902, 14,297 t., **03,** 172, 991; 1909, 27,209 t., **10,** 1289; 1911, 13,975 t., **12,** 1599.

CONTRACTS.

1903. Van Sant & Boehm, dr., 16¾¢ c. y., **03,** 990.
1905. A. J. Rider, dr., 15⅞¢ c. y., p. m., **06,** 1054.
1908. C. P. Grim, dr., 16.5¢ c. y., p. m., **08,** 1158.
1909. Pennsylvania Dredging Co., dr., 25¢ c. y., p. m., **10,** 1289.
1910. Pennsylvania Dredging Co., dr., 19¢ c. y., **11,** 1380.
1911. Pennsylvania Dredging Co., dr., 23.4¢ c. y., **12,** 1598.

ENGINEERS.

Chief of Engineers. R., 97, 154; **99,** 182; **00,** 207; **02,** 184; **03,** 172; **04,** 163; **05,** 170; **06,**

* Allotment. [1] H. D. 403, 60th, 1st. [2] H. D. 646, 61st, 2d.

182; **07,** 194; **08,** 203; **09,** 208; **10,** 236; **11,** 256; **12,** 305.

In charge:
Maj. C. W. Raymond, 1890–1900. **R., 97,** 1230; (Lt. Col.) **00,** 1612, 1614.
Col. J. A. Smith, 1902. **R., 02,** 1052.
Capt. J. C. Sanford, 1903. **R., 03,** 990.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1234; **05,** 1102; **06,** 1054; **07,** 1116; **08,** 1157.
Capt. L. H. Rand, 1909. **R., 09,** 1165.
Maj. R. R. Raymond, 1910–. **R., 10,** 1288; **11,** 1379; **12,** 1597.

Assistant. Lt. S. Cosby. **R., 97,** 1231.

OBSTRUCTIONS.

Work suspended on account of oyster beds leased by N. J. lying in path of chan., **07,** 194.

Dec. 16, 1907, chief of Bureau of Shell Fisheries of State of New Jersey advised Eng. Dept. that all objections to proposed dr. had been removed, and that owners of oyster lots had given release to U. S. to do required dr., **08,** 1157.

OPERATIONS.

1902-03. 14,477 c. y. dr. and thrown over adjacent banks, **03,** 990.
1903-04. 56,522 c. y. removed and thrown over upon adjacent banks, **04,** 1234.
1905-06. 60,495 c. y. dr. and deposited upon adjacent marsh, **06,** 1054.
1908-09. 1,048 c. y. dr. for 500′ toward mouth of creek, **09,** 1165.
1909-10. 23,196 c. y. dr. and dumped at head of Story Isld. chan., **10,** 1288.
1910-11. 51,763 c. y. dr., **11,** 1379.
1911-12. 24,851 c. y. dr., completing and opening to navigation new chan. across Little Egg H.; 89,207 c. y. dr. from milldam at Tuckerton down l. of 9,880,′ and old mouth closed, **12,** 1598.
About 97% of proj. completed, **12,** 306.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1232; **1900,** 1613, 1614.

PROJECTS.

Lt. Col. Raymond est., 1900, $61,380 to imp. R. from mouth of creek to head of navigation, **00,** 1615.

Act June 13, 1902, au. dr. chan. 6′ x 80′, Gaunts Pt., ⅞ m., to mouth of creek; thence 6′ x 75′ x 1 m. to Parkers Landing; thence 6′ x 60′ x ⅝ m. to West Tuckerton Landing; thence 5′ x 60′ to just above Scow Landing; thence 3′ to milldam at Tuckerton, together with w. chan. at sharp bends, chan. across cove between mouth of creek, and Oyster Bed Pt. to be supple. by revet. wall along n. side; est., $61,380, **02,** 184.

Citizens of Tuckerton requested proj. be changed so that chan. be dr. s.-se. to d. w. at head of Marchelder Chan. instead of dr. to Gaunts Pt., **04,** 164. Plan au. by Sec. of War, Apr. 11, 1905, **05,** 1102.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Raymond, 1896 (**R.** fav.), **97,** 1231.

Ex. and sur. au. act Mar. 3, 1899; made, 1900, by Lt. Col. Raymond (**R.** fav.; see Projects), **00,** 1613, 1614.

I-12 FLATBEACH, OR TUCKERS ISLAND, N. J. (To preserve anchorage.)

APPROPRIATION.

Mar. 2, 1829, $100.

SURVEYS.

Sur.—**R.,** Mar. 6, 1830; est., $5,605.40. (H. D. 482, 55th, 2d.)

I-13(a) CAPE MAY TO GREAT BAY, N. J. (Thoroughfare.)

COMMERCE.

Unimportant, **88,** 728, 729.

ENGINEERS.

Chief of Engineers. **R., 88,** 86; **91,** 118.

In charge:
Lt. Col. H. M. Robert, 1888. **R., 88,** 724, 730.
Maj. C. W. Raymond, 1891. **R., 91,** 1097.

Assistant. L. Y. Schermerhorn. **R., 88,** 725, 731.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 724, 726; **91,** 1097.

PLANS.

By Lt. Col. Robert, 1888, excavating chan. 50′ x 6′ m. l. w. throughout l. of the thoroughfare running back of the ocean from Cape May to Great B., N. J., in removing 1,310,000 c. y.; est., by contract, $200,000; by hired labor, $130,000, **88,** 731.

SURVEYS.

Made, 1888, by Lt. Col. Robert, **88,** 730.
Ex., 1890, by Maj. Raymond (**R.** unfav.), **91,** 1098.
Maps. **88,** 734.

I-15 WADING RIVER, N. J.

COMMERCE.

Not sufficient to justify imp. of R., **97,** 1235.

ENGINEERS.

Chief of Engineers. **R., 97,** 154.

In charge. Maj. C. W. Raymond, 1896–97. **R., 97,** 1233.

Assistant. Lt. S. Cosby. **R., 97,** 1234.

HYSICAL CHARACTERISTICS.

Description of; 22 m. long; flows s. into Mullica R.; latter flows into Great B., **97,** 1234.

SURVEY.

Ex. au. act July 3, 1896; made, 1896, by Maj. Raymond (see Commerce), **97,** 1233.

I-16(a) BRIGANTINE BEACH AND INLET, N. J. (Channel behind.) Absecon and Brigantine Inlets.

COMMERCE.

Small.

ENGINEERS.

Chief of Engineers. **R., 87,** 86.
In charge. Lt. Col. H. M. Robert, 1886. **R., 87,** 821.

PHYSICAL CHARACTERISTICS.

Difficult to keep a chan. open, **87,** 821.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Robert (**R.** unfav.), **87,** 821.

I-17 ATLANTIC CITY HARBOR (Absecon Inlet), N. J.

APPROPRIATIONS.

1886, [1] $5,000, **87,** 814.
1912, 190,000, **12,** 1599.

Total, 195,000 ($190,000, **12,** 1599).

COMMERCE.

Necessity for H. of refuge on the N. J. coast, **81,** 831; **85,** 862; **87,** 816.
Important, 1898, **98,** 1126, 1130.

ENGINEERS.

Chief of Engineers. **R., 80,** 98; **81,** 129; **85,** 127; **87,** 85; **88,** 85; **95,** 133; **98,** 158; **10,** 256; **11,** 278; **12,** 307.

Boards:
Constituted, 1886, to report upon a H. of refuge, Atlantic City. **R., 87,** 815.
(Lt. Cols. Comstock, Robert, and McFarland.)

In charge:
Capt. W. Ludlow, 1881. **R., 81,** 831.
Maj. W. H. Heuer, 1885. **R., 85,** 862.
Lt. Col. H. M. Robert, 1886–88. **R., 87,** 814; **88,** 717.
Maj. C. W. Raymond, 1890–98. **R., 95,** 1094; **98,** 1125.
Maj. R. R. Raymond, 1912–. **R., 12,** 1599.

Assistants:
G. Daubeney. **R., 81,** 832.
L. d'Auria. **R., 87,** 819.
R. G. Pearson. **R., 98,** 1129.

PHYSICAL CHARACTERISTICS.

Absecon Inlet, **81,** 831; **85,** 863; **87,** 817; **95,** 1094.
Tidal and current observations, **81,** 833; **87,** 815, 819.
Details, **12,** 307.

PLANS.

By Maj. Heuer, 1884, for imp. entrance to the d. w. inside of Absecon Inlet by means of 2 js.; est., $960,000; work not considered public necessity, **85,** 862–864.
By BE., 1887, for a H. of refuge in the inner H.; est. cost of js., $3,000,000. If the entire amount of material to be removed from chan. between the js. should require to be dr., the cost would be increased by $600,000, **87,** 817, 818.

PROJECTS.

Maj. Raymond est., 1898, it would cost $500,000 to imp. Absecon Inlet, **98,** 1128.
Act July 25, 1912, au. chan. 12′ d. m. l. w. and 300′ w., to be increased ultimately to 600′; est., $190,000, with $45,000 an. for operation of dr. plant,[2] **12,** 307.

SURVEYS.

Au. act June 14, 1880; made by Capt. Ludlow, 1880, **80,** 98; **81,** 831.
Au. act Aug. 5, 1886; made by BE., 1876, **87,** 815.
Ex. of the locality inside of the inlet au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (**R.** unfav.), **95,** 1094.
Sur. au. act June 3, 1896; made by Maj. Raymond, 1898 (see Projects), **98,** 1126.
Ex. au. act Mar. 3, 1909, with view to obtaining 12′ over bar; made by Capt. Rand. **Rs.,** Sept. 15 and Oct. 25, 1909 (unfav.),[3] **10,** 256.
Pre. ex. and sur. au. act June 25, 1910, by special BE.; reviewed by BERH.; **Rs.,** 1910 and 1911; est., first cost of $270,000 and $50,000 an.,[2] **11,** 278.
Maps. **87,** 818.

I-18 ABSECON CREEK, N. J.

APPROPRIATIONS.

1912, $15,000, **12,** 1600.

ENGINEERS.

Chief of Engineers. **R., 12,** 307.
In charge. Maj. R. R. Raymond, 1912. **R., 12,** 1600.

PHYSICAL CHARACTERISTICS.

Details, **12,** 308.

PROJECT.

Act July 25, 1912, au. chan. 5′ d. m. l. w., 50′ w. Absecon to mouth, thence 80′ w. across Absecon B. to head of Absecon B. chan., incl. turning-basin at Absecon; est., $15,000, with $1,600 an. mainten., **12,**[4] 308.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910. **R.** by Maj. Raymond, June 15, 1911; est., $15,000, with $1,600 an. mainten.[4]
Map.[4]

I-20 BEACH THOROUGHFARE, N. J.

COMMERCE.

A large traffic would be benefited by an imp. of the thoroughfare, **97,** 1237.
The thoroughfare is navigated principally by truck and pleasure boats, **01,** 1356, 1357.

ENGINEERS.

Chief of Engineers. **R., 97,** 154; **00,** 208; **01,** 263, 1353.
In charge. Maj. C. W. Raymond, 1896–1901. **R., 97,** 1235; (Lt. Col.) **01,** 1353.
Assistant. Lt. S. Cosby. **R., 97,** 1236.

[1] Sur. [2] H. D. 1395, 61st, 3d. [3] H. D. 747, 61st, 2d. [4] H. D. 71, 62d, 1st.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1236.

Beach thoroughfare extends in a general ne. direction from Risleys (Ridley) chan., through which it connects with Great Egg Harbor and Egg Harbor Inlet to Absecon Inlet, **97,** 1237.

PROJECTS.

By Lt. Col. Raymond, chan. 6′ d. m. l. w., bottom w. 100′ and l. about 7,000′; est., $36,000, **01,** 1357.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Raymond, 1896 (**R.** fav.), **97,** 1235.

Ex. and sur. au. act June 6, 1900; made by Lt. Col. Raymond, 1900 (**R.** fav.),[1] **01,** 1353, 1355.

I-23(a) TOWNSEND INLET AND CORSONS SOUND, N. J.

ENGINEERS.

Chief of Engineers. R., 85, 126.

In charge. Maj. W. H. Heuer, 1884. **R., 85,** 858.

SURVEY.

Ex. au. act July 5, 1884; made, 1884, by Maj. Heuer (**R.** unfav.), (est. $1,000,000), **85,** 858.

I-27 COLD SPRING INLET, N. J.

APPROPRIATIONS.

1907,	$311,000,	**07,** 1118.
1908,	236,200,	**08,** 1160.
1909,	284,000,	**09,** 1168.
1911,	130,000,	**11,** 1382.
Total,	961,200	(incl. $100,000 contributed by Cape May Real Estate Co., $1,061,200, **12,** 1602).

COMMERCE.

Unimportant, **95,** 1099.

No C.—H. D. 388, 59th, 2d, **12,** 1602.

CONTRACTS.

1908. Breakwater Construction & Engineering Co., st. js., 285,000 t. st., $2 t.; and pile, brush, and st. js., at $16 and $12 l. f., **08,** 1160.

1909. The Breakwater Co. (supple.), omission of lower wale from pile, brush, and st. j., and replacing a quantity of st. by brush; rebates allowed for substitution, **09,** 1168. E. H. Godshalk, hire of boathouse, $25 for term of 7 months, **10,** 1291.

1910. The Breakwater Co. (supple.), placing 450 addl. t. st., at $3.85 t., **10,** 1291. H. S. Rutherford, hire of boathouse, $48 per an., **10,** 1291.

1911. H. S. Rutherford, hire of boathouse, $4 per month, **11,** 1383.

1912. American Dredging Co., dr., 6.8¢ c. y., **12,** 1602.

ENGINEERS.

Chief of Engineers. R., 95, 133; **07,** 195, 207; **08,** 205; **09,** 210; **10,** 238; **11,** 258; **12,** 308.

In charge:

Maj. C. W. Raymond, 1894–95. **R., 95,** 1098.

Maj. C. A. F. Flagler, 1907–08. **R., 07,** 1117; **08,** 1159.

Capt. L. H. Rand, 1909. **R., 09,** 1167.

Maj. R. R. Raymond, 1910–. **R., 10,** 1290; **11,** 1381; **12,** 1600.

OPERATIONS.

1906-07. Arrangements in progress to acquire deeds to U.S. of the required land, and the execution of a bond for the contribution of $100,000 by the Cape May Real Estate Co., **07,** 1118.

1907-08. Cape May Real Estate Co. deposited with the Asst. Treas. of the U.S., Phila., Pa., $100,000 on Feb. 28, 1908, and all deeds for conveyance of land made as required by act of 1907; contracts let for j. work and plant assembled by contractor, **08,** 205.

1908-09. About 75,079 t. st. placed, piling placed in w. j., and 369 piles placed in e. j., **09,** 1167.

1909-10. Pile, brush, and st. portion of w. j. and wing, and the pile, brush, and st. wing of e. j. completed, and about 128,962 t. st. placed in e. and w. js.; 1,520 t. riprap st. placed; 344 t. st. furnished and deposited in w. j. where filling had settled, **10,** 1290.

1910-11. 44,477 t. st. deposited in w. j.; 72,038 t. deposited in e. j.; double-track RR. trestle constructed from Two Mile Beach, **11,** 1381.

1911-12. 613 t. st. placed in w. j., completing j.; 256 t. riprap placed along chan. side of w. j.; 6 groins built; 9,721 t. st. placed in e. j., completing work; detailed summary of entire constr. given; 144,744 c. y. dr. under contract, **12,** 1600, 1601.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1098; **07,** 195.

3 m. e. of Cape May. Inlet orig. 6′ x 60 acres. Throat, 29′, but on outside bar, ½ m. out, depth was 3.5′, **12,** 308.

PRIVATE WORK.

Imp. of locality was begun by Cape May Real Estate Co. to enlarge basin inside inlet to an area of 500 acres, with a depth of from 30′–40′, **07,** 195; various delays and extension of agreements, **12,** 309.

PROJECTS.

Act Mar. 2, 1907, au. entrance chan. 25′ between basin inside inlet and d. w., with parallel js. 750′ apart, and dr. between them; est., $1,311,700; conditional upon contribution of $100,000 toward the imp. by private parties; amount pledged; continuing contracts au. in the sum of $900,000,[2] **07,** 195.

Sec. of War, 1911, au. immediate dr. of chan. between js. 15′x 400′ m. l. w., **12,** 309.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (see Commerce), **95,** 1098.

Pre. ex. and sur. au. act Mar. 3, 1905, to secure chan. from proposed H. to d. w., and creation of H. of refuge; made, 1905; various plans presented, est. from $895,000 to $1,311,000,[3] **07,** 207.

Maps:[3]

Plan and profile showing j. constr., **10,** 1290.

Sketch showing progress on j. constr., **11,** 1382.

I-28 CAPE MAY CITY, N. J. (Breakwater.)

ENGINEERS.

Chief of Engineers. R., 91, 118.

In charge. Maj. C. W. Raymond. **R., 91,** 1099.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1099.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1099.

[1] H. D. 94, 56th, 2d. [2] H. D. 388, 59th, 2d. [3] H. D. 388, 59th, 2d.

I-30 GOSHEN CREEK, N. J.

APPROPRIATIONS.

1892,	$3,000,	**93,** 1181.
1894,	3,000,	**95,** 1074.
1896,	3,000,	**96,** 934.
1899,	8,000,	**99,** 1363.
Total,	17,000	

COMMERCE.

Value, 1900, $438,900; 1903, $3,300, **05,** 170.

CONTRACTS.

1892. F. C. Somers, dr., 14.9¢ c. y. ($2,011.50), **93,** 1181.

1897. F. C. Somers, dr., 14¢ c. y., pile-dike constr., at $4.99 l. f. ($4,114), **97,** 1226.

ENGINEERS.

Chief of Engineers. R., 91, 119; **93,** 128; **94,** 117; **95,** 131; **96,** 121; **97,** 153; **98,** 155; **99,** 180; **00,** 204; **01,** 245; **02,** 183; **03,** 170; **04,** 162; **05,** 169.

In charge:
Maj. C. W. Raymond, 1890–1901. **R., 91,** 1116; **93,** 1180; **94,** 859; **95,** 1073; **96,** 933; **97,** 1225; (Lt. Col.) **98,** 1102; **99,** 1362; **00,** 1585; **01,** 1334.
Col. Jared A. Smith, 1902. **R., 02,** 1052.
Capt. J. C. Sanford, 1903. **R., 03,** 989.
Capt. C. A. F. Flagler, 1904–. **04,** 1233; **05,** 1101.

OPERATIONS.

1892-93. 15,770 c. y. dr., **93,** 1181.

1896-97. 600 l. f. pile dike constr., and 8,002 c. y., dipper measurement, **97,** 1225.

1898-99. 310 cords brush, 150 poles, and 371 t. st. delivered for new dike, **99,** 1363.

1899-00. 118 cords brush, and 1,301 t. st. placed for repair and constr. of dikes, and 10,436 c. y. dr., **00,** 1586.

PHYSICAL CHARACTERISTICS.

Description of; rises in central part of Cape May Co. and flows into Delaware B., 15 m. n. of Cape May, **91,** 1116.

PROJECTS.

By Maj. Raymond, 1891, chan. below Goshen Landing to 3′ x 30′, dr. chan. 3′ x 50′ through bar at the mouth of the creek and out to the limit of the sand formation beyond the l.-w. shore line, and the protection of the dr. chan. by a sheet-pile j. on the s. side of the chan. extending about 600′ outside of the l.-w. line of the B.; est., $12,000, **91,** 1119.

Maj. Raymond reported, 1897–98, the cost of completing the proj. should be increased $8,000 to provide for extension of the dike, and for necessary dr., **98,** 1102.

By Lt. Col. Raymond, 1899, expend. available funds in dike constr. and extension, and dr., **99,** 1363.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Raymond, **91,** 1118.

Ex. by Maj. Raymond, 1897–98, **98,** 1102.

Ex., 1902, by Col. Smith. Mouth of creek practically closed at l. w. Creek not considered worthy of further imp., **02,** 1052.

I-31 DENNIS CREEK, N. J.

APPROPRIATION.

1896, $5,000, **96,** 930.

COMMERCE.

Description of, **93,** 1188.

CONTRACT.

1897. F. C. Somers, dr., 11¢ c. y. ($4,400), **97,** 1223.

ENGINEERS.

Chief of Engineers. R., 93, 129; **95,** 133; **96,** 119; **97,** 151.

In charge: Maj. C. W. Raymond, 1892–97. **R., 93,** 1187; **95,** 1105; **96,** 929; **97,** 1222.

Assistant. F. Sylvester. **R., 95,** 1106.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1187; **95,** 1105.

OPERATIONS.

1896-97. 38,613 c. y. dr. and old wreck removed, **97,** 1222.

PROJECTS.

By Maj. Raymond, 1895, dr. chan. 60′ x 8′; est., $10,000, **95,** 930.

SURVEYS.

Ex. au. act July 13, 1892; made by Maj. Raymond, 1892 (**R.** fav.), **93,** 1187.

Sur. au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (see Projects), **95,** 1105.

I-32 MAURICE RIVER, N. J.

APPROPRIATIONS.

1882,	$3,000,	**83,** 639.
1884,	17,000,	**84,** 836.
1886,	5,000,	**86,** 856.
1888,	10,000,	**88,** 738.
1890,	8,000,	**90,** 916.
1910,	25,000,	**10,** 1287.
1912,	20,000,	**12,** 1594.
Total,	88,000,	**12,** 1594.

COMMERCE.

Important, **83,** 640.

Increase in amount of shipping consequent upon imp., **88,** 739.

Description, **00,** 1607, 1603.

CONTRACTS.

1885. American Dredging Co., dr., 15¢ c. y., **85,** 868.

1889. American Dredging Co., dr., 15¢ c. y., **90,** 916.

1891. American Dredging Co., dr., 19¢ c. y., **91,** 1089.

1910. The Rickards Dredging Co., dr., 14¢ c. y., **11,** 1376.

ENGINEERS.

Chief of Engineers. R., 81, 129; **82,** 126; **83,** 125; **84,** 134; **85,** 127; **86,** 124; **87,** 86; **88,** 86; **89,** 102; **90,** 92; **91,** 117; **92,** 119; **99,** 182; **00,** 207; **06,** 195; **10,** 235; **11,** 254; **12,** 302.

In charge:
Capt. W. Ludlow, 1882–83. **R., 82,** 809.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 639.
Maj. W. H. Heuer, 1884–85. **R., 84,** 836.
W. F. Smith, U. S. agt., 1885–91. **R., 85,** 868; **86,** 855; **87,** 826; **88,** 738; (Maj.) **89,** 880; **90,** 916.
Maj. C. W. Raymond, 1891. **R., 91,** 1088; **92,** 938 (Lt. Col.); **00,** 1605, 1610.
Maj. C. A. F. Flagler, **06,** 177.
Capt. L. H. Rand, **10,** 224.
Maj. R. R. Raymond, 1910–. **R., 10,** 1287; **11,** 1376; **12,** 1593.

Assistants:
E. A. Gieseler. **R., 82,** 812.
J. J. Lee. **R., 83,** 639.
A. Stierle. **R., 84,** 837.

OPERATIONS.

1885–86. 110,015 c. y. dr. from various pts. in the chan. between Millville and the mouth, **86,** 856.
1887–88. 29,363 c. y. dr. from chan., **88,** 738.
1889–90. 49,918 c. y. dr., **90,** 916.
1890–91. 6,785 c. y. dr., **91,** 1088.
1891–92. 37,392 c. y. dr., **92,** 939.
1910–11. 13,491 c. y. dr., **11,** 1376.
1911–12. 130,143 c. y. dr., work completed, **12,** 1594.

PHYSICAL CHARACTERISTICS.
Description of, **82,** 812; **00,** 1606.
General, tides, etc., **10,** 235; **11,** 254.

PROJECTS.
By Capt. Ludlow, 1882, Millville to mouth, chan. 4′ x 100′ m. l. w., beginning 2¼ m. below the br. at Millville, to a point called Pea Landing; also a cut of the same w. and d. through a pt. of land at Silver R.; Pea Landing to the br., chan. to be 4′ x 50′ x 400′ above the br., the 100′ w. to be resumed, being reduced to 50′ for the next 500′; est., $114,500, **82,** 811; **85,** 868; **87,** 86; **92,** 938; actual au. proj. covering chan. 6′ for 4 m. below Millville Br., and 4′ along city wharves; 1890 modification covered 6′ to upper limits, and 1892 modification extended later 50′ x 500′; completed, 1892, at total cost of $43,000, **12,** 302.
Lt. Col. Raymond est., 1899, $98,000 to imp. R. from below Frenchs Bar to head of navigation, **1900,** 1605.
Act June 25, 1910, au. chan. of 7′ across bar at mouth and to head of navigation at Millville, incl. turning basin; w. to be 100′ to Millville Br. and 60′ thence to milldam; est., $156,200,[1] **10,** 235.

SURVEYS.
Au. act Mar. 3, 1881; made, 1882, by Col. Macomb, **82,** 809.
Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Lt. Col. Raymond (**R.** fav.; see Projects), **1900,** 1606, 1610.
Pre. ex. au. act Mar. 3, 1905. **R.,** Maj. Flagler, 1905 and 1906; est., $156,200 (see Projects),[1] **06,** 195.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 303.
Map.[1]

I-33 BUCKSHUTEM CREEK, N. J.

COMMERCE.
Not important, **95,** 1097.

ENGINEERS.
Chief of Engineers. **R., 95,** 133.
In charge. Maj. C. W. Raymond, 1894–95. **R., 95,** 1096.

PHYSICAL CHARACTERISTICS.
Description of; empties into Maurice R., N. J., 18 m. above mouth, **95,** 1096.

SURVEY.
Ex. au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (**R.** unfav.), **95,** 1096.

I-34 DIVIDING CREEK, N. J.

COMMERCE.
Description of; important, **97,** 1242, 1244.

ENGINEERS.
Chief of Engineers. **R., 97,** 154.
In charge. Maj. C. W. Raymond, 1896–97. **R., 97,** 1242.

PHYSICAL CHARACTERISTICS.
Description of, **97,** 1243.

SURVEYS.
Ex. au. act June 3, 1896; made by Maj. Raymond, 1896 (**R.** fav.), **97,** 1243.

I-38 COHANSEY CREEK (River), N. J.

APPROPRIATIONS.

1873,	$10,000,	**73,** 82, 870; **75,** ii, 195; **76,** 277; **77,** 269.
1878,	5,000,	**78,** 62, 442.
1879,	4,500,	**79,** 69, 415.
1880,	4,500,	**80,** 592.
1881,	7,000,	**81,** 790.
1882,	5,000,	**82,** 773.
1907,	55,800,	**07,** 1116.
1909,	*6,000,	**10,** 1287.
1912,	3,500,	**12,** 1593.
Total,	101,300 (incl. sales, $101,400, **12,** 1593).	

COMMERCE.
Tonnage, 1910, 107,390 t., **12,** 301.

CONTRACTS.
1873. American Dredging Co., dr., **73,** 871.
1878. M. F. Brainard, dr., 24½¢ c. y., annulled, **79,** 416.
1880. J. V. Patten, dr., 25¢ c. y., **80,** 592.
1881. J. V. Patten, dr., 32¢ c. y., **81,** 791.
1882. F. C. Somers, dr., 57¢ c. y., **83,** 629.
1907. Bowers Hydraulic Dredging Co., dr., 25¢ c. y., p. m., **08,** 1157.
1911. Rickards Dredging Co., dr., 12.4¢ c. y., p. m., **11,** 1375.

ENGINEERS.
Chief of Engineers. **R., 72,** 78; **73,** 81, 82, 83; **74,** 93; **75,** 99; **76,** 61; **77,** 56; **78,** 62; **79,** 68; **80,** 95; **81,** 124, 129; **82,** 122, 126; **83,** 123; **84,** 132; **85,** 125; **86,** 122; **87,** 84; **88,** 84; **06,** 195; **07,** 193; **08,** 202; **09,** 207; **10,** 133; **11,** 252; **12,** 300.

In charge:
Lt. Col. J. D. Kurtz, 1872–77. **R., 72,** 791; **73,** 870, 889; **74,** ii, 144; **75,** ii, 195; **76,** 277; **77,** 269.
Capt. Wm. Ludlow, 1877, in temporary charge, **78,** 431; **79,** 403.
Col. J. N. Macomb, 1878–81. **R., 78,** 442; **79,** 414; **80,** 590; **81,** 789.
Capt. W. Ludlow, 1882–83. **R., 82,** 773.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 629.
Maj. W. H. Heuer, 1884–85. **R., 84,** 831.

[1] H. D. 664, 59th, 1st.

*Allotment.

Lt. Col. H. M. Robert, 1885–88. **R., 85,** 853; **86,** 847; **87,** 812; **88,** 714.
Maj. C. A. F. Flagler, 1907–08. **R., 07,** 1115; **08,** 1156.
Capt. L. H. Rand, 1909. **R., 09,** 1164.
Maj. R. R. Raymond, 1910–. **R., 10,** 1286; **11,** 1375; **12,** 1592.

Assistants:
J. J. Lee. **R., 73,** 889; **78,** 442; **83,** 629.
Capt. W. Ludlow, **78,** 431; **79,** 403.

ESTIMATES. (See Projects.)

By J. J. Lee, 3′ chan., $22,000, **73,** 890, 891; **75,** ii, 195; **76,** 277; **77,** 269.

LEGAL PROCEEDINGS.

No work can be done at mouth until title is secured to land needed for cut-off; negotiations in progress but not completed, **07,** 193; **10,** 234. Title papers for land required for cut-offs furnished to Sec. of War, and accepted, Oct. 5, 1910, **11,** 253.

OBSTRUCTIONS.

Delay of city authorities in lowering gas and water pipes at Broad St. Br. to permit continuation of dr., **81,** 789; removed, **08,** 202, 1156.
Br. and milldam limit tidal basin, **12,** 301.

OPERATIONS.

1873–74. 24,139 c. y. sand and mud removed; a chan. 75′ to 80′ in w. and 3′ in d. at l. w. opened along the wharves of city of Bridgeton and for ½ m. below Broad St. Br. to deeper water, **74,** 93, ii, 144, 145.
1879–80. 28,605 c. y. dr., **80,** 590.
1880–81. 10,788 c. y. dr., **81,** 789.
1907–08. 84,223 c. y. removed, completing chan. from Stony Pt. to Nail Works, **08,** 1156.
1911–12. 166,676 c. y. removed from entrance and chan. in R., **12,** 1593.

PHYSICAL CHARACTERISTICS.

Described, **73,** 890, 891; **79,** 414, 415; **07,** 193.
Obstacles to navigation, **82,** 774.
Max. draft, 5′ over bar, and 7′ thence to Bridgeton; range of tide, 5¾′, **11,** 252.
About 90% of proj. completed, **12,** 301.

PROJECTS. (See Estimates.)

Submitted by J. J. Lee, 1872; adopted by Lt. Col. J. D. Kurtz, chan. 4′ x 130′ d. w. at the lower SS. landing to Broad St. Br., and 3′ d. to the Nail Works Br., 67,988 c. y., $30,000, **73,** 889, 891. Modified by Col. Macomb to make the chan. 5′–7′ x 80′; addl. cost, $10,500, **79,** 69, 415; **80,** 591.
Au. act Mar. 2, 1907, expend. of $55,800 for dr. a cut 7′ x 100′ m. l. w. at mouth, and a chan. of the same d. with varying w. from Stony Pt. to the Nail Works Br.,[1] **07,** 193. 1909, for expend. of $6,000 in mainten., **10,** 234.

SURVEYS.

Under direction of Col. Kurtz, by J. J. Lee, 1872. **R., 73,** 889.
Au. act Mar. 3, 1881; made, 1881, by Col. Macomb, **81,** 129.
Ex. and sur. au. act Mar. 3, 1905, for 7′ chan., Bridgeton, N. J., to Delaware B.; made, 1905; est., $69,400, and $2,500 or $3,000 an. mainten.,[1] **06,** 195.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 302.
Maps.[1] Chart of Cohansey Creek at Bridgeton, **79,** 414.

I-42 ALLOWAY CREEK, N. J.

APPROPRIATIONS.

1890,	$6,000,	**91,** 1087.
1892,	3,000,	**92,** 938.
1894,	3,000,	**95,** 1070.
1896,	3,000,	**96,** 929.
1899,	3,000,	**99,** 1359.
1902,	3,000,	**02,** 1051.
1905,	3,000,	**05,** 1101.
1907,	5,000,	**07,** 1115.
1909,	*5,000,	**10,** 1285.
1910,	3,500,	**10,** 1285.
1911,	5,000,	**11,** 1374.
1912,	3,000,	**12,** 1591.
Total,	45,500 ($45,600, incl. $100 from sales,	**12,** 1591).

COMMERCE.

Freight rates reported lowered, **07,** 192; **11,** 252.
Traffic, 1911, 17,000+ t. Less delay waiting on tides, **12,** 300.

CONTRACTS.

1891. F. C. Somers, dr., 18¢ c. y., **91,** 1087.
1892. F. C. Somers, dr., 18¢ c. y. ($2,232), **93,** 1177.
1895. B. F. Sweeten & Son, dr., 19¢ c. y., and pile-dike constr., at $3.47 l. f. ($2,561), **95,** 1070.
1897. J. L. Grim, dr., 18¢ c. y., and pile-dike constr., at $3.60 l. f. ($2,790), **97,** 1221.
1899. River & Harbor Improvement Co., dr., 15¢ c. y., ($2,475), **99,** 1359.
1903. River & Harbor Improvement Co., dr., 13¢ c. y., p. m., **03,** 988.
1905. Dredge employed under emer. contract, **06,** 1053.
1908. The Rickards Dredging Co., dr., 9¢ c. y., p. m., **09,** 1163.
1909. The Rickards Dredging Co., dr., 12½¢ c. y., p. m., **10,** 1286.
1911. River & Harbor Improvement Co., dr., 16.9¢ c. y., p. m., and dike removal at average hourly earnings of dr. for previous 4 weeks, **12,** 1591, 1592.

ENGINEERS.

Chief of Engineers. **R., 89,** 102; **90,** 92; **91,** 117; **92,** 118; **93,** 127; **94,** 116; **95,** 130; **96,** 119, **97,** 150; **98,** 154; **99,** 175; **00,** 203; **01,** 244; **02,** 182; **03,** 169; **04,** 161; **05,** 167; **06,** 181; **07,** 191; **08,** 200; **09,** 205; **10,** 232; **11,** 251; **12,** 299.

In charge:
Lt. Col. H. M. Robert, 1888–91. **R., 90,** 906, 910.
Maj. C. W. Raymond, 1891–1901. **R., 91,** 1086; **92,** 937; **93,** 1176; **94,** 855; **95,** 1069; **96,** 928; **97,** 1220; (Lt. Col.) **98,** 1099; **99,** 1358; **00,** 1583; **01,** 1332.
Col. Jared A. Smith, 1902–03. **R., 02,** 1050.
Capt. J. C. Sanford, 1903–04. **R., 03,** 988.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1233; **05,** 1100; (Maj.) **06,** 1052; **07,** 1114; **08,** 1155.
Maj. Herbert Deakyne, 1908. **09,** 199.
Capt. L. H. Rand, 1908–10. **R., 09,** 1163.
Maj. R. R. Raymond, 1910–. **R., 10,** 1285; **11,** 1373; **12,** 1591.

Assistant. L. Y. Schermerhorn. **R., 90,** 907.

LEGAL PROCEEDINGS.

Title papers, land for cut-off, Fosters Bottle, procured, free to U. S., as au. by act 1907, **09,** 1163.

OPERATIONS.

1890–91. 18,341 c. y. dr., **91,** 1086.
1891–92. 4,893 c. y. dr., **92,** 937.
1892–93. 15,000 c. y. dr., **93,** 1176.
1895–96. 7,806 c. y. dr., **96,** 928.
1896–97. 404 l. f. of dike constr., **97,** 1220.
1897–98. 4,269 c. y. dr., **98,** 1099.
1899–00. 14,690 c. y., p. m., dr., **00,** 1584.
1902–03. 18,019 c. y., p. m., removed and deposited on banks, **03,** 988.
1905–06. 8,370 c. y., p. m., removed, **06,** 1053.
1908–09. 42,188 c. y., p. m., removed to make chan. through Fosters Bottle, 1,070′ l., **09,** 1163.
1909–10. 24,699 c. y. removed from various pts. in the R. from the mouth to within 1 m. of

[1] H. D. 645, 59th, 1st. *Allotment from app. for preser. and mainten. R. and H. works.

Quinton, resulting in a chan. 6′ d. at m. l. w., 75′ w. to Upper Hancocks Br. and 60′ w. above, **10,** 1285.

1910-11. 12,566 c. y. removed and thrown over upon adjacent banks above h. w., producing chan. 6′ x 60′ m. l. w. from 1,000′ above Hancocks Br. to Quinton, **11,** 1373.

1911-12. 38,777 c. y. removed from various pts. to 8′, and 200′ fallen dike removed, completing contract, **12,** 1591.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 907; **91,** 1086.

Max. draft carried, 1911, 5′ to Quinton; max. range of tide, 6′ at mouth, 4′ at Quinton, **11,** 252.

PROJECTS.

By Lt. Col. Robert, 1889, dr. chan. 6′ d. m. l. w. and 60′ w. from Quinton to a pt. about 1,000′ above Upper Hancock Br.; from thence a chan. of the same d. and a least w. of 75′ down the stream to the lower side of the bar at the Square; at a locality in the creek known as the Canal, in addition to obtaining a chan. of the dimensions named, the w. of the creek to be increased to about 150′ between its l.-w. lines; at the Square the dr. chan. to be supple. by a deflecting dike 500′ l., formed of the dr. material, with its chan. face protected by a riprap of st. Est., $25,000, **90,** 913; **92,** 937.

By Maj. Raymond, 1894, wooden dike at the Square, 300′ l., to be backed by dr. material, **95,** 1069.

By Lt. Col. Raymond, 1899, enlarging existing chan. at the shoals below Upper Hancock Br., as far as available funds would permit, **99,** 1358.

Act 1907 au. $5,000 for mainten., etc. (see Legal proceedings), **12,** 300.

SURVEY.

Au. act Aug. 11, 1888; made, 1889, by Lt. Col. Robert, **90,** 910.

I-43 SALEM RIVER, N. J.

APPROPRIATIONS.

1871,	$4,000,	**71,** 80, 695.
1878,	3,000,	**78,** 62, 442.
1880,	3,000,	**80,** 593.
1881,	3,000,	**81,** 792.
1882,	1,500,	**82,** 776.
1892,	2,500,	**93,** 1179.
1894,	1,700,	**95,** 1072.
1907,	29,000,	**07,** 1114.
1910,	*5,000,	**10,** 1284.
1910,	12,000,	**10,** 1284.
1911,	10,600,	**11,** 1372.
1912,	5,000,	**12,** 1590.

Total, 80,300 (incl. misc., $80,400, **12,** 1590).

COMMERCE.

Description of, **97,** 1247.

CONTRACTS.

1871. American Dredging Co., removal of r., **71,** 695.

1878. M. F. Brainard, dr., 22¢ c. y.; annulled, work readvertised, and 1 bid received, which was rejected, **79,** 413, 414.

1879. American Dredging Co., dr., 35¢ c. y., **80,** 593.

1880. American Dredging Co., dr., 40¢ c. y., **81,** 792.

1881. American Dredging Co., dr., 30¢ c. y., **82,** 777.

1892. F. C. Somers, dr., 39¢ c. y., s. m., $1,950, **93,** 1180.

1894. F. C. Somers, dr., 39¢ c. y., s. m., $1,-179.36, **95,** 1073.

1908. Pennsylvania Dredging Co., dr., 19.9¢ c. y., **08,** 1155.

1910. River & Harbor Improvement Co., dr., 19.4¢ c. y., **11,** 1372.

1912. American Dredging Co., dr., 29.5¢ c. y., **12,** 1590.

ENGINEERS.

Chief of Engineers. R., 70, 31, 72; **71,** 80; **78,** 62; **79,** 68; **80,** 96; **81,** 125, 129; **82,** 123, 126; **83,** 123; **84,** 132; **85,** 124, 127; **86,** 122; **87,** 84; **88,** 84; **93,** 127; **94,** 116; **95,** 130, 133; **97,** 155; **07,** 191; **08,** 199; **09,** 204; **10,** 230, 255; **11,** 249; **12,** 297.

In charge:

Lt. Col. J. D. Kurtz, 1871. **R., 71,** 694–697.

Capt. W. Ludlow, 1877, in temporary charge, **78,** 431.

Col. J. N. Macomb, 1877–82. **R., 78,** 442; **79,** 412; **80,** 592; **81,** 791.

Capt. W. Ludlow, 1882–83. **R., 82,** 775, 814.

Lt. Col. G. Weitzel, 1883–84. **R., 83,** 631.

Maj. W. H. Heuer, 1884–85. **R., 84,** 832.

Lt. Col. H. M. Robert, 1885–88. **R., 85,** 852, 860; **86,** 846; **87,** 811; **88,** 712.

Maj. C. W. Raymond, 1890–98. **R., 93,** 1178; **94,** 857; **95,** 1071, 1091; **97,** 1245.

Maj. C. A. F. Flagler, 1907–08. **R., 07,** 1113; **08,** 1154.

Maj. H. Deakyne, **08,** 199.

Capt. L. H. Rand, 1908–10. **R., 09,** 1161.

Maj. R. R. Raymond, 1910–. **R., 10,** 1283; **11,** 1371; **12,** 1589.

Assistants:

Capt. W. Ludlow, **79,** 403.

J. J. Lee. **R., 79,** 413; **83,** 632.

A. Stierle. **R., 84,** 833.

R. G. Pearson. **R., 97,** 1247.

ESTIMATES. (See Plans and Projects.)

By Col. J. D. Kurtz, 1870, removal of fast and loose r., to 7′–8′ of w., $4,000, **71,** 695, 696.

By Col. Macomb, 1879, completion of existing proj., $3,000, **79,** 413.

OPERATIONS.

1871. R. probably removed from chan. to 9′ below l. w., **71,** 695.

1878-79. Removal of 1,400 c. y. by contract; contract annulled, **79,** 413.

1879-80. 6,034 c. y. dr. from the bar at R. mouth, **80,** 593.

1880-81. Dr. continued in increasing w. of cut at bar, **81,** 791.

1881-82. Chan. 60′ w. and from 6′–7′ d. dr. from head of canal to above the landing, **82,** 776.

1893-94. 5,600 c. y. dr., **94,** 858.

1894-95. 3,913 c. y. dr., **95,** 1072.

1908-09. 121,640 c. y. dr., **09,** 1161.

1910-11. 70,475 c. y. dr., **11,** 1371.

1911-12. 35,159 c. y. dr., **12,** 1589.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 80, 695, 696, 697; **79,** 412; **88,** 712; **95,** 1091; **97,** 1247.

PLANS. (See Estimates and Projects.)

Col. Robert, 1888, recom. further imp. be postponed to await increase in C., **88,** 712.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Kurtz, 1871, removal of r. for chan. 9′ x 200′; est., $4,000, **71,** 695.

By Col. Macomb, 1878, dr. 8′ chan. through the bar; est., $3,000, **79,** 413.

By Col. Macomb, 1879, to unite the work with that of Cohansey Creek in one contract, **79,** 413.

*Allotment.

In 1881 operations were transf. to the formation of a chan. 6′ x 60′ l. w. through the shoals above the head of the canal, **81,** 791; **87,** 84.

By Maj. Raymond, 1894, chan. 6′ x 50′ in continuation of chan. previously dr., **95,** 1072.

Maj. Raymond, 1897, est. cost of necessary dr. would be $31,500, **97,** 1246.

Act Mar. 2, 1907, au. dr. chan. 9′ x 100′ m. l. w., amplifying at bends to permit passage of vessels 200′ l., and removal of stony bars in front of city wharves; est., $31,500, **07,** 1113. Est. for completion of this proj. increased by BERH. to $38,600, **08,** 199.

SURVEYS.

By Lt. Col. Kurtz, 1870. **R., 71,** 695.

Ex. au. act Mar. 3, 1881; made by Capt. Ludlow, **82,** 814.

Ex. of mouth au. act July 5, 1884; made, 1884, by Maj. W. H. Heuer, **85,** 860.

Sur. made, 1893, by Maj. Raymond, **93,** 1178.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Raymond (**R.** fav.), **95,** 1091.

Sur. au. act June 3, 1896; made, 1897, by Maj. Raymond (**R.** fav.), **97,** 1246. (See Projects.)

Supp. **R.** by BERH., Jan. 16, 1907, reviewing former reports of ex. and surs. Recom. imp. at cost of $29,000 and mainten. at $5,000 an. for 2 years, for chan. 100′ x 9′.[1]

Pre. ex. au. act Mar. 3, 1909, from mouth to Salem. **R.** by Capt. Rand, May 4, 1909[2] (not worthy of imp. further than existing proj.), **10,** 255.

Maps:
Chart of entrance to R., **79,** 412.
95, 1072.

I-43(a) SALEM RIVER, N. J. (Sharptown to Delaware Canal.)

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 75.

In charge. Col. J. N. Macomb, 1878. **R., 79,** 474.

Assistant. J. J. Lee. **R., 79,** 476.

ESTIMATES. (See Plans.)

By Col. Macomb, 1878, 5′ to Kigers Landing, $7,800; to Sharptown, incl. terminal basin, $15,700, **79,** 475.

By J. J. Lee, 1878, 5′ chan. to Sharptown, $20,872, **79,** 478.

PHYSICAL CHARACTERISTICS.

Described, **79,** 476.

PLANS. (See Estimates.)

By Col. Macomb, 1878, j. at mouth of canal; for increasing capacity of canal, and d. creek to 10′; not recom., **79,** 475.

By J. J. Lee, 1878, 5′, Delaware Canal to Sharptown, by dr., **79,** 477, 478.

SURVEY.

By J. J. Lee, 1878, under direction of Col. Macomb. **R., 79,** 474, 476.

I-44 LITTLE SALEM CREEK, N. J.

ENGINEERS.

Chief of Engineers. R., 89, 102.

In charge. Lt. Col. H. M. Robert, 1888. **R., 89,** 876.

Assistant. L. Y. Schermerhorn. **R., 89,** 877.

PHYSICAL CHARACTERISTICS.

Description of; has another name—Fenwick Cr.—and flows into Salem Cr., 3 m. above latter's mouth, **89,** 877.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Robert (**R.** unfav.), **89,** 877.

I-45 OLDMANS CREEK, N. J.

APPROPRIATION.

1910, $45,000, **10,** 1283.

COMMERCE.

Description of, **97,** 1240; **00,** 1601.

An. value, 1897, $358,254, **97,** 1241.

ENGINEERS.

Chief of Engineers. R., 97, 154; **99,** 182; **00,** 207; **08,** 218; **09,** 224; **10,** 230; **11,** 248; **12,** 296.

In charge:

Maj. C. W. Raymond, 1896. **R., 97,** 1238; (Lt. Col.) **00,** 1598, 1602.

Maj. C. A. F. Flagler, **08,** 194; **09,** 199.

Maj. H. Deakyne, **09,** 199.

Capt. L. H. Rand, **09,** 199; **10,** 224.

Maj. R. R. Raymond, 1910–. **R., 10,** 1283; **11,** 1370; **12,** 1589.

LEGAL PROCEEDINGS.

Title papers to lands needed for cut-offs received and submitted to U. S. dist. atty. for exam., **12,** 1589.

OBSTRUCTIONS.

List of, **97,** 1239.

Fixed br. at Auburn, head of navigation, **12,** 296.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1238; **00,** 1599, 1600, 1603, 1604; **12,** 296.

27 m. l.; flows nw. betw. Gloucester and Salem Cos., N. J.; enters Del. R. 4½ m. below mouth of Raccoon Cr., about 3 m. above Penns Grove, N. J., **12,** 296.

PROJECTS.

Lt. Col. Raymond est., 1900, $60,000 to imp. R. from mouth to Auburn, **00,** 1605.

Act June 25, 1910, au. new chan. 6′ x 100′ across bar at mouth, with j. to maintain it; a chan. 6′ x 75′ thence to Pedricktown; and a chan. 5′ x 40′ thence to Auburn, with necessary cut-offs and new mouth; est., $89,500[3] (see Surveys), all necessary land for right of way for cut-offs to be deeded free of cost to US., etc., **10,** 230.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Raymond, 1896 (**R.** fav.), **97,** 1238.

Ex. and sur. au. act Mar. 3, 1889; made, 1900, by Lt. Col. Raymond (**R.** fav.; see Projects), **00,** 1599, 1602.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Maj. Flagler on pre. ex., 1907, and of Capt. Rand on sur., 1908; est., $89,500[3] (see Projects), **08,** 218; **09,** 224.

Map.[3]

[1] Comm. D. 12, 59th, 2d. [2] H. D. 318, 61st, 2d. [3] H. D. 1083, 60th, 2d.

I-46 RACCOON CREEK (or River), N. J.

APPROPRIATIONS.

1882, $3,000, **83,** 646.
1902, 15,000, **02,** 1053.
1905, 15,000, **05,** 1104.
1907, 15,000, **07,** 1112.
1910, 12,500, **10,** 1282.
1911, 5,000, **11,** 1370.
1912, 4,000, **12,** 1588.

Total, 69,500 (incl. misc., $69,600, **12,** 1588).

COMMERCE.

Description of, **00,** 1593, 1594.
1903, 252,389 t., **04,** 173; 1909, 58,107 t., **09,** 229.
Bulky freight by water costs only half that by rail, and carried faster, **08,** 198.
Effect of imp. on rates, **10,** 229.

CONTRACTS.

1903. River & Harbor Improvement Co., dr., 15¢ c. y., p. m., **03,** 992.
1905. Edward F. Fonder Co., dr., 9½¢ c. y., p. m., **06,** 1055.
1909. Rickards Dredging Co., dr., 11.8¢ c. y., p. m., and 5.9¢ for overdepth up to 1′, **09,** 1160.
1910. River & Harbor Improvement Co., dr., 14.9¢ c. y., p. m., **11,** 1370.
1911. Rickards Dredging Co., dr., 16.8¢ c. y., p. m., **12,** 1588.

ENGINEERS.

Chief of Engineers. **R., 83,** 126; **84,** 135; **85,** 124; **86,** 121; **87,** 83; **88,** 84; **99,** 182; **00,** 207; **02,** 184; **03,** 173; **04,** 165; **05,** 172; **06,** 184; **07,** 189; **08,** 197; **09,** 202; **10,** 228; **11,** 246; **12,** 294.

In charge:
Lt. Col. G. Weitzel, 1882–84. **R., 83,** 646.
Maj. W. H. Heuer, 1884–85. **R., 84,** 839.
Lt. Col. H. M. Robert, 1885–88. **R., 85,** 851; **86,** 844; **87,** 810; **88,** 712.
Lt. Col. C. W. Raymond, 1900. **R., 00,** 1590, 1596.
Col. Jared A. Smith, 1901–03. **R., 02,** 1053.
Capt. J. C. Sanford, 1903–04. **R., 03,** 991.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1235; **05,** 1103; (Maj.) **06,** 1055; **07,** 1112; **08,** 1152.
Maj. J. C. Sanford, **08,** 194.
Maj. H. Deakyne, **09,** 199.
Capt. L. H. Rand, 1908–10. **R., 09,** 1159.
Maj. R. R. Raymond, 1910–. **R., 10,** 1281; **11,** 1369; **12,** 1587.

Assistants:
E. A. Gieseler. **R., 83,** 647.
A. Stierle. **R., 84,** 839.

LEGAL PROCEEDINGS.

Land for Molonox Shoal cut-off deeded to U. S., **09,** 1159.

OPERATIONS.

1903-04. 79,791 c. y. dr., **04,** 1235.
1905-06. 59,846 c. y. dr., **06,** 1055.
1908-09. 33,384 c. y. dr., **09,** 1160.
1909-10. Molonox cut-off completed and chan. w. and redr. to restore proj. d. to Swedesboro; total dr., 165,840 c. y., **10,** 1281.
1910-11. 88,262 c. y. dr., **11,** 1370.
1911-12. 21,970 c. y. dr.; proj. 95% done, **12,** 1588.

PHYSICAL CHARACTERISTICS.

Description of, **02,** 184.
Tidal range at various pts., **02,** 185.
Shoaling, **04,** 166.
Tidal range in upper R. increased as result of work done, **07,** 190.
Rises Gloucester Co., N. J.; flows nw. into Del. R. nearly opp. Marcus Hook, Pa., **12,** 294.

PLANS. (See Projects.)

By Col. Weitzel, 1883, chan. 3′ d. l. w., with a bottom w. of 40′ from mouth up to Swedesboro R.R. Br.; est., $17,940, **83,** 649; **87,** 810.

PROJECTS. (See Plans.)

Lt. Col. Raymond est., 1899, $102,135 to imp. creek, mouth to Swedesboro, **00,** 1598.
Act June 13, 1902, au. dr. chan. 7′ d. at l. w., 75′ w. to Bridgeport, 1¾ m. from mouth; thence 60′ w. to Springers Wharf, 5 m. from mouth; thence 5′ x 40′ to head of navigation at Swedesboro, 9¼ m. from mouth, in accordance with plans of Lt. Col. Raymond; est., $102,135,[1] **02,** 184, 185, 1053.
Act Mar. 2, 1907, au. making cut-off at Molonox Shoal, with provisions that no expend. should be made until necessary land deeded to U. S. free of expense, **07,** 190.

SURVEYS.

Au. act Aug. 2, 1882; made, 1883, by Lt. Col. Weitzel, **83,** 646.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Raymond (**R.** unfav.; see Projects), **00,** 1591, 1596.

I-47 MANTUA CREEK, N. J.

APPROPRIATIONS.

1882, $3,000, **83,** 641.
1899, 25,000, **99,** 1366.
1902, 35,000, **02,** 182, 1049.
1907, 34,450, **07,** 1111.
1909, *7,000, **10,** 1280.
1910, 28,000, **10,** 1280.
1911, 6,000, **11,** 1369.
1912, 3,000, **12,** 1586.

Total, 141,450 (incl. misc., $141,550, **12,** 1586).

COMMERCE.

Valued at $2,002,875, 1894, **95,** 1090; **98,** 1125.
Imp. reduced rates on car floats 25%, **06,** 180.
1911, 170,444 t., **12,** 293.

CONTRACTS.

1899. American Dredging Co., dr., 13¢ c. y., **90,** 904.
1900. American Dredging Co., dr., 11¢ c. y., p. m.; bank constr., 25¢ c.y., p. m., **01,** 1331.
1903. River & Harbor Improvement Co., dr., 17¢ c. y., p. m., **03,** 988.
1906. Richard Parrott, js. at new mouth, $17.75 l. f., and dike to close gap in bank, $5 l. f., **07,** 1110, 1111.
1907. Richard Parrott, supple. contract, 325′ dike, more or less, to close gap in bank. Franklin K. Wills Co., completion of js., $19.90 l. f., and dike to close old mouth, $9.25 l.f., **07,** 1110, 1111.
1908. American Dredging Co., dr., 15.7¢ c. y., p. m., **08,** 1151, 1152.
1911. Tatnall, Brown Co., j. constr., $10.90 l. f.; sheet-piling reinforcement, $4.95 l. f., **12,** 1586, 1587.
1912. Rickards Dredging Co., dr., 9¢ c. y., **12,** 1586, 1587.

ENGINEERS.

Chief of Engineers. **R., 81,** 129; **82,** 126; **83,** 126; **84,** 134; **85,** 123; **86,** 121; **87,** 83; **88,** 83; **89,** 101; **90,** 91; **95,** 132; **98,** 158; **99,** 178; **00,** 201; **01,** 241; **02,** 181; **03,** 168; **04,** 159; **05,** 166; **06,** 179; **07,** 188; **08,** 196; **09,** 200; **10,** 226, 255; **11,** 244; **12,** 292.

In charge:
Capt. W. Ludlow, 1881–83. **R., 82,** 806.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 640.

[1] H. D. 231, 56th, 1st.

*Allotment.

Maj. W. H. Heuer, 1884–85. **R., 84,** 837.
Lt. Col. H. M. Robert, 1885–90. **R., 85,** 850; **86,** 844; **87,** 809; **88,** 711; **89,** 873.
Maj. C. W. Raymond, 1890–1901. **R., 90,** 904; **95,** 1088; (Lt. Col.) **98,** 1122; **99,** 1364; **00,** 1582; **01,** 1330.
Col. Jared A. Smith, 1901–02. **R., 02,** 1048.
Capt. J. C. Sanford, 1903. **R., 03,** 987.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1230; **05,** 1099; (Maj.) **06,** 1052; **07,** 1109; **08,** 1151.
Capt. L. H. Rand, 1909. **R., 09,** 1158.
Maj. R. R. Raymond, 1910–. **R., 10,** 1280; **11,** 1369; **12,** 1585.

Assistants:
E. A. Gieseler. **R., 82,** 807.
A. Stierle. **R., 84,** 837.

LEGAL PROCEEDINGS.

Condemnation proceedings for right of way, **00,** 1582.
All necessary rights of way above the phosphate works and below Paulsboro secured by condemnation proceedings and purchase, **01,** 1330.

OBSTRUCTIONS.

Stream crossed, 1897, by 4 brs., 2 of them without draws, **98,** 1122.

OPERATIONS.

1889–90. 20,000 c. y. dr., **90,** 904.
1900–01. 120,819 c. y., p. m., dr. from chan., of which 8,133 c. y. placed in meadow banks constr. under the contract, and 112,686 c. y. deposited behind the banks, **01,** 1331.
1903–04. Temporary dike constr. across upper end of line of cut to be dr. to 3′ above m. l. w.; chan. dr. 570′ from the Del. R.; cut made on each side of chan. and material thrown up to form embankments, **04,** 1231.
1904–05. Work under contract completed; total quantity removed, 101,381 c. y., p. m., **05,** 1099.
1906–07. 608 l. f. of j. constr., 307 l. f. on e. and 301 l. f. on w. side of entrance; also 186′ of dike, **07,** 1110.
1907–08. Entire length of 385 l. f. of dike, to close gap in bank in side entrance to mouth, completed under the contract; 447 l. f. added to e. j. and 278.5 l. f. to w. j., making them, resp., 754′ and 579.5′ l.; and 524 l. f. of dike constr. to close old mouth, **08,** 1151.
1908–09. 70,000 c. y., p. m., removed and deposited on meadows behind banks above h. w., **09,** 1158.
1911–12. 435 l. f. dike reinforced; 74 piles driven in e. j.; 8,980 c. y. dr., **12,** 1586.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 711; **95,** 1089; **98,** 1123; **12,** 292.
Empties into Del. R. about 3 m. below Phila. 11 m. above its mouth it has a w. of 100′ and l.-w. d. of 2′, 1895; obstr. by bar at mouth, shoals, and numerous sharp bends, **95,** 1089; **98,** 1123.

PLANS.

Plan for imp. presented; est., $19,800, **10,** 256.

PROJECTS.

By Capt. Ludlow, 1882, Mantua to mouth, chan. having a l.-w. d. of 10′ and a w. of 80′ at the mouth, diminishing to 4′ x 40′ at Mantua; est., $35,000, **82,** 806.
By Lt. Col. Robert, 1889, chan. 60′ w. and not less than 8′ d. m. l. w., 8′ curve in the Del. R. to Phosphate Wharf, 3,000′; est., $2,900, **89,** 874.
By Maj. Raymond, 1897, dr. a 12′, 8′, and 7′ chan., 100′, 80′, and 60′ w., resp., mouth to Parkers Landing; constr. of cut-offs, removal of overhanging trees, and, if necessary, js. at the mouth; est., $145,030, **98,** 1122; **99,** 1365.
Act 1899 app. $25,000, $8,000 to be expend. for right of way, but not unless all rights should be obtained within that sum, **99,** 1365.
By Lt. Col. Raymond, chan. 8′ x 80′, Paulsboro toward phosphate works, by way of the cut-offs, as far as available funds ($17,000) would permit, **01,** 1331.
By Maj. Flagler, 1906, js. to protect chan. at new mouth, **07,** 1109.
By Maj. Flagler, 1907, completing js. to 12′ curve in Del. R., and constr. of dike to close old mouth, **07,** 1110.
By Maj. Raymond, 1911, proj. embraced 12′ x 100′ chan., from Del. R. for 2,200′; thence 8′ x 80′ to Paulsboro, cutting off bends; thence 3 m. with 1 cut-off, 7′ x 60′, and extension of js. at mouth; **12,** 293.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. Ludlow, **82,** 806.
Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Raymond (**R.** fav.), **95,** 1088.
Sur. au. act June 3, 1896; made, 1897, by Maj. Raymond (**R.** fav.; see Projects), **98,** 1122.
Pre. ex. and sur. au. act Mar. 3, 1909, for imp. to head of navigation,[1] **10,** 227, 255.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 294.
Maps.[1]

I-48 WOODBURY CREEK, N. J.

APPROPRIATIONS.

1882,	$5,000, **83,** 641.
1896,	[2] 2,500, **96,** 932.
Total,	7,500

ENGINEERS.

Chief of Engineers. **R., 83,** 126; **84,** 135; **85,** 123; **86,** 121; **87,** 82; **88,** 83; **12,** 329.

In charge:
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 641.
Maj. W. H. Heuer, 1884–85. **R., 84,** 838.
Lt. Col. H. M. Robert, 1885–88. **R., 85,** 850; **86,** 843; **87,** 808; **88,** 710.
Maj. R. R. Raymond, **12,** 290.

Assistants:
E. A. Gieseler. **R., 83,** 642.
A. Stierle. **R., 84,** 838.

PROJECT.

By Lt. Col. Weitzel, 1883, chan. of navigable w. and 8′ d. at h. w., Del. R. to Broad St. Br., Woodbury; est., $15,000, **83,** 642.

SURVEYS.

Made, 1883, by Lt. Col. G. Weitzel (see Project), **83,** 641.
Pre. ex. and sur. au. act June 25, 1910. **R.** by Maj. Raymond, 1910 and 1912, with maps; est., $38,000, with $2,000 an. mainten.;[3] provided local interests furnish free of cost to U. S. land necessary for cut-offs and for deposit of dr. material, **12,** 329.
Maps.[3]

[1] H. D. 523, 61st, 2d.
[2] Part of $37,000, act June 3, 1896, for Cooper Creek, **96,** 932.
[3] H. D. 635, 62d, 2d.

I-50 NEWTON CREEK, N. J.

ENGINEERS.

Chief of Engineers. **R., 81,** 129; **82,** 126; **84,** 139.

In charge. Capt. W. Ludlow. **R., 82,** 805.

OBSTRUCTIONS.

On account of the permanent brs. near the mouth, no imp. of the stream could be attempted, **82,** 805.

PHYSICAL DATA.

Flows into Del. R. above Gloucester, N. J., **82,** 805.

SURVEY.

Ex. au. act Mar. 3, 1881; made by Capt. Ludlow (see Obstructions), **82,** 805.

I-51 COOPER RIVER (Creek), N. J.

APPROPRIATIONS.

1896,	$34,500,	**96,** 932.
1909,	*5,000,	**09,** 1158.
1910,	8,000,	**10,** 1278.
1911,	5,000,	**11,** 1368.
1912,	5,000,	**12,** 1584.
Total,	57,500	(incl. $2,500 in repairing US. reservation dike at mouth of Woodbury Creek, N. J., $60,000, **12,** 1584).

COMMERCE.

Description of, **93,** 1191; **95,** 1104.

Imp. has reduced rates by permitting larger vessels to be secured for long voyages, **10,** 225; **11,** 243.

Tonnage, 1910, 260,934 t., **11,** 1368; 1911, 267,000 t., **12,** 1585.

CONTRACTS.

1896. F. C. Somers, repair of dike at mouth of Woodbury Creek at a total cost of $2,500, **97,** 1223. A.M. Clegg, dr., 13.7¢ c. y., **97,** 1224. (Proceedings taken to annul contract, **98,** 1100.)

1906. River & Harbor Improvement Co., dr., 24¢ c. y., p. m., **07,** 1109.

1909. The Rickards Dredging Co., dr., 19¢ c. y., p. m., **10,** 1279.

1911. River & Harbor Improvement Co., dr., 24.8¢ c. y., p. m., **12,** 1584.

ENGINEERS.

Chief of Engineers. **R., 93,** 129; **95,** 133; **96,** 120; **97,** 152; **98,** 154; **99,** 177; **00,** 199; **01,** 239; **02,** 180; **03,** 167; **04,** 158; **05,** 165; **06,** 178; **07,** 186; **08,** 194; **09,** 199; **10,** 224; **11,** 242; **12,** 290.

In charge:

Maj. C. W. Raymond, 1890. **R., 93,** 1189; **95,** 1102; **96,** 931; **97,** 1223; (Lt. Col.) **98,** 1100; **99,** 1360; **00,** 1580; **01,** 1329.

Col. Jared A. Smith, 1902. **R., 02,** 1048.

Capt. J. C. Sanford, 1903. **R., 03,** 986.

Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1229; **05,** 1098; (Maj.) **06,** 1052; **07,** 1108; **08,** 1150.

Capt. L. H. Rand, 1909. **R., 09,** 1157.

Maj. R. R. Raymond, 1910–. **R., 10,** 1277; **11,** 1367; **12,** 1583.

Assistant. F. Sylvester. **R., 95,** 1104.

OBSTRUCTION.

List of brs. crossing the stream, **93,** 1190; **95,** 1103.

OPERATIONS.

1896-97. 55 c. y. dr., **97,** 1224.

1897-98. 47,735 c. y. dr., **98,** 1100.

1898-99. 115,640 c. y. dr., **99,** 1360.

1902-03. Removal of large tree and repair of damage to R. bank, **03,** 986.

1906-07. 19,969 c. y., p. m., removed and deposited above h. w. at Line Ditch, Camden, N. J., **07,** 1108.

1909-10. 39,207 c. y., p. m., removed and work completed, resulting in a chan. not less than 12′ d. at m. l. w. from the Del. R. to the Camden Iron Works, **10,** 1278.

1911-12. 42,344 c. y. dr., and contract completed, making a chan. 12′ x 70′ m. l. w., from 12′ contour in Del. R. to 900′ above Federal St. Br., Camden, N. J., **12,** 1584.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1190; **95,** 1103.

Max. draft, June 30, 1911, 6½′ x 12′; range of tide about 6′, **11,** 243.

The contractor's dr. sank Dec. 6, 1911, on a row of submerged piles; severe weather and ice in creek forced contractor to again suspend work on Jan. 5, 1912; contract completed Apr. 24, 1912, **12,** 1584.

PROJECTS.

By Maj. Raymond, 1895, to dr. chan. 18′ x 70′ at m. h. w., mouth of creek to Brownings Chemical Works; est. cost, $35,000, **96,** 932.

By Maj. Flagler, 1906, dr. chan. 13′ x 70′ m. l. w., side slopes 1 on 1, Del. R. to State St. Br., **07,** 1108.

SURVEYS.

Ex. au. act July 13, 1892; made by Maj. Raymond, 1892 (**R.** fav.), **93,** 1190.

Sur. au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (see Projects), **95,** 1103.

Act June 25, 1910, au. pre. ex. and sur., with view to extension of proj.; **R.** deferred pending action on proposed H. lines, **12,** 291, 329.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 291.

I-52 PENSAUKEN CREEK, N. J.

ENGINEERS.

Chief of Engineers. **R., 84,** 138; **91,** 118; **12,** 329.

In charge:

Lt. Col. G. Weitzel. **R., 84,** 852.

Maj. C. W. Raymond, 1890–91. **R., 91,** 1100.

Maj. R. R. Raymond, **12,** 290.

Assistant. E. A. Gieseler. **R., 84,** 852.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1101.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1882, by Lt. Col. Weitzel (**R.** unfav.), **84,** 852.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1100.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 329.

*Allotment.

I-53 RANCOCAS RIVER, N. J.

APPROPRIATIONS.

1881,	$10,000,	**81,** 795.
1882,	10,000,	**82,** 778.
1890,	[1] 10,000,	**91,** 1085.
1892,	5,000,	**92,** 936.
1894,	3,000,	**95,** 1068.
1896,	[2] 2,000,	**96,** 927.
1899,	[2] 2,000,	**99,** 1356.
1902,	3,000,	**02,** 1047.
Total,	45,000	

COMMERCE.

Description of, **95,** 1084, 1087.
1901, 321,135 t., **02,** 1048.

CONTRACTS.

1881. American Dredging Co., dr., 55¢ c. y., **81,** 796.
1882. American Dredging Co., dr., 32¢ c. y., **83,** 635.
1891. F. C. Somers, dr., 22¢ c. y., and removal of 3 wrecks, at a total of $800, **91,** 1085.
1892. F. C. Somers, dr., 14½¢ c. y., **92,** 935. J. P. Randerson, dr., 20¢ c. y. ($4,000), **93,** 1175.
1894. F. L. Somers, dr., 17¢ c. y. ($2,125), **95,** 1068.
1897. F. C. Somers, dr., $1,767.59, **98,** 1097.
1899. J. L. Mills, dr., 25¢ c. y. ($1,700), **99,** 1357.
1903. F. K. Wills Construction Co., contraction works (wing dams) on Lumberton Branch, **03,** 984.

ENGINEERS.

Chief of Engineers. R., 80, 98; **81,** 126; **82,** 123; **83,** 124; **84,** 133; **85,** 123; **86,** 120; **87,** 82; **88,** 82; **91,** 116; **92,** 117; **93,** 126; **94,** 115; **95,** 129, 132; **96,** 118; **97,** 150; **98,** 153; **99,** 174; **00,** 198; **01,** 238; **02,** 179; **03,** 166; **04,** 157; **05,** 164; **06,** 177; **07,** 185; **08,** 194; **10,** 256.

In charge:
Col. J. N. Macomb, 1880–82. **R., 81,** 795.
Capt. W. Ludlow, 1882–83. **R., 82,** 777.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 635.
Maj. W. H. Heuer, 1884–85. **R., 84,** 833.
Lt. Col. H. M. Robert, 1885–91. **R., 85,** 849; **86,** 841; **87,** 807; **88,** 708.
Maj. C. W. Raymond, 1891–1901. **R., 91,** 1084; **92,** 935; **93,** 1174; **94,** 854; **95,** 1066, 83, 86; **96,** 925; **97,** 1219; (Lt. Col.) **98,** 1097; **99,** 1356; **00,** 1578; **01,** 1327.
Col. Jared A. Smith, 1902. **R., 02,** 1046.
Capt. J. C. Sanford, 1903. **R., 03,** 984.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1228; **05,** 1097; (Maj.) **06,** 1051; **07,** 1107; **08,** 1149.

Assistant: A. Stierle. **R., 83,** 635; **84,** 834.

OPERATIONS.

1881-82. 723 l. f. dike built from n. bank to upper end of Hamills Isld.; 17,000 c. y. dr. from the chan., **82,** 778.
1882-83. 25,983 c. y. dr. from the chan., **83,** 636.
1883-84. Removal of "Coates Bar" completed, **84,** 834.
1890-91. 3 wrecks and 32,749 c. y. removed from chan. between the mouth and Centerton, **91,** 1085.
1891-92. 7,330 c. y. dr., **92,** 935.
1892-93. 19,936 c. y. dr., **93,** 1174.
1894-95. 12,044 c. y. dr., **95,** 1067.
1897-98. 5,026 c. y. dr., **98,** 1097.
1899-00. 5,879 c. y., p. m., dr., **00,** 1579.
1902-03. 5 wing dams completed; about 60% of entire work completed, **03,** 984.
1903-04. 18 wing dams in all built; work completed, **04,** 1228.

PHYSICAL CHARACTERISTICS.

Description of R. and obstr. therein, **81,** 796; **95,** 1084, 1086.

PROJECTS.

By Col. Macomb, 1881, chan. from 150′–200′ w., l.-w. d. of 6′ from mouth to Centerton, 7½ m., and 5′ l.-w. chan. thence to Mount Holly; est., $81,236, **81,** 798; **91,** 1084.
By Maj. Raymond, 1894, chan. 5′ x 50′ in continuation of chan. dr. in 1893. Extension found to be impracticable, **95,** 1067.
By Maj. Raymond, 1897, 6′ chan. 30′ w. at Pattersons Landing and Paxsons Landing in Lumberton Branch as far as the $2,000 app. in 1896 would permit, **98,** 1097.
By Lt. Col. Raymond, 1899, 6′ chan. m. l. w., 30′ w., through the shoals below Moores Landing and below Hainesport as far as available funds would permit, **99,** 1356.
Act 1902 au. $3,000 for continuing imp., **02,** 1007.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Col. Macomb, **81,** 796.
Ex. au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (**R.** unfav.), **95,** 1083.
Ex. of Lumberton Branch au. act Aug. 17, 1894; made by Maj. Raymond, 1894 (**R.** unfav.), **95,** 1086.
Sur. of Lumberton Branch made by Maj. Raymond, 1897, **97,** 1219.
Pre. ex. and sur., mouth to Mount Holly; **R.** by Capt. L. H. Rand [3] (**R.** unfav.), **10,** 256.
Maps.[3]

I-54 DARBY RIVER (Creek), PA.

COMMERCE.

Small, **87,** 823.

ENGINEERS.

Chief of Engineers. R., 87, 86; **12,** 329.
In charge:
Lt. Col. H. M. Robert. **R., 87,** 822.
Maj. R. R. Raymond, **12,** 290.

PHYSICAL CHARACTERISTICS.

Description of creek; probable lack of permanence of a chan., **87,** 822.
Situated almost in city of Phila.

SURVEYS.

Ex. au. act Aug. 4, 1886; made, 1886, by Lt. Col. Robert (**R.** unfav.), **87,** 822.
Ex. au. act June 25, 1910; **R.** by Maj. Raymond, 1910, (unfav.),[4] **12,** 329.

[1] Part of an app. of $250,000 for Delaware R.
[2] Lumberton Branch.
[3] H. D. 850, 61st, 2d.
[4] H. D. 266, 62d, 2d.

I-55 CRUM RIVER, PA.

ENGINEERS.

Chief of Engineers. R., 11, 278.
In charge. Maj. R. R. Raymond, **11,** 242.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1909, mouth to Leiperville; **Rs.** by Capt. L. H. Rand, May 17 and Nov. 6, 1909 (unfav.),[1] **11,** 278.

Supple. report by BERH., Nov. 13, 1911, requested by R. and H. Comm. Concur in former opinion, "unfavorable."[2]

I-56 RIDLEY RIVER (Creek), PA.

(See I-57a.)

ENGINEERS.

Chief of Engineers. R., 81, 129; **12,** 329.
In charge:
Col. J. N. Macomb. **R., 81,** 828.
Maj. R. R. Raymond, **12,** 290.

PRIVATE WORK.

In 1880 creek was being imp. by private enterprise, **81,** 828.

SURVEYS.

Ex. au. act June 14, 1880; made by Col. Macomb (see Private work), **81,** 828.

Pre. ex. au. act June 25, 1910. **R.,** Maj. Raymond, Oct. 24, 1910[4] (unfav.), **12,** 329.

I-57 CHESTER RIVER, PA.

(See I-57a.)

ENGINEERS.

Chief of Engineers. R., 12, 329.
In charge. Maj. R. R. Raymond, **12,** 290.

SURVEY.

Ex. and sur. au. act June 25, 1910; **R.,** Maj. Raymond; est., $3,600, and $550 an. mainten.,[4] **12,** 329.

Maps.[4]

I-57(a) CHESTER AND RIDLEY CREEKS, PA.

(See I-56, 57.)

APPROPRIATIONS.

1881,	$3,000,	**81,** 793.
1882,	3,000,	**82,** 777.
Total,	6,000	

CONTRACTS.

1882. F. C. Somers, dr., 52¢ c. y., **83,** 634.

ENGINEERS.

Chief of Engineers. R., 80, 98; **81,** 125; **82,** 123; **83,** 124.

In charge:
Col. J. N. Macomb, 1880–82. **R., 81,** 792, 793.
Capt. W. Ludlow, 1882–83. **R., 82,** 777.
Lt. Col. G. Weitzel, 1883. **R., 83,** 633.

Assistant. T. G. Locke. **R., 83,** 634.

OPERATIONS.

1882–83. 10,613 c. y. dr.; proj. completed, **83,** 634.

PROJECTS.

By Col. Macomb, 1881, imp. Chester Creek, dr. and removing silt to 7′ l. w. at the entrance, diminishing upward; est., $10,781, **81,** 125, 794.

By request of city authorities dr. confined to area between Second St. Br. and mouth of creek, **83,** 634; completed, 1883, **83,** 634.

SURVEY.

Of Chester and Ridley Creeks, near their outlets into the Delaware, au. act Mar. 3, 1879; made, 1880, by Col. Macomb, **81,** 793.

I-58 WILMINGTON HARBOR (Christiana River), DEL.

APPROPRIATIONS.

1836–38,	$32,356,	**70,** 426.
1870,	15,000,	**70,** 71; **71,** 78, 688.
1872,	10,000,	**72,** 76, 779; **73,** 80, 865.
1873,	6,000,	**73,** 81, 866; **74,** ii, 136.
1874,	6,000,	**74,** 91, ii, 136; **75,** ii, 178.
1875,	10,000,	**75,** 97, ii, 178; **76,** 269.
1876,	16,000,	**76,** 59, 270; **77,** 260.
1878,	7,000,	**78,** 60, 436.
1879,	3,500,	**79,** 72, 441.
1880,	10,000,	**80,** 586.
1881,	50,000,	**81,** 771.
1882,	50,000,	**82,** 758.
1884,	25,000,	**84,** 826.
1886,	18,750,	**86,** 858.
1888,	30,000,	**88,** 740.
1890,	30,000,	**90,** 919.
1892,	40,000,	**92,** 947.
1894,	[5] 25,000,	**95,** 1111.
1896,	[6] 20,000,	**96,** 943.
1898,	205,846,	**99,** 1371.
1899,	45,000,	**99,** 1371.
1900,	200,000,	**00,** 1628.
1902,	50,000,	**03,** 993.
1905	25,000,	**05,** 1107.
	*250,	**07,** 1120.
1907	75,000,	**07,** 1120.
	*1,250,	**08,** 1162.
1909,	*40,000,	**09,** 1170.
1910,	100,000,	**10,** 1293.
1911,	100,000,	**11,** 1384.
1912,	250,000,	**12,** 1604.
Total,	1,496,852	(incl. $667.26 misc., and less $3,223.50 ret. to Treas., etc., $1,494,395.76 **12,** 1604).

[1] H. D. 1063, 61st, 3d.
[2] Comm. D. 6, 62d, 2d.
[3] H. D. 259, 62d, 2d.
[4] H. D. 677, 62d, 2d.
[5] To include a sur. of Christiana R.
[6] $5,000 to be used for upper Christiana R.
*Allotment.

COMMERCE.

1896 est. that total an. trade of Wilmington $39,254,087, **96,** 976.

Description of, **95,** 1149; **96,** 976.

Shipbuilding industry quite extensive, **06,** 187.

1909, 815,245 t.; value, $64,707,575; shipbuilding extensive; has largest steel shipbuilding output on Atlantic coast, with exception of Philadelphia and Newport News in 1905; shipments by water 25% lower than by rail, **10,** 242.

1911, 859,736 t.; value, $68,674,051, **12,** 312.

"The tonnage of the leading articles shipped to and from Wilmington during the calendar year 1911 is reported to have been 859,736 short tons valued at $68,674,051.

"The shipbuilding industry on the river is quite extensive, the records of the Department of Commerce and Labor showing that, with the exception of Philadelphia and Newport News, Wilmington had the largest steel shipbuilding output on the Atlantic coast for the 10 years ending June 30, 1905.

"The harbor improvements do not directly affect freight rates on light-draft boats to any large extent. Shipments thereon made by water range about 25 per cent lower in rate than by rail, but much more in deep-draft vessels, of which there are many, covering shipments to and from the manufacturers and shipbuilding plants." **12.**

CONTRACTS.

1871. S. P. Shelbourne, dr., 33¢ c. y., **71,** 689. American Dredging Co., removing r., **71,** 689.

1872. American Dredging Co., removing r., $50 c. y.; dr., 25, 32, and 37¢ c. y., **73,** 867.

1873. American Dredging Co., removing r., $37.50 c. y., **74,** ii, 137.

1874. American Dredging Co., removing r., $40 c. y., **75,** ii, 181.

1875. American Dredging Co., removing r., $38 c. y.; W. H. Beard, dr., 15½¢ c. y., **75,** ii, 181.

1878. F. B. Colton, dr., 9½¢ c. y.; T. Cuming, removing r., $35 c. y., **79,** 442.

1879. T. Cuming, r. removal, $28.50 c. y., **80,** 587.

1880. National Dredging Co., dr., 24$\frac{7}{10}$¢ c. y., **81,** 771.

1881. I. Neveling & Son, j. constr.; National Dredging Co., dr., 31¢ c. y., **82,** 760. Delaware & Chesapeake Improvement Co., dr., 29½¢ c. y., **83,** 620. I. Neveling & Son, j. constr., **83,** 621.

1884. I. Lunt, j. constr., **85,** 870. American Dredging Co., dr., 17¢ c. y., **85,** 871.

1887. National Dredging Co., dr., 12¢ c. y., **87,** 829.

1889. National Dredging Co., dr., 13.9¢ c. y.; I. Lunt, j. repair, **90,** 920.

1891. Atlas Dredging Co., dr., 8¢ c. y., **91,** 1137.

1892. Atlas Dredging Co., dr., 13$\frac{7}{10}$¢ c. y., p. m.; r. removal, $14 c. y., p. m., **93,** 1195.

1895. Atlas Dredging Co., dr., **96,** 942.

1896. Atlas Dredging Co., dr., 23¢ c. y., p. m. **97,** 1253.

1897. Atlas Dredging Co., dr., 17$\frac{8}{10}$¢ c. y., p. m., **97,** 1253.

1898. J. J. Fitzpatrick, r. removal, $7.13 c. y.; The New York Dredging Co., dr., 12$\frac{8}{10}$¢ c. y., p. m., **99,** 1372.

1899. B. T. Collins, j. constr., Brandywine R., $7,310.80; Christiana R., $33,512. Sanford & Brooks Co., repair and extension of j., Christiana R., $31,100. Bowers Hydraulic Dredging Co., dr., 10⅞¢ c. y., p. m., **00,** 1629, 1630, 1631.

1900. J. J. Fitzpatrick, r. removal, $10.99 c. y., p. m., **01,** 1336.

1903. John L. Grim, dr., 14½¢ c. y., p. m., **04,** 1237.

1905. Franklin K. Wills, repairing js., Christiana and Brandywine Rs.; est., $1,315.20; unit prices given, **05,** 1107, 1108. Bowers Hydraulic Dredging Co., dr., 11¢ c. y., p. m., **06,** 1056, 1057.

1906. Bowers Hydraulic Dredging Co., dr., 11¢ c. y., p. m., **07,** 1118.

1907. Bowers Hydraulic Dredging Co., dr., 15.9¢ c. y., p. m., **07,** 1119.

1908. The Rickards Dredging Co., dr., 19.5¢ c. y., p. m., **09,** 1169. Emil F. Patterson, removing stumps, logs, and parts of wrecks, **09,** 1169.

1909. American Dredging Co., dr., 18½¢ c. y., p. m.

1910. American Dredging Co., dr., 7.4¢ c. y., p. m., **11,** 1384.

1912. American Dredging Co., dr., 8.3¢ c. y., **12,** 1604.

ENGINEERS.

Chief of Engineers. R., 70, 71; **71,** 78; **72,** 76; **73,** 80; **74,** 91; **75,** 96; **76,** 58; **77,** 53; **78,** 60; **79,** 72; **80,** 94, 98; **81,** 122; **82,** 120; **83,** 120; **84,** 130; **85,** 127; **86,** 124; **87,** 87; **88,** 87; **89,** 103; **90,** 93; **91,** 119; **92,** 120; **93,** 129; **94,** 118; **95,** 134, 150; **96,** 122, 137; **97,** 155; **98,** 159; **99,** 182; **00,** 208; **01,** 246; **02,** 185; **03,** 174; **04,** 166; **05,** 173; **06,** 185; **07,** 196; **08,** 206; **09,** 212; **10,** 240, 255; **11,** 261; **12,** 310.

Boards:

For R. and H. imp. **R., 81,** 775; **82,** 765. (See Projects.)

Commission constituted by S. O. No. 66, at Philadelphia, Pa., June 18, 1891, to consider and report upon the imp. of Wilmington H. **R., 91,** 1138. (Col. Houston, Maj. Raymond, and L. Y. Schemerhorn, C. E.)

Convened, Wilmington, Del., by S. O. No. 35, 1895, to consider and report upon the subject of a proposed flushing basin at the mouth of the Christiana R. **R., 96,** 992. (Col. P. C. Hains, Majs. C. W. Raymond and C. E. L. B. Davis.)

Convened, Wilmington, Del., by S. O. No. 30, 1896, to consider and report upon a plan of imp. of Wilmington H. and Christiana R., Del. **R., 97,** 1255. (Col. P. C. Hains, Majs. C. J. Allen and C. W. Raymond.)

BE. convened Dec. 8, 1904, to consider estab. of H. lines, **05,** 1106.

Chief of Engineers convened a board of officers to determine method of imp. at a less cost, **11,** 1383. Consider "existing" proj. adequate, but recom. mainten. by U. S.-owned dredge to cost $250,000 and $30,000 an. for operation, **12,** 330.

In charge:

Lt. Col. I. C. Woodruff, 1870; **70,** 71. **R., 70,** 475.

Lt. Col. J. D. Kurtz, 1870–77. **R., 71,** 688; **72,** 778; **73,** 865; **74,** ii, 136; **75,** ii, 178; **76,** 269; **77,** 260.

Capt. W. Ludlow, in temporary charge, 1877; **78,** 430.

Col. J. N. Macomb, 1877–82. **R., 78,** 435; **79,** 441; **80,** 585; **81,** 769, 771; **82,** 761.

Capt. W. Ludlow, 1882–83. **R., 82,** 756, 758.

Lt. Col. G. Weitzel, 1883–84. **R., 83,** 620.

Maj. W. H. Heuer, 1884–85. **R., 84,** 826.

W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 869; **86,** 857; **87,** 827; **88,** 739; (Maj.) **89,** 881; **90,** 917; **91,** 1136; **92,** 946; **93,** 1194; **94,** 870; **95,** 1110, 1147; **96,** 941, 973; **97,** 1250; **98,** 1145; **99,** 1369; **00,** 1626.

Lt. Col. C. W. Raymond, 1901. **R., 01,** 1335.

Col. Jared A. Smith, 1902. **R., 02,** 1053.

Capt. J. C. Sanford, 1903. **R., 03,** 992.

Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1237; **05,** 1105; (Maj.) **06,** 1056; **07,** 1118; **08,** 1160.

Capt. L. H. Rand, 1909. **R., 09,** 1168.

Maj. R. R. Raymond, 1910–. **R., 10,** 1291; **11,** 1383; **12,** 1603.

Assistants:

Capt. M. R. Brown, **71,** 77; **72,** 74; **73,** 79; **74,** 90; **75,** 95; **76,** 58.

Capt. W. Ludlow, **77,** 52.

T. Valentine. **R., 78,** 435; **84,** 826.

J. H. Dager. **R., 83,** 621.

A. Stierle. **R., 95,** 1148; **96,** 978.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Woodruff, 1870, dr., $40,000, **70,** 427.

By Lt. Col. Kurtz, 1870, removing r., dr., and surs., $83,000, **74,** ii, 137; **75,** ii, 179; **76,** 270.

By Col. Macomb, 1879, to complete existing proj., $10,000, **79,** 441.

LEGISLATION.

Act June 13, 1902, app. $50,000 with proviso that not more than $25,000 be expend. until arrange-

ments had been made by city of Wilmington to dispose of sewage, **01,** 185, 186.

Act Mar. 3, 1905, app. $25,000, removed restrictions upon expend., **05,** 1106.

OPERATIONS.[1]

1870-71. Dr., **71,** 688.

1871-72. Dr. about 39,000 c. y. sand and mud; 28 c. y. r. removed by blasting, **72,** 779.

1872-73. 24,065 c. y. removed by dr., **73,** 80, 865.

1873-74. 35 c. y. r. removed, **74,** ii, 136.

1874-75. 240 c. y. solid r. removed by blasting, **75,** 96, ii, 178.

1875-76. 105 c. y. solid r. and 30,077 c. y. mud and gravel removed, **76,** 269.

1876-77. 88,000 c. y. mud removed; removal of r. in progress, **77,** 53, 260.

1877-78. Removal of r. below Third St., and dr. between Iron Co.'s wharf and Brandywine Creek, giving depths of 13′ and 12′, resp., **78,** 60, 435.

1878-79. Dr. mud and removal of r., **79,** 72. 441.

1879-80. 70 c. y. r. removed, **80,** 586.

1880-81. 35,630 c. y. mud dr., completing proj. of 1871, **81,** 769.

1881-82. 38,290 c. y. dr.; work on j. begun, **82,** 757.

1882-83. 1,100 l. f. of j. completed; 120,678 c. y. dr., **83,** 620.

1883-84. 700 c. y. st. filling placed and 1,420 l. f. st. pavement laid, **84,** 826.

1884-85. 9,571 c. y. dr.; j. raised for entire l., **85,** 870.

1885-86. Sunken crib removed; lighthouse wharves removed; 3,650 c. y. dr., **86,** 857.

1886-87. 168,787 c. y. dr. under contract, **87,** 827.

1887-88. Dr. under contract with American Dredging Co. completed, **88,** 739.

1889-90. 165,214 c. y. dr.; repairs made to j., **90,** 918.

1890-91. 235,340 c. y. dr., **91,** 1136.

1891-92. 67,645 c. y. dr., **92,** 946.

1892-93. About 73,000 c. y., p. m., dr.; 467 c. y., p. m., r. removed, **93,** 1194.

1893-94. 85,411 c. y., p. m., dr.; 217 c. y., p. m., r. removed, **94,** 870.

1895-96. 24,474 c. y. dr., **96,** 942.

1896-97. 14,647 c. y., p. m., dr. from Christiana R., 2 wrecks removed, **97,** 1250; and 5,676 c. y., p. m., dr. from Wilmington H., **97,** 1251.

1897-98. 108,480 c. y., p. m., dr., **98,** 1146.

1898-00. 3,635 c. y., p. m., r. removed; pile and st. j., at mouth of the Brandywine R., completed; constr. of j. on s. side of mouth of the Christiana R. in progress; j. on n. side of the mouth of R. being repaired; terminal crib being built, and some dr. done, **99,** 1370; **00,** 1626, 1627.

1900-01. Total quantity removed, 1,202,548 c. y., p. m., and pumped ashore on the meadows, **01,** 1336. 354 c. y., p. m., r. removed, **01,** 1336.

1904-05. 141,941 c. y., p. m., removed and pumped ashore above h. w., **05,** 1106.

1905-06. 256,757 c. y., p. m., removed and pumped ashore; repairs to js. completed at total cost of $1,458.38, **06,** 1057.

1906-07. 376,694 c. y., p. m., removed under the 2 contracts with Bowers Hydraulic Dredging Co., completing the dr. to Third St. Br., under the terms of the app., **07,** 1119.

1907-08. Jetties at mouths of the Brandywine and Christiana Rs. repaired under accepted proposal of Franklin K. Wills, at a total cost of $450; retaining banks completed and 332,324 c. y., p. m., removed from chan. and placed ashore behind banks above h. w., **08,** 1160. A log and 4 large stumps removed from chan. at cost of $234.81, **08,** 207.

1908-09. 17,870 c. y., p. m., removed from chan.; a total of 350,194 c. y., p. m., removed under the contract and contract completed, **09,** 1168, 1169. 40,558 c. y., p. m., removed from chan. and contract completed; 32,280 c. y., p. m., removed from chan., **09,** 1169. 18 stumps and logs and parts of 2 wrecks removed from chan. at cost of $265.88, **09,** 1170.

1909-10. Contract required dr. to be done in 2 periods. During the first period 112,911 c. y. removed, and during the second 115,391 c. y. from different pts. between Delaware R. and Harlan & Hollingsworth, resulting in chan. 19′ x 150′ up to Market St. Br.; material deposited at Eagle Pt., N. J., **10,** 1292.

1910-11. 217,607 c. y. dr., **11,** 1383.

1911-12. 634,525 c. y. dr., **12,** 1603.

PHYSICAL CHARACTERISTICS.

Described, **70,** 427; **71,** 688.

Description of H. and Christiana R., **95,** 1149; **96,** 978. Fresh-water inflow, fall of the tides, and an. deposits in the Christiana R., **96,** 974, 976.

Tidal basin above has been considerably increased by breaking of the levees, the banks have been eroded and a large amount of material has been carried into deeper water below, **02,** 1054.

Range of tide slightly over 6′ at mouth, and about 3.6′ at Christiana village, **10,** 242.

Condition of chan., details given, **11,** 262; **12,** 312.

PLANS. (See Estimates and Projects.)

By commission, 1891, permanent imp. of H. by (1) altering the sewerage system of Wilmington so as to prevent discharge of solid matter into Christiana R.; (2) rectifying chan. at the mouth of R. by constr. of 1,400 l. f. of earth and st. j. and 1,200 l. f. of pile and st. dike on the s. side of the entrance; (3) rectification of chan. at junction of the Brandywine and Christiana by constr. of 600 l. f. of h.-w. dike; (4) by dr. a chan. 15′ x 150′ m. l. w. from mouth to Pulp Works; (5) chan. thus excavated to be maintained either by further dr. or the constr. of a flushing reservoir. Total est. cost of imp., excl. of the reservoir, $192,000, or incl. of the same, $392,000. **91,** 1138, 1159.

PRIVATE (CITY) WORK.

Water main crossing R. at Third St. Br. lowered from 18′ to 25′ below m. l. w., **01,** 1336.

City of Wilmington app. $4,857 in accordance with act of State legislature, Mar. 9, 1901, making it mandatory upon the city to make app. in the amount of 10% of sums expend. by US., to continue until $60,000 had been app., **06,** 186.

City of Wilmington app. $4,857 in accordance with act of State legislature, Mar. 9, 1901, and removed from chan. above Third St. Br. 16,004 c. y., p. m.; cost, $4,382.04, **07,** 1119.

City of Wilmington app. $6,567.41 for imp. of H., **08,** 1161.

$500 expend. from city funds, **10,** 241.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Kurtz, 1870, securing chan. in Christiana R., from 100′–200′ w. and 12′ d. at l. w., by dr. and blasting; est., $83,000, **74,** ii, 137. Increased by Col. Macomb, 1879, to $93,000, **79,** 441. Completed at cost of $83,500, **81,** 769.

By Col. Macomb, 1881, j. at H. entrance, dr. 15′ chan. from entrance to Pulp Works, and 12′ chan. from thence to Delaware RR. br.; est., $175,551, **81,** 770, 774. Increased, 1883, by Lt. Col. Weitzel to $191,384, for chan. 15′ x 150′, mouth to Delaware RR. br., **83,** 622. Proj. modified, 1884, providing for an addl. height to j. of 4′ and to extend it 322′ in l., **89,** 882; **91,** 1136.

By Maj. Smith, US. agent, 1895, dr. chan. 3′ x 25′, Churchmans Br. to Smalleys Br., **97,** 1250.

By BE., 1896, j. at s. side of the mouth of Christiana R., as recom. by commission of 1891; rectification of chan. of the Christiana at mouth of the Brandywine by j. on the n. side of the entrance to the latter; and necessary dr. to give chan. of 21′ m. l. w. from the mouth to upper line of the Pulp Works, with w. of 500′ at mouth, gradually narrowing to 300′ at Third St. Br., continuing thence to Market St. Br.; est., $377,542, **97,** 1259. In 1897 Maj. Smith, U. S. agent, est. cost of r. removal not provided for by above board would be $99,083, **97,** 1251.

By Capt. Flagler, dr. shoals in Christiana R., **04,** 1237.

[1] Prior to 1870 confined to dr.; suspended since 1840, **70,** 426.

By Capt. Flagler, dr. chan. 18′ x 200′ from Third St. Br. to mouth of Brandywine R., thence 250′ w. to Delaware R., and repairing n. j. at mouth of Christiana R., and that at mouth of Brandywine R., **05,** 1106.

By Maj. Flagler, repairs to js. at mouth of Christiana and Brandywine Rs., and dr. and maintaining 18′ chan. from Delaware R. to Baltimore & Ohio RR. br., **07,** 1119.

By Maj. Flagler, recom. constr. of dr. for exclusive use in H.; est., $175,000; cost of operation, $30,000 per year, **08,** 1161. Act June 25, 1910, au. purchase or constr. of dr. plant,[1] **12,** 312.

Explanation of est. and what dr. records indicate; recom. that work be done by U. S. dr., **10,** 1292, 1293.

SURVEYS.

By Maj. H. Bache, 1835, **70,** 426.

Under direction of Lt. Col. Woodruff, by A. B. Sears, 1870, **70,** 426.

By Lt. Col. Kurtz, 1874, **74,** ii, 136.

By Col. Macomb, 1878–79, **79,** 441.

From mouth of R. to Delaware RR. br. au. act Mar. 3, 1879, **80,** 98; made, 1880, by Col. Macomb, **81,** 771.

Ex. of p. at mouth of Christiana R. made in 1893 by Maj. Smith, U. S. agent, **93,** 1194.

Ex. of Christiana R. above Wilmington au. act Aug. 17, 1894; made by Maj. Smith, U. S. agent, 1894 (**R.** fav.), **95,** 1148.

Sur. of Christiana R. and Wilmington H. with view to 21′ au. act Aug. 17, 1894; made by Maj. Smith, U. S. agent, 1895 (**R.** fav.; see Projects), **96,** 973.

Sur., 1897–98, by Maj. Smith, U. S. agent, **98,** 1146.

Ex. from Pulp Works to mouth showed rapid shoaling of area dr., **01,** 1336.

Of R., from Delaware R. to draw pier of Phila., Balt. & Wash. RR. cut-off br. No. 4, made by Capt. Sanford, **03,** 174, 993.

Ex. au. Mar. 3, 1909, of Christiana R., from Newport to Christiana. **R.** by Capt. Rand, May 8 1909[2] (unfav.), **10,** 255.

Reex. with view to determining method of adequate imp. at less cost, au. act Feb. 27, 1911. **R.** by BE., Oct. 6, 1911. Existing proj. considered adequate, but most economical method of maintenance is by U. S. dr., to cost $250,000, with $30,000an. for operation, [1]**12,** 330.

Maps. Detail of n. j., **82,** 767; **87,** 828.

I-59 BRANDYWINE RIVER, DEL.

COMMERCE.

Important, **84,** 881, 885.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 139.

In charge. Lt. Col. G. Weitzel, 1884. **R.,** **84,** 879, 882.

Assistants:
E. A. Giesler. **R.,** **84,** 880.
J. H. Dager. **R.,** **84,** 883.

PHYSICAL CHARACTERISTICS.

84, 883.

PLANS.

By Lt. Col. Weitzel, 1883, dr. chan., mouth to Market St. Br., Wilmington, 6′–9′ x 50′–100′; est., $96,525, **84,** 883, 884.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Lt. Col. Weitzel, 1882, **84,** 879.

Sur., 1883, **84,** 882.

I-60 CHESAPEAKE AND DELAWARE CANAL.[3 4]

(See also J535-a.)

APPROPRIATIONS.

Mar. 3, 1825,	$300,000
Mar. 2, 1829,	150,000
Total,	450,000

I-61 APPOQUINIMINK RIVER, DEL.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1161.
1892,	5,000,	**92,** 951.
1894,	5,000,	**95,** 1114.
1896,	5,000,	**96,** 947.
1899,	5,000,	**99,** 1375.
1902	*3,000,	**03,** 996.
	*4,000,	**04,** 1240.
1905,	*5,500,	**05,** 1110, 1111.
1907	*5,000,	**07,** 1124.
	*100,	**07,** 1124.
1909,	*5,000,	**09,** 1173.
1910,	*6,000,	**10,** 1297.
1911,	*5,000,	**11,** 1387.
1912,	*3,500,	**12,** 1608.
Total,	62,100	($62,246.91, sales incl., etc., **12,** 1608).

COMMERCE.

At 1911, 31,000+t. Traffic rates apparently not affected by imp. of R., but passenger business increased, **12,** 314.

CONTRACTS.

1891. F. C. Somers, dr., 19¢ c. y., **91,** 1162.

1892. F. C. Somers, dr., 11¢ c. y., p. m., **93,** 1198.

1895. F. L. Somers, dr., 12.7¢ c. y., p. m., **95,** 1115. (Contract annulled July 27, 1896, **97,** 1261.)

1897. Egan & Bochman, dr., 10¢ c. y., p. m., **97,** 1262.

1899. River & Harbor Improvement Co., dr., 12¢ c. y., p. m., **00,** 1634.

1902. Atlas Dredging Co., dr., 14¢ c. y., p. m., **03,** 995.

1904. Houston-Rickards Dredging Co., dr., 15.4¢ c. y., p. m., **05,** 1110.

1905. River & Harbor Improvement Co., dr., 9⅞¢ c. y., p. m., in making cut-off through neck on left bank of R. halfway between mouth and Odessa, **06,** 1061.

1907. Rickards Dredging Co., dr., 14½¢ c. y., p. m., **07,** 1124.

1909. Pennsylvania Dredging Co., dr., 12¢ c. y., p. m., **10,** 1297.

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[1] H. D. 359, 62d, 2d.
[2] H. D. 399, 61st, 2d.
[3] First, for 1,500 shares of canal company, and again for 750 shares. (Treas. Doc. 373, 1882.)
[4] See also p. 477.
*From app. Appoquinimink, Murderkill, and Mispillion Rs., Del.

1910. Rickards Dredging Co., dr., 12.8¢ c. y., p. m., **10,** 1297.
1911. River & Harbor Improvement Co., dr., 12.8¢ c. y., p. m., **11,** 1388.
1912. River & Harbor Improvement Co., dr., 16¢ c. y., p. m., **12,** 1608.

ENGINEERS.

Chief of Engineers. **R., 81,** 129; **89,** 112; **90,** 102; **91,** 121; **92,** 121; **93,** 131; **94,** 119; **95,** 135; **96,** 124; **97,** 158; **98,** 161; **99,** 185; **00,** 211; **01,** 250; **02,** 186; **03,** 175; **04,** 168; **05,** 175; **06,** 187; **07,** 198; **08,** 208; **09,** 214; **10,** 243; **11,** 263; **12,** 313;

In charge:
Col. J. N. Macomb. **R., 81,** 826.
Maj. W. F. Smith, U. S. agent, 1890–1900. **R., 90,** 943; **91,** 1161; **92,** 950; **93,** 1197; **94,** 875; **95,** 1114; **96,** 946; **97,** 1261; **98,** 1149; **99,** 1374; **00,** 1633.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1339.
Col. Jared A. Smith, 1902–03. **R., 02,** 1055.
Capt. J. C. Sanford, 1903–04. **R., 03,** 995.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1240; **05,** 1110; (Maj.) **06,** 1060; **07,** 1123; **08,** 1164.
Maj. Herbert Deakyne, 1908; **09,** 199.
Capt. L. H. Rand, 1908–10. **R., 09,** 1172.
Maj. R. R. Raymond, 1910–. **R., 10,** 1295; **11,** 1386; **12,** 1606.

Assistants:
W. S. Edwards. **R., 81,** 826.
A. Stierle. **R., 90,** 943.

LEGAL PROCEEDINGS.

Levy Court, New Castle Co., Del., agrees to build br. over cut-off, without expense to U. S., **05,** 1110.

LEGISLATION.

By the State of Del., giving consent to proposed cutting through or across the public highway, **05,** 1110.

OPERATIONS.

1890-91. 24,985 c. y. dr., **91,** 1161.
1892-93. 38,575 c. y., p. m., dr., **93,** 1197.
1898-99. 60,091 c. y. dr., **99,** 1375.
1899-00. 37,596 c. y. dr., **00,** 1633.
1902-03. 17,510 c. y., p. m., removed and placed ashore above h. w. line, **03,** 995.
1904-05. 21,220 c. y., p. m., removed and deposited on banks above h. w., **05,** 1110.
1905-06. 31,706 c. y., p. m., removed from cut-off, **06,** 1060.
1907-08. 27,367 c. y., p. m., removed from chan. and deposited on the banks above h. w., **08,** 1164.
1909-10. 26,311 c. y., p. m., removed 7′ m. l. w. over a w. of 50′ for 33,000′ downstream from Odessa, **10,** 1296.
1910-11. 6,500 c. y., p. m., dr. and deposited upon adjacent banks above h. w., producing a chan. 60′ at bottom and 7′ d. m. l. w., **11,** 1387.
1911-12. 46,132 c. y., p. m., dr. and deposited on land above h. w., **12,** 1607.

PHYSICAL CHARACTERISTICS.

Details of, **90,** 944.
Max. draft, 1912, 6′ in R. and 4′ across flats at mouth, **12,** 314.

PLANS.

By Col. Macomb, 1880, for imp. of creek by dr. from Odessa to its mouth, 9¼ m., to give 6′ d. m. l. w.; est. cost, $71,382, **81,** 826.

PROJECTS.

By Maj. Smith, 1889, chan. 8′ d. m. l. w., w. 80′, from br. at Odessa to Townsends Wharf, 3¾ m.; w. of 100′ from this wharf to mouth, 5 m.; est., $39,963, **90,** 947.
By Capt. Flagler, dr. shoals from chan., and expend. of allotment of $5,500 in making cut-off No. 4 across the public highway at Fennimores Br., and dr. chan. where required to 7′ x 50′ m. l. w., **05,** 1110.
By Maj. Raymond, inviting attention to need of addl. d. over bar at mouth, **12,** 1607.

SURVEYS.

By W. S. Edwards, 1880, **81,** 826.
Au. act Aug. 11, 1888; made, 1889, by Maj. Smith, **90,** 945.
Act Feb. 27, 1911, au. ex. and sur., **12,** 330.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 315.

I-63 SMYRNA RIVER (Duck Creek), DEL.

APPROPRIATIONS.

1880,	$5,000, **80,** 590.
1881,	3,000, **81,** 788.
1882,	2,000, **82,** 772.
1888,	10,000, **88,** 742.
1890,	5,000, **90,** 924.
1892,	3,000, **92,** 953.
1894,	5,000, **95,** 1116.
1896,	5,000, **96,** 949.
1899,	5,000, **00,** 1636.
1902	[1] 15,000, **02,** 1060.
	[2] *6,000, **04,** 1246.
1905,	[3] 5,365, **05,** 1118, 1119.
1906,	*1,600, **06,** 1067, 1068.
1907	*2,000, **07,** 1131, 1132.
	*2,500, **08,** 1172, 1173.
1909,	*6,500, **09,** 1179.
1910,	25,000, **10,** 252, 1305.
1911,	15,000, **11,** 1395.
Total,	121,965 (less $4,157.37 returned to credit of app., $117,807.63, **12,** 1613).

COMMERCE.

Excellent H. of refuge at Duck Creek, **79,** 471, 473.
Advantages of the imp., **87,** 849.
Imp. has reduced rates 25%, and caused a saving of time in shipment, **10,** 252.

CONTRACTS.

1881. F. Pidgeon, jr., dr., 26½¢ c. y., **81,** 789.
1882. American Dredging Co., dr., 25¢ c. y., **82,** 772.
1883. American Dredging Co., dr., 24¢ c. y., **83,** 627.
1889. F. C. Somers, dr., 19¢ c. y., **89,** 885.
1891. National Dredging Co., dr., 17¢ c. y., **91,** 1164.
1892. C. T. Caler, dr., 13¢ c. y., p. m., **93,** 1199.
1895. F. L. Somers, dr., 12.7¢ c. y., p. m., **95,** 1117. (Contract annulled July 27, 1896, **97,** 1263.)
1896. Haupt & Franklin, dr., 19.7¢ c. y., p. m., **97,** 1265.
1897. Egan & Bochman, dr., 12¢ c. y., p. m., **97,** 1265.
1899. River & Harbor Improvement Co., dr., 12¢ c. y., p. m., **00,** 1636.
1904. Edward F. Fonder, dr., 14⅓¢ c. y., p. m., **05,** 1118.
1905. River & Harbor Improvement Co., dr., 10¢ c. y., p. m., **05,** 1118, 1120.
1906. River & Harbor Improvement Co., dr., 18.4¢ c. y., p. m., **06,** 1068.

[1] No part to be expended until satisfactory title of land required for cross cuts and other portions of imp. shall be obtained without expense to U. S.
[2] For chan. across bar at mouth.
[3] Sec. of War au. to modify plans for cut-offs.
* Allotment.

1907. The Rickards Dredging Co., dr., 16¢ c. y., p. m., **07,** 1132.
1908. The Rickards Dredging Co., dr., 12¢ c. y., p. m., **08,** 1173.
1909. River & Harbor Improvement Co., dr., 17¢ c. y., p. m., **10,** 1304, 1305.

ENGINEERS.

Chief of Engineers. **R., 78,** 63; **79,** 75; **80,** 95; **81,** 124; **82,** 122; **83,** 122; **84,** 131; **85,** 129; **86,** 126; **87,** 89, 97; **88,** 88; **89,** 104; **90,** 94; **91,** 121; **92,** 121; **93,** 131; **94,** 120; **95,** 136; **96,** 124; **97,** 159; **98,** 162; **99,** 187; **00,** 212, 231; **01,** 252, 263, 1361; **02,** 188; **03,** 179; **04,** 174; **05,** 182; **06,** 193; **07,** 205; **08,** 214; **09,** 220; **10,** 250; **11,** 272; **12,** 321.

In charge:
Col. J. N. Macomb, 1878–82, **78,** 63; **79,** 66, 74. **R., 79,** 470; **80,** 590; **81,** 787.
Capt. W. Ludlow, 1882–83. **R., 82,** 772.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 627.
Maj. W. H. Heuer, 1884–85. **R., 84,** 830.
W. F. Smith, U. S. agent, 1885–1901. **R., 85,** 876; **86,** 859; **87,** 831, 847; **88,** 741; **89,** 885; **90,** 923; **91,** 1162; **92,** 951; **93,** 1198; **94,** 876; **95,** 1115; **96,** 948; **97,** 1263; **98,** 1151; **99,** 1376; **00,** 1635; **01,** 1361, 1363.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1340.
Col. Jared A. Smith, 1902. **R., 02,** 1059.
Capt. J. C. Sanford, 1903. **R., 03,** 1000.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1245; **05,** 1118; (Maj.) **06,** 1067; **07,** 1131; **08,** 1172.
Capt. L. H. Rand, 1909. **R., 09,** 1178.
Maj. R. R. Raymond, 1910–. **R., 10,** 1304; **11,** 1395; **12,** 1613.

Assistants:
W. S. Edwards. **R., 79,** 472.
J. N. Odiorne. **R., 83,** 628.
C. Humphreys. **R., 87,** 848, 850.
George W. T. Miller. **R., 01,** 1364.

OPERATIONS.

1880–81. Excavation of chan. 8′ d. with a w. of from 50′–25′ and a l. of 600 yards, **81,** 787.
1882–83. 7,198¾ c. y. dr., **83,** 627.
1888–89. 45,151 c. y. dr., **89,** 885.
1890–91. 13,139 c. y. dr., **91,** 1163.
1891–92. 12,000 c. y. dr., **92,** 951.
1893–94. 19,593 c. y., p. m., dr., **94,** 876.
1895–97. 11,694 c. y., p. m., dr., **96,** 948; **97,** 1264.
1897–98. 28,875 l. f. dr., **98,** 1151.
1899–00. 32,640 c. y. dr., **00,** 1635.
1904–05. Chan. 6′ x 50′ m. l. w., dr. across bar at mouth, **05,** 1118. Work begun on cut-off above Brick Store Landing, 11,978 c. y., p. m., removed, **05,** 1118, 1119.
1905–06. Cut-offs made, shoals removed, and chan. dr. across flats at mouth; total removed, 157,476 c. y., p. m., **06,** 1067. 8,117 c. y., p. m., removed from chan., **06,** 1068.
1906–07. 10,495 c. y., p. m., removed from chan., **07,** 1132.
1907–08. 18,997 c. y., p. m., removed from chan., **08,** 1173.
1909–10. 55,392 c. y., p. m., removed. Dr. from R. deposited upon banks above h. w.; dr. across the flats at mouth, thrown over along s. side of cut, **10,** 1305.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 472, 473.
List of shoals, **79,** 472, 473.
Max. draft, 5′ in R. to Smyrna, and 6′ across flats at mouth, **12,** 322.

PLANS. (See Projects.)

Discussion of plans, for cutting canals to shorten distances and avoid sharp curves, by Col. Macomb; not recom.; considered too costly, **79,** 471–474.
By W. F. Smith, 1887, imp. of chan. over the bar at river's mouth to 7′ l. w. by j. 2,000′ l.; est., $20,000 to $53,300, **87,** 850.

PROJECTS. (See Plans.)

By Col. Macomb, 1879, w. old "cut-off" and removing shoals by dr.; est., $12,000, **79,** 471.
Revised, 1881, by Col. Macomb, excavation of an 8′ chan. through the bar not less than 100′ w.; also for removal of shoals in the creek, making the entire cost of the proj. $24,000, **81,** 124, 788.
By W. F. Smith, 1886, 7′ l. w. navigation to Smyrna, Del., the head of navigation; chan. at the entrance to be 100′ w. and inside the creek 60′ w.; chan. to be protected at the entrance by constr. of a st. j.; est., $90,698.40, **88,** 742; **92,** 952.
By Maj. Smith, 2 cuts to shorten distance between head of navigation and Delaware B.; est., $15,000, **01,** 1361, 1363.

SURVEYS.

Ex. ordered and in progress, 1878, **78,** 63.
Ex. completed by W. S. Edwards, 1879, **79,** 75, 472.
Made, 1880, by Col. Macomb, **81,** 787; ex. au. act Aug. 5, 1886; made by W. F. Smith, U. S. agent (see Projects), **87,** 847, 850.
Pre. ex. made by Maj. Smith, in conformity with act June 6, 1900[1] (**R.** fav.), **01,** 263, 1361, 1363.
Pre. ex. and sur. au. act of Mar. 2, 1907; made by Maj. Flagler,[2] **08,** 217.
Maps.[2]

I-64 LEIPSIC RIVER, DEL.

APPROPRIATIONS.

1910,	$18,500,	**10,** 1306.
1912,	19,600,	**12,** 1614.
Total,	38,100,	**12,** 1614.

COMMERCE.

In 1911, 16,000± t., consisting largely of agricul. prod. and canned goods, **12,** 324.

CONTRACTS.

1911. River & Harbor Improvement Co., dr., 9.7¢ c. y., **11,** 1396.

ENGINEERS.

Chief of Engineers. **R., 84,** 138; **10,** 252, 256; **11,** 274; **12,** 323, 330.

In charge:
Lt. Col. G. Weitzel. **R., 84,** 854.
Capt. L. H. Rand, **10,** 224.
Maj. R. R. Raymond, 1910–. **R., 10,** 1306; **11,** 1396; **12,** 1613.

Assistant. E. A. Giesler. **R., 84,** 854.

OPERATIONS.

1910–11. 8,480 c. y. dr., **11,** 1396.
1911–12. 78,870 c. y. dr., **12,** 1614.

PHYSICAL DATA.

Tidal stream entering Del. B., 10½± m. below Bombay Hook Light at mouth of Smyrna R.
Garrison's mill is head of navigation, 18 m. up; Leipsic is 5½± m. below, **12,** 323.

PROJECTS.

Act June 25, 1910, au. 3 cut-offs, making a chan. 6′ x 50′ between mouth and Leipsic; est., $18,500, **10,** 252; **12,** 324.
Act July 25, 1912, modified proj. 1910, au. making cut-offs numbered 1 and 5, land to be furnished to U. S. free of all claims whatsoever, **12,** 324.

[1] H. D. 90, 56th, 2d.
[2] H. D. 815, 60th, 1st.

Act July 25, 1912, also au. 5′ x 40′ chan., Leipsic to Garrison's mill, incl. one cut-off and a turning basin; est., $19,600, 1st constr., and $1,500 an. mainten.: land to be furnished the U. S. free, and all obstr. at Martins Br. to be removed prior to U. S. commencing work, **12,** 324.

SURVEYS.

Ex. au. act Aug. 2, 1884; made by Lt. Col. Weitzel (**R.** unfav.), **84,** 854.

Pre. ex. and sur. au. act Mar. 3, 1909; made, 1909, by Capt. Rand; **Rs.,** June 24 and Nov. 17, 1909; est., $18,500,[1] **10,** 256.

Pre. ex. au. act Feb. 27, 1911; **Rs.,** Maj. Raymond, June 3 and Dec. 19, 1911; est., $19,600, with $1,500 an. mainten.,[2] **12,** 330.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 324.

Maps.[1]

I-66 MAHON (Harbor) RIVER, DEL.

COMMERCE.

Description of, **95,** 1151.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 112; **95,** 150; **01,** 263, 1358.

In charge. Maj. Smith, U. S. agent, 1889–95. **R.,** **89,** 908; **95,** 1149; **01,** 1358.

Assistant. A. Stierle. **R.,** **89,** 909; **95,** 1150.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 909; **95,** 1150.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Smith (**R.** unfav.), **89,** 908.

Ex. au. act Aug. 17, 1894; made by Maj. Smith, 1894 (**R.** unfav.), **95,** 1149.

Ex. au. act June 6, 1900. **R.,** Maj. Smith (unfav.),[3] **01,** 263, 1358.

I-67 LITTLE RIVER (Creek), DEL.

APPROPRIATIONS.

1912, $14,000, **12,** 1613.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 98; **81,** 129; **06,** 195; **08,** 217; **12,** 321, 330.

In charge:

Col. J. N. Macomb. **R.,** **81,** 829.

Maj. C. A. F. Flagler, 1906–08. **06,** 177; **08,** 149.

Maj. R. R. Raymond, 1912–. **R.,** **12,** 1613.

BERH. (See Surveys.)

Assistant. W. S. Edwards. **R.,** **81,** 829.

PLANS.

By Col. Macomb, 1880, chan. mouth to Little Creek Landing, 3½ m. x 6′ x 40′, with 4 short canals across sharp bends in the creek; est., $17,200, **81,** 830.

PHYSICAL DATA.

Tidal stream, 8 m. l., emptying into Del. B., 70± m. below Phila. Town of Little Creek, 3½ m. above mouth, the head of navigation. For other P. D. details, see **12,** 321.[4 5 6]

PROJECTS.

Act July 25, 1912, au. chan. 5′ x 40′, increased to 60′ across flats at mouth, incl. 5 cut-offs; est., $14,000, with $1,000 an. mainten.,[4] **12,** 321.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Macomb, **81,** 829.

Pre. ex. of St. Jones and Little Rs., Del., for connecting same by canal; **R.,** Maj. Flagler, Nov 9, 1905 (unfav.)[5], **06,** 195.

Pre. ex. au. act Mar. 3, 1907, by Maj. Flagler **R.,** May 6, 1907 (unfav.),[6] **08,** 217.

Supple. **R.** by BERH., Oct. 26, 1908. Concur in former opinion C. insufficient to warrant imp.[7]

Pre. ex. and sur. au. act Feb. 27, 1911; **R.,** Maj. Raymond, 1911 and 1912; est., $14,000, with $1,000 an. mainten.,[4] **12,** 330.

I-68 ST. JONES RIVER, DEL.

APPROPRIATIONS.

1881,	$5,000,	**81,** 799.
1884,	10,000,	**84,** 835.
1886,	10,000,	**86,** 861.
1888,	15,000,	**88,** 743.
1894,	[8] 1,500,	**95,** 1118.
1900,	*3,500,	**01,** 1344.
1902,	*4,500,	**04,** 1245.
1905,	*9,650,	**06,** 1065, 1066.
1907	3,000,	**07,** 1130.
	*3,000,	**08,** 1171.
1909,	*7,000,	**09,** 1177.
1910,	25,000,	**10,** 250, 1303.
1911,	11,700,	**11,** 1394.
Total,	108,850 (less $1,593.50 returned to Treas., $107,256.50, **12,** 1612).	

COMMERCE.

Reduction in rates consequent upon imp., **88,** 743.

Description of, **93,** 1231; **97,** 1291; **00,** 1663.

Not likely that C. will exceed at any time that done in 1892, amounting to $1,201,565, **93,** 1231.

Rates reduced one-fourth to one-half, **11,** 271.

Shipments increasing, especially fruit, **11,** 271.

1910, 121,871 t., **11,** 271; 1911, 100,154 t.; value, $5,876,550, **12,** 320.

CONTRACTS.

1884. T. Draper, dr., 15¾¢ c. y., **85,** 877.

1886. American Dredging Co., 12¢ c. y., **87,** 832.

1889. F. C. Somers, dr., 18¢ c. y., and for placing fender piles, $8 l. f., **89,** 888.

1895. F. L. Somers, dr., 12.7¢ c. y., p. m., **95,** 1119.

1900. Atlas Dredging Co., dr., 12¢ c. y., p. m., **01,** 1344.

1904. Wilmington Dredging Co., dr., 14¢ c. y., p. m., **05,** 1116.

1906. Houston-Rickards Dredging Co., dr., 8¾¢ c. y., p. m., **06,** 1066.

1907. Rickards Dredging Co., dr., 16¢ c. y., p. m., **07,** 1130.

1908. Rickards Dredging Co., dr., 10¢ c. y., p. m., **08,** 1171.

1909. River & Harbor Improvement Co., dr., 13.9¢ c. y., p. m., **10,** 1302.

1910. River & Harbor Improvement Co., dr., 11.8¢ c. y., p. m., **10,** 1304.

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[1] H. D. 574, 61st, 2d.
[2] H. D. 647, 62d, 2d.
[3] H. D. 72, 56th, 2d.
[4] H. D. 626, 62d, 2d.
[5] H. D. 133, 59th, 1st.
[6] H. D. 78, 60th, 1st.
[7] Comm. D. 49, 61st, 2d.
[8] Allotted from 1894 app. of $6,500 for Murderkill R.
*Allotment.

ENGINEERS.

Chief of Engineers. R., 80, 98; **81,** 126, 129; **82,** 124; **83,** 125; **84,** 133; **85,** 129; **86,** 126; **87,** 89; **88,** 89; **89,** 104; **90,** 95; **91,** 122; **93,** 143; **97,** 171; **99,** 202; **00,** 230; **01,** 256; **03,** 177; **04,** 173; **05,** 181, 182; **06,** 191; **07,** 203; **08,** 213; **09,** 219; **10,** 248; **11,** 270; **12,** 319.

In charge:
Col. J. N. Macomb, 1880–82. **R., 81,** 799.
Capt. W. Ludlow, 1882–83. **R., 82,** 779.
Lt. Col. G. Weitzel, 1883–84. **R., 83,** 636.
Maj. W. H. Heuer, 1884–85. **R., 84,** 835.
W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 877; **86,** 860; **87,** 831; **88,** 742; (Maj.) **89,** 887; **90,** 925; **91,** 1165; **93,** 1229; **97,** 1290; **00,** 1662, 1664.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1343.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1245; **05,** 1116; (Maj.) **06,** 1065; **07,** 1129; **08,** 1170.
Capt. L. H. Rand, 1909. **R., 09,** 1177.
Maj. R. R. Raymond, 1910–. **R., 10,** 1302; **11,** 1394; **12,** 1612.

Assistants:
Capt. W. Ludlow. **R., 81,** 800.
W. S. Edwards. **R., 81,** 802.
J. N. Odiorne. **R., 83,** 638.
J. M. Stewart. **R., 84,** 835.
A. Stierle. **R., 93,** 1230.

LEGAL PROCEEDINGS.

Title papers for land required for cut-offs submitted, **12,** 320.

OPERATIONS.

1884–85. Work of dr. and straightening chan. commenced, **85,** 877.
1885–86. 54,128 c. y. dr. from Cherry Bend and Dover cut-offs and at Cypress Pt. and Broad Reach Shoal, **86,** 861.
1886–87. 55,838 c. y. dr. from chan., **87,** 832.
1887–88. 5,482 c. y. dr. from chan. and bar at entrance, **88,** 742.
1889–90. 58,015 c. y. dr., **90,** 925.
1895–96. 9,798 c. y., p. m., dr., **96,** 951.
1900–01. 22,960 c. y. removed, **01,** 1344.
1902–03. $1,500 from app. of Aug. 18, 1894, expend. in removing shoal at mouth, **03,** 177.
1904–05. 26,615 c. y., p. m., removed from shoals in R. and chan. across flats at mouth, **05,** 1116, 1117.
1905–06. 41,625 c. y., p. m., removed, **06,** 1066.
1906–07. 83,504 c. y., p. m., removed from shoals in R. and chan. across flats at mouth, completing contract; 2,130 c. y., p. m., removed from R. and from chan. across bar at mouth, **07,** 1130.
1907–08. 15,434 c. y., p. m., removed from R. and from across flats at mouth, completing contract, **08,** 1170. 3,099 c. y., p. m., removed from across flats at mouth, **08,** 1171.
1908–09. 16,832 c. y., p. m., removed from R. and from mouth to 6′ in Delaware B., **09,** 1177.
1909–10. 11,501 c. y., p. m., removed, resulting in a chan. across the flats 7′ x 40′ m. l. w., **10,** 1303. 24,917 c. y., p. m., removed, resulting in a chan. 7′ x 50′ m. l. w. to 6′ curve in Delaware B., **10,** 1302.
1910–11. 24,000 c. y., p. m., dr. from bar at mouth and from 5 shoals, **11,** 1394.

PHYSICAL CHARACTERISTICS.

Description, **81,** 801; **93,** 1230; **12,** 319, 320.

PROJECTS.

By Col. Macomb, 1881, chan. through bar at the river's mouth and at other points to 3′ m. l. w., with a w. of 200′–250′; also constr. of 3,300 l. f. of j. at entrance; est., $35,000, **81,** 799, 801; **87,** 831.
Imp. completed, 1891, after an expend. of $40,000, **91,** 1165.
By Maj. Smith, U. S. agent, 1894, dr. cut 6′ x 60′ m. l. w., across bar and obstrs. at mouth, **95,** 1118.
Maj. Smith, U. S. agent, est., 1899, it would cost, incl. contingencies, $47,074.50 for 7′ chan. to Lebanon, **00,** 1665.
Congress au. m. l. w. d. of 7′, Dover to 7′ in Delaware B., with bottom w. of 100′ on flats outside the mouth, 50′ from mouth to Lebanon, 40′ from Lebanon to Dover, w. sharp bends, incl. necessary cut-offs, and constr. of 5,000 l. f. of j.; est., $181,425,[1] **10,** 250.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Macomb, **81,** 801.
Ex. au. act July 13, 1892; made by Maj. Smith, US. agent, 1892 (**R.** fav.), **93,** 1229.
Ex. au. act June 3, 1896; **R.** (fav. to limited imp.) submitted by Maj. Smith, U. S. agent, 1896, **97,** 1290.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Maj. Smith, U. S. agent (**R.** fav.; see Projects), **00,** 1663, 1664.
Pre. ex. au. act Mar. 3, 1905; made, 1905, by Maj. Flagler, with view to connecting same with Little R. at or near Dover by a canal, or by diverting one of said streams[2] (**R.** unfav.), **06,** 195, 1065, 1066.
Pre. ex. and sur., mouth to Dover, au. act Mar. 2, 1907; made, and a plan for imp. presented by Maj. Flagler; est., $181,425,[1] **08,** 218, 1171; **09,** 224.
Maps.[1]

I-69 MURDERKILL RIVER, DEL.

APPROPRIATIONS.

1892,	$7,000,	**93,** 1201.
1894,	[3] 6,500,	**95,** 1119.
1896,	6,500,	**96,** 951.
1899,	5,000,	**99,** 1378.
1902,	*2,000,	**03,** 996, 997.
1904,	*5,500,	**04,** 1241, 1242.
1905	*5,500,	**05,** 1112, 1113.
	*3,860,	**06,** 1062.
1907	*8,000,	**07,** 1126.
	*3,000,	**08,** 1166, 1167.
1909,	*7,000,	**09,** 1174.
1910,	*15,000,	**10,** 1299.
1911,	*5,000,	**11,** 1390.
1912,	*3,000,	**12,** 1610.
Total,	82,860 (less $1,500 expend. at mouth of St. Jones R. and $409.01 returned to Treas., $80,950.99, **12,** 1610).	

COMMERCE.

Water rates 25 to 50% lower than by rail; rail rates increased in winter when boats can not run, **11,** 266.
In 1910 amounted to 35,173 t.; value, $1,437,200, **12,** 316.

CONTRACTS.

1892. C. T. Caler, dr., 13¢ c. y., p. m., **93,** 1201.
1895. F. L. Somers, dr., $12\frac{7}{10}$¢ c. y., p. m., **95,** 1119.
1896. Atlas Dredging Co., dr., $17\frac{5}{10}$¢ c. y., p. m., **97,** 1267.
1899. River & Harbor Improvement Co., dr., 12¢ c. y., p. m., **00,** 1638.
1902. Atlas Dredging Co., dr., 13¢ c. y., p. m., **03,** 996.
1904. Wilmington Dredging Co., dr., 15¢ c. y., p. m., **05,** 1112.
1905. Houston-Rickards Dredging Co., dr., $9\frac{7}{8}$¢ c. y., p. m., **05,** 1113.
1906. River & Harbor Improvement Co., dr., 16¢ c. y., p. m., **06,** 1062.
1907. The Rickards Dredging Co., dr., 14¢ c. y., p. m., **07,** 1126.
1908. Pennsylvania Dredging Co., dr., 9.4¢ c. y., p. m., **08,** 1167.
1910. River & Harbor Improvement Co., dr., 12.9¢ c. y., p. m.; dr., 10.9¢ c. y., p. m., to be done in conjunction with dr. on St. Jones R., **10,** 1299.

[1] H. D. 1116, 60th, 2d.
[2] H. D. 133, 59th, 1st.
[3] $1,500 to be used for removal of shoal at mouth of St. Jones R.
* Allotment.

1911. The Rickards Dredging Co., dr., 9.8¢ c. y., **11,** 1390.
1912. River & Harbor Improvement Co., dr.,, 11¢ c. y., **12,** 1610.

ENGINEERS.

Chief of Engineers. **R., 81,** 129; **82,** 126; **92,** 131; **93,** 132; **94,** 121; **95,** 137; **96,** 125; **97,** 160; **98,** 163; **99,** 188; **00,** 213; **01,** 254; **02,** 186; **03,** 176; **04,** 170; **05,** 177; **06,** 188; **07,** 199; **08,** 209; **09,** 216; **10,** 244; **11,** 265; **12,** 315.

In charge:

Capt. W. Ludlow. **R., 82,** 817.
Maj. Smith, U.S. agent, 1890–1900. **R., 92,** 981, 983; **93,** 1200; **94,** 879; **95,** 1118; **96,** 950; **97,** 1266; **98,** 1152; **99,** 1378; **00,** 1637.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1342.
Col. Jared A. Smith, 1902. **R., 02,** 1057.
Capt. J. C. Sanford, 1903. **R., 03,** 996.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1241; **05,** 1112; (Maj.) **06,** 1061; **07,** 1125; **08,** 1166.
Capt. L. H. Rand, 1909. **R., 09,** 1174.
Maj. R. R. Raymond, 1910–. **R., 10,** 1298; **11,** 1388; **12,** 1609.

Assistants:

E. A. Gieseler. **R., 82,** 819.
A. Stierle. **R., 92,** 982, 985.

OPERATIONS.

1892-93. 2,350 c. y., p. m., dr., **93,** 1200.
1893-94. 45,454 c. y., p. m., dr., **94,** 879.
1894-95. 21,411 c. y., p. m., dr., **95,** 1119.
1895-96. 21,020 c. y., p. m. (9,798 c. y. from St. Jones R.), dr., **96,** 951.
1896-97. 24,425 c. y., p. m., dr., **97,** 1266.
1899-00. 34,367 c. y. dr., **00,** 1637.
1902-03. 13,782 c. y., p. m., removed, **03,** 997.
1904-05. 30,483 c. y., p. m., removed, **05,** 1112.
1905-06. 46,811 c. y., p. m., removed from shoals and cut across flats at mouth, **06,** 1062. 20,145 c. y., p. m., removed, 15,718 c. y., p. m., of which was dr. across flats, **06,** 1062.
1907-08. 45,162 c. y., p. m., removed from chan. in R. and across flats at mouth, **08,** 1166. 220 c. y., p. m., removed, **08,** 1166.
1908-09. Entire amount removed from chan. in R. and across flats at mouth, 27,917 c. y., p. m., **09,** 1174.
1909-10. 32,792 c. y., p. m., removed, giving a continuous chan. 6′ x 50′ m. l. w., Frederica to the 6′ curve in Delaware B.; work completed; 23,476 c. y., p. m., addl. removed, **10,** 1298.
1910-11. 3,828 c. y. dr., completing old contract; 32,891 c. y. dr. under new contract, **11,** 1389.
1911-12. 100,009 c. y. dr., completing old contract; 38,433 c. y. dr. under new contract, **12,** 1609. About 64% proj. done.

PHYSICAL CHARACTERISTICS.

Creek described, **82,** 819; **92,** 985.
Chan. d., 7′, **12,** 316.
Tidal stream, flowing through Kent Co. to Delaware B., Del.; nav. for 9 m., **12,** 315.

PLANS. (See Projects.)

By Capt. Ludlow, 1882, imp. of entrance to creek and dr. Webbs Landing to mouth to obtain l.-w. chan. 4′ d.; est., $72,000 to $89,000, **82,** 818.

PROJECTS. (See Plans.)

By Maj. Smith, 1891, chan. 7′ d. l. w., Frederica to the 7′ curve in Delaware B., 80′ w. down to the mouth, and 150′ w. at the bottom and 250′ w. at top from the mouth to the 7′ curve in the B., the cut at the mouth to be protected by an embankment of the dr. material on either side to height of 2′ above high spring tides; est., $47,550, **92,** 984.

By Maj. Smith, 1894–95, cut 7′ x 40′ m. l. w. at the shoals and bars forming the most serious obstr. to navigation, to include a cut-off at Lower Landing, and for dr. cut 6′ x 60′ m. l. w. across the bar and obstr. at the mouth of the St. Jones R., **95,** 1118.

See Appr. for amounts used for mainten.; 1910–11 Sec. War. au. allotment of $15,000 for imp. and mainten.

By Maj. Raymond, j. at mouth; est., $66,000, and cut-off in R., **10,** 246, 1298, 1299.

SURVEYS.

Ex. au. act Mar. 3, 1881; made by Capt. Ludlow, **82,** 817.
Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Smith, **92,** 983.
Ex. and sur. au. act Feb. 27, 1911; **R.** to come, **12,** 330.

I-70 MISPILLION CREEK (River), DEL.

PPROPRIATIONS.

1879,	$3,000, **79,** 73.
1880,	4,000, **80,** 589.
1881,	3,500, **81,** 786.
1882,	3,000, **82,** 769.
1888,	3,500, **88,** 744.
1892,	12,000, **92,** 954.
1894,	10,000, **95,** 1122.
1899,	2,500, **99,** 1380.
1900,	*1,050, **01,** 1346.
1902	*10,000, **03,** 998, 999.
	*5,300, **04,** 1243, 1244.
1904,	*1,800, **05,** 1114, 1115.
1905	*9,000, **05,** 1114, 1115.
	*10,000, **06,** 1064.
1907,	*40,000, **07,** 1128.
1909,	*7,000, **09,** 1176.
1910,	*39,000, **10,** 1301.
1911,	*5,000, **11,** 1393.
1912,	*6,000, **12,** 1611.
Total,	175,650

COMMERCE.

Shipbuilding, **79,** 469.
Benefit of imp., **82,** 769.
In 1896–97, $835,995, **97,** 1293.
Important shipbuilding interests; C. valued at $1,902,480, **01,** 1369.
Imp. reduced freight rates 25%, **10,** 248; **12,** 318.
In 1910, 191,745 t. (none obtainable for 1911), **12,** 318.

CONTRACTS.

1879. American Dredging Co., dr., 35¢ c. y., **80,** 589.
1880. American Dredging Co., dr., 45¢ c. y., **81,** 785.
1881. F. Pidgeon, jr., dr., 43¢ c. y., **81,** 786.
1882. F. Pidgeon, dr., 43¢ c. y., **82,** 769. American Dredging Co., dr., 44¢ c. y., **83,** 625.
1888. F. C. Somers, dr., 35¢ c. y., **89,** 889.
1892. C. T. Caler, dr., 13¢ c. y., p. m., **93,** 1202.
1893. Sanford & Brooks, dike constr., $8.90 l. f., **94,** 883.
1895. F. L. Somers, dr., 12.7¢ c. y., p. m., **95,** 1122. Sweeten & Co., crib-dike constr., $2.06 l. f.; $12.57 vertical f. of crib foundation, **96,** 953.
1897. B. T. Collins, brush mattress, $1.28 c. y., p. m.; st., $2.60 c. y., p. m., **97,** 1269. Egan & Bochman, dr., 18¢ c. y., p. m., **97,** 1269.
1899. B. T. Collins, j. constr., Sand Pt. j., $3.59 l. f.; Green Pt. j., $3.90 l. f., **00,** 1640.
1901. Wilson M. Vinyard, removal of crib dike at mouth of R. for $876, **01,** 1345.
1902. Atlas Dredging Co., dr., 16¢ c. y., p. m., **03,** 998.
1903. Benjamin F. Collins, j. across bar; brush, $3 cord; st., $3 c. y.; piles, 15¢ l. f.; timber, $40 M f., b. m.; bolts and washers, 4¢ lb., **03,** 999.
1904. Christiana Construction Co., filling with st., gap between pile j. at Sand Pt. and inner end of new j., $3 c. y., p. m.; Wilmington Dredging Co., dr., 15.4¢ c. y., p. m.; Wilmington Dredging Co. (supple.), dr. at mouth, 15.4¢ c. y., p. m., **05,** 1114.

*Allotment.

1905. Charles P. Grim, dr., 11¢ c. y., p. m.; Franklin K. Wills, j. work, $6.68 l. f. for extension and $3.73 l. f. for repairs, **06,** 1063, 1065.

1906. Pennsylvania Dredging Co., dr., 9.9¢ c. y., p. m., **06,** 1064, 1065. Tatnall-Brown Co., extension of Green Pt. j., $7.50 l. f., **07,** 1128.

1907. Tatnall-Brown Co., j. constr., $10.35 l. f. For repairs in place: Lumber, incl. spikes, etc., $60 M f., b. m.; st., $4 c. y.; brush, $5 cord, **07,** 1027, 1028.

1908. River & Harbor Improvement Co., dr., 12.2¢ c. y., p. m., **08,** 1168, 1169.

1909. Pennsylvania Dredging Co., dr., 20¢ c. y., p. m., **10,** 1301.

1910. Rickards Dredging Co., dr., 15¢ c. y., p. m., **10,** 1301. Rickards Dredging Co., dr., 11¢ c. y., **11,** 1393.

1911. Tatnall-Brown Co., j. constr. and repairs, $10.45 l. f. for j. constr., and $4 c. y. for st. in place for repairs, **11,** 1393. Tatnall-Brown Co., j. constr., $12.35 l. f., **12,** 1612.

ENGINEERS.

Chief of Engineers. R., 78, 63; **79,** 73, 75; **80,** 95; **81,** 123, 129; **82,** 121; **83,** 121; **84,** 131; **85,** 130; **86,** 127; **87,** 90; **88,** 90; **89,** 105; **90,** 96; **91,** 122, 132; **92,** 122, 131; **93,** 132; **94,** 122; **95,** 138; **96,** 126; **97,** 161, 171; **98,** 164; **99,** 189; **00,** 215, 231; **01,** 257, 264, 1365, 1367; **02,** 186, 187; **03,** 178; **04,** 171; **05,** 178; **06,** 190; **07,** 201; **08,** 211; **09,** 214; 217; **10,** 246; **11,** 267; **12,** 317.

In charge:
Col. J. N. Macomb, 1879–81. **R., 79,** 467; **80,** 587; **81,** 785.
Capt. W. Ludlow, 1881–82. **R., 82,** 768.
Lt. Col. G. Weitzel, 1882–84. **R., 83,** 625.
Maj. W. H. Heuer 1884. **R., 84,** 829.
W. F. Smith, U. S. agent, 1884–1900. **R., 85,** 878; **86,** 861; **87,** 833; **88,** 743; (Maj.) **89,** 889; **90,** 927; **91,** 1166; **92,** 953, 988, 990; **93,** 1201; **94,** 881; **95,** 1120; **96,** 952; **97,** 1268, 1291; **98,** 1154; **99,** 1379; **00,** 1639; **01,** 1365, 1368.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1345
Col. Jared A. Smith, 1902. **R., 02,** 1058.
Capt. J. C. Sanford, 1903. **R., 03,** 998.
Capt. C. A. F. Flagler, 1904–08. **R., 04,** 1243; **05,** 1114; (Maj.) **06,** 1063; **07,** 1127; **08,** 1168.
Capt. L. H. Rand, 1909. **R., 09,** 1175.
Maj. R. R. Raymond, 1910–. **R., 10,** 1300; **11,** 1391; **12,** 1610.

Assistants:
W. S. Edwards. **R., 79,** 468.
J. N. Odiorne. **R., 83,** 626.
A. Stierle. **R., 92,** 989, 991.
George W. T. Miller. **R., 01,** 1370.

OPERATIONS.

1879–80. 7,340 c. y. dr., **80,** 588.
1880–81. 7,580 c. y. dr., **81,** 785.
1881–82. 6,343 c. y. dr., **82,** 768.
1882–83. 5,720 c. y. dr., **83,** 626.
1888–89. 8,646 c. y. dr., **89,** 889.
1892–93. 6,829 c. y., p. m., dr., **93,** 1202.
1893–94. 500 l. f. pile dike constr.; 23,500 c. y., p. m., dr., **94,** 881.
1895–96. Crib dike 350′ l. completed; 12,360 c. y., p. m., dr., **96,** 953.
1897–98. 200′ pile dike constr.; 6,254 c. y., p. m., dr., **98,** 1154.
1899–00. Sand Pt. and Green Pt. js. constr., **00,** 1639.
1900–01. Crib dike at mouth removed, **01,** 1346.
1902–03. 23,383.8 c. y., p. m., removed, of which 11,215.9 c. y. was charged to U. S., the excess representing w. dr. beyond that required by specifications; 720 l. f. piling driven for j. across bar, **03,** 998.
1903–04. J. consisting of a double row of piles 12′ apart, filled with brush and st., extending 805 l. f. from end of old st. dike, completed, **04,** 1243.
1904–05. 313 c. y., p. m., deposited in gap between js.; 31,207 c. y., p. m., removed from R. and from across flats in the B., **05,** 1114.
1905–06. 20,103 c. y., p. m., removed from across flats at mouth of R., and 18,666 c. y., p. m., from shoals in R.; j. extended 381.75 l. f., existing j. repaired and sheathed for 203 l. f.; 13,665 c. y., p. m., removed from chan. across flats, **06,** 1063, 1064.
1906–07. 22,368 c. y., p. m., removed from chan. across flats at mouth of R.; 22,456 c. y., p. m., dr. from R.; Green Pt. j. extended 511.2 l. f.; 160 piles driven, 170′ of waling placed, and 84′ of repairs to n. j. completed, **07,** 1127.
1907–08. Brush and st. j. 2,200′ l. constr. as extension of s. j.; repairs to n. j. made at cost of $350, **08,** 1168. 21,093 c. y., p. m., removed from outer end of s. j., middle ground in front of Mispillion Lighthouse, and chan of R., **08,** 1168, 1169.
1908–09. 5,558 c. y., p. m., removed from chan. in R. and at mouth, resulting in chan. 5′ x 50′ from 4′ curve in Delaware B. to lighthouse, and 6′ x 40′ thence to Milford, **09,** 1175.
1909–10. 10,738 c. y., p. m., dr. from R., and 20,911 c. y., p. m., dr. from across flats at mouth, producing a chan. 6′ x 50′ in R. from Milford to mouth, and a chan. 4′ x 150′ across flats at mouth, **10,** 1300.
1910–11. 137,858 c. y. dr.; 426 l. f. j. constr.; 48 c. y. st. placed for repairs, **11,** 1392.
1911–12. 1,374.5 l. f. st. j. constr.; st. filling placed for repairs; 400′ n. side j. extended, completing work, **12,** 1611.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 468, 469; **97,** 1292.
List of obstr., **79,** 468.
Tidal observations, **79,** 469.
Water d., 6′ in R., 4′ across flats at mouth, **12,** 318.
Tidal stream entering Delaware B., 17± m. nw. of Cape Henlopen; navigable for 12± m., **12,** 317.

PLANS. (See Projects.)

By Col. Macomb, 1879, cut-off canals connecting the deeper bends; canals aggregating 20,336 l. f., with a section of 10′ x 30′; est., $30,892. Plan too costly as compared with results to be obtained, **79,** 467, 468, 470.

PROJECTS. (See Plans.)

By Col. Macomb, 1879, l.-w. chan., Milford to the bar at mouth, 6′ x 40′, with repairs to pile structures at mouth to prevent littoral sand drift; est., $10,000, **79,** 467.

By Lt. Col. Weitzel, 1883, 4′ l.-w. chan. through bar at mouth; est., $55,000, making, together with $3,500 for completion of former proj., $58,500, **83,** 625, 626.

By Maj. Smith, 1891, chan. 6′ x 150′ m. l. w. outlet of R. in a se. direction to the 6′ d. in Delaware B., cut to be protected by a wall of dr. material along its n. side; est., $24,000, **22,** 991.

By Maj. Smith, 1893–94, dike at n. side of entrance to R. to protect proposed dr. in that locality; est., $5,000, **94,** 881.

By Maj. Smith, 1894–95, deflecting crib dike about 350′ l. on the s. side of chan. from h. w. near the lighthouse, and for completion of dr. only to end of dike completed on the n. side of chan. in 1893; est., $4,600, **95,** 1121.

By Maj. Flagler, dr. chan. 4′ x 40′ m. l. w., Milford to mouth, and 5′ x 50′ across flats at mouth, **06,** 1064.

By Maj. Smith, au. act Mar. 2, 1907, dr. chan, 6′ x 60′ m. l. w., increasing to 75′ at sh arp turns Milford to mouth, thence 4′ x 150′ across flats, and constr. of j. along s. side of chan.; est., $87,065,[1] **01,** 1369; **07,** 202.

By Maj. Raymond, to increase d. across flats at mouth to 6′, **10,** 1301.

SURVEYS.

Ex. au. and in progress, **78,** 63; completed by W. S. Edwards, **79,** 75, 468.

Au. act Mar. 3, 1881; made, 1882, by Capt. Ludlow, **82,** 769.

[1] H. D. 102, 56th, 2d.

Sur. for a canal to shorten distance to B. au. act Sept. 19, 1890; made, 1891, by Maj. Smith, **92,** 990.
Ex. au. act June 3, 1896; made by Maj. Smith, 1896 (**R.** fav.), **97,** 1291.
Ex. and sur., mouth to head of navigation, au. act June 6, 1900; made by Maj. Smith (**R.** fav.),[1] **01,** 1346, 1365, 1368.

Pre. ex. au. act Feb. 27, 1911. **R.,** Maj. Raymond, June 2 and Nov. 28, 1911; est., $70,400, 1st constr., with $5,000 an. mainten.,[2] **12,** 330.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 319.
Maps.[2]

I-71 CEDAR CREEK, DEL.

COMMERCE.

An. C., 1896, $51,900, **97,** 1294.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 171.
In charge. Maj. W. F. Smith, U. S. agent, 1896. **R.,** **97,** 1293.

PHYSICAL CHARACTERISTICS.

Description of; creek is in e. section of Sussex Co.; flows in ne. direction into Delaware B. at point 16 m. nw. of Cape Henlopen Lighthouse, **97,** 1294.

SURVEY.

Ex. au. act June 3, 1896; **R.** (unfav.), 1896, by Maj. Smith, **97,** 1293.

I-72 PRIME HOOK CREEK, DEL.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 112.
In charge. Maj. W. F. Smith, U.S. agent, 1888. **R.,** **89,** 905.
Assistant. A. Stierle. **R.,** **89,** 905.

PHYSICAL CHARACTERISTICS.

Description of; in Sussex Co., Del.; about 9½ m. l., with little or no outlet, at or near 8½ m. ne. of Cape Henlopen Light, **89,** 906.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Smith, U. S. agent (**R.** unfav.), **89,** 905.

I-73 BROADKILL (River) CREEK, DEL.

APPROPRIATIONS.

1873,	$10,000,	**73,** 82, 871.
1880,	5,000,	**80,** 587.
1881,	5,000,	**81,** 780.
1882,	5,000,	**82,** 768.
1888,	10,000,	**88,** 744.
1907,	33,330,	**07,** 1134.
1908,	*7,700,	**09,** 1181.
1909,	*3,000,	**09,** 1181.
1910,	5,000,	**10,** 1307.
1911,	10,000,	**11,** 1397, 1398.
1912,	5,000,	**12,** 1616.
Total,	99,030	($98,962.67, incl. sales and returned to Treas., **12,** 1616).

COMMERCE.

Description of, **93,** 1233; **95,** 1153; **11,** 276.
Tonnage using the R., 1895, 1,523 t., **95,** 1153.
Rates are about two-thirds of those by rail, **10,** 253.
Tonnage, 1910, 10,929 t., **12,** 325.

CONTRACTS.

1874. American Dredging Co., dr., 30¢ c. y., **74,** ii, 143.
1885. American Dredging Co., dr., 12¢ c. y., **86,** 863.
1889. American Dredging Co., dr., 7¢ c. y., **90,** 929.
1907. Latta & Terry Construction Co., constr. of j., viz, sec. 1, 230 l. f., $20.20 f.; sec. 2, 500 l. f., $8 f.; sec. 3, 650 l. f., $11.35 f., **08,** 1176. River & Harbor Improvement Co., dr. (about 90,000 c. y.), 19.2¢ c. y., p. m., **08,** 1176.
1908. Tatnall-Brown Co., reinforcing j., 45′ piles, $8 each; 30′ piles, $5.50 each; 20′ piles, $4 each; 6″ x 12″ wales, 18′ long, $6 each; st., $4.50 c. y.; brush, $5 cord; drift bolts, 20¢ each; tie rods, incl. nuts and washers, $1 each, **09,** 1181, 1182. Tatnall-Brown Co., addl. work and materials at same prices, **09,** 1182.
1909. Latta & Terry Construction Co., furnishing st. and placing it in j. at mouth, at $3.35 t., **10,** 1308.
1911. Rickards Dredging Co., dr., 19¢ c. y.; U. S. Drainage & Irrigation Co., reinforcing j., $9.87 l. f.; st. filling, $4 t., **12,** 1616.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 78, 792, 793; **73,** 82; **74,** 93; **75,** 99; **76,** 61; **77,** 55; **78,** 62; **79,** 73; **80,** 95; **81,** 122; **82,** 121; **83,** 121; **84,** 130; **85,** 130; **86,** 128; **87,** 90; **88,** 90; **89,** 105; **90,** 96; **91,** 122; **92,** 123; **93,** 133, 143; **94,** 123; **95,** 139, 150; **97,** 162; **98,** 166; **99,** 190; **00,** 216; **01,** 260; **06,** 195; **07,** 206; **08,** 215; **09,** 222; **10,** 253; **11,** 275; **12,** 325.

In charge:
Lt. Col. J. D. Kurtz, 1871. **R.,** **72,** 792, 797; **73,** 871; **74,** ii, 142; **75,** ii, 194; **76,** 276; **77,** 268.
Capt. W. Ludlow, 1877, **78,** 431.
Col. J. N. Macomb, 1878–81. **R.,** **78,** 441; **79,** 445; **80,** 587; **81,** 780, 782.
Capt. W. Ludlow, 1881–82. **R.,** **82,** 768.
Lt. Col. G. Weitzel, 1882–84. **R.,** **83,** 623.
Maj. W. H. Heuer, 1884–85. **R.,** **84,** 828.
W. F. Smith, U. S. agent, 1885–1900. **R.,** **85,** 879; **86,** 862; **87,** 834; **88,** 744; (Maj.) **89,** 890; **90,** 928; **91,** 1167; **92,** 955; **93,** 1203, 1231; **94,** 883; **95,** 1122, 1151; **96,** 954; **97,** 1270; **98,** 1156; **99,** 1380; **00,** 1641.
Lt. Col. C. W. Raymond, 1901. **R.,** **01,** 1347.
Maj. C. A. F. Flagler, 1907–08. **R.,** **07,** 1133; **08,** 1174.
Capt. L. H. Rand, 1908–10. **R.,** **09,** 1180.
Maj. R. R. Raymond, 1910–. **R.,** **10,** 1307; **11,** 1397; **12,** 1615.

Assistants:
Capt. M. R. Brown. **R.,** **72,** 793–797; **74,** ii, 143.
J. A. Chase, **72,** 792, 794.
J. H. Odiorne. **R.,** **83,** 624.
J. M. Stewart. **R.,** **84,** 828.
A. Stierle. **R.,** **93,** 1232; **95,** 1152.

LEGAL PROCEEDING.

Land needed for cut across Lewes Cape deeded to U.S., **08,** 1175; **09,** 1180; **12,** 325.

[1] H. D. 102, 56th, 2d. [2] H. D. 678, 62d, 2d. *Allotment.

OPERATIONS.

1873-74. Chan. 5′ x 35′, Milton to Oyster Rock Shoals, near mouth of R., dr., **74,** 93, ii, 142.
1885-86. 92,737 c. y. dr., mouth to Milton Del., **86,** 862.
1889-90. 20,972 c. y. dr., **90,** 928.
1890-91. 104,284 c. y. dr., **91,** 1167.
1907-08. Sec. 2 of j., 468 l. f., completed and work on sec. 1 well advanced, **08,** 1174, 1175. 22,424 c. y., p. m., removed from cut across the cape, **08,** 1175.
1908-09. J. on n. side of new entrance to mouth completed; total l., 1,263′, **09,** 1180. Addl work on j., 10 45′ piles, 110 30′ piles, 70 20′ piles, 389 c. y. brush, and 571 c. y. st. placed in position; a total of 67,960 c. y., p. m., removed from 6′ d. in Delaware B. to same d. in Lewes Sound, completing work under contract, **09,** 1180, 1181.
1909-10. 729 t. st. placed in j., filling structure across old creek to top of piling and balance to top of waling at a cost of $2,653.46, **10,** 1307.
1911-12. 34,696 c. y. dr; work on reinforcing n. side of j. in progress, **12** 1615.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 792–797; **93,** 1232; **11,** 276.
Description of mouth, **95,** 1152.

PRIVATE WORK.

Canal cut by citizens of Lewes from Lewes Creek to old back chan., **72,** 796.
The Lewes River Improvement Co. completed an outlet from Broadkill R. to Delaware B., **01,** 1347.
Dr. chan. from Lewes Creek to Broadkill R. and closing of mouth of Lewes Creek, provided for in the proj., being performed by private enterprises, **08,** 1175.

PROJECTS.

By Capt. Brown, 6′ chan. from Milton to mouth by reopening Old Inlet, dr. a cut across beach, dr. and clearing R., and building a dam to turn the water from Lewes Sound, **72,** 792, 795.
By Lt. Col. Kurtz, expend. app. by dr. R. above drawbr. as far as the money would allow, **73,** 871.
By Col. Macomb, 1881, formation of R. entrance below junction of Lewes and Broadkill Creeks, to obtain, by dr. and constr. of a deflecting j., a chan. 6′ m. l. w.; est., $51,500, **81,** 782; **91,** 1167; **92,** 955.
By Maj. Flagler, cutting new outlet across Lewes Cape, opening up old chan. of Lewes Creek, and constr. of j. extending into Delaware B. beyond 6′ d., **07,** 1133, 1134.
Act Mar. 2, 1907, au. proj. for permanent entrance at mouth by dr. from 6′ curve in Delaware B. to same d. in R., and constr. j. on n. side of chan.,[1] **07,** 207.
By Maj. Raymond, expend. of funds in repair of j. at mouth and redr. of R. from Milton down, **11,** 1397.

SURVEYS.

Allotment for sur., $600, **72,** 792.
Under direction of Lt. Col. Kurtz, by Capt. M. R. Brown and James A. Chase. **R., 72,** 792–797.
Ex. for an inland waterway to connect Mispillion and Broadkiln Rs. so as to reopen navigation of Cedar, Slaughter, and Primehook Creeks, au. act July 13, 1892; made by Maj. Smith, 1892 (**R.** unfav.), **93,** 1231.
Ex. of mouth au. act Aug. 17, 1894; made by Maj. Smith, 1894 (**R.** unfav.), **95,** 1151.
Ex. and sur. au. act Mar. 3, 1905; made 1905–06; Capt. Flagler's **R.** fav.,[1] **07,** 206, 207, 208.
Maps.[1]

I-76(a) REHOBOTH BAY TO DELAWARE BAY, DEL. (Inland waterway.)

APPROPRIATION.

1912, $50,000, **12,** 1617.

ENGINEERS.

Chief of Engineers. R., 08, 218; **12,** 326.

In charge:
Maj. C. A. F. Flagler, **08,** 194.
Maj. R. R. Raymond, 1912. **R., 12,** 1616.

PHYSICAL DATA.

Imp. au. 1912, embraces section of a former proj. for inland waterway bet. Chincoteague B., Va., and Delaware B., Del., avoiding, so far as possible, the high lands of route, and following Lewes Creek nearly to its mouth, thence by short cut into Broadkill R., just above its mouth, **12,** 326.

PROJECTS.

Act July 25, 1912, au. proj. for canal between Rehoboth B. and Delaware B., of 6′ m. l. w., 50′ w. at bottom, narrowing to 40′ through deep cutting; est., $356,000; land for right of way (cost probably $14,275) to be furnished to U. S. free,[2] **12,** 326.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Maj. Flagler, May 17, 1907, and Jan. 17, 1908; est., $356,000,[2] **08,** 218.
R. by Maj. Raymond, Sept. 20 and Aug. 11, 1910, and BERH., Oct. 3, 1910, requested by R. and H. Comm., to determine if work contemplated can be executed at less cost. Revised est. of $239,328.74 given.[3]
Map.[2]

I-77 INDIAN RIVER, DEL.

APPROPRIATION.

1882, $10,000, **83,** 651.

COMMERCE.

Prospective benefit of imp. to C., **88,** 745.

CONTRACT.

1883. F. C. Somers, dr., 34½¢ c. y., **83,** 651.

ENGINEERS.

Chief of Engineers. R., 81, 129; **82,** 127; **83,** 127; **84,** 135, 151; **85,** 131; **86,** 129; **87,** 91; **88,** 90; **07,** 208.

In charge:
(See Surveys.)
Capt. W. Ludlow, 1883. **R., 82,** 828; **83,** 650.
Maj. W. H. Heuer, 1884–85. **R., 84,** 840.
W. F. Smith, U. S. agent, 1885–88. **R., 85,** 881; **86,** 864; **87,** 835; **88,** 744.
Maj. C. A. F. Flagler, **07,** 185.

Assistants:
E. Ludlow. **R., 82,** 830.
J. N. Odiorne. **R., 83,** 651; **84,** 841.

OPERATIONS.

1882-83. 2,476 c. y. dr., **83,** 650.
1883-84. 23,326 c. y. dr., **84,** 841.

PHYSICAL CHARACTERISTICS.

Tides in Indian R. and Rehoboth Bs., **82,** 832.
Rainfall, **82,** 833.

[1] H. D. 214, 59th, 2d. [2] H. D. 823, 60th, 1st. [3] Comm. D. 51, 61st, 3d.

PROJECTS.

By Capt. Ludlow, 1882, imp. R., mouth to Millsboro, by excavating chan. through "Bulkhead" Shoal, 4′ x 80′ x 3,000′; thence to inlet, 5′ x 150′ x 2,000′ chan. to be protected by a dike on its n. side. Est., $50,000, **82,** 833. Increased in 1883 to $60,000, **83,** 650; **87,** 835.

SURVEYS.

Au. act Mar. 3, 1881; made, 1882, by Col. Macomb, **82,** 829.

Ex. Isle of Wight and Upper Synepuxent Bs., Md., and Indian R., Del., and intervening land, for connecting their waters, au. act Aug. 2, 1882; made, 1882, by Lt. Col. Craighill, and adjudged by him as unworthy of imp., **84,** 957.

Pre. ex. and sur. au. act Mar. 3, 1905; **Rs.,** Maj. Flagler, 1905 and 1906 (unfav.),[1] **07,** 208.

I-78 CHINCOTEAGUE INLET, VA.

ENGINEERS.

Chief of Engineers. **R., 80,** 110; **10,** 256; **11,** 278; **12,** 328.

In charge:
Maj. W. P. Craighill. **R., 80,** 742.
Capt. L. H. Rand, 1910. **10,** 224.
Maj. R. R. Raymond, 1910–. **11,** 242; **12,** 290.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 742.

PLANS.

By Maj. Craighill, 1880, Franklin to Chincoteague Isld., chan. 6′–8′ x 200′ m. l. w.; est., $61,250 to $143,750, resp., **80,** 743.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 81; **80,** 110; made, 1880, by Maj. Craighill, **80,** 742.

Pre. ex. and sur. au. act Mar. 3, 1909, to gain 15′ chan. (**Rs.** to come), **10,** 256; **11,** 278; **12,** 328.

I-78(a) CHINCOTEAGUE INLET, VA. (Breakwater.)

ENGINEERS.

Chief of Engineers. **R., 89,** 112; **90,** 102.
In charge. Maj. W. F. Smith, U. S. agent. **R., 90,** 980.

Assistants:
D. C. Hudson. **R., 90,** 980.
A. Stierle. **R., 90,** 982.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 980.

PLANS.

By Maj. Smith, 1890, 1,200 l. f. of st. break'r and 15,150 l. f. of j., Wallops Beach and Fishing Pt.; est., $3,782,688, **90,** 982.

SURVEY.

Sur. for break'r au. act Aug. 11, 1888; made, 1890 by Maj. Smith, **90,** 981.

I-79(a) CHINCOTEAGUE BAY TO DELAWARE BAY. (Inland waterway between.)

APPROPRIATIONS.

1886,	$18,750,	**87,** 836.
1888,	50,000,	**88,** 746.
1890,	50,000,	**90,** 932.
1892,	25,000,	**92,** 965.
1894,	25,000,	**95,** 1124.
1896,	25,000,	**96,** 956.
1910,	1,500,	**10,** 254, 1308.
Total,	195,250,	**11,** 1399.

COMMERCE.

Not unimportant, **85,** 891, 895; **88,** 746; **89,** 893. Small local C. created by opening of the waterway, **93,** 1204.

The canal as planned can be used only by launches or very small boats. Work unworthy of further imp., **02,** 1061.

CONTRACTS.

1889. C. McLean, dr., 21.9¢ c. y., **89,** 892.
1890. W. H. Virden, constr. of 3 brs., $1,193, **90,** 932.
1893. P. McManus, dr., 21¢ c. y., p. m., **94,** 886.
1895. J. Jacoby & Co., dr., 23.5¢ c. y., p. m., **95,** 1125.
1902. Lea & Smith, dr. and j. constr., viz: Brush mattress, $1.55 sq. y.; small st., $3.15 t.; large st., $3.30 t.; removing and depositing sand or clay, 35¢ c. y., s. m.; removing and depositing mud and soil, 33¢ c. y., s. m., **02,** 1060, 1062.

ENGINEERS.

Chief of Engineers. **R., 85,** 137; **87,** 91; **88,** 91; **89,** 106; **90,** 97; **91,** 123; **92,** 123; **93,** 133; **94,** 123; **95,** 139; **96,** 127; **97,** 162; **98,** 166; **99,** 190; **00,** 217; **01,** 260; **02,** 188; **03,** 180; **04,** 175; **05,** 184; **06,** 195; **10,** 254; **11,** 276.

In charge:
W. F. Smith, U. S. agt., 1885–1900. **R., 85,** 891, 897, 899; **87,** 836; **88,** 745; (Maj.) **89,** 892; **90,** 930; **91,** 1168, 1171; **92,** 956; **93,** 1203; **94,** 884; **95,** 1123; **96,** 955; **97,** 1270; **98,** 1156; **99,** 1381; **00,** 1642.
Lt. Col. C. W. Raymond, 1901. **R., 01,** 1348.
Col. Jared A. Smith, 1901–02. **R., 02,** 1060.
Capt. J. C. Sanford, 1903–04. **R., 03,** 1002.
Capt. C. A. F. Flagler, 1904–06. **R., 04,** 1247; **05,** 1120.
Maj. R. R. Raymond, 1910–. **R., 10,** 1308; **11,** 1398.

Assistants:
C. M. Bird. **R., 85,** 891, 898, 900.
A. Stierle. **R., 91,** 1174; **92,** 962.

LEGAL PROCEEDINGS.

The Sec. of War informed in 1892 by the U. S. Atty. Gen. that the validity of the title to the right of way was vested in the U. S., **93,** 1204. In 1895 the Delaware, Maryland & Virginia RR. obtained an injunction restraining the U. S. from crossing its tracks until the U. S. had obtained right of way, **95,** 1124.

By condemnation proceedings, 1899, an award of $37,343.58 was made to the Delaware, Maryland & Virginia RR. Co. for the right of way over its br., **99,** 1381.

Notice given, 1901, to the Levy Court, Sussex County, Del., that 2 of the 3 brs. crossing the waterway would not be repaired by the U. S., **01,** 1348.

[1] H. D. 482, 59th, 2d.

The Judge Adv. Gen., 1901, passed upon the question of the expend. of the app., act June 3, 1896, for dr. between Indian R. and the crossing of the Delaware, Maryland & Virginia RR. at Rehoboth; the Sec. of War concurred; instructions issued to submit a proj., **01,** 1348, 1349.

LEGISLATION.

Act Mar. 3, 1905, repealed acts theretofore passed for the work, and required the amount unexpend. to be paid into the Treas., **05,** 1121.

OPERATIONS.

1888-89. 46,619 c. y. dr., **89,** 892.
1889-90. 64,209 c. y. dr., **90,** 930.
1890-91. Excavation of cut between Assawoman and Indian R. Bs. completed, and 3 temporary wooden brs. erected, **91,** 1170.
1891-92. Draws placed in 3 wooden brs., **92,** 957.
1892-93. About 4 m. of canal constr., and 3 temporary wooden brs. constr., **93,** 1204.
1893-94. 232,823 c. y., p. m., shoveled and dr., **94,** 884.
1894-95. 109,044 c. y., p. m., shoveled and dr., **95,** 1124.
1895-96. 32,935 c. y., p. m., removed, **96,** 956.
1897-98. Negotiations for the condemnation of land belonging to the Delaware, Maryland & Virginia RR. in progress, **98,** 1157.
1900-01. "Middle" or Ocean Br., near Ocean View, Del., repaired by the U. S. at a cost of $227.94, **01,** 1348.
1902-03. 2 parallel js. of st. and brush, each 700′ l., extending out from entrance to canal leading n. from Rehoboth B., completed; 9,229 c. y., s. m., dr. from Rehoboth B. and the canal n. of it, **03,** 1002.
1903-04. Shoal at entrance to canal removed, dr. done in Rehoboth B., and chan. 6′ x 40′ dr. through shoal at Raccoon Pt., 2,700′ l., into 6′ in Whites Creek, resulting in chan. from just below RR. crossing to Ocean View; 19,107 c. y., p. m., removed under contract, **04,** 1247.
1910-11. Jefferson, Middle, and Cedar Neck Brs. repaired by hired labor; proj. completed, **11,** 1399.

PHYSICAL CHARACTERISTICS.

Description of route, **85,** 892, 902; **91,** 1174.

PLANS. (See Projects.)

By Maj. Smith, 1891, excavation of a canal between Rehoboth and Delaware Bs. Est., (1) by the Lone Creek route, $460,224; (2) by the Burton Creek route, $692,132; (3) by the Stockley Creek route, $574,581, **91,** 1178, 1179. Stockley Creek route reported the best, **91,** 1180.

PROJECTS. (See Plans.)

By W. F. Smith, 1885, inland navigation between Chincoteague and Delaware Bs., 73 m., where necessary by a dr. chan. 6′ x 70′ m. l. w.; est., $350,000, **85,** 897, 879, 904; **91,** 1169; **92,** 956.

Proj. of 1885 modified, 1892, reducing the w. of the canal between Rehoboth B. and Delaware B. from 70′ to 20′, **93,** 1204.

By Maj. Smith, 1893, dr. 4′ x 20′ between Sinepuxent and Rehoboth Bs., and excavation of as much of a cut 6′ x 20′ as could be made with available funds, head of Rehoboth B. toward Lewes Creek, **93,** 1204.

By Maj. Smith, 1894, expend. app. of 1894 in continuing the imp. proj. between Indian R. and Delaware B., and expend. of any balance from previous apps. in dr. along the route between Assawoman and Delaware Bs., **95,** 1124.

The app. of 1896 was made with a proviso that no part of it should be expend. until the right of way should be secured without cost to the U. S. except over RR. and county brs., and then it could be secured by condemnation proceedings, **96,** 956.

Act June 25, 1910, au. $1,500 for restoration and repair of existing br. built by the U. S.,[1] **10,** 154.

SURVEYS.

Ex. au. act July 5, 1884; made by W. F. Smith, **85,** 891, 897, 899; **87,** 836.

Sur. for canal between Rehoboth and Delaware Bs.; made, 1891, by Maj. Smith, **91,** 1174.

Ex. made in 1894 by Maj. Smith, **94,** 885.

Ex. waterway between Indian R. and the crossing of the Delaware, Maryland & Virginia RR. at Rehoboth; made, 1901, by Lt. Col. Raymond, **01,** 1349.

Ex. au. act Mar. 3, 1905, in progress, **05,** 186, 1121.

Pre. ex. of waterway made; plan presented for constr. of 4 brs.; est., $50,300, with $220 an. for mainten.,[1] **06,** 195.

Maps.[1]

I-79(b) FRANKLIN CITY, VA., TO CAPE CHARLES, VA. (Internal waterway from.)

COMMERCE.

Not sufficient to warrant imp. asked for, **95,** 1159.
Description of, **95,** 1161.

ENGINEERS.

Chief of Engineers. **R., 95,** 151.
In charge. Maj. W. F. Smith, U. S. agent, 1895. **R., 95,** 1158.
Assistant. A. Stierle. **R., 95,** 1159.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1159.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Maj. Smith, 1894 (see Commerce), **95,** 1158.

I-80 SINEPUXENT BAY, MD.

ENGINEERS.

Chief of Engineers, **12,** 329.
In charge. Maj. R. R. Raymond, **12,** 290.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, with view to securing a chan. 5′ from mouth of St. Martins R. s., **12,** 329.

[1] H. D. 538, 59th, 1st.

I-80(a) DELAWARE LINE (through Worcester County, Md.) TO CHINCOTEAGUE INLET, VA. (Canal.)

APPROPRIATIONS. (See Expenditures.)

ENGINEERS.
Chief of Engineers. **R., 72,** 78; **73,** 83.
In charge. Lt. Col. J. D. Kurtz, 1872. **R., 72,** 791; **73,** 892.
Assistant. F. M. Eppley. **R., 73,** 894.

EXPENDITURES.
For sur., $2,170.64, **73,** 894.

PLANS.
By Mr. Eppley, canal 6′ x 125′ x 2,000′, B. to the ocean, sheet-pile wing dams in the B. 950′ l., and dr. Massays Shoals; est., $62,714.55, **73,** 897. Dimensions of canal modified by Lt. Col. Kurtz to 7′ x 250′; est. increased to $120,605, **73,** 894.

SURVEY.
In 1872, for inlet at the "Hommocks," Md. under direction of Lt. Col. Kurtz, by F. M. Eppley. **R., 72,** 791; **73,** 892, 894.

I-81(a) ISLE OF WIGHT BAY, MD., UPPER SINEPUXENT BAY, AND INDIAN RIVER. (Connection of.)

ENGINEERS.
Chief of Engineers. **R., 84,** 151.
In charge. Capt. T. Turtle. **R., 84,** 957.

SURVEY.
Ex. au. act Aug. 2, 1882; made by Capt. Turtle (**R.** unfav.), **84,** 957.

I-83 ST. MARTINS RIVER, MD.

ENGINEERS.
Chief of Engineers. **R., 12,** 329.
In charge. Maj. R. R. Raymond, **12,** 290.

SURVEY.
Pre. ex. and sur. au. act June 25, 1910, of St. Martins R., Md., in Worcester Co. (**R.** to come), **12,** 329.

I-85(a) CAT RIVER (Creek) AND BOGUES BAY, VA.

APPROPRIATION.
1910, $12,100, **10,** 1309.

COMMERCE.
Mainly oysters; 1907, about 58,000 t.[1]
In 1911, 47,169 t., **12,** 327.

CONTRACTS.
1911. C. A. Miner, dr., 15½¢ c. y., **11,** 1400.

ENGINEERS.
Chief of Engineers. **R., 08,** 218; **10,** 254; **11.** 277; **12,** 327.

Boards. BERH. favors imp. proposed by Maj. Flagler, 1908.[1]

In charge:
Maj. C. A. F. Flagler, **08,** 194.
Maj. R. R. Raymond, 1910–. **R., 10,** 1309; **11,** 1399; **12,** 1617.

OPERATIONS.
1911–12. 51,592 c. y. dr. for 12,530′, **12,** 1617.

PHYSICAL DATA.
Details; Cat R. is a link in the chain of inland waterways on the Atlantic side of the e. shore of Va. On the n. connects with Bogues B.[1]

PROJECTS.
Act June 25, 1910, au. dr. chan. 4′ d., m. l. w., through Cat R. and across Bogues B. from Cat R. into Island Hole Narrows, bottom w. of 25′ in Cat R. and 50′ in Bogues B., w. chan. where necessary at sharp bends; est., $12,100, and $1,200 an. mainten.,[1] **10,** 254.

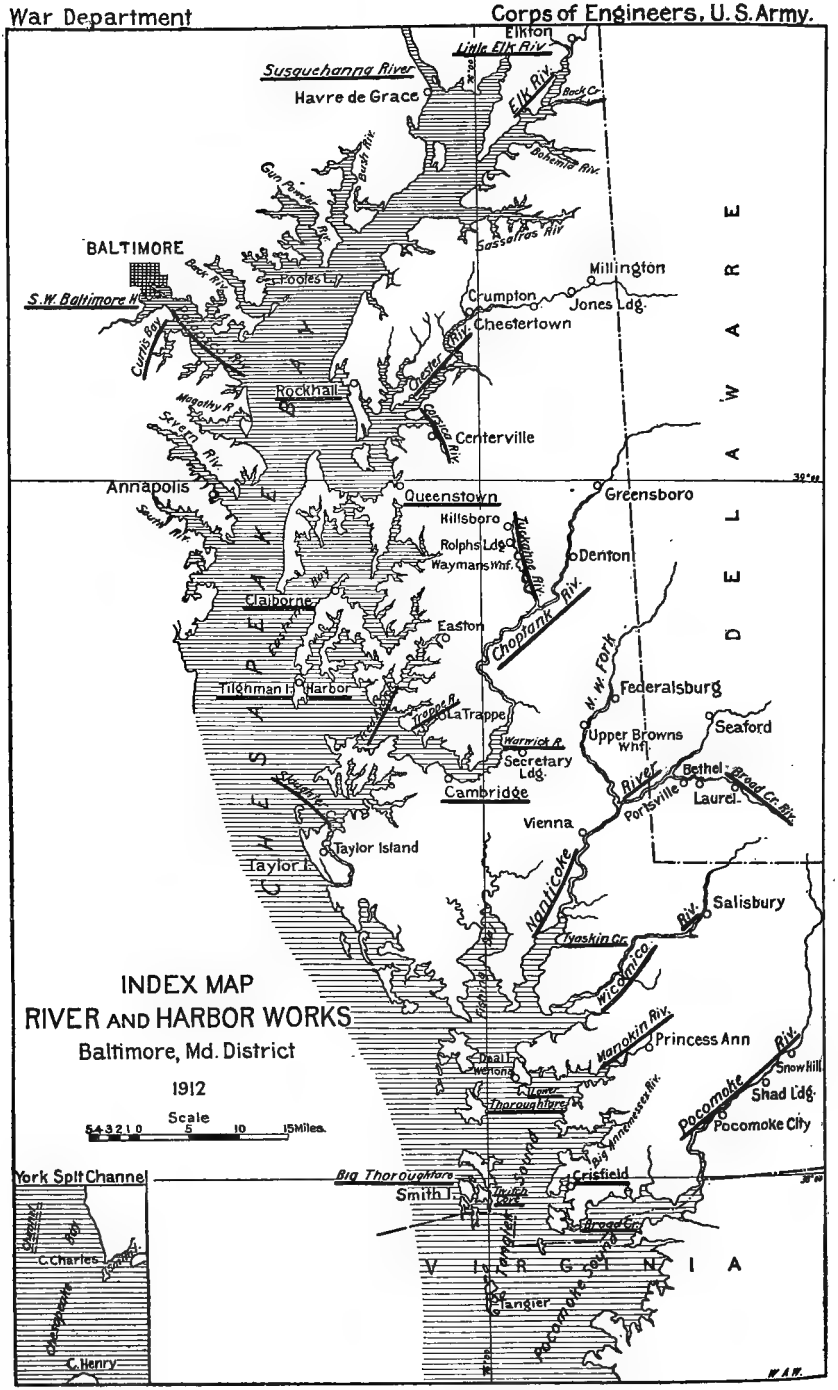
SURVEYS.
Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Maj. Flagler, 1907 and 1908; est., $12,100,[1] **08,** 218. Maps.[1]

[1] H. D. 957, 60th, 1st.

RIVER AND HARBOR WORKS.

SOUTH ATLANTIC COAST.

J.—BALTIMORE, MD., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Baltimore, Md. District
1912
Scale
5 4 3 2 1 0 5 10 15 Miles.
Elkton
Little Elk Riv.
Susquehanna River
Havre de Grace
Elk Riv.
Bohemia Riv.
Sassafras Riv.
BALTIMORE
S.W. Baltimore H.
Pooles I.
Millington
Crumpton
Jones Ldg.
Chestertown
Curtis Bay
Rockhall
Centerville
Annapolis
Queenstown
Greensboro
Hillsboro
Rolphs Ldg.
Waymans Whf.
Denton
Claiborne
Easton
Choptank Riv.
Tilghman I.
Harbor
Federalsburg
N. W. Fork
La Trappe
Upper Browns Whf.
Seaford
Warwick R.
Secretary Ldg.
Cambridge
Bethel
Laurel
Portsville
Broad Cr. Riv.
Vienna
Taylor Island
Taylor I.
Nanticoke River
Salisbury
Tyaskin Cr.
Wicomico Riv.
Manokin Riv.
Princess Ann
Snow Hill
Shad Ldg.
Pocomoke Riv.
Pocomoke City
Big Annemessex Riv.
Big Thoroughfare
Smith I.
Crisfield
Broad Cr.
Tangier
Tangier Sound
Pocomoke Sound
DELAWARE
VIRGINIA
CHESAPEAKE BAY
York Spit Channel
C. Charles
C. Henry
W.A.W.

J.—BALTIMORE, MD., DISTRICT.[1]

In charge of U. S. Engineer Office,
Baltimore, Md.

J 1 Chesapeake B., Md. and Va.
J 2 Pocomoke Sound, Md. and Va. (1)
J 3 Pocomoke R., Md. and Va. (2)
J 4 Drum B., Va. (2)
J 5 Fishing Cr., Va. (2)
J 6 Starling Cr., Va. (2)
J 7 Saxis Island H., Va. (2)
J 8 Jacks Cr., Va. (3)
J 9 Corkers Cr., Md. (3)
J 10 Hardship Branch, Md. (3)
J 11 Pattys Branch, Md. (3)
J 12 Old Mill Branch, Md. (3)
J 13 Ninepin Bridges Cr., Md. (3)
J 14 Timmonstown Branch, Md. (3)
J 15 Libertytown Branch, Md. (14)
J 16 Franklin Branch, Md. (3)
J 17 Gumbridge Branch, Md. (3)
J 18 Double Bridge Branch, Md. (3)
J 19 Grays Prong, Del. and Md. (3)
J 20 Bald Cypress Branch, Del. (3)
J 21 Gum Branch, Del. (3)
J 22 Green Run, Md. (3)
J 23 North Fork, Del. and Md. (22)
J 24 South Fork, Md. (22)
J 25 Aydelotte Branch, Md. (3)
J 26 Campbell Ditch Run, Md. (25)
J 27 Givens Branch, Md. (3)
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J 29 Nassawango Cr., Md. (3)
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J 38 Apes Hole Cr., Md. (2)
J 39 Broad Cr., Md. (2)
J 40 Cedar Straits, Md. (2) (45)
J 41 Ellinger Cove, Va. (40)
J 42 Planner Cove, Va. (2)
J 43 Little Thorofare, Va. (2) (45)
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J 45 Tangier Sound, Md. (1)
J 46 Crisfield H. (Little Annemessex R.), Md. (45)
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J 48 West Cr., Md. (46)
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J 85 Monie B., Md. (81)
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J 101 Beaglin Branch, Md. (97)
J 102 Middle Neck Branch, Md. (81)
J 103 Brewington Branch, Md. (81)
J 104 Leonard Pond, Md. (81)
J 105 Little Burnt Branch, Md. (81)
J 106 Rockwalking Cr., Md. (81)
J 107 Ellis B., Md. (81)
J 108 Broad Cr., Md. (107)
J 109 Nanticoke R., Md. (45)

[1] See note at beginning of District L.

J 110 Windsor Cr., Md. (109)
J 111 Dung Cr., Md. (109)
J 112 Tyaskin Cr., Md. (109)
J 113 Quantico Cr., Md. (109)
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J 142 Beaverdam Cr., Md. (141)
J 143 Middletown Branch, Md. (140)
J 144 Scotland Cr., Md. (140)
J 145 Blackwater R., Md. (137)
J 146 Jobs Ditch, Md. (145)
J 147 Blackgarden Cr., Md. (145)
J 148 Blackgarden Pond, Md. (147)
J 149 Snarepole Gut, Md. (145)
J 150 Otter Pond, Md. (145)
J 151 Bullock Pond, Md. (145)
J 152 Simons Ditch, Md. (145)
J 153 Keene Ditch, Md. (145)
J 154 Harpers Pond, Md. (145)
J 155 Little Blackwater R., Md. (145)
J 156 Twin Ponds, Md. (145)
J 157 Coulson Pond, Md. (145)
J 158 Raymond Ditch, Md. (145)
J 159 Beaverdam Cr., Md. (145)
J 160 Meekin Cr., Md. (145)
J 161 Round Pond, Md. (145)
J 162 Barbadoes Pond, Md. (145)
J 163 Swan Pond, Md. (145)
J 164 Booze Ditch, Md. (145)
J 165 Raccoon Cr., Md. (145)
J 166 Holts Ridge Gut, Md. (165)
J 167 Swimming Gut, Md. (165)
J 168 Thorofare Cr., Md. (137)
J 169 Cedar Cr., Md. (137)
J 170 Farm Cr., Md. (137)
J 171 Goose Cr., Md. (137)
J 172 Tedious Cr., Md. (137)
J 173 Hooper Strait, Md. (1) (45)
J 174 Hopkins Cove, Md. (173)
J 175 Piney Island Cove, Md. (45)
J 176 Great Cove, Md. (45)
J 177 Holland Straits, Md. (1) (45)
J 178 Pungers Cr., Md. (45)
J 179 Kedges Straits, Md. (45)
J 180 Sheepshead H., Md. (179)
J 181 Goose Cr., Md. (179)
J 182 Fog Point Cove, Md. (179)
J 183 Back Cove, Md. (45)
J 184 Terrapin Sand Cove, Md. (45)
J 185 Barnes Cove, Md. (45)
J 186 Otter Cr., Md. (185)
J 187 Joes Ridge Cr. (185)
J 188 Barnes Landing Cr., Md. (185)
J 189 Wellridge Cr., Md. (45)
J 190 Twitch Cove, Md. (45)
J 191 Big Thorofare, Md. (1) (45)
J 192 Rock Cr., Md. (45)
J 193 Tylers Cr., Md. (45)
J 194 Cod H., Va. (45)
J 195 Shanks Cr., Md. (1)
J 196 Sawney Cove, Md. (191)
J 197 Lighting Knot Cove, Md. (191)
J 198 Oyster Cr., Md. (1)
J 199 Pry Cove, Md. (177)
J 200 Northeast Cove, Md. (177)
J 201 Onkanikan Cove, Md. (1)
J 202 Honga R., Md. (1)
J 203 Norman Cove, Md. (202)
J 204 Duck Point Cove, Md. (202)
J 205 Fox Cr., Md. (202)
J 206 Joes Cove, Md. (202)
J 207 Lakes Cr., Md. (202)
J 208 Charles Cr., Md. (202)
J 209 Worlds End Cr., Md. (208)
J 210 Wallace Cr., Md. (202)
J 211 Great Marsh Cr., Md. (202)
J 212 Fishing Cr., Md. (202) (222)
J 213 Gunners Cove, Md. (202)
J 214 Long Cr., Md. (202)
J 215 Back Cr., Md. (202)
J 216 Cat Cove, Md. (202)
J 217 Bentley Cove, Md. (202)
J 218 Flag Cove, Md. (202)
J 219 Hickory Cove, Md. (202)
J 220 Richland Cove, Md. (1)
J 221 Tom Cove, Md. (1)
J 222 Tar B., Md. (1)
J 223 Punch Island Cr., Md. (1)
J 224 Dunnock Slough, Md. (223)
J 225 Beaverdam Cr., Md. (223)
J 226 Saint John Cr., Md. (223)
J 227 Oyster Cr., Md. (1)
J 228 Little Choptank R., Md. (1)
J 229 Cators Cove, Md. (228)
J 230 Slaughter Cr., Md. (228
J 231 Traverse Cove, Md. (230
J 232 Chapel Cove, Md. (230)
J 233 Davis Cr., Md. (232)
J 234 Parsons Cr., Md. (230)
J 235 Woolford Cr., Md. (228)
J 236 Madison B., Md. (228)
J 237 Fishing Cr., Md. (228)
J 238 Church Cr., Md. (237)
J 239 Smith Cove, Md. (228)
J 240 Gaines Cr., Md. (228)
J 241 Carey Cr., Md. (228)
J 242 Beckwith Cr., Md. (228)
J 243 Phillips Cr., Md. (228)

J 244 Back Cr., Md. (228)
J 245 Hudson Cr., Md. (228)
J 246 Brooks Cr., Md. (228)
J 247 Riell Cove, Md. (228)
J 248 Hills Point Cove, Md. (228)
J 249 Trippe B., Md. (1)
J 250 Brannock B., Md. (249)
J 251 Covey Cr., Md. (249)
J 252 Choptank R., Md. (1)
J 253 Cook Point Cove, Md. (252)
J 254 Chapel Cr., Md. (252)
J 255 Lecompte B., Md. (252)
J 256 Lecompte Cr., Md. (255)
J 257 Jenkins Cr., Md. (252)
J 258 Cambridge H., Md. (252)
J 259 Shoal Cr., Md. (252)
J 260 Hurst Cr., Md. (252)
J 261 New Whitehall Cr., Md. (252)
J 262 Indian Cr., Md. (252)
J 263 Goose Cr., Md. (252)
J 264 Warwick R. (Secretary Cr.), Md. (252)
J 265 Cabin Cr., Md. (252)
J 266 Blinthorne Cr., Md. (252)
J 267 Hunting Cr., Md. (252)
J 268 Gravel Run, Md. (267)
J 269 Marsh Cr., Md. (252)
J 270 Skeleton Cr., Md. (252)
J 271 Mitchell Run, Md. (252)
J 272 Crowberry Cr., Md. (252)
J 273 Hog Cr., Md. (252)
J 274 Bell Cr., Md. (252)
J 275 Berry Run, Md. (252)
J 276 Dawson Branch, Md. (252)
J 277 Fowling Cr., Md. (252)
J 278 Robins Cr., Md. (252)
J 279 Mill Cr., Md. (252)
J 280 Gravelly Branch, Md. (279)
J 281 Watts Cr., Md. (252)
J 282 Herring Run, Md. (281)
J 283 Chapel Branch, Md. (252)
J 284 Spring Branch, Md. (252)
J 285 Tubmill Branch, Md. (252)
J 286 Gravelly Branch, Md. (252)
J 287 Tanners Branch, Del. (252)
J 288 Broadway Branch, Del. (252)
J 289 Oldtown Branch, Del. (252)
J 290 Forge Branch, Del. (252)
J 291 Tuckahoe R., Md. (252)
J 292 Deep Cr., Md. (291)
J 293 Knott Millpond, Md. (291)
J 294 Piney Branch, Md. (291)
J 295 Geary Millpond, Md. (291)
J 296 Mason Branch, Md. (291)
J 297 Long Marsh Ditch, Md. (296)
J 298 Beaverdam Ditch, Md. (296)
J 299 German Branch, Md. (291)
J 300 Blockston Branch, Md. (291)
J 301 Norwich Cr., Md. (291)
J 302 Kings Cr., Md. (252)
J 303 Beaverdam Branch, Md. (302)
J 304 Wootenaux Cr., Md. (302)
J 305 Galloway Run, Md. (304)
J 306 Williams Cr., Md. (252)
J 307 Barker Cr., Md. (252)
J 308 Miles Cr., Md. (252)
J 309 Raccoon Cr., Md. (252)
J 310 Bolinbroke Cr., Md. (252)
J 311 Muddy Cr., Md. (252)
J 312 Porpoise Cr., Md. (252)
J 313 Dickinson B., Md. (252)
J 314 Reeds Cr., Md. (313)
J 315 Crosierdoer Cr., Md. (313)
J 316 LaTrappe Cr., Md. (252)
J 317 Connolly Cove, Md. (316)
J 318 Lowry Cove, Md. (316)
J 319 Leonard Cove, Md. (316)
J 320 Sawmill Cove, Md. (316)
J 321 Island Cr., Md. (252)
J 322 Boone Cr., Md. (252)
J 323 Tred Avon R., Md. (252)
J 324 Mud Cr., Md. (323)
J 325 Goldsboro Cr., Md. (323)
J 326 Trippe Cr., Md. (323)
J 327 Peachblossom Cr., Md. (323)
J 328 Dixon Cr., Md. (323)
J 329 Maxmore Cr., Md. (323)
J 330 Plaindealing Cr., Md. (323)
J 331 Tar Cr., Md. (323)
J 332 Foxhole Cr., Md. (323)
J 333 Broad Cr., Md. (252)
J 334 Irish Cr., Md. (333)
J 335 Bridge Cr., Md. (333)
J 336 Edge Cr., Md. (333)
J 337 Elberts Cove, Md. (336)
J 338 Spencer Cr., Md. (336)
J 339 Solitude Cr., Md. (336)
J 340 San Domingo Cr., Md. (336)
J 341 Edgar Cove, Md. (333)
J 342 Leadenham Cr., Md. (333)
J 343 Grace Cr., Md. (342)
J 344 Caulk Cove, Md. (342)
J 345 Balls Cr., Md. (333)
J 346 Harris Cr., Md. (252)
J 347 Northeast Branch, Md. (346)
J 348 Northwest Branch. Md. (346)
J 349 Cummings Cr., Md. (346)
J 350 Briery Cr., Md. (346)
J 351 Waterhole Cove, Md. (346)
J 352 Dun Cove, Md. (346)
J 353 Knapp Narrows, Md. (346) (1)
J 354 Tilghman Island H., Md. (346)
J 355 Blackwalnut Cove, Md. (252)
J 356 Pawpaw Cove, Md. (1)
J 357 Back Cr., Md. (353)
J 358 Force Cr., Md. (1)
J 359 Eastern B., Md. (1)
J 360 Poplar Island H., Md. (359)
J 361 Haddaway (or Ferry) Cove, Md. (359)
J 362 Harbor Cove, Md. (359)
J 363 Claiborne H., Md. (359)
J 364 Tilghman Cr., Md. (359)
J 365 Porter Cr., Md. (359)
J 366 Miles R., Md. (359)
J 367 Hambleton Cr., Md. (366)
J 368 Long Haul Cr., Md. (366)
J 369 Spencer Cr., Md. (366)
J 370 Oak Cr., Md. (366)
J 371 Newcomb Cr., Md. (366)
J 372 Globe Cr., Md. (366)
J 373 Goldsboro Cr., Md. (366)
J 374 Potts Mill Cr., Md. (366)
J 375 Hunting Cr., Md. (366)
J 376 Leeds Cr., Md. (366)

J 377 Woodland Cr., Md. (366)
J 378 Wye R., Md. (359)
J 379 Shaw B., Md. (378)
J 380 Front Wye R., Md. (378)
J 381 Lloyd Cr., Md. (380)
J 382 Gross Cr., Md. (381)
J 383 Quarter Cove, Md. (380)
J 384 Pickering Cr., Md. (380)
J 385 Skipton Cr., Md. (380)
J 386 Mill Cr., Md. (385)
J 387 Wye Narrows, Md. (380)
J 388 Covington Cove, Md. (387)
J 389 Granary Cr., Md. (380)
J 390 Dividing Cr., Md. (380)
J 391 Back Wye R., Md. (378)
J 392 Quarter Cove, Md. (391)
J 393 Greenwood Cr., Md. (359)
J 394 Prospect B., Md. (359)
J 395 Hoghole Cr., Md. (394)
J 396 Cabin Cr., Md. (394)
J 397 Marshy Cr., Md. (394)
J 398 Kent Island Narrows, Md. (394) (413)
J 399 Goodhands Cr., Md. (394)
J 400 Kirwan Cr., Md. (394)
J 401 Crab Alley B., Md. (359)
J 402 Crab Alley Cr., Md. (401)
J 403 Cox Cr., Md. (359)
J 404 Thompson Cr., Md. (403)
J 405 Warehouse Cr., Md. (403)
J 406 Shipping Cr., Md. (403)
J 407 Long Point Cr., Md. (359)
J 408 Bloody Point Cr., Md. (1)
J 409 Carter Cr., Md. (1)
J 410 Tolson Cr., Md. (1)
J 411 Craney Cr., Md. (1)
J 412 Broad Cr., Md. (1)
J 413 Chester R., Md. (1)
J 414 Macum Cr., Md. (413)
J 415 Piney Cr., Md. (413)
J 416 Muddy Cr., Md. (413)
J 417 Jackson Cr., Md. (413)
J 418 Winchester Cr., Md. (413)
J 419 Wolsey Cr., Md. (413)
J 420 Queenstown Cr., Md. (413)
J 421 Little Queenstown Cr., Md. (420)
J 422 Queenstown H., Md. (420)
J 423 Salthouse Cove, Md. (420)
J 424 Ditchers Cove, Md. (420)
J 425 Abbott Cove, Md. (413)
J 426 Tilghman Cr., Md. (413)
J 427 Earle Cove, Md. (413)
J 428 Butler Cove, Md. (413)
J 429 Piney Cove, Md. (413)
J 430 Reed Cr., Md. (413)
J 431 Grove Cr., Md. (430)
J 432 Robin Cove, Md. (413)
J 433 Corsica R., Md. (413)
J 434 Middle Quarter Cove, Md. (433)
J 435 Tilghman Cove, Md. (433)
J 436 Miller Cr., Md. (433)
J 437 Earle Cr., Md. (433)
J 438 Earle Cove, Md. (433)
J 439 Alder Branch, Md. (433)
J 440 Emory Cr., Md. (433)
J 441 White Cove, Md. (413)
J 442 Oyster Cove, Md. (413)
J 443 Southeast Cr., Md. (413)
J 444 Island Cr., Md. (443)
J 445 Browns Branch, Md. (443)
J 446 Hambleton Cr., Md. (413)
J 447 Foreman Branch, Md. (413)
J 448 Pearl Branch, Md. (413)
J 449 Red Lion Branch, Md. (413)
J 450 Unicorn Branch, Md. (413)
J 451 Andover Sewell Branch, Md. (413)
J 452 Cypress Branch, Md. (413)
J 453 Mills Branch, Md. (413)
J 454 Morgan Cr., Md. (413)
J 455 Radcliff Cr., Md. (413)
J 456 Broad Cr., Md. (413)
J 457 Browns Cr., Md. (413)
J 458 Jarrett Cr., Md. (413)
J 459 Oyster Cove, Md. (413)
J 460 Shippen Cr., Md. (413)
J 461 Commegy Bight, Md. (413)
J 462 Commegy Cr., Md. (461)
J 463 Cliffs Bight, Md. (413)
J 464 Langford Cr., Md. (413)
J 465 East Fork, Md. (464)
J 466 Kings Cr., Md. (465)
J 467 Wann Cove, Md. (465)
J 468 Philip Cr., Md. (465)
J 469 Lovely Cove, Md. (465)
J 470 West Fork, Md. (464)
J 471 Horner Cove, Md. (470)
J 472 Long Cove, Md. (470)
J 473 Sianai Cove, Md. (470)
J 474 Shipyard Cr., Md. (470)
J 475 Bungay Cr., Md. (470)
J 476 Graveyard Cove, Md. (470)
J 477 Davis Cr., Md. (464)
J 478 Lawyers Cove, Md. (464)
J 479 Long Cove, Md. (464)
J 480 Deep Cove, Md. (464)
J 481 Grays Inn Cr., Md. (413)
J 482 Herringtown Cr., Md. (481)
J 483 Browns Cove, Md. (481)
J 484 Goose Cove, Md. (481)
J 485 Lucy Cove, Md. (481)
J 486 The Narrows, Md. (413) (1)
J 487 Church Cr., Md. (486)
J 488 Fryingpan Cove, Md. (486)
J 489 Bogles Cove, Md. (413)
J 490 Durdin Cr., Md. (413)
J 491 Shipyard Cr., Md. (413)
J 492 Hail Cr., Md. (413)
J 493 Cabin Cove, Md. (413)
J 494 Calf Pasture Cove, Md. (413)
J 495 Tubbys Cove, Md. (413)
J 496 Short Cove, Md. (486)
J 497 Long Cove, Md. (486)
J 498 Rockhall Cr., Md. (1)
J 499 Rockhall H., Md. (498)
J 500 Huntingfield Cr., Md. (498)
J 501 Swan Cr., Md. (1)
J 502 The Haven, Md. (501)
J 503 Tavern Cr., Md. (1)
J 504 Fairlee Cr., Md. (1)
J 505 Worton Cr., Md. (1)
J 506 Still Pond, Md. (1)
J 507 Churn Cr., Md. (506)
J 508 Still Pond Cr., Md. (506)
J 509 Sassafras R., Md. (1)
J 510 Lloyd Cr., Md. (509)

J 511 Turner Cr., Md. (509)
J 512 Freeman Cr., Md. (509)
J 513 Island Cr., Md. (509)
J 514 Mill Cr., Md. (509)
J 515 Pearce Cr., Md. (509)
J 516 Sawmill Cr., Md. (509)
J 517 Swan Cr., Md. (509)
J 518 Jacobs Cr., Md. (509)
J 519 Duffy Cr., Md. (509)
J 520 Craigs Cr., Md. (509)
J 521 Back Cr., Md. (509)
J 522 Moneys Cr., Md. (509)
J 523 Elk R., Md. (1)
J 524 Pond Cr., Md. (523)
J 525 Pearce Cr., Md. (523)
J 526 Cabin John Cr., Md. (523)
J 527 Bohemia R., Md. (523)
J 528 Scotchman Cr., Md. (527)
J 529 Little Bohemia Cr., Md. (527)
J 530 Great Bohemia Cr., Md. (527)
J 531 Manor Cr., Md. (527)
J 532 Herring Cr., Md. (523)
J 533 Back Cr., Md. (523)
J 534 Hog Cr., Md. (533)
J 535 Chesapeake and Delaware Canal, Del. and Md. (533)
J 536 Long Cr., Md. (533)
J 537 Paddy Piddles Cove, Md. (523)
J 538 Perch Cr., Md. (523)
J 539 Big Elk Cr., Md. (523)
J 540 Little Elk R., Md. (523)
J 541 Dogwood Branch, Md. (540)
J 542 Laurel Run, Md. (540)
J 543 Plum Cr., Md. (523)
J 544 Piney Cr. Cove, Md. (523)
J 545 Piney Cr., Md. (544)
J 546 Rogues H., Md. (523)
J 547 Northeast R., Md. (1)
J 548 Carrot Cove, Md. (547)
J 549 Little Northeast Cr., Md. (547)
J 550 West Branch, Md. (549)
J 551 Northeast Cr., Md. (547)
J 552 Stony Run, Md. (547)
J 553 Principio Cr., Md. (1)
J 554 Baker Cove, Md. (553)
J 555 Mill Cr., Md. (553)
J 556 Susquehanna R., Md. (1)
J 557 Happy Valley Branch, Md. (556)
J 558 Rock Run, Md. (556)
J 559 Octorora Cr., Md. (556)
J 560 East Branch, Pa. (559)
J 561 Knight Cr., Pa. (560)
J 562 West Branch, Pa. (559)
J 563 Conowingo Cr., Md. and Pa. (556)
J 564 Fishing Cr., Pa. (556)
J 565 Muddy Run, Pa. (556)
J 566 Pequea Cr., Pa. (556)
J 567 Conesota Cr., Pa. (556)
J 568 Mill Cr., Pa. (567)
J 569 Conestoga Cr., Pa. (567)
J 570 Muddy Cr., Pa. (569)
J 571 Leist Cr., Pa. (569)
J 572 Middle Cr., Pa. (569)
J 573 Cocalico Cr., Pa. (572)
J 574 Hammer Cr., Pa. (572)
J 575 Letitz Cr., Pa. (569)
J 576 Little Conestoga Cr., Pa. (567)
J 577 West Branch, Pa. (576)
J 578 Chiquesalunga Cr., Pa. (556)
J 579 Little Chiquesalunga Cr., Pa. (578)
J 580 Donegal Cr., Pa. (556)
J 581 Coney Cr., Pa. (556)
J 582 Conewago Cr., Pa. (556)
J 583 Swatora Cr., Pa. (556)
J 584 Quittapahilla Cr., Pa. (583)
J 585 Beck Cr., Pa. (584)
J 586 Little Swatora Cr., Pa. (583)
J 587 Stone Cr., Pa. (586)
J 588 Monroe Cr., Pa. (583)
J 589 Little Swatora Cr., Pa. (583)
J 590 Black Cr., Pa. (583)
J 591 Swatard Cr., Pa. (583)
J 592 Bow Cr., Pa. (583)
J 593 Beaver Cr., Pa. (583)
J 594 Paxton Cr., Pa. (556)
J 595 Fishing Cr., Pa. (556)
J 596 Stoney Cr., Pa. (556)
J 597 Clark Cr., Pa. (556)
J 598 Powells Cr., Pa. (556)
J 599 South Fork, Pa. (598)
J 600 North Fork, Pa. (598)
J 601 Armstrong Cr., Pa. (556)
J 602 Wicomisco Cr., Pa. (556)
J 603 Rattling Cr., Pa. (602)
J 604 Bear Cr., Pa. (602)
J 605 Little Wicomisco Cr., Pa. (602)
J 606 Mahantango Cr., Pa. (556)
J 607 Pine Cr., Pa. (606)
J 608 Deep Cr., Pa. (607)
J 609 Schwaben Cr., Pa. (556)
J 610 Zerbe Run, Pa. (556)
J 611 Mahanoy Cr., Pa. (610)
J 612 Shamokin Cr., Pa. (556)
J 613 Little Shamokin Cr., Pa. (612)
J 614 Plum Cr., Pa. (612):
J 615 North Branch, Pa. (556)
J 616 Roaring Cr., Pa. (615)
J 617 South Branch, Pa. (616)
J 618 Catawissa Cr., Pa. (615)
J 619 Big Catawissa Cr., Pa. (618)
J 620 Tomhicken Cr., Pa. (618)
J 621 Nescopeck Cr., Pa. (615)
J 622 Big Wapwallopen Cr., Pa. (615)
J 623 Little Wapwallopen Cr., Pa. (615)
J 624 Pond Cr., Pa. (623)
J 625 Lackawanna R., Pa. (615)
J 626 Spring Brook, Pa. (625)
J 627 Gardner Cr., Pa. (615)
J 628 Hartley Cr., Pa. (615)
J 629 Falls Cr., Pa. (628)
J 630 Tunkhannock Cr., Pa. (615)
J 631 South Branch, Pa. (630)
J 632 East Branch, Pa. (630)
J 633 Butler Cr., Pa. (630)
J 634 Martin Cr., Pa. (630)
J 635 Hop Bottom Cr., Pa. (634)
J 636 Horton Cr., Pa. (630)
J 637 Meshoppen Cr., Pa. (615)
J 638 West Branch, Pa. (637)
J 639 Riley Cr., Pa. (637)
J 640 Tascarora Cr., Pa. (615)
J 641 Wyalusing Cr., Pa. (615)
J 642 East Branch, Pa. (641)
J 643 Middle Branch, Pa. (641)

J 644 North Branch, Pa. (641)
J 645 Rummerfield Cr., Pa. (615)
J 646 Wysox Cr., Pa. (615)
J 647 Johnston Cr., Pa. (646)
J 648 Sutterlee Cr., Pa. (615)
J 649 Wappasening Cr., Pa. and N. Y. (615)
J 650 Apalachin Cr., Pa. and N. Y. (615)
J 651 Choconut Cr., Pa. and N. Y. (615)
J 652 Snake Cr., Pa. and N. Y. (615)
J 653 Wiley Cr., Pa. (615)
J 654 Salt Lick Cr., Pa.(615)
J 655 Starruca Cr., Pa. (615)
J 656 Chenango R., N. Y. (615)
J 657 Nanticoke Cr., N. Y. (615)
J 658 Catatonk Cr., N. Y. (615)
J 659 Pipe Cr., N. Y. (615)
J 660 Cayuta Cr., N. Y. (615)
J 661 Chemung R., N. Y. (615)
J 662 Newtown Cr., N. Y. (661)
J 663 Sing Sing Cr., N. Y. (661)
J 664 Chicton R., N. Y. (661)
J 665 Meads Cr., N. Y. (664)
J 666 Tioga R., Pa. and N. Y. (661)
J 667 Canisteo R., N. Y. (666)
J 668 Bennett Cr., N. Y. (667)
J 669 Tuscarora Cr., N. Y. (667)
J 670 Cowanesque R., Pa. (666)
J 671 Crooked Cr., Pa. (666)
J 672 Elkhorn Cr., Pa. (671)
J 673 Hills Cr., Pa. (671)
J 674 Marvin Cr., Pa. (666)
J 675 Cory Cr., Pa. (666)
J 676 Mill Cr., Pa. (666)
J 677 Elk Run, Pa. (676)
J 678 Hammond Cr., N. Y. and Pa. (661)
J 679 Seely Cr., N. Y. and Pa. (678)
J 680 Bentley Cr., N. Y. and Pa. (661)
J 681 Bucks Cr., Pa. (680)
J 682 Orcult Cr., Pa. (661)
J 683 Walcott Cr., Pa. (661)
J 684 Buck Cr., Pa. (615)
J 685 Sugar Cr., Pa. (615)
J 686 Shrader Branch, Pa. (615)
J 687 Towanda Cr., Pa. (686)
J 688 Bennett Cr., Pa. (615)
J 689 Durell Cr., Pa. (615)
J 690 Sugar Run, Pa. (615)
J 691 Mehoapany Cr., Pa. (615)
J 692 North Branch, Pa. (691)
J 693 Bowman Cr., Pa. (615)
J 694 Abraham Cr., Pa. (615)
J 695 Toby Cr., Pa. (615)
J 696 Harvey Cr., Pa. (615)
J 697 Harvey Lake, Pa. (696)
J 698 Pike Cr., Pa. (696)
J 699 Hunlock Cr., Pa. (615)
J 700 Little Shickshinny Cr., Pa. (615)
J 701 Brair Cr., Pa. (615)
J 702 Fishing Cr., Pa. (615)
J 703 Huntington Cr., Pa. (702)
J 704 Kitchen Cr., Pa. (703)
J 705 Pine Cr., Pa. (703)
J 706 Coles Cr., Pa. (702)
J 707 Raven Cr., Pa. (706)
J 708 East Branch, Pa. (706)
J 709 West Branch, Pa. (706)
J 710 West Cr., Pa. (706)
J 711 Green Cr., Pa. (702)
J 712 Little Fishing Cr., Pa. (702)
J 713 Hemlock Cr., Pa. (702)
J 714 Mahonning Cr., Pa. (615)
J 715 West Branch, Pa. (556)
J 716 Chillisquaque Cr., Pa. (715)
J 717 Muddy Run, Pa. (715)
J 718 Warrior Run, Pa. (715)
J 719 Delaware Run, Pa. (715)
J 720 Glade Run, Pa. (715)
J 721 Muncy Cr., Pa. (715)
J 722 Laurel Run, Pa. (721)
J 723 Wolf Run, Pa. (715)
J 724 Carpenter Run, Pa. (715)
J 725 Loyal Sock Cr., Pa. (715)
J 726 Hill Cr., Pa. (725)
J 727 Little Bear Cr., Pa. (725)
J 728 Big Bear Cr., Pa. (725)
J 729 Kettle Cr., Pa. (725)
J 730 Ogdonia Cr., Pa. (729)
J 731 Pigeon Cr., Pa. (725)
J 732 Little Loyal Sock Cr., Pa. (725)
J 733 Lick Cr., Pa. (732)
J 734 Back Cr., Pa. (732)
J 735 Lick Cr., Pa. (732)
J 736 Elk Cr., Pa. (725)
J 737 Mill Cr., Pa. (725)
J 738 Plunkett Cr., Pa. (725)
J 739 Wallis Run, Pa. (725)
J 740 West Mill Cr., Pa. (725)
J 741 Lyconing Cr., Pa. (715)
J 742 Pleasant Stream, Pa. (741)
J 743 Rock Run, Pa. (741)
J 744 Grays Run, Pa. (741)
J 745 Trout Run, Pa. (741)
J 746 Hoagland Run, Pa. (741)
J 747 Larry Cr., Pa. (715)
J 748 Pine Cr., Pa. (715)
J 749 Little Pine Cr., Pa. (748)
J 750 Block House Run, Pa. (749)
J 751 Blacks Cr., Pa. (749)
J 752 Texas Run, Pa. (749)
J 753 Zimmerman Cr., Pa. (752)
J 754 Otter Cr., Pa. (749)
J 755 Mill Run, Pa. (748)
J 756 Babb Cr., Pa. (748)
J 757 Stony Fork, Pa. (756)
J 758 Marsh Cr., Pa. (748)
J 759 Phoenix Cr., Pa. (748)
J 760 Cushing Cr., Pa. (748)
J 761 West Branch, Pa. (748)
J 762 Cedar Run, Pa. (748)
J 763 Gamble Run, Pa. (748)
J 764 Queen Run, Pa. (715)
J 765 Lick Run, Pa. (715)
J 766 Hyner Cr., Pa. (715)
J 767 Young Womans Cr., Pa. (715)
J 768 Paddy Run, Pa. (715)
J 769 Drury Run, Pa. (715)
J 770 Kettle Cr., Pa. (715)
J 771 Little Kettle Cr., Pa. (770)
J 772 Cross Fork, Pa. (770)
J 773 Hammersly Fork, Pa. (770)
J 774 Cook Run, Pa. (715)
J 775 Sinnemahoning Cr., Pa. (715)
J 776 First Fork, Pa. (775)
J 777 East Fork, Pa. (776)

J 778 Prouty Branch, Pa. (776)
J 779 Freemans Run, Pa. (776)
J 780 Hunts Run, Pa. (775)
J 781 Portage Cr., Pa. (775)
J 782 Driftwood Branch, Pa. (775)
J 783 North Cr., Pa. (782)
J 784 Deep Cr., Pa. (782)
J 785 Clear Cr., Pa. (782)
J 786 West Cr., Pa. (782)
J 787 Sterling Run, Pa. (775)
J 788 Hicks Run, Pa. (775)
J 789 Dent Run, Pa. (775)
J 790 Bennett Branch, Pa. (775)
J 791 Spring Run, Pa. (790)
J 792 Trout Run, Pa. (791)
J 793 Mix Run, Pa. (775)
J 794 Wykoff Run, Pa. (775)
J 795 Upper Jerry Run, Pa. (775)
J 796 Moccasin Run, Pa. (775)
J 797 Birch Island Run, Pa. (715)
J 798 Upper Tree Run, Pa. (715)
J 799 Mosquito Cr., Pa. (715)
J 800 Sandy Cr., Pa. (715)
J 801 Deer Cr., Pa. (715)
J 802 Trout Run, Pa. (715)
J 803 Lick Run, Pa. (715)
J 804 Upper Moose Cr., Pa. (715)
J 805 Montgomery Cr., Pa. (715)
J 806 Anderson Cr., Pa. (715)
J 807 Bell Run, Pa. (715)
J 808 Curry Run, Pa. (715)
J 809 Cush Cr., Pa. (715)
J 810 Chest Cr., Pa. (715)
J 811 Clearfield Cr., Pa. (715)
J 812 Little Clearfield Cr., Pa. (811)
J 813 Potts Run, Pa. (811)
J 814 Beaver Dam Run, Pa. (811)
J 815 Moravian Run, Pa. (715)
J 816 Alden Run, Pa. (715)
J 817 Moshannon Cr., Pa. (715)
J 818 Cold Stream, Pa. (817)
J 819 Six Mile Run, Pa. (817)
J 820 Little Moshannon Cr., Pa. (817)
J 821 Hall Run, Pa. (715)
J 822 Backer Run, Pa. (715)
J 823 Tangascootack Cr., Pa. (715)
J 824 Bald Eagle Cr., Pa. (715)
J 825 Beech Cr., Pa. (824)
J 826 Big Run, Pa. (825)
J 827 Marsh Cr., Pa. (824)
J 828 Spring Cr., Pa. (824)
J 829 Buffalo Cr., Pa. (828)
J 830 Fishing Cr., Pa. (824)
J 831 Little Fishing Cr., Pa. (830)
J 832 Big Fishing Cr., Pa. (830)
J 833 Cherry Run, Pa. (832)
J 834 Long Run, Pa. (830)
J 835 McElhattan Cr., Pa. (715
J 836 Uppernose Cr., Pa. (715)
J 837 Antis Cr., Pa. (836)
J 838 Spring Cr., Pa. (715)
J 839 White Deer Hole Cr., Pa. (838)
J 840 Buffalo Cr., Pa. (715)
J 841 Spruce Run, Pa. (840)
J 842 Rapid Run, Pa. (840)
J 843 Turtle Cr., Pa. (715)
J 844 Penn Cr., Pa. (556)
J 845 Pine Cr., Pa. (844)
J 846 Elk Cr., Pa. (845)
J 847 Poe Cr., Pa. (844)
J 848 Wolf Run, Pa. (844)
J 849 Middle Cr., Pa. (844)
J 850 North Branch, Pa. (849)
J 851 South Branch, Pa. (849)
J 852 West Mahantango Cr., Pa. (556)
J 853 Barger Cr., Pa. (556)
J 854 Hunter Cr., Pa. (556)
J 855 Juniata R., Pa. (556)
J 856 Wild Cat Cr., Pa. (855)
J 857 Cocolamus Cr., Pa. (855)
J 858 Doe Run, Pa. (855)
J 859 Lost Cr., Pa. (855)
J 860 Jacks Cr., Pa. (855)
J 861 Kishacoquillas Cr., Pa. (855)
J 862 Honey Cr., Pa. (861)
J 863 Mill Cr., Pa. (855)
J 864 Shaver Cr., Pa. (855)
J 865 Little Juniata R., Pa. (855)
J 866 Spruce Cr., Pa. (865)
J 867 Tipton Run, Pa. (865)
J 868 Bell Gap Run, Pa. (865)
J 869 Canoe:Cr., Pa. (855)
J 870 Sugar Run, Pa. (855)
J 871 Poplar Run, Pa. (855)
J 872 Piney Cr., Pa. (855)
J 873 Clover Cr., Pa. (855)
J 874 Crooked Cr., Pa. (855)
J 875 Raystown Branch, Pa. (855)
J 876 Valley Run, Pa. (875)
J 877 Dunning Cr., Pa. (875)
J 878 Scrub Grass Cr., Pa. (877)
J 879 Bobs Cr., Pa. (877)
J 880 George Cr., Pa. (877)
J 881 Schuber Run, Pa. (877)
J 882 Cove Cr., Pa. (877)
J 883 Clear Cr., Pa. (875)
J 884 Shavers Cr., Pa. (875)
J 885 Sherman Run, Pa. (875)
J 886 Trough Cr., Pa. (875)
J 887 Hares Valley Cr., Pa. (855)
J 888 Hill Valley Cr., Pa. (855)
J 889 Aughwick Cr., Pa. (855)
J 890 Little Aughwick, Pa. (889)
J 891 Black Hog Cr., Pa. (889)
J 892 Licking Cr., Pa. (855)
J 893 Raccoon Cr., Pa. (855)
J 894 Buffalo Cr., Pa. (855)
J 895 Little Buffalo Cr., Pa. (855)
J 896 Little Juniata Cr., Pa. (855)
J 897 Sherman Cr., Pa. (556)
J 898 Laurel Run, Pa. (897)
J 899 McCabe Run, Pa. (897)
J 900 Cove Cr., Pa. (556)
J 901 Fishing Cr., Pa. (556)
J 902 Connedoguinet Cr., Pa. (556)
J 903 Big Run, Pa. (902)
J 904 Middle Spring, Pa. (902)
J 905 Breeches Cr., Pa. (556)
J 906 Mountain Cr., Pa. (905)
J 907 Fishing Cr., Pa. (556)
J 908 Conewago Cr., Pa. (556)
J 909 Beaver Cr., Pa. (908)
J 910 Bermudian Cr., Pa. (908)
J 911 Latimore Cr., Pa. (910)

J 912 Mud Run, Pa. (910)
J 913 Little Conewago Cr., Pa. (908)
J 914 Codorus Cr., Pa. (556)
J 915 West Branch, Pa. (914)
J 916 East Branch, Pa. (914)
J 917 Mill Cr., Md. (914)
J 918 Creitz Cr., Pa. (556)
J 919 Cabin Cr., Pa. (556)
J 920 Muddy Cr., Pa. (556)
J 921 Broad Cr., Md. (556)
J 922 Deep Cr., Pa. (921)
J 923 Peddler Run, Md. (556)
J 924 Deer Cr., Md. (556)
J 925 Hollands Branch, Md. (924)
J 926 Falling Branch, Pa. (924)
J 927 Big Branch, Pa. (924)
J 928 Island Branch, Md. (924)
J 929 Little Deer Cr., Md. (924)
J 930 Stirrup Run, Md. (924)
J 931 Thomas Run, Md. (924)
J 932 Tobacco Run, Md. (924)
J 933 Coolbranch Run, Md. (924)
J 934 Mill Brook, Md. (924)
J 935 Graveyard Cr., Md. (924)
J 936 Elbow Branch, Md. (924)
J 937 Rock Run, Md. (556)
J 938 Velvet Rock Branch, Md. (556)
J 939 Swan Cr., Md. (1)
J 940 Gasheys Cr., Md. (939)
J 941 Carsins Run, Md. (939)
J 942 Spesutie Narrows, Md. (1)
J 943 Mosquito Cr., Md. (1)
J 944 Delph Cr., Md. (1)
J 945 Romney Cr., Md. (1)
J 946 Little Romney Cr., Md. (945)
J 947 Back Cr., Md. (945)
J 948 Bridge Cr., Md. (945)
J 949 Long Bridge Cr., Md. (945)
J 950 Bush R., Md. (1)
J 951 Abbey Island Cr., Md. (950)
J 952 Cod Cr., Md. (950)
J 953 Redmon Cove, Md. (950)
J 954 Sod Run, Md. (950)
J 955 Church Cr., Md. (950)
J 956 Cranberry Run, Md. (955)
J 957 Grays Run, Md. (955)
J 958 Bush Cr., Md. (950)
J 959 James Run, Md. (958)
J 960 Broad Run, Md. (959)
J 961 Bynum Run, Md. (958)
J 962 Otter Point Cr., Md. (950)
J 963 Haha Branch, Md. (962)
J 964 Winters Run, Md. (962)
J 965 Plumtree Run, Md. (964)
J 966 Bear Cabin Branch, Md. (964)
J 967 East Branch, Md. (964)
J 968 West Branch, Md. (964)
J 969 Mountain Branch, Md. (964)
J 970 Monks Cr., Md. (950)
J 971 Lauderick Cr., Md. (950)
J 972 Kings Cr., Md. (950)
J 973 Doves Cove, Md. (950)
J 974 Cooper Cr., Md. (950)
J 975 Boone Cr., Md. (950)
J 976 Gunpowder R., Md. (1)
J 977 Watson Cr., Md. (976)
J 978 Swaderick Cr., Md. (976)
J 979 Wright Cr., Md. (976)
J 980 Canal Cr., Md. (976)
J 981 Reardon Inlet, Md. (976)
J 982 Foster Branch, Md. (976)
J 983 Little Gunpowder Falls, Md. (976)
J 984 Wildcat Branch, Md. (983)
J 985 Rocky Branch, Md. (984)
J 986 Yellow Branch, Md. (983)
J 987 Thornton Branch, Md. (983)
J 988 Nelson Branch, Md. (983)
J 989 Parker Branch, Md. (983)
J 990 Sawmill Branch, Md. (983)
J 991 Dick Branch, Md. (983)
J 992 Gunpowder Falls, Md. (976)
J 993 Broad Run, Md. (992)
J 994 Sweathouse Branch, Md. (992)
J 995 Long Green Cr., Md. (992)
J 996 Hay Stack Branch, Md. (995)
J 997 Cowen Run, Md. (992)
J 998 Pierce Branch, Md. (997)
J 999 Dulaney Valley Branch, Md. (992)
J 1000 Jenkins Run, Md. (992)
J 1001 Fitzhugh Run, Md. (992)
J 1002 Overshot Run, Md. (992)
J 1003 Bayston Branch, Md. (992)
J 1004 Greens Branch, Md. (992)
J 1005 Carroll Branch, Md. (992)
J 1006 My Lady's Manor Branch, Md. (1005)
J 1007 Charles Run, Md. (992)
J 1008 Little Falls, Md. (992)
J 1009 First Mine Branch, Md. (1008)
J 1010 Second Mine Branch, Md. (1008)
J 1011 Third Mine Branch, Md. (1008)
J 1012 Fourth Mine Branch, Md. (1008)
J 1013 Beetree Run, Md. and Pa. (1008)
J 1014 Owl Branch, Md. (1008)
J 1015 Silver Run, Md. (992)
J 1016 Walker Run, Md. and Pa. (992)
J 1017 Muddy Cr., Md. and Pa. (992)
J 1018 South Branch, Md. and Pa. (992)
J 1019 Poplar Run, Md. (992)
J 1020 Georges Cr., Md. (992)
J 1021 Compass Run, Md. (1020)
J 1022 Murphy Run, Md. (1020)
J 1023 Peggys Run, Md. (1020)
J 1024 Prettyboy Branch, Md. (992)
J 1025 Bush Cabin Run, Md. (992)
J 1026 Mingo Branch, Md. (992)
J 1027 Panther Branch, Md. (992)
J 1028 Piney Cr., Md. (992)
J 1029 Buffalo Cr., Md. (1028)
J 1030 Western Run, Md. (992)
J 1031 Blackrock Run, Md. (1030)
J 1032 Indian Run, Md. (1031)
J 1033 Beaverdam Run, Md. (1030)
J 1034 Oregon Branch, Md. (1033)
J 1035 Baisman Branch, Md. (1033)
J 1036 Goodwin Run, Md. (1033)
J 1037 Parks Run, Md. (1033)
J 1038 Wolftrap Branch, Md. (1030)
J 1039 Merryman Branch, Md. (992)
J 1040 Peterson Run, Md. (992)
J 1041 Kelly Branch, Md. (1040)
J 1042 Spring Branch, Md. (1040)
J 1043 Long Quarter Branch, Md. (1040)
J 1044 Rush Brook, Md. (992)

J 1045 Towson Run, Md. (992)
J 1046 Minebank Run, Md. (992)
J 1047 Jenifer Branch, Md. (992)
J 1048 Bird R., Md. (976)
J 1049 Whitemarsh Run, Md. (1048)
J 1050 Honeygo Run, Md. (1049)
J 1051 Windlass Run, Md. (1048)
J 1052 Saltpeter Cr., Md. (976)
J 1053 Dundee Cr., Md. (1052)
J 1054 Hawthorn Cove. Md. (1)
J 1055 Seneca Cr., Md. (1)
J 1056 Middle R., Md. (1)
J 1057 Galloway Cr., Md. (1056)
J 1058 Frog Mortar Cr., Md. (1056)
J 1059 Stansbury Cr., Md. (1056)
J 1060 Dark Head Cr., Md. (1056)
J 1061 Hopkins Cr., Md. (1056)
J 1062 Norman Cr., Md. (1056)
J 1063 Hogpen Cr., Md. (1056)
J 1064 Sue Cr., Md. (1056)
J 1065 Hawk Cove, Md. (1)
J 1066 Browns Cr., Md. (1065)
J 1067 Back R., Md. (1065)
J 1068 Muddy Gut, Md. (1067)
J 1069 Deep Cr., Md. (1067)
J 1070 Northeast Cr., Md. (1067)
J 1071 Brien Run, Md. (1070)
J 1072 Stemmer Run, Md. (1070)
J 1073 Red House Cr., Md. (1067)
J 1074 Herring Run, Md. (1067)
J 1075 Moores Run, Md. (1074)
J 1076 Chinkapin Run, Md. (1074)
J 1077 Bread and Cheese Cr., Md. (1067)
J 1078 Shallow Cr., Md. (1)
J 1079 Patapsco R., Md. (1)
J 1080 Old Road B., Md. (1079)
J 1081 North Point Cr., Md. (1080)
J 1082 Jones Cr., Md. (1080)
J 1083 Humphreys Cr., Md. (1079)
J 1084 Bear Cr., Md. (1079)
J 1085 Greys Cr., Md. (1084)
J 1086 Bullneck Cr., Md. (1084)
J 1087 Peach Orchard Cr., Md. (1084)
J 1088 Colgate Cr., Md. (1079)
J 1089 Gorsuch Cr., Md. (1079)
J 1090 Baltimore H., Md. (1079)
J 1091 Jones Falls, Md. (1090)
J 1092 Stony Run, Md. (1091)
J 1093 Lake Roland, Md. (1091)
J 1094 Roland Run, Md. (1093)
J 1095 Deep Run, Md. (1091)
J 1096 Dippingpond Run, Md. (1091)
J 1097 North Run, Md. (1091)
J 1098 Slaughter House Run, Md. (1091)
J 1099 Moores Branch, Md. (1091)
J 1100 Winans Cove, Md. (1079)
J 1101 Southern Baltimore H. (1079)
J 1102 Gwynns Falls, Md. (1101)
J 1103 Red Run, Md. (1102)
J 1104 Horsehead Branch, Md. (1102)
J 1105 Scotts Level Branch, Md. (1102)
J 1106 Dead Run, Md. (1102)
J 1107 Smith Cove, Md. (1101)
J 1108 Herbert Run, Md. (1079)
J 1109 Soapstone Branch, Md. (1079)
J 1110 Bull Branch, Md. (1109)
J 1111 Cooper Branch, Md. (1079)
J 1112 Miller Run, Md. (1079)
J 1113 Cedar Branch, Md. (1079)
J 1114 Dogwood Run, Md. (1079)
J 1115 Ben Run, Md. (1079)
J 1116 Brice Run, Md. (1079)
J 1117 Mardella Branch, Md. (1116)
J 1118 Granite Branch, Md. (1116)
J 1119 North Branch, Md. (1079)
J 1120 Falls Run, Md. (1119)
J 1121 Locust Run, Md. (1119)
J 1122 Chimney Branch, Md. (1121
J 1123 Cooks Branch, Md. (1119)
J 1124 Timber Run, Md. (1123)
J 1125 Norris Branch, Md. (1119)
J 1126 Keysers Run, Md. (1119)
J 1127 Board Run, Md. (1119)
J 1128 Deep Run, Md. (1119)
J 1129 Aspen Run, Md. (1128)
J 1130 East Branch, Md. (1119)
J 1131 Indian Run, Md. (1130)
J 1132 Aspen Run, Md. (1130)
J 1133 Whiteoak Run, Md. (1132)
J 1134 West Branch, Md. (1119)
J 1135 Cranberry Branch, Md. (1134)
J 1136 Roaring Run, Md. (1119)
J 1137 Beaver Run, Md. (1119)
J 1138 Middle Run, Md. (1137)
J 1139 Middle Run, Md. (1119)
J 1140 Prugh Branch, Md. (1139)
J 1141 Morgan Run, Md. (1119)
J 1142 Little Morgan Run, Md. (1141)
J 1143 South Branch, Md. (1079)
J 1144 Piney Run, Md. (1143)
J 1145 Gillis Falls, Md. (1143)
J 1146 Davis Branch, Md. (1079)
J 1147 Sucker Branch, Md. (1079)
J 1148 Blackburn Branch, Md. (1079)
J 1149 Deep Run, Md. (1079)
J 1150 Piney Run, Md. (1149)
J 1151 Stony Run, Md. (1079)
J 1152 Holly Cr., Md. (1079)
J 1153 Curtis B., Md. (1079)
J 1154 Stonehouse Cove, Md. (1153)
J 1155 Cabin Branch, Md. (1153)
J 1156 Curtis Cr., Md. (1153)
J 1157 Back Cr., Md. (1156)
J 1158 Furnace Cr., Md. (1156)
J 1159 Sawmill Cr., Md. (1158)
J 1160 Marley Cr., Md. (1156)
J 1161 Tanyard Cove, Md. (1160)
J 1162 Arundel Cove, Md. (1156)
J 1163 Thoms Cove, Md. (1079)
J 1164 Swan Cr., Md. (1079)
J 1165 Cox Cr., Md. (1079)
J 1166 Stoney Cr., Md. (1079)
J 1167 Back Cr., Md. (1166)
J 1168 Nabbs Cr., Md. (1166)
J 1169 Big Burley Cr., Md. (1166)
J 1170 Long Cove, Md. (1166)
J 1171 Eli Cove, Md. (1166)
J 1172 Rock Cr., Md. (1079)
J 1173 Tar Cove, Md. (1172)
J 1174 Walts Cove, Md. (1172)
J 1175 Bodkin Cr., Md. (1079)
J 1176 Back Cr., Md. (1175)
J 1177 Main Cr., Md. (1175)
J 1178 Wharf Cr., Md. (1175)

J 1179 Locust Cove, Md. (1175)
J 1180 Magothy Narrows, Md. (1) (1184)
J 1181 Redhouse Cr., Md. (1180)
J 1182 Otter Pond, Md. (1)
J 1183 Magothy R., Md. (1)
J 1184 Sillery B., Md. (1183)
J 1185 Cornfield Cr., Md. (1180)
J 1186 Tar Cove, Md. (1184)
J 1187 Grays Cr., Md. (1184)
J 1188 Pork Cr., Md. (1183)
J 1189 Broad Cr., Md. (1183)
J 1190 Blackhole Cr., Md. (1183)
J 1191 Ross Cove, Md. (1183)
J 1192 Cockeys Cr., Md. (1183)
J 1193 Old Man Cr., Md. (1183)
J 1194 Cattail Cr., Md. (1183)
J 1195 Cypress Cr., Md. (1183)
J 1196 Dividing Cr., Md. (1183)
J 1197 Mill Cr., Md. (1183)
J 1198 Robinson Cove, Md. (1183)
J 1199 Forked Cr., Md. (1183)
J 1200 Deep Cr., Md. (1183)
J 1201 Little Magothy R., Md. (1183)
J 1202 Shorts Cr., Md. (1)
J 1203 Mass Pond, Md. (1)
J 1204 Goose Pond, Md. (1)
J 1205 Whitehall Cr., Md. (1)
J 1206 Merediths Cove, Md. (1205)
J 1207 Ridout Cr., Md. (1205)
J 1208 Mill Cr., Md. (1205)
J 1209 Duvalls Cr., Md. (1208)
J 1210 Martins Cove, Md. (1208)
J 1211 Severn R., Md. (1)
J 1212 Carrs Cr., Md. (1211)
J 1213 Winchester Pond, Md. (1211)
J 1214 Cool Spring Cove, Md. (1211)
J 1215 Chase Cr., Md. (1211)
J 1216 Aisquith Cr., Md. (1211)
J 1217 Ringold Cove, Md. (1211)
J 1218 Sullivan Cove, Md. (1211)
J 1219 Yantz Cr., Md. (1211)
J 1220 Forked Cr., Md. (1211)
J 1221 Severn Run, Md. (1211)
J 1222 Jabez Branch, Md. (1221)
J 1223 Plum Cr., Md. (1211)
J 1224 Gumbottom Cr., Md. (1223)
J 1225 Valentine Cr., Md. (1211)
J 1226 Round B., Md. (1211)
J 1227 Little Round B., Md. (1226)
J 1228 Little Round B. Cr., Md. (1227)
J 1229 Sunken Island Cr., Md. (1227)
J 1230 Brewer Pond, Md. (1211)
J 1231 Brewer Cr., Md. (1211)
J 1232 Clements Cr., Md. (1211)
J 1233 Saltworks Cr., Md. (1211)
J 1234 Luce Cr., Md. (1211)
J 1235 Weems Cr., Md. (1211)
J 1236 Dorsey Cr., Md. (1211)
J 1237 Spa Cr., Md. (1211)
J 1238 Back Cr., Md. (1211)
J 1239 Ogleton Lake, Md. (1211)
J 1240 Blackwalnut Cr., Md. (1)
J 1241 Oyster Cr., Md. (1)
J 1242 Fishing Cr., Md. (1)
J 1243 South R., Md. (1)
J 1244 Cherrytree Cove, Md. (1243)
J 1245 Duvall Cr., Md. (1243)
J 1246 Harness Cr., Md. (1243)
J 1247 Aberdeen Cr., Md. (1243)
J 1248 Crab Cr., Md. (1243)
J 1249 Church Cr., Md. (1243)
J 1250 Gingerville Cr., Md. (1243)
J 1251 Broad Cr., Md. (1243)
J 1252 North R., Md. (1243)
J 1253 Flat Cr., Md. (1243)
J 1254 Beards Cr., Md. (1243)
J 1255 Warehouse Cr., Md. (1243)
J 1256 Almshouse Cr., Md. (1243)
J 1257 The Glebe Cr., Md. (1243)
J 1258 Brewer Cr., Md. (1243)
J 1259 Limehouse Cr., Md. (1243)
J 1260 Selby B., Md. (1243)
J 1261 Ramsays Gut, Md. (1243)
J 1262 Big Pond, Md. (1243)
J 1263 West R., Md. (1)
J 1264 Rhodes R., Md. (1263)
J 1265 Cadle Cr., Md. (1264)
J 1266 Whitemarsh Cr., Md. (1264)
J 1267 Waters Cr., Md. (1264)
J 1268 Muddy Cr., Md. (1264)
J 1269 Cheston Cr., Md. (1263)
J 1270 Scaffold Cr., Md. (1263)
J 1271 Inspectinghouse Cr., Md. (1263)
J 1272 Lane Cr., Md. (1263)
J 1273 Coxs Cr., Md. (1263)
J 1274 Tenthouse Cr., Md. (1263)
J 1275 Gales Cr., Md. (1263)
J 1276 Parish Cr., Md. (1263)
J 1277 Broadwater Cr., Md. (1)
J 1278 Parker Cr., Md. (1)

J-1 (a) CHESAPEAKE BAY TO LAKE ONTARIO.

SURVEY.

To determine practicability of SS. navigation, Feb. 7, 1867, **67**, 17.

J-3 POCOMOKE RIVER, MD. AND VA.

APPROPRIATIONS.

1878,	$10,000.00,	**79**, 77.
1879,	2,500.00,	**79**, 77.
1886,	8,000.00,	**87**, 847.
1896,	5,000.00,	**97**, 1284.
1899,	3,000.00,	**99**, 1396.
1902,	*4,800.00,	**02**, 1076.
1905,	*1,743.00,	**05**, 1140.
1907,	*2,298.60,	**07**, 1153.
1909,	*2,500.00,	**09**, 1200.
1911,	*2,368.42,	**11**, 1421.
Total,	42,210.02	

*Allotment.

COMMERCE.

Est., 1892, that after completion of inland waterway the C. on it from Pocomoke R. to Indian R. would amount to not less than $5,000,000 per an., **93,** 1236.

Imp. has had no effect on rates, **10,** 272.

In 1911, 78,644 t.; value, $5,188,888; no notable effect of imp. on rates, **12,** 349, 1642.

CONTRACTS.

1878. With D. Constantine, dr., 23¢ and 26¢ c. y., **79,** 507. D. W. Constantine, dr., 17½¢ c. y., **80,** 645.

1888. Atlas Dredging Co., dr., 10¢ c. y., **88,** 752.

1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1285.

1899. Baltimore Dredging Co., dr., 12¾¢ c. y., p. m., **00,** 1659.

1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1016.

1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1084.

1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1154.

1909. River & Harbor Improvement Co., dr., 11.95¢ c. y., **10,** 1326.

1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1642.

ENGINEERS.

Chief of Engineers. R., 79, 77; **80,** 104; **81,** 141; **82,** 137; **83,** 140; **84,** 151; **85,** 137; **87,** 96; **88,** 95; **89,** 111; **93,** 143; **95,** 151; **96,** 23; **97,** 169; **98,** 173; **99,** 200; **00,** 228; **01,** 271; **02,** 199; **03,** 189; **04,** 188; **05,** 197; **06,** 208; **07,** 221; **08,** 231; **09,** 239; **10,** 271, 2821; **11,** 294; **12,** 348.

Board. Convened, Philadelphia, Pa., Aug. 10, 1895, by S. O. No. 29, 1895, to consider and **R.** upon the subject of H. lines at or near Snowhill, on the Pocomoke R., Md., **96,** 996. (Lt. Col. P. C. Hains. Maj. C. W. Raymond, and Lt. Spencer Cosby.)

In charge:

Maj. W. P. Craighill, 1878–85. **R., 79,** 505; (Lt. Col.) **80,** 644; **81,** 889; **82,** 859; **83,** 683; **84,** 949.

W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 904; **87,** 847; **88,** 752; (Maj.) **89,** 904; **93,** 1234; **95,** 1154, 1167; **97,** 1284; **98,** 1168; **99,** 1395; **00,** 1658.

Lt. Col. O. H. Ernst, 1901. **R., 01,** 1388.

Col. P. C. Hains, 1902. **R., 02,** 1076.

Capt. J. C. Sanford, 1903. **R., 03,** 1015.

Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1266; **05,** 1140; **06,** 1084; (Col.) **07,** 1153; **08,** 1195.

Maj. W. E. Craighill, 1909. **R., 09,** 1200.

Col. Thos. L. Casey, 1910–11. **R., 10,** 1326; **11,** 1421.

Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1642.

Assistants:

G. W. Parsons. **R., 79,** 507.

Capt. J. W. Cuyler, **79,** 75; **80,** 98.

Lt. Thomas Turtle, **79,** 75; **80,** 98.

J. L. Seager. **R., 84,** 949.

T. I. George. **R., 85,** 905.

C. M. Bird. **R., 85,** 906; **95,** 1155.

A. Stierle. **R., 93,** 1235; **95,** 1168.

OPERATIONS.

1879–80. Dr. in progress, proj. completed, **80,** 645.

1887–88. 53,386 c. y. dr., completing proj., **88,** 752.

1896–97. 39,329 c. y., p. m., dr., **97,** 1284.

1900–01. 20,192 c. y. dr., **01,** 1388.

1903–04. 21,700 c. y. dr., **04,** 1266.

1905–06. 12,938 c. y. dr., **06,** 1084. Proj. completed, **07,** 221.

1907–08. 10,690 c. y. dr., **08,** 1195.

1909–10. 18,843 c. y. dr., **10,** 1326.

1911–12. 11,283 c. y. dr., **12,** 1642.

PHYSICAL CHARACTERISTICS.

General description, **79,** 507; **93,** 1235.

Obstructions, abrupt bends, narrow and crooked chans., bars and shoals, sunken stumps, etc., **79,** 508.

Tides, **79,** 509.

Description of the country between Pocomoke R. and Indian R., **95,** 1155.

Max. draft over shoalest part of chan. under imp., 1911, 9′; tides, etc., **12,** 349.

Rises partly in Del. and Md.; about 50 m. l.; flows sw. and empties into Pocomoke Sound; proj. section 4½ m., and lower end 24 m. above mouth of R., **12,** 348.

PROJECTS.

By Maj. Craighill, 1878, dr. chan. 7′ d., and removal of logs, snags, and obstr.; est., $9,975, **79,** 505–510. Proj. completed, 1880, **81,** 889.

By W. F. Smith, U. S. agent, 1885, excavating a cut-off below Sand Hill 7′ x 80′ m. l. w., l. to be 1,100′; est., $8,000, **85,** 906; **88,** 752. Proj. completed, 1888, **88,** 752.

Maj. Smith, U. S. agent, in 1895, est. that to make a cut 20′ w. at bottom and 6′ d. below m. l. w. from Sinepuxent B. to Pocomoke R. would cost $564,272, **95,** 1167; and to make a chan. 9′ d. m. l. w. from 100′–130′ w. would cost $14,000, from Snow Hill to Shad Landing, **95,** 1168. Au. act June 3, 1896, **12,** 349.

SURVEYS.

By G. W. Parsons, 1878. **R., 79,** 507.

Ex. of Pocomoke R., with view to cut-off in the bend just below Snow Hill (**R.** unfav.), **84,** 949.

Of Pocomoke R., from Snow Hill to Dighton, 1885, **85,** 906.

Ex. of Pocomoke R. au. act July 13, 1892; made by Maj. Smith, U. S. agent, 1892 (**R.** fav.), **93,** 1234.

Ex. for a canal from Pocomoke R. to Indian R., Del., au. act Aug. 17, 1894; made by Maj. Smith, US. agent, 1894 (**R.** unfav.), **95,** 1154.

Sur. of Pocomoke R. to Sinepuxent B. au. act Aug. 17, 1894; made by Maj. Smith, U. S. agent, 1895 (**R.** unfav.; see Projects), **95,** 1167.

Ex., Snow Hill, Md., to Gumboro, Del., au. act Mar. 3, 1909; made 1909 by Maj. Craighill (**R.** unfav.),[1] **10,** 282.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 349.

Maps. **95,** 1168.

J-39 BROAD CREEK, MD.

APPROPRIATIONS.

1912, $57,200, **12,** 1653.

ENGINEERS.

Chief of Engineers. R., 81, 150; **82,** 144; **91,** 132; **12,** 361.

In charge:

Lt. Col. W. P. Craighill. **R., 82,** 948.

Maj. W. F. Smith, U. S. agent. **R., 91,** 1221, 1223.

Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1653.

Assistant. A. Stierle. **R., 91,** 1222, 1224.

PHYSICAL CHARACTERISTICS.

Details of, **91,** 1222.

Connects Pocomoke Sound and Little Annemessex R., 2½ m. l., **12,** 362.

PLANS.

By Col. Craighill, 1882, dr. chan. 8′ d. m. l. w. and 150′ w. on the w. side of Kent Isld.; also an interior basin 800′ sq.; est., $60,000, **82,** 948.

By Maj. Smith, 1891, excavation of a 7′ l.-w. chan. 120′ w., from the 7′ d. in Pocomoke Sound to the same d. in Little Annemessex R., removing 270,000 c. y.; est., $54,000, **91,** 1223.

[1] H. D. 344, 61st, 2d.

PROJECTS.

Act July 25, 1912, au. chan. 6′ d. m. l. w., 100′ w. in straight reaches and 130′ w. at bends and about 2 m. l.; nothing to be expended until right of way deeded, and permission granted for deposit of dr. material at sufficient distance to prevent its return to creek, both free of cost to U. S.[1] (see Surveys, 1911), **12,** 362.

SURVEYS.

Ex. au. act Mar. 3, 1881; made by Col. Craighill, **82,** 948.

Au. act Sept. 19, 1890; made, 1891, by Maj. Smith, **91,** 1223.

Ex. au. act June 25, 1910; **R.** by Col. Langfitt, Oct. 7, 1910, and Jan. 16, 1911; est., $57,200, and $200 an. mainten., subject to condition of local cooperation,[1] **12,** 362.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 362.

Maps.[1]

J-45(a) TANGIER ISLAND (Tangier Harbor), TANGIER SOUND, VA.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 131; **00,** 231.

In charge. Maj. W. F. Smith, U.S. agent, 1900–. **R.,** **91,** 1207; **00,** 1684.

Assistant. A. Stierle. **R.,** **91,** 1208.

PHYSICAL CHARACTERISTICS.

Description of; H. an indentation on e. side and near s. extremity of Tangier Isld. The isld. is most s. one of chain of islds. in Chesapeake B. which extend in an almost due s. direction from Bishops Head Pt.; in Dorchester Co., e. shore of Md., **91,** 1208.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Smith, U. S. agent (**R.** unfav.), **91,** 1207.

Ex. with view to dr. chan. leading to Tangier Isld., in Tangier Sound, and to ascertain most feasible chan. for imp., au. act Mar. 3, 1899; made, 1899, by Maj. Smith, U. S. agent (**R.** unfav.), **00,** 1685.

J-46 CRISFIELD HARBOR, MD.

APPROPRIATIONS.

1875,	$37,317.50,	**75,** 88, ii, 71; **76,** 64, 290.
1907,	37,707.00,	**07,** 1161.
1910,	10,055.00,	**10,** 1333.
1912,	5,000.00,	**12,** 1651.
Total,	90,079.50,	**12,** 1651.

COMMERCE.

U.S. works produced no change in rates, **10,** 280.

Tonnage, 1906, 30,000 t.; 1911, 239,027 t., **12,** 360, 1651.

CONTRACTS.

1875. G. H. Ferris, dr., 13¾¢ c. y., **75,** ii, 71; **76,** 64, 290.

1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1161.

1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1429.

ENGINEERS.

Chief of Engineers. **R.,** **75,** 87, 90; **76,** 64; **06,** 215; **07,** 227; **08,** 238; **09,** 246; **10,** 280; **11,** 303; **12,** 359.

In charge:

Maj. W. P. Craighill, 1874–76. **R.,** **75,** ii, 71, 105; **76,** 290.

Col. R. L. Hoxie, 1907–08. **R.,** **07,** 1161; **08,** 1204.

Maj. W. E. Craighill, 1909. **R.,** **09,** 1207.

Col. Thos. L. Casey, 1910–11. **R.,** **10,** 1333; **11,** 1429.

Lt. Col. W. C. Langfitt, 1912–. **R.,** **12,** 1651.

Assistants:

C. Humphreys, **75,** ii, 106.

H. Bacon, in immediate charge, 1875. **R.,** **75,** ii 106.

Capt. C. B. Phillips, **76,** 290.

OPERATIONS.

1874–75. Dr., by contract, 36,195 c. y., **75,** 88, ii, 71; 13¾¢ c. y., **75,** 88.

1875–76. Removing 202,194 c. y. by dr., completing work, **76,** 64, 290.

1908–09. 179,982 c. y. dr., **09,** 1207.

1910–11. 50,733 c. y. dr. in making 4 cuts, each 45′ x 900′–1,540′, **11,** 1429.

PHYSICAL CHARACTERISTICS.

Described, **75,** ii, 106; **07,** 227; **11,** 304.

95 m. from Norfolk, 116 m. from Baltimore. Max. draft, 12′, **12,** 361.

PROJECTS.

By H. Bacon, adopted by Maj. Craighill, for 12′ chan. of uniform w. of 150′, 67,200 c. y. excavation $20,405; for chan. 150′ x 400′–300′, 128,700 c. y. excavation, $37,317.50, **75,** ii, 105, 107; **76,** 290. Completed, **76,** 64, 290.

Lt. Col. Hoxie, 1906, proposed restoring chan. to 12′ and w. anchorage basin; est., $37,700, and $800 an. mainten.,[2] **06,** 215; au. act Mar. 2, 1907, **07,** 228; est. increased, 1909, to $47,762, **09,** 247; again increased, 1911, to $51,942, **11,** 1429.

SURVEYS.

Ex. by Maj. Craighill, 1874, and sur., under his direction, by H. Bacon. **R.,** **75,** ii, 105.

Au. act Mar. 3, 1905; made, 1906, by Lt. Col. Hoxie,[2] **06,** 215.

Ex., **10,** 1333.

Maps.[2]

J-64 MANOKIN RIVER, MD.

APPROPRIATIONS.

1890,	$7,500.00,	**91,** 1197.
1892,	7,500.00,	**92,** 977.
1894,	4,000.00,	**95,** 1143.
1896,	[3] 4,000.00,	**96,** 970.
1899,	1,500.00,	**99,** 1395.
1905,	*4,772.50,	**05,** 1142.
1907,	*9,160.69,	**07,** 1156.
1910,	*14,181.93,	**10,** 1328.
1911,	*3,947.37,	**11,** 1424.
1912,	*5,000.00,	**12,** 1644.
Total,	61,562.49,	**12,** 1644.

*Allotments. [1] H. D. 269, 62d, 2d. [2] H. D. 783, 59th, 1st. [3] See Projects.

COMMERCE.

Imp. has had no effect on rates, **10,** 274; **12,** 351. In 1911, 4,805 t., **12,** 351.

CONTRACTS.

1891. F. C. Somers, dr., 15¾¢ c. y., **91,** 1197.
1892. F. C. Somers, dr., 9¢ c. y., p. m., **93,** 1224.
1895. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1144.
1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1283.
1899. Baltimore Dredging Co., dr., 12.4¢ c. y., p. m., **00,** 1658.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1086.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1156.
1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1424.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1644.

ENGINEERS.

Chief of Engineers. **R., 84,** 151; **89,** 112; **90,** 102; **91,** 129; **92,** 129; **93,** 141; **94,** 130; **95,** 148; **96,** 135; **97,** 168; **98,** 172; **99,** 200; **00,** 227; **01,** 270; **02,** 202; **03,** 193; **04,** 192; **05,** 198; **06,** 210; **07,** 222; **08,** 233; **09,** 241; **10,** 273; **11,** 296; **12,** 350.

In charge:

Capt. T. Turtle. **R., 84,** 951.
Maj. W. F. Smith, U. S. agent, 1888–1900. **R., 90,** 959; **91,** 1195; **92,** 976; **93,** 1223; **94,** 901; **95,** 1143; **96,** 969; **97,** 1282; **98,** 1168; **99,** 1394; **00,** 1657.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1387.
Col. P. C. Hains, 1902. **R., 02,** 1079.
Capt. J. C. Sanford, 1903. **R., 03,** 1022.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1273; **05,** 1142; **06,** 1086; (Col.) **07,** 1155; **08,** 1197.
Maj. W. E. Craighill, 1909. **R., 09,** 1201.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1328; **11,** 1423.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1644.

Assistant. A. Stierle. **R., 90,** 960.

OPERATIONS.

1890–91. 42,016 c. y. dr., **91,** 1196.
1892–93. 62,013 c. y., p. m., dr., **93,** 1223.
1895–96. 15,062 c. y., p. m., dr., **96,** 970.
1899–00. 34,033 c. y. dr., **00,** 1657.
1900–01. 10,388 c. y. dr., **01,** 1388.
1905–06. 35,425 c. y. dr., **06,** 1086.
1907–08. 41,736 c. y. dr., **08,** 1197.
1910–11. 22,413 c. y. dr., for completing proj.; 44,826 c. y. dr., for mainten., **11,** 1423.
1911–12. 12,986 c. y. dr., for mainten., **12,** 1644.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 951; **90,** 960; **10,** 273.

Creation and mainten. of chan. through "mud flats" at mouth difficult and uncertain; chan. deteriorated rapidly, **07,** 223; **12,** 351.

Max. draft over shoalest part of chan., 5′ m. l. w., **12,** 351.

Rises in Md., flows generally sw. and empties into Tangier Sound; l. of proj. section, 2½ m.; lower end, 5½ m. above mouth, **12,** 350.

PROJECTS.

By Maj. Smith, 1890, chan., Locust to Sharps Pts., 6′ x 100′ m. l. w.; est., $30,000, **90,** 961; **92,** 976.

App. of 1896 made with the proviso that $2,000 should be used to imp. the R., Dashiells Creek to Red Bridge, **96,** 970.

1907, est. increased to $42,103.99, **12,** 351.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Turtle (**R.** unfav.), **84,** 951.

Au. act Aug. 11, 1888; made, 1890, by Maj. Smith, **90,** 961.

Ex., **03,** 1022; **06,** 1086.

Pre. ex. au. act Feb. 27, 1911. **R.** by Col. Casey, July 19, 1911[1] (unfav.), **12,** 363.

J-79 DEAL ISLAND, MD. (Upper Thoroughfare.)

APPROPRIATION.

1882, $5,000, **82,** 855.

COMMERCE.

Details, **82,** 855; **86,** 870.

ENGINEERS.

Chief of Engineers. **R., 81,** 150; **82,** 134; **83,** 138; **84,** 145; **85,** 136; **86,** 132; **87,** 96.

In charge:

Lt. Col. W. P. Craighill, 1882–84. **R., 82,** 855; **83,** 679; **84,** 903.
W. F. Smith, U. S. agent, 1884–88. **R., 85,** 889; **86,** 870; **87,** 846; **88,** 751.

Assistant. G. W. Parsons. **R., 82,** 856.

PHYSICAL DATA.

Details; separated from Somerset Co., Md., by Upper or Laws Thoroughfare, **82,** 856.

PROJECTS.

By Lt. Col. Craighill, 1882, H. of refuge for small vessels and a landing place for steamers by dr. an anchorage basin with an approach from d. w. with break'r to protect the dr. chan. from filling; est., $20,000, **82,** 856; **83,** 680.

SURVEYS.

Upper thoroughfare between isld. and mainland; au. act Mar. 3, 1881; made by Lt. Col. Craighill, **82,** 856.

J-80 DEAL ISLAND, MD. (Lower Thoroughfare.)

APPROPRIATIONS.

1881,	$5,000,	**81,** 884.
1910,	5,300,	**10,** 1334.
1912,	2,000,	**12,** 1652.
Total,	12,300	

COMMERCE.

1911, 13,421 t.; effect of imp. on C. not apparent, **12,** 1652.

CONTRACTS.

1881. D. Constantine, dr., 27¢ c. y., **81,** 884.
1911. Maryland Dredging & Contracting Co., dr. 25,200± c. y., 18½¢ c. y., **11,** 1431.

ENGINEERS.

Chief of Engineers. **R., 80,** 111; **81,** 138, 150; **82,** 133; **83,** 138; **08,** 239; **10,** 280; **11,** 305; **12,** 360.

[1] H. D. 398, 62d 2d.

In charge:
Lt. Col. W. P. Craighill, 1879–83. **R., 81,** 882; **82,** 853; **83,** 679.
Col. Thos. L. Casey. **R., 10,** 1334.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1430; **12,** 1652.

Assistants:
G. W. Parsons. **R., 81,** 883.
Capt. E. H. Ruffner, **82,** 127.
Capt. Thomas Turtle, **82,** 127.

OPERATIONS.

1881-82. 16,561 c. y. dr., **82,** 854.
1910-11. 24,053 c. y. dr., resulting in completion of proj. chan. of 6′ in Tangier Sound, to second or inner angle; w. anchorage basin 50′ on w. side for 700′ between 1st and 2d angles; work not completed for lack of funds, **11,** 1430.

PHYSICAL DATA.

Tidal waterway between Deal Isld. and Little Deal Isld., extending from Tangier Sound, with varying w. of ⅛ to ½ m. x 1½ m. long. It is 20± m. n. of Crisfield, Md., **12,** 360.

PLANS.

By Lt. Col. Craighill, 1881, protecting chan. near its mouth by riprap dike; est., $15,000 to $20,000, **81,** 883.

PROJECTS.

By Lt. Col. Craighill, 1881, chan. 7′ x 100′ m. l. w., Tangier Sound, by the wharves of Daniel and of Vetra & Son, with turning basin at upper end; est., $10,000, **81,** 882.
By Col. Hoxie, 1907, restoring chan. 6′ x 80′ and w. it to 100′ at angles to furnish anchorage, and extending the latter 100′, to facilitate navigation and form H. of refuge; est., $5,300, and $200 an. mainten.,[1] **08,** 239; au. act June 25, 1910, **10,** 281.
Chief of Engineers au. increase in est. to $7,200, **11,** 1430.

SURVEYS.

Of lower thoroughfare between Deal and Little Deals Isld., au. act June 14, 1880; made, 1880, by Lt. Col. Craighill, **81,** 883.
Ex. at or near Wenona, Deal Isld., Md., au. act Mar. 2, 1907; made, 1907, by Col. Hoxie,[1] **08,** 239.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 361.

J-81 WICOMICO RIVER, MD.

APPROPRIATIONS.

1872,	$5,000,	**72,** 67, 685.
1873,	5,000,	**73,** 73, 766.
1874,	5,000,	**74,** 83, ii, 25.
1875,	5,000,	**75,** 87, ii, 68.
1876,	5,000,	**76,** 64, 289.
1878,	5,000,	**78,** 65, 453.
1879,	3,000,	**79,** 77, 503, 504.
1880,	5,000,	**80,** 644.
1881,	2,000,	**81,** 889.
1884,	10,000,	**85,** 888.
1890,	10,000,	**91,** 1194.
1892,	6,500,	**92,** 975.
1894,	3,000,	**94,** 130; **95,** 1141.
1896,	3,700,	**96,** 968.
1900,	18,	**10,** 1332.
1902,	*6,798,	**02,** 1077.
1905,	*5,000,	**05,** 1146.
1907,	2,500,	**07,** 1160.
1909,	*5,000,	**09,** 1206.
1910,	29,000,	**10,** 1332.
1911,	*3,000,	**11,** 1428.
1912,	*3,000,	**12,** 1640.
Total,	127,516	

COMMERCE.

Value of Salisbury exports, **80,** 644; **82,** 858.
Value of imp., **82,** 859.
C. interests to be furthered by imp., **90,** 948, 949.
Extensive oyster industry. Est. trade of 600 t. of wheat, 2,250 t. of tobacco, produce, etc., in 1892 would be benefited by an imp., **93,** 1314. C. not sufficient to warrant an imp., **93,** 1315.
No effect on rates, **10,** 279.
Slowly increasing; in 1911, 362,545 t., **12,** 348.
RR. rates reduced, **12,** 348.

CONTRACTS.

1872. J. H. Teemeyer, dr., 28¢ c. y., **73,** 765, 766.
1874. G. W. Parsons, dr., 32¢ and 22¢ c. y., **75,** ii, 71.
1878. G. H. Ferris, dr., 17½¢ c. y., **79,** 504.
1880. G. W. Parsons, dr., 22¢ and 32¢ c. y., chuted or scowed, **81,** 889.
1883. G. W. Parsons, dr., 22¢ and 30¢ c. y., deposited or scowed, **83,** 682.
1884. P. S. Ross, dr., 17¢ c. y., **85,** 888.
1891. F. C. Somers, dr., 12¢ c. y., **91,** 1194.
1892. C. T. Caler, dr., 9 9/10¢ c. y., s. m., **93,** 1223.
1895. Baltimore Dredging Co., dr., 19 9/10¢ c. y., p. m., **95,** 1142.
1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1281.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1017.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1090.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1160.
1909. River & Harbor Improvement Co., dr., 11.95¢ c. y., **10,** 1332.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1641.
1912. River & Harbor Improvement Co., dr., 16.8¢ c. y., **12,** 1641.

ENGINEERS.

Chief of Engineers. R., 71, 76; **72,** 67; **73,** 73; **74,** 82; **75,** 87; **76,** 63; **77,** 59; **78,** 65; **79,** 77; **80,** 104; **81,** 140; **82,** 136; **83,** 140; **84,** 145, 151, 163; **85,** 136; **86,** 132; **87,** 95; **89,** 112; **90,** 102; **91,** 128; **92,** 128; **93,** 140, 158; **94,** 129; **95,** 147; **96,** 134; **97,** 168; **98,** 172; **99,** 199; **00,** 226; **01,** 270; **02,** 199; **03,** 189; **04,** 189; **05,** 201; **06,** 213, 215; **07,** 226; **08,** 237; **09,** 245; **10,** 278, 282; **11,** 302; **12,** 346.

In charge:
Maj. W. P. Craighill, 1871–84. **R., 71,** 620, 621; **72,** 685; **73,** 765; **74,** ii, 24; **75,** ii, 68; **76,** 288; **77,** 282; **79,** 502; (Lt. Col.) **80,** 643; **81,** 888; **82,** 858; **83,** 682; **84,** 903, 959.
Capt. Chas. B. Phillips, in temporary charge, 1878. **R., 78,** 451.
W. F. Smith, U. S. agent, 1884–1900. **R., 85,** 888; **86,** 869; **87,** 844; **88,** 751; (Maj.) **90,** 947; **91,** 1193; **92,** 975; **93,** 1222; **94,** 899; **95,** 1140; **96,** 967; **97,** 1280; **98,** 1166; **99,** 1392; **00,** 1655.
Maj. C. E. L. B. Davis, 1892–5. **R., 93,** 1312.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1386.
Col. P. C. Hains, 1902. **R., 02,** 1077.
Capt. J. C. Sanford, 1903. **R., 03,** 1017.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1267; **05,** 1145; **06,** 1089; (Col.) **07,** 1160; **08,** 1202.
Maj. W. E. Craighill, 1909. **R., 09,** 1205.
Col. T. L. Casey, 1910–11. **R., 10,** 1332; **11,** 1428.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1640.

*Allotment.

[1] H. D. 76, 60th, 1st.

Assistants:
W. Popp. **R., 71,** 622.
Capt. Phillips, **72,** 66; **76,** 289; **77,** 283.
H. Bacon. **R., 75,** ii, 68.
Lt. Thomas Turtle, **75,** 84; **78,** 63; **79,** 75; **80,** 98; (Capt.) **81,** 129; **82,** 127; **84,** 960.
Capt. J. W. Cuyler, **79,** 75; **80,** 98.
Capt. E. H. Ruffner, **81,** 129; **82,** 127.
Lt. W. M. Black, **81,** 129.
Lt. C. McD. Townsend, **82,** 127.
J. L. Seager, **84,** 957.
N. W. Parsons. **R., 87,** 845.
A. Stierle. **R., 90,** 947, 950.

ESTIMATES. (See Plans and Projects.)

By W. Popp, 1871, dr. chan. 7′ x 75′, bridge to head of navigation, and building dikes, $17,000, **71,** 622, 623. Increased by Maj. Craighill to $20,000, **72,** 67; **74,** ii, 24. For an. dr., $2,500, **74,** 82, ii, 25.

By Maj. Craighill, causes for large increase of orig. proj., **79,** 503. In 1879, to complete existing proj., $7,000, **79,** 504.

OPERATIONS.[1]

1872-73. Chan. dr. about 5′-7′ x 25′ and four-fifths of a mile long, from br. through the shallowest part of the R., **73,** 73, 765, 766.
1874-75. 12,547 c. y. dr. under contract, **75,** 87, ii, 68.
1875-76. Dr., and 1,636′ of dikes built, **76,** 64, 289.
1877-78. Repairs to dikes; dr. in chan. and basin; 16,147 c. y. removed, **78,** 65, 452.
1878-79. Repairs to dikes and dr., **79,** 77, 504. Beneficial results, **79,** 504.
1879-80. 11,213 c. y. dr. from chan., **80,** 643.
1880-81. 15,721 c. y. dr. and deposited behind dike, **81,** 888.
1881-82. 454 c. y. dr., **82,** 858.
1883-84. 4,000 c. y. dr., **84,** 903.
1884-85. 20,327 c. y. dr., **85,** 888.
1885-86. Dr. continued under Ross contract to completion of imp., **86,** 869; **87,** 844.
1891-92. 65,918 c. y. dr., **92,** 975.
1893-94. 55,000 c. y., s. m., dr., **94,** 899.
1895-96. 12,430 c. y., p. m., dr., **96,** 968.
1898-99. 28,209 c. y. dr., **99,** 1393.
1903-04. 29,923 c. y. dr., **04,** 1267.
1905-06. 37,478 c. y. dr., **06,** 1089.
1907-08. 11,830 c. y. dr., **08,** 1202.
1909-10. 37,837 c. y. dr., **10,** 1332.
1911-12. 14,398 c. y. dr. (mainten.), and 8,644 c. y. dr. for orig. work and mainten., **12,** 1640.

PHYSICAL CHARACTERISTICS.

Described, **71,** 622; **75,** ii, 69.

R. on e. shore of Maryland, entering Monie B. at head of Tangier Sound, **90,** 948.

Description of. The lower part of the R. a safe H. in ne. storms for vessels navigating the Potomac, **93,** 1314.

PLANS. (See Estimates and Projects.)

By Maj. Smith, US. agent, 1889, imp. of Wicomico R. by excavation of 9′ l.-w. chan. from the natural 9′ curve to the drawbr. at the town of Salisbury, involving removal of about 116,000 c. y. of material; est., $23,200, **90,** 950.

PRIVATE AND CORPORATE WORK.

2,700′ of dikes built by the citizens, **71,** 623; **72.** 67, 685; **73,** 73, 766; **74,** 82, ii, 24; **75,** ii, 69; **76,** 289, Dr. done by the citizens of Salisbury, **84,** 903.

PROJECTS. (See Estimates and Plans.)

By W. Popp, 1871, dr. chan. 7′ x 75′, br. to head of navigation; dikes to be built by private parties, **71,** 621, 623; **72,** 67, 685. Building a portion of the dikes by the US., **75,** 87, ii, 70. Modification of orig. proj., 1876, for chan. 50′ x 5′, **77,** 59, 282; in 1879, modified to 65′ x 7′, **79,** 503.

By Lt. Col. Craighill, 1871, chan. 7′ x 75′ l. w. from mouth to Salisbury, part of the dikes to be built by private parties, **71,** 621, 623; **72,** 685; **75,** ii, 70.

In 1884 proj. modified to give increased w. to the chans. and to straighten them at bends, **84,** 959; **87,** 96.

Work completed in 1885 under aggregate app. of $50,000, **87,** 844.

By W. F. Smith, 1890, excavation of 9′ l.-w. chan. from natural 9′ d. in the R. below to the drawbr. at Salisbury, chan. w. to be 150′; est., $23,200, **90,** 948.

By Lt. Col. Hoxie, 1906, restoring imp. chan. and extension to mouth of R.; est., $53,000, and $3,000 an. mainten.,[2] **06,** 215.

By Lt. Col. Craighill, 1909, plan for extension of imp., incl. turning basin 360′ x 650′; est., $24,000,[3] **10,** 282.

SURVEYS.

Under direction of Maj. Craighill, by W. Popp 1871, **71,** 76, 620. **R., 71,** 621.

By Maj. Craighill, 1878, **78,** 65, 452.

Ex. au. act Aug. 2, 1882; made, 1882, by Lt. Col. Craighill, **84,** 959.

R. worthy of imp., but work not a public necessity, **84,** 960.

Au. act Aug. 11, 1888; made, 1889, by W. F. Smith, US. agent (see Plans), **90,** 947, 950.

Ex. au. act July 13, 1892; made by Maj. Davis, 1892 (**R.** unfav.), **93,** 1313.

Ex. made, 1898, by Maj. Smith, U. S. agent, **99,** 1393.

From mouth to Salisbury, Md., au. act Mar. 3, 1905; made, 1905-06, by Lt. Col. Hoxie,[2] **06,** 215.

Ex. at city of Salisbury, from foot of main st. to Salisbury milldam, au. act Mar. 3, 1909; made, 1909, by Col. Craighill,[3] **10,** 282.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 347.

Maps.[3]

J-81(a) NEWPORT CREEK, (Head of Wicomico River), MD.

ENGINEERS.

Chief of Engineers. **R., 91,** 146.
In charge. Lt. Col. P. C. Hains, 1891. **R., 91,** 1281.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1281.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Hains (**R.** unfav.), **91,** 1281.

[1] History of, from the commencement to 1879, **75,** ii, 69; **79,** 502.
[2] H. D. 908, 59th, 1st.
[3] H. D. 569, 61st, 2d.

J-109 NANTICOKE RIVER, DEL. AND MD.

APPROPRIATIONS.

1896, $3,000, **97,** 1260.
1899, 3,000, **99,** 1391.
1905, 2,000, **05,** 1144.
1907, 2,000, **07,** 1157.
1909, *2,000, **09,** 1203.
1910, 12,960, **10,** 1330.
1911, 36,000, **11,** 1426.
1912, 5,000, **12,** 1648.

Total, 65,960 (total, incl. $5,000 of app. for Broad Creek R., Del., 1894, applied to removing bar on Nanticoke R., $70,960, **12,** 1648–49).

COMMERCE.

Est., 1892, that a C. by water amounting to not less than $3,000,000 would be doubled if the R. were imp., **93,** 1238.

Imp. has made no appreciable difference in water rates; RR. rates lessened, **10,** 276; **12,** 357.

Steadily increasing; in 1903, 119,038 t.; in 1911, 148,006 t., **12,** 356.

CONTRACTS.

1887. F. C. Somers, dr., 11¾¢ c. y., **87,** 842.
1895. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1140. (See Broad Creek River, Del.)
1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1260.
1899. Baltimore Dredging Co., dr., 12.4¢ c. y., p. m., **00,** 1652.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1088.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1158.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1330.
1910. Maryland Dredging & Contracting Co., dr. about 61,400 c. y., 18½¢ c. y., **11,** 1426.
1911. Maryland Dredging & Contracting Co., dr. about 162,000 c. y., 18½¢ c. y., **12,** 1648.

ENGINEERS.

Chief of Engineers. **R., 80,** 110; **87,** 94; **88,** 94; **89,** 112; **91,** 131; **93,** 143; **95,** 151; **97,** 157; **98,** 171; **99,** 197; **00,** 224; **01,** 269; **02,** 201; **03,** 192; **04,** 191; **05,** 200; **06,** 212; **07,** 225; **08,** 236; **09,** 243; **10,** 276; **11,** 299; **12,** 355.

In charge:
Lt. Col. W. P. Craighill, 1879. **R., 80,** 740.
W. F. Smith, U. S. agent, 1887–1900. **R., 87,** 842; **88,** 749; (Maj.) **89,** 916; **91,** 1204; **93,** 1236; **95,** 1165; **97,** 1260; **98,** 1165; **99,** 1391; **00,** 1652.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1384.
Col. Peter C. Hains, 1902. **R., 02,** 1078.
Capt. J. C. Sanford, 1903. **R., 03,** 1021.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1271; **05,** 1144; **06,** 1088; (Col.) **07,** 1157; **08,** 1199.
Maj. W. E. Craighill, 1909. **R., 09,** 1203.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1330; **11,** 1425.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1648.

Assistants:
J. L. Seager. **R., 80,** 74.
N. H. Hutton. **R., 80,** 741.
A. Stierle. **R., 89,** 917; **91,** 1205; **93,** 1238; **95,** 1166.

OPERATIONS.

1886–87. Dr. began under contract, **87,** 842.
1887–88. 61,747 c. y. dr. from chan. and turning basin, **88,** 749.
1898–99. 20,765 c. y., p. m., dr., **99,** 1391.
1899–00. 1,669 c. y., p. m., dr., **00,** 1652.
1900–01. 11,738 c. y. dr., **01,** 1384.
1905–06. 14,959 c. y. dr., **06,** 1088.
1907–08. 9,400 c. y. dr., **08,** 1199.
1909–10. 14,976 c. y. dr., **10,** 1330.
1910–11. 62,072 c. y. dr.; result of work given in detail, **11,** 1425–26.
1911–12. 9,301 c. y. dr. for mainten., Nanticoke R., and 165,730 c. y. on Northwest Fork for completing proj., **12,** 1648.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 741; **93,** 1238.
Tidal observations, **95,** 1167.
Description of Northwest Fork (Marshyhope Creek), **10,** 276, 277.
Max. draft in Nanticoke R., 9′, and in Northwest Fork, 5½′; tides described, etc., **12,** 357.
Tidal stream; headwaters, numerous branches; R. flows through Sussex Co. into Tangier Sound, Chesapeake B.; about 50 m. l.; l. of proj. section, 2 m., with lower end 34 m. above mouth of R., **12,** 355.

PLANS.

By W. F. Smith, 1888, chan. 8′ m. l. t. and 60′ w. from Seaford to Concord, Del.; est., $10,000, **89,** 916.

In 1891 Maj. Smith, U. S. agent, did not consider the Northwest Fork worthy of imp. by U. S., **91,** 1205.

PRIVATE AND CORPORATE WORK.

$12,500 expend. in 1888 by citizens of Laurel in wharf constr. and dr. in front of same, **88,** 750.

PROJECTS.

Lt. Col. Craighill considered that as there was not less than 8′ l. w. in main R. from the forks to Seaford no imp. necessary, **80,** 742. App. of Aug. 5, 1886, was to be applied to extending the 5′ l.-w. navigation to Laurel, **87,** 842.

By Maj. Smith, U. S. agent, in 1895, chan. 9′ x 100′, the w. to be increased to about 150′ at sharp turns, to within 100′ of the county br.; est., $13,000, **95,** 1166.

By Lt. Col. Craighill, to allow slight w. between the br. in H. of Seaford, a modification of existing proj. by act of June 25, 1910; est., $2,860,[1] **10,** 276, 282.

By Col. Hoxie, chan. 6′ x 60′ in Northwest Fork (Marshyhope Creek) between Upper Browns Wharf and Federalsburg, with turning basin at upper end, au. act June 25, 1910; est., $44,197.44, with $2,000 an. mainten., **10,** 277.

SURVEYS.

Au. act Mar. 3, 1879; made, 1879, by Lt. Col. Craighill, **79,** 81; **80,** 740.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Smith, **91,** 1205.

Ex. au. act July 13, 1892; made by Maj. Smith, 1892 (**R.** fav.), **93,** 1237.

Sur. au. act Aug. 17, 1894; made by Maj. Smith, US. agent, 1895 (see Projects), **95,** 1165.

Ex. under direction of Capt. Sanford, **03,** 1021.

Of Northwest Fork (Marshyhope Creek) from mouth to Federalsburg, au. act Mar. 2, 1907; made by Col. Hoxie,[2] **08,** 240.

Of R. up to Middleford, au. act Mar. 3, 1909; made by Lt. Col. Craighill, and plan presented; est., $2,860,[1] **10,** 282.

Cong. docs., etc., relating to ex., sur., plans, etc., **11,** 300.

*Allotment. [1] H. D. 674, 61st, 2d. [2] H. D. 869, 60th, 1st.

J-112 TYASKIN (Wetipquin) CREEK, MD.

APPROPRIATIONS.

1902,	*$8,000.00,	**02,** 1077.
1905,	*2,158.00,	**05,** 1143.
1907,	*6,500.00,	**07,** 1156.
1910,	*4,000.00,	**10,** 1329.
1911,	*1,578.94,	**11,** 1424.
1912,	*3,000.00,	**12,** 1645.
Total,	25,236.94	

COMMERCE.

Prospective C. justifies imp., **00,** 1684.
Not large, but prospective C. justifies imp., **03,** 190.
1911, 4,344 t.; value, $162,333, **12,** 352.

CONTRACTS.

1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1019.
1905. Maryland Dredging & Contracting Co., dr. 16,200 c. y., 12¢ c. y., **06,** 1087.
1907. Maryland Dredging & Contracting Co., dr. 30,789 c. y., 19¢ c. y., **07,** 1156.
1910. Maryland Dredging & Contracting Co., dr. 19,000 c. y., 18½¢ c. y., **11,** 1425.

ENGINEERS.

Chief of Engineers. R., 84, 151; **89,** 112; **99,** 203; **1900,** 231; **02,** 200; **03,** 190; **04,** 189; **05,** 199; **06,** 210, 214; **07,** 224; **08,** 234; **09,** 242; **10,** 274; **11,** 297; **12,** 351.

In charge:
Lt. Col. W. P. Craighill. **R., 84,** 956.
Maj. W. F. Smith, U. S. agent, 1889–1900. **R., 89,** 910; **00,** 1681, 1683.
Col. P. C. Hains, 1902. **R., 02,** 1077.
Capt. J. C. Sanford, 1903. **R., 03,** 1018.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1269; **05,** 1143; **06,** 1087; **07,** 1156; **08,** 1198.
Maj. W. E. Craighill, 1909. **R., 09,** 1202.
Col. T. L. Casey, 1910–11. **R., 10,** 1329; **11,** 1424.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1645.

Assistants:
Capt. Turtle. **R., 84,** 956.
J. L. Seager. **R., 84,** 956.
A. Stierle. **R., 89,** 910.

OPERATIONS.

1903-04. 35,587 c. y. dr., making chan. 60′ x 9′ m. l. w., from 9′ curve in Nanticoke R. to wharf at Tyaskin, and turning-basin made at that point, **04,** 1269.
1905-06. 16,187 c. y. dr., w. 60′ chan. to 90′, and dr. basin out for 2,730′, **06,** 1087.
1907-08. 30,661 c. y. dr., of which 13,403 c. y. were for mainten., **08,** 1198.
1910-11. 19,399 c. y. removed, of which 9,612 c. y. were for completing proj.—turning-basin at inner end of chan.—and 9,787 c. y. for mainten., **11,** 1424.
1911-12. 7,572 c. y. dr., restoring chan. to 50′ for 1,300′, **12,** 1645.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 956; **89,** 910; **1900,** 1681.
Creek, also known as Wetipquin Creek or R., is small tributary of Nanticoke R., having l. of about 5 m. D., 1903, 8′, and on bar at mouth, 3½′, **03,** 190.
Average rise and fall of tide, 3′, **12,** 352.
L. of imp. portion of work, 3,500′, **12,** 352.
Stream navigable to Tyaskin, about ¾ m. from mouth, **12,** 352.

PLANS. (See Projects.)

Capt. Turtle, 1882, did not consider imp. public necessity, **84,** 956.
In 1889 Col. Craighill did not consider R. worthy of imp., **89,** 910.

PROJECTS. (See Plans.)

Maj. Smith, U.S. agent, est., 1899, $13,200 to imp. entrance to creek, **00,** 1683.
Act June 13, 1902, au. imp. of creek by making chan. 9′ x 120′; est., $13,200,[1] **02,** 190.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1882, by Lt. Col. Craighill (**R.** unfav.), **84,** 956.
Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Smith, U.S. agent, **89,** 910.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Maj. Smith, U. S. agent (**R.** fav.; see Projects), **1900,** 1682, 1683.
Pre. ex. and sur. au. act Mar. 3, 1905, of creek at and near Tyaskin. **R.** by Col. Hoxie, Sept. 25, 1905, and Mar. 22, 1906. Cost of completion of proj. with addition of turning-basin at town of Tyaskin, $6,500,[2] **06,** 214.
Maps.[2]

J-121 BROAD CREEK (River), DEL.

APPROPRIATIONS.

1880,	$5,000,	**80,** 643.
1881,	10,000,	**81,** 886.
1882,	5,000,	**82,** 858.
1886,	[3] 10,000,	**87,** 844.
1888,	5,000,	**88,** 750.
1892,	5,000,	**93,** 1221.
1894,	5,000,	**95,** 1139. (See Projects.)
1896,	5,000,	**96,** 967.
1899,	5,000,	**99,** 1390.
1907,	1,500,	**07,** 1159.
1909,	*2,000,	**09,** 1204.
1910,	2,000,	**10,** 1331.
1911,	2,000,	**11,** 1427.
1912,	14,520,	**12,** 1649.
Total,	77,020,	

COMMERCE.

Important, **80,** 642; **81,** 885; **85,** 880.
Beneficial effects of imp., **91,** 1210.
Imp. reported to have made a reduction of 25% in RR. rates, **09,** 245; **12,** 358.
1911, 31,201 t.; passengers, 300, **12,** 1650.

CONTRACTS.

1881. G. W. Parsons, dr., 23¾¢ c. y., **81,** 887.
1886. Frank C. Somers, dr., 11¾¢ c. y., **87,** 842.
1889. F. C. Somers, dr., 20¢ c. y., **89,** 894.
1892. C. T. Caler, dr., 9 9/10¢ c. y., p. m., **93,** 1221.
1895. Baltimore Dredging Co., dr., 19 8/10¢ c. y., p. m., **95,** 1140.
1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1280.
1899. Baltimore Dredging Co., dr., 12 4/10¢ c. y., p. m., **00,** 1654.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1159.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1331.
1910. Maryland Dredging & Contracting Co., dr. about 9,500 c. y., 18½¢ c. y., **11,** 1427.
1911. Maryland Dredging & Contracting Co. dr. about 9,000 c. y., 18½¢ c. y., **12,** 1650.

ENGINEERS.

Chief of Engineers. R., 80, 103, 110; **81,** 139; **82,** 135; **83,** 138; **84,** 145; **85,** 130; **86,** 128; **87,** 95; **88,** 94; **89,** 107; **90,** 98; **91,** 131; **93,** 140; **94,** 128; **95,** 146; **96,** 133; **97,** 167; **98,** 170; **99,** 196; **00,**

*Allotments. [1] H. D. 109, 56th, 1st. [2] H. D. 682, 59th, 1st. [3] Improving Nanticoke R., Del., **87,** 843.

225; **01,** 270; **02,** 202; **03,** 192; **04,** 192; **05,** 201; **06,** 213; **07,** 226; **08,** 237; **09,** 244; **10,** 277, 282; **11,** 301; **12,** 358.

In charge:
Lt. Col. W. P. Craighill, 1880–85. **R., 80,** 640 **81,** 885; **82,** 857; **83,** 680; **84,** 903.
W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 880 **86,** 863; **87,** 843; **88,** 750; (Maj.) **89,** 894; **90,** 933; **91,** 1209; **93,** 1220; **94,** 897; **95,** 1138; **96,** 966; **97,** 1278; **98,** 1164; **99,** 1389; **00,** 1653.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1386.
Col. Peter C. Hains, 1902. **R., 02,** 1079.
Capt. J. C. Sanford, 1903–04. **R., 03,** 1022.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1272; **05,** 1145; **06,** 1089; (Col.) **07,** 1158; **08,** 1201.
Maj. Wm. E. Craighill, 1909. **R., 09,** 1204.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1331; **11,** 1427.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1649.

Assistants:
J. L. Seager, **80,** 640.
G. W. Parsons. **R., 81,** 887.
Capt. E. H. Ruffner, **82,** 127.
Capt. Thomas Turtle, **82,** 127; **83,** 131.
Lt. C. McD. Townsend, **83,** 131.
A. Stierle. **R., 91,** 1209.

OPERATIONS.

1880-82. Cut dr. about 7,000′ x 32′, **82,** 857.
1882-83. Continuation of dr., **83,** 680.
1886-87. Continuation of dr. under new contract, **87,** 842.
1887-88. 61,747 c. y. dr. under this contract, **88,** 749.
1889-90. 19,987 c. y. dr., **90,** 933.
1892-93. 43,997 c. y., p. m., dr., **93,** 1221.
1895-96. 19,986 c. y., p. m., dr. in removing bar in Nanticoke R., **96,** 967.
1898-99. 39,981 c. y. dr., **99,** 1389.
1899-00. 30,307 c. y. dr., **00,** 1653.
1907-08. 7,097 c. y. removed, **08,** 1201.
1909-10. 14,977 c. y. removed, restoring chan. to dimensions of proj., **10,** 1331.
1910-11. Dr. completed by removal of 9,599 c. y., restoring chan. for 2,075′, **11,** 1427.
1911-12. 9,746 c. y. dr., resulting in restoring chan. to dimensions of previous proj. for 2,100′ downstream from a point about 1,000′ above Hitch's upper wharf, **12,** 1649.

PHYSICAL CHARACTERISTICS.

Described, **80,** 641; **11,** 301.
A tributary of the East Fork of Nanticoke R., **00,** 225.

PRIVATE AND CORPORATE WORK.

$12,500 expend. in 1888 by the citizens of Laurel in wharf constr. and dr. in front of same, **88,** 750.

PROJECTS.

By Lt. Col. Craighill, 1880, chan. 7′ x 60′ by dr., mouth to Laurel, supple. by wing dams and training walls; est., $60,000, **80,** 641.
In 1883 Col. Craighill reported, after an aggregate app. of $20,000, that further dr. without training works would be useless, and est. that $32,625 would be required to complete the proj. involving such works, **83,** 681.
In 1891 Maj. Smith, U. S. agent, proposed excavation of chan., Laurel to Bethel, Del., to 8′ x 70′ m. l. w.; est., $15,000, **91,** 1210.
Congress au., 1894, that as much of the app. of $5,000 made in that year as necessary should be used to remove the bar extending from the RR. br. at Seaford toward the mouth of the Nanticoke R. As this was not in the proj. for the imp. of Broad Creek R., and the cost of removing the bar would exceed $5,000, it was decided to use this amount as far as it would go in removing the bar by dr. the existing chan. to 9′ below m. l. w. and about 50′ w. from Seaford to d. w. below, **95,** 1139.
Act July 25, 1912, au. 8′ m. l. w. chan. 70′ w. between Portsville Landing and Laurel; straightening and w. bends in R.; and w. chan. below RR. br. to provide a suitable turning-basin (see Surveys, 1909), **12,** 358.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 81; **80,** 110; made by Lt. Col. Craighill, 1880, **80,** 640.
Ex. au. act Sept. 19, 1890; made, 1890, by Maj. W. F. Smith, **91,** 1209.
Ex., 1900, by Maj. Smith, **00,** 1653.
From mouth to town of Laurel, au. act Mar. 3, 1909; made, 1909, by Maj. Craighill; est., $14,520,[1] **10,** 282.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 358.
Maps. **91,** 1210.

J-190(a) TWITCH COVE, AND BIG THOROUGHFARE RIVER, MD.

APPROPRIATIONS.

1912, $2,900, **12,** 1650.

ENGINEERS.

Chief of Engineers. R., 12, 359, 362.
In charge. Lt. Col. W. C. Langfitt, 1912. **R., 12,** 1650.

PHYSICAL CHARACTERISTICS.

A tidal stream, extending from Chesapeake B. on the w. to Tangier Sound on the e. side, of Smiths Isld., Md.; flows through center of the isld. in a general nw. and se. direction, trend of current varying with rise and fall of tide; about 4 m. l., **12,** 359.

PROJECTS.

Act July 25, 1912, au. chan. 4′ x 25′, Tangier Sound into Big Thoroughfare R., and one of same dimensions around point between said R. and Tylers R.; est., $2,900, **12,** 359.

SURVEY.

Pre. ex. and sur. au. June 25, 1910. **R.** by Col. T. L. Casey, 1910 and 1911; est., $2,900, with $100 an. mainten.,[2] **12,** 362.
Maps.[2]

J-230 SLAUGHTER CREEK, MD.

APPROPRIATIONS.

1912, $4,140, **12,** 1647.

ENGINEERS.

Chief of Engineers. R., 80, 110; **11,** 306; **12,** 355.
In charge:
Lt. Col. W. P. Craighill, 1879. **R., 80,** 739.
Col. T. L. Casey, **11,** 279.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1647.

PHYSICAL CHARACTERISTICS.

Description of creek and adjacent country, **80,** 740.

[1] H. D. 601, 61st, 2d.
[2] H. D. 285, 62d, 2d.

PLAN.

By Maj. Craighill, 1880, chan. below the br. at Ferry Pt. 7′ d. m. l. w.; est., $7,250, **80,** 740.

PROJECTS.

Act July 25, 1912, au. chan. 7′ x 100′ m. l. w. through bar at mouth; est., $4,140, **12,** 355.

SURVEYS.

Au. act Mar. 3, 1879; made, 1880, by Maj. Craighill, **79,** 81; **80,** 739.

Ex. and sur. au. act June 25, 1910, with view to removing bar at mouth. **R.** by Col. Casey, Oct. 24, 1910, and May 22, 1911; est., $4,140,[1] **11,** 306.

J-252 CHOPTANK RIVER, MD.

APPROPRIATIONS.

1880,	$5,000.00,	**80,** 636.
1881,	5,000.00,	**81,** 874.
1882,	5,000.00,	**82,** 852.
1884,	5,000.00,	**84,** 902.
1886,	10,000.00,	**86,** 869.
1888,	7,500.00,	**88,** 749.
1890,	7,500.00,	**90,** 939.
1892,	3,000.00,	**92,** 972.
1894,	2,000.00,	**95,** 1131.
1896,	2,000.00,	**96,** 961.
1899,	8,000.00,	**99,** 1385.
1902,	*3,000.00,	**02,** 1075.
1905,	*7,885.00,	**05,** 1138.
1907,	*9,662.55,	**07,** 1151.
1910,	*4,451.25,	**10,** 1323.
1911,	*3,947.37,	**11,** 1419.
1912,	*3,000.00,	**12,** 1638.
Total,	91,946.17,	**12,** 1638.

COMMERCE.

Value of the imp. to, **88,** 748.

Tonnage, 1910, 237,273 t., **11,** 1420; 1911, 253,000 t., **12,** 1638.

RR. rates reduced, **12,** 345.

CONTRACTS.

1880. D. Constantine, dr., 23¢ c. y., **81,** 875.
1881. D. Constantine, dr., 27½¢ c. y., **81,** 876.
1882. D. Constantine, dr., 27½¢ c. y., **83,** 677.
1884. Morris & Cumings, dr., 21¢ c. y., **85,** 887.
1886. T. P. Morgan, dr., 16¢ c. y., **87,** 840.
1889. American Dredging Co., dr., 15¢ c. y., **90,** 938.
1891. C. T. Caler, dr., 14½¢ c. y., **91,** 1191.
1892. C. T. Caler, dr., 10¢ c. y., s. m., **93,** 1214.
1895. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1131.
1896. C. T. Caler, dr., 9.5¢ c. y., p. m., **97,** 1275.
1899. Baltimore Dredging Co., dr., 12.4¢ c. y., p. m., **00,** 1647.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1012.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1083.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1151.
1910. Maryland Dredging & Contracting Co., dr. 21,100 c. y., 18½¢ c. y., **11,** 1419.
1912. Maryland Dredging & Contracting Co., dr. 17,763 c. y., 18½¢ c. y., **12,** 1638.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 102; **81,** 135; **82,** 131; **83,** 136; **84,** 144; **85,** 134; **86,** 131; **87,** 94; **88,** 93; **89,** 110; **90,** 100; **91,** 127; **92,** 127; **93,** 137; **94,** 126; **95,** 143; **96,** 130; **97,** 164; **98,** 168; **99,** 193; **00,** 220; **01,** 267; **02,** 198; **03,** 187; **04,** 186; **05,** 196; **06,** 206; **07,** 219; **08,** 230; **09,** 237; **10,** 269; **11,** 292; **12,** 344.

In charge:

Lt. Col. W. P. Craighill, 1879–85. **R.,** **80,** 634; **81,** 874; **82,** 851; **83,** 676; **84,** 901.

W. F. Smith, U. S. agent, 1885–1900. **R.,** **85,** 886; **86,** 868; **87,** 840; **88,** 748; (Maj.) **89,** 900; **90,** 938; **91,** 1189; **92,** 972; **93,** 1213; **94,** 891; **95,** 1130; **96,** 960; **97,** 1275; **98,** 1160; **99,** 1384; **00,** 1646.

Lt. Col. O. H. Ernst, 1901. **R.,** **01,** 1381.

Col. P. C. Hains, 1902. **R.,** **02,** 1075.

Capt. J. C. Sanford, 1903. **R.,** **03,** 1012.

Lt. Col. R. L. Hoxie, 1904–08. **R.,** **04,** 1263; **05,** 1138; **06,** 1082; (Col.) **07,** 1150; **08,** 1192.

Maj. W. E. Craighill, 1909. **R.,** **09,** 1198.

Col. T. L. Casey, 1910–11. **R.,** **10,** 1323; **11,** 1418.

Lt. Col. W. C. Langfitt, 1912–. **R.,** **12,** 1637.

Assistants:

John L. Seager, **80,** 634.

G. W. Parsons. **R.,** **81,** 876.

Capt. E. H. Ruffner, **82,** 127; **83,** 131.

Capt. Thomas Turtle, **82,** 127; **83,** 131.

Lt. C. McD. Townsend, **82,** 127; **83,** 131.

OPERATIONS.

1881–82. 32,071 c. y. dr., **82,** 852.
1882–83. 4,470′ of chan., 6′ x 22′, dr., **83,** 677; 1,250′ chan., 22′ w., with a d. of 5′ m. l. w., dr. through shoal below Cose's, **84,** 901.
1884–85. Addl. w. 25′ given to the 22′ cut throughout its l., **85,** 135.
1886–87. 1,671 c. y. dr. from chan., **87,** 841.
1887–88. 45,220 c. y. dr. from chan., **88,** 748.
1889–90. Dr. resumed, **90,** 938.
1890–91. 43,827 c. y. dr., **91,** 1189.
1892–93. 70,538 c. y., s. m., dr., **93,** 1213.
1895–96. 7,526 c. y., p. m., dr., **96,** 960.
1898–99. 15,988 c. y., p. m., dr., **99,** 1384.
1899–00. 55,003 c. y., p. m., dr., **00,** 1647.
1902–03. 10,928 c. y. dr., **03,** 1012.
1905–06. 59,101 c. y. removed, of which 7,989 c. y. were for mainten., **06,** 1082.
1907–08. 45,736 c. y. removed, of which 4,725 c. y. were for mainten., **08,** 1192.
1910–11. 7,834 c. y. dr. for completing proj. and 13,937 c. y. for mainten. in removing shoals from abreast Devils Isld. and the RR. br. at Denton, **11,** 1418, 1419.
1911–12. 18,884 c. y. dr., restoring chan. to proj. dimensions, excepting for short distance at upper end, completing contract, **12,** 1637.

PHYSICAL CHARACTERISTICS.

R. dimensions and br. crossings, **80,** 634, 635.

Shoaling, **03,** 1012.

Max. draft, 1911, at m. l. w., 8′, **11,** 292, 293.

70 m. l.; proj. covers 8 m., the lower end of which is 38 m. above mouth of R. Empties into Chesapeake B., **12,** 340.

PROJECTS.

By Lt. Col. Craighill, 1880, dr. chan. 8′ x 75′ m. l. w., Denton to Greensboro; est., $79,000, **80,** 636; **87,** 94; **91,** 1190; **92,** 972.

Allotment of $7,885 from app. act Mar. 3, 1905, to be applied toward completion of proj. of 1880, in the dr. of about 1 m. of chan. at upper end and restoring completed chan. where shoaled, **05,** 196.

SURVEY.

Au. act Mar. 3, 1879, **79,** 81; made, Denton to Greensboro, 1880, by Maj. Craighill, **80,** 634.

Made by Capt. Sanford, 1903, **03,** 1012.

* Allotment.

[1] H. D. 87, 62d, 1st.

J-258 CAMBRIDGE HARBOR, MD.

APPROPRIATIONS.

1871,	$10,000.00,	**71,** 75, 615.
1872,	10,000.00,	**72,** 68, 687; **73,** 72.
1873,	5,000.00,	**73,** 72, 765; **74,** 82, ii, 24.
1878,	5,000.00,	**78,** 175; **79,** 501.
1879,	2,500.00,	**79,** 76, 501.
1888,	5,000.00,	**88,** 93.
1890,	5,000.00,	**90,** 940.
1892,	7,737.00,	**92,** 974.
1902,	*3,000.00,	**02,** 1073.
1905,	*3,120.80,	**05,** 1136.
1907,	*1,531.63,	**07,** 1148.
1910,	*6,450.58,	**10,** 1321.
1911,	*2,368.42,	**11,** 1416.
Total,	66,708.43,	**12,** 1635.

COMMERCE.

Important, **97,** 1297.
Tonnage, 1911, 122,176 t., **12,** 343.

CONTRACTS.

1871. G. H. Ferris, dr., 27¢ c. y., **71,** 615; **72,** 687.
1872. G. H. Ferris, dr., 18¾¢ c. y., **73,** 765.
1873. A. A. Dodge, dr., 27¢ c. y., **73,** 765; **74,** ii, 24.
1878. G. H. Ferris, dr., 13¾¢ c. y., s. m., and 10¢ c. y. thrown behind bulkheads, **79,** 501.
1884. American Dredging Co., dr., **84,** 902; completed, **85,** 888.
1889. C. T. Caler, dr., 18½¢ c. y., **89,** 904.
1892. American Dredging Co., dr., 9.4¢ c. y., s. m., **93,** 1219.
1895. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1138.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1010.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1081.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1149.
1910. Maryland Dredging & Contracting Co., dr, about 30,000 c. y., 18½¢ c. y., **11,** 1416.
1911. Maryland Dredging & Contracting Co., dr. 10,658 c. y., 18½¢ c. y., **12,** 1635.

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 70; **71,** 75; **72,** 68; **73,** 72; **74,** 82; **75,** 87; **76,** 63; **79,** 76; **80,** 103; **81,** 137; **82,** 132; **83,** 137; **84,** 144; **85,** 135; **87,** 97; **88,** 93; **89,** 110; **90,** 101; **91,** 127; **92,** 127; **93,** 139; **94,** 128; **95,** 145; **96,** 133; **97,** 172; **02,** 196; **03,** 186; **04,** 185; **05,** 194; **06,** 204; **07,** 217; **08,** 228; **09,** 235; **10,** 267, 282; **11,** 290; **12,** 342.

In charge:
Col. J. H. Simpson. **R., 70,** 421.
Maj. Wm. P. Craighill, 1871–85, **71,** 71, 585. **R., 71,** 614–620; **72,** 687; **73,** 765; **74,** ii, 24; **75,** ii, 68; **76,** 288; **79,** 500; **80,** 637; (Lt. Col.) **81,** 879; **82,** 853; **83,** 678; **84,** 902.
W. F. Smith, U. S. agent, 1885–97. **R., 85,** 888; **87,** 851, 853; (Maj.) **89,** 902; **90,** 940; **91,** 1191; **92,** 973; **93,** 1218; **94,** 895; **95,** 1136; **96,** 965; **97,** 1296.
Col. Peter C. Hains, 1902. **R., 02,** 1073.
Capt. J. C. Sanford, 1903. **R., 03,** 1009.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1261; **05,** 1135; **06,** 1080; (Col.) **07,** 1148; **08,** 1190.
Maj. W. E. Craighill, 1909. **R., 09,** 1195.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1321; **11,** 1416.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1635.

Assistants:
W. Popp. **R., 71,** 616.
C. J. Bates. **R., 71,** 616.
Capt. C. B. Phillips, 71, 71; **73,** 71; **74,** 78.
Lt. Thomas Turtle, **73,** 71; **74,** 78; **79,** 75.
Capt. J. W. Cuyler, **79,** 75.
C. Humphreys. **R., 87,** 852.

ESTIMATES. (See Projects.)

By Wm. Popp, adopted by Maj. Craighill, dr. entrance way at the mouth and a basin abreast of Cambridge, if 10′ d., $36,000; $21,600 if 8′ d., **71,** 614, 616, 618; **74,** 82, ii, 24.

LEGISLATION.

Company chartered by Maryland, 1868, for imp. of the H., etc., petitioned to have their charter confirmed by the U. S., **71,** 619.

OBSTRUCTIONS. (See Projects.)

OPERATIONS.

1870-71. Dr. by contract in progress, **71,** 75, 615.
1871-72. Dr. ceased the last day of Aug. for want of funds, **72,** 68, 687.
1872-73. Dr. commenced Sept. 10. Width of entrance was increased from 50′ to 100′, and nearly all of the inner basin was dr. to a d. of 8′, **73,** 72, 765.
1873-74. Dr. ceased Aug. 11, 1873; entrance w. to 125′, **74,** 82, ii, 24.
1878-79. Dr. by contract in the inner H. and approaches, **79,** 76, 501.
1883-85. Enlargement of H. by dr. to extent of available funds, **84,** 902; **85,** 888.
1888-89. 23,000 c. y. dr., **89,** 902.
1892-93. 42,744 c. y., s. m., dr., **93,** 1218.
1893-94. 11,862 c. y., s. m., dr., **94,** 895.
1894-95. 26,429 c. y., p. m., dr., and the proj. completed, **95,** 1137.
1903-04. Chan. was dr. inside the drawbr. for 8′ x 130′ x 450′; 13,690 c. y. removed, **04,** 1261.
1905-06. 23,230 c. y. removed, **06,** 1080.
1907-08. 7,240 c. y. dr., of which 1,320 c. y. was mainten. work., **08,** 1190.
1910-11. 16,750 c. y. dr. under contract for completing proj., and 13,451 c. y. for mainten., restoring proj. d. for 1,700′ to point opposite phosphate works, **11,** 1416.
1911-12. 11,500 c. y. dr. under contract, restoring proj. dimensions for distance above and below SS. wharf, **12,** 1635.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 616–620; **79,** 500; **84,** 144.
Until protective works are constr. the chan. across the bar will have a tendency to fill so as to require redr., **96,** 965.
General description of previous imp., **02,** 196.
Max. draft below br., 12′; above br., 8′; range of tide, 1.7′, **12,** 343.
H. on e. side of R., about 20 m. above mouth, and 65 m. se. of Baltimore H., **12,** 342.

PLANS. (See Projects.)

By W. F. Smith, 1887, dr. chan. 12′ x 150′ to the RR. wharf, 10′ to the drawbr., and 8′ to the head of the wharfage; est., $17,136, **87,** 853.

PRIVATE WORK.

About $8,000 was raised and expend. by the citizens in 1869 in dr. and building a j., **71,** 617. Results, **79,** 501.

PROJECTS.

By Maj. Craighill, 1871, dr. a chan. of entrance to Choptank Creek and a basin 8′ d. abreast of Cambridge, **74,** ii, 24. Modified in 1874 for enlargement of basin and chan. leading thereto, **79,** 501. Amount app. from 1871 to 1879, incl., $32,500, **87,** 852.
In 1890, after an expend. of $42,500, $7,736 was est. as required for completion of existing proj., **90,** 940, 941; **91,** 1193.
By Maj. Smith, 1893, for the expend. of as much of the available funds as might be needed for dr. in Cambridge H. below the br. in accordance with act July 13, 1892, that no money should be expend. on

*Allotment.

this imp. above the br. until the draw in it should be w. to accommodate the C. of the R., **93,** 1218. Sec. of War, 1894-95, approved the plans of the Dorchester Co., Md., commissioners for alteration of the br., providing for a draw opening of 49′ 1½″, **95,** 1137.

Maj. Smith, 1896, est. the total cost of completing the imp. would be $8,120, **97,** 1297; embracing 12′ x 150′ chan., from 12′ curve in Choptank R. to a point 500′ outside B., C. & A. Ry. Co.'s wharf, etc.; from SS. wharf to mill wharf, etc., increasing w. of lower H. 40′ on n. side, and widening upper H. aver. of 360′ along dr. chan. to 8′, **07,** 218.

Act June 13, 1902, app. $74,000 for certain Hs. and Rs. on the e. shore of Maryland; $3,000 of this allotted to Cambridge H., for extension of the 8′ chan. farther up the H. inside the drawbr., the w. of the chan. to be 150′, **03,** 186; **12,** 343.

Completion, 1897, proj. delayed; $8,120 for mainten. added to est.; increased, 1907, to $13,858.25, **07,** 218.

SURVEYS.

Au. act July 11, 1870; assigned to Col. Simpson, and made, 1870, by Wm. Popp and C. J. Bates. **R., 71,** 614, 620.

Resur. of H. and approaches, **80,** 638.

Au. act Aug. 5, 1886; made by Maj. Smith, **87,** 851, 853.

Sur. au. act June 3, 1896; made, 1896, by Maj. Smith (**R.** fav.; see Projects), **97,** 1297.

Pre. ex. and sur. au. act Mar. 3, 1909; est., $14,500,[1] **10,** 282.

Maps.[1] Of Wm. Popp's sur., mentioned, **71,** 615.

J-264 WARWICK (Secretary Cr.) RIVER, MD.

APPROPRIATIONS.

1880,	$3,000.00,	**80,** 637.
1881,	3,000.00,	**81,** 878.
1892,	6,000.00,	**93,** 1217.
1894,	2,000.00,	**95,** 1135.
1896,	2,000.00,	**96,** 964.
1899,	2,000.00,	**99,** 1388.
1902,	*4,000.00,	**02,** 1076.
1905,	*1,909.00,	**05,** 1139.
1907,	*3,493.87,	**07,** 1152.
1909,	*3,000.00,	**09,** 1199.
1910,	*3,000.00,	**10,** 1325.
1911,	*1,578.95,	**11,** 1420.
1912,	*4,000.00,	**12,** 1639.
Total,	38,981.82	

COMMERCE.

Present and prospective C., **80,** 637.
Imp. has had no effect on rates, **10,** 271.
Slight increase since 1903, **12,** 346.
1911, 73,056 t.; value, $3,719,623, **12,** 346.

CONTRACTS.

1880. American Dredging Co., dr., 18¢ c. y., **81,** 878.
1881. American Dredging Co., dr., 20¢ c. y., **81,** 878.
1892. C. T. Caler, dr., 10¢ c. y., p. m. ($5,381.10), **93,** 1218.
1894. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1135.
1896. C. T. Caler, dr., 9.5¢ c. y., p. m., **97,** 1278.
1899. Baltimore Dredging Co., dr., 12.4¢ c. y., p. m., **00,** 1651.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1014.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1084.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1152.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1325.
1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1420.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1639.

ENGINEERS.

Chief of Engineers. **R., 80,** 103; **81,** 136; **82,** 132; **83,** 137; **89,** 112; **91,** 132; **93,** 138; **94,** 127; **95,** 144; **96,** 132; **97,** 166; **98,** 169; **99,** 195; **00,** 222; **01,** 268; **02,** 198; **03,** 188; **04,** 187; **05,** 196; **06,** 207; **07,** 220; **08,** 230; **09,** 238; **10,** 270; **11,** 293; **12,** 345.

In charge:

Lt. Col. W. P. Craighill, 1879–83. **R., 80,** 636; **81,** 877; **82,** 852; **83,** 678.
Maj. W. F. Smith, U. S. agent, 1888–1900. **R., 89,** 918; **91,** 1218; **93,** 1216; **94,** 894; **95,** 1134; **96,** 964; **97,** 1277; **98,** 1163; **99,** 1387; **1900,** 1650.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1383.
Col. P. C. Hains, 1902. **R., 02,** 1075.
Capt. J. C. Sanford, 1903. **R., 03,** 1014.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1265; **05,** 1139; **06,** 1083; (Col.) **07,** 1152; **08,** 1194.
Maj. W. E. Craighill, 1909. **R., 09,** 1199.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1324; **11,** 1420.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1639.

Assistants:

J. L. Seager. **R., 80,** 637.
Capt. E. H. Ruffner, **81,** 129.
Lt. W. M. Black, **81,** 129.
Capt. Thomas Turtle, **81,** 129.
A. Stierle. **R., 89,** 919; **91,** 1218.

OPERATIONS.

1880–81. 29,215 c. y. dr. from chan. and turning-basin, **81,** 878.
1892–93. 53,811 c. y., p. m., dr., **93,** 1217.
1894–95. 3,816 c. y., p. m., dr., **95,** 1135.
1895–96. 4,645 c. y., p. m., dr., **96,** 964.
1897–98. 10,451 c. y., p. m., dr., **98,** 1163.
1898–99. 4,561 c. y., p. m., dr., **99,** 1388.
1899–00. 13,797 c. y., p. m., dr., **00,** 1650.
1903–04. 16,055 c. y. dr., **04,** 1265.
1905–06. 14,325 c. y. dr., **06,** 1083.
1907–08. 16,488 c. y. dr., **08,** 1194.
1909–10. 20,998 c. y. dr., **10,** 1324.
1910–11. 14,290 c. y. dr., restoring chan. from Harrisons Gut to entrance of turning-basin, about 2,600′, as well as s. side of latter for 400′, **11,** 142 .
1911–12. 7,588 c. y. dr., **12,** 1639.

PHYSICAL CHARACTERISTICS.

Description of the locality, **89,** 919; **91,** 1219; **10,** 270.
Max. draft over shoalest part of chan., 9½′, **12,** 346.

PLANS.

By W. F. Smith, 1889, 12′ l.-w. chan. 100′ w. across the bar at the river's mouth; est., $27,000, **89,** 920.
By Maj. Smith, U. S. agent, 1892, dr. chan. 10′ x 100′ from 10′ in the Choptank R. to the wharves at Secretary Landing; est., $18,600, **93,** 1217.

PROJECTS.

By Lt. Col. Craighill, 1880, imp. Secretary Creek by excavation of a 7′ l.-w. chan. 75′ w. from mouth up to the town of East New Market; est., $3,500, **80,** 637.

SURVEYS.

Ex. au. act Mar. 3, 1879; made, 1880, by Lt. Col. Craighill, **79,** 81; **80,** 636.
Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Smith, U. S. agent, **89,** 919.
Sur. made, 1891, by Maj. Smith, U. S. agent, **91,** 1219.

*Allotment.

[1] H. D. 560, 61st, 2d.

J-265 CABIN CREEK, MD.

COMMERCE.
Unimportant, **80,** 739.

ENGINEERS.
In charge. Maj. W. P. Craighill, 1880. **R., 80,** 738.

PHYSICAL CHARACTERISTICS.
Description, **80,** 739.

SURVEYS.
Sur. au. act Mar. 3, 1879; **79,** 81.
Ex. by Maj. W. P. Craighill, **80,** 739.

J-267 LINCHESTER RIVER (Hunting Cr.), MD.

ENGINEERS.
Chief of Engineers. **R., 91,** 131, 1202.
In charge. Maj. W. F. Smith, U. S. agent, 1891. **R., 91,** 1203.
Assistant. A. Stierle. **R., 91,** 1203.

PHYSICAL CHARACTERISTICS.
Description of; a small prong of the Choptank R.; stream forms part of s. boundary of Caroline Co., Md., and was formerly called Hunting Cr., **91,** 1203.

SURVEY.
Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Smith (**R.** unfav.), **91,** 1203.

J-291 TUCKAHOE CREEK (River), MD.

APPROPRIATIONS.
1912, $15,600, **12,** 1646.

ENGINEERS.
Chief of Engineers. **R., 80,** 110; **85,** 137; **08,** 240; **09,** 248; **12,** 353.

Boards. BERH. **R., 09,** 248.

In charge:
Lt. Col. W. P. Craighill, 1879. **R., 80,** 736.
W. F. Smith, U. S. agent, 1884–88. **R., 85,** 908, 909, 911; **89,** 921.
Col. R. L. Hoxie, **08,** 218.
Maj. W. E. Craighill, **09,** 224.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1646.

Assistants:
J. L. Seager. **R., 80,** 737.
T. I. George. **R., 85,** 910.
A. Stierle. **R., 89,** 922.

PHYSICAL CHARACTERISTICS.
Description of, **80,** 737; **89,** 922.
Average rise and fall of tide, 2.3′, **12,** 353.
Stream navigable to Hillsboro, 12¾ m. above mouth, **12,** 353, 354.

PLANS.
By Lt. Col. Craighill, 1880, chan. 8′ x 200′ l. w. Hillsboro to Waymans, and one 6′ x 75′, Waymans to mouth; est., $41,250, **80,** 738.
By W. F. Smith, imp., Waymans Wharf to Hillsboro, by excavating 8′ x 75′, cost, $55,575; or a similar chan. 60′ w., cost, $46,200, **85,** 910.
By W. F. Smith, 1889, chan. 10′ l. w. and 50′ w. from Waymans Wharf to the br. at Hillsboro; est., $42,000, **89,** 923.

PROJECTS.
Act July 25, 1912, au. chan. 8′ x 50′ m. l. w. from Waymans Wharf for 1 m., to Rolphs Landing, and removal of shoals below Waymans Wharf; est., $15,600, **12,** 354.

SURVEYS.
Au. act Mar. 3, 1879; made, 1880, by Lt. Col. Craighill, **79,** 81 (see Plans), **80,** 736.
Ex. and sur. au. act July 5, 1884; made, 1884–85, by W. F. Smith, U. S. agent (see Plans), **85,** 908, 909.
Ex. au. act Aug. 11, 1888; made, 1889, by W. F. Smith.
Pre. ex. and sur. au. act Mar. 2, 1907, from Waymans Wharf to town of Hillsboro, **08,** 240. **R.** by Col. Hoxie, 1907 and 1908, with view to obtaining increased d.; est., $15,600,[1] **09,** 248.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 354.
Maps.[1]

J-316 LA TRAPPE (Dividing Cr.) RIVER, MD.

APPROPRIATIONS.

1892,	$2,500.00.	
1894,	4,750.00.	
1905,	*1,867.50,	**05,** 1141.
1907,	*2,135.39,	**07,** 1154.
1909,	*3,000.00,	**09,** 1201.
1911,	*1,578.95,	**11,** 1422.
1912,	*3,000.00,	**12,** 1643.
Total,	18,831.84	

COMMERCE.
Satisfactorily provided for, 1896, by existing imp., **97,** 1296.
Imp. has had no effect on f. rates, **10,** 273; **12,** 350.
Increasing slowly; 1911, 18,530 t., **12,** 350.

CONTRACTS.
1892. C. T. Caler, dr., 10¢ c. y., p. m., **93,** 1216.
1894. Baltimore Dredging Co., dr., 15¢ c. y., s. m., **95,** 1133.

*Allotment.

[1] H. D. 1160, 60th, 2d.

1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1085.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1155.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1327.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1643.

ENGINEERS.

Chief of Engineers. **R., 84,** 151, **89,** 112; **91,** 132; **93,** 138; **94,** 126; **95,** 144; **96,** 131; **97,** 165, 171; **98,** 169; **99,** 194; **00,** 222; **01,** 268; **02,** 200; **03,** 191; **04,** 190; **05,** 198; **06,** 209; **07,** 222; **08,** 232; **09,** 240; **10,** 272; **11,** 295; **12,** 349.

In charge:
Lt. Col. W. P. Craighill, **R., 84,** 962.
Capt. T. Turtle, **R., 84,** 963.
Maj. W. F. Smith, U. S. agent, 1888–1900. **R., 89,** 920; **91,** 1215; **93,** 1215; **94,** 892; **95,** 1132; **96,** 962; **97,** 1276, 1295; **98,** 1161; **99,** 1386; **00,** 1648.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1382.
Col. P. C. Hains, 1902. **R., 02,** 1078.
Capt. J. C. Sanford, 1903. **R., 03,** 1019.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1270; **05,** 1141; **06,** 1085; (Col.) **07,** 1154; **08,** 1196.
Maj. W. E. Craighill, 1909. **R., 09,** 1201.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1327; **11,** 1422.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1643.

Assistants.
J. L Seager, **R., 84,** 963.
A. Stierle. **R., 89,** 920; **91,** 1215, 1217.

OPERATIONS.

1892–93. 20,000 c. y., p. m., dr., **93,** 1215.
1895–96. 26,998 c. y., s. m., dr., **96,** 962.
1905–06. 13,866 c. y. dr., **06,** 1085.
1907–08. 10,068 c. y. dr., **08,** 1196.
1909–10. 22,506 c. y. dr., **10,** 1327.
1911–12. 7,500 c. y. dr. for mainten., **12,** 1643.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 921; **91,** 1215.
Max. draft, 11′ across bar, 8′ inside; tides, etc., **12,** 350.
Formerly known as Dividing Creek; is a trib. of Choptank R. (q. v.); is a small tidal basin, 3 m. l.

PLANS.

In 1889 Maj. Smith est. cost of dr. desired chan. at $13,000, **89,** 921.

PRIVATE WORK.

Increase from 4′ to 8′ by private subscription, **12,** 549.

PROJECTS.

By Maj. Smith, 1892, chan. 11′ x 150′ across the bar at the mouth, and dr. existing chan. inside the R. where needed to 8′ x 75′ from mouth to Trappe Landing; est., $7,250, **93,** 1215. Est. increased, 1896, to $9,750 on account of shoaling in the upper R. since the last sur., **96,** 962.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Lt. Col. Craighill (**R.** unfav.) and Capt. Turtle, **84,** 962, 963.
Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Smith, **89,** 920.
Sur. made, 1891, by Maj. Smith, **91,** 1216.
Sur. au. act June 3, 1896. **R.,** Maj. Smith, 1896 (**R.** unfav.; see Commerce), **97,** 1296.

J-323 TRED AVON RIVER, MD.

(See J-323a.)

APPROPRIATIONS.

1880,	$3,000,	**80,** 640.
1881,	3,000,	**81,** 881.
1912,	9,200,	**12,** 1647.
Total,	15,200	

COMMERCE.

Described, **80,** 639.

CONTRACTS.

1880. American Dredging Co., dr., 20¢ c. y., **81,** 881.
1881. American Dredging Co., dr., 22¢ c. y., **81,** 882.

ENGINEERS.

Chief of Engineers. **R., 80,** 103, 110; **81,** 138; **82,** 133; **83,** 138; **12,** 354.

In charge:
Lt. Col. W. P. Craighill, 1879–83. **R., 80,** 638; **81,** 880; **82,** 853; **83,** 679.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1647.

Assistants:
J. L. Seager. **R., 80,** 639.
Capt. E. H. Ruffner, **80,** 98.
Capt. Thomas Turtle, **80,** 98.

OPERATIONS.

1880–81. 27,094 c. y. dr., **81,** 881.

PHYSICAL CHARACTERISTICS.

This stream, formerly called Tredhaven Creek, is tributary to Choptank R., which it joins about 10 m. from its mouth. It rises in Talbot Co., Md., is about 10 m. l., and flows in a general s. direction; imp. section is 3 m. l. The controlling d. before beginning of imp. was less than 7′ to Easton Pt., **12,** 354, 355.

PROJECTS.

By Lt. Col. Craighill, 1879, 8′ m. l. w. chan. 150′ x 3 m. below Easton; est., $8,250, **80,** 639.
Act July 25, 1912, au. restoring chan. formerly dr. from Peach Blossom Creek to Easton Pt. 8′ d., m. l. w., and 150′ w., w. out at upper end; est., $9,200, **12,** 355.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 81; made, 1880, by Lt. Col. Craighill, **80,** 638.
Pre. ex. and sur. au. act June 25, 1910, with view to securing increased w. of chan. from Easton Pt. to mouth of Peach Blossom Creek. **R.** by Lt. Col. Langfitt, Oct. 6, 1910, and June 26, 1911,[1] **12,** 363.
Maps.[1]

[1] H. D. 399, 62d, 2d.

J-323(a) EASTON POINT HARBOR, MD.

(See also J-323.)

ENGINEERS.

Chief of Engineers. **R., 85,** 137.
In charge. W. F. Smith, U. S. agent. **R., 85,** 890.
Assistant. W. P. Smith. **R., 85,** 890.

PHYSICAL CHARACTERISTICS.

Imp. already made on Tread Haven Creek sufficient, **85,** 890.

SURVEY.

Ex. au. act July 5, 1884; made by W. F. Smith, **85,** 890.

J-354 TILGHMAN ISLAND HARBOR, MD.

APPROPRIATIONS.

1912, $7,820, **12,** 1647.

ENGINEERS.

Chief of Engineers. **R., 12,** 354.
Boards. BERH. **R., 12,** 363.
In charge. Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1647.

PHYSICAL CHARACTERISTICS.

Dimensions of H., 1,200′ x 600′; controlling d., 6½′, **12,** 354.
Avalon is the head of navigation. H. is situated at e. aide of Tilghmans Isld., bet. Chesapeake B. and Choptank R., 60 m. from Baltimore H., **12,** 354.

PROJECTS.

Act July 25, 1912, au. proj. for anchorage basin n. from the SS. wharf, 10′ x 300′ x 700′ d; est., $7,820,[1] **12,** 354.

SURVEYS.

Pre. ex. and sur. au. act June 25, 1910, with view to securing increased d. **R.** by Lt. Col. Langfitt, Oct. 8, 1910, and May 22, 1911; est., $7,820,[1] **12,** 363.
Maps.[1]

J-355 BLACK WALNUT HARBOR, MD.

ENGINEERS.

Chief of Engineers. **R., 93,** 143.
In charge. Maj. W. F. Smith, U. S. agent, 1893. **R., 93,** 1237.
Assistant. A. Stierle. **R., 93,** 1240.

PHYSICAL CHARACTERISTICS.

Description of; on s. extremity of Tilghmans Isld., in Talbot Co., Md., just inside mouth of Choptank R., **93,** 1240.

SURVEYS.

Ex. au. act July 13, 1892; made by Maj. Smith, 1892 (**R.** unfav.), **93,** 1239.

J-363 CLAIBORNE HARBOR, MD.

APPROPRIATIONS.

1902,	*$15,000.00,	**02,** 1073.
1905,	*1,863.35,	**05,** 1135.
1907,	*3,440.24,	**07,** 1147.
1909,	*12,000.00,	**09,** 1194.
1910,	*14,597.81,	**10,** 1320.
1911,	*3,947.37,	**11,** 1415.
1912,	*3,000.00,	**12,** 1634.
Total,	[2] 53,848.77.	

COMMERCE.

Imp. intended to develop a large trade in receiving, canning, and shipping oysters, **95,** 1200.
Description of, **00,** 1681.
Imp. has not affected rates; tonnage, 1903, 89,549 t.; 1910, 104,201 t., **10,** 267; 1911, 105,511 t., **12,** 342.

CONTRACTS.

1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1009.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1080.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1147.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1320.
1910. Maryland Dredging & Contracting Co., dr. 57,400 c. y., at 18½¢ c. y., **11,** 1415.
1911. Sanford & Brooks Co., j. constr. (about 253′), at $2,087.25, **11,** 1415. Maryland Dredging & Contracting Co., dr., 17,763 c. y., at 18½¢ c. y., **12,** 1634.

ENGINEERS.

Chief of Engineers. **R., 95,** 157; **99,** 203; **00,** 230; **02,** 196; **03,** 185; **04,** 185; **05,** 194; **06,** 203; **07,** 216; **08,** 226; **09,** 233; **10,** 265; **11,** 289; **12,** 341.

In charge:
Col. W. P. Craighill, 1890–95. **R., 95,** 1200.
Maj. Wm. F. Smith, U. S. agent, 1900–. **R., 00,** 1677, 1680.
Col. Peter C. Hains, 1902. **R., 02,** 1073.
Capt. J. C. Sanford, 1903. **R., 03,** 1008.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1260; **05,** 1134; **06,** 1079; (Col.) **07,** 1147; **08,** 1189.
Maj. W. E. Craighill, 1909. **R., 09,** 1194.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1320; **11,** 1415.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1634.

Assistant. C. M. Baird. **R., 00,** 1678.

OPERATIONS.

1903–04. 68,170 c. y. removed, **04,** 1261.
1905–06. 13,851 c. y. removed in mainten., **06,** 1079.
1907–08. 16,258 c. y. removed in mainten., **08,** 1189.
1909–10. 77,829 c. y. removed, restoring chan. to 12′ at m. l. w., **10,** 1320.
1910–11. 57,414 c. y. dr., proj. completed; work of j. constr. in progress, **11,** 1415.
1911–12. 253′ of j. constr. under contract; completed July 29, 1911; 18,866 c. y. dr., restoring chan. to proj. dimensions, **12,** 1634.

*Allotment.
[1] H. D. 400, 62d, 2d.
[2] Of this amount, $1,202.68 was turned into Treas., 1910, **10,** 1320.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1200; **00,** 1678; **02,** 196.
Scour at Tilghmans Pt., **10,** 266.
Max. draft over shoalest part of chan., 1911, 10′; l. of imp. sections, 2,040′, **11,** 289; at close of fiscal year 1912, about 12′, **12,** 342.
Located e. side of Eastern B., a tributary of Chesapeake B., about 42 m. se. of Baltimore H., **12,** 341.

PRIVATE WORK.

Dr. by Baltimore & Eastern Shore RR. Co., at a cost of about $20,000, **95,** 1200.

PROJECTS.

Maj. Smith est., 1899, $17,490 for 12′ chan., **00,** 1681.

Adopted by act June 13, 1902 (in accordance with est. and plans of Maj. Smith, 1899), for dr. chan. 12′ x 300′ m. l. w. from 12′ contour in Eastern B. to RR. p. in H., a distance of about 1,900′, then shoreward along s. side of said p. for 195′ x 500′; est., $17,490, and a further sum of $2,500 for possible extension of existing j.,[1] **03,** 185.
Insufficient app. prolonged work; est. increased to $27,408.30, **07,** 217.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Col. Craighill, 1894 (**R.** unfav.), **95,** 1200.
Ex. and sur. au. act Mar. 3, 1899; ex. made, 1899, by Maj. Smith (**R.** fav.); sur. made, 1899, by Maj. Smith (see Projects), **00,** 1677, 1678, 1680.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 342.

J-366 MILES RIVER, MD.

ENGINEERS.

Chief of Engineers. R., 12, 363.
In charge. Col. T. L. Casey, **12,** 330.

SURVEY.

Pre. ex. of chan. connecting Miles R. and Tred Avon R. near Royal Oak, Md., au. act Feb. 27, 1911. **R.,** Col. Casey, July 6, 1911[2] (unfav.), **12,** 363.

J-385 SKIPTON CREEK, MD.

ENGINEERS.

Chief of Engineers. R., 81, 150; **82,** 144; **85,** 137.

In charge:
Lt. Col. W. P. Craighill. **R., 82,** 948.
W. F. Smith, U. S. agent. **R., 85,** 907.

PLANS.

By Lt. Col. Craighill, 1882, dr. chan. through bar at mouth 6′ x 100′ l. w., with turning-basin at Skipton Landing 300′ x 200′; est., $15,000, **82,** 949; **85,** 908.

SURVEYS.

Ex. au. act Mar. 3, 1881; made by Lt. Col. Craighill, **82,** 948.
Ex. au. act July 5, 1884; made by W. F. Smith, U. S. agent, **85,** 907.

J-398 KENT ISLAND NARROWS, MD.

(See J-413.)

ENGINEERS.

Chief of Engineers. R., 06, 214.
In charge. Lt. Col. R. L. Hoxie, **06,** 196.

SURVEY.

Ex. au. act Mar. 3, 1905; **R.,** Lt. Col. Hoxie, July 18, 1905 (unfav.),[3] **06,** 214.

J-413 CHESTER RIVER, MD.

APPROPRIATIONS.

1873,	$15,000.00,	**73,** 72, 77, 760; **74,** 81; **75,** ii, 64.
1874,	5,000.00,	**74,** 81, ii, 17; **75,** 85, ii, 64.
1876,	5,000.00,	**76,** 62, 63, 284; **77,** 56, 273.
1878,	3,000.00,	**78,** 64, 447.
1881,	6,500.00,	**86,** 866.
1882,	6,500.00,	**82,** 841.
1890,	5,000.00,	**91,** 1188.
1892,	3,000.00,	**92,** 971.
1894,	1,500.00,	**95,** 1128.
1896,	1,500.00,	**96,** 959.
1899,	3,200.00,	**99,** 1383.
1902,	*5,402.00,	**02,** 1074.
1905,	*1,245.00,	**05,** 1137.
1907,	*2,417.36,	**07,** 1150.
1909,	*5,000.00,	**09,** 1197.
1910,	*3,000.00,	**10,** 1322.
1911,	*2,368.42,	**11,** 1418.
Total,	74,632.78,	**12,** 1636.

COMMERCE.

Tonnage, 1910, 54,616 t., **11,** 292; 1911, 69,000 t., **12,** 1637.
US. work caused lower RR. rates, **12,** 344.

CONTRACTS.

1875. W. H. Beard, dr., 16⅞¢ c. y., **75,** 86, ii, 64; **76,** 283, 284.
1881. D. Constantine, dr., 27¢ c. y., **82,** 841.
1891. National Dredging Co., dr., 10¢ c. y., **91,** 1189.
1892. American Dredging Co., dr., 15¢ c. y., s. m., **93,** 1212.
1895. Baltimore Dredging Co., dr., 19.8¢ c. y., p. m., **95,** 1129.
1896. C. T. Caler, dr., 9.5¢ c. y., p. m., **97,** 1274
1899. Baltimore Dredging Co., dr., 12.4¢ c. y., p. m., **00,** 1646.
1902. American Paving & Construction Co., dr., 19¢ c. y., **03,** 1010.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1082.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1150.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1322.
1910. Maryland Dredging & Contracting Co., dr. about 14,200 c. y., at 18½¢ c. y., **11,** 1418.
1911. Maryland Dredging & Contracting Co., dr. about 10,658 c. y., at 18½¢ c. y., **12,** 1636.

*Allotment. [1] H. D. 81, 56th, 1st. [2] H. D. 455, 62d, 2d. [3] H. D. 69, 59th, 1st.

ENGINEERS.

Chief of Engineers. R., 72, 74; **73,** 71, 77; **74,** 81; **75,** 85; **76,** 62; **77,** 56; **78,** 63; **79,** 75; **80,** 100, 111; **81,** 132, 150; **82,** 129, 130; **83,** 133, 134; **84,** 141; **85,** 133; **86,** 130; **87,** 93; **89,** 112; **90,** 102; **91,** 126; **92,** 126; **93,** 136; **94,** 125; **95,** 142; **96,** 129; **97,** 164; **98,** 167; **99,** 193; **00,** 219; **01,** 267; **02,** 197; **03,** 187; **04,** 186; **05,** 195; **06,** 205, 214; **07,** 219; **08,** 229; **09,** 236; **10,** 268; **11,** 291; **12,** 344.

In charge:

Maj. W. P. Craighill, 1872–84; **72,** 74. **R., 73,** 760, 817–819, 825; **74,** ii, 17; **75,** ii, 64; **76,** 283; **77,** 271; **79,** 489; **80,** 624; (Lt. Col.) **81,** 839, 856; **82,** 841, 843; **83,** 667, 669; **84,** 893.

Capt. C. B. Phillips, 1878, in temporary charge. **R., 78,** 445.

W. F. Smith, U. S. agent, 1884–1900. **R., 85,** 884; **86,** 866; **87,** 838; **88,** 747; (map) **90,** 954; **91,** 1188; **92,** 970; **93,** 1211; **94,** 889; **95,** 1128; **96,** 958; **97,** 1273; **98,** 1159; **99,** 1383; **00,** 1645.

Lt. Col. O. H. Ernst, 1901. **R., 01,** 1381.

Col. Peter C. Hains, 1902. **R., 02,** 1074.

Capt. J. C. Sanford, 1903. **R., 03,** 1010.

Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1263; **05,** 1136; **06,** 1081; (Col.) **07,** 1149; **08,** 1191.

Maj. W. E. Craighill, 1909. **R., 09,** 1196.

Col. Thos. L. Casey, 1910–11. **R., 10,** 1322; **11,** 1417.

Col. W. C. Langfitt, 1912–. **R., 12,** 1636.

Assistants:

W. Popp. **R., 73,** 818, 826.

H. Bacon. **R., 75,** ii, 64; **81,** 856.

Capt. C. B. Phillips. **R., 76,** 284; **77,** 273.

Lt. Thomas Turtle, **75,** 84; (Capt.) **82,** 127; **83,** 131.

Lt. Edward Maguire, **75,** 84; **76,** 62.

Capt. E. H. Ruffner, **82,** 127.

Lt. C. McD. Townsend, **83,** 131; **84,** 139.

A. Stierle. **R., 90,** 955.

ESTIMATES. (See Projects.)

By W. Popp, adopted by Maj. Craighill, dr. 7′ chan. through causeway, $23,100; dr. 6′ chan., $15,000, **73,** 760, 817, 818, 825; **74,** ii, 17. For 7′ chan., increased to $25,000 by Maj. Craighill on account of long delays in operations, **75,** 86, ii, 64; **76,** 63, 284. Addl. increase of $3,000 for same cause, **77,** 57, 273.

LEGISLATION.

Maryland, Apr. 11, 1874, consented to the removal of the causeway, with the proviso "that before said causeway should be cut or opened there shall be built a bridge with a draw of not less than 60 f.," **74,** 81, ii, 17.

OPERATIONS.

History of, **75,** ii, 64; **76,** 283; **77,** 271.

Deferred until a br. was built, **74,** 81, ii, 17.

1874–75. Dr. by contract in progress, **75,** 86, ii, 64; about 10,000 c. y. removed, **76,** 283.

1875–76. Dr. continued; about 88,000 c. y. removed, **76,** 62, 63, 284.

1876–77. Dr. under contract ceased July 7, 1876, the available funds being exhausted; addl. vent through the causeway was given; 4 pile wings constr.; chan. defined by guide piles; some riprapping done, and, June 28, 1877, a dr. chartered by the day to dr. at the sharp turns in the chan., **77,** 57, 272, 273.

1877–78. 10,970 c. y. removed by dr., **78,** 446.

1881–82. Chan. over shoals dr. 70′ w. and 8′ d. at l. w., **82,** 841.

1882–83. Chan. being w. to 120′ as orig. proposed, **83,** 130.

1883–84. Chan. w. to 120′; proj. completed, **86,** 130.

1891–92. 20,061 c. y. dr., **92,** 971.

1892–93. 26,734 c. y., p. m., dr., **93,** 1211.

1895–96. 5,502 c. y., p. m., dr., **96,** 959.

1898–99. 10,483 c. y., p. m., dr., **99,** 1383.

1899–00. 20,090 c. y., p. m., dr., **00,** 1645.

1902–03. 23,907 c. y. dr., **03,** 1011.

1905–06. 9,295 c. y. dr., **06,** 1081.

1907–08. 11,397 c. y. dr., **08,** 1191.

1909–10. 21,463 c. y. dr., **10,** 1322.

1910–11. 14,093 c. y. dr. under contract, **11,** 1417.

1911–12. 11,494 c. y. dr., restoring chan. from Crumpton to Jones Landing to 6′ m. l. w., and w. of 60′, **12,** 344, 1636.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 817–819, 827; **75,** ii, 65.

Max. draft, 1911, at m. l. w. over the shoalest part of the chan. was 5′, **11,** 291.

R. rises in Kent Co., Del., flows sw. into Chesapeake B.; 50 m. l. Proj. covers 6¼ m.; its lower end 33 m. above mouth, **12,** 344.

PRIVATE (COUNTY AND PRIVATE) WORK.

A solid causeway was built across the "Narrows" about 1820 by Queen Anns Co.; also a tide mill and race was constr., to the injury of the chan., **73,** 817–819, 826; drawbr. built by the county authorities at the causeway, **76,** 283; repairs made to the causeway and draw by the county authorities, **77,** 57, 272.

PROJECTS.

Making an opening through the causeway, and dr. a chan. 7′ x 100′, **75,** ii, 64; **76,** 283; **77,** 271.

By Maj. Craighill, 1874, reopening a chan. formerly existing between Chester R. and Eastern B., closed by a solid causeway, under the au. of Maryland; est., $25,000, **75,** ii, 64; **85,** 133. Proj. completed, at a cost of $25,000, in 1878; no further work deemed necessary, **85,** 133.

By Maj. Craighill, 1881, Spry's landing to Crampton, excavation of chan. 8′ x 120′ m. l. w.; est., $13,167, **81,** 857; **83,** 667. Proj. completed in 1883, **83,** 133; **86,** 130.

In 1889, Maj. Smith, Crampton to Jones Landing, excavation of a chan., Crampton to 1 m. below Millington, supposed to be Jones Landing, 6¼ m., 6′ x 60′ m. l. w.; est., $12,750, **90,** 956; **91,** 1186; **92,** 971; est. increased, 1896, to $14,250; later to $19,562.50, **12,** 344.

SURVEYS.

Au. act June 10, 1872; assigned to Maj. Craighill, **72,** 74, and made by W. Popp, in October, 1872. **R., 73,** 817, 818, 825, 826.

Under direction of Maj. Craighill, 1877–78, **79,** 491.

Resur. of chan., 1880, **80,** 624.

Rirby's to Spry's landing, au. June 14, 1880; made, 1881, by Maj. Craighill, **81,** 150, 856.

Sur., Crampton to Jones Landing, au. act Aug. 11, 1888; made, 1889, by Maj. Smith, **90,** 956.

Ex. au. act Mar. 3, 1905; made, 1905, by Lt. Col. Hoxie (**R.** unfav.),[1] **06,** 214.

J-418 WINCHESTER HARBOR (Creek), MD.

ENGINEERS.

Chief of Engineers. R., 12, 362.

In charge. Lt. Col. W. C. Langfitt, **12,** 330.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.** by Col. T. L. Casey, Oct. 17, 1910[2] (unfav.), **12,** 362.

[1] H. D. 69, 59th, 1st.

[2] H. D. 275, 62d, 2d.

J-422 QUEENSTOWN HARBOR, MD.

APPROPRIATIONS.

1871, $5,000.00, **71,** 75, 612.
1872, 6,000.00, **72,** 68, 686; **73,** 71.
1879, 3,000.00, **79,** 75, 488.
1896, 5,000.00, **97,** 1286.
1902, *12,000.00, **02,** 1072.
1905, *4,606.50, **05,** 1134.
1907, *4,975.70, **07,** 1146.
1910, *8,607.40, **10,** 1319.
1911, *2,368.42, **11,** 1414.
1912, *5,000.00, **12,** 1632.

Total, 56,558.02

COMMERCE.

Increase, **79,** 488.
Description of, **00,** 1676.
Imp. has had no effect on rates, **10,** 265.
Steadily increasing; 1900, 12,373 t.; 1911, 28,142 t.; value, $1,389,460; imp. has had no notable effect on rates, **12,** 341.

CONTRACTS.

1871. J. W. Parks, dr., 35¢ c. y., **71,** 612, 613; **72,** 686.
1872. M. F. Brainard, dr., 19¾¢ c. y., **73,** 759, 760.
1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1287.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1007.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1079.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1146.
1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1414.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1633.

ENGINEERS.

Chief of Engineers. R., 70, 32, 70; **71,** 75; **72,** 68; **73,** 71; **74,** 80; **75,** 85; **76,** 62; **79,** 75; **80,** 100; **81,** 133; **82,** 130; **83,** 135; **97,** 169; **98,** 174; **99,** 201, 203; **00,** 219, 230; **01,** 266; **02,** 195; **03,** 185; **04,** 184; **05,** 193; **06,** 202; **07,** 215; **08,** 225; **09,** 232; **10,** 264; **11,** 288; **12,** 340.

In charge:
Col. J. H. Simpson, 1870. **R., 70,** 421.
Maj. W. P. Craighill, 1870–83; **71,** 71, 585. **R., 71,** 612, 613; **72,** 786; **73,** 759; **74,** ii, 16; **75,** ii, 64; **76,** 283; **79,** 487; (Lt. Col.) **80,** 623; **81,** 860; **82,** 843; **83,** 669.
Maj. Smith, U. S. agent, 1896–1900. **R., 97,** 1286; **98,** 1170; **99,** 1397; **00,** 1644, 1673, 1675.
Lt. Col. O. H. Ernst, 1901. **R., 01,** 1380.
Col. P. C. Hains, 1902. **R., 02,** 1072.
Capt. J. C. Sanford, 1903. **R., 03,** 1007.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1260; **05,** 1133; **06,** 1079; (Col.) **07,** 1146; **08,** 1188.
Maj. W. E. Craighill, 1909. **R., 09,** 1193.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1319; **11,** 1413.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1632.

Assistants:
W. Popp. **R., 71,** 613.
C. J. Bates. **R., 71,** 613.
Capt. C. B. Phillips, **71,** 71; **72,** 66; **73,** 71.
Lt. Thomas Turtle, **81,** 129.
Lt. W. M. Black, **81,** 129.

OPERATIONS.

1870-71. Dr. by contract, **71,** 612.
1871-72. Dr. by contract, **72,** 686.
1872-73. Dr. by contract, **73,** 71, 759, 760.
1879-80. Dr. resumed, **80,** 623.
1880-81. Chan. 8′ x 100′ m. l. w. dr. from Chester R. to inner H., **81,** 860.
1896-97. 2,993 l. f. of the R. dr., **97,** 1286.
1899-00. 4,875 c. y. dr. from chan., **00,** 1644.
1902-03. 27,368 c. y. dr., **03,** 1007.
1903-04. 27,255 c. y. dr., **04,** 1260.
1905-06. 34,369 c. y. dr., **06,** 1079.
1907-08. 23,553 c. y. dr., **08,** 1188.
1910-11. 27,800 c. y. removed for completing proj., and 13,945 c. y. for mainten., **11,** 1414.
1911-12. 11,500 c. y. dr. for mainten., **12,** 1632

PHYSICAL CHARACTERISTICS.

71, 613, 614; **79,** 488; **00,** 1673.
Max. draft over shoalest part of locality under imp., 1912, 9′, **12,** 341.
The H. is a B. making from Chester R., and is navigable to Queenstown, ½ m. above mouth of H., **12,** 341.

PROJECTS.

By Maj. Craighill, 1870, chan. in Queenstown Creek; est., $9,500, **71,** 75, 612–614.
By Maj. Craighill, 1879, to straighten chan. and d. it to 8′ by dr., **79,** 488.
By Maj. Smith, 1896, to restore chan. to 8′ m. l. w., and w. of 100′ from the 8′ curve in the Chester R. to the inner H., **97,** 1286.
By Maj. Smith, est., 1899, $23,100 to imp. chan., **1900,** 1673. Act June 13, 1902, au. increasing the dimensions of chan. to 10′ x 200′; est., $23,000,[1] **03,** 185; est. increased, 1907, to $25,886.35, **07,** 216.

SURVEYS.

Under direction of Maj. Craighill, 1870, by Wm. Popp and C. J. Bates. **R., 71,** 612, 613.
Sur. by Maj. Smith, 1896–97, **97,** 1286.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Maj. Smith (**R.** fav.; see Projects), **00,** 1673, 1675.

J-433 CORSICA RIVER (Creek), MD.

APPROPRIATIONS.

1882, $5,000, **82,** 842.
1884, 5,000, **84,** 892.
1886, 10,000, **86,** 867.
1888, 10,000, **88,** 747.
1912, 5,368, **12,** 1646.

Total, 35,368, **12,** 1646.

COMMERCE.

Important, **86,** 868.

CONTRACTS.

1883. American Dredging Co., dr., 18¢ c. y., **84,** 891.
1884. Baltimore Dredging Co., dr., 13¢ c. y., **85,** 884.
1886. National Dredging Co., dr., 11¢ c. y., **87,** 839, 840.
1889. Baltimore Dredging Co., dr., 12½¢ c. y., **89,** 900.

ENGINEERS.

Chief of Engineers. R., 81, 150; **82,** 129; **83,** 134; **84,** 141; **85,** 133; **86,** 131; **87,** 93; **88,** 92; **89,** 109; **90,** 100; **10,** 282; **12,** 353.

In charge:
Lt. Col. W. P. Craighill, 1881–84. **R., 82,** 842; **83,** 668; **84,** 891.
Maj. W. H. Heuer, 1884. **R., 85,** 867.
W. F. Smith, U. S. agent, 1884–90. **R., 85,** 884; **86,** 867; **87,** 838; **88,** 747; (Maj.) **89,** 899; **90,** 937.
Lt. Col. W. E. Craighill, 1910. **10,** 256.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1646.

*Allotment.

[1] H. D. 92, 56th, 1st.

Assistants:
John L. Seager. **R., 82,** 842.
Lt. C. McD. Townsend, **84,** 139.

OPERATIONS.

1883-84. 23,514 c. y. dr. near Centerville, **84,** 891.
1884-85. 24,569 c. y. dr. to extend previous work, **85,** 884.
1886-87. 77,390 c. y. dr. from chan. and turning-basin, **87,** 839.
1888-89. 67,575 c. y. dr. and proj. completed, **89,** 899.

PHYSICAL CHARACTERISTICS.

About 10 m. long; imp. section, 1¼ m. long, **12,** 353.

PRIVATE WORK.

Dr., **87,** 839.

PROJECTS.

By Lt. Col. Craighill, 1882, for chan., Hoopers Landing to Centerville, 8′ x 100′ m. l. w.; also a turning-basin at Centerville 200′ x 300′; est., $30,000, **82,** 842.
By Lt. Col. Craighill, 1909, plan for imp.; est., $5,368,[1] **10,** 282; au. act July 25, 1912, providing for the restoration of chan.,[1] **12,** 353.

SURVEYS.

Au. act Mar. 3, 1881; made by Col. Craighill, 1881, **82,** 842; resur. of portion, **83,** 669.
Au. act Mar. 3, 1909; **R.** by Lt. Col. Craighill,[1] **10,** 282.
Maps. **87,** 838.

J-443 SOUTHEAST RIVER, MD.

ENGINEERS.

Chief of Engineers. **R., 89,** 112.
In charge. Maj. W. F. Smith, U. S. agent, 1888. **R., 89,** 911.
Assistant. A. Stierle. **R., 89,** 912.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 912.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Smith, U. S. agent (**R.** unfav.), **89,** 911.

J-499 ROCKHALL HARBOR, AND INNER HARBOR AT ROCKHALL, MD.

APPROPRIATIONS.

1896,	$16,600.00,	**97,** 1288.
1902,	*12,000.00,	**02,** 1071.
1905,	*12,829.35,	**05,** 1133.
1907,	*14,383.97,	**07,** 1146.
1910,	*21,711.03,	**10,** 1319.
1911,	*3,947.37,	**11,** 1413.
1912,	*5,000.00,	**12,** 1631.
Total,	86,471.72	

COMMERCE.

In 1890 the value of farm products shipped, $103,150, **95,** 1164.
Description of, **00,** 1672; **02,** 1072.
No effect on rates, **10,** 264.
Large decrease since 1909. In 1911, 8,570 t.; value, $194,350, **12,** 340.

CONTRACTS.

1896. C. T. Caler, dr., 9½¢ c. y., p. m., **97,** 1288.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1006.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1078.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1146.
1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1413.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1632.

ENGINEERS.

Chief of Engineers. **R., 91,** 132; **92,** 132; **95,** 151; **97,** 170; **98,** 174; **99,** 201, 203; **00,** 218, 230; **02,** 195; **03,** 184; **04,** 183; **05,** 192; **06,** 201; **07,** 214; **08,** 224; **09,** 231; **10,** 263; **11,** 286; **12,** 339.

In charge:
Maj. W. F. Smith, U. S. agent, 1890–1900. **R., 92,** 999, 1001; **95,** 1162; **97,** 1287; **98,** 1171; **99,** 1397; **00,** 1643, 1670.
Col. P. C. Hains, 1902. **R., 02,** 1071.
Capt. J. C. Sanford, 1903. **R., 03,** 1005.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1259; **05,** 1133; **06,** 1078; (Col.) **07,** 1145; **08,** 1187.
Maj. W. E. Craighill, 1909. **R., 09,** 1192.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1318; **11,** 1413.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1631.

Assistant. A. Stierle. **R., 92,** 999, 1002; **95,** 1164.

OPERATIONS.

1896-97. 22,045 c. y., p. m., dr., **97,** 1288.
1897-98. 117,339 c. y., p. m., dr., **98,** 1171.
1903-04. 55,487 c. y. dr., **04,** 1259.
1905-06. 95,844 c. y. dr., **06,** 1078.
1907-08. 5,135 c. y. dr., **08,** 1187.
1908-09. 62,822 c. y. dr., **09,** 1192.
1910-11. 27,312 c. y. dr., **11,** 1413.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1002; **95,** 1164.
Chan. across Swan Pt. Bar practically obliterated; questionable if it can be maintained; may be necessary to make detour to avoid bar, **07,** 215.
Max. draft across Swan Pt. Bar, 8′, and in the inner H., 12′; range of tide, etc., **12,** 339.
H. on e. shore of Chesapeake B., 25 m. se. of Baltimore H., **12,** 339.

PLANS.

By Maj. Smith, 1891, 10′ l.-w. chan. 100′ w. from the chan. in Swan Creek Inlet to the old p. in the H.; est., $9,513, **92,** 1001.

PROJECTS.

By Maj. Smith, 1895, 10′ l.-w. chan. 100′ w., Swan Creek Inlet to the old p. in the H.; est., $7,134, **97,** 1287.
By Maj. Smith, 1896–97, cut 80′ w. across the bar and 100′ w. for the chan. inside the bar, **97,** 1288.
Maj. Smith est., 1899, $23,925, with $8,320 biennially for mainten., to imp. outer chan.; $19,140, with $888 biennially for mainten., to imp. inner H.; and $31,515, with $8,320 biennially for mainten., to imp. chan. across the bar, **00,** 1670; au. act June 13, 1902, **03,** 184.
Est. increased, 1907, to $60,386.81 from higher unit price of dr., and again, 1912, to $71,196.81, due to broadening of outer bar, **12,** 339.
Lt. Col. Langfitt recom. elimination of proj. for inner H., on account of lack of use by navigation, **12,** 1631.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Smith, **92,** 1001.
Sur. au. act Aug. 17, 1894; reex. instead made by Maj. Smith in 1894 (**R.** fav.), **95,** 1162.
Ex. and sur. for 12′ chan. 150′ w. through Swan Pt. Bar and in the inner H., and a 12′ chan. 190′ w. across the bar, au. act Mar. 3, 1899; made, 1899, by Maj. Smith (**R.** fav.; see Projects), **00,** 1670.
Ex., **03,** 1006.

*Allotment.

[1] H. D. 537, 61st, 2d.

J-504 FAIRLEE CREEK, MD.

APPROPRIATIONS.

1888, $5,000, **88,** 92.
1890, 5,000, **90,** 936.
Total, 10,000

CONTRACTS.

1889. C. T. Caler, dr., 23¢ c. y., **89,** 899.
1891. C. T. Caler, dr., 16¢ c. y., **91,** 1187.

ENGINEERS.

Chief of Engineers. R., 87, 97; **88,** 92; **89,** 109; **90,** 99; **91,** 126; **92,** 126; **93,** 136; **94,** 125; **95,** 142; **96,** 129.

In charge. W. F. Smith, U.S. agent, 1886–96. **R., 87,** 854; (Maj.) **89,** 898; **90,** 936; **91,** 1186; **92,** 969; **93,** 1210; **94,** 888; **95,** 1127; **96,** 958.

Assistant. C. Humphreys. **R., 87,** 854.

OPERATIONS.

1888–89. 18,500 c. y. dr., **89,** 898.
1890–91. 28,125 c. y. dr., **91,** 1186.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 855.

PROJECTS.

By W. F. Smith, 1887, chan. across the bar at mouth of creek 7′ x 100′; est., $15,450, **87,** 856; **91,** 1187; **92,** 970.

SURVEYS.

Au. act Aug. 5, 1886; made, 1887, by W. F. Smith, **87,** 855.

J-505 WORTON (Creek) HARBOR, MD.

APPROPRIATION.

1872, $12,000, **72,** 67, 686.

CONTRACT.

1873. Morris & Cumings, dr., 18¢ c. y., **73,** 757

ENGINEERS.

Chief of Engineers. R., 72, 67, 71; **73,** 71; **74,** 80; **75,** 85; **76,** 62.

In charge. Maj. W. P. Craighill, 1872–76. **R., 72,** 686, 699; **73,** 757; **74,** ii, 16; **75,** ii, 63; **76,** 283.

Assistants:
W. Popp. **R., 72,** 699.
Capt. C. B. Phillips, **72,** 66; **73,** 71; **74,** 78.
Lt. Thomas Turtle, **73,** 71; **74,** 78.

OPERATIONS.

1872–73. Chan. 7′ x 100′ dr., connecting wharves in use with the d. w. of the creek; a basin 150′ sq. dr., **73,** 71, 757.
1873–74. Few guiding piles driven, **74,** 80, ii, 16.

PHYSICAL CHARACTERISTICS.

Described, **72,** 700.

PROJECT.

By W. Popp, 1872, adopted by Maj. Craighill, dr. chan. about 7′ x 100′ x 2,000′ from head of Worton Creek to confluence of Worton and Times Creeks; est., $12,000, **72,** 67, 686, 700.

SURVEY.

Under direction of Maj. Craighill, by W. Popp, 1872. **R., 72,** 699.

J-508 STILL POND (Creek) HARBOR, MD.

ENGINEERS.

Chief of Engineers. R., 89, 112.

In charge. Maj. W. F. Smith, U.S. agent, 1888. **R., 89,** 906.

Assistant. A. Stierle. **R., 89,** 907.

PHYSICAL CHARACTERISTICS.

Description, **89,** 907.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by W. F. Smith, U.S. agent (**R.** unfav.), **89,** 906.

J-509 SASSAFRAS RIVER, MD.

ENGINEERS.

Chief of Engineers. R., 85, 137; **89,** 112.

In charge. W. F. Smith, US. agent, 1885–89. **R., 85,** 912, 914; (Maj.) **89,** 924.

Assistants:
C. M. Bird. **R., 85,** 912.
V. M. Newton. **R., 85,** 914.
A. Stierle. **R., 89,** 925.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 913; **89,** 925.

PLANS.

By W. F. Smith, 1885, dr. chan. 10′ x 75′ x 100′ m. l. w., Georgetown to Lime Landing; est., $56,527, **85,** 915, 916.

By Maj. Smith, 1889, 8′ chan. 100′ w., mouth to Fox Hole Wharf, about 5,000′; also turning-basin; est., $18,000, **89,** 926.

SURVEYS.

Above Georgetown, au. act July 5, 1884.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Smith, US. agent, **89,** 924.

J-511 TURNER CREEK, MD.

ENGINEERS.

Chief of Engineers. R., 91, 132.

In charge. Maj. W. F. Smith, U.S. agent, 1890. **R., 91,** 1211, 1213.

Assistant. A. Stierle. **R., 91,** 1212, 1214.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1212.

PLANS.

By Maj. Smith, 1891, dr. point projecting into mouth of creek, and constr. spur dike 400′ l. near entrance; est., $4,060, **91,** 1213.

J-523(a) ELK AND LITTLE ELK RIVERS, MD.

APPROPRIATIONS.

1874,	$5,000,	**74,** 80, ii, 16.
1875,	5,000,	**75,** 85, ii, 62.
1880,	10,000,	**80,** 623.
1881,	5,000,	**81,** 855.
1882,	6,500,	**82,** 841.
1890,	10,000,	**91,** 1185.
1892,	5,000,	**92,** 969.
1902,	16,665,	**02,** 1066.
1905,	2,000,	**05,** 1131.
1907,	18,803,	**07,** 1143.
1909,	*10,000,	**09,** 1190.
1910,	10,000,	**10,** 1317.
1912,	4,040,	**12,** 1628.
Total,	108,008,	**12,** 1628.

COMMERCE.

Description of, **00,** 1668, 1669.
Freight rates reduced, **10,** 262.
1911, 40,408 t., **12,** 337.

CONTRACTS.

1875. A. A. Dodge, dr., 25¢ c. y., **76,** 62, 282.
1880. G. H. Ferris, dr., 24¢ c. y., **81,** 855.
1881. G. H. Ferris, dr., 33⅓¢ c. y., **81,** 855.
1883. G. W. Parsons, dr., 31¢ c. y., **83,** 667.
1891. C. T. Caler, dr., 12⅓¢ c. y., **91,** 1185.
1892. C. T. Caler, dr., 9.9¢ c. y., p. m., **93,** 1209.
1902. American Paving & Construction Co., dr., 19¢ c. y., s. m., **03,** 1003.
1905. Maryland Dredging & Contracting Co., dr., 12¢ c. y., **06,** 1076.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1143.
1909. River & Harbor Impvt. Co., dr., 11.95¢ c. y., **10,** 1317.
1910. Maryland Dredging & Contracting Co., dr. about 47,000 c. y., at 18⅓¢ c. y., **11,** 1410.

ENGINEERS.

Chief of Engineers. R., 73, 77; **74,** 79, 89; **75,** 84; **76,** 62; **80,** 99; **81,** 131; **82,** 128; **83,** 132; **84,** 140; **85,** 132; **89,** 112; **90,** 102; **91,** 125; **92,** 125; **93,** 135; **94,** 124; **95,** 142; **99,** 203; **00,** 230; **02,** 191; **03,** 182; **04,** 181; **05,** 190; **06,** 199, 214; **07,** 212; **08,** 222; **09,** 229; **10,** 261; **11,** 284; **12,** 336.

In charge:

Maj. W. P. Craighill, 1873–85. **R., 73,** 815; **74,** ii, 15, 81; **75,** ii, 61; **76,** 282; (Lt. Col.) **80,** 622; **81,** 853; **82,** 840; **83,** 666; **84,** 889.
W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 883; (Maj.) **90,** 965; **91,** 1184; **92,** 968; **93,** 1207; **94,** 888; **95,** 1126; **00,** 1665, 1668.
Col. Peter C. Hains, 1902. **R., 02,** 1066.
Capt. J. C. Sanford, 1903. **R., 03,** 1003.
Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1256; **05,** 1130; **06,** 1076; (Col.) **07,** 1143; **08,** 1185.
Maj. W. E. Craighill, 1909. **R., 09,** 1190.
Col. Thos. L. Casey, 1910–11. **R., 10,** 1316; **11,** 1410.
Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1628.

Assistants:

W. Popp. **R., 73,** 816; **74,** ii, 81, 82.
H. Bacon. **R., 75,** ii, 62.
Capt. C. B. Phillips, **76,** 282.
Lt. Thomas Turtle, **75,** 84; (Capt.) **81,** 129; **82,** 127; **83,** 131.
Capt. E. H. Ruffner, **81,** 129; **82,** 127.
Lt. C. McD. Townsend, **83,** 131; **84,** 139.
Lt. W. M. Black, **81,** 129.
A. Stierle. **R., 90,** 965.

ESTIMATES. (See Projects.)

By W. Popp, 7′ chan., $27,800; 6′ chan., $18,200, **73,** 815, 816.
Maj. Craighill, 1873, chans. in both branches; 6′ x 75′, $36,000; or 6′ x 50′, $25,000, **74,** ii, 15, 82, **75,** 85, ii, 61.

OPERATIONS.

1874–75. About 900′ of dike built by open purchase and hired labor; completed Oct. 31, 1874; 5,441 c. y. dr., **75,** 85, ii, 62, 63.
1875–76. 15,565 c. y. dr., **76,** 62, ii, 282.
1879–80. 15,565 c. y. dr., **80,** 622.
1881–82. 24,308 c. y. dr., **82,** 840.
1882–83. Old dike removed and bank sloped back, **83,** 667.
1883–84. Work of dr. and removal of old pierhead continued, **84,** 890.
1884–85. Dr. and p. removal completed, **85,** 883, 884.
1891–92. 56,069 c. y. dr., **92,** 968.
1892–93. 45,255 c. y., p. m., dr., **93,** 1208.
1893–94. Proj. completed, **94,** 888.
1902–03. 75,110 c. y. dr., **03,** 1003.
1905–06. 14,990 c. y. dr., **06,** 1076.
1907–08. 91,484 c. y. dr.; proj. completed, **08,** 1185.
1909–10. 69,387 c. y. dr., **10,** 1316.
1910–11. 8,213 c. y. removed, restoring proj. chan., **11,** 1410.
1911–12. 48,853 c. y. removed, **12,** 1628.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 816; **74,** ii, 82, 83; **90,** 966.
Shoaling more rapid than expected, **08,** 222.
Rises in Pa. and empties into head of Chesapeake B., flowing for 35 m. About 15 m. from mouth joined by Little Elk (12 m. l.). Proj. portions are at junction of R. Water depth, June 30, 1912, 4′, **12,** 337.

PRIVATE WORK. (See Projects, 1912.)

PROJECTS. (See Estimates.)

By Lt. Col. Craighill, 1873, chan. 6′ x 75′, by dr. and diking in the Big Elk from Cedar Pt. to Elkton, and in Little Elk as far as Burnetts Wharf; est. $36,000, **74,** ii, 15, 82, 83; **80,** 622.
Amended to include 8′ d., dike renewal and crib removal, increasing the est. to $38,600, **81,** 854, 855.
By Maj. Smith, 1890, excavating chan., upper wharves at the br. to below Cedar Pt., to 8′ m. l. w. and 100′ w.; est., $24,000, **91,** 1184.
Maj. Smith est., 1899, $16,665, with $2,500 an. for mainten. to restore navigable chan., **00,** 1669.
By Lt. Col. Hoxie, 1906, obtaining and maintaining chan. 6′ x 100′, Elkton to Cedar Pt.; est., $16,802.77, and $2,000 an. mainten.,[1] **06,** 214; au. act Mar. 2, 1907, **07,** 213.
Act July 25, 1912, au. chan. 7′ x 80′ m. l. w., junction of Elk and Little Elk Rs., 1,200′ up former and 2,000′ up latter; est., $6,060, local interests to contribute $2,020, and U. S. $4,040, **12,** 336.

SURVEYS.

Ex. by W. Popp, under direction of Maj. Craighill. **R., 73,** 815, 816; **74,** ii, 81, 82.
A resur. by Maj. Craighill, **76,** 282.
Resur., 1883, **83,** 667.
Au. act Aug. 11, 1888; made, 1890, by Maj. Smith, **90,** 966.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Maj. Smith (**R.** fav.; see Projects), **00,** 1667.
Ex. and sur. au. act Mar. 3, 1905; made, 1905–06, by Col. Hoxie,[1] **06,** 214.
Pre. ex. au. act Feb. 27, 1911; **R.,** Col. Casey, 1911, and Lt. Col. Langfitt, 1912; est., $6,060, 1st constr., provided local interests contribute one-third of this sum ($2,020),[1] **12,** 364.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 337.
Maps.[1] [2]

*Allotment. [1] H. D. 738, 59th, 1st. [2] H. D. 770, 62d, 2d.

J-535(a) CHESAPEAKE TO DELAWARE (BAYS). (Ship-canal surveys.)

APPROPRIATIONS.

1879,	*$16,000, **79,** 590.
1881,	10,000, act Mar. 3.
1882,	10,000, **82,** 144 (sur.).
1894,	5,000, act Aug. 18.
1906,	10,000, **06,** 2427.
Total,	51,000

COMMERCE.

72, 702, 707.
Saving in time and distance by canal, **80,** 715.
C. passing through Delaware and Chesapeake Canal, **82,** 958.
Importance of the imp., **83,** 742.
C. that would probably be benefited by constr. of a large ship canal connecting the Chesapeake with Delaware B., **95,** 1198.

ENGINEERS.

Chief of Engineers. R., 72, 71; **78,** 69; **79,** 81; **80,** 110; **81,** 150; **82,** 144; **83,** 148, 725; **95,** 156; **06,** 798; **07** 228.

Boards:
Congress, 1894, au. President to appoint a board to ex. and determine, from sur. already made by War Dept., the most feasible route for a ship canal from Chesapeake B. to Delaware B. **R., 95,** 1195.
(The Board met in Washington on Nov. 1, 1894, and was composed of Brig. Gen. T. L. Casey, Chief of Engineers, U. S. Army; Col. W. P. Craighill, Corps of Engineers; Capt. G. Dewey, U. S. Navy; Mendes Cohen, Maryland, and E. Porter Alexander, South Carolina.)
Congress, 1906, au. the President to appoint a commission to examine and appraise the value of the works and franchises of the Chesapeake and Delaware Canal, connecting the waters of the Delaware and Chesapeake Bs., with reference to the desirability of purchasing said canal and the constr. of a free and open waterway to accommodate largest vessels; also to ex. and investigate the feasibility, for the purpose of such waterway, of the route known as the Sassafras route (commission composed of Gen. Felix Agnus, Maj. C. A. F. Flagler, Corps of Engineers, and Civil Engineer Frank Taylor Chambers, U. S. Navy), **06,** 798.

In charge. Maj. W. P. Craighill. **R., 72,** 701; **79,** 587; **80,** 713; (Lt. Col.) **82,** 950; **83,** 726, 749.

Assistants:
N. H. Hutton. **R., 79,** 590; **80,** 717.
Capt. T. Turtle. **R., 82,** 950; **83,** 727, 752.
M. Paret. **R., 83,** 727.

OPERATIONS.

1878. Field work and preparation of maps in progress, **79,** 590.

PHYSICAL CHARACTERISTICS.

Description, **72,** 702; **79,** 588, 589.
Geological formation of peninsula, **80,** 717.
Tidal observations, **80,** 729.
Ice records in Chesapeake and Delaware Bs., **80,** 734; **82,** 954, 959; **83,** 744.
Results of borings, **83,** 728.
Table giving the several routes considered, **95,** 1197. The line of the existing Delaware & Chesapeake Canal thought by the Board to be the best adapted for defense and for giving facilities to C., **95,** 1199.

PLANS.

By Maj. Craighill, 1872, sur., $20,000, **72,** 702; **79,** 590.
By Maj. Craighill, 1879, canal 100′ at bottom, 26′ d., by Ferry Creek route, $16,250,000; by Queenstown route, $34,000,000; by Sassafras R. route, $8,250,000, and $150,000 addl. for each for right of way, **79,** 589.
By Lt. Col. Craighill, 1879, ship canal 26′ d. at m. l. w., 100′ w. at bottom, and 178′ w. at w. l. without locks, except tide locks. The following locations were presented:
Choptank route, canal proper, 37.7 m.; est., $16,500,000, **80,** 715, 725.
Wye route, canal, 43 m.; est., $26,333,000, **80,** 715, 725.
Queenstown route, canal, 53.8 m.; est., $37,225,000, **80,** 715, 725.
Centerville route, canal, 51 m.; est., $41,500,000, **80,** 715, 725.
Southeast Creek route, canal, 38½ m.; est., $25,000,000, **80,** 715, 726.
Sassafras route, canal, 16¼ m.; est., $8,500,000, **80,** 715, 726, 735, 736.
Addl. consideration of Choptank and Sassafras routes, **82,** 951.
In 1883, after addl. ex. and increasing the d. of the canal to 27′, the following ests. were presented:
Choptank route, $18,184,766, **83,** 741; Sassafras route, $11,410,000, **83,** 742; Back Creek route $7,605,471, **83,** 742.
Mainten. of canal, **83,** 747.

PRIVATE (CORPORATE) WORK.

Description of canal, **80,** 713; **82,** 957.
Protests of the Maryland & Delaware Ship Canal Co. against further surs., **83,** 751, 753, 761.
Specifications of the Maryland & Delaware Ship Canal, **83,** 758.

PROJECTS.

Commission, 1906, selected existing Chesapeake & Delaware Canal as the most suitable route for water-way; works, franchises, etc., appraised at $2,514,289.70,[1] **06,** 798; **07,** 228.

SURVEYS.[2] (See Boards.)

By N. H. Hutton, 1878, under direction of Maj. Craighill. **R., 79,** 587.
Previous sur. made, **80,** 714; **83,** 753.
(See Board of Engineers.)
Maps. **80,** 716; **83,** 742.

J-547 NORTHEAST RIVER, MD.

APPROPRIATIONS.

1872,	$10,000, **72,** 67, 679.
1880,	5,500, **80,** 622.
1890,	2,500, **91,** 1183.
1892,	2,640, **92,** 967.
Total,	20,640

COMMERCE.

Information as to, **81,** 853.

CONTRACTS.

1872. Morris & Cumings, dr., **73,** 71, 759.
1880. J. Van Patten, dr., 24¢ c. y., **81,** 853.
1891. C. T. Caler, dr., 13¾¢ c. y., **91,** 1183.
1892. American Dredging Co., dr., 11½¢ c. y., s. m., **93,** 1207.

ENGINEERS.

Chief of Engineers. R., 72, 67, 71; **73,** 71; **74,** 79; **75,** 84; **76,** 62; **79,** 81; **80,** 99; **81,** 130; **82,** 128;

*Allotment.
[1] H. D. 215, 59th, 2d.
[2] Sur. Back Cr., Md.—**R.**, Apr. 3, 1830; est., $40,000—H.D., 482, 55th, 2d.

83, 132; **89,** 112; **90,** 102; **91,** 124; **92,** 124; **93,** 135; **12,** 363.

In charge:
Maj. W. P. Craighill, 1872–83. **R., 72,** 679, 700; **73,** 759; **74,** ii, 14; **75,** ii, 61; **76,** 281; (Lt. Col.) **80,** 621; **81,** 852; **82,** 840; **83,** 666.
Maj. W. F. Smith, U. S. agent, 1888–93. **R., 90,** 951; **91,** 1182; **92,** 967; **93,** 1206.
Lt. Col. W. C. Langfitt, **12,** 330.

Assistants:
N. H. Hutton. **R., 72,** 701.
Capt. C. B. Phillips, **73,** 71.
Capt. Thomas Turtle, **81,** 129.
John L. Seager. **R., 80,** 621.
Capt. E. H. Ruffner, **81,** 129.
Lt. W. M. Black, **91,** 129.
A. Stierle. **R., 90,** 951.

OPERATIONS.

1872–73. Dr. chan. under contract 5′ x 60′ from the 5′ curve to wharf at Northeast, and a basin 120′ x 120′ in front of the wharf; also a chan. 3′ x 25′ to Alexanders Mill, **73,** 71, 759.
1880–81. 19,876 c. y. dr. from chan., **81,** 852.
1890–91. 16,000 c. y. dr., **91,** 1183.
1892–93. 19,954 c. y., s. m., dr. and proj. completed, **93,** 1207.

PHYSICAL CHARACTERISTICS.
Description of, **72,** 701; **74,** 79, ii, 15; **90,** 952.

PROJECTS.
By Lt. Col. Craighill, 1880, increasing d. of the existing chan. from the 5′ curve near the river's mouth to the wharf at Northeast, to 6′ m. l. w.; also w. the same to 75′ and enlarging the turning-basin in front of the wharf; est., $5,500, **80,** 621.
By Maj. Smith, U. S. agent, 1889, excavation of a chan. 6′ x 75′ m. l. w. across the bar at the mouth of Stony Run; thence to the head of navigation a chan. 60′ x 6′; est., $5,140, **90,** 953.

SURVEYS.
Under direction of Maj. Craighill; ex. by N. H. Hutton, 1872. **R., 72,** 679, 700, 701.
By Maj. Craighill, 1879, **79,** 81.
Ex., 1880, **80,** 621.
Au. act Aug. 11, 1888; made, 1889, by Maj. Smith, US. agent, **90,** 953.
Pre. ex. and sur. au. act June 25, 1910, mouth of R. to town of Northeast. **R.** by Lt. Col. Langfitt, Oct. 11, 1910, and July 3, 1911[1] (unfav.), **12,** 363.

J-556 SUSQUEHANNA RIVER, MD. AND PA.

(See J–556f and g.)

Part.	Title.	Period.	Appropriations.
a	Above and below Havre de Grace	1852–1912	$265,390
b	North Branch	1879–1904	45,000
c	Below Northumberland, Pa	1902–1904	
d	West Branch	1890–1891	
	Total		310,390

Part (a), J-556 Susquehanna River (above and below Havre de Grace), Md.

APPROPRIATIONS.[2]

1852,	$10,000,	**66,** iii, 36.
1866,	26,400,	**66,** iii, 36.
1868,	*5,000,	**68,** 25.
1869,	*990,	**69,** 23.
1870,	12,000,	**70,** 70, 420; **71,** 590.
1879,	*500,	**79,** 75, 487.
1880,	28,000,	**80,** 621.
1881,	15,000	**81,** 851.
1882,	25,000,	**82,** 836.
1884,	20,000,	**84,** 889.
1886,	6,000,	**86,** 865.
1888,	10,000,	**88,** 747.
1890,	4,000,	**90,** 935.
1892,	4,000,	**92,** 966.
1894,	4,000,	**95,** 1126.
1902,	10,000,	**02,** 1067.
1905,	10,000,	**05,** 1132.
1907,	20,000,	**07,** 1144.
1910,	20,000,	**10,** 1318.
1911,	34,500,	**11,** 1412.
Total,	265,390	

COMMERCE.
Est. value of, on R., **88,** 746.
Description of, Nanticoke to Pittston, limited, **95,** 1101.
Imp. has had no effect on rates, **10,** 263.
1911, 352,335 t.; value, $2,864,688, **12,** 338.

CONTRACTS.

1867. J. A. Davis, constr. of cribs. J. J. Heckart, st., $1.88 c. y. Syke, Kelly & Co., iron, **68,** 693.
1870. American Dredging Co., dr., 25¢ c. y., **70,** 70, 421; **71,** 591.
1881. Morris & Cumings Dredging Co., dr., 14⅝¢ c. y., **81,** 852.
1883. American Dredging Co., dr., 19½¢ c. y., **83,** 665.
1885. Baltimore Dredging Co., dr., 18¢ c. y., **86,** 865.
1886. Baltimore Dredging Co., dr., 22¢ c. y., **87,** 837.
1889. Baltimore Dredging Co., dr., 16¢ c. y., **89,** 898.
1903. John L. Mills, dr., 15½¢ c. y., **04,** 1258.
1904. Maryland Dredging & Contracting Co., dr., 14.4¢ c. y., **04,** 1258.
1905. Maryland Dredging & Contracting Co., dr., 11½¢ c. y., **06,** 1077.
1907. Maryland Dredging & Contracting Co., dr., 19¢ c. y., **07,** 1144.
1910. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **11,** 1412.
1911. Maryland Dredging & Contracting Co., dr., 18½¢ c. y., **12,** 1630.

ENGINEERS.
Chief of Engineers. R., 66, 3, ii, 24–27, 41, iii, 23, 24, 36; **67,** 42; **68,** 25, 62; **69,** 23, 53; **70,** 69; **71,**

*Allotment.
[1] H. D. 397, 62d, 2d.
[2] $20,000 allotted for the imp. of Susquehanna and Patapsco Rivers from the general fund for harbors on the seaboard, **66,** ii, 24; **67,** 426.

72; **72,** 66; **73,** 71; **74,** 78; **75,** 84; **76,** 62; **79,** 75; **80,** 98; **81,** 129; **82,** 127; **83,** 131; **84,** 139; **85,** 131; **86,** 129; **87,** 92; **88,** 91; **89,** 108; **90,** 98; **91,** 124, 132; **92,** 124, 131; **93,** 134; **94,** 124; **95,** 133, 141, 152; **96,** 128; **97,** 163; **98,** 167; **99,** 192; **00,** 218; **01,** 264; **02,** 191; **03,** 183; **04,** 182; **05,** 191; **06,** 200; **07,** 213; **08,** 223; **09,** 230; **10,** 262; **11,** 285; **12,** 337.

In charge:

Col. J. D. Graham, 1865. **R., 66,** 37, 38.

Maj. W. P. Craighill, 1866–67. **R., 66,** iv, 235, 236; **67,** 419, 425–430.

Maj. J. G. Parke, 1867–68; **68,** 692, 694.

Col. J. H. Simpson, 1868–70; **68,** 694. **R., 68,** 692; **69,** 375; **70,** 420.

Maj. W. P. Craighill, 1870–85. **R., 71,** 590; **72,** 678; **73,** 758; **74,** ii, 14; **75,** ii, 61; **76,** 281; **79,** 487; (Lt. Col.) **80,** 615; **81,** 849; **82,** 836, 837; **83,** 664; **84,** 888.

W. F. Smith, U. S. agent, 1885–1900. **R., 85,** 882; **86,** 864; **87,** 836; **88,** 746; (Maj.) **89,** 896; **90,** 934; **91,** 1181; **92,** 966, 994, 996; **93,** 1205; **94,** 886; **95,** 1125, 1169; **96,** 957; **97,** 1272; **98,** 1157; **99,** 1382; **1900,** 1642.

Maj. C. W. Raymond. (See Surveys.)

Lt. Col. O. H. Ernst, 1901. **R., 01,** 1374.

Col. P. C. Hains, 1902. **R., 02,** 1066.

Capt. J. C. Sanford, 1903. **R., 03,** 1004.

Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1257; **05,** 1131; **06,** 1077; (Col.) **07,** 1144; **08,** 1186.

Maj. W. E. Craighill, 1909. **R., 09,** 1191.

Col. Thos. L. Casey, 1910–11. **R., 10,** 1318; **11,** 1411.

Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1629.

Assistants:

N. H. Hutton. **R., 73,** 758.

Capt. C. B. Phillips, **71,** 71; **72,** 66; **73,** 71; **74,** 78.

Lt. Thomas Turtle, **74,** 78; (Capt.) **81,** 129; **82,** 127; **83,** 131; **84,** 139.

Capt. J. W. Cuyler, **79,** 75.

Capt. E. H. Ruffner, **81,** 129; **82,** 127.

Lt. W. M. Black, **81,** 129.

Lt. C. McD. Townsend, **83,** 131; **84,** 139.

A. Stierle. **R., 92,** 995; **95,** 1172.

ESTIMATES. (See Plans and Projects.)

By Col. Graham, 1865, dr. chan. 8′ x 100′ between Havre de Grace and mouth of the R., $26,400, **66,** 3, 38.

By Maj. Craighill, 1866: (1) dr. chan. 10′ x 100′ and a deflector of earth, $65,070, **66,** ii, 27; (2) in 1867, floating deflector, $20,200, **67,** 428; (3) chan. 8′, 9′, or 10′ in d., $17,500, $31,500, or $42,000, resp., **67,** 425.

By Col. Simpson, 1869, permanent deflector, $40,000, **69,** 376.

By Maj. Craighill, 1879, complete existing proj., $5,000, **79,** 487.

OPERATIONS.[1]

1867-68. Constr. of floating deflector begun; 30,000 c. y. removed, giving 8′ of water through the shoal, **68,** 62, 692.

1868-69. Deflector stiffened and replaced, **69,** 53, 375.

1870-71. Dr. near Fishing Battery; constr. of pile dike in progress, **70,** 70, 421; **71,** 72, 591.

1871-72. About 4,000′ of the dike completed, **72,** 66, 678.

1872-73. Repairs to dike, **73,** 71, 758.

1873-74. Dike repaired with canal-boat hulks filled with st., **74,** 78, ii, 14.

1878-79. Dr. near Spesutie Isld. to aid U. S. Commissioner of Fish and Fisheries, **79,** 75, 487.

1880-81. 81,576 c. y. dr. from chan. between Havre de Grace and Spesutie Isld.; 16 boom-crib ps. removed by dynamite, **81,** 850.

1881-82. Moving crib near gateway extended 200′, and crib line built in prolongation of nw. face of main basin, **82,** 836.

1883-84. 73,000 c. y. dr. from chan. above and below the br., **84,** 888.

1884-85. Basin formed by 580 l. f. of pile and sheet-piling constr., **85,** 882.

1885-86. 63,433 c. y. dr. from chan. through shoals below RR. br. and at Watsons Isld., **86,** 865.

1886-87. Dr. continued between Havre de Grace and Watsons Isld., **87,** 837.

1889-90. 47,978 c. y. dr., **90,** 935.

1903-04. 44,490 c. y. dr., **04,** 1257.

1904-05. 64,716 c. y. dr., **05,** 1131.

1905-06. 79,000 c. y. dr., **06,** 1077.

1908-09. 94,670 c. y. dr., **09,** 1191.

1910-11. 40,180 c. y. dr., **11,** 1411.

1911-12. 57,272 c. y. dr. for mainten. and 167,849 c. y. for imp. proper; results accomplished, **12,** 1629.

PHYSICAL CHARACTERISTICS.

Described, **66,** 38, ii, 26; **67,** 419, 429; **73,** 758.

Description of R. above Havre de Grace, **92,** 995

Nanticoke to Pittston, **95,** 1101.

Shoals near Havre de Grace a probable cause of ice gorges, **95,** 1170.

Max. draft, 1912, over shoalest part of chan., 12′ **12,** 338.

Tides, etc., **12,** 338.

PLANS. (See Estimates and Projects.)

By Lt. Col. Craighill, 1882, permanent imp. below Havre de Grace, to 15′ m. l. w., by deflectors and dr.; also d. by dr. to 8′ the chan. through the bar above the br.; est., $168,000, **82,** 838.

For plans of fish basin, see **84,** 888.

By Maj. Smith, U. S. agent, 1891, imp. above Havre de Grace by d. the shoal between the Pennsylvania, Wilmington & Baltimore RR. br. so as to enlarge the cross section of the R. at that point, and constr. 8 ps. at the Hog Back above Port Deposit to break up ice; est., $425,109, **92,** 998.

PROJECTS. (See Estimates and Plans.)

Orig., for dr. chan. 8′ x 100′ between Havre de Grace and the mouth of the R., **66,** 38.

By Col. Simpson, 1869, permanent deflector of cribs; est., $40,000, **69,** 376.

Orig. proj. of 1853 proposed dr. chan. 10′ x 100′ m. l. w. bet. Havre de Grace and the mouth of the R.; est., $37,000, **80,** 616.

In 1886, it having been found that the above-described dr. chan. had largely refilled, Maj. Craighill proposed use of a temporary floating deflector to train the current toward the line of the main chan., **67,** 42, 419, 427; **80,** 617.

In 1871 floating deflector replaced by pile dike, **71,** 590, 591; **80,** 618.

In 1880 Maj. Craighill proposed chan. with a m. l. w. d. of 12′ bet. Havre de Grace and Spesutie Isld.; also dr. at Battery Light, and removal of cribs above Havre de Grace, **80,** 621.

Since 1882 dr. chan. maintained by systematic dr. to 12′ below Havre de Grace and 8′ through the shoal near Watsons Isld.; an ultimate d. of 15′ is proposed below the br., **87,** 92.

Maj. Smith, U. S. agent, 1895, est. cost of forming deflecting works to remove shoal near Havre de Grace, a probable cause of ice gorges, would be $34,000, **95,** 1170.

Div. Eng. Col. Craighill est. cost of a suitable iceboat for the purpose of keeping the R. clear of ice would be $70,000, with a daily cost of $60 when in commission, **95,** 1172.

Capt. Sanford recom., 1903, removal of small amount of r. near Port Deposit, and dr. to 8′ opposite Watsons Isld., with balance from previous app., and dr. to 15′ and max. w. of 200′, Havre de Grace Lighthouse, past Fishers Battery Lighthouse, to head of Spesutie Isld., with $10,000 app., 1902, **03,** 1004.

SURVEYS.

Ex. by Lt. Col. Graham, 1865, **66,** 37.

Under direction of Maj. Craighill, by Coast Sur. party, 1866, **66,** iii, 24.

Under direction of Maj. Craighill, by Coast Sur. party, 1867, resur. between Spesutie Isld. and the RR. br. near Havre de Grace, **67,** 42.

Under direction of Maj. Craighill, by N. H. Hutton, 1872. **R., 73,** 758.

[1] Suspended since 1852, **66,** 3, iv, 235.

Sur. above Havre de Grace au. act Sept. 19, 1890 made, 1891, by Maj. Smith, U. S. agent, **92,** 966.
Ex., Nanticoke to Pittston, au. act Aug. 17, 1894; made, 1894, by Maj. Raymond (**R.** unfav.), **95,** 1100.
Sur. from a point below Havre de Grace to about 1 m. above Port Deposit to ascertain what would prevent the accumulation of ice, au. act Aug. 17, 1894; made by Maj. Smith, U. S. agent, 1895 (see Projects), **95,** 1169.
From Below Spesutie Isld. to Port Deposit, **03,** 1004.

Pre. ex. au. act Feb. 27, 1911. **R.** by Col. Casey, Aug. 8, 1911[1] (further imp. not deemed advisable at present time), **12,** 363.

Maps:
Of the R. mouth, **66,** i.
Above Havre de Grace, **87,** 836.
95, 1172.
Plan and sections of fish basin, **84,** 888.

Part (b), J-556 Susquehanna River, Pa. (North Branch of.)

APPROPRIATIONS.

1880,	$15,000,	**80,** 594.
1881,	15,000,	**81,** 804.
1882,	15,000,	**82,** 781.
Total,	45,000	

CONTRACTS.

1880. Coon & Mooney, dr., 70¢ c. y. J. Van Patten, dike constr., $4.72 per running f., **81,** 806. R. C. Mitchell, dr., 90¢ c. y., **82,** 781.
1883. R. C. Mitchell, dr., 75¢ c. y.; r. backing, $2 c. y.; and dike constr., $8 l. f., **83,** 652.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 96, 97; **81,** 127; **82,** 124; **83,** 128; **84,** 136, 139; **85,** 125, 127; **04,** 194, 1290.

Boards. BERH. **R.,** **04,** 1296.

In charge:
Col. J. N. Macomb, 1879–82. **R.,** **80,** 594; **81,** 804.
Capt. W. Ludlow, 1882–83. **R.,** **82,** 779.
Lt. Col. G. Weitzel, 1883–84. **R.,** **83,** 652.
Maj. W. H. Heuer, 1884–85. **R.,** **84,** 842, 869.
Lt. Col. H. M. Robert, 1885. **R.,** **85,** 854, 864.
Col. J. A. Smith. **R.,** **04,** 1291.

Assistants:
J. Worrall. **R.,** **80,** 594.
H. Alrichs. **R.,** **80,** 599.
G. H. Dager. **R.,** **81,** 806; **83,** 653; **84,** 869.
A. Stierle. **R.,** **84,** 842.

OPERATIONS.

1880-81. 2,548 c. y. dr. from Richards and Wilkesbarre Isld. Shoals, and 625 l. f. of dike built, **81,** 807.
1881-82. 6,042 c. y. dr. from Hillmans Ripple and Forty Foot Shoal, **82,** 780.
1882-83. 5,433 c. y. dr. from Forty Foot Shoal, and 927 c. y. r. blasted from Hillmans Ripple, **83,** 653.
1883-84. 3,677 c. y. dr. from shoals at Richards and Wilkesbarre Islds., **84,** 842.

PHYSICAL CHARACTERISTICS.

Description of R. and its obstrs., Athens to Wilkesbarre, **80,** 600.
Description of, **04,** 1292.
Serious damage by floods, **04,** 1294.
Chan. narrow and flow obstr. by waste from mines, by br. ps. and abutments, etc., **04,** 1294.

PROJECTS.

By Col. Macomb, 1881, chan. through shoals at various points, Wilkesbarre to Pittston, average d. 3′; also for submerged dikes or deflectors at points of excavation; est., $48,537, **81,** 805.
No general proj. ever adopted, **85,** 125.
Col. Smith reported, 1902, that removal of dikes constr. in R. would accomplish no possible good,[2] **04,** 1295.

SURVEYS.

Ex. au. act Mar. 3, 1879; made, 1880, by Col. Macomb, **79,** 75; **80,** 594.
Au. act Aug. 2, 1882; made, 1883, by Lt. Col. Weitzel, **84,** 869.
Of West Branch au. act July 5, 1884; made, 1884, by Maj. Heuer, **85,** 864; (**R.** unfav.) **84,** 869.
Ex. au. act June 13, 1902; made, 1902, by Col. Smith,[2] **04,** 1290.

Part (c), J-556 Susquehanna River (below Northumberland), Pa.

COMMERCE.

History of attempted navigation, **04,** 1299.

ENGINEERS.

Chief of Engineers. **R.,** **04,** 194, 1296.
Boards. BERH. **R.,** **04,** 1298.
In charge. Col. J. A. Smith. **R.,** **04,** 1297.
Assistant. C. A. Miner. **R.,** **04,** 1299.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 1300.

PROJECTS.

Col. Smith reported, 1902, that benefits to be derived were incommensurate with vast expense of imp., **04,** 1298.

SURVEYS.

Ex. au. act June 13, 1902; made, 1902, by Col. Smith,[3] **04,** 1296.

Part (d), J-556 Susquehanna River, Pa. (West Branch.)

COMMERCE.

Local, **91,** 1113.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 118.
In charge. Maj. C. W. Raymond, 1890. **R.,** **91,** 1102.

PHYSICAL CHARACTERISTICS.

Description of the W. Branch, **91,** 1103.
Navigation of the R., **91,** 1104.
Floods, **91,** 1105, 1107, 1109.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Raymond (**R.** unfav.), **91,** 1102.

J-556(e) BATTERY ISLAND, CHESAPEAKE BAY, MD.

APPROPRIATION.
1886, $17,275, **87,** 866.

ENGINEERS.
Chief of Engineers. R., 87, 99.
In charge. Col. W. P. Craighill, 1887. **R., 87,** 864.
Assistant. N. H. Hutton. **R., 87,** 865.

OPERATIONS.
1886-87. 620 l. f. of cribwork sunk by hired labor to repair damaged part of break'r, **87,** 865.

PROJECT.
By Maj. W. F. Smith, U. S. agent, 1886, to repair ps. and break'r, and to riprap j.; est., $17,275, **87,** 864.

J-556(f) HAVRE DE GRACE, MD. (Harbor at).

(See J-556.)

COMMERCE.
110,250 t. in 1900; regular steamers to Baltimore, **01,** 1393.

ENGINEERS.
Chief of Engineers. R., 01, 273, 1392.
In charge. Gen. Wm. F. Smith, U. S. agent. **R., 01,** 1392, 1393.

PROJECTS.
By Gen. Smith, removal of r. to 9'; est., $15,000, **01,** 1394.

SURVEYS.
Au. act June 6, 1900; made, 1900, by Gen. Smith,[1] **01,** 1392.

J-556(g) CHESAPEAKE BAY (Headwaters of) AND HAVRE DE GRACE HARBOR, MD.[2]

(See also J-535 (a).)

APPROPRIATION.[3]
July 4, 1836, $500 (sur.).

J-950 BUSH RIVER, MD.

ENGINEERS.
Chief of Engineers. R., 81, 150; **82,** 144.
In charge. Col. W. P. Craighill. **R., 82,** 949.

PLANS.
By Col. Craighill, dr. chan. to Public Landing 6' d. at m. l. w. and 100' w.; also a basin at Public Landing 200' x 400'; est., $30,000. To continue the imp. to mouth of James, cost would be $27,000 addl., **82,** 950.

SURVEY.
Ex. au. act Mar. 3, 1881; made by Col. Craighill, **82,** 949.

J-1079(a) PATAPSCO RIVER, MD. (W. Branch, from Light St. Bridge to head of tidewater.)

(See J-1090.)

ENGINEERS.
Chief of Engineers. R., 78, 69; **79,** 81.
In charge. Maj. W. P. Craighill. **R., 79,** 579.
Assistants:
Capt. J. W. Cuyler. **R., 79,** 581.
J. L. Seager, **79,** 579, 581.

PHYSICAL CHARACTERISTICS.
79, 581, 583, 585.

PLANS.
By Capt. Cuyler, 1879, 6' chan. by dr., diking embankments, etc.; est., $173,000, **79,** 580, 584.
By Maj. Craighill, 1879, canal preferable to imp of the R., **79,** 580.

SURVEY.
By J. L. Seager, 1878, under direction of Ma Craighill and Capt. Cuyler. **R., 79,** 579, 581.

J-1081(a) NORTH POINT TO MILLERS ISLAND, CHESAPEAKE BAY, MD.

ENGINEERS.
Chief of Engineers. R., 10, 281.
In charge. Lt. Col. W. E. Craighill, **10,** 256.

SURVEY.
Ex. au. act Mar. 3, 1909, between North Pt. and Millers Isld. Lighthouses (Craighill Chan. Rear Range) to gain chan. to Baltimore Co. shore; also e. side of B. to gain chan. to Kent Co. shore; **R.** by Maj. Craighill, June 25, 1909 (unfav.),[4] **10,** 281.

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[1] H. D. 73, 56th, 2d.
[2] Sur.—**R.,** Jan. 30, 1837; est., $58,000. (H. D. 482, 55th, 2d.)
[3] Sur. pursuant to resolution of the Maryland Legislature. (Treas. Doc. 373, 1882.)
[4] H. D. 349, 61st, 2d.

J-1090 BALTIMORE HARBOR, MD.[1]

APPROPRIATIONS.

Baltimore Harbor:

1836,	$20,000,	**66,** iii, 36.
1837,	15,000,	**66,** iii, 36.
1838,	20,000,	**66,** iii, 36.
1852,	20,000,	**66,** iii, 36.
1856,	100,000,	**66,** iii, 36.
1364,	20,000,	**66,** iii, 36.
1866,	5,200,	**66,** ii, 24, iii, 23; **67,** 426; **70,** 419.
1867,	75,000,	**67,** 420, 423, 426; **70,** 419.
1868,	17,000,	**68,** 25, 62, 691; **69,** 53; **70,** 419.
1869,	26,730,	**69,** 22.
1870,	42,900,	**70,** 69, 420; **71,** 71, 585.
1871,	50,000,	**71,** 71.
1872,	100,000,	**72,** 67, 680; **74,** ii, 18.
1873,	200,000,	**73,** 72, 761; **74,** ii, 18.
1874,	75,000,	**74,** 81, ii, 18.
1875,	75,000,	**75,** 87, ii, 67.
1876,	75,000,	**76,** 62, 285; **77,** 59, 275.
1878,	75,000,	**78,** 65, 449.
1879,	160,000,	**79,** 76, 494.
1880,	100,000,	**80,** 626.
1881,	150,000,	**81,** 863.
1882,	450,000,	**82,** 844.
1884,	250,000,	**84,** 895.
1886,	150,000,	**86,** 874.
1888,	300,000,	**88,** 756.
1890,	340,000,	**90,** 988.
1891,	151,200,	**91,** 1229.
1892,	208,000,	**92,** 1007.
1894,	50,000,	**95,** 1177.
1896,	450,000,	**96,** 1000, 1006.
1899,	200,000,	**99,** 1406.
1900,	324,648,	**00,** 1688.
1901,	475,352,	**01,** 1376.
1902,	25,000,	**02,** 1068.
1905,	250,000,	**05,** 1126.
1906,	500,000,	**06,** 1073.
1907,	1,000,000,	**07,** 1139.
1908,	750,000,	**08,** 1181.
1909,	965,000,	**09,** 1186.
1912,	50,000,	**12,** 1624.
Total,	8,311,030	($8,311,054.90, incl. sales, **12,** 1624).

Curtis Bay Channel, Patapsco R.:

1892,	$28,000,	**92,** 1007.
1894,	12,000,	**95,** 1182.
1902,	50,000,	**02,** 1071.
1903,	146,000,	**02,** 1031.
1909,	*9,000,	**09,** 1189.
1910,	10,000,	**10,** 1315.
1911,	5,000,	**11,** 1409.
Total,	260,000,	**12,** 1627.

Spring Garden (sw. Baltimore):

1896,	$5,000,	**96,** 1000, 1006.
1902,	88,000,	**02,** 1071.
1903,	221,000,	**02,** 1032.
1907,	6,500,	**07,** 1141.
1909,	*34,000,	**09,** 1189.
1910,	34,000,	**10,** 1316.
1911,	10,000,	**11,** 1410.
Total,	398,500,	**12,** 1627.

RECAPITULATION.

Baltimore H.	$8,311,030
Curtis Bay Chan.	260,000
Sw. Baltimore H.	398,500
Grand total	8,969,530

COMMERCE.

C. interests of Baltimore, **89,** 929, 934; **90,** 989.

The development of business in the vicinity of, and in Baltimore warranted, 1892–93, an imp. of the H., **93,** 1263.

Growing importance of, at Sparrows Pt., **04,** 1282.

Increase due to imp., **06,** 197, 199.

Decreasing C., **09,** 226.

Increasing C., **11,** 281.

Works of imp. have put Baltimore on same plane with ports having same facilities, **12,** 333.

Chart showing, for 5 decades, **12,** 1624, 1625.

Traffic, 1911, 8,561,810 t., **12,** 1626.

"The tonnage movement of the port has been as follows:

1889	3,632,179
1890	4,745,844
1891	5,034,925
1892	5,850,927
1893	5,160,037
1894	5,323,300
1895	5,370,360
1896	6,007,561
1897	7,682,294
1898	8,220,134
1899	7,664,854
1900	8,894,570
1901	9,021,619
1902	8,433,454
1903	8,664,820
1904	8,214,350
1905	8,411,999
1906	9,270,349
1907	9,461,987
1908	9,453,958
1909	8,328,626
1910	9,425,046
1911	9,806,421
1911 (cal. year)	10,123,355

"The statistics of the port for the past (1911–12) fiscal year are illustrated briefly by the following statement:

Value of commerce; coal, coke, grain, iron, oysters, lumber, etc.	$200,908,059.00
Dutiable imports have decreased	3,022,151.00
Free imports have decreased	972,749.00
Domestic exports have increased	20,398,400.00
Tonnage, foreign and coastwise, has increased (short tons)	316,934.00
Duties collected have decreased	623,863.82
Duties on merchandise in bond have decreased	14,613.06
Duties on merchandise in bond, with and without appraisement, have decreased	676,436.06

"**12,** 333."

CONTRACTS.

1871. M. F. Brainard, dr., 28¢ c. y., **71,** 71, 588; **73,** 761. A. Dodge, dr., **72,** 679; **73,** 761.

1872. G. H. Ferris, dr., **74,** ii, 22.

1873. Curtis, Fobes & Co., dr., **73,** 761; **74,** ii, 22.

1874. Curtis, Fobes & Co., dr., 16¢ c. y., **75,** 86.

1876. Curtis, Fobes & Co., dr., 9¾¢ c. y., **77,** 275. Morris & Cumings, dr., 12¼¢ c. y., **75,** 86.

1877. A. P. Brown, dr., 9½¢ c. y., **77,** 275.

1878. American Dredging Co., dr., 9⅝¢ c. y., **79,** 494.

1880. G. C. Fobes & Co., dr., 18 7/10¢ c. y., **80,** 626.

1881. American Dredging Co., dr. 10⅜¢ c. y., **81,** 864.

*Allotment.

[1] Sur.—**R.,** Feb. 24, 1828; est., $23,081.58. Est. required an. for dredging. (H. D. 482, 55th, 2d.)

1882. Morris & Cumings Dredging Co., 2,500,000 c. y., 16¢ c. y.; Thomas Potter, 500,000 c. y., 13½¢ c. y., **83,** 671.

1884. American Dredging Co., removal of 1,500,000 c. y., 15¢ c. y.; completed June 30, 1885, **85,** 918.

1886. American Dredging Co., dr., 13¢ c. y., **87,** 861.

1888. American Dredging Co., dr., 11¢ c. y., **89,** 928.

1889. American Dredging Co., dr., 11½¢ c. y., **89,** 929.

1890. American Dredging Co., dr., 10½¢ c. y., **91,** 1229.

1892. National Dredging Co., dr., 12¢ c. y. ($30,000), **93,** 1250.

1894. Baltimore Dredging Co., dr., 8¼¢ c. y. ($20,625), **95,** 1177.

1896. Virginia Dredging Co., dr., 7$\frac{99}{100}$¢ c. y., s. m. ($399,500), **97,** 1301.

1897. R. M. Spedden & Co., steel-hull tugboat, $24,487, **97,** 1302.

1899. S. Hess, dr., 8$\frac{33}{100}$¢ c. y. ($833,000), **99,** 1406.

1900. Baltimore Dredging Co., dr., 11¢ c. y. ($11,000), **00,** 1692.

1902. Maryland Dredging & Contracting Co., dr., 12½¢ c. y., **03,** 1032.

1903. Sanford & Brooks Co., dr., 11¾¢ c. y., **03,** 1031. Maryland Dredging & Contracting Co., dr., 17½¢ c. y., **04,** 1252.

1904. General Electric Co., electric plant for U. S. S. *Sentinel*, **05,** 1127.

1905. Charles W. Eaton, dr. about 7,102,222 c. y., 6.45¢ c. y.; Maryland Dredging & Contracting Co., dr. about 719,999 c. y. in Patapsco R., 20¢ c. y., and about 1,552,779 c. y. off York Spit, 23¢ c. y., **06,** 1073.

1907. Maryland Dredging & Contracting Co., dr. chan. to Curtis B., about 19,687 c. y., 16¢ c. y., and dr. H. of sw. Baltimore, about 36,563 c. y., 16¢ c. y., **07,** 1141, 1142. Maryland Dredging & Contracting Co., dr. about 8,516,470 c. y., 8.5¢ c. y.; 508,348 c. y., 20¢ c. y.; and 1,621,125 c. y., 23¢ c. y., **08,** 1181.

1909. Maryland Dredging & Contracting Co., dr. about 1,500,000 c. y. from main chan., 5¢ c. y., **09,** 1187. Sanford & Brooks Co., dr. about 80,000 c. y. from chan. to Curtis B., 9.9¢ c. y., and about 300,000 c. y. from H. of sw. Baltimore, 9.9¢ c. y. **09,** 1189. Maryland Dredging & Contracting Co., dr. about 400,000 c. y. from main chan., 23¢ c. y., **10,** 1313.

1910. Maryland Dredging & Contracting Co., dr. about 400,000 c. y., 15¢ c. y., **11,** 1407. Sanford & Brooks Co., dr. about 90,000 c. y. from Curtis B., 9¾¢ c. y., **11,** 1409. Sanford & Brooks Co., dr. about 310,000 c. y. from H. of sw. Baltimore, 9¾¢ c. y., **11,** 1410.

1911. Maryland Dredging & Contracting Co., dr. about 2,260,000 c. y., 9½¢ c. y., from main chan., **11,** 1407.

ENGINEERS.

Chief of Engineers. **R., 66,** 3, ii, 24, 41, iii, 23, 36; **67,** 41, 42, 424; **68,** 25, 62; **69,** 25, 62; **70,** 69; **71,** 71; **72,** 67; **73,** 72; **74,** 81; **75,** 86; **76,** 63; **77,** 58; **78,** 64; **79,** 76; **80,** 101; **81,** 134; **82,** 131; **83,** 135; **84,** 142; **85,** 137; **86,** 133; **87,** 97, 101; **88,** 95; **89,** 113; **90,** 102; **91,** 132; **92,** 132; **93,** 144, 145, 148; **94,** 132, 133; **95,** 152, 154, 157; **96,** 137, 138; **97,** 172, 173, 174; **98,** 175, 176, 177; **99,** 203, 204, 205; **00,** 231, 233; **01,** 264, 265, 266, 273; **02,** 192, 194; **03,** 194, 195, 196, 197; **04,** 178, 180, 181, 193, 194; **05,** 186, 189; **06,** 196, 198, 199; **07,** 208, 210, 211; **08,** 218, 220, 221; **09,** 224, 227, 228; **10,** 256, 259, 260; **11,** 279, 282, 283; **12,** 330, 333, 335.

Board. An advisory board appointed by the President at the request of the State of Maryland to consider the p. and bulkhead lines of Baltimore H. **R., 79,** 497, 500.

(Brig. Gen. Humphreys, C. P. Patterson, U. S. C. S., and Maj. Craighill.)

R. on ex. of Patapsco R. from main ship chan. to drawbr. at mouth of Bear Creek, **04,** 1281, 1287.

In charge:

Maj. H. Brewerton, 1853, **66,** 37.

Col. J. D. Graham, 1865, **66,** 3. **R., 66,** 37, 38, 39, ii, 24.

Maj. J. G. Parke, 1867, **68,** 694.

Col. J. H. Simpson, 1868–70, **68,** 694. **R., 68,** 688; **69,** 374; **70,** 416, 420.

Maj. W. P. Craighill, 1866–94, **66,** ii, 24. **R., 66,** iv, 232–236; **67,** 417, 423, 424; **71,** 585; **72,** 679; **73,** 760; **74,** ii, 17–23; **75,** ii, 66; **76,** 284; **77,** 273; **79,** 492; **80,** 625; (Lt. Col.) **81,** 860; **82,** 843; **83,** 669 **84,** 894; **85,** 917; **86,** 874; (Col.) **87,** 860, 880; **88,** 756; **90,** 987; **91,** 1227; **92,** 1005; **93,** 1243, 1249, 1262; **94,** 909, 914.

Capt. C. B. Phillips, 1878, in temporary charge. **R., 78,** 447.

Capt. T. Turtle, 1889–90. **R., 89,** 927.

Lt. Col. P. C. Hains, 1895–99. **R., 95,** 1175, 1181, 1201; (Col.) **96,** 999, 1005; **97,** 1299, 1306, 1307, 1308; **99,** 1405, 1409, 1410.

2d Lt. C. W. Kutz, 1898. **R., 98,** 1175, 1180, 1181.

Lt. Col. O. H. Ernst, 1900–1901. **R., 00,** 1687, 1692, 1693; **01,** 1374, 1379, 1394.

Col. P. C. Hains, 1902. **R., 02,** 1067, 1070, 1071.

Col. W. A. Jones, 1903. **R., 03,** 1027, 1031, 1032.

Lt. Col. R. L. Hoxie, 1904–08. **R., 04,** 1252, 1255, 1256, 1278, 1284; **05,** 1125, 1129, 1130; **06,** 1072, 1075; (Col.) **07,** 1137, 1141, 1142; **08,** 1179, 1183, 1184.

Maj. W. E. Craighill, 1909. **R., 09,** 1185, 1188, 1189.

Col. Thos. L. Casey, 1910–11. **R., 10,** 1311, 1315, 1316; **11,** 1405, 1409.

Lt. Col. W. C. Langfitt, 1912–. **R., 12,** 1623, 1626, 1627.

Assistants:

Lt. W. R. Livermore, **69,** 52.

Capt. C. B. Phillips, **71,** 71; **72,** 67; **73,** 70; in immediate charge, **77,** 275.

N. H. Hutton, in immediate charge, **74,** ii, 23; **85,** 918.

Lt. Edward Maguire, **75,** 84; **76,** 62.

Lt. Thomas Turtle, **73,** 71; **74,** 78; **75,** 84; **77,** 56; **78,** 63; **79,** 75; **80,** 98.

Capt. J. W. Cuyler, **77,** 56; **78,** 63; **79,** 75; **80,** 98.

Lt. W. M. Black, **80,** 98; **81,** 129.

Capt. Thomas Turtle, **81,** 129; **82,** 127; **83,** 131; **84,** 139.

Capt. E. H. Ruffner, **81,** 129; **82,** 127; **83,** 131.

Lt. C. McD. Townsend, **82,** 127; **83,** 131; **84,** 139.

Lt. G. J. Fiebeger, **89,** 112.

Lt. Charles W. Kutz, **97,** 172; **99,** 203.

ESTIMATES. (See Projects.)

For Brewerton Chan., 150′ w., 22′ d., $390,000, **70,** 419.

By Lt. Col. Graham, 1865, for removal of lumps from chan. by dr., $5,200, **66,** 38.

By Maj. Craighill, 1866, for chan. 22′ x 150′, $193,050 to $223,500; for chan. 22′ x 200′, $320,250 to $329,700, **66,** ii, 24, 25; revised after resur. to $164,700 to $148,500; $295,200 to $198,900, **66,** iv, 233, 234. The latter adopted, **70,** 419.

For completing the work, $250,000, **67,** 417.

By Col. Simpson, 1869, for completing revised proj., $107,600, **70,** 420.

By Maj. Craighill, 1871, numerous ests. for w. and d. chan., **71,** 585.

By Maj. Craighill, 1879, for completing existing proj., $100,000, **79,** 494; $50,000 per an. for repairs, **79,** 492.

LEGISLATION.

An act to protect the "Craighill Channel," **81,** 863. Protection of aids to navigation, **82,** 844.

OPERATIONS.

1865–66. Dr. with U. S. dredges, **66,** ii, 25.

1866–67. Dr. in Brewerton Chan. below North Pt., **67,** 42.

1867–68. Result of dr., the extension of chan. from Brewerton Chan. s., past the Belvidere Shoal, with w. of 500′ for a distance of 5 m., **68,** 62, 688.

1868–69. Dr. in Brewerton and Craighill Chans., **69,** 52, 374.

1869–70. Dr. in Brewerton and Craighill Chans., **70,** 416, 417.

1870–71. Dr. with U. S. dredges, and by contract, in Brewerton and Craighill Chans., **71,** 71, 585, 586.

1871-72. Dr. by contract, **72,** 67, 679.
1872-73. Dr. by US., **73,** 72, 761, 762.
1873-74. Dr. continued, **74,** 81, ii, 17.
1874-75. Dr. by contract continued, **75,** 86.
1875-76. Brewerton Chan. w. 40′ by dr., **76,** 63, 284.
1876-77. Dr. by contract continued, **77,** 58, 274.
1877-78. Dr. 300,145 c. y., **78,** 64, 449.
1878-79. Dr. 481,416 c. y., **79,** 76, 493.
1879-80. 431,000 c. y. dr., **80,** 625.
1880-81. 181,930 c. y. dr., **81,** 860.
1881-82. 709,725 c. y. dr., **82,** 843.
1882-83. 2,554,861 c. y. dr., **84,** 895.
1883-84. 1,583,397 c. y. dr., **84,** 895.
1884-85. 1,715,247 c. y. dr., **85,** 918.
1886-87. 1,111,317 c. y. dr., **87,** 860.
1888-89. 1,761,088 c. y. dr., **89,** 928.
1890-91. 1,334,000 c. y. dr., **91,** 1228.
1891-92. 3,506,443 c. y. dr., **92,** 1006.
1892-93. 1,366,493 c. y. dr., **93,** 1244. Chan. to Curtis B. in Patapsco R., Baltimore H., dr. to a d. of 25′, **93,** 1250.
1894-96. In connection with previous year, 341,420 c. y. dr., **95,** 1176; **96,** 1000.
1896-97. 1,270,582 c. y., s. m., dr., **97,** 1300.
1897-98. 3,423,708 c. y., s. m., dr., **98,** 1176.
1899-00. 2 057,414 c. y. dr., **00,** 1688, 1692.
1900-01. 4,068,502 c. y. dr., **01,** 1375.
1901-02. 3,415,924 c. y. dr., and 2,469 c. y. r. removed, **02,** 1067.
1902-03. 1,585,397 c. y. dr., **03,** 1027. 716,526 c. y. dr. from chan. to Curtis B. and 557,406 c. y. dr. from H. of sw. Baltimore, **03,** 1031.
1903-04. 138,211 c. y. dr., **04,** 1252. 764,547 c. y. dr. from chan. to Curtis B., **04,** 1255. 1,155,391 c. y. dr. from H. of sw. Baltimore, **04,** 1256.
1904-05. 608,621 c. y. dr. from H. of sw. Baltimore, **05,** 1130.
1905-06. 3,405,911 c. y. dr., **06,** 1072.
1906-07. 5,110,008 c. y. dr., **07,** 1138.
1907-08. 6,532,098 c. y. dr. from main chan., **08,** 1180. 19,687 c. y. dr. from chan. to Curtis B., **08,** 1183. 36,563 c. y. dr. from H. of sw. Baltimore, **08,** 1184.
1908-09. 5,033,662 c. y. dr. and small amount of r. removed from main chan., **09,** 1186. 16,429 c. y. dr. from chan. to Curtis B., **09,** 1188. 13,250 c. y. dr. from H. of sw. Baltimore, **09,** 1189.
1909-10. 2,818,209 c. y. dr. from main chan., 67,027 c. y. from Curtis B. Chan., and 296,040 c. y. from H. of sw. Baltimore, **10,** 1312, 1315, 1316.
1910-11. 679,810 c. y. dr. from main chan., and 219,181 c. y. from H. of sw. Baltimore, **11,** 1406, 1409, 1410.
1911-12. 2,162,215 c. y. dr. from main chan., 9,068 c. y. from H. of sw. Baltimore, and 90,013 c. y. from chan. to Curtis B., **12,** 1624, 1626, 1627.

PHYSICAL CHARACTERISTICS.

66, 37, ii, 25; **67,** 420, 421; **74,** ii, 19, 22, 23; **79,** 493; **95,** 1201.

Description of sw. Baltimore H., **96,** 1006.

At 1901, the Fort McHenry Chan., 30′ d. m. l. w. with 565′ w.; 460′ in the Brewerton Chan.; 450′ in the cut-off; and 565′ in the Craighill, covering the shoalest portions of chan. from Chesapeake B. to Baltimore H., **01,** 265.

Max. draft at m. l. w., 1901, 27′, Patapsco R. Chan. to Curtis B., **01,** 266.

15′ m. l. w. and 100′ w. in sw. Baltimore H. (Spring Garden), made by city dr., **01,** 266.

Shoaling of imp. of H. at Spring Garden, **06,** 199; **07,** 1142; large, **08,** 221; in chan. to Curtis B., **07,** 1141.

Cost of mainten. of dr. chan. near Baltimore insignificant, **07,** 1138; and 40′ chan. readily creatable. **08,** 1180.

Details, Curtis B., **12,** 333.

Max. draft over shoalest part, 1912, chan. to Curtis B., 30′ m. l. w. Length of imp. section, 2¼ m., **12,** 334; in Spring Garden, 27′; l. of this latter section, 4 m., **12,** 335.

PRIVATE (CITY AND STATE) WORK.

Dr. by city and State authorities, **66,** ii, 25.

The city and State, from 1852 to 1868, app. for H. imp. $257,233.81; $184,317.06 expend. in d. chan. below Fort McHenry, **70,** 419.

The city app. $200,000 for dr., **72,** 67, 679; $200,000 more, **73,** 72, 761, 762.

History, **74,** ii, 19, 23.

The State of Maryland app. $5,000, in 1876, to defray the expenses of an advisory board and sur. R., **79,** 497–500.

The city of Baltimore and State of Maryland contrib., up to 1885, $584,000 toward the imp., **85,** 138.

$500,000 expend. in work of imp. by the city of Baltimore and the State of Maryland, up to 1890, **91,** 133.

Spring Garden. (See Physical characteristics.)

PROJECTS. (See Estimates.)

From 1836 to 1838, incl., $55,000 was app. for Baltimore H., **66,** iii, 36.

In 1852 the proj. originated for imp. the chan. at the approach from d. w. in Chesapeake B., and was begun under the joint action of the U. S. and State of Maryland in the imp. of Brewerton Chan. to a w. of 150′ and a d. of 22′, **67,** 420; **70,** 418; **74,** ii, 19; **79,** 492.

In 1866 Maj. Craighill proposed an alteration in the direction of a part of the chan., with a w. of the chan. to 200′, **66,** iv, 233, 234; **67,** 42, 417, 420, 422.

In 1872 the proj. was revised to provide for chan. 24′ d. at m. l. w. and from 250′–400′ w., **72,** 67; **73,** 761; **74,** ii, 21.

In 1881 Lt. Col. Craighill proposed d. of the chan. to 27′ at m. l. w., together with the formation of a cut-off between the lower part of the Brewerton and the upper part of the Craighill Chan., **81,** 861. This work was practically accomplished in 1885, **86,** 874.

The total amount app. from 1852 to 1886, incl., was $2,216,830.

By Col. Craighill, 1887, for imp. of the chan. between d. w. in Chesapeake B. and Baltimore, by dr. to 27′ m. l. w., and 600′ w.; est. cost, $1,300,000, **87,** 860, 881; **88,** 756.

Amount est. for completion in 1891, $208,800, **91,** 134.

By Col. Craighill, 1890, for dr. a chan. 150′ w. at bottom and 27′ d. at m. l. w., from the main ship chan. of the Patapsco R., Baltimore H., to Curtis B.; est. cost, $85,000, **93,** 1249.

By Col. Craighill, 1894, for dr. a chan. 30′ d., 600′ w. at bottom, and over 1,200′ at the bends, in Baltimore H.; est. cost, $2,500,000, and $50,000 an. mainten., **95,** 1202; **96,** 1000; **97,** 1300.

By Col. Hains, 1896, for dr. a chan. 100′ w. at bottom with side slopes of 1 on 3 from the main ship chan. near Fort McHenry to the foot of Eutaw St., with a turning-basin 400′ x 400′ near the upper end; est. cost, $314,000, **96,** 1007.

$196,000 est. as cost of d. chan., Curtis B., to 30′ and 250′ w.; and from over $9,000,000 to about $11,000,000 for chan. 35′ d. and 1,000′ w. from Baltimore to ocean. If bottom w. of 600′ instead of 1,000′ be made, the total to the ocean might be $5,300,000, **01,** 1395. Est. revised and reduced to $3,465,000, **03,** 1032.

R. and H. act June 13, 1902, app. $50,000 for d. chan., Patapsco R., to 30′, w. of 250′; under C. Con. system; est., $196,000, **02,** 194.

Proj. for 30′., Patapsco R., completed, 1903, at cost of $1,371,710 (orig. est., $2,509,000), **03,** 195.

Widening of existing chan., 1904, to 200′ and 30′ d. from Brewerton Chan. of Patapsco R. to Sparrows Pt., Md., au. act June 13, 1902, **04,** 1289.

Act Mar. 3, 1905, provides for chan. 35′ x 600′ from Fort McHenry to d. w. above Sandy Pt. Light, and through shoals opposite York Spit; est., $3,465,000, **05,** 187, 1126.

$6,500 app., R. and H. act Mar. 2, 1907, for mainten. of Spring Garden imp., **07,** 211.

Proj. of 1905 extended by act Mar. 3, 1909, to include the w. of Fort McHenry division near its intersection with Curtis B. Chan. so as to provide an anchorage basin, **09,** 225; and further extended by act Feb. 27, 1911, to include increased w. of chan. at the entrances and in the bends, **11,** 280.

Desirable that York Spit section be increased in w. from 600′ to 1,000′, for benefit of heavy-draft vessels, **11,** 280, 1406.

Existing proj., with all modifications, in detail, **12,** 332. Max. draft 1912, over shoalest part

Patapsco R. and Chan. to Baltimore, 35′ at m. l. w. Length of imp. sections, **12,** 332, 1624.

Urgent that w. of Baltimore chan. at bends and entrances be further w., **10,** 257, 1312; at York Spit, **11,** 1406; and chan. near York Spit done, **10,** 258.

$10,000 app. by R. and H. act June 25, 1910, for restoring dimensions, Curtis B. work, **10,** 259; and $5,000 by R. and H. act Feb. 27, 1911, **11,** 282. Same act app. $34,000 for similar work at Spring Garden, **10,** 260; and R. and H. act Feb. 27, 1911, app. $10,000, **11,** 283.

SURVEYS.

Made, 1859, **66,** ii, 25.

By Col. Graham, 1865, ex., **66,** 37.

By Maj. Craighill, 1866, ex., **66,** ii, 24.

Under direction of Maj. Craighill, by U. S. Coast Sur., resur., 1866, **66,** iii, 23, iv, 234; **67,** 41, 42, 417.

Under direction of Maj. Craighill, resur., 1874, **74,** 81, ii, 17.

Under direction of Coast Sur., by I. M. Down, p. and bulkhead lines. **R., 79,** 499, 500.

By J. L. Seager, 1881, **81,** 862.

Sur. of chan., 1885, **86,** 874.

Sur. of chan. with view of w. to 600′, au. act Aug. 5, 1886; made, 1886, by Col. Craighill, **87,** 880.

Ex. of s. and middle branches of the Patapsco R., au. act July 13, 1892; made, 1892 by Col. Craighill (**R.** fav.), **93,** 1262.

Sur. made by Col. Craighill and Col. Hains, **94,** 910; **96,** 1000.

Sur. of Baltimore H., au. act Aug. 17, 1894; made by Col. Craighill, 1894 (see Projects), **95,** 1201.

Est. cost of d. chan., sw. Baltimore H., called for by resol. of Congress, Mar. 2, 1896; submitted, 1896, by Col. Hains, **96,** 1006.

Sur. of Baltimore H. with view to securing 30′ chan., au. act June 3, 1896; made by Col. P. C. Hains, 1896 (see Projects), **97,** 1308.

Est. cost of d. chan. of Curtis B. to 30′, 250′ w., and of main ship chan. of Patapsco R. and Baltimore H. to 35′, 1,000′ w.; asked by conc. resol. of Congress, Jan. 19, 1901; made by Lt. Col. Ernst, **01,** 1394.

Pre. ex. au. act June 13, 1902, from main ship chan. to Sparrows Pt., and Patapsco R. to the drawbr. at mouth of Bear Creek, by Col. Hains; est. cost for imp., $99,000 to $146,000; reviewed by BERH. (**R.** unfav.), **04,** 194, 1278, 1284, 1289.

Sur. of dumping grounds in Chesapeake B., **09,** 1186.

List of Cong. docs. relating to surveys, **02,** 193; **03,** 195, 196, 197; **04,** 180, 181; **11,** 281, 282, 283; **12,** 332, 333, 334.

Maps. Of Patapsco R. and approaches, **66,** 42; **95,** 1180; **97,** 1306; **12,** 1624.

J-1243 ANNAPOLIS HARBOR (South R.), MD.

APPROPRIATIONS.

1880,	$5,000,	**80,** 634.
1881,	5,000,	**81,** 874.
Total,	10,000	

COMMERCE.

Benefit of proposed imp., **79,** 578, 579.

Benefit to C. from proposed imp. small, **81,** 874; **82,** 850; **85,** 134.

Extremely small, and Naval Academy averse to increase of, **97,** 1312.

CONTRACT.

1886. American Dredging Co., dr., 8¢ c. y., **86,** 877.

ENGINEERS.

Chief of Engineers. R., 78, 69; **79,** 81; **80,** 102; **81,** 135, 150; **82,** 131; **83,** 136; **84,** 143; **85,** 134; **86,** 134; **87,** 98; **97,** 175.

In charge:

Maj. W. P. Craighill, 1876–88; **78,** 69. **R., 79,** 574; (Lt. Col.) **80,** 633; **81,** 871; **82,** 850; **83,** 676; **84,** 900; **85,** 886; **86,** 877; **87,** 863; (Col.) **88,** 761.

Col. P. C. Hains, 1895–97. **R., 97,** 1309.

Assistants:

Capt. C. B. Phillips. **R., 79,** 578.

Capt. J. W. Cuyler, **79,** 574. **R., 79,** 575.

John L. Seager, **79,** 574.

W. R. Hutton. **R., 81,** 872.

Lt. C. W. Kutz. **R., 97,** 1310.

OPERATIONS.

1885–86. Dr. shoals within the H., **86,** 877.

1886–87. Dr. of shoals continued, **87,** 863.

PHYSICAL CHARACTERISTICS.

General description, **79,** 575, 576; **81,** 872; **97,** 1311. Bars at mouth of H., **79,** 576. Tides, **79,** 574, 575.

PLANS.

By Capt. Cuyler. 1. To dr. chan. 24′ x 150′, connecting d. w. of B. with d. w. of Severn R.; est., $55,000. 2. To constr. a series of light shore groins or deflectors to maintain chan.; est., $17,000, **79,** 575.

By Maj. Craighill, est. expend., per an., of $10,000 for dr., **79,** 574, 575, 577. Correspondence relative to proposed imp. of H., **79,** 577, 578.

PROJECTS.

By Col. Craighill, 1880, chan. through the bars abreast of the Naval Academy, by dr. to 24′ x 150′ l. w.; est., $66,000, **81,** 872; **85,** 134.

In 1881 Col. Craighill recom. postponement of operations as the amount available, $10,000, not sufficient to effect any substantial imp., **81,** 874.

1896, Col. Hains est. that to dr. a chan. 3½ m. l. with side slopes of 1 on 3, 28′ d. m. l. w., would cost $142,000, **97,** 1310.

SURVEYS.

Included in Coast Sur., 1844–45, **79,** 575.

Ex. by Capt. Phillips, 1876. **R., 79,** 578.

By Capt. Cuyler and J. L. Seager, 1878–79. **R., 79,** 575.

By W. F. Smith, 1886, of shoals in H., **86,** 134.

Sur. with view to obtaining a ship's chan. 28′ x 150′ m. l. w., from Chesapeake B. to the wharves of U. S. Naval Academy, au. act June 3, 1896. **R.** submitted by Col. Hains in 1896 (see Projects), **97,** 1309.

J-1276 PARISH CREEK, MD.

COMMERCE.

Oyster-dr. industry not great enough to warrant an imp. of the mouth, **93,** 1311.

ENGINEERS.

Chief of Engineers. R., 93, 158.

In charge. Maj. C. E. L. B. Davis, 1892–95. **R., 93,** 1310.

PHYSICAL CHARACTERISTICS.

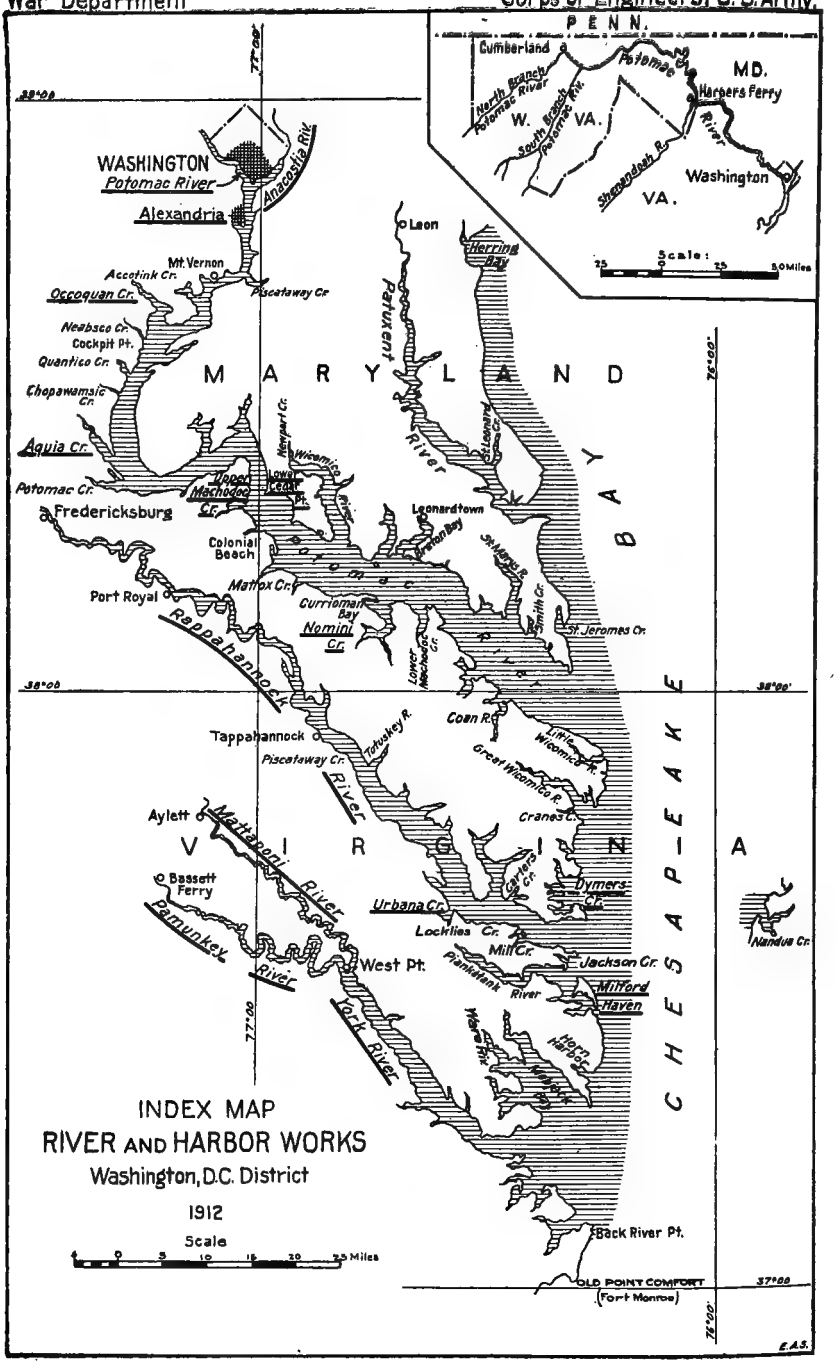
Description of, **93,** 1311.

SURVEYS.

Ex. of the mouth au. July 13, 1892; made by Maj. Davis, 1892 (**R.** unfav.) **93,** 1311.

RIVER AND HARBOR WORKS—SOUTH ATLANTIC.

K.—WASHINGTON, D. C., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
PENN.
Cumberland
Potomac
MD.
Harpers Ferry
North Branch Potomac River
W. VA.
South Branch Potomac Riv.
Shenandoah R.
River
Washington
VA.
Scale:
25 0 25 50 Miles
WASHINGTON
Potomac River
Anacostia Riv.
Alexandria
Mt. Vernon
Accotink Cr.
Occoquan Cr.
Piscataway Cr.
Neabsco Cr.
Cockpit Pt.
Quantico Cr.
Chopawamsic Cr.
Aquia Cr.
Potomac Cr.
Fredericksburg
Upper Machodoc Cr.
Lower Machodoc Cr.
Newport Cr.
Wicomico
Colonial Beach
Port Royal
Mattox Cr.
Rappahannock
Currioman Bay
Nomini Cr.
Leon
Herring Bay
Patuxent
River
Leonardtown
Breton Bay
St. Marys R.
Smith Cr.
St. Jerome Cr.
Lower Machodoc Cr.
Coan R.
Little Wicomico R.
Great Wicomico R.
Cranes Cr.
Tappahannock
Piscataway Cr.
Tatuskey R.
Aylett
Mattaponi River
Bassett Ferry
Pamunkey River
Garrets Cr.
Dymers Cr.
Urbana Cr.
Lockliss Cr.
Mill Cr.
Jackson Cr.
Milford Haven
Piankatank River
West Pt.
York River
Ware Riv.
Horn Harbor
Mobjack
Back River Pt.
OLD POINT COMFORT
(Fort Monroe)
Nandua Cr.
MARYLAND
VIRGINIA
CHESAPEAKE BAY
INDEX MAP
RIVER AND HARBOR WORKS
Washington, D.C. District
1912
Scale
4 0 5 10 15 20 25 Miles
E.A.S.

K.—WASHINGTON, D. C., DISTRICT.

In charge of U. S. Engineer Office,
Washington, D. C.

K 1 Chesapeake B., Md.[1]
K 2 Herring B., Md. (1)
K 3 Red Lion Cr., Md. (1)
K 4 Fishing Cr., Md. (1)
K 5 Parker Cr., Md. (1)
K 6 Governors Run, Md. (1)
K 7 Patuxent R., Md. (1)
K 8 Mill Cr., Md. (7)
K 9 St. John Cr., Md. (7)
K 10 Back Cr., Md. (7)
K 11 Hellen Gut, Md. (7)
K 12 Hellens Cr., Md. (7)
K 13 Mears Cr., Md. (7)
K 14 St. Leonards Cr., Md. (7)
K 15 Island Cr., Md. (7)
K 16 Battle Cr., Md. (7)
K 17 Buzzard Isld. Cr., Md. (7)
K 18 Hunting Cr., Md. (7)
K 19 Little Lyons Cr., Md. (7)
K 20 Hall Cr., Md. (7)
K 21 Lyons Cr., Md. (7)
K 22 Little Patuxent R., Md., (upper limit of 7)
K 23 Western Branch, Md. (7)
K 24 Rock Cr., Md. (7)
K 25 Black Swamp Cr., Md. (7)
K 26 Swanson Cr., Md. (7)
K 27 Indian Cr., Md. (7)
K 28 Trent Hall Cr., Md. (7)
K 29 Washington Cr., Md. (7)
K 30 Persimmon Cr., Md. (7)
K 31 Cremona Cr., Md. (7)
K 32 Mud Cr., Md. (7)
K 33 Spring Cr., Md. (7)
K 34 Horse Landing Cr., Md. (7)
K 35 Cat Cr., Md. (7)
K 36 Roslin Cr., Md. (7)
K 37 Second Cr., Md. (7)
K 38 Cole Cr., Md. (7)
K 39 St. John Cr., Md. (7)
K 40 Cuckold Cr., Md. (7)
K 41 Mill Cr., Md. (7)
K 42 Town Cr., Md. (7)
K 43 Harper Cr., Md. (7)
K 44 Parson Cr., Md. (7)
K 45 St. Jerome Cr. and Bay, Md. (1)
K 46 Potomac R., Md. (1)
K 47 Tanner Cr., Md. (46)
K 48 Point Lookout Cr., Md. (46)
K 49 Potter Cr., Md. (46)
K 50 Briscoe Cr., Md. (46)
K 51 Calvert B., Md. (46)
K 52 Smith Cr., Md. (46)
K 53 St. Marys R., Md. (46)
K 54 Inigoes Cr., Md. (46)
K 55 Easer Branch, Md. (46)
K 56 Carthagena Cr., Md. (46)
K 57 St. George R., Md. (46)
K 58 Price Cr., Md. (46)
K 59 Herring Cr., Md. (46)
K 60 Blake Cr., Md. (46)
K 61 Flood Cr., Md. (46)
K 62 Breton B., Md. (46)
K 63 St. Clement B., Md. (46)
K 64 Dukeharts Cr., Md. (46)
K 65 St. Catherine Sound, Md. (46)
K 66 Wicomico R., Md. (46)
K 67 Chaptico B., Md. (66)
K 68 Newport Cr., Md. (66)
K 69 Allen Fresh, Md. (66)
K 70 Charleston Cr., Md. (66)
K 71 Neals Sound, Md. (46)
K 72 Cuckold Cr., Md. (46)
K 73 Piccowaxton Cr., Md. (46)
K 74 Popes Cr., Md. (46)
K 75 Port Tobacco R., Md. (46)
K 76 Goose Cr., Md. (75)
K 77 Nanjemoy Cr., Md. (46)
K 78 Mallows B., Md. (46)
K 79 Chicomuxen Cr., Md. (46)
K 80 Mattawoman Cr., Md. (46)
K 81 Pamunkey Cr., Md. (46)
K 82 Piscataway Cr., Md. (46)
K 83 Broad Cr., Md. (46)
K 84 Oxen Cr., Md. (46)
K 85 Anacostia R., Md. (46)
K 86 Beaver Dam Branch, Md. (85)
K 87 Northeast Branch, Md. (85)
K 88 Northwest Branch, Md. (85)
K 89 Rock Cr., D. C. (46)
K 90 Chain Br., at Little Falls, Va. (upper limit of 46)
(K 90(a) Shenandoah R., Va., and W. Va. (46))
K 91 Four Mile Run, Va. (46)
K 92 Hunting Cr., Va. (46)
K 93 Little Hunting Cr., Va. (46)
K 94 Dogue Cr., Va. (46)
K 95 Gunston Cove, Va. (46)
K 96 Accotink B., Va. (95)
K 97 Pohick B., Va. (95)
K 98 Occoquan B., Va. (46)
K 99 Belmont B., Va. (98)
K 100 Occoquan Cr., Va. (98)
K 101 Bull Run, Va. (98)
K 102 Cedar Run, Va. (98)

[1] Beginning on west side, below South R., Md., or immediately after J 1278, p. 340.

K 103 Neabsico Cr., Va. (46)
K 104 Powells Cr., Va. (46)
K 105 Quantico Cr. and Bay, Va. (46)
K 106 Chopawamsic Cr., Va. (46)
K 107 Aquia Cr., Va. (46)
K 108 Austins Run, Va. (107)
K 109 Potomac Cr., Va. (46)
K 110 Jotank Cr., Va. (46)
K 111 Upper Machodoc Cr., Va. (46)
K 112 Rosier Cr., Va. (46)
K 113 Monroe Cr., Va. (46)
(K 113(a) Colonial Beach, Westmoreland Co., Va. (46))
K 114 Mattox Cr., Va. (46)
K 115 Pope Cr., Va. (46)
K 116 Nomini B., Va. (46)
K 117 Currioman B., Va. (117)
K 118 Nomini Cr., Va. (116)
K 119 Lower Machodoc Cr., Va. (46)
K 120 Jacksons Cr., Va. (46)
K 121 Yeocomico R., Va. (46)
K 122 White Point Branch, Va. (121)
K 123 West Yeocomico R., Va. (121)
K 124 Hall Branch, Va. (121)
K 125 South Yeocomico R., Va. (121)
K 126 Mill Cr., Va. (121)
K 127 Lodge Branch, Va. (121)
K 128 Cornish Cr., Va. (121)
K 129 Coan R., Va. (46)
K 130 Kingscote Cr., Va. (129)
K 131 The Glebe, Va. (129)
K 132 Presley Cr., Va. (46)
K 133 Hulls Cr., Va. (46)
K 134 Cubitt Cr., Va. (46)
K 135 Hack Cr., Va. (46)
K 136 Little Wicomico R., Va. (46)
K 137 Great Wicomico R., Va. (1)
K 138 Cockrells Cr., Va. (137)
K 139 Reason Cr., Va. (137)
K 140 Coughers Cr., Va. (137)
K 141 Cranes Cr., Va. (137)
K 142 Towles Cr., Va. (137)
K 143 Mill Cr., Va. (137)
K 144 Cloverdale Cr., Va. (1)
K 145 Ball Cr., Va. (1)
K 146 Dividing Cr., Va. (1)
K 147 Natty Point Cove, Va. (upper limit of 146)
K 148 Lawrence Cove, Va. (146)
K 149 Prentice Cr., Va. (146)
K 150 Jarvis Cr., Va. (146)
K 151 Barnes Cr., Va. (1)
K 152 Indian Cr., Va. (1)
K 153 Henrys Cr., Va. (152)
K 154 Bells Cr., Va. (152)
K 155 Arthurs Cove, Va. (upper limit of 152)
K 156 Pitmans Cove, Va. (upper limit of 152)
K 157 Longs Cr., Va. (152)
K 158 Dymers Cr., Va. (1)
K 159 Rones B., Va. (158)
K 160 Lees Cove, Va. (158)
K 161 Hunts Cove, Va. (158)
K 162 Johnsons Cr., Va. (upper limit of 158)
K 163 Chases Cove, Va. (158)
K 164 Poplar Neck Cr., Va. (158)
K 165 Georges Cr., Va. (158)
K 166 Ashleys Cove, Va. (158)
K 167 Tabbs Cr., Va. (1)
K 168 Little B., Va. (1)
K 169 Antipoison Cr., Va. (1)
K 170 Oyster Cr., Va. (1)
K 171 Rappahannock R., Va. (1)
K 172 Windmill Point Cr., Va. (1)
K 173 Mosquito Cr., Va. (171)
K 174 Carters Cr., Va. (171)
K 175 Eastern Branch, Va. (174)
K 176 Carter Cove, Va. (174)
K 177 Corrotoman R., Va. (171)
K 178 Taylor Cr., Va. (177)
K 179 Eastern Branch, Va. (177)
K 180 Western Branch, Va. (177)
K 181 Myer Cr., Va. (177)
K 182 White House Cr., Va. (177)
K 183 Beach Cr., Va. (171)
K 184 Paynes Cr., Va. (171)
K 185 Deep Cr., Va. (171)
K 186 Mulberry Cr., Va. (171)
K 187 Lancaster Cr., Va. (171)
K 188 Morattico Cr., Va. (171)
K 189 Farnham Cr., Va. (171)
K 190 Corbins Cr., Va. (171)
K 191 Totuskey R., Va. (171)
K 192 Little Carters Cr., Va. (171)
K 193 Slash Cr., Va. (171)
K 194 Cat Point Cr., Va. (171)
K 195 Peters Cr., Va. (171)
K 196 Troy Cr., Va. (171)
K 197 Gincatic Cr., Va. (171)
K 198 Millbank Cr., Va. (171)
K 199 Thoroughfare, Va. (171)
K 200 Jones Top Cr., Va. (171)
K 201 Dogue Cr., Va. (171)
K 202 Kays Cr., Va. (171)
K 203 Hough Cr., Va. (171)
K 204 Lamb Cr., Va. (171)
K 205 Muddy Cr., Va. (171)
K 206 Fall Run, Va. (upper limit of 171)
K 207 Hazel Run, Va. (171)
K 208 Deep Cr., Va. (171)
K 209 Massapomock Cr., Va. (171)
K 210 Mount Cr., Va. (171)
K 211 Taylor Cr., Va. (171)
K 212 Mill Cr., Va. (171)
K 213 Port Tobago B., Va. (171)
K 214 Green B., Va. (171)
K 215 Blackbourne Cr., Va. (171)
K 216 Occupacia Cr., Va. (171)
K 217 Mount Landing Cr., Va. (171)
K 218 Hoskins Cr., Va. (171)
K 219 Piscataway Cr., Va. (171)
K 220 Mud Cr., Va. (171)
K 221 Parrotts Cr., Va. (171)
K 222 Harry George Cr., Va. (171)
K 223 Weeks Cr., Va. (171)
K 224 La Grange Cr., Va. (171)
K 225 Robinsons Cr., Va. (171)
K 226 Dargman Cr., Va. (171)
K 227 Urbana Cr., Va. (171)
K 228 Meachim Cr., Va. (171)
K 229 Lockies Cr., Va. (171)
K 230 Mill Cr., Va. (171)
K 231 Bush Pork Cr., Va. (171)

K 232 Hunting Cr., Va. (171)
K 233 Sturgeon Cr., Va. (171)
K 234 Broad Cr., Va. (171)
K 235 Plankatank R., Va. (1)
K 236 Jacksons Cr., Va. (235)
K 237 Fishing B., Va. (235)
K 238 Moores Cr., Va. (235)
K 239 Shaws Cr., Va. (235)
K 240 Wilton or Mill Cr., Va. (235)
K 241 Freeport Cr., Va. (upper limit of 235)
K 242 French Cr., Va. (235)
K 243 Ferry Cr., Va. (235)
K 244 Dancing Cr., Va. (235)
K 245 Cobb Cr., Va. (235)
K 246 Warehouse Cove, Va. (235)
K 247 Godfreys B., Va. (235)
K 248 Hills B., Va. (235)
K 249 Queens Cr., Va. (235)
K 250 Milford Haven, Va. (1)
K 251 Lanes Cr., Va. (252)
K 252 Stutts Cr., Va. (252)
K 253 Callis Cr., Va. (252)
K 254 Morris Cr., Va. (1)
K 255 Billups Cr., Va. (252)
K 256 Stocks Cr., Va. (250)
K 257 White Cr., Va. (250)
K 258 Garden Cr., Va. (1)
K 259 Winter H., Va. (1)
K 260 Horn H., Va. (1)
K 261 Dyer Cr., Va. (1)
K 262 Mobjack B., Va. (1)
K 263 Deep Cr., Va. (262)
K 264 Pepper Cr., Va. (262)
K 265 East R., Va. (262)
K 266 Tabbs Cr., Va. (265)
K 267 Westons Cr., Va. (265)
K 268 Pudding Cr., Va. (upper limit of 265)
K 269 Milles Cr., Va. (265)
K 270 Raines Cr., Va. (265)
K 271 Thomas Cr., Va. (265)
K 272 Whites Cr., Va. (265)
K 273 North R., Va. (262)
K 274 Godsey Cr., Va. (273)
K 275 Sipleys Cr., Va. (273)
K 276 Raymond Cr., Va. (273)
K 277 Blackwater Cr., Va., (273)
K 278 North End Branch, Va. (upper limit of 273)
K 279 Toddsbury Cr., Va. (273)
K 280 Elmington Cr., Va. (273)
K 281 Back Cr., Va. (273)
K 282 Belleville Cr., Va. (273)
K 283 Davis Cr., Va. (273)
K 284 Ware R., Va. (262)
K 285 Mill Pond Cr., Va. (284)
K 286 Wilson Cr., Va. (284)
K 287 Old House Cr., Va. (284)
K 288 Severn R., Va. (262)
K 289 Caucus B., Va. (288)
K 290 Whittakers Cr., Va. (288)
K 291 Free School Cr., Va. (288)
K 292 Bryans B., Va. (288)
K 293 Northwest Branch, Va. (288)
K 294 Southwest Branch, Va. (288)
K 295 Browns B., Va. (262)
K 296 Monday Cr., Va. (262)
K 297 York R., Va. (1)
K 298 Sedger Cr., Va. (297)
K 299 Sarah Cr., Va. (297)
K 300 Timber Neck Cr., Va. (297)
K 301 Carter Cr., Va. (297)
K 302 Jones Cr., Va. (297)
K 303 Purtan B., Va. (297)
K 304 Potopotank (Poropotank) Bay and Cr., Va. (297)
K 305 Mattaponi R., Va. (297)
K 306 Beverley Run, Va. (305)
K 307 Mat Run, Va. (305)
K 308 Ta Run, Va. (305)
K 309 Po Run, Va. (305)
K 310 Ny Run, Va. (305)
K 311 Pamunkey R., Va. (297)
K 312 North Anna R., Va. (311)
K 313 South Anna R., Va. (311)
K 314 Pony Cr., Va. (311)
K 315 Matadequin or Boundary Cr., Va. (311)
K 316 Baker Cr., Va. (297)
K 317 Kings Cr., Va. (297)
K 318 Felgates Cr., Va. (297)
K 319 West Branch Va. (297)
K 320 Wormley Cr., Va. (297)
K 321 Thoroughfare, Va. (297)[1]

K-(a) HUNTERS CREEK, VA.

ENGINEERS.

Chief of Engineers. **R.,** 87, 114.
In charge. S. T. Abert, U. S. agent, 1886. **R.,** 87, 962.

SURVEY.

Ex. au. act Aug. 5, 1886, but S. T. Abert unable to discover any such creek, **87,** 962.

K-7 PATUXENT RIVER, MD.

APPROPRIATIONS.

1888,	$5,000,	**89,** 998.
1890,	6,000,	**90,** 1060.
1902,	*3,000,	**03,** 1048.
Total,	14,000	

COMMERCE.

Trade of the R., **88,** 847.
Description of, **00,** 1740, 1741.
In general, considerable; at Bristol Landing, small; chan. at other than low stages ample for existing C., **03,** 1049.

[1] List continues on p. 411.

*Allotment.

Est. at $150,000 and 1,000 passengers per an.; rates not altered, but shipments facilitated by imp., **05,** 209.

CONTRACTS.

1889. T. P. Morgan, dr., 20¢ c. y., **90,** 1060.
1904. Maryland Dredging & Contracting Co., dr., 25¢ c. y., **04,** 1314.

ENGINEERS.

Chief of Engineers. **R., 88,** 110, 116; **89,** 124; **90,** 111; **91,** 141; **92,** 142; **93,** 154; **94,** 141; **99,** 223; **00,** 254; **02,** 206; **03,** 203; **04,** 200; **05,** 209; **08,** 264.

Boards. BERH. **R., 03,** 1048.

In charge:
S. T. Abert, U. S. agent, 1886–91. **R., 88,** 846, 848; **89,** 998; **90,** 1060.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1262.
Maj. C. E. L. B. Davis, 1892–94. **R., 92,** 1049; **93,** 1294; **94,** 953.
Lt. Col. C. J. Allen, 1900–03. **R., 00,** 1739, 1741; **02,** 1088; **03,** 1047.
Col. A. M. Miller, 1904. **R., 04,** 1314.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1160.

OPERATIONS.

1889–90. 18,295 c. y. dr., **90,** 1060.
1890–91. 19,525 c. y. dr., **91,** 1263.
1903–04. 6,125 c. y. dr., **04,** 1314.
1904–05. 5,758 c. y. dr., **05,** 1160.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 846; **93,** 1294; **94,** 953; **00,** 1740; **05,** 209.

PROJECTS.

By S. T. Abert, 1888, imp. Patuxent R. between Benedict and Hills Landing by dr. through Bristol and Swanns Pt. bars a chan. 12′–13′ x 200′; est., $80,000, **88,** 850; **91,** 1263.

In 1891 Lt. Col. Hains considered the imp. already made upon the R. sufficient; recom. no further app., **91,** 1263.

Lt. Col. C. J. Allen est. $6,840 or $10,500 to make the imp. desired in 1899, **00,** 1742. Act June 13, 1902, au. chan. through Bristol Bar 10′ x 100′, with turning-basin of same d., 300′ x 400′ at SS. wharf; est., $10,500, **03,** 203.

BERH. did not consider it advisable, 1903, to continue imp.,[1] **03,** 1049.

SURVEYS.

Sur., Benedict to Hills Landing, au. act Aug. 5, 1886, **87,** 114; made, 1888, by S. T. Abert, **88,** 848.
Sur. made, 1894, by Maj. Davis, **94,** 954.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Allen (**R.** fav.; see Projects), **00,** 1740, 1741.
Ex. au. act Mar. 2, 1907; **R.** by Maj. Cosby (**R.** unfav.),[2] **08,** 264.
Maps. **88,** 850; **90,** 1060.

K-14 ST. LEONARDS CREEK, MD.

ENGINEERS.

Chief of Engineers. **R., 91,** 145, 1277.
In charge. Lt. Col. P. C. Hains, 1891. **R., 91,** 1277.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1277.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Hains (**R.** unfav.), **91,** 1277.

K-45(a) ST. JEROME CREEK, MD.

APPROPRIATIONS.

1881,	$6,500,	**81,** 153.
1882,	5,000,	**82,** 1017.
1884,	15,000,	**84,** 985.
Total,	26,500	

CONTRACTS.

1881. T. P. Morgan, dr., 35¢ c. y. for inner chan. and 15¢ c. y. for outer chan., **81,** 956.
1882. T. P. Morgan, dr., 35¢ c. y., **82,** 1015.
1883. D. Constantine, dr., 25¢ c. y., **83,** 801. G. E. Ward, dr., **84,** 984.
1884. J. Caler & Sons, dr., 13¢ c. y., **85,** 969.

ENGINEERS.

Chief of Engineers. **R., 81,** 153; **82,** 148; **83,** 154; **84,** 156; **85,** 146; **86,** 141; **87,** 108; **88,** 110; **89,** 127; **90,** 114.

In charge:
Lt. Col. W. P. Craighill, 1880–81. **R., 81,** 935.
S. T. Abert, U. S. agent, 1881–90. **R., 81,** 955; **82,** 1015; **83,** 800; **84,** 984; **85,** 968; **86,** 904; **87,** 983; **88,** 818; **89,** 1005; **90,** 1064.

Assistant. W. R. Hutton. **R., 81,** 935.

OPERATIONS.

1880–81. 90,092 c. y. dr. from inner chan., **81,** 957.
1881–82. 22,320 c. y. dr. from outer end of inner chan., **82,** 1016.
1882–83. 15,526 c. y. dr. from Cuts A and B, **83,** 802.
1883–84. 4,151 c. y. dr. from continuation of Upper Pond chan., **84,** 984.
1884–85. 51,954 c. y. dr. from chan., **85,** 969.
1885–86. 11,106 c. y. dr. from chan., **86,** 905.
1886–87. 500 c. y. dr. from chan., **87,** 934.

PRIVATE (U. S. FISH COMMISSION) WORK.

Chan. to Upper Pond dr. by U. S. Fish Commission, **84,** 984.

PROJECTS.

By S. T. Abert, 1880, chan. 9′ x 100′ through bar at mouth, and chan. 6′ x 40′ into s. fork, material to be formed into a dike inclosing part of s. fork for pond for U. S. Fish Commission; est., $21,500.

1886, amount to complete proj. est. at $26,000, **85,** 970; **87,** 934. Increased to $34,700 in 1888, **88,** 819.

In 1890 the proj. reduced to chan. through bar at mouth; est. to complete, $26,000, **90,** 1065.

SURVEY.

Au. act Dec. 13, 1880; made by Lt. Col. Craighill, **81,** 935.
Maps. **86,** 904.

[1] R. and H. C. Doc. 32, 61st, 2d.

[2] H. D. 531, 60th, 1st.

K-45(b) ST. JEROME BAY, MD.

ENGINEERS.

Chief of Engineers. **R., 91,** 145.

In charge. Lt. Col. P. C. Hains, 1891. **R., 91,** 1278.

PHYSICAL CHARACTERISTICS.

Description of; a small indentation in w. side of Chesapeake B. and St. Jerome Cr. flows into St. Jerome B., **91,** 1278.

SURVEY.

Ex., 1891, by Lt. Col. Hains (**R.** unfav.), **91,** 1278.

K-46 POTOMAC RIVER, VA., D. C., and MD.

Part.	Title.	Period	Appropriation.
a	Potomac R.	1867–1878	$51,500
b	Below Washington, D. C.	1899–1912	186,000
c	Anacostia R., D. C. (Eastern Branch of Potomac R.)	1876, 1889–1912	787,000
d	South Branch	1889	.....
	SPECIAL POINTS ON THE POTOMAC, ARRANGED FROM MOUTH UPWARD.		
e	Lower Cedar Pt.	1908–1912	$13,300
f	Mount Vernon Chan.	1879–1892, 1908	17,000
g	Alexandria	1910–1912	116,000
h	Alexandria Canal, D. C. and Va.	1837	300,000
i	Alexandria H., Va.	1904	.....
j	Chan. from Alexandria to the Maryland side	1889	.....
k	Vicinity of Washington, D. C.	1880–1912	3,212,000
l	Washington and Georgetown Hs., D. C.	1873–1879	300,000
m	Potomac R. to Baltimore, Md. (Canal)	.....	.....
n	Juniata to the Potomac R. (Canal)	1826	.....
o	James Creek Canal, D. C.	1888	.....
p	Chesapeake & Ohio Canal	1828–1876	1,015,000
	Total	.....	5,997,800

Part (a), K-46 Potomac River.

APPROPRIATIONS.

1849, $1,500 (sur.), act Mar. 3.
1870, 50,000, **70,** 529; **71,** 72, 591.

Total, 51,500

COMMERCE.

Requirements discussed, **71,** 592.

CONTRACTS.

1870. N. G. Dodge, dr., completed Dec., 1871, **72,** 687.

ENGINEERS.

Chief of Engineers. **R., 67,** 17, 18; **68,** 61; **70,** 84; **71,** 72; **72,** 68.

In charge:

Maj. N. Michler, 1868–71. **R., 68,** 889, 913–924; **69,** 493, 514, 517; **70,** 517, 529, 530; **71,** 974.

Maj. W. P. Craighill, 1871–72. **R., 71,** 591; **72,** 687.

Assistants:

C. P. Patterson, C. Fendall, **68,** 914.
Capt. C. B. Phillips, **71,** 594; **72,** 687.
Capt. J. H. Johnson, **77,** 357.

ESTIMATES. (See Plans and Projects.)

By Maj. Michler, aggregate for R. imp., $475,431, **68,** 924. Modified for imp. Virginia Chan., $138,000, **68,** 61, 911, 913; $123,000, **69,** 514.

By Maj. Craighill, for imp. Washington Chan., $50,000; Virginia Chan., $100,000; removal of r. near Georgetown, $10,000, **71,** 595.

By Capt. Johnson, chan. below Long Br., $57,640, **77,** 357.

LEGISLATION.

Required, **68,** 903.

OPERATIONS.

1870–71. Dr. of Virginia Chan. in progress, **71,** 72, 593.

1871–72. Chan. 15′ x 200′ completed in Dec., **72,** 68, 687.

PHYSICAL CHARACTERISTICS.

Discussed, **68,** 914–922; **69,** 525; **70,** 517; **71,** 594, 595.

PLANS. (See Estimates and Projects.)

By Maj. Craighill, dr. and removal of r., **71,** 595. Further imp. referred by Congress to a commission, **72,** 68, 688.

PRIVATE AND CORPORATE WORK.

Dr. in Georgetown Chan. by Georgetown city au., **69,** 494.

PROJECTS. (See Estimates and Plans.)

By Maj. Michler, removal and rebuilding part of Long Br., and dr., **68,** 61, 889, 913.

By Maj. Craighill, dr. Georgetown Chan. 15′ x 200′, **71,** 592.

SURVEYS.

History of early, **68,** 914. Under direction of Maj. Michler by C. Fendall. **R., 68,** 913.

Under direction of Maj. Craighill, by Capt. Phillips, **72,** 687.

Maps:

Showing removal of r. in 1876, **77,** 356.

Of the Hs., by G. H. Gill, under direction of S. T. Abert, 1878, **78,** 504.

Part (b), K-46 Potomac River, below Washington, D. C.

APPROPRIATIONS.

1899,	*$26,000,	**99,** 1421.
1900,	52,000,	**00,** 1708.
1901,	98,000,	**01,** 1406.
1905,	10,000,	**05,** 1155.
Total,	186,000	

COMMERCE.

Imp. has had no material effect on rates, **10,** 286.
In 1910, 1,701,490, **11,** 1441.

CONTRACTS.

1899. R. Moore, dr. in lower Potomac R., 7¢ and 7.2¢ c. y. ($69,110), **00,** 1708.

1902. R. Moore (supple.), excavating hard material at Mattawoman Shoal, 52¢ c. y.; R. Moore (supple.), increasing w. of chan. through Mattawoman Shoal by dr., 18¢ c. y., **03,** 1039.

1904. Maryland Dredging & Contracting Co., dr., 9¢ c. y., **05,** 1155.

ENGINEERS.

Chief of Engineers. R., 99, 209; **00,** 238; **01,** 276; **02,** 205; **03,**200; **04,**197; **05,**205; **06,**217; **07,** 231; **08,** 243, 264; **09,** 252; **10,** 285; **11,** 309; **12,** 390.

In charge:

Lt. Col. C. J. Allen, 1899–1903. **R., 99,** 1419; **00,** 1706; **01,** 1405; **02,** 1085; **03,** 1038.
Col. A. M. Miller, 1904. **R., 04,** 1309.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1153.
Capt. S. Cosby, 1906–08. **R., 06,** 1095; (Maj.) **07,** 1167; **08,** 1211.
Maj. J. J. Morrow, 1909. **R., 09,** 1216.
Capt. W. T. Hannum, 1910. **R., 10,** 1340.
Lt. Col. W. C. Langfitt, 1911. **R., 11,** 1439.

OPERATIONS.

1900–01. 452,740 c. y. dr. from Mattawoman Shoal, **01,** 1406.

1901–02. 397,880 c. y. dr. and wreck removed, **02,** 1086.

1902–03. 196,191 c. y. dr., **03,** 1039.

1904–05. 182,833 c. y. dr., **05,** 1154.

1905–06. 33,070 c. y. dr., completing proj., **06,** 1095.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 1419.
Beds of hard gravel and sand in chan. at Mattawoman Shoal, **01,** 1406; **02,** 1086.

PROJECTS.

By Col. Hains, 1891, chan. 24′ x 200′ through all shoals of less than 24′ ruling d. below the city of Washington; est., $158,400, **92,** 1072. Au. act Mar. 3, 1899, and put under continuous contract system, **99,** 1420.
By Maj. Cosby, 1908, chan. of 400′; est., $204,000,[1] **08,** 264.

SURVEYS.

Ex., 1899, by Lt. Col. Allen, **00,** 1706.
Ex. Mattawoman Shoal, **01,** 1406; **02,** 1086.
Ex. at shoals, **05,** 1153; **10,** 1340.
Au. act Mar. 2, 1907; made, 1907–08, by Maj. Cosby,[1] **08,** 264, 1211.
Pre. ex. and sur. au. act Feb. 27, 1911, of Potomac R. at Colonial Beach, Va., with view to proper approach to the landing place (**R.** to come), **12,** 390.
Maps.[1] **00,** 1708; **02,** 1086; **03,** 1038.

Part (c), K-46 Anacostia River, D. C. (Eastern Branch of Potomac River.)

APPROPRIATIONS.

1890,	[2] $20,000,	**92,** 1035.
1902,	150,000,	**02,** 1088.
1907,	127,000,	**07,** 1170.
1909,	*10,000,	**09,** 1220.
1910,	230,000,	**10,** 1343.
1911,	200,000,	**11,** 1445.
1912,	50,000,	**12,** 1664.
Total,	787,000 (incl. misc., $787,500, **12,** 1664).	

COMMERCE.

Trade of branch insignificant; its imp. of but little importance, except in relation to the proposed canal, **76,** 358.
Description of, **99,** 1451.
Of Washington, increasing; present wharf facilities inadequate, **03,** 1041.
Important locally, and nationally on account of navy yard; great increase expected, **04,** 198.
Imp. will admit many vessels of Navy to navy yard, **04,** 1311.
Considerable traffic diverted from Washington Chan. (of Potomac), **05,** 207.
1911, 335,347 t., **12,** 369.
Diagram, **12,** 1666.

CONTRACTS.

1891. F. C. Somers, dr., 17.9¢ c. y., **92,** 1035.

1903. Sanford & Brooks Co., dr. chan., 10.95¢, and trench, 14.75¢ c. y.; C. G. Smith & Son, riprapping, $1.075 c. y., **03,** 1043.

1907. John Miller, dr. trench, 13¢ c. y.; filling behind riprap wall, 18¢ c. y., **07,** 1170. C. G. Smith & Son, furnishing and placing riprap, $1.475 c. y., **07,** 1171. Thomas Banks, removing piles, $2.24¾ each; Maryland Dredging & Contracting Co., dr., soft material, 9½¢, and hard material, 20¢ c. y., **08,** 1217.

1909. Columbia Granite & Dredging Corporation, riprapping, $1.27½ c. y., **09,** 1220.

1910. Sanford & Brooks Co., dr., 15¢ c. y.; Potomac Sand & Gravel Co., riprap st., $1.09 c. y., and cobblest., 39¢ c. y.; Atlantic, Gulf & Pacific Co., dr., 6.89¢ c. y., **11,** 1445.

1912. Sanford & Brooks Co., dr., 5.49¢ c. y.; Columbia Granite & Dredging Corporation, dr. (prices listed), for bldg. st., $1.97 c. y., and for riprap st., $1.27 c. y.; Security Cement & Lime Co., cement, $1.40 bbl., **12,** 1665.

ENGINEERS.

Chief of Engineers. R., 76, 68; **89,** 124; **91,** 146; **92,** 138, 146, 398; **93,** 148; **94,** 138; **95,** 159; **96,** 143; **98,** 192; **99,** 222; **02,** 206; **03,** 200; **04,** 197; **05,** 206; **06,** 218; **07,** 232; **08,** 244; **09,** 252; **10,** 286; **11,** 310; **12,** 367

Boards. Convened, Washington, D. C., May 16, 1892, by S. O. No. 10, to report upon estab. of H. lines in Anacostia R. **R., 92,** 1080. (Col. Craighill, Lt. Col. Elliot, and Maj. Davis.)

In charge:

S. T. Abert, U. S. C. E., 1875. **R., 76,** 355.
Lt. Col. P. C. Hains, 1888–92. **R., 89,** 993.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1035 1064, 1079; **93,** 1265; **94,** 939; **95,** 1217.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1032; (Lt Col.) **99,** 1443; **02,** 1087; **03,** 1040.
Col. A. M. Miller, 1904. **R., 04,** 1310.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1155.
Capt. S. Cosby, 1906–08. **R., 06,** 1096; (Maj.) **07,** 1168; **08,** 1213.
Maj. J. J. Morrow, 1909. **R., 09,** 1217.

*Allotment. [1] H. D. 859, 60th, 1st. [2] Part of $280,000 allotted for Potomac R.

Capt. W. T. Hannum, 1910. **R., 10,** 1341.
Lt. Col. W. C. Langfitt, 1911-. **R., 11,** 1441; **12,** 1661.

Assistants:
J. B. Duncklee, **76,** 356.
J. E. Weyss, Mr. Thompson, **70,** 530.

ESTIMATES. (See Plans and Projects.)

By S. T. Abert, 1875, chan. 8′ d. from Bladensburg to the navy yard, $168,269, **76,** 358. Imp. Eastern Branch between arsenal and navy yard, $157,500, **70,** 534.

LEGAL PROCEEDINGS.

Atty. Gen. of opinion, Sept. 6, 1905, that land embraced in Anacostia Flats belonged to U. S. for public purposes, subject to certain claims, **06,** 1097,

MISCELLANEOUS.

Description of sea wall for retaining dr. material, **08,** 1214.

OBSTRUCTIONS.

Brs. crossing the R., description of; should be remodeled before dr. for a deeper chan., **99,** 1447, 1457.

OPERATIONS.

1891-92. 90,217 c. y. dr., **92,** 1035.
1891-92. Bulkhead and wharf lines estab., **92,** 1080, 1083.
1902-03. 22,692 c. y. dr. and placed in embankment along R., weirs constr., bank protected with 8,767 c. y. riprap, and other work preparatory to filling flats in front of insane asylum, **03,** 1040.
1903-04. 680,346 c. y. dr., embankments raised, and 2 small wrecks removed, **04,** 1310.
1904-05. 423,107 c. y. dr.; 2 wrecks, 80 piles, and timber platform removed, and 3,478 c. y. deposited in embankment, **05,** 1156.
1906-07. 10,590 c. y. dr. from trench, and 2,403 c. y. st. deposited in trench, **07,** 1168.
1907-08. 17,466 c. y. dr. and 12,174 c. y. riprap placed in constr. of sea wall, **08,** 1215.
1908-09. 729,170 c. y. soft and 26,696 c. y. hard material dr., and 3 wrecks and 9 snags removed, **09,** 1217. 4,203 c. y. riprap placed in sea wall, and 60,503 c. y. dr. from trench and placed in embankment, **09,** 1218.
1909-10. 46,484 c. y. dr. for embankments, and 6,333 c. y. riprap used in raising wall foundations, **10,** 1342.
1910-11. 412,488 c. y. dr. and 22 obstr. removed from chan. Results obtained given. Riprap placed in sea-wall foundations and extension of sea wall; 123,639 c. y. excavated from trench for embankment; raising of flats in front of Govt. Hospital in progress, **11,** 1443.
1911-12. 2,215,677 c. y. dr. and obstr. removed from chan.; 31,200 c. y. excavated in cutting off Buzzards Pt.; extension of sea-wall foundations at Giesboro Pt. completed; extension from outfall sewer to Anacostia Br. begun; restoration of sea-wall foundations made; embankment work prosecuted; 1,400 l. f. sea wall completed; drainage work finished; entire proj. 50% completed, **12,** 1663.

PHYSICAL CHARACTERISTICS.

Description of, **76,** 357; **92,** 1065; **94,** 939; **95,** 1217; **99,** 1445. Private lands within the limit of imp., **99,** 1457.
Unsanitary condition of flats along R., **03,** 1041.
Dr. stopped by ice, **04,** 1310.
Max. draft, 21′; range of tide, about 3′, **12,** 369.

PLANS. (See Estimates and Projects.)

By Maj. Michler, removal of obstr. from Eastern Branch, **70,** 530.
By S. T. Abert, 1875, for chan. from Bladensburg to the navy yard, 8′ x 100′ x 21,000′, **76,** 358.
In 1888 Lt. Col. Hains did not consider the Eastern Branch of the Potomac worthy of imp., **89,** 993, 994.

PRIVATE (NAVY DEPARTMENT) WORK.

The Navy Dept. completed in 1892 dr. chan. in ront of the navy yard, 22′ x 100′–200′; cost, $10,000, **93,** 1271.
133,721 c. y. dr. by Q. M. Dept., Navy Dept., and private parties, **08,** 1213. 81,082 c. y. dr. by other depts. and private parties, **09,** 1217.
15,000 c. y. placed in embankments by private parties; old Navy Yard Br. removed by Comrs. of D. C., **10,** 1342.
333,760 c. y. dr. by other depts. of the U. S. and by private parties, up to June 30, 1911, **11,** 310.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Hains, 1891, imp. of Anacostia R. by excavation of a chan. 20′ x 200′ (ultimately to be increased to 24′) from the mouth to the Navy Yard Br., with a basin in front of the yard 20′ x 400′; this chan. to be w. at a reduced d. to 1,000′ as the demands of C. require in the future; total amount of material to be dr., 4,100,000 c. y.; est., $656,000, **92,** 1068.
Lt. Col. Allen est., 1898, $2,194,720 to imp. chan. for needs, **99,** 1456.
Act 1902 au. part of proj. of Lt. Col. Allen, providing for chan. 20′ x 400′ from mouth to navy yard,[1] **02,** 206, 1087.
The existing proj. for this imp. was au. act June 13, 1902; imp. of the portion of Anacostia R. below the Navy Yard Br., by dr. a chan. at least 24′ x 400′, gradually decreasing the d. to 6′ at the bulkhead lines, and depositing dr. material on the adjacent flats to an average elevation of 7′ above low tide, the reclaimed area to be surrounded by an earth embankment to 14′ above low tide, protected by a masonry sea wall, and provided with suitable drainage through the embankment; est., $1,218,525, **04,** 198.

SURVEYS.

By J. E. Weyss and Mr. Thompson. **R., 70,** 530.
Under direction of S. T. Abert, 1875, by J. B. Duncklee. **R., 76,** 355.
Sur. of Anacostia R. (Eastern Branch of the Potomac) au. act Sept. 19, 1890; made, 1891, by Lt. Col. Hains, **92,** 1065.
Sur. au. joint resol. of Congress approv. Apr. 11, 1898; made, 1898, by Lt. Col. Allen (see Projects), **99,** 1449.
Minor, **06,** 1096; **07,** 1169.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 368.
Maps. **03,** 1042; **04,** 1312; **06,** 1096; **09,** 1220; **12,** 1662.

Part (d), K-46 Potomac River, South Branch, W. Va.

ENGINEERS.

Chief of Engineers. **R., 89,** 124.
In charge. Lt. Col. P. C. Hains, 1888. **R., 89,** 994.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 994.

PLANS.

In 1888 Lt. Col. Hains did not consider the South Branch of the Potomac R. worthy of imp., **89,** 995.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Hains, **89,** 994.

[1] H. D. 87, 55th, 3d.

Part (e), K-46 Potomac River, at Lower Cedar Point, Md.

APPROPRIATION.

1910, $13,300, **10,** 1345.

COMMERCE.

Imp. allows SS. of fully 3′ d. draft to land at this port, making it possible for the SS. of the Washington & Baltimore line to trade at this port, **11,** 314.

In 1911, 1,755 t., **12,** 1670.

CONTRACT.

1910. John H. Miller, dr. about 41,000 c. y., 21.9¢ c. y., **11,** 1450.

ENGINEERS.

Chief of Engineers. **R., 08,** 264; **10,** 289; **11,** 313; **12,** 371.

In charge:

Capt. W. T. Hannum, 1910. **R., 10,** 1345.

Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1449; **12,** 1669.

OPERATIONS.

1910–11. 3,870 c. y. dr.; 1 log removed by dr.; hydraulic dr. *Potomac* excavated and deposited on adjacent shores 35,297 c. y.; proj. completed Aug. 27, 1911, **11,** 1449–50.

1911–12. Floating plant constr. or repaired, **12,** 1669.

PHYSICAL CHARACTERISTICS.

Lower Cedar Pt. is a long, narrow point of land projecting into the Potomac R. on left bank, 61 m. below Washington. On s. side of point a spacious wharf is used as a shipping point for a radius of 6 or 7 m., **12,** 371.

Ruling d., 1907, 7′, **12,** 371.

Portions of chan. gradually shoaled until w. was insufficient for navigation, **12,** 371.

PRIVATE WORK.

Chan. previous to 1910 dr. by private parties, **10,** 289.

PROJECT.

By Maj. Cosby, 1907, dr. chan. 10′ x 150′ to Dills Wharf with turning-basin 300′ x 400′; est., $13,300, and $600 an. mainten.,[1] **08,** 264; au. act June 25, 1910, **10,** 289.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907, with view to obtaining greater d. **R.** by Maj. Cosby, July 26, and Dec. 13, 1907; est., $13,300,[1] **08,** 264.

Map.[1] **11,** 1450.

Part (f), K-46 Potomac River, Md., Mt. Vernon Channel.

APPROPRIATIONS.

1879,	$4,000,	**79,** 83, 599.
1880,	3,000,	**80,** 753.
1881,	1,500,	**81,** 946.
1888,	6,000,	**88,** 814.
1890,	2,500,	**90,** 1061.
Total,	17,000	

COMMERCE.

Important, **79,** 599; **86,** 900.

CONTRACTS.

1879. G. H. Ferris, dr., 17¢ c. y., **80,** 752.

1881. National Dredging Co., dr., 12½¢ c. y., **81,** 946.

1882. National Dredging Co., dr., 15¾¢ c. y., **82,** 1005.

1888. F. C. Somers, dr., 11¾¢ c. y., **89,** 999.

1891. F. C. Somers, dr., 11½¢ c. y., **91,** 1253.

ENGINEERS.

Chief of Engineers. **R., 79,** 83; **80,** 112; **81,** 151; **82,** 146; **83,** 152; **84,** 154; **85,** 144; **86,** 139; **87,** 106; **88,** 108; **89,** 125; **90,** 112; **91,** 138; **92,** 138; **08,** 264.

In charge:

S. T. Abert, U. S. C. E., 1879–91. **R., 79,** 598; (U. S. agent) **80,** 752; **81,** 945; **82,** 1003; **83,** 795; **84,** 980; **85,** 962; **86,** 899; **87,** 927; **88,** 813; **89,** 999; **90,** 1061.

Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1252.

Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1038.

Maj. S. Cosby, **08,** 240.

ESTIMATES. (See Projects.)

By S. T. Abert, 1879, dr. chan. 6′–7′ x 150′, $13,800, **79,** 598, 599; for completion of existing proj., $10,000, **79,** 599.

OPERATIONS.

1879–80. 20,379 c. y. dr. from chan. and basin **80,** 753.

1880–81. 21,005 c. y. dr., **81,** 946.

1881–82. 8,118 c. y. dr., **82,** 1005. Chan. 145′ x 7′–9′ completed, **83,** 795.

1888–89. 38,296 c. y. dr., **89,** 999.

1890–91. 12,846 c. y. dr., **91,** 1253.

PHYSICAL CHARACTERISTICS.

A wide flat of soft mud, with 4′ of w., **79,** 598, 599.

PRIVATE WORK.

The Ladies' Mt. Vernon Assn. built a wharf at a cost of $9,000, **79,** 599.

PROJECTS. (See Estimates.)

By S. T. Abert, 1879, for dr. chan. from d. w. in the Potomac to the wharf at Mt. Vernon 7′ x 150′, with a suitable turning-basin at the wharf; est., $14,000, **79,** 598, 599; **86,** 139.

Necessity for further d. in 1886 increased this est. to $17,000, **88,** 814.

In 1888 proj. amended to provide for chan. 9′–10′ x 200′, with a turning-basin of 200′ radius; total cost of amended proj., $26,000, **91,** 1252.

In 1892, after an expend. of $17,000, dimensions of the chan. were considered sufficient for the needs of existing navigation and no further work was recom., **92,** 1039.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1907. **R.** by Maj. Cosby; est., $11,000,[2] **08,** 264.

Maps. **89,** 1000; **90,** 1061.

[1] H. D. 918, 60th, 1st.

[2] H. D. 654, 60th, 1st.

Part (g), K-46 Potomac River, at Alexandria, Va.

APPROPRIATIONS.

1910, $60,000, **10,** 1344.
1911, 56,000, **11,** 1448.

Total, 116,000

COMMERCE.

In 1911, 212,560, **12,** 1669.

CONTRACTS.

1910. Potomac Sand & Gravel Co., retaining wall, 49¢ c. y., est. 6,000 c. y. st.; Sanford & Brooks Co., dr. (300,000 c. y.), 11.75¢ c. y., **11,** 1448.
1911. Sanford & Brooks Co., dr. (300,000 c. y.), 15.6¢ c. y., **11,** 1448.

ENGINEERS.

Chief of Engineers. **R., 09,** 273; **10,** 288; **11,** 312; **12,** 369.

In charge:
Capt. W. T. Hannum, 1910. **R., 10,** 1344.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1446; **12,** 1667.

LEGAL PROCEEDINGS.

Owner of land adjoining upper 400′ of h.-w. line of Battery Cove objected to the boundary line, a barbed-wire fence; referred to Dept. of Justice for settlement, **12,** 1667–68.

OPERATIONS.

1910-11. 4,300 l. f. chan. completed by excavation of 205,781 c. y. deposited in Battery Cove, raising that area to an average elevation of 3½′ above m. l. w.; retaining wall constr. inclosing Battery Cove, 2,730′ l. and containing 8,631 c. y. st.; necessary embankments made for retaining dr. material, **11,** 312, 1446.
1911-12. 332,497 c. y. excavated, and retaining wall and embankments rebuilt where settlement had occurred. The dr. material deposited in Battery Cove reclaimed this area, about 50 acres to a h. of 7½′ above m. l. w. About 7,300′ chan. dr. in front of city. Proj. fully completed, **12,** 370–71, 1667.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 288.

PROJECT.

By Maj. Morrow, au. act June 25, 1910, dr. chan. 24′ x 300′ x 6,700′ over area in front of Alexandria between d. w. of through chan. and a line drawn 20′ outside of the estab. pierhead line; est., $116,000, and $2,000 an. mainten.,[1] **09,** 273; **10,** 288.

SURVEYS.

Pre. ex. au. act Mar. 2, 1907, with view to removal of recently former bar, **08,** 265. **R.** by Maj. Cosby, 1907 and 1908; est., $116,000,[1] **09,** 273.

Part (h), K-46 Alexandria Canal, D. C. and Va.[3] (Canal to Washington.)

APPROPRIATIONS.

1837, $300,000, act Mar. 3.[3]

Part (i), K-46 Alexandria Harbor, Va.

ENGINEERS.

Chief of Engineers. **R., 04,** 217.
Boards. BERH. Reports c. small and local, and that cost of imp. would be expensive, **04,** 1345.
In charge. Lt. Col. Chas. J. Allen, 1904. **R., 04,** 1343.
Assistant. F. C. Warman. **R., 04,** 1345.

PHYSICAL CHARACTERISTICS.

Details, **04,** 1346.

SURVEY.

Pre. ex. au. act June 13, 1902, with view to imp. chan. in Hunting Creek and across the Potomac R. to Maryland. **R.** by Lt. Col. Allen, Dec. 20, 1902, (unfav.;[2] est., over $100,000), **04,** 217, 1343.

Part (j), K-46 Potomac River (channel from Alexandria, Va., to the Maryland side).

ENGINEERS.

Chief of Engineers. **R., 89,** 134.
In charge. S. T. Abert, U. S. agent, 1888. **R., 89,** 1029.

PLANS.

In 1888 S. T. Abert did not consider the locality worthy of imp., **89,** 1029.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert, **89,** 1029.

[1] H. D. 1253, 60th, 2d. [2] H. D. 223, 58th, 2d. [3] H. D. 482, 55th, 2d.

Part (k), K-46 Potomac River, vicinity of Washington, D. C.

APPROPRIATIONS.

1880,	[1] $40,000,	**80,** 751.
1881,	[1] 50,000,	**81,** 944.
1882,	[2] 400,000,	**83,** 794.
1884,	[2] 500,000,	**84,** 978.
1886,	[2] 375,000,	**86,** 887.
1888,	300,000,	**88,** 787.
1890,	[3] 260,000,	**90,** 1040.
1892,	200,000,	**92,** 1037.
1894,	150,000,	**95,** 1215.
1896,	100,000,	**96,** 1031.
1899,	[4] 74,000,	**99,** 1417.
1902,	75,000,	**02,** 1084.
1904,	*50,000,	**04,** 1309.
1905,	50,000,	**05,** 1152.
1907,	258,000,	**07,** 1166.
1908,	25,000,	**08,** 1210.
1909,	*25,000,	**09,** 1214.
1910,	180,000,	**10,** 1339.
1911,	60,000,	**11,** 1437.
1912,	40,000,	**12,** 1660.

Total, 3,212,000 (incl. amts. under Parts A and B, except $150,000 allotment of 1833; less $25,000 allotment of 1908 for tidal gates Potomac R., and incl. misc. rects. of $585.79—$3,389,085.79, **12,** 1660).

COMMERCE.

Imp. R. a cause for a reduction in rates, **96,** 1030; **97,** 1317.

With increased d. more deep-draft vessels would seek port, **03,** 1036.

Deeper draft vessels engaged in trade here; rates much reduced, **05,** 204.

1911, 795,900 t., **12,** 366.

"The work of the project is now about 82 per cent completed and the benefits to navigation and general health of the community derived from the improvement have been most marked. Larger and deeper draft vessels are now engaged in trade and it is understood that freight rates have been materially reduced from those formerly charged. The maximum draft that could be carried June 30, 1912, at mean low water over the shoalest part of the Washington Channel was 24 feet and of the Virginia Channel 17.5 feet. The mean range of tide is about 3 feet. The Potomac River is navigable to the foot of Little Falls, 3½ miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, 113 miles above the mouth of the river, has no draw and limits the navigation of large steamers and masted vessels.

"The principal articles of commerce, in the order of their relative values, are general merchandise, coal, fish, oils, lumber, oysters and clams, sand, and gravel, gasoline, produce, stone, manufactured iron, and steel, melons, crabs and crab meat, fertilizers, laths, canned goods, asphalt, and ice. The receipts and shipments during 1911 amounted to 795,900 short tons and were estimated to be worth $12,-995,447." **12,** 366.

CONTRACTS.

Washington and Georgetown Harbors:

1879. C. G. Fobes & Co., dr., 40¢ c. y., **80,** 747.

1880. National Dredging Co., dr., 14¢ c. y., **81,** 939. Contract annulled, **81,** 940.

1881. National Dredging Co., dr., 24¢ c. y., **82,** 972.

1882. Potomac Dredging Co., dr., 28¢ c. y., **82,** 975.

1883. American Dredging Co., r. removal, **83,** 768.

1884. American Dredging Co., r. removal, **84,** 968. E. R. Lowe, r. removal, **85,** 924.

Potomac River:

1882. P. S. Ross, dr., 21¢ c. y., **83,** 786.

1883. T. P. Morgan, dr. trench, 7¢ c. y., for foundation and 14¢ for ridge, **83,** 789. H. P. Gilbert, riprap st., 74½¢ c. y., **83,** 789. S. T. Thomas and J. A. Blundon, brush, $8.20 and $2.50 cord, resp., **83,** 790. J. T. Summers, flatboat constr., **83,** 790. F. C. Somers, dr. along slope wall of Potomac Flats and deposit of material behind same, 11¢ c. y., **84,** 974. J. Taylor, filling, 24¢ c. y., **84,** 974, 975. Contract closed before completion, **84,** 974. T. P. Morgan, filling, 21¢ c. y., **84,** 975.

1884. Potomac Red Sandstone Co., riprap, 87¢ c. y., **84,** 974, 975. Benson & McNee, dr., 12.37¢ c. y., **85,** 928. D. E. Culver, dr. and embankment foundation, 11½¢ c. y., **85,** 930. F. C. Somers, dr. and embankment foundation, 10⅝¢ c. y., **85,** 930.

1885. G. Vanderwerken, riprap, 85¢ c. y., **85,** 933. Benson & McNee, dr., 15¢ c. y., **85,** 934.

1886. F. C. Somers, dr., 10⅝¢ c. y., **87,** 890. G. Vanderwerken, riprap st., 83¢ c. y., **87,** 891. Benson & McNee, dr., 15¢ c. y., **87,** 891. H. Wilson, dr., 10¢ c. y., **87,** 892. R. Moore, dr., 13¢ c. y., **87,** 893.

1887. T. W. Smith, lumber; American Improved Cement Co., cement; J. Miller, sand and pebbles; Atcheson Bros., iron, **87,** 896. Nolan & Son, masonry constr., **87,** 897.

1888. F. W. Smith, lumber, $34.50 per M f., b. m.; D. H. Shoemaker, broken st., $1.40 to $1.55 c. y.; E. E. Burroughs, sand, 75¢ c. y., and pebbles, $1.20 c. y.; C. S. Beebe, piles, 7¢ l. f., **88,** 788, 789.

1889. H. Wilson, dr., 11½¢ c. y.; T. P. Morgan, dr., 22¢ c. y., **89,** 987. California Hydraulic Dredging & Reclamation Co., dr., 12½¢ c. y., **89,** 988.

1890. J. H. McGill, cement, $2.34 barrel; F. C. Somers, dr., 20¢ c. y., **90,** 1041.

1891. F. C. Somers, dr., 17.9¢ c. y.; W. H. Mohler, building st., $1.70 c. y.; F. C. Somers, dr., 15½¢ c. y., **91,** 1251.

1892. San Francisco Bridge Co., dr., 14¢ c. y. ($112,000), **93,** 1272. G. J. Simpson, gravel, 46¢ c. y. ($2,300), **93,** 1273 (material purchased in open market by U. S. at contractor's expense at 60¢ c. y., **94,** 933); riprap st., 72¢ c. y. ($14,400), **93,** 1273 (purchased in open market by U. S. at contractor's expense at 90¢ c. y., **94,** 935).

1894. New York Dredging Co., dr., 9¢ and 16½¢ c. y. ($59,875), **95,** 1216. C. G. Smith & Son, building st., $1.48 c. y. ($17,760), **95,** 1216. E. G. Gummel, riprap st., 69¢ c. y. ($7,590), **95,** 1216.

1897. A. M. Clegg, dr., 10⅝¢ c. y. ($57,375), **97,** 1320; new contract made after Comptroller's decision that no contract existed between this contractor and the U. S. annulled May 9, 1900, **00,** 1702.

1900. Atlantic, Gulf & Pacific Co., dr. Virginia Chan., 12.8¢, and Washington Chan., 14.8¢ c. y., **01,** 1404.

1903. Atlantic, Gulf & Pacific Co., dr. Virginia Chan., 12.6¢, and Washington Chan., 15¢ c. y., **04,** 1309.

1904. Atlantic, Gulf & Pacific Co., dr., 13.9¢ c. y., **05,** 1153.

1905. Atlantic, Gulf & Pacific Co., dr., 14.6¢ c. y., **06,** 1094.

1907. Maryland Dredging & Contracting Co., dr. tidal reservoir, 9½¢, Virginia Chan., 10¢ c. y.; Carter & Clarke, furnishing piles, 9¢ l. f., and driving piles, 5½¢ l. f., **08,** 1210.

1908. Potomac Granite Co., broken st., $1.34 c. y.; J. B. Kendall, reinforcing steel, $0.0172 lb.; L. E. Smoot, gravel and sand, 65¢ and 40¢, resp., c. y.; National Mortar Co., cement, $1.47½ bbl., **09,** 1215.

1909. Columbia Granite & Dredging Corporation, building st., $2.20 c. y., **09,** 1215. G. & W. Mfg. Co., furnishing and installing lock and curtain gates and operating mechanism, $8,997, **09,** 1216.

1910. National Mortar Co., cement, $1.37 bbl.; Columbia Granite & Dredging Corporation, build-

*Allotment.

[1] Washington and Georgetown Hs.

[2] Potomac R.

[3] Part of $280,000, $20,000 of which was allotted to Anacostia R.

[4] Part of $100,000, $26,000 of which was allotted for Potomac R. below Washington.

ing st., $2.20 c. y., **10,** 1340. Atlantic, Gulf & Pacific Co., dr. 1,500,000 c. y., 7.89¢ c. y., **11,** 1438.

1911. Washington Stone Co., riprap on training dike (20,000 c. y.), 93¢ c. y., **12,** 1660.

ENGINEERS.

Chief of Engineers. R., 80, 111, 158; **81,** 150, 154; **82,** 145, 980; **83,** 149, 150; **84,** 151, 152; **85,** 139, 140, 938; **86,** 135, 136; **87,** 102; **88,** 104; **89,** 121; **90,** 108; **91,** 135, 146; **92,** 136, 147; **93,** 148; **94,** 135; **95,** 157; **96,** 141; **97,** 175; **98,** 178; **99,** 206; **00,** 234; **01,** 273; **02,** 203; **03,** 197; **04,** 194; **05,** 203; **06,** 215; **07,** 229; **08,** 240; **09,** 248; **10,** 282; **11,** 306; **12,** 364.

Boards:

Convened, Feb. 18, 1882, by S. O. No. 129, C. of E., to report upon imp. Potomac R. at Washington, the raising of the flats in front of the city, and the estab. of H. lines. **R., 82,** 987. (Lt. Cols. Gillmore, Craighill, and Comstock, and Capt. Turtle.)

Reconvened, New York, Oct. 13, 1884, by S. O. No. 124, to report upon proposed modification of plan of imp. as submitted by Maj. Hains, **85,** 941. (Col. Gillmore and Lt. Cols. Comstock and Craighill.)

In charge:

S. T. Abert, U. S. agent, 1875–83. **R., 80,** 745; **81,** 937; **82,** 969, 980.

Maj. P. C. Hains, 1883–92. **R., 83,** 763, 770; **84,** 965, 970; **85,** 923, 926; **86,** 879, 881; **87,** 884; (Lt. Col.) **88,** 777, 782; **89,** 983; **90,** 1037, 1042, 1045; **91,** 1246; **92,** 1070.

Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1030; **93,** 1265; **94,** 925; **95,** 1203.

Lt. Col. C. J. Allen, 1896–1903. **R., 96,** 1017; **97,** 1313; **98,** 1183; **99,** 1413; **00,** 1702; **01,** 1399; **02,** 1081; **03,** 1035.

Col. A. M. Miller, 1904. **R., 04,** 1306.

Lt. Col. S. S. Leach, 1905. **R., 05,** 1150.

Capt. S. Cosby, 1906–08. **R., 06,** 1092; (Maj.) **07,** 1163; **08,** 1205.

Maj. J. J. Morrow, 1909. **R., 09,** 1209.

Capt. W. T. Hannum, 1910. **R., 10,** 1335.

Lt. Col. W. C. Langfitt, 1911. **R., 11,** 1433; **12,** 1657.

Assistant. L. R. Grabill. **R., 92,** 1074.

LEGAL PROCEEDINGS.

The Supreme Court of the D. of C., 1895, declared null and void claims of about 40 persons to ownership of Kidwells Meadows and land at Long Br., and granted damages to several whose land was condemned for U. S., **96,** 1023.

Decision in Potomac Flats case given, 1898–99, sustained the claims of the U. S. and removed all obstacles to continuation of the imp., **99,** 1415. Proceedings to stop unau. occupation of Potomac Park, **00,** 1704.

LEGISLATION.

Congress in 1897 set aside the reclaimed flats of the Potomac R. for a public park, **98,** 1189; **99,** 1416; **00,** 1702.

MISCELLANEOUS.

Description of combined inlet gates and br., **09,** 1211.

OBSTRUCTIONS.

Long Br. at Washington considered a menace to the navigation of the R. Special **R.** on, **93,** 1274.

Navigation limited by Aqueduct Br. at Georgetown, **03,** 197.

OPERATIONS.

Washington and Georgetown Harbors:

1879–80. Washington Chan., 90,744 c. y. dr.; Georgetown Chan., 159,979 c. y. dr., **80,** 747, 748.

1881–82. Washington Chan., 240,111 c. y. dr.; Georgetown Chan., dr. under contract of 1882 commenced.

1883–84. 490 c. y. r. blasted and removed, **84,** 968.

1884–85. Removal of rs. designated as "K" and "O" completed, **85,** 924.

1885–86. Rock groups designated as "L," "M," "N," "F," and "C" removed, **86,** 879, 880.

Potomac River:

1882–83. 200,000 c. y. dr. and deposited upon the flats; 13,000 l. f. railroad built, equipped, and put into operation; 5,000 l. f. of trench completed; constr. and placing of mattress commenced by hired labor, **83,** 787–791.

1883–84. 1,136,531 c. y. dr. and deposited upon flats; 8,000 l. f. slope revet. foundation laid; 100,945 c. y. dr. and deposited in embankment; 6 acres of the flats filled; 763 c. y. st. deposited in slope wall, **84,** 153, 970–975.

1884–85. 1,207,000 c. y. excavated under all the dr. contracts, **85,** 140, 928–934.

1885–86. 1,686,183 c. y. dr. and deposited on the flats, **86,** 136, 882.

1886–87. Progress on constr. of reservoir outlet and embankment; 1,081,567 c. y. dr. and deposited on the flats, **87,** 885, 887.

1887–88. 1,192,112 c. y. dr. from R. bed and deposited upon the flats; excavation of tidal reservoir continued, and cofferdam built and placed, **88,** 779, 781.

1888–89. Dr. in Washington Chan. continued; embankments maintained along margin of the fill, and constr. of the reservoir outlet resumed, **89,** 984.

1889–90. Masonry of reservoir outlet completed and cut dr. through Virginia Chan. bar, **90,** 1039.

1890–91. 5,100 l. f. of dry st. wall built; erection of embankments along margin of reclaimed flats, **91,** 1247.

1891–92. 8,740 l. f. of st. sea wall built; 352,027 c. y. dr. from the Virginia Chan.; dr. continued in the Washington Chan.; 90,217 c. y. dr. from Anacostia R. Chan.; reservoir outlet and wing walls completed, **92,** 1033–1035.

1892–93. 4,450 l. f. sea wall built; 109,137 c. y. dr. from Virginia Chan., and 7,280 c. y. st. placed in dike on w. side of Virginia Chan., **93,** 268; 27,693 c. y. dr. from Washington Chan., **94,** 933.

1893–94. 7,205 l. f. sea wall built, 497,327 c. y. dr. from Washington Chan., 168,611 c. y. dr. from tidal reservoir, 146,004 c. y. dr. from Virginia Chan., and 2,922 c. y. st. placed in training dike on w. side of Virginia Chan., **94,** 934, 935.

1894–95. 202,483 c. y. dr. from Virginia Chan., 221,742 c. y. dr. from Washington Chan., 1,300 l. f. sea wall built at tidal reservoir, and training dike extended 800 l. f., **95,** 1211.

1895–96. 6,240 l. f. sea wall built and the training dike extended 190′, **96,** 1029.

1896–97. Table of quantities of material dr. since 1882, **97,** 1317; 527 l. f. sea wall built, 35,289 l.f. total to date, and wall around tidal reservoir completed, 2,730 l. f. of old sea wall repaired, **97,** 1317.

1897–98. Table of quantities of material dr. since 1882, **98,** 1188; 12,554 c. y. dr. from Virginia Chan., 2,780 l. f. of old sea wall relaid, **98,** 1188.

1898–99. 119,667 c. y. dr. from Virginia Chan.; wharf at Easbys Pt. extended to d. w., **99,** 1415.

1899–00. Minor work of repair and mainten., **00,** 1702.

1900–01. 107,245 c. y. dr. from Washington Chan., 173,918 c. y. from Virginia Chan., and minor works of imp. at Potomac Park, **01,** 1400.

1901–02. 390,657 c. y. dr. from Virginia Chan., and other work of repair and mainten., **02,** 1082.

1902–03. New storehouse built, fence rebuilt, brush, etc., cut, and other works of mainten., **03,** 1035.

1903–04. 83,086 c. y. dr. from Washington Chan., 406,448 c. y. from Virginia Chan., and minor works of mainten., **04,** 1306.

1904–05. 319,375 c. y. dr. and 770 l. f. sea wall relaid, **05,** 1150.

1905–06. 1,386 l. f. sea wall relaid, embankment built, fence erected, and other minor work of repair and mainten., **06,** 1092.

1906–07. 277,826 c. y. dr. from Washington Chan., wharf repaired, sunken piles removed, and st. for repair of sea wall stored in park, **07,** 1164.

1907–08. 556,396 c. y. dr. from tidal reservoir and 256,057 c. y. from Virginia Chan., **08,** 1206. Tidal gates of reservoir repaired and foundation dr. for inlet gate and br., **08,** 1207. 8 wrecks and 19

logs, snags, etc., removed from tidal reservoir, **08,** 1208.

1908-09. 153,582 c. y. dr. from tidal reservoir. 275,588 c. y. from Virginia Chan., 4,970 c. y. from Washington Chan., and 11 wrecks, 22 snags, etc., and riprap mound removed from reservoir, and hard gravel lump from Virginia Chan., **09,** 1209. Combined inlet gates and br. almost completed, except lock, curtain and automatic gates; 497′ sea wall built, and 290′ rebuilt at inlet gates, **09,** 1212. 100′ sea wall built across old sewer canal, other sea walls repaired, and 1,100′ rebuilt along Washington Chan., **09,** 1213.

1909-10. 117′ sea wall built, 225′ raised and rebuilt, and all other work at inlet gates and br., except lights, completed, **10,** 1336. 6,402 l. f. sea wall around park repaired or rebuilt, **10,** 1336. Wharf, storehouse, etc., moved from Easbys Pt., **10,** 1337.

1910-11. 1,365,562 c. y. dr. and deposited upon sec. 3 of Potomac Park, raising the latter to 11′ above m. l. w.; constr. of embankment completed; tearing down, rebuilding, and repairing old sea wall completed Oct. 27, 1910; raising sea wall fronting on Washington Chan. begun; training dike in Virginia Chan. restored to its proj. height; outlet gates of tidal reservoir overhauled, and floating plant repaired, **11,** 1434–35.

1911-12. 453,552 c. y. dr. from Washington Chan. and deposited on sec. 3 of Potomac Park; mainten. work consisting in redr. in Washington Chan., in repairing and rebuilding 2,700 l. f. of sea wall and 3,584 l. f. of training dikes; repairs made to inlet and outlet gates for tidal reservoir; building and repairing floating plant, **12,** 1658.

PHYSICAL CHARACTERISTICS.

Flood of Feb., **81,** 940.

Cross sections of Potomac R. between Aqueduct Br. and Arsenal Wharf, **82,** 982.

Velocity observations, **82,** 983.

Potomac R. front, **82,** 992.

Description of R., **83,** 781. Long Br., **83,** 783. Sewer canal, **83,** 791. Lakes, **83,** 792. Sluice gates, **83,** 793.

Description of condition of the R. prior to imp., **88,** 778; **89,** 984; **93,** 1265; **94,** 925; **95,** 1203; **96,** 1017.

Freshet of June 2, 1889, **89,** 985.

In the winter of 1892 the ice in the R. was from 12 to 14 inches thick, **93,** 1069.

Areas of the reclaimed lands of the Potomac, **93,** 1270; **94,** 929; **95,** 1207; **96,** 1021; **97,** 1316; **98,** 1188; **99,** 1415.

Shoaling of dr. areas, **99,** 1414.

Severe winter weather, effect of, on R., **99,** 1414.

Description of Potomac Park, **01,** 1401.

Description of, **01,** 273.

Ice, **04,** 1306; **05,** 1150.

Dr. material from time to time placed upon the R. flats by private parties without cost to the U. S. and by U. S. under contracts, reclaiming area of 628 acres by above operations (incl. reservoir of 739 acres); declared public park named Potomac Park, and turned over "Public Buildings and Grounds," and by them developed into one of the most beautiful parks of U. S., **11,** 307, 308.

Virginia Chan. 20′ x 500′ x 4 m., **12,** 366.

Washington Chan. 24′–26′ x 400′ x 2¾ m., and 18′–20′ x 350′, **12,** 366.

Freshet accretion, **12,** 366.

PLANS. (See Projects.)

Description of these considered by BE. of 1882, **82,** 988, 995, 996.

Special **R.** by Lt. Col. Hains on separating the wagon road from the RR. on the n. side of main chan. of the Potomac R., **90,** 1042. Also as to the most suitable kind of br. from foot of New York Ave. across the Potomac R. to Arlington, **90,** 1045.

By Lt. Col. Hains, 1891, chan. 24′ x 200′ l. t. through 5 bars up to Georgetown; est., $300,000, **92,** 1072.

PRIVATE (CORPORATE) WORK.

The Baltimore & Potomac RR. Co. in 1892–93 partly repaired Long Br. on plans approv. by Sec. of War, **93,** 1270; repaired again, 1895, **95,** 1214.

15,000 c. y. material dumped in Potomac Park by private parties, **01,** 1402; 35,000 c. y., **02,** 1083; 11,000 c. y., **03,** 1036; 7,000 c. y., **04,** 1307; 16,000 c. y., **05,** 1151; 34,000 c. y., **06,** 1092; 150,000 c. y., **07,** 1164; 90,000 c. y., **08,** 1208; 200,000 c. y., **09,** 1212; 5,600 c. y. earth in sec. 3, Potomac Park, **11,** 1435.

Removal of Long Br. by Balto. & Potomac RR. Co. completed, **08,** 1207.

PROJECTS. (See Plans.)

Washington and Georgetown Harbors:

In 1833 app. of $150,000 made for removal of obstr. in Potomac R., the purchase of Little Falls Br., and the constr. of a turnpike road, **79,** 591.

In 1870 it was proposed to secure 16′ at l. w. to Georgetown and along the wharves of the Washington H. from Arsenal Pt. to Long Br., and the removal of the most dangerous obstr. in Georgetown H., **70,** 534; **71,** 592, 595; **83,** 776; **86,** 135.

1882, imp. merged in that of the imp. of the Potomac R. at Washington, **82,** 990, 992.

Potomac River:

1882, BE. recom. w. and d. of the chans. between Giesborough Pt. and Easbys Pt., so as to accommodate largest vessels that could reach the former locality; the reclamation of the flats and marshes along the city front, between Easbys Pt. and the Arsenal, by depositing thereon material dr. from the chans.; the estab. of H. lines beyond which wharves should not be built; the removal or rebuilding of Long Br.; the interception of sewage discharged into the navigation chan., and its conveyance to James Creek; est., $2,500,000, **82,** 990; **83,** 780.

1883, est. increased to $2,716,365, **83,** 794.

In 1885 Maj. Hains proposed modification of height of filling over reclaimed areas below Long Br., and the omission of the surrounding levee and drainage system; also constr. of tidal reservoir for flushing the canal sewer, **85,** 939. Approv. by BE., 1885, **85,** 942.

In 1891, $881,365 est. as required for completion of the imp., **91,** 1249.

By Lt. Col. Allen, 1896, dr. above Long Br. to 20′ at l. t., dr. material to be deposited on secs. 1 and 2, and for w. natural chan. below the br., with 20′ at l. t., **97,** 1316.

In 1897 Lt. Col. Allen est. cost of 1882 should be increased by $236,655, on account of shrinkage and settlement, **97,** 1318.

Lt. Col. Allen est., 1901, dr. chans. to 24′ would increase cost of imp. $592,000, **01,** 1401.

Lt. Col. Allen recom., 1901, preparation and adoption of definite plans for imp. of Potomac Park, for sake of economy and facility in disposing of dr. material from public and private work, **01,** 1402.

Lt. Col. Allen est., 1901, $5,000 an. mainten. of Potomac Park, **01,** 1403.

SURVEYS.

Au. act Mar. 3, 1881; made, 1881, by S. T. Abert, **82,** 980.

Of Virginia Canal, 1882, **82,** 974.

Of Potomac R. between Aqueduct Br. and Giesborough Pt., 1882, **82,** 980.

Ex. and borings for site of sluice gates, **86,** 885.

Sur. of the Potomac R. up to Washington au. act Sept. 19, 1890; made, 1891, by Lt. Col. Hains, **92,** 1070.

Ex. by Maj. Davis, 1894, of the chan. dr. over the bar in 1892, **94,** 934.

Sur. of the bar at Long Br. made, 1896, by Lt. Col. Allen, **97,** 1316.

Of chans. and part of park, **06,** 1092.

For H. lines at Georgetown, D. C., **10,** 1337.

Maps. **80,** 750; **81,** 944; **83,** 794; **84,** 978; **85,** 938; **86,** 886; **87,** 890; **88,** 782; **89,** 986; **90,** 1038; **91,** 1248; **92,** Atlas, 17; **94,** 938; **95,** 1216; **96,** 1030; **97,** 1320; **98,** 1190; **99,** 1418; **00,** 1704; **01,** 1404; **02,** 1084; **03,** 1036; **04,** 1308; **06,** 1094; **09,** 1216.

Part (l), K-46 Washington and Georgetown Harbors, D. C.[1]

APPROPRIATIONS.

1833,	[2] $150,000, **79,** 591.
1873,	50,000, **73,** 73, 767; **74,** 83, ii, 26.
1878,	50,000, **78,** 70, 507; **79,** 82.
1879,	50,000, **79,** 82, 598
Total,	300,000

CONTRACTS.

1874. W. H. Beard, dr., **75,** ii, 112.
1878. H. P. Gilbert, dr., 20¢ c. y., **78,** 502. Brainerd & Rice, dr., 9½¢ c. y.; annulled, **79,** 594, 595.
1879. George C. Forbes & Co., dr., 13$\frac{3}{10}$¢ c. y., **79,** 595.

DOCUMENTS. (Not published in reports.)

R. of Board of Sur., S. D. 15, 42d Cong., 3d sess., **73,** 73, 766; **74,** 83, ii, 25; **75,** 91.

ENGINEERS.

Chief of Engineers. R. (1867–72, see Potomac R.), **73,** 73; **74,** 83; **75,** 91; **76,** 66; **77,** 63; **78,** 70; **79,** 82.

Board of Survey. Appointed, 1872, to consider the subject of the imp. of the Potomac R. **R.,** S. D. 15, 43d Cong., 3d sess., **73,** 73, 766; **74,** 83, ii, 25; **75,** 91, ii, 111; **76,** 345.

In charge:
Maj. N. Michler, 1867–70; Maj. Wm. P. Craighill, 1870–72; see Potomac R.
Maj. W. P. Craighill, 1873–75. **R., 73,** 766; **74,** ii., 25.
S. T. Abert, U. S. C. E., 1875–83. **R., 75,** ii, 110; **76,** 343; **77,** 351; **78,** 501, 508; **79,** 591.

Assistant. Lt. T. Turtle, **73,** 767; **74,** ii, 26.

ESTIMATES.

By Board of Sur., aggregate for thorough imp., $6,050,000, **75,** ii, 111.
By S. T. Abert, Easbys Pt., land damages, $62,411; imp., $870,002; total, $932,413. Analostan Isld., land damages, $2,300; imp., $878,348; total, $879,648; contingencies, etc., $90,603. Grand total, $1,902,664, **75,** ii, 116, 119. Georgetown Chan. $42,233 for chan. 18′ x 250′, **77,** 63, 357.
For modified proj., 1878, viz, for a 20′ and 15′ d. of chan., to be obtained by dr., slope protection, cribwork, etc.; aggregate, $2,592,000, **78,** 505, 506, **79,** 597.
For completion, 1879, of existing projs., $2,592,000, **79,** 598.

OPERATIONS.

1874–75. Chan. 15′–16′ x 200′ cut through the bar above and below Long Br., **75,** 91; 146,381 c. y. dr., **75,** ii, 113.
1875–76. 336 c. y. r. removed by hired labor, **76,** 66, 334.
1876–77. Removing r. by hired labor continued; 522 c. y. removed, **77,** 63, 351–356.
1877–78. Small balance of funds available expend. in dr., **78,** 70, 502.
1878–79. Dr. in Washington and Georgetown Chans. continued, **79,** 82, 595, 596.

PHYSICAL CHARACTERISTICS.

General description, **75,** ii, 111, 112; **76,** 345; **78,** 501.

PLANS. (See Estimates and Projects.)

By Board of Sur. (see Mis. S. Doc. 15, 42d Cong. 3d sess.), **73,** 73, 766; **75,** 91, ii, 111; **78,** 502.

PRIVATE AND CORPORATE WORK.

Temporary chan. dr. by coal shippers and merchants, 1878, **78,** 70, 502.

PROJECTS. (See Estimates and Plans.)

By Maj. Craighill, dr. to d. of 14′ in the Virginia Chan. and 12′ along the Washington front as high as Seventh St., **73,** 73, 767.
By S. T. Abert, dr. the Virginia Chan. below Easbys Pt. and below Giesboro Pt. to 15′, **75,** 111, 112. Modification of proj. of Board of Sur. in 1878 for a 20′ and 15′ chan. by dr., slope protection, cribwork, etc., **78,** 70, 505, 506; **79,** 596, 597.

SURVEYS.

1873. By Lt. Turtle, under direction of Maj. Craighill, **73,** 767; **74,** ii, 26.
1878. By S. T. Abert, **78,** 504.

Part (m), K-46 Potomac River to Baltimore, Md. (Canal).[3]

Part (n), K-46 Juniata to the Potomac River (for canal).[4]

Part (o), K-46 James Creek Canal, D. C.

ENGINEERS.

Chief of Engineers. R., 88, 107.
In charge. Lt. Col. P. C. Hains, 1887. **R., 88,** 807.

PHYSICAL CHARACTERISTICS.

Description of; empties into Anacostia R., D. C., **88,** 807.

PLANS.

By Lt. Col. Hains, 1887, filling in low areas, and constr. retaining walls, vicinity of Washington Barracks; est., $226,270 to $514,000, **88,** 809, 811.

SURVEY.

Sur., 1887, by Lt. Col. Hains (see Plans), **88,** 807. Maps. **88,** 810.

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[1] Sur.—**R.,** Nov. 24, 1849. (H. D. 482, 55th, 2d.)
[2] For enlarging and deepening cut below Georgetown; for road to District line on Va. side of river; and for purchase of bridge over Little Falls; with proviso that road and bridge should be free, and be kept in repair by Georgetown forever. Act Mar. 2, 1833.
[3] Sur.—**R.,** June 25, 1827; est., $2,980,815.40. (H. D. 482, 55th, 2d.)
[4] Ex.—**R.** (indefinite), Mar. 30, 1826. (H. D. 482, 55th, 2d.)

Part (p), K-46 Chesapeake and Ohio Canal (including survey for extension).[1]

APPROPRIATIONS.

May 24,	1828,	[2] $1,000,000
	1873,	[3] 5,000
	1874,	[4] 10,000
Total,		1,015,000

COMMERCE.

Important, **74,** 512, 547.

Tax on coal by RR. and possible saving by canal, **74,** 512. Coal fields of Pa., capacity of, **74,** 547.

Dimensions of boats on Chesapeake & Ohio Canal, **74,** 535. Effect of small tunnel sections on traffic and transit, **76,** ii, 79.

Rate of travel on canals, **74,** 535. Steam power must finally be used, **76,** ii, 81.

Coal and iron interests desire slack-water navigation to Connellsville, **76,** ii, 84.

Local extension of canal from Cumberland via n. branch of Potomac to Savage R. justified by value of coal interest, **74,** 544; **76,** ii, 88.

Comparison with third subdivision (central route) of transportation routes to the seaboard, **77,** 678.

ENGINEERS.

Chief of Engineers. R., 73, 60; **74,** 67; **75,** 73; **76,** 90.

Boards. "Board of internal imp.," 1826. Discussion of routes ex. between the N. Branch of the Potomac R. and the Ohio at Pittsburgh, **74,** 514. Consideration of Savage R. and Deep Creek route, **74,** 516, 528. Of continuation via valleys of Youghiogheny and Monongahela Rs., **74,** 525. Of a passage of the Alleghanies, via Wills Creek route, **74,** 524, 529, 537. Comparison of, with Savage R. route, **74,** 532, 533. Adoption of Wills Creek route, **74,** 474, 531, 533. Attempt to deflect line from valley of Youghiogheny at Briery Mountain, **74,** 525, 526. Inadmissible, **74,** 533.

Location of line from tidewater on the Potomac to Pittsburgh (341 m.), **74,** 536. Discussion of canal sections and est. (see Plans), **74,** 534. Cost, $22,375,427, **74,** 543. Division of line into e., middle, and w. sections, **74,** 513. Final conclusion and recom. that route and general plan (see Projects) be adopted for w. and e. sections, submitting expediency of making surs., and investigations as to comparative merits of RR. or canal for middle section, **74,** 543.

Consideration of a subdivision of e. section, to wit, from mouth of Savage R. to Cumberland, for the purpose of reaching coal fields at Savage R., **74,** 544.

(Col. Barnard and Maj. Totten. Capt. Poussin and W. Howard, assistants to board.)

In charge. Maj. W. E. Merrill, 1874–76. **R., 74,** 493, 550; **75,** 769; **76,** ii, 58.

Assistants:

T. S. Sedgwick (in charge of sur.), **74,** 493; **75,** 770; **76,** ii, 59. **R., 74,** 500, 550; **76,** ii, 96.

C. L. Fulton, **74,** 502.

F. W. Frost, **74,** 502.

ESTIMATES. (See Plans and Projects.)

By board of internal imp., 1826, canal from Georgetown (Potomac R.) to Pittsburgh (Ohio R.); from Georgetown to Cumberland (now built), $8,177,081; from Cumberland to Castleman R. (Wills Creek route), $10,028,123; from Castleman R. to Pittsburgh, $4,170,224; total, $22,375,428, **74,** 503, 543.

NOTE.—From Cumberland to Connellsville, $11,543,559, **74,** 511. Revision of est. by board of civil engineers (1826), reducing est. of e. section (Georgetown to Cumberland) to $4,330,992. Afterwards built, and cost, with modifications, $11,071,176, **74,** 504.

Preliminary est. of T. S. Sedgwick, 1874, Cumberland (via Savage R. route) to Connellsville, $20,268,085, **74,** 507, 510; increased by Maj. Merrill to $23,133,585, by extending terminus of canal to McKeesport, **74,** 497; if inclined planes be used at designated points, **74,** 553, the est. would be reduced $2,246,279, **74,** 554.

Revision of foregoing by Maj. Merrill, increasing canal section to that of present Chesapeake & Ohio Canal, $28,801,313, **74,** 498. Final est. (1875) of recom. route from Cumberland, via Wills Creek and Castleman R. and Youghiogheny R., to Connellsville, thence by slack-water navigation to McKeesport (mouth of Youghiogheny).

Canal proper, as per T. S. Sedgwick, $21,176,795, **76,** ii, 88, 102, 114; Summit reservoir (approx.), $600,000, **76,** ii, 87, 88; addl. cost of inclined planes, $1,134,000, **76,** ii, 82, 88; addl. cost of new terminus, Connellsville, $75,245, **76,** ii, 86, 88; total cost to Connellsville, $22,986,040, **76,** ii, 88; add slack-water navigation from Connellsville to McKeesport, $1,254,040, **76,** ii, 87, 88; grand total, $24,240,080.

By board of internal imp., 1826, for local extension of Chesapeake & Ohio Canal, Cumberland to mouth of Savage R. (via n. branch of Potomac), $1,794,964, **74,** 544.

By T. S. Sedgwick, 1875, same route, $2,656,558, **76,** ii, 89, 123; if to mouth of Georges Creek (omitting upper 2 m. of foregoing), $2,238,244, **76,** ii, 89.

Of cost of completing detailed surs., $20,000, **75,** 771.

PHYSICAL CHARACTERISTICS.

Divide between n. branch of Potomac R. and Monongahela R., **74,** 494, 500, 513, 545.

Savage R. and tributaries, discharge of, **74,** 519; elevation of points on, **74,** 494; **76,** ii, 123.

N. branch of Potomac R., elevation of; headwaters of, **74,** 495, 502; **76,** ii, 123; rate of descent, **74,** 502.

Monongahela R., **74,** 525.

Youghiogheny R., elevation of points on, **74,** 521; **76,** ii, 86, 114; of the Narrows (Pyle Falls), **76,** ii, 83.

Distances from tide water (Potomac) to Pittsburgh, **74,** 527.

Distances and elevations of points on proposed extension **76,** ii, 114, 123.

Rainfall of valley of Ohio and tributaries, **74,** 507 520, 523, 532; **76,** ii, 100; ratio collectible, **74,** 507, 532, 538; **76,** ii, 100.

Geological strata pierced by summit tunnel, **74,** 511.

Quantity of coal in basin traversed by proposed canal, **74,** 512; geological report on Somerset coal basin, **74,** 545.

PLANS. (See Estimates and Projects.)

By board of internal imp., 1825, for canal (in passage of Allegheny Mountains) from mouth of Savage R. (n. branch of Potomac) via Crabtree Creek and Deep Creek, to Youghiogheny R., part of a general proj. to connect tide water of Potomac with Ohio R., **74,** 494; discussion and consideration of, **74,** 513; length of summit tun., 1.33 m., **74,** 494, 518, 528; distance, 41 m.; lockage, 2,388', **74,** 524, 529; summit level to be supplied by reservoirs, **74,** 522.

In 1826 a better crossing of the Allegheny Mountains was determined, via Wills Creek and Castle-

[1] Ex.—**R.,** (fav.), Feb. 3, 1825; report (indefinite), Dec. 1, 1833. Sur.—**R.,** Oct. 23, 1826; est., $22,375,427.69. (H. D. 482, 55th, 2d.)

[2] For 10,000 shares of the capital stock of the canal company. (Treas. Doc. 373, 1882.)

[3] (Exploration), **74,** 493. See Transportation Routes to Seaboard, in Finding List at back of this Index.

[4] Allotment, continuation of sur., **75,** 73; **76,** ii, 59.

man R. (see Projects), causing the abandonment of Savage R. and Deep Creek route, **74,** 494, 500, 529.

By T. S. Sedgwick, 1874, for extending Chesapeake & Ohio Canal from Cumberland, via n. branch of the Potomac, Savage R., and Blue Lick, thence by tun. to Castleman R., thence following Castleman and Youghiogheny Rs. to Connellsville, **74,** 494, 496, 500, 510; length of canal, 127½ m., **74,** 510; of summit tun., 5 m., **74,** 494, 497, 505, 509; dimensions of, **74,** 509; summit level supplied from Castleman R., **74,** 504, 506, 510; section of canal, 5 x 33′ x 48″; dimension of locks, 8′ x 15′ x 100′, **74,** 498, 504, 507; at designated places subsequent consideration suggested use of inclined planes in place of locks (see Projects), **74,** 498, 550; est. cost of plan, $20,268,085, **74,** 510; revised by Maj. Merrill, **74,** 498; modified by proposed use of inclined planes, **74,** 554.

Memoranda in connection with plans:

Difficulty of maintaining sufficient water supply on short levels, **74,** 453, 495.

Consideration of water supply and amount required, **74,** 504, 505, 507, 520, 538; **76,** ii, 60, 63, 67, 73, 97.

Loss by evaporation, filtration, and leakage, **74,** 505, 507, 520; **76,** ii, 60, 65, 67, 73, 97.

Distance between locks, **74,** 495, 553.

Protection of slopes by surf berms, **74,** 534.

Discussion of canal section, relation between canal section and boats, and cost of towing, **74,** 534, 535, 536; **76,** ii, 80.

Equation of lockage to level line, **74,** 536, 556, 558; **77,** 681.

Determination of lock dimensions, **74,** 536.

Inclined planes, use of, in place of locks, **74,** 550; **76,** ii, 82, 100.

Lockage, time required for, **74,** 536, 556.

Canal tunnels, **74,** 493, 509, 549; **76,** ii, 79, 81, 124.

Method of transit through, **74,** 493; **76,** ii, 79.

Effects of small tunnels on transit and traffic, **76,** ii, 79.

Summit reservoirs and feeders, **76,** ii, 89.

Method of making canal water-tight, **76,** ii, 74.

PRIVATE (CORPORATE) WORK.

Chesapeake & Ohio Canal. (See Board of Engineers and Projects.) A scheme of Gen. Washington, **74,** 493. Projected by board of internal imp. (1825), **74,** 513. Constr. (1850), with modifications, from Georgetown to Cumberland (185 m.), **74,** 504, 513, 543. Dimensions of canal section and locks, **74,** 504. Cost, $11.071,176, **74,** 504.

PROJECTS. (See Estimates and Plans.)

By "board of internal improvement," 1825, for canal from tide water on the Potomac R. to the Ohio R., as follows: Eastern section, from Georgetown (on Potomac R.) to Cumberland, on n. branch of Potomac, 185 m., **74,** 513. Middle section, from Cumberland (via Wills and Flaughertys Creeks) to mouth of Castleman R., 70.5 m.; lockage, 1,368′, **74,** 494, 536. Western section, from mouth of Castleman R. (via valleys of Youghiogheny and Monongahela Rs.) to Pittsburgh, 85.25 m.; lockage, 619′, **74,** 543. Section of canal, 5′ x 33′ x 48′; surf berms, 2′ w.; towpath, 9′ w.; guard bank, 5′. w. and 2′ above water surface, **74,** 534; locks, 5′ x 14′ x 102′, with an average lift of 8′, **74,** 536; summit level, with tunnel 4½ m. long, 22′ x 23½′, **74,** 537; supplied by reservoirs on Castleman R., **74,** 531, 537; est. (see Estimates), $22 375,429, **74,** 543.

BE. recom. omission of middle section until further sur. and investigation should determine the relative merits of canal or RR. for, **74,** 543.

By Maj. Merrill, 1875, extending Chesapeake & Ohio Canal to connect with navigable tributaries of Ohio R., beginning at Cumberland ("present" terminus of Chesapeake & Ohio Canal); thence via Wills Creek (28.43 m.) and summit level (6 m.) and valleys of Flaughertys Creek and Castleman R. to Youghiogheny R. (31.28 m.); thence by valley of the Youghiogheny (28.48 m.) to terminus of proposed canal, below Connellsville; thence by slackwater navigation (44.3 m.) to McKeesport, **74,** 494, 497, 500, 529, 558; **75,** 770; **76,** ii, 59, 83, 90, 101, 113. Canal section 7′ x 70′, **76,** ii, 59, 92; except at designated points, **76,** ii, 59, 92; locks 20′ x 120′, **76,** ii, 59, 92. On the heaviest grades locks to be replaced by inclined planes, **74,** 498, 550; **75,** 770; **76,** ii, 82, 95, 101. Summit to be passed by tunnel (3¾ m. long) with section 26′ x 42′, **76,** ii, 78, 81, 92, 102, 103, 124; without towpaths, and to be worked by steam, **74,** 498, 511; **76,** ii, 81, 102; summit level to be fed by reservoirs, **74,** 504, 521; **76,** ii, 87, 99. Slackwater navigation on Youghiogheny R. by means of 15 locks and dams, upper (12) locks 26′ x 146′, lower (3) 56′ x 250′, dams to be of st., **74,** 558, 497; **76,** ii, 84, 86, 92. Est., $24,240,080, **76,** ii, 88.

For local extension of Chesapeake & Ohio Canal via n. branch of Potomac R. to mouth of Savage R., proposed by "board of internal improvement" (1826), 30.2 m.; lockage, 312′, **74,** 544; dimensions same as main line, **74,** 534, 544; est., $1,794,963, **74,** 544.

For same route, Maj. Merrill, 1874, 30½ m.; lockage, 353′; canal section, 6′ x 32′ x 62′ locks, 15′ x 100′, **76,** ii, 89, 116. Est., $2,656,558, **76,** ii, 89, 123.

SURVEYS.

Ordered for exploration of routes for extension of Chesapeake & Ohio Canal, Mar., 1873, **73,** 60; **74,** 67, 493; **76,** ii, 58.

History of early surs., **74,** 493, 502, 513; **76,** ii, 90. Surs. of 1873–75 restricted to n. branch of the Potomac, reason for, **74,** 493.

Routes sur., **74,** 494, 496; **76,** ii, 90, 115.

Line definitely located (1875) from Cumberland to near Ohio Pyle Falls, **75,** 770; **76,** ii, 91.

Additional (1876) sur. required, **76,** ii, 89.

K-52 SMITH CREEK, MD.

ENGINEERS.

Chief of Engineers. R., 91, 146.

In charge. Lt. Col. P. C. Hains, 1890. **R., 91,** 1282.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1282.

Chan. facilities sufficient, **91,** 1283.

SURVEY.

Ex., 1891, by Lt. Col. Hains, **91,** 1283.

K-62 BRETON BAY, MD. (Leonardtown Harbor.)

APPROPRIATIONS.

1878,	$5,000,	**78,** 72, 513.
1879,	4,000,	**79,** 83, 601.
1880,	3,000,	**80,** 756.
1881,	3,000,	**81,** 951.
1882,	5,000,	**82,** 1012.
1884,	3,000,	**84,** 981.
1886,	6,500,	**86,** 902.
1888,	3,000,	**88,** 816.
1890,	5,000,	**90,** 1062.
1903,	*6,000,	**03,** 1044.
1905,	*6,000,	**05,** 1159.
1909,	*4,000,	**09,** 1221.
Total,	53,500,	**09,** 1221.

*Allotment.

COMMERCE.

Important, **75,** ii, 109; **78,** 513.
Description of, **00,** 1744.
Est. at $225,000 yearly, **03,** 202.
Tonnage, 1909, 11,668 t.; passengers, 2,000. Apparently no effect on freight rates from U. S. imp., **10,** 291.

CONTRACTS.

1878. G. H. Ferris, dr., 12½¢ c. y., **79,** 600.
1879. G. C. Fobes & Co., dr., 16¢ c. y., **80,** 756.
1880. National Dredging Co., dr., 15¢ c. y., **81,** 950.
1881. National Dredging Co., dr., 15¾¢ c. y., **82,** 1011.
1882. Potomac Dredging Co., dr., 18¢ c. y., **83,** 797.
1884. T. P. Morgan, dr., 12¢ c. y., **85,** 964.
1886. National Dredging Co., dr., 11¢ c. y., **87,** 930.
1888. Atlas Dredging Co., dr., 13½¢ c. y., **89,** 1001.
1891. Baltimore Dredging Co., dr., 12½¢ c. y., **91,** 1258.
1902. John Miller, dr., 17.4¢ c. y., **03,** 1044.
1906. C. P. Grim, dr., 19⅜¢ c. y., **06,** 1099.
1909. Miner Engineering Co., dr., 11¢ c. y., **10,** 1347.

ENGINEERS.

Chief of Engineers. **R., 75,** 90; **78,** 72; **79,** 83; **80,** 112; **81,** 152; **82,** 147; **83,** 152; **84,** 155; **85,** 145; **86,** 140; **87,** 107; **88,** 109; **89,** 126; **90,** 112; **91,** 140; **92,** 141; **99,** 223; **00,** 254; **02,** 206; **03,** 201; **04,** 199; **05,** 207; **06,** 219; **07,** 233; **08,** 246; **09,** 254; **10,** 290.

Boards. BERH. **R., 03,** 1045, 1047.

In charge:
Maj. W. P. Craighill, 1874. **R., 75,** ii, 108.
S. T. Abert, U. S. agent, 1878–91. **R., 78,** 512; **79,** 600; **80,** 756; **81,** 949; **82,** 1009; **83,** 797; **84,** 981; **85,** 964; **86,** 901; **87,** 928; **88,** 815; **89,** 1001; **90,** 1062.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1258.
Maj. C. E. L. B. Davis, 1892. **R., 92,** 1045.
Lt. Col. C. J. Allen, 1900–03. **R., 00,** 1743, 1745; **02,** 1088; **03,** 1044.
Col. A. M. Miller, 1904. **R., 04,** 1313.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1159.
Capt. S. Cosby, 1906–08. **R., 06,** 1098; (Maj.) **07,** 1171; **08,** 1218.
Maj. J. J. Morrow, 1909. **R., 09,** 1221.
Capt. W. T. Hannum, 1910. **R., 10,** 1347.

Assistant. H. Bacon. **R., 75,** ii, 109.

ESTIMATES. (See Plans and Projects.)

By H. Bacon, concurred in by Maj. Craighill, chan. 9′ x 150′, $30,000; chan. 8′ x 150′, $19,000; chan. 9′ x 100′, $21,000; chan. 8′ x 100′, $13,000, **75,** ii, 108, 109. First adopted by Mr. Abert, **78,** 513.
By S. T. Abert, 1879, to complete existing proj., $21,000, **79,** 601.

OPERATIONS.

1878–79. Chan. dr. 9′ x 60′ through the shallowest water and a basin for turning steamers at the wharf, **79,** 83, 600.
1879–80. 21,600 c. y. dr. from basin and chan., **80,** 756.
1880–81. 17,976 c. y. dr. from chan. and basin, **81,** 950.
1881–82. 16,256 c. y. dr. from basin, **82,** 1011.
1882–83. 22,048 c. y. dr. from chan. and basin, **83,** 798.
1884–85. 20,359 c. y. dr. from chan. and basin, **85,** 964.
1886–87. 40,930 c. y. dr., **87,** 930.
1888–89. 13,141 c. y. dr., **89,** 1001.
1890–91. Dr. in progress under contract, **91,** 1258.
1891–92. 28,800 c. y. dr., **92,** 1046.
1902–03. 31,805 c. y. removed, completing chan. 10′ x 100′ x 3,800′, and a turning-basin 200′ x 400′ at Leonardtown Wharf, **03,** 1044.
1906–07. 25,066 c. y. removed, completing chan. between Leonardtown and d. w. in Breton B., 10′ x 150′ x 6,100′, with a turning-basin 275′ x 500′, **07,** 1171.
1909–10. 13,207 c. y. removed in redr. chan. 10′ x 170′x 3,000′, **10,** 1347.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 109; **78,** 513; **00,** 1745; **03,** 201.
Tidal estuary of Potomac R., 6½ m. long, 15′ d. for 4 m., **12,** 290.

PLANS. (See Estimates and Projects.)

By H. Bacon, dr. chan. 8′ or 9′ x 100′ or 150′ and a basin for turning steamers, **75,** ii, 108, 110.

PROJECTS. (See Estimates and Plans.)

By S. T. Abert, dr. chan. 9′ x 150′ and a basin for turning steamers at the wharf, **78,** 513; **79,** 600.
By Lt. Col. Craighill, 1875, dr. chan. 9′ x 150′ from Breton B. to Leonardtown Wharf; est., $30,000, **75,** ii, 108; **80,** 757. After an expend. of $23,000, S. T. Abert proposed, in 1885, an amended proj., whereby the chan. was to be w. to 200′, the basin and chan. to be not less than 10′; est., $26,000, **85,** 965. In 1890 the orig. proj. was resumed, a w. of 150′ and d. of 9′ being deemed sufficient to furnish all the facilities required by existing navigation, **91,** 1258; **92,** 1045.
Lt. Col. Allen est., 1899, $36,480 to imp. chan. in B., **00,** 1746.
Act June 13, 1902, au. chan. 10′ x 200′, and a turning-basin 400′ x 600′; est., $36,480, **03,** 202.
BE. recom., 1903, that $6,000 be expend. at the earliest date in providing a chan. 10′ d. and w. enough to accommodate needs of trading vessels, incl. a turning-basin of ample dimensions at Leonardtown Wharf, $4,000 to be applied to new work and $2,000 to maintenance; opinion of board that $4,000 every 4 years thereafter would provide sufficient turning-basin, and a chan. at least 10′ x 100′,[1] **05,** 208.

SURVEYS.

By H. Bacon, 1874, under direction of Maj. Craighill. **R., 75,** ii, 108, 109.
Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Lt. Col. Allen (**R.** fav.; see Projects), **00,** 1743, 1745.
Maps. **87,** 930; **89,** 1002.
Cong. docs., etc., relating to exs., surs., plans, etc., **10,** 292.

K-75(a) CHAPEL POINT HARBOR (Port Tobacco Creek [River]), MD.

COMMERCE.

Unimportant, **95,** 1254; **97,** 1352.

ENGINEERS.

Chief of Engineers. **R., 84,** 163; **95,** 166; **97,** 189.

In charge:
S. T. Abert, U. S. agent. **R., 84,** 163.
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1252.
Lt. Col. C. J. Allen, 1896. **R., 97,** 1350.

PHYSICAL CHARACTERISTICS.

Description of; Port Tobacco R. is a branch of the Potomac, which it enters on the left of the ne. end of Nanjemoy Reach, opp. Mathias Pt., about 55 m. below Washington, D. C.; Chapel Pt. is at junction of Potomac with Port Tobacco R., **95,** 1253; **97,** 1351.

[1] R. and H. C. Doc. 33, 61st, 2d.

PROJECTS.

Lt. Col. Allen, 1897, submitted ests. for chans. of 10′ and 15′ d. over 2 different routes from wharf at Chapel Pt. to the chan. of the Potomac R., $52,800 to $330,000, **97,** 1350.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1882, by S. T. Abert (imp. not a necessity), **84,** 1008.

Ex. au. act Aug. 17, 1894; made by Maj. Davis, 1894 (**R.** unfav.), **95,** 1253.

Sur. au. act June 3, 1896; made by Lt. Col. Allen, 1896 (**R.** unfav.), **97,** 1350.

K-79 CHICOMUXEN CREEK, MD.

ENGINEERS.

Chief of Engineers. **R., 84,** 163.

In charge. S. T. Abert, U. S. agent. **R., 84,** 1005.

SURVEY.

Ex. au. act Aug. 2, 1882; made by S. T. Abert (**R.** unfav.), **84,** 1005.

K-82 PISCATAWAY CREEK, MD.

COMMERCE.

Local, **91,** 1281.

ENGINEERS.

Chief of Engineers. **R., 84,** 163; **91,** 145, 1279.

In charge:
S. T. Abert, U. S. agent. **R., 84,** 1005.
Lt. Col. P. C. Hains, 1890. **R., 90,** 1280.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1280.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Hains (**R.** unfav.), **91,** 1280.

Ex. au. act Aug. 2, 1882; made, 1882, by S. T. Abert (**R.** unfav.), **84,** 1005.

K-90(a) SHENANDOAH RIVER, VA. AND W. VA.

APPROPRIATIONS.

1880,	[1] $15,000, **80,** 661.
1881,	[1] 2,500, **81,** 904.
Total,	17,500

COMMERCE.

Did not warrant cost of proposed imp., $49,802, **90,** 1055.

ENGINEERS.

Chief of Engineers. **R., 80,** 106, 110; **81,** 143; **82,** 140; **83,** 143; **84,** 148; **85,** 143; **86,** 139; **87,** 105; **90,** 111.

In charge:
Lt. Col. W. P. Craighill, 1879–85. **R., 80,** 661; **81,** 903; **82,** 912; **83,** 699; **84,** 927.
Lt. Col. P. C. Hains, 1885–90. **R., 85,** 957; **86,** 891; **87,** 925; **88,** 804; **90,** 1050.

Assistants:
N. H. Hutton. **R., 80,** 664.
J. Herron. **R., 80,** 667, 670.
C. B. Fisk. **R., 80,** 674.

LEGAL PROCEEDING.

Title could not be secured by the US. to the necessary lands until 1883, **83,** 699. Still further legal difficulties arose, **84,** 927.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1051.

PROJECTS.

By Lt. Col. Craighill, 1880, imp. R. by slackwater navigation, securing 1½′ x 20′ at l. w., Port Republic to Harpers Ferry, by rebuilding locks, dams, and chutes of Navigation Co.; est., $72,250, **80,** 666, 667. (See Appropriations.)

Lt. Col. Hains could not recom. U. S. imp., **90,** 1055.

SURVEY.

Au. act Mar. 3, 1879, **79,** 81; made, 1880, by Lt. Col. Craighill, **80,** 662.

K-90(b) GREAT CACAPON RIVER, W. VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 124.

In charge: Lt. Col. P. C. Hains, 1888. **R., 89,** 995.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 995.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Col. Hains (**R.** unfav.), **89,** 995.

K-90 (c) BOWMANS RUN TO CUMBERLAND, MD.

Map and profile, office of Chief of Engineers, U. S. A., for a canal. Date, 1825–5. **R.,** April 19, 1826, made by Capt. W. G. McNeill. Bowmans Run (or River) is a small creek emptying into Wills Cr. about 30 m. above the Potomac at Cumberland, Md.—*U. S. Engr. Office, Washington, D. C.*, and H. D. 421, 57th, 2d, p. 32.

[1] Not to be used till corporate rights or franchises connected with the river were relinquished, **85,** 957.

K-92 HUNTING CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 134; **04,** 217, 1343.

Boards. BERH. considers C. too small; inadvisable to imp., **04,** 1345.

In charge:
S. T. Abert, U. S. agent, 1888. **R., 89,** 1028.
Lt. Col. C. J. Allen, 1904. **R., 04,** 1343.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert (unfav.), **89,** 1028.

Pre. ex. au. act June 13, 1902, for imp. chan. to Hunting Creek, Va. **R.,** Lt. Col. Allen, Dec. 20, 1902 (unfav.[1], **04,** 217, 1343.

K-96 ACCOTINK BAY AND CREEK, VA.

APPROPRIATIONS.

1872, $5,000, **72,** 69, 688; **77,** 358; **79,** 83, 601.

CONTRACT.

1872. J. H. Teemeyer, dr., **73,** 73, 767, 768.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 68, 71; **73,** 73; **74,** 83; **75,** 91; **76,** 66; **77,** 64; **78,** 71; **79,** 83.

In charge:
Maj. W. P. Craighill, 1871–74. **R., 71,** 620; **72,** 688, 707; **73,** 767; **74,** ii, 29.
S. T. Abert, U. S. C. E., 1875–79, **75,** ii, 110. **R., 75,** ii, 120; **76,** 346; **77,** 358; **78,** 509; **79,** 601.

Assistants:
Capt. C. B. Phillips, in immediate charge, **72,** 707. **R., 72,** 710.
J. E. Weyss and G. Thompson, **72,** 707, 710.

ESTIMATES. (See Projects.)

By Capt. Phillips, chan. by dr., $14,081.76, **72,** 707, 711.

By Maj. Craighill, increased to $19,000, **72,** 68, 71, 688, 708.

By S. T. Abert, 1879, completing existing proj., $14,000, **79,** 601.

OPERATIONS.

1872–75. Completion of chan. by dr. 40′ w. 2½′–3′ d., from 2½′ in the B. to point about 200 y. within the mouth, and from that point to the village, 4′ d. and 25′ w., **73,** 73, 767; **74,** 83, ii, 29; **75,** 91.

PHYSICAL CHARACTERISTICS.

Described, **72,** 711.

PRIVATE WORK.

Considerable amount expend. on chan. by private parties, **72,** 711. Willows planted on the banks for their preservation, **74,** ii, 29.

PROJECTS. (See Estimates.)

By Capt. Phillips, dr. chan. 5′ x 40′ from mouth of the B. to the village of Accotink, and protecting banks by matting, **72,** 688, 707, 711.

By Maj. Craighill, expend. ap. of 1872 of $5,000 to dr. chan. 2½′ d., as w. as funds would permit, **72,** 688.

SURVEYS.

Under direction of Maj. Craighill, 1871, by Capt. Phillips, **71,** 76, 620; **72,** 688.

By J. E. Weyss and G. Thompson, 1872. **R., 72,** 688, 707, 710.

K-100 OCCOQUAN CREEK, VA.

APPROPRIATIONS.

1873,	$5,000.00,	**73,** 74, 78, 768.
1874,	5,000.00,	**74,** 84, ii, 29.
1875,	5,000.00,	**75,** 92, ii, 121; **76,** 347.
1878,	10,000.00,	**78,** 71, 509.
1890,	10,000.00,	**91,** 1255; **99,** 1421.
1892,	5,000.00,	**92,** 1042.
1894,	5,000.00,	**94,** 139; **95,** 1223.
1896,	2,500.00,	**96,** 1035.
1899,	2,500.00,	**99,** 1422.
1902,	*2,600.00,	**03,** 1052.
1905,	*5,971.44,	**05,** 1165.
1907,	*[2] 20,000.00,	**07,** 1178.
1909,	*1,000.00,	**09,** 1231.
1910,	18,000.00,	**10,** 1359.
Total,	[3] 97,571.44	(less $2,472.03 trans. to other works, $95,099.41 **12,** 1685).

COMMERCE.

Before imp., **73,** 768, 769, 819, 821, 826.
Materially benefited by imp., **96,** 1034; **97,** 1322.
Imp. a material benefit to C. of locality, **02,** 208.
Shipments facilitated and rates reduced, **05,** 214.
1911, 32,297 t., **12,** 1686.

CONTRACTS.

1873. A. A. Dodge, dr., **73,** 768; **74,** ii, 29.
1874. A. A. Dodge, dr., **75,** ii, 120.
1876. T. P. Morgan, dr., **76,** 347.
1878. C. D. Spaids, dr., 11¢ c. y., **79,** 602.
1891. D. McConville, dr., 10¾¢ for material dr. and deposited, measured in place, and 14½¢ for material measured in scows, **91,** 1255.
1892. F. L. Somers, dr., 22¢ c. y., **92,** 1041.
1892. D. McConville, dr., 12½¢ and 19¾¢ c. y. ($1,691.25); riprap st., 79¢ c. y. ($2,607), **93,** 1285. (Contract for st. ended by supple. agreement on account of an injunction having been obtained preventing the constr. of the dike for which it was purchased, **93,** 1284.)
1894. T. P. Morgan, dr., 20¢ and 40¢ c. y., **95,** 1223.
1897. Baltimore Dredging Co., dr., 18¢ c. y. ($1,800), **98,** 1192.
1899. J. L. Mills, dr., 16¾¢ c. y. ($1,675), **00,** 1710.
1903. H. P. Gilbert, rebuilding dikes; st., $1.25 c. y., **03,** 1052.
1906. C. P. Grim, dr., 17¢ c. y., **06,** 1103.
1907. Miner Engineering Co., dr., 17¢ c. y.; C. G. Smith & Son, constr. riprap js., $1.97 c. y.; Miner Engineering Co., dr., 16¢ c. y., **08,** 1228.
1910. Maryland Dredging & Contracting Co., dr. approx. 50,000 c. y., 18.2¢ c. y.; Potomac Sand & Gravel Co., 600 c. y. riprap st., $1.35 c. y., **11,** 1466.

ENGINEERS.

Chief of Engineers. **R., 72,** 74; **73,** 74, 77; **74,** 83; **75,** 92; **76,** 66; **77,** 64; **78,** 71; **79,** 83, **80;**

*Allotment.
[1] H. D. 223, 58th, 2d.
[2] $2,200 trans. to Mattaponi R., 1908.
[3] $272.03 trans. to consolidated app. under act June 2, 1902.

112; **89,** 135; **90,** 121; **91,** 138; **92,** 139; **93,** 150; **94,** 138; **95,** 159; **96,** 143; **97,**177; **98,**180; **99,** 209; **00,** 239; **01,** 278; **02,** 207; **03,** 205; **04,** 202; **05,** 213; **06,** 225, 237; **07,** 238; **08,** 251; **09,** 260; **10,** 297; **11,** 321; **12,** 382.

In charge:
Maj. W. P. Craighill, 1872–74; **72,** 74. **R., 73,** 768, 819, 825; **74,** ii, 29.
S. T. Abert, U. S. agent, 1874–91; **75,** ii, 110. **R., 75,** ii, 120; **76,** 347; **77,** 358; **78,** 509; **79,** 601; **80,** 753; **90,** 1089, 1091.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1253.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1039; **93,** 1281; **94,** 941; **95,** 1219.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1032; (Lt. Col.) **97,** 1321; **98,** 1190; **99,** 1421; **00,** 1709; **01,** 1407; **02,** 1090; **03,** 1051.
Col. A. M. Miller, 1904. **R., 04,** 1317.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1164.
Capt. S. Cosby, 1906–08. **R., 06,** 1102; (Maj.) **07,** 1177; **08,** 1225.
Maj. J. J. Morrow, 1909. **R., 09,** 1230.
Capt. W. T. Hannum, 1910. **R., 10,** 1359.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1465; **12,** 1684.

Assistant. W. Popp. **R., 73,** 820, 825.

ESTIMATES. (See Plans and Projects.)

By W. Popp, 1872, dr. chan. through the flats called "Upper Mud," "Lower Mud," and "Sand Bar," 5′ x 100′, $18,000; chan. 4′ x 100′, $10,000, **73** 820, 821; revised, after final sur., to chan. 100′ x 5′, $15,000; chan. 5′ x 75′, $13,000, **73,** 825, 826.
By S. T. Abert, 1875, addl. for constr. of dike midway between the br. and Occoquan, $5,000, **76,** 67, 347; in 1877, to complete existing proj., $10,000, **77,** 359.

LEGAL PROCEEDINGS.

Injunction obtained by owner of a wharf at Occoquan Bar restraining the U. S. from constr. a dike which he claimed would injure his property, **93,** 1283.
Shoals formed by sand dredger removed by owner of dr., **01,** 1407.
Steps taken to prevent dumping of quarry refuse in creek, **02,** 1090.

OPERATIONS.

1872–73. Dr. by contract, **73,** 74, 768.
1873–74. Dr. Lower Mud Chan. 5′ x 50′ by contract, **74,** 84, ii, 29.
1874–75. Dr. by contract through the "Upper Mud," making chan. 5′ x 60′, **75,** 92, ii, 120.
1875–76. Chan. excavated through bar between RR. br. and Occoquan, 5′ x 80′, and chan. at mouth of R. partly redr., **76,** 66, 347.
1878–79. Chan. 5′ – 6′ redr. through bar at mouth of R. between Taylors Pt. and Sand Pt., and w. to 100′; removal of bar near Occoquan by dr., **79,** 83, 602, 603.
1879–80. Dr. under contract of 1878 completed; chan. through sand bar below Occoquan redr.; chan. 75′ w. dr. through bar opposite wharves at Occoquan; 876 l. f. of pile dike built; completing operations in accordance with the proj. for imp. and the demands of C., **80,** 754, 755.
1890–91. 36,640 c. y. dr., **92,** 1041.
1891–92. 20,967 c. y. dr., **92,** 1041.
1892–93. 622 l. f. dike constr. and 161 l. f. partly completed, **93,** 1284.
1893–94. About 8,867 c. y. dr., **94,** 944.
1894–95. 6,420 c. y. dr., 153 c. y. st. placed in gap of dike at Occoquan Bar, and 802 l. f. dike constr. at Sand Bar, **95,** 1222.
1897–98. 9,971 c. y. dr., **98,** 1191.
1898–99. Snags, logs, and other obstr. removed, **99,** 1421.
1899–1900. 10,035 c. y. dr., **00,** 1709.
1902–03. 500 c. y. st. used in repair to dike, **03,** 1052.
1903–04. 1,620 c. y. st. used in repair and extension of dikes, **04,** 1317.
1906–07. 2,676 c. y. dr., **07,** 1177.
1907–08. 117,546 c. y. dr. and 40 logs and snags removed, completing proj., **08,** 1225. 575 c. y. st. placed in extension and repair of dikes, **08,** 1226.
1910–11. 73,354 c. y. material, 23 logs and mound of riprap st. removed from Lower Mud Bar and chan., and deposited upon flats 500′ e., **11,** 1465.
1911–12. Work of extending and repairing riprap j. at Sand Bar completed; j. extended 257′ and repaired where required, placing 559.6 c. y. riprap; aggregate l. of js. at Sand Bar and Occoquan Bar is now 2,220′, containing 7,826.6 c. y. riprap, **12,** 1684.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 820, 826; **74,** ii, 29; **76,** 347; **90,** 1092.
Description of characteristics, and orig. condition, **93,** 1281; **94,** 941; **95,** 1219; **96,** 1032; **97,** 1321; **98,** 1190.

PLANS. (See Estimates and Projects.)

By S. T. Abert, 1890, excavation of an 8′ chan. through Occoquan and Upper and Lower Mud Bars with 4,450 l. f. of brush and pile mattress dike constr.; est., $91,250, **90,** 1095.

PRIVATE WORK.

Cut dr., 1871, by citizens, costing about $600, **73,** 820, 825, 826; **75,** ii, 120.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Craighill, 1873, excavation of chan. 5′ x 100′ at l. w. through the flats "Lower Mud," "Upper Mud," and "Sand Bar;" est., $18,000, **73,** 820, 825; **80,** 754.
In 1875 S. T. Abert proposed constr. of a dike for the imp. of the bar below Occoquan; cost, $5,000, **76,** 347; **80,** 754.
By Lt. Col. Hains, 1890, excavation of a chan. 6′ x 100′ at Lower and Upper Mud, and at Sand and Occoquan Bars, the chan. to be maintained at the two latter localities by sheet pile dike constr.; est., $45,000, **91,** 1254.
By Maj. Davis, 1892, dike of riprap st. instead of one built of piles and sheet piling at Occoquan Bar, on account of less expense and more durability, **93,** 1282.
By Maj. Davis, 1894, completion of dike at Occoquan Bar, completion of dr. of chan. at Upper Mud and the removal of deposits in other chans., and constr. of a riprap dike at Sand Bar to maintain the chan., **95,** 1221.
By Lt. Col. Hoxie, 1905, removal of outer bar to 6′ x 150′; est., $19,000, and $750 an. mainten.,[1] **06,** 237; au. act Mar. 2, 1907, as extension of proj. of 1890, **07,** 238.

SURVEYS.

Under direction of Maj. Craighill, by W. Popp, 1872. **R., 73,** 78, 819, 820, 825.
Au. act Aug. 1888; made, 1889, by S. T. Abert **90,** 1091.
Ex. by Lt. Col. Allen, 1897, **97,** 1322.
Ex. of chans., **05,** 1164.
Ex. and sur. au. act Mar. 3, 1905; made, 1905, by Lt. Col. Leach and Lt. Col. Hoxie, resp.,[1] **06,** 237.
Of bars, **10,** 1359.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 383.
Maps.[1]

[1] H. D. 190, 59th, 1st.

K-103 NEABSCO CREEK, VA.

APPROPRIATION.

1881, $5,000, **81,** 949.

CONTRACT.

1881. National Dredging Co., dr., 15¾¢ c. y., **82,** 1007.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 71; **80,** 117; **81,** 152; **82,** 146; **83,** 152; **84,** 155; **85,** 144; **86,** 140; **87,** 106; **88,** 108.

In charge:
Maj. W. P. Craighill, 1871–72. **R., 71,** 620; **72,** 707.
S. T. Abert, U. S. agent, 1880–88. **R., 81,** 947; **82,** 1006; **83,** 796; **84,** 980; **85,** 962; **86,** 901; **87,** 928; **88,** 814.

Assistants:
Capt. C. B. Phillips. **R., 72,** 711.
J. E. Weyss, **72,** 707, 711.
G. Thompson, **72,** 707,711.

OPERATIONS.

1881–82. 23,613 c. y. dr. from chan., **82,** 1008.

PHYSICAL CHARACTERISTICS.

Description of; sometimes called Neapseco Cr.; 28 m. below Washington City, in Prince William Co., Va., and is trib. to Potomac R., **81,** 947.

PLANS.

By Capt. Phillips, 1872, dr. chan. 6′ x 40′, protecting the banks by wattling, from the mouth of the B. to d. w. below Atkinsons Landing; est., $10,215.26, **72,** 712.
By Maj. Craighill, est. increased to $13,500, **72,** 708.

PROJECTS.

By S. T. Abert, 1881, excavating chan. 7′ x 100′, from 7′ curve in the Potomac R. at Atkinsons Upper Landing, 14,800′ incl. a chan. to Atkinsons Lower Landing and Willis Wharf; est., $55,924, **81,** 948.

SURVEYS.

Under direction of Maj. Craighill, by Capt. Phillips, J. E. Weyss, and G. Thompson, 1871. **R., 71,** 620; **72,** 707, 711.
Au. act June 14, 1880; made, 1880, by S. T. Abert, **81,** 947.

K-104(a) COCKPIT POINT, VA. (Ice harbor.)

ENGINEERS.

Chief of Engineers. **R., 85,** 153.

In charge. S. T. Abert, U. S. agent. **R., 85,** 999.

PHYSICAL DATA.

Details; part of Potomac R., **85,** 999.

SURVEY.

Ex. au. act July 5, 1884; made by Mr. Abert (**R.** unfav.), **85,** 999.

K-105(a) QUANTICO CREEK, VA.

COMMERCE.

Value of locality as an ice H., **84,** 1012.
In 1893, 14,815 t. of iron ore, RR. ties, lumber, etc., **95,** 1255. Expend. necessary for an imp. would not be justified by the C., **95,** 1256.
Description of present and prospective, **01,** 1443, 1444.

ENGINEERS.

Chief of Engineers. **R., 84,** 163; **89,** 135; **95,** 166; **1900,** 255; **01,** 292, 1440; **06,** 237.

In charge:
S. T. Abert, U. S. agent, 1884–88. **R., 84,** 1010, 1011; **89,** 1030.
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1254.
Lt. Col. C. J. Allen, 1901. **R., 01,** 1440.
Lt. Col. S. S. Leach, **06,** 215.

Assistant. F. C. Warman. **R., 01,** 1442.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1010; **89,** 1030; **95,** 1254; **01,** 1442.

PLANS.

By S. T. Abert, 1883, turning-basin 18′ x 300′, with an addl. w. of 130′ and 11′ d. to serve as an ice H.; est., $33,453, **84,** 1012.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by S. T. Abert, **84,** 1010.
Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert (**R.** unfav.), **89,** 1030.
Ex. au. act Aug. 17, 1894; made by Maj. Davis, 1894 (**R.** unfav.), **95,** 1254.
Pre. ex. au. act June 6, 1900. **R.** by Lt. Col. Allen[1] (unfav.), **01,** 1440.
Pre. ex. au. act Mar. 3, 1905. **R.** by Lt. Col. Leach[2] (unfav.), **06,** 237.

K-105(b) QUANTICO BAY, VA.

COMMERCE.

Unimportant, **72,** 714.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 71.

In charge. Maj. W. P. Craighill, 1871–72. **R., 71,** 620; **72,** 707.

Assistants:
Capt. C. B. Phillips. **R., 72,** 713.
J. E. Weyss, **72,** 707.
G. Thompson, **72,** 707.

SURVEYS.

Under direction of Maj. Craighill, by Capt. Phillips (see Commerce), J. E. Weyss, and G. Thompson. **R., 71,** 620; **72,** 707, 713.

[1] H. D. 101, 56th, 2d.

[2] H. D. 138, 59th, 1st.

K-106 CHOPAWAMSIC BAY, VA.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **76,** 71.

In charge. Maj. W. P. Craighill, 1871. **R., 71,** 620; **72,** 707.

Assistants:
Capt. C. B. Phillips. **R., 72,** 713.
J. E. Weyss, **72,** 707, 713.
G. Thompson, **72,** 707, 713.

PHYSICAL CHARACTERISTICS.

An estuary of the Potomac **R.,** 40 m. below Washington City; the bottom soft mud; the banks well timbered; at the head of the B. is Chopawamsic Creek, **72,** 713.

PLANS.

By Capt. Phillips, concurred in by Maj. Craighill, opening a cut across from the creek to the Potomac, forming a new mouth ½ m. from the present one. Est. cost, by Capt. Phillips, of a cut 80′ w. at bottom by 10′ d., $6,945.40; or 12′ d., $9,522.92. Increased, by Maj. Craighill, to $7,000 and $10,000, resp., **72,** 707, 708, 714, 715.

SURVEYS.

Under the direction of Maj. Craighill and the immediate supervision of Capt. Phillips, by J. E. Weyss and G. Thompson. **R., 71,** 620; **72,** 707, 713.

K-107 AQUIA CREEK, VA.

APPROPRIATIONS.

1872,	$1,500,	**72,** 69, 688; **73,** 74, 772; **74,** 84.
1873,	2,000,	**73,** 74, 772; **74,** 84; **75,** 92.
1875,	2,000,	**75,** 92, ii, 122.
1878,	5,000,	**78,** 71, 510.
1890,	10,000,	**91,** 1257.
1892,	5,000,	**92,** 1044.
1894,	3,000,	**95,** 1227.
1896,	3,000,	**96,** 1038.
1903,	*100,	**03,** 1055.
1912,	21,400,	**12,** 1672.
Total,	53,000 ($52,900, omitting 1903, **12,** 1672).	

COMMERCE.

Requirements of, do not justify carrying out the proj., **74,** ii, 37.

Resources of the country tributary to Aquia Creek, **90,** 1100.

Imp. of benefit to C. Two vessels able to pass in the dr. chan., **98,** 1194.

Chiefly lumber and farm produce; C. materially benefited, rates reduced, **05,** 215.

Traffic about 20,000 t. an., **12,** 375.

CONTRACTS.

1872. A. A. Dodge, dr., 15¢ c. y., **75,** ii, 121.
1875. A. A. Dodge, dr., 13¢ c. y., **76,** 348.
1878. G. H. Ferris, dr., 11¾¢ c. y., **79,** 604.
1891. F. C. Somers, dr., 12½¢ c. y., **91,** 1257.
1893. F. C. Somers, dr., 11¢ c. y. ($3,300), **93,** 1288.
1894. T. P. Morgan, dr., 15¢ c. y. ($2,400), **95,** 1223.
1897. Baltimore Dredging Co., dr., 18¢ c. y. ($3,240), **98,** 1192.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 69, 71; **73,** 74; **74,** 84; **75,** 92; **76,** 67; **77,** 64; **78,** 71; **79,** 84; **89,** 135; **90,** 121; **91,** 139; **92,** 140; **93,** 151; **94,** 139; **95,** 160; **96,** 144; **97,** 179; **98,** 182; **99,** 210; **02,** 207, 210; **03,** 207; **04,** 205; **05,** 215; **08,** 265; **12,** 373.

In charge:
Maj. Wm. P. Craighill. **R., 71,** 620; **72,** 688, 707; **73,** 771; **74,** ii, 37.
S. T. Abert, U. S. agent, **75,** ii, 110. U. S. C. E., 1874–91. **R., 75,** ii, 121; **76,** 348; **77,** 359; **78,** 510; **79,** 603; **90,** 1096, 1097.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1255.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1042; **93,** 1286; **94,** 944; **95,** 1224.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1036; (Lt. Col.) **97,** 1324; **98,** 1193; **99,** 1423; **03,** 1055.
Col. A. M. Miller, 1904. **R., 04,** 1320.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1167.
Lt. Col. W. C. Langfitt, 1911–. **R., 12,** 1672.

Assistants:
Capt. C. B. Phillips. **R., 72,** 708.
J. E. Weyss and G. Thompson; **72,** 707, 708; **73,** 710.

ESTIMATES. (See Plans and Projects.)

By Capt. Phillips, 51,667 c. y. of dr. and 972 rods of wattling, $13,505.14; **72,** 707, 709. Increased by Maj. Craighill to $18,000, **72,** 69, 71, 688, 708; **73,** 74, 771; **75,** ii, 121.

Increased by S. T. Abert, U. S. C. E., to $20,000, **76,** 67, 348. To complete existing proj., $14,500; **77,** 64, 359. The work reported completed, **79,** 84, 605.

OBSTRUCTIONS.

The Sec. of War, 1892, ordered the Richmond, Fredericksburg & Potomac RR. to widen the draw of its br. over the creek to 40′ and revoked the order, 1893, **93,** 1287.

Sec. of War, 1895, approv. plans and granted permission to the Richmond, Fredericksburg & Potomac RR. to erect temporary structures in the creek, and to close the draw to navigation while new girders were being placed in the br., **95,** 479, 1227.

OPERATIONS.

1874–75. 17,576 c. y. removed, **75,** ii, 122.
1875–76. Chan. begun 1874 was completed 4′ x 40′, and a portion w. to 80′, **76,** 348.
1878–79. Chans. completed by dr. 5′ x 50′, being all that the requirements of C. demanded, **79,** 84, 605.
1890–91. 2,670 l. f. chan. dr. to 6′ x 80′, **91,** 1257.
1891–92. Chan. completed to the Richmond, Fredericksburg & Potomac RR. br., **92,** 1044.
1893–94. 28,554 c. y. dr., **94,** 947.
1894–95. 17,731 c. y. dr., **95,** 1227.
1897–98. About 18,000 c. y. dr., **98,** 1192, 1194.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 708, 709; **74,** ii, 37; **75,** 92; **90,** 1100; **97,** 1324; **98,** 1193; **12,** 373, 374.

PLANS.

By S. T. Abert, 1890, excavation of a cut from Brents Pt. to the Narrows, 8′ x 150′ at the mouth of Austens Creek, with the constr. of 100 l. f. of brush and pile dike; est., $101,278, **90,** 1102; **91,** 1256.

PROJECTS.

By Capt. Phillips, and concurred in by Maj. Craighill, dr. chan. 6′ x 40′ from the "Narrows" to the 6′ curve below the new RR. br., and wattling the chan. banks from the "Narrows" to the br., 972 r.; est., $18,000, **72,** 69, 71, 688, 708, 709.

*Allotment.

By Maj. Craighill, expend. app. of 1872, dr. chan. 4′ x 20′ from the draw in the RR. br. toward the "Narrows" as far as practicable, **72,** 69, 689. Completion of, not justified by the wants of C., **74,** ii, 37. Modified by S. T. Abert to 50′ w. and 5′ d., **78,** 71, 510; **79,** 84, 604.

Act 1890 au. dr. chan. 8′ x 150′, mouth to Narrows; 8′ x 80′ off mouth of Austin Run and dike there; est., $101,278. Modified by Sec. of War, to gain 6′ x 80′ chan. mouth to Narrows (w. above Narrows omitted); est., $40,000, later reduced to $21,000, **90,** 1097, 1102; **12,** 374.

By Maj. Davis, 1893, the orig. proj. modified to permit the foot of the slope of dr. material deposited on the bank above the RR. br. to be 15′ from the edge instead of 20′, on account of a dr. large enough to secure the latter distance not being able to get through the RR. br. draw, **93,** 1287. Completed, 1898, **98,** 1194.

Act 1902 combined imp. of Aquia Creek with that of other Rs. and creeks, **03,** 208.

Act July 25, 1912, au. plan of Lt. Col. Langfitt for chan. 6′ x 100′ mouth to RR. br., 60′ w. from RR. br. to 400 y. below Coal Landing, and 100′–150′ w. from 400 y. below to 100 y. above Coal Landing; est., $21,400, with $1,000 an. mainten., **12,** 374.

SURVEYS.

Au. act Mar. 3, 1871, assigned to Maj. Craighill, and made under his direction and the immediate supervision of Capt. Phillips, **71,** 76, 620; **72,** 69, 71, 688.

By J. E. Weyss and G. Thompson, in June and July, 1871, **72,** 707, 708; **73,** 74, 771; **74,** 84; **75,** 92, ii, 121.

Au. act Aug. 11, 1888; made, 1890, by S. T. Abert, **90,** 1097.

Ex. by Lt. Col. Allen, 1897, **97,** 1325.

Sur., 1904, showed chan. completed, **05,** 1167.

From Coal Landing to Wharton Landing, au. act Mar. 2, 1907; made, 1907–08; Maj. Spencer Cosby's **R.** unfav.,[1] **08,** 265.

Ex., Coal Landing to mouth, au. act June 25, 1910; Capt. W. T. Hannum's **R.,** Oct. 24, 1910; sur. of same au. by same act, made 1911; Lt. Col. W. C. Langfitt's **R.,** June 16, 1911; est., $21,400, with $1,000 an. mainten.[2] (see Projects), **12,** 390.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 375.

K-109 POTOMAC CREEK, VA.

COMMERCE.

Small, **91,** 1286.

ENGINEERS.

Chief of Engineers. **R., 91,** 146, 1285.

In charge. Lt. Col. P. C. Hains, 1890. **R., 91,** 1285.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1285.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Hains (**R.** unfav.), **91,** 1286.

K-111 UPPER MACHODOC CREEK, VA.

APPROPRIATIONS.

1910,	$10,000,	**10,** 1346.
1911,	13,200,	**11,** 1452.
Total,	23,200	

COMMERCE.

In 1911, about 10,000 t., **12,** 373.

CONTRACTS.

1910. J. H. Miller, dr., 12.9¢ c. y., **11,** 1452.
1911. Miner Engr. Co., dr., 14.8¢ c. y., **12,** 1671.

ENGINEERS.

Chief of Engineers. **R., 81,** 158; **82,** 154; **91,** 146, 1286; **06,** 237; **10,** 289; **11,** 314; **12,** 372.

In charge:
S. T. Abert, U. S. agent. **R., 82,** 1067.
Lt. Col. P. C. Hains, 1890. **R., 91,** 1287.
Lt. Col. S. S. Leach, **06,** 215.
Lt. Col. R. L. Hoxie, **06,** 215.
Capt. S. Cosby, **06,** 215.
Capt. W. T. Hannum, 1910. **R., 10,** 1346.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1451; **12,** 1671.

OPERATIONS.

1910-11. 61,305 c. y. dr., giving chan. 6½′ x 100′ through 3 lower bars, **11,** 1451.

1911-12. 67,063 c. y. dr., completing proj., **12,** 1671.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1287; **10,** 289.

Tidal stream, 10 m. l., having "few fluvial" characteristics; enters Potomac 63 m. below Washington, **12,** 372.

PLANS.

By S. T. Abert, 1882, 7½′ chan. 75′ w., Potomac R. to Clannahans Wharf, $35,771; for a similar chan. from Potomac R. to Milford Landing, $53,769, **82,** 1067, 1068.

PROJECT.

Act June 25, 1910, au. dr. chan. 6½′ x 100′, mouth Little Ferry Wharf, 6′ x 50′ to Milford Landing, and turning-basins; est., $23,200, and $1,600 an. mainten.,[3] **10,** 290; **12,** 373.

SURVEYS.

Au. act Mar. 3, 1881; made, 1882, by S. T. Abert, **82,** 1067.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Hains (**R.** unfav.), **91,** 1287.

Ex. au. act Mar. 3, 1905; made, 1905, by Lt. Col. Leach (**R.** unfav.),[4] **06,** 237.

K-113(a) COLONIAL BEACH, WESTMORELAND COUNTY, VA.

ENGINEERS.

Chief of Engineers. **R., 85,** 153.

In charge. S. T. Abert, U. S. agent. **R., 85,** 1001, 1002, 1003, 1004.

PHYSICAL CHARACTERISTICS.

Description of locality, **85,** 1001, 1005.

PLANS.

By S. T. Abert, 1885, dr. chan. 16′ x 300′ and a turning-basin 400′ sq.; est., $20,800, **85,** 1003, 1005. Not approv. by the Chief of Engineers, **85,** 1004.

SURVEY.

Au. act July 5, 1884; made by S. T. Abert (see Plans), **85,** 1001, 1002.

[1] H. D. 964, 60th, 1st. [2] H. D. 579, 62d, 2d. [3] R. & H. C. D. 4, 61st, 2d. [4] H. D. 136, 59th, 1st.

K-114 MATTOX CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 87,** 114; **10,** 308.

In charge:
S. T. Abert, U. S. agent, 1886. **R., 87,** 959.
Maj. J. J. Morrow, **10,** 282.

PHYSICAL CHARACTERISTICS.

Description. Sufficient d., **87,** 959.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by S. T. Abert (**R.** unfav.), **87,** 959.
Ex. au. act Mar. 3, 1909, for increased d. through bar at entrance to 15′; made, 1909, by Maj. Morrow (**R.** unfav.),[1] **10,** 308.

K-117 CURRIOMAN BAY, VA.

ENGINEERS.

Chief of Engineers. **R., 80,** 117, 158; **81,** 158.
In charge. S. T. Abert, U. S. agent, 1880. **R., 81,** 982.

PLANS.

By S. T. Abert, 1881, dr. chan. through bar 11′ x 150′ x 2,050′ l. w.; est., $8,278, **81,** 983.

SURVEY.

Of mouth au. act June 14, 1880; made, 1880, by S. T. Abert, **81,** 982.

K-118 NOMINI CREEK, VA.

APPROPRIATIONS.

1873,	$10,000,	**73,** 75, 78; **74,** 85.
1874,	6,000,	**74,** 85.
1875,	5,000,	**75,** 93, ii, 124.
1879,	2,500,	**79,** 84, 607.
1880,	5,000,	**80,** 113, 760.
1881,	2,000,	**81,** 953.
1882,	2,000,	**82,** 1015.
1888,	5,000,	**88,** 817.
1890,	5,000,	**90,** 1064.
1892,	10,000,	**92,** 1048.
1894,	5,000,	**94,** 140; **95,** 1230.
1896,	2,500,	**96,** 1042.
1899,	10,000,	**99,** 1424.
1905,	4,000,	**05,** 1171.
1907,	5,000,	**07,** 1181.
1909,	*4,000,	**09,** 1234.
1910,	5,000,	**10,** 1348.
1911,	8,000,	**11,** 1453.
Total,	96,000	

COMMERCE.

Requirements discussed, **78,** 511; **79,** 606, 607.
Industries affected by imp., **88,** 817.
Shipments of grain, oysters, truck, etc., by 2 lines of SS. facilitated by the imp., **96,** 1041; **97,** 1327.
Imp. benefit to navigation, **06,** 228.
1911, 20,777 t., **12,** 1674.
Rates considerably reduced, and shipments much facilitated, **12,** 376.

CONTRACTS.

1873. G. H. Ferris, dr., **73,** 774; **74,** 85, ii, 38.
1874. E. M. Payne, dr., 26½¢ c. y., **75,** ii, 123.
1875. J. H. Teemeyer, dr., 30¢ c. y., **76,** 349.
1879. G. C. Fobes & Co., dr., 29¾¢ c. y., **80,** 758.
1880. National Dredging Co., dr., 20¢ c. y., **81,** 952.
1881. National Dredging Co., dr., 15¾¢ c. y., **82,** 1014.
1883. H. Birch, dr., 19¢ c. y., **84,** 983.
1888. C. W. Ridley, dr., 25¢ c. y., **89,** 1003.
1891. F. L. Somers, dr., 26½¢ c. y., **91,** 1260.
1892. G. W. Gray, j. constr., oyster shells at $1.73 c. y., riprap st. at $5.19 c. y. ($9,861), **93,** 1294.
1894. T. P. Morgan, dr., 23¢ c. y. ($3,910), **95,** 1231. (Contract annulled in 1895, **96,** 1041.)
1896. C. T. Caler, dr., 22½¢ c. y. ($2,025), **96,** 1042.
1897. Baltimore Dredging Co., dr., 22¢ c. y. ($1,760), **98,** 1192.
1899. J. L. Mills, dr., 16¾¢ c. y. ($586.25), **00,** 1710. J. Valliant, oyster shells for j., 94¢ c. y. ($1,128); J. McCuen, quarry st. for j., $2.10 c. y. ($777), **00,** 1713.
1904. Maryland Dredging Co., dr., 15¢ c. y., **05,** 1171.
1906. Charles G. Smith & Son, st., $2.67 c. y., **06,** 1106.
1907. Charles G. Smith & Son, constr. riprap j., st., $3.34 c. y., **08,** 1231.
1909. Chesapeake Stevedore Co., constr. and repairing riprap js., st., $2.60 c. y., **09,** 1235.
1910. Maryland Dredging & Contracting Co., dr. about 10,000 c. y., 25.3¢ c. y.; Potomac Sand & Gravel Co., riprap st. (about 1,000 c. y.), $2.75 c. y., **11,** 1453–54.

ENGINEERS.

Chief of Engineers. **R., 72,** 74; **73,** 75, 78; **74,** 85; **75,** 92; **76,** 67; **77,** 64; **78,** 71; **79,** 84; **80,** 113, 117; **81,** 153, 158; **82,** 147; **83,** 153; **84,** 155; **85,** 145; **86,** 141; **87,** 107; **88,** 109; **89,** 126; **90,** 113; **91,** 140; **92,** 141; **93,** 153; **94,** 140; **95,** 116; **96,** 145; **97,** 179; **98,** 183; **99,** 211; **00,** 241; **01,** 279; **02,** 210; **03,** 209; **04,** 207; **05,** 217; **06,** 228; **07,** 240; **08,** 253; **09,** 263; **10,** 292; **11,** 315; **12,** 375.

In charge:
Maj. W. P. Craighill, 1873. **R., 73,** 774, 822, 825.
S. T. Abert, U. S. agent, 1874–92. **R., 75,** ii, 110; **76,** 349; **77,** 359; **79,** 605; **80,** 757; **81,** 951, 954; **82,** 1012; **83,** 799; **84,** 982; **85,** 966; **86,** 903; **87,** 932; **88,** 816; **89,** 1003; **90,** 1063; **91,** 1259.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1047; **93,** 1292; **94,** 948; **95,** 1228.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1039; (Lt. Col.) **97,** 1326; **98,** 1195; **99,** 1423; **00,** 1711; **01,** 1409; **02,** 1092; **03,** 1057.
Col. A. M. Miller, 1904. **R., 04,** 1322.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1170.
Capt. S. Cosby, 1906–08. **R., 06,** 1106; (Maj.) **07,** 1181; **08,** 1230.
Maj. J. J. Morrow, 1909. **R., 09,** 1234.
Capt. W. T. Hannum, 1910. **R., 10,** 1348.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1453; **12,** 1673.

Assistant. W. Popp. **R., 73,** 822, 828.

ESTIMATES. (See Projects.)

By W. Popp, dr. chan. 9′ x 100′, $20,000, **73,** 822, 823.
By Maj. Craighill, dr. chan. through at the mouth of creek 8′ d., $18,000; 7′ d., $13,000; 6′ d., $8,000, **73,** 822. Increased to $22,000, **74,** ii, 38.

OPERATIONS.[1]

History of operations, **80,** 757; **82,** 1012.
1872–73. Dr. by contract, **75,** 774.
1873–74. Results of dr. a chan. 7′ x 50′, **74,** 85, ii, 38.

*Allotment.
[1] H. D. 361, 61st, 2d.
[2] History of operations, **80,** 757; **82,** 1012.

1874–75. Removal of 20,759 c. y., **75,** 92, ii, 123.
1875–76. Removal of 6,016 c. y.; piles driven to mark the chan., **76,** 349.
1876–77. Removal of 5,003 c. y., **77,** 64, 359.
1879–80. 6,800 c. y. dr. from bar across the chan., **80,** 759.
1880–81. 21,271 c. y. dr. from chan., **81,** 953.
1881–82. 10,002 c. y. dr. from inside chan., **82,** 1014.
1883–84. 8,996 c. y. dr. from chan. near Ice-House Pt., **84,** 983.
1888–89. 12,738 c. y. dr., **89,** 1003.
1890–91. 406 c. y. riprap used in dike constr., **91,** 1260, 1261; **93,** 1293.
1892–93. 10,927 c. y. dr.; 200 l. f. j. constr. at White Pt., **93,** 1293.
1893–94. 465 l. f. j. constr., **94,** 950.
1894–95. 819 l. f. j. constr., **95,** 1230.
1895–96. 17,939 c. y. dr., **96,** 1041.
1897–98. 8,000 c. y. dr., **98,** 1196.
1899–00. 1,432 c. y. dr., and 130 l. f. dike raised, **00,** 1711, 1712.
1900–01. 742 l. f. e. j. raised and lengthened 53′, **01,** 1409.
1904–05. 15,138 c. y. dr., **05,** 1170.
1905–06. Jetty extended 180′, and 169′ shore protection built, **06,** 1106.
1906–07. Willow trees and clover planted as protection for sand against wind and wave action, **07,** 1181.
1907–08. Jetty extended 370′, **08,** 1230.
1908–09. Jetty extended 288′ on outer end and 266′ on inner end, **09,** 1234.
1910–11. 8,574 c. y. dr. by hydraulic dr. *Elk*, and dr. material deposited on flats a distance of at least 500′ from chan., **11,** 1453.
1911–12. Repairs to riprap j. begun, and 1,222.9 c. y. riprap and about 3,000 c. y. oyster shells placed; j. now 2,410′ long and contains a total of 7,237 c. y. riprap and 3,000 c. y. oyster shells, **12,** 1673.

PHYSICAL CHARACTERISTICS.

Described, **73,** 822, 823, 828; **74,** 85; **77,** 359, 360; **79,** 606; **81,** 954; **98,** 1195; **01,** 279.

PROJECTS. (See Estimates.)

Orig. proj. au. 1873 for dr. chan. through the bar 9′ x 100′ l. t.; est., $20,000, **73,** 75, 774; **74,** ii, 38.
Proj. amended, 1879, by increasing the w. to 150′, **79,** 606.
1885, proj. again modified to provide for chan. 9′ x 200′; also for dr. training chan. and constr. of training dikes; total est. amended proj., $62,500.
In 1888, owing to deterioration during suspension of work, 1883 to 1889, est. increased to $72,500, **91,** 1260; **92,** 1047.
Est. revised, 1897, increased to $105,000, **98,** 1195.
1908, proj. modified to provide for chan. through the bar 9′ x 150′, with j. about 2,370′ l. at the mouth; revised est., $105,000, **08,** 254.

SURVEYS.

Under direction of Maj. Craighill, **72,** 74, by W. Popp, 1872. **R., 73,** 822, 825, 828.
By S. T. Abert, U. S. C. E., 1876, **77,** 359.
Au. act June 14, 1880; made, 1881, by S. T. Abert, **81,** 954.
Ex. of chan. near Ice-House Pt., 1883, **83,** 799.
Ex., 1897, by Lt. Col. Allen, **97,** 1327.
Ex., 1899, by Lt. Col. C. J. Allen, **99,** 1423.
Of chan. by Maj. Cosby, **08,** 1230.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 376.
Maps. **85,** 966; **89,** 1004.

K-119 LOWER MACHODOC CREEK, VA.

APPROPRIATIONS.

1892,	$3,000, **93,** 1290.
1894,	3,000, **95,** 1233.
1896,	1,500, **96,** 1045.
1899,	1,500, **99,** 1425.
1902,	*2,180, **03,** 1054.
Total,	[1] 11,180

COMMERCE.

Benefit to C. largely prospective, **96,** 1045. Steamer from Washington making weekly trips to newly established wharf in 1897, **97,** 1330.
Great benefit of imp. to navigation and C.; large sailing vessels and regular lines of steamers now enter; impossible before, **02,** 209.

CONTRACTS.

1893. F. L. Somers, dr., 21¢ c. y. ($2,394), **93,** 1291.
1894. T. P. Morgan, dr., 23¢ c. y. ($2,760), **95,** 1231. (Annulled in 1895 on account of failure of contractor, **96,** 1044.)
1896. C. T. Caler, dr., 22½¢ c. y. ($2,362.50), **96,** 1042.
1897. Baltimore Dredging Co., dr., 22¢ c. y. ($1,110), **98,** 1192.
1899. J. L. Mills, dr., 16¾¢ c. y. ($837.50), **00,** 1710.
1902. John Miller, dr., 17.4¢ c. y., **03,** 1054.

ENGINEERS.

Chief of Engineers. R., 89, 135; **93,** 152; **94,** 141; **95,** 162; **96,** 146; **97,** 181; **98,** 184; **99,** 212; **00,** 242; **01,** 281; **02,** 209; **03,** 206; **04,** 203.

In charge:

Col. W. P. Craighill, 1889. **R., 89,** 1037.
Maj. C. E. L. B. Davis, 1892–95. **R., 93,** 1289; **94,** 950; **95,** 1231.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1043; (Lt. Col.) **97,** 1329; **98,** 1197; **99,** 1424; **00,** 1714; **01,** 1410; **02,** 1091; **03,** 1053.
Col. A. M. Miller, 1904. **R., 04,** 1318.

OPERATIONS.

1892–93. Dr. in progress, **93,** 1290.
1893–94. 11,691 c. y. dr., **94,** 952.
1895–96. 10,398 c. y. dr., **96,** 1044.
1897–98. 4,957 c. y. dr., **98,** 1198.
1899–00. 6,240 c. y. dr., **00,** 1714.
1902–03. 7,095 c. y. dr., completing proj., **03,** 1053.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1037; **03,** 206.
Description of, and of orig. condition, **97,** 1329.

PROJECTS.

By Maj. Davis, 1892, dr. chan. 9′ x 150′ through the bar at the Narrows; est., $15,000, **93,** 152; available funds to be used to obtain a chan. 6′ x 100′ or more w. until Congress should app. more money for the imp., **93,** 1290.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert (Col. Craighill's **R.** unfav.), **89,** 1037.
Sur. made, 1892, by Maj. Davis, **93,** 1290.
Ex., 1897, by Lt. Col. Allen, **97,** 133; and in 1899, **99,** 1424.
Maps. **94,** 952.

*Allotment. [1] $487.65 and $175.88 trans. to consolidated app., **04,** 1319.

K-129 COAN RIVER, VA.

ENGINEERS.

Chief of Engineers. **R., 06,** 237.
In charge:
Lt. Col. S. S. Leach, **06,** 215.
Lt. Col. R. L. Hoxie, **06,** 215.

SURVEY.

Ex. and sur. au. act Mar. 3, 1905; made, 1905, by Lt. Col. Leach and Lt. Col. Hoxie, resp. (**Rs.** unfav.),[1] **06,** 237.

K-133 HULLS CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 84,** 163; **89,** 134.

In charge. S. T. Abert, U. S. agent, 1884–88. **R., 84,** 1004; **89,** 1025.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1004; **89,** 1026.

PLANS.

In 1883–88 S. T. Abert considered imp. of Hulls Creek not a public necessity, **84,** 1004; **89,** 1027.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by S. T. Abert (**R.** unfav.), **84,** 1004.
Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert (**R.** unfav.), **89,** 1025.

K-136 LITTLE WICOMICO RIVER, VA.

COMMERCE.

Benefit of proposed imp., **75,** ii, 144, 146.
C. would not justify large expend. necessary for a permanent imp., **93,** 1317; **95,** 1261. In 1894, 4,945 t., **95,** 1261.

ENGINEERS.

Chief of Engineers. **R., 75,** 95; **93,** 158; **95,** 167.

In charge:
S. T. Abert, U. S. agent. **R., 75,** ii, 142.
Maj. C. E. L. B. Davis, 1892–95. **R., 93,** 1315; **95,** 1258.

Assistant. J. B. Duncklee. **R., 75,** ii, 145.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 142, 143.
Bar at mouth of R., **75,** ii, 145.
Description of, **93,** 1316; **95,** 1259.
Ruling d. over bar at mouth, 1895, 3′, **95,** 1260.

PLANS.

By S. T. Abert, pile j. 2,600′ l.; dr. chan. 7′ x 150′; est., $30,529. For canal uniting Great and Little Wicomico Rs., 15′ x 4,480′ on the bottom, and 5′ m. l. w.; est., $57,300, **75,** ii, 143, 144, 145.

SURVEYS.

Included in Coast Sur., 1849, 1856, **75,** ii, 142.
By J. B. Duncklee, 1874–75, sur. of mouth and of a proposed line for a canal uniting Great and Little Wicomico Rs. **R., 75,** ii, 142, 145.
Ex. au. act July 13, 1892; made, 1892, by Maj. Davis (**R.** unfav.), **93,** 1315.
Ex. of bar at mouth au. act Aug. 17, 1894; made by Maj. Davis, 1894 (**R.** unfav.), **95,** 1258.

K-137 GREAT WICOMICO RIVER, VA.

COMMERCE.

Unimportant, **91,** 1288.
1893, 1,118 t., **95,** 1257. Character of the trade would not justify imp., **95,** 1258.

ENGINEERS.

Chief of Engineers. **R., 84,** 163; **91,** 146; **95,** 166.

In charge:
S. T. Abert, U. S. agent. **R., 84,** 1016, 1018.
Lt. Col. P. C. Hains, 1891. **R., 91,** 1288.
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1256.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1017, 1018; **91,** 1288; **95,** 1257.

PLANS.

By S. T. Abert, chan. 9′ x 150′, Holland Pt. to Seine House Pt., with a turning-basin at latter pt.; est., $46,419, **84,** 1019.

SURVEYS.

Au. act Aug. 2, 1882; made by S. T. Abert, **84,** 1018.
Ex. made, 1891, by Lt. Col. Hains (**R.** unfav.), **91,** 1288.
Ex. Cedar Pt. to Indian Pt. au. act Aug. 17, 1894; made by Maj. Davis, 1894 (**R.** unfav.), **95,** 1256.

K-141 CRANES CREEK, VA.

COMMERCE.

If creek were imp. it was est., 1894-95, there would be an an. C. of about 51,000 t., **95,** 1274.

ENGINEERS.

Chief of Engineers. **R., 91,** 146; **95,** 167.

In charge:
Lt. Col. P. C. Hains, 1891. **R., 91,** 1289.
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1271.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1289; **95,** 1272.

PROJECTS.

Maj. Davis, 1895, submitted 2 plans of imp.; est., $56,040 and $29,160, resp., **95,** 1273, 1274.

SURVEYS.

Ex., 1891, by Lt. Col. Hains (**R.** unfav.), **91,** 1289.
Sur. of the mouth au. act Aug. 17, 1894; made, 1895, by Maj. Davis (**R.** unfav.; see Projects), **95,** 1271.

[1] H. D. 288, 59th, 1st.

K-158 DYMERS CREEK, VA.

APPROPRIATIONS.

1910, $9,000, **10,** 1349.

COMMERCE.

1911, 16,663 t., **12,** 378, 1675.
Work has benefited navigation by making this stream a H. of refuge, **12,** 377.

CONTRACT.

1910. John H. Miller, dr. 26,000 c. y., 24.9¢ c. y., **11,** 1455.

ENGINEERS.

Chief of Engineers. R., 10, 293, 308; **11,** 316; **12,** 377.

In charge:
Capt. W. T. Hannum, 1910. **R., 10,** 1349.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1455; **12,** 1674.

OPERATIONS.

1910-11. 17,889 c. y. dr., completing proj. May 20, 1911, **11,** 1455.

1911-12. Floating plant constr. or repaired during year, **12,** 1674.

PHYSICAL CHARACTERISTICS.

Tidal estuary entering Fleets B., 3 m. or so n. of Rappahannock R. Land-locked H., 1 m. sq., affords anchorage of 15′–18′, **12,** 377.
Description of, **10,** 293.
Max. draft, about 15½′; range of tide, 1.3′, **12,** 377.

PROJECT.

By Maj. Morrow, 1909, dr. 15′ x 200′ x 600′ through sand bar at mouth; est., $9,000, and $500 an. for mainten.,[1] **10,** 293, 308; au. act June 25, 1910, **10,** 293.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909; **Rs.,** Maj. J. J. Morrow, May 13 and Sept. 20, 1909; est., $9,000,[1] **10,** 308.

K-171 RAPPAHANNOCK RIVER, VA.[2]

APPROPRIATIONS.

1852,	$3,000.00,	sur. Aug. 30.
1871,	15,000.00,	**71,** 72, 596.
1872,	15,000.00,	**72,** 69, 690.
1873,	15,000.00,	**73,** 74, 770.
1874,	7,000.00,	**74,** 84, ii, 31.
1875,	5,000.00,	**75,** 93, ii, 125.
1876,	10,000.00,	**76,** 67, 350; **77,** 65, 360.
1878,	13,500.00,	**78,** 71, 512.
1879,	10,000.00,	**79,** 85, 614.
1880,	25,000.00,	**80,** 766.
1881,	15,000.00,	**81,** 964.
1882,	17,000.00,	**82,** 1027.
1884,	20,000.00,	**84,** 986.
1886,	20,000.00,	**86,** 909.
1888,	[3] 12,000.00,	**88,** 823.
1890,	15,000.00,	**90,** 1069.
1892,	20,000.00,	**92,** 1054.
1894,	10,000.00,	**94,** 142; **95,** 1238.
1896,	8,000.00,	**96,** 1050.
1896,	1,916.97,	act Aug. 23.
1899,	15,000.00,	**99,** 1426.
1902,	25,000.00,	**02,** 1094.
1904,	*25,000.00,	**04,** 1326.
1905,	40,000.00,	**05,** 1173.
1907,	77,729.00,	**07,** 1184.
1908,	58,000.00,	**08,** 1235.
1909	*15,000.00,	**09,** 1238.
1909	32,000.00,	**09,** 1238.
1910,	15,000.00,	**10,** 1364.
1912,	5,000.00,	**12,** 1689.
Total,	565,145.97	(incl. misc. rects., and less $3,000 allotted in 1852 and $1,916.97 in 1896, $561,942, **12,** 1689).

COMMERCE.

Requirements, **73,** 770; **74,** ii, 30; **79,** 613.
Extent and character of C., **80,** 766.
Imp. of material relief by enabling craft to proceed to Fredericksburg at all stages of the tide. Tonnage steadily increasing; in 1895, 151,466 t., **97,** 1334.
Rates reduced, **05,** 219.
1911, 220,333 t., **12,** 386.
Imp. affords the coastwise trade access to upper portion of R., **12,** 386.

CONTRACTS.

1871. G. H. Ferris, dr., 24½¢ c. y., **71,** 596; **73,** 770. R. D. Minor, removal of wrecks, **71,** 596; **72,** 689. Hebrew & Asserson, removal of wrecks, **71,** 596; **72,** 689. B. Maillefert, removal of wrecks, **71,** 596; **72,** 689.
1872. A. A. Dodge, dr., 33¢ c. y., **73,** 770.
1873. A. A. Dodge, dr., 33¢ c. y., **74,** ii, 29, 31.
1875. E. M. Payne, dr., 34½¢ c. y.; constr. dike, $4.31 l. f., **76,** 350.
1876. G. H. Ferris, dr., 34½¢ c. y., **76,** 350.
1877. T. P. Morgan, dr., 28¢ c. y.; constr. dike, $4.90 l. f., **77,** 360.
1878. E. F. De Graw, constr. dikes, $2.35 and $3.25 l. f., **79,** 611, 612. D. Constantine, dr., 23¢ c. y., **79,** 612.
1880. A. Kishpaugh, dike constr., **80,** 764. H. Birch, dr., 19¾¢ c. y., **81,** 961. A. Kishpaugh, dike constr., **81,** 961.
1887. A. Kishpaugh, crib and pile dike constr., $4.70 and $5.85 l. f., resp., **87,** 936.
1888. American Dredging Co., dr., 23¢ c. y., **88,** 821.
1889. G. E. Ward, brush mattress dike constr., $4.53, $3.45, and $2.65, resp., l. f., **89,** 1006.
1891. F. C. Somers, dr., 31¢ c. y., **92,** 1053. H. T. Morrison & Co., constr. of plant, $6,129.75, **92,** 1053.
1893. G. K. Baker, dr., 27¢ c. y. ($13,500), **93,** 1300.
1895. W. S. Embrey, white oak piles, $2.80 pile; white oak lumber, $15 M f., b. m., **95,** 1238.
Virginia Dredging Co., dr., 23.7¢ c. y. ($4,266), **96,** 1051.
1898. A. M. Clegg and M. A. Dugan, dr., 29.75¢ c. y.; r. removal, $3 c. y. ($7,955), **99,** 1427.
1899. J. Miller, dr., 27¢ c. y. ($5,670), **00,** 1716.
1901. W. H. French, dr., 32¢ c. y., **01,** 1413.
1902. W. S. Embrey, pine lumber, **03,** 1060.
1904. John L. Grim, dr., 29¾¢ c. y., **04,** 1326. John L. Grim, dr., 33¢ c. y., **05,** 1174.
1906. E. L. Miner, dr., 24½¢ c. y.; Duke & Smith (Inc.), lumber, $18 M; piles, 7¢ l. f., **06,** 1109.
1907. Carter & Clarke, lumber, $22.70 M; W. A. Eubank, piles, 6¾¢ l. f.; J. H. Davis, riprap st., $2.10 c. y., **08,** 1236.
1908. Bowers Hydraulic Dredging Co., dr., 14.9¢ c. y., **08,** 1236.

*Allotment.
[1] H. D. 325, 61st, 2d.
[2] Sur.—**R.,** Nov. 26, 1852; est., $40,000. (H. D. 482, 55th, 2d.)
[3] Part of $15,000, $3,000 of which was for Urbana Creek, **90,** 1068.

1909. Chesapeake Stevedore Co., constr. and repairing riprap js., $2.40 c. y., **09,** 1238.

1912. Miner Engineering Co., dr. 36,000 c. y., 23¢ c. y., **12,** 1689.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 68; **71,** 72; **72,** 69; **73,** 74; **74,** 84; **75,** 93; **76,** 67; **77,** 64; **78,** 71; **79,** 85; **80,** 113; **81,** 153; **82,** 148; **83,** 154; **84,** 156; **85,** 146; **86,** 142; **87,** 108; **88,** 111; **89,** 128; **90,** 114; **91,** 142; **92,** 143; **93,** 154; **94,** 142; **95,** 163; **96,** 148; **97,** 181; **98,** 184; **99,** 213; **00,** 243; **01,** 282; **02,** 211; **03,** 210; **04,** 208; **05,** 218; **06,** 229, 1112; **07,** 241; **08,** 254; **09,** 264; **10,** 300; **11,** 323; **12,** 384.

In charge:

Maj. W. P. Craighill, 1870–75; **70,** 68. **R., 71,** 595; **72,** 689; **73,** 770; **74,** ii, 29, 31.

S. T. Abert, U. S. C. E., 1875–91. **R., 75,** ii, 124; **76,** 350; **77,** 360; **78,** 511; **79,** 607; **80,** 760; **81,** 957; **82,** 1017; **83,** 802; **84,** 985; **85,** 971; **86,** 906; **87,** 935; **88,** 819; **89,** 1005; **90,** 1065.

Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1264.

Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1050; **93,** 1296; **94,** 954; **95,** 1234.

Maj. C. J. Allen, 1896–1903. **R., 96,** 1046; (Lt. Col.) **97,** 1331; **98,** 1198; **99,** 1425; **00,** 1715; **01,** 1411; **02,** 1093; **03,** 1058.

Col. A. M. Miller, 1904. **R., 04,** 1324.

Lt. Col. S. S. Leach, 1905. **R., 05,** 1171.

Lt. Col. R. L. Hoxie, 1906. **R., 06,** 1110.

Capt. S. Cosby, 1906–08. **R., 06,** 1107; (Maj.) **07,** 1182; **08,** 1232.

Maj. J. J. Morrow, 1909. **R., 09,** 1235.

Capt. W. T. Hannum, 1910. **R., 10,** 1361.

Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1467; **12,** 1687.

Assistant. N. H. Hutton. **R., 73,** 770; **74,** ii, 33.

ESTIMATES. (See Projects.)

By N. H. Hutton, 1871, chan. 10′ x 100′, $83,360, **71,** 596; **72,** 689; **74,** ii, 33–35.

By Maj. Craighill, 1873, an. dr. to maintain chan. 8′ d., $6,000 to $7,500, **73,** 770; **74,** 84, ii, 30. In 1874, to complete to 10′ in d., $56,940, **74,** ii, 30.

By S. T. Abert, U. S. C. E., 1877, to complete existing proj., $59,500, **77,** 361. Revised, 1879, to $290,000, **79,** 85, 612–614.

MISCELLANEOUS.

Description and use of sheet pile dikes, **08,** 1233.

OPERATIONS.

1870–71. Dr. in progress, **71,** 596.

1871–72. Chan. dr. through Spottswood and Fredericksburg Bars 8′ x 70′; wrecks removed, **72,** 69, 689.

1872–73. Chan. increased to 125′ w., wrecks removed, and over 1,600′ of dikes built, **73,** 74, 770.

1873–74. Dr. 17,500 c. y., **74,** ii, 29, 30.

1874–75. Dr., **75,** 93, 124, 125.

1875–76. Dr., **76,** 350.

1876–77. Dike built; dr. in progress, **77,** 361.

1877–78. 22,828 c. y. dr. and 352½ l. f. of dike built, **78,** 511.

1878–79. Building dikes and dr., **79,** 85, 610.

1879–80. Dikes 4 and 5 completed, 56 snags and 1 wreck removed from the Spottswood Bar reach; Fredericksburg Dike No. 6 built; constr. of Spottswood Bar spur dams commenced; 80′ of crib dike built, **80,** 764.

1880–81. Spottswood Bar spur dikes completed; Dikes A, B, C, D, E, and F completed; 20,572 c. y. dr. at Spottswood and Fredericksburg Bars, **81,** 962.

1881–82. 1,580 l. f. Dike K, deflecting Dike I, Spur Dike G, and Dikes H and L built; 62,008 c. y. dr. at Fredericksburg and Spottswood Bars, **82,** 1019, 1020, 1021.

1882–83. 1,310 l. f. Dike No. 5 removed; crib dike and 155 l. f. of deflecting log dike built; dike at Pratts Bar repaired; 170 l. f. wattling built, and 4 snags removed from Spottswood Bar; 6 log dikes built at Castle Ferry Bar, aggregating 1,046′; 52,307 c. y. dr. from Fredericksburg, Pollocks, and Castle Ferry Bars, **83,** 810.

1884–85. Repairs to following dikes by hired labor: Fredericksburg, Pollocks Bar, Bernards Bar, Pratts Reach Bar, Castle Ferry Bar, Spottswood and Farleyvale Bars; a total l. of 518′ of diking also built by contract; 3,867 c. y. dr. from the turning-basin, **85,** 973, 974, 975.

1885–86. 39,494 c. y. dr. from Fredericksburg and Spottswood Bars; dike repaired at Fredericksburg Bar, and mats sunk at Spottswood and Farleyvale, **86,** 907, 908.

1886–87. Crib and pile dike constr. commenced under contract; extensive repairs made to existing dikes; 26 snags and 125 trees cut and removed, **87,** 937.

1887–88. 730 l. f. crib dike and 678 l. f. pile dike built, and 1,596 l. f. brush mattress sunk; 12,438 c. y. dr.; 197 c. y. st. blasted and removed, **88,** 822.

1888–89. Repairs to plant; 758 l. f. brush bank protection repaired; 617 l. f. sheet pile dike repaired; 1,840 s. f. mattress sunk; 133 snags, logs, and trees removed; the above work was done by hired labor; 450 l. f. dike built under contract, **89,** 1006.

1889–90. 156 l. f. retaining dike, 462 l. f. shore connection, and 1,291 l. f. brush mattress dike built, **90,** 1066.

1890–91. Repairs to dike constr. at Fredericksburg, Pollock, Bernard, Spottswood, and Castle Ferry Bars, **91,** 1266.

1891–92. 18,028 c. y. dr.; sunken scow removed from the chan., **92,** 1053.

1892–93. 14 snags removed, 712 l. f. dikes constr., and dr. in progress, **93,** 1299.

1893–94. In connection with previous year, 39,670 c. y. dr., **94,** 957: 5,629 l. f. brush fences constr. behind Dikes Nos. 7, E, and F, **94,** 958.

1895–96. 595 l. f. sheet-pile dike constr., 12,464 c. y. dr., 2,551 l. f. brush fences built on dikes, and 2,894 willow cuttings planted to protect dr. material from being carried away by freshets, **96,** 1049.

1898–99. 1,339 c. y. r., 10,000 c. y. mud dr., some snags removed, and constr. of Dike H in progress, **99,** 1426.

1899–00. 4,435 c. y. dr. and constr. of Dike H completed, **00,** 1715.

1900–01. 19,730 c. y. dr., **01,** 1411; 95 l. f. wattling dike built, willows planted, and cross drain cleaned and repaired, **01,** 1412.

1901–02. 10,168 c. y. dr., large bowlders removed, wattling constr., and other work of repair and mainten., **02,** 1093.

1902–03. Large trees removed from fill, Dikes No. 3 reconstr. and No. 4 partly reconstr., **03,** 1058.

1903–04. 1,566′ dike repaired and constr.; 20,109 c. y. dr., **04,** 1324.

1904–05. 37,815 c. y. dr. and 4,800 l. f. dike repaired, **05,** 1172.

1905–06. 48,107 c. y. dr., **06,** 1107. Wattling constr., willows planted and other minor mainten. work done, and dike work begun, **06,** 1108.

1906–07. Old dikes repaired, 3,620 l. f. dikes built, 47,422 c. y. dr., obstr. removed, wattlings built, and willows planted, **07,** 1182.

1907–08. 10,364 c. y. dr., and 5 snags and 1 wreck removed, **08,** 1232: 5,809 l. f. timber dikes completed, 5,486 l. f. partly completed, 675 l. f. riprap dike built, and timber dike protected with riprap, **08,** 1233.

1908–09. 461,430 c. y. dr., **09,** 1235. 5,486 l. f. timber dike completed, 492 l. f. dike repaired, riprap j. extended 240′, timber dikes protected with riprap, wattlings and drains built, and willows planted, **09,** 1237.

1909–10. 186,110 c. y. dr., **10,** 1362. 8 dikes, aggregating 700′, built; 991 l. f. riprap j. built, j. completed; wattlings and drains placed and willows planted, **10,** 1363.

1910–11. Repairs to dikes, digging ditches, placing drain tiling, repairing wattling, fencing, planting willowslips, etc., **11,** 1467.

1911–12. 12,925 c. y. dr. from turning-basin, protection work for sand fills, and repairs to floating plant, **12,** 1687.

PHYSICAL CHARACTERISTICS.

Orig. condition of the R., **88,** 819–820; **98,** 1198.
Ruling chan. d. before and after imp., **98,** 1200.
Description of, **02,** 211.

PRIVATE WORK.

Wreck of steamer *Richmond* removed by owners, **03,** 1058.

PROJECTS. (See Estimates.)

By Maj. Craighill, 1871, chan. 10′ x 100′ l. w. by dr. through shoals, removal of rs., and with training dikes at various points, **71,** 596; **72,** 689.

By S. T. Abert, 1879, chan. 10′ x 100′ over the bars between Fredericksburg and Port Royal, by dr. and with dikes and wing dams; also for increasing the chan. w. to 15′ x 200′ below Port Royal, mainten. with training dikes; est., $291,000, **79,** 85, 613; **80,** 764; **87,** 935. Amount app. from 1871 to 1886, incl., $187,500; amount est. to complete proj., $194,000, **86,** 142; **87,** 937; **91,** 1265.

By Maj. Davis, 1894, constr. and repair of dikes and removal of obstrs. by open-market purchases and hired labor, and for dr. by contract as might be found necessary and practicable, at Fredericksburg and other bars, **95,** 1237, 1238.

By Lt. Col. Hoxie, chan. 12′ x 100′, Fredericksburg to Port Royal, and 200′ w. from Port Royal to mouth by dr. and dike constr.; est., $363,228.86, **06,** 1108, 1110.

SURVEYS.

1852. Ex. by J. K. F. Mansfield, **74,** ii, 36.
1853–54. By U. S. Coast Sur., **74,** ii, 31, 32.
1870. Under direction of Maj. Craighill, by N. H. Hutton, **74,** ii, 31, 37.
1879. Of Spottswood Bar, under direction of S. T. Abert, **79,** 612.
Bars at Nanzatico Reach and Naylors Hole, 1885, **86,** 909.
Surs. made in 1892 by Maj. Davis, **93,** 1298.
Ex. by Lt. Col. Allen in 1897, **97,** 1333.
Of bars, au. act Mar. 3, 1905; made, 1905, **06,** 1108, 1110.

Maps:
Fredericksburg and Spottswood Bars, **80,** 760; **81,** 964.
Fredericksburg, Spottswood, Farleyvale, and Castle Ferry Bars, **83,** 812.
Rappahannock and Spottswood Bars, **85,** 976.
Fredericksburg, Spottswood, and Farleyvale Bars, **86,** 908.
Nanzatico Reach, **86,** 908.
Fredericksburg and Pollocks Bars, **87,** 937.
88, 822; **90,** 1066; **06,** 1110; **09,** 1238; **10,** 1364.

K-174 CARTERS CREEK, VA.

APPROPRIATIONS.

1902	*$7,000.00,	**03,** 1056.
	*487.65,	**04,** 1321.
	*2,984.18,	**05,** 1168, 1169.
1905,	*9,116.65,	**05,** 1169.
1907,	*[1]10,000.00,	**07,** 1180.
1909,	*1,000.00,	**09,** 1233.
Total,	30,588.48	(less $1,000 trans. to Mattaponi R., $29,588.48, **10,** 1360).

COMMERCE.

Description of, **00,** 1750, 1751.
Important; port also used as a H. of refuge, **06,** 227.
Tonnage, 1909, 69,000 t., **10,** 299.

CONTRACTS.

1904. John L. Grim, dr., 19¼¢ c. y., **04,** 1322.
1905. Charles G. Smith & Son, riprap st., $2.48 c. y., **06,** 1105.
1906. Charles P. Grim, dr., 26⅞¢ c. y., **06,** 1105.
1907. Miner Engineering Co., dr., 27¢ c. y., **08,** 1229.

ENGINEERS.

Chief of Engineers. **R., 99,** 223; **00,** 254; **02** 210; **03,** 208; **04,** 206; **05,** 216, 718; **06,** 226; **07** 239; **08,** 252; **09,** 261; **10,** 299.

In charge:
Lt. Col. C. J. Allen, 1900–03. **R., 00,** 1747, 1750; **03,** 1056.
Col. A. M. Miller, 1904. **R., 04,** 1321.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1168, 1182.
Capt. S. Cosby, 1906–08. **R., 06,** 1104; (Maj.) **07,** 1179; **08,** 1228.
Maj. J. J. Morrow, 1909. **R., 09,** 1232.
Capt. Warren T. Hannum, 1910–. **R., 10,** 1360.

OPERATIONS.

1904–05. 25,985 c. y. removed, **05,** 1168.
1905–06. 1,508 c. y. riprap st. placed by hired labor, forming j. 742′ l., at cost of $10.32 l. f., **06,** 1104.
1906–07. 5,191 c. y. removed from Gallyhook Pt.; 7,282 c. y. removed from bar at mouth, **07,** 1179.
1907–08. 27,435 c. y. removed; proj. completed, **08,** 1229.

PHYSICAL CHARACTERISTICS.

Description of; creek on the left bank of the Rappahannock R.; general characteristics of a tidal estuary rather than that of a tributary, **00,** 1751.

PROJECTS.

Lt. Col. Allen est., 1899, $33,900 for a chan. 200′ w., or $25,600 if the w. were reduced to 150′; he also submitted an est., by request of the citizens of the locality, for imp. the Eastern Branch near Gallyhook Pt. at a cost of about $1,700 or $1,800, **00,** 1751, 1752.

Act June 13, 1902, au. dr. chan. at mouth 15′ x 200′ m. l. w., and necessary dr. at Crab Pt., j. constr., and dr. of a 12′ x 100′ chan. at Gallyhook Pt.; est., $35,700, **03,** 208.

Est., 1910, $5,000 required every 8 yrs. for mainten., **10,** 299.

SURVEYS.

Ex. and sur., with view to imp. mouth of creek, au. act Mar. 3, 1899; made, 1899, by Lt. Col. Allen (**R.** fav.; see Projects), **00,** 1748, 1750.
Of chan., **07,** 1179; **10,** 1360.

K-188 MORATTICO CREEK, VA.

COMMERCE.

Unimportant, **93,** 1319.

ENGINEERS.

Chief of Engineers. **R., 93,** 158.

In charge. Maj. C. E. L. B. Davis, 1892–93. **R., 93,** 1317.

PHYSICAL CHARACTERISTICS.

Description of; branch of Rappahannock R., which it enters on the left at Tarpleys Pt., 28 m. above the mouth, **93,** 1318.

SURVEYS.

Ex. of obstr. at mouth au. act July 13, 1892; made, 1892, by Maj. Davis (**R.** unfav.), **93,** 1318.

*Allotment. [1] Of this amount, $1,000 was trans. to Mattaponi R., July 23, 1908. **09,** 1233.

K-191 TOTUSKEY RIVER, VA.

APPROPRIATIONS.

1880,	$2,500,	**80,** 769.
1881,	2,500,	**81,** 966.
1882,	5,000,	**82,** 1029.
Total,	10,000	

COMMERCE.

Valuable timber lands tributary to R., **75,** ii, 160.

ENGINEERS.

Chief of Engineers. R., 75, 95; **80,** 114; **81,** 154; **82,** 149; **83,** 155; **84,** 157; **85,** 147; **86,** 142; **87,** 109; **88,** 111; **89,** 129; **90,** 116; **08,** 264; **10,** 308.

In charge:
S. T. Abert, U. S. C. E., 1875–90. **R., 75,** ii, 159; **80,** 768; **81,** 964; **82,** 1027; **83,** 813; **84,** 988; **85,** 976; **86,** 913; **87,** 938; **88,** 824; **89,** 1011; **90,** 1071.
Maj. S. Cosby, **08,** 240.
Maj. J. J. Morrow, **10,** 282.

Assistant. J. B. Duncklee, **75,** ii, 160.

OPERATIONS.

1882–83. 2,117 l. f. pile dike built, **83,** 814.
1887–88. Dike at Brookers Bar repaired and mats sunk in front of same, **88,** 825.

PHYSICAL CHARACTERISTICS.

Described, **75,** ii, 159.
Obstructions, **75,** ii, 159.
Description of orig. condition of the R., **88,** 824.

PROJECTS.

By S. T. Abert, 1875, chan. 8′ x 60′ through Brookers Bar, and 2,400 l. f. of dike parallel to the chan.; est., $14,960, **75,** ii, 160. Amount est. to complete proj., $12,000, **87,** 939.

SURVEYS.

Ex. by J. B. Duncklee, 1874, **75,** ii, 95.
Pre. ex. au. act Mar. 2, 1907. **R.** by Maj. Cosby[1] (unfav.), **08,** 264.
Pre. ex. and sur. from d. w. in Rappahannock R. to br. about 5 m. above mouth, au. act Mar. 3, 1909. **R.** by Maj. Morrow[2] (unfav.), **10,** 308.

K-219 PISCATAWAY CREEK, VA.

ENGINEERS.

Chief of Engineers. R., 84, 163; **91,** 146, 1289.

In charge:
S. T. Abert, U. S. agent. **R., 84,** 1006.
Lt. Col. P. C. Hains, 1890. **R., 91,** 1289.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1289.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1883, by S. T. Abert (**R.** unfav.), **84,** 1006.
Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Hains (**R.** unfav.), **91,** 1290.

K-227 URBANA CREEK, VA.

APPROPRIATIONS.

1879,	$5,000,	**79,** 85.
1880,	2,500,	**80,** 770.
1881,	4,000,	**81,** 967.
1882,	4,000,	**82,** 1031.
1888,	[3] 3,000,	**89,** 1010.
1890,	3,000,	**90,** 1071.
1892,	3,000,	**92,** 1056.
1894,	3,000,	**94,** 143; **95,** 1241.
1896,	3,000,	**96,** 1053.
1899,	3,000,	**99,** 1428.
1905,	10,000,	**05,** 1175.
1909,	*4,000,	**09,** 1240.
1910,	8,500,	**10,** 1366.
1911,	10,000,	**11,** 1470.
Total,	66,000	

COMMERCE.

Com. advantages of the vicinity, **75,** ii, 139, 140.
Advantages as a H. of refuge, **75,** ii, 140.
Imp. has been of material benefit by allowing craft to land at the town of Urbana instead of at a wharf about 1½ m. distant, **96,** 1053.
Imp. permits entrance of sailing vessels, and enables SS. of Weems Line to enter and land at wharf, **02,** 213.
New industries being estab., and C. increasing, **04,** 210.
Rates reduced, **05,** 220.
Description of, **12,** 387.
1911, 21,810 t., **12,** 387.

CONTRACTS.

1879. T. P. Morgan, dr., 24¢ c. y., **80,** 769.
1880. National Dredging Co., dr., 30¢ c. y., **81,** 967.
1881. Potomac Dredging Co., dr., 29¾¢ c. y., **82,** 1030.
1882. D. Constantine, dr., 15¢ c. y., **83,** 816.
1889. American Dredging Co., dr., 19¢ c. y., **90,** 1070.
1893. G. K. Baker, dr., 16¢ c. y. ($1,600), **93,** 1300.
1895. Virginia Dredging Co., dr., 16½¢ c. y. ($1,650), **96,** 1051.
1898. A. M. Clegg and M. A. Dugan, dr., 18¢ c. y. ($1,800), **99,** 1427.
1899. J. Miller, dr., 19¢ c. y. ($1,900), **00,** 1716.
1900. John Miller, dr., 24¢ c. y., **01,** 1414.
1907. C. G. Smith & Son, riprap j., $3.93 c. y.; Miner Engineering Co., dr., 22¢ c. y., **08,** 1238.
1909. Chesapeake Stevedore Co., constr. and repairing riprap js., $2.64 c. y., **09,** 1240.
1910. Maryland Dredging & Contracting Co., dr., 21.7¢ c. y., **11,** 1470. Potomac Sand & Gravel Co., riprap st., $2.50 c. y., **11,** 1470–71.

ENGINEERS.

Chief of Engineers. R., 75, 95; **79,** 85; **80,** 114; **81,** 154; **82,** 149, 154; **83,** 155; **84,** 158; **85,** 143; **86,** 143; **87,** 109; **88,** 112; **89,** 128; **90,** 115; **91,** 142; **92,** 143; **93,** 155; **94,** 143; **95,** 163; **96,** 149; **97,** 183; **98,** 186; **99,** 215; **00,** 245; **01,** 283; **02,** 212; **03,** 212; **04,** 210; **05,** 220; **06,** 230; **07,** 243; **08,** 256; **09,** 266; **10,** 302; **11,** 324; **12,** 386.

In charge:
S. T. Abert, U. S. agent, 1875–91. **R., 75,** ii, 139; **79,** 616; **80,** 769; **81,** 966; **82,** 1029, 1032; **83,** 815; **84,** 990; **85,** 977; **86,** 914; **87,** 939; **88,** 825; **89,** 1009; **90,** 1070.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1268.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1054; **93,** 1301; **94,** 959; **95,** 1239.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1051; (Lt. Col.) **97,** 1335; **98,** 1202; **99,** 1428; **00,** 1717; **01,** 1414; **02,** 1095; **03,** 1060.

*Allotment. [1] H. D. 451, 60th, 1st. [2] H. D. 830, 61st, 2d. [3] Part of $15,000 for Rappahannock R.

Col. A. M. Miller, 1904. **R., 04,** 1327.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1174.
Capt. S. Cosby, 1906–08. **R., 06,** 1113; (Maj.) **07,** 1185; **08,** 1237.
Maj. J. J. Morrow, 1909. **R., 09,** 1239.
Capt. W. T. Hannum, 1910. **R., 10,** 1365.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1470; **12,** 1690.

Assistant. J. B. Duncklee. **R., 75,** ii, 140.

LEGAL PROCEEDINGS.

Criminal proceedings brought in U. S. district court against owners, Donaldson-Shultz, of obstructive dock; acquittal of defendant. Civil proceedings instituted for circuit court injunction, **05,** 221.

Case against Donaldson-Shultz dismissed on grounds that previous acquittal in criminal trial constituted bar to the suit in equity; appeal made to the U. S. circuit court of appeals, **06,** 1113.

Court of appeals reversed decree of circuit court and opened case for retrial, **07,** 1185. Donaldson-Shultz applied for permit to reconstr. wharf along lines suggested by Engineer officer; permit granted **07,** 1186.

OBSTRUCTIONS.

Further work prevented by dock built in chan. by private corporation, **05,** 220.

Complaints against br. at Urbana, **08,** 1237.

OPERATIONS.

1879–80. 16,991 c. y. dr. from bar, **80,** 770.
1881–82. 11,870 c. y. dr. from chan., **82,** 1031.
1882–83. 5,900 c. y. dr. from bar at mouth, **83,** 816.
1883–84. 6,083 c. y. dr. from bar, **84,** 990.
1889–90. 8,069 c. y. dr. under contract; 240 l. f. sand dike built, and 212 l. f. brush wattling repaired by hired labor, **90,** 1070.
1891–92. 5,674 c. y. dr., **92,** 1055.
1892–94. In connection with previous year, 19,285 c. y. dr., **93,** 1302; **94,** 960.
1895–96. 13,965 c. y. dr., **96,** 1052.
1898–99. 10,000 c. y. dr., **99,** 1428.
1899–1900. 9,990 c. y. dr., **00,** 1717.
1902–03. 3,050 c. y. dr., **03,** 1060.
1907–08. 1,095 c. y. st. deposited in j.; 18,459 c. y. dr., **08,** 1237.
1909–10. 1,281 t. st. used in extending j., **10,** 1365.
1910–11. 20,061 c. y. dr. by hydraulic dr. and deposited upon flats back of st. j., resulting in a chan. 1,250 l. f. through outer bar, **11,** 1470.
1911–12. Jetty extended 566 l. f., and repaired by placement of 1,561.1 c. y. riprap st., **12,** 1691.

PHYSICAL CHARACTERISTICS.

General description, **75,** ii, 139, 140; **88,** 825; **95,** 1239.
Bar at the mouth, **75,** ii, 139, 140, 141; **79,** 85.
Tides, **75,** ii, 141.
Max. draft June 30, 1912, over shoalest part of locality, 10′, **12,** 386.

PRIVATE WORK.

Reconstr. of Donaldson-Shultz Wharf, **07,** 1186; **08,** 1237.

PROJECT.

By S. T. Abert, 1875, imp. of creek by excavation of a chan. 10′ x 150′ m. l. w. through the bar at its mouth; est. increased to $22,100, **75,** ii, 139; **79,** 616; **86,** 915.

Proj. extended, 1883, to include removal of bar in the H., increasing the total est. to $22,500, **84,** 990; **87,** 939.

After an ex., 1888, system of dikes was adopted to prevent the dr. chan. from filling with sand, and a revised est. made the cost $19,080, **89,** 1009; **92,** 1054; revised to $34,580, **92,** 1054.

In 1897 Lt. Col. Allen est. cost of completing the orig. proj. $70,000, incl. the completion of the imp. by means of dr. and the constr. of a j. to protect the chan. dr. through the outer bar, **97,** 1335.

SURVEYS.

Included in Coast Sur., 1869 **75,** ii, 141.
By J. B. Duncklee, 1874–75. **R., 75,** ii, 140.
From the village of Urbana to the Oaks, au. act June 14, 1880; made, 1882, by S. T. Abert, US. agent, **82,** 1032.
Sur. by Maj. Davis, 1892, **93,** 1301.
Sur. by Lt. Col. Allen, 1897, **97,** 1335.
Ex. of chans.; H. lines marked, **05,** 1174.
Minor, **08,** 1237; **09,** 1239.
Maps. **89,** 1010; **90,** 1070.

K-235 PIANKATANK RIVER, VA.

ENGINEERS.

Chief of Engineers. **R., 84,** 163.

In charge. S. T. Abert, U. S. agent. **R., 84,** 1013, 1014.

PLANS.

By S. T. Abert, 1883, excavating chan. 11′ x 200′. through the bar at mouth; est., $58,533; or for a chan. same d. and 150′ w., $43,900, **84,** 1015, 1016.

SURVEY.

Au. act Aug. 2, 1882; made, 1883, by S. T. Abert (see Projects), **84,** 1014.

K-236 JACKSONS CREEK, VA.

COMMERCE.

In 1894, 7,000 t. of oysters, etc.; would probably be doubled by imp., **95,** 1262. Limited interests would not justify expend. necessary to gain permanent imp., **95,** 1263.

Description of, **00,** 1753, 1754.

ENGINEERS.

Chief of Engineers. **R., 95,** 167; **99,** 223; **00,** 254.

In charge:
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1261.
Lt. Col. C. J. Allen, 1900. **R., 00,** 1753.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1262; **00,** 1753.

SURVEYS.

Ex. near mouth of the Piantatank R. au. act Aug. 17, 1894; made, 1894, by Maj. Davis (**R.** unfav.), **95,** 1261.

Ex. for removal of bar at mouth of Jacksons Creek au. act Mar. 3, 1899; **R.** submitted, 1899, by Lt. Col. Allen (**R.** unfav.), **00,** 1753.

K-249 QUEENS CREEK, VA.

ENGINEERS.

Chief of Engineers. R., 08, 264.
In charge. Maj. S. Cosby, **08,** 240.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907, from mouth to Capital Landing Br. **R.** by Maj. Cosby[1] (unfav.), **08,** 264.

K-250 MILFORD HAVEN, VA.

APPROPRIATIONS.

1899,	$12,500,	**99,** 1431.
1902,	5,000,	**02,** 1097.
1910,	3,000,	**10,** 1367.
1911,	2,500,	**11,** 1472.
1912,	5,000,	**12,** 1693.
Total,	28,000	(incl. $3,032.97 judgment recovered, $31,032.97, **12,** 1693).

COMMERCE.

Small vessels use the place as a H. of refuge. An. C., $150,000±, **93,** 1321; **95,** 1270.
Description of, **99,** 1430.
Shipments facilitated, **05,** 222.
Rates advanced, **09,** 268; **12,** 389.
In 1911, 12,163 t., **12,** 389.
Considerably benefited, **12,** 389.

CONTRACTS.

1899. A. M. Clegg & Co., dr., 14¾¢ c. y. ($5,015; annulled, 1899), **00,** 1720.
1900. Norfolk Dredging Co., dr., 24¢ c. y. ($8,160), **00,** 1720.
1900. John Miller, dr., 16¢ c. y., **01,** 1416.
1904. John L. Grim, dr., 19½¢ c. y., **04,** 1329.
1907. C. G. Smith, riprap j., $4.48 c. y., **08,** 1240.
1910. Potomac Sand & Gravel Co., 1,000 c. y. riprap st., $2.75 c. y., **11,** 1472.

ENGINEERS.

Chief of Engineers. R., 84, 177; **93,** 158; **95,** 167; **99,** 216; **00,** 246; **01,** 284; **02,** 213; **03,** 213; **04,** 211; **05,** 221; **06,** 232; **07,** 244; **08,** 258; **09,** 267; **10,** 303; **11,** 325; **12,** 387.

In charge:
Capt. J. Mercur. **R., 84,** 1053.
Maj. C. E. L. B. Davis, 1892–95. **R., 93,** 1319; **95,** 1267.
Lt. Col. C. J. Allen, 1899–1903. **R., 99,** 1429; **00,** 1719; **01,** 1415; **02,** 1096; **03,** 1062.
Col. A. M. Miller, 1904. **R., 04,** 1328.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1176.
Capt. S. Cosby, 1906–08. **R., 06,** 1114; (Maj.) **07,** 1187; **08,** 1239.
Maj. J. J. Morrow, 1909. **R., 09,** 1241.
Capt. T. W. Hannum, 1910. **R., 10,** 1367.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1472; **12,** 1692.

LEGAL PROCEEDINGS.

Action at law instituted in the Supreme Court of the D. of C. against a former contractor and his surety; judgment in the sum of $3,032.97 received thereon; deposited in Treas. to credit of app., **02,** 1096.

OPERATIONS.

1899–00. 9,825 c. y. dr., **00,** 1719.
1900–01. Chan. through outer bar completed, **01,** 1415.
1902–03. 12,587 c. y. dr., **03,** 1062.
1904–05. 15,305 c. y. dr., **05,** 1176.
1907–08. 491 c. y. st. deposited in j., completing same, **08,** 1239.
1911–12. Jetty extended 565 l. f. and repaired by placement of 1,202 c. y. riprap, **12,** 1692.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1320; **95,** 1268; **99,** 1429; **02,** 213.
Narrows Point eroded several hundred feet, and outer bar formed by n. storms, **09,** 1241.
Tidal estuary of Chesapeake B., ½–1 m. x 4 m. 35± m. from Ft. Monroe. 2 entrances—one at nw. end from Hills B., an arm of Piankatank R., and another at se. end from Chesapeake B. Se. entrance seldom used. Imp. covers nw. entrance, **12,** 388.

PROJECTS.

By Maj. Davis, 1895, 10′ chan., 200′ or more w., dr. through bar at entrance to the haven; est., $12,500, **95,** 1270; **99,** 1430.
Extended, 1900, to include imp. of inner bar; est. addl. cost, $5,000, **01,** 285.
Capt. Cosby recom., 1906, constr. of 333′ j. nw. entrance for protection of chan., with available balance; est., completing proj., $17,500, **06,** 1114.
By Maj. Morrow, 1909, extending j. 800′; est., $10,000, **09,** 1241.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Mercur (**R.** unfav.), **84,** 1053.
Ex. of bar at the mouth au. act July 13, 1892; made by Maj. Davis, 1892 (**R.** fav.), **93,** 1319.
Sur. au. act Aug. 17, 1894; made by Maj. Davis, 1895 (**R.** fav.; see Proj.), **95,** 1268.
Ex., 1899, by Lt. Col. Allen, **99,** 1430.
Ex. of outer bar, **05,** 1176.
Ex. of chans., **06,** 1114; **08,** 1239.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 388.

K-260 HORN HARBOR, VA.

ENGINEERS.

Chief of Engineers. R., 08, 264.

In charge. Maj. S. Cosby, **08,** 240.

SURVEY.

Ex. au. act Mar. 2, 1907; made, 1907, by Maj. Cosby (**R.** unfav.),[2] **08,** 264.

[1] H. D. 446, 60th, 1st.

[2] H. D. 396, 60th, 1st.

K-284 WARE RIVER, VA.

COMMERCE.

Unimportant, **95,** 1265.

ENGINEERS.

Chief of Engineers. **R., 89,** 135; **95,** 167.

In charge:
S. T. Abert, U.S. agent, 1888. **R., 89,** 1034.
Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1263.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1034; **95,** 1264.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by S. T. Abert (**R.** unfav.), **89,** 1034.
Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Davis (**R.** unfav.), **95,** 1263.

K-297 YORK RIVER, VA.

APPROPRIATIONS.

1880,	$10,000.00,	**80,** 778.
1881,	25,000.00,	**81,** 973.
1882,	25,000.00,	**82,** 1040.
1884,	20,000.00,	**84,** 995.
1886,	18,750.00,	**86,** 920.
1888,	30,000.00,	**88,** 832.
1890,	30,000.00,	**90,** 1077.
1892,	35,000.00,	**92,** 1058.
1894,	20,000.00,	**94,** 144; **95,** 1244.
1896,	16,000.00,	**96,** 1057.
1899,	10,000.00,	**99,** 1432.
1902	*[1] 2,176.98,	**03,** 1051.
	*5,000.00,	**04,** 1316.
1905,	*3,111.91,	**05,** 1162.
1907,	*7,000.00,	**07,** 1173.
1909,	*[2] 22,000.00,	**09,** 1223; **10,** 1351.
1910,	*5,000.00,	**10,** 1351.
Total,	[3] 284,038.89	(less $167.03 trans. to consolidated app. and $1,220.37 to allot. for Pamunkey R., $282,651.49, **12,** 1676).

COMMERCE.

Probable increase in the shipment of cotton consequent upon imp., **80,** 777.
Large and important C. benefited by imp. of the R., **97,** 1340.
Decrease due to Southern Ry. Co. moving cotton-shipping point from West Pt., 1896, **02,** 207.
Rates somewhat reduced, **05,** 211.
History of navigation; great decrease since 1890, **10,** 1351.
1911, 186,486 t., **12,** 379.

CONTRACTS.

1880. National Dredging Co., dr., 15¢ c. y., **81,** 972.
1881. National Dredging Co., dr., 16¢–20¢ c. y., according to distance of dumping ground, **82,** 1039.
1882. Delaware & Chesapeake Impvt. Co., dr., 13¢–13½¢ c. y., **83,** 821.
1884. T. P. Morgan, dr., 8½¢ c. y., **85,** 985.
1886. American Dredging Co., dr., 9¾¢ c. y. **87,** 946.
1888. American Dredging Co., dr., 12¢ c. y., **89,** 1015.
1891. Baltimore Dredging Co., dr. and depositing material in dike, 14⅞¢ c. y.; contract amended for dr. alone, 9¢ c. y., **91,** 1271.
1893. Sanford & Brooks, dike constr., $4.68 and $5.42 l. f. ($37,690), **93,** 1305.
1894. W. H. Ruark, dike constr., **95,** 1243. H. Wilson, dr., 13¢ c. y. ($13,000), **95,** 1245.
1898. J. McCarthy, dike constr., $5.85 l. f. ($15,795); contract annulled after about one-quarter completed and the American Bond & Trust Co., bondsmen of Balto., Md., completed contract June 5, 1899, **99,** 1432.
1900. John Miller, dr., 16¢ c. y., **01,** 1418.
1908. Denmead Bros., lumber, $18 M, **09,** 1224.
1909. R. P. Clarke Co., lumber, $17.80 M, **09,** 1224.

ENGINEERS.

Chief of Engineers. **R., 80,** 115, 125; **81,** 155; **82,** 151; **83,** 157; **84,** 159; **85,** 149; **86,** 144; **87,** 110; **88,** 113; **89,** 131; **90,** 118; **91,** 143; **92,** 144; **93,** 156; **94,** 143; **95,** 164; **96,** 150; **97,** 184; **98,** 187; **99,** 217; **00,** 247; **01,** 286; **02,** 207; **03,** 204; **04,** 201; **05,** 210; **06,** 221; **07,** 235; **08,** 247; **09,** 256; **10,** 293; **11,** 317; **12,** 378.

In charge:
Capt. C. B. Phillips, 1879–81. **R., 80,** 776, 897.
S. T. Abert, U. S. agent, 1881–91. **R., 81,** 971; **82,** 1038; **83,** 820; **84,** 994; **85,** 984; **86,** 918; **87,** 944; **88,** 830; **89,** 1015; **90,** 1076.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1270.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1056; **93,** 1303; **94,** 961; **95,** 1241.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1054; (Lt. Col.) **97,** 1337; **98,** 1203; **99,** 1431; **00,** 1721; **01,** 1417; **02,** 1089; **03,** 1050.
Col. A. M. Miller, 1904. **R., 04,** 1315.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1161.
Capt. S. Cosby, 1906–08. **R., 06,** 1099; (Maj.) **07,** 1173; **08,** 1219.
Maj. J. J. Morrow, 1909. **R., 09,** 1222.
Capt. W. T. Hannum, 1910. **R., 10,** 1350.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1456; **12,** 1676.

Assistant. J. M. Wolbrect. **R., 80,** 898.

LEGAL PROCEEDINGS.

U. S. circuit court, 1900, in suits for damages because of alleged injury to oyster beds by R. imp., rendered a verdict in favor of the U. S., **00,** 1721.

OPERATIONS.

1880–81. 58,809 c. y. dr., **81,** 972.
1881–82, 137,989 c. y. dr. from West Pt. Chan., **82,** 1039.
1882–83. 135,606 c. y. dr. from West Pt. Bar, **83,** 821.
1884–85. 75,917 c. y. dr., **85,** 985.
1885–86. 87,421 c. y. dr., **86,** 919.
1886–87. 140,162 c. y. dr., **87,** 946.
1888–89. 223,500 c. y. dr., **89,** 1016.
1890–91. Dr. in progress, **91,** 1271.
1891–92. 166,130 c. y. dr., **92,** 1058.
1892–93. Constr. of dike at West Pt. Bar in progress, **93,** 1304.
1893–94. 7,456 l. f. dike constr., and 183 l. f shore connection made, **94,** 964; **95,** 1243.
1894–95. 1,600 l. f. of brush and pile dike constr. at West Pt. Bar, and 38,070 c. y. dr., **95,** 1243, 1244.
1895–96. 69,355 c. y. dr., **96,** 1056.
1898–99. 2,700 l. f. of dike contracted for, 667 l. f. constr., **99,** 1431.
1899–00. 10 fascines and 2 mattresses weighted with sand bags placed around dike at West Pt. Bar to check erosion by the tidal current which had taken place, **00,** 1721.
1900–01. 22,725 c. y. dr., main dike strengthened, and 400′ transverse dike built, **01,** 1417.

* Allotment.
[1] $167.03 trans. to consolidated app.
[2] $1,000 trans. to Mattaponi R., from $23,000 allot., leaving $22,000.
[3] $1,220.37 trans. to allot. for Pamunkey R.

1901-02. 9,262 c. y. dr., **02,** 1089.
1903-04. Repairs to dike, **04,** 1315.
1904-05. Plant and 32 breaks in dike repaired, **05,** 1161.
1905-06. Reconstr. of dikes continued, **06,** 1099.
1908-09. 3,192 l. f. dike reconstr., **09,** 1222.
1909-10. 5,032 l. f. dike reconstr. and plant repaired, **10,** 1350.
1910-11. Completion of new hull for combined steam pile driver and derrick boat, repair of plant, and misc. work; proj. 75% completed, **11,** 317, 1456.
1911-12. Floating plant constr. and repaired, **12,** 1676.

PHYSICAL CHARACTERISTICS.

Description of, and of orig. condition, **95,** 1241.
Damage by storm, **09,** 1223.

PROJECTS.

By Capt. Phillips, 1880, imp. of R. from West Pt. to the mouth by excavation of a chan. 22′ x 400′ l. w., with the formation of a basin in front of the wharves; est., $256,000, **80,** 777; **85,** 984; **87,** 946.
Modified, 1887, by the addition of a dike extending from the bank opposite West Pt., increasing the total est. to $309,750, **87,** 946; **92,** 1057.

By Maj. Davis, 1894, dr. West Pt. Chan. by contract, the material to be deposited behind the dike at that place; and for the constr. of subsidiary dikes needed to retain the material so deposited, by hired labor and open-market purchases, and the use of U. S. plant, **95,** 1243.
By Lt. Col. Allen, 1897, modification of the proj. by extending the existing dike on the right of the upper part of the dr. chan. so as to maintain the lower part of that chan., **98,** 1204.
Capt. Hannum of opinion that R. not worthy of further imp.; available d. of 20′ sufficient for "present" and prospective C., **11,** 1457.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 95; made, 1880, by Capt. Phillips, **80,** 897.
Sur. of West Pt. Bar made, 1892, by Maj. Davis, **93,** 1304.
Ex. West Pt. Bar made, 1897, by Lt. Col. Allen, **97,** 1338.
Ex. of the chans. made, 1899, by Lt. Col. Allen, **00,** 1721.
Of West Pt. Bar, **05,** 1161; **10,** 1350.
Of Potopotank Bar, **06,** 1100.

Maps:
85, 986; **87,** 946; **94,** 964.
Vicinity of West Pt., **86,** 919; **87,** 946.

K-305 MATTAPONI RIVER, VA.

APPROPRIATIONS.

1880,	$2,500.00,	**80,** 114, 773.
1881,	3,300.00,	**81,** 969.
1884,	2,500.00,	**84,** 992.
1886,	5,000.00,	**86,** 916.
1888,	3,000.00,	**88,** 827.
1890,	3,000.00,	**90,** 1073.
1892,	4,000.00,	**92,** 1061.
1894,	4,000.00,	**95,** 1248.
1896,	2,500.00,	**96,** 1061.
1903,	*800.00,	**03,** 1064.
1905	*5,500.00,	**05,** 1163.
	*[1] 5,981.31,	**09,** 1225, 1226.
1907,	*6,500.00	**07,** 1175.
1908	*[2] 2,200.00	**09,** 1226
	*[3] 1,000.00	
1909,	*7,500.00,	**09,** 1226.
1910	*[4] 1,000.00	**10,** 296, 1356.
	*[5] 800.00	
	*3,000.00	
	*17,000.00	
1911,	*5,000.00,	**11,** 1460.
1912,	10,000.00,	**12,** 1678.
Total,	96,081.31	(incl. misc., $96,591.31, **12,** 1678).

COMMERCE.

Important, **75,** ii, 168.
Imp. of benefit to C. In 1894, 39,300 t., **97,** 1343.
Description of, **99,** 1434; **00,** 1723.
Work of great benefit to C., **02,** 215.
Shipments facilitated, and rates reduced by imp., **05,** 212; **12,** 380.
In 1911, 74,000± t., **12,** 380, 1681.

CONTRACTS.

1887. D. A. Gillies, dike constr., **87,** 941.
1891. H. T. Morrison & Co., constr. of plant, $6,129, **92,** 1060.
1900. John Miller, dr., 23¢ c. y., **01,** 1420.
1906. C. P. Grim, dr., 29½¢ c. y., **06,** 1101.
1907. Miner Engineering Co., dr., 29½¢ c. y.; Miner Engineering Co., dr., 35¢ c. y., **08,** 1222.
1909. Miner Engineering Co., dr., 23¢ c. y., **10,** 1356.
1911. W. H. French, dr., 19½¢ c. y., **12,** 1679.

ENGINEERS.

Chief of Engineers. R., 75, 95; **80,** 114; **81,** 155; **82,** 150; **83,** 156; **84,** 158; **85,** 148; **86,** 143; **87,** 109; **88,** 112; **89,** 129; **90,** 116; **91,** 144; **92,** 145; **93,** 156; **94,** 144; **95,** 165; **96,** 151; **97,** 185; **98,** 188; **99,** 218; **00,** 249; **01,** 287; **02,** 214; **03,** 214; **04,** 212; **05,** 211; **06,** 222; **07,** 236; **08,** 248; **09,** 257; **10,** 295, 308; **11,** 318; **12,** 379.

In charge:
S. T. Abert, U. S. agent, 1875–91. **R., 75,** 95; **80,** 770; **81,** 968; **82,** 1033; **83,** 817; **84,** 991; **85,** 979; **86,** 915; **87,** 940; **88,** 826; **89,** 1012; **90,** 1072.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1273.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1059; **93,** 1306; **94,** 966; **95,** 1246.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1058; (Lt. Col.) **97,** 1342; **98,** 1206; **99,** 1433; **00,** 1722; **01,** 1419; **02,** 1098; **03,** 1063.
Col. A. M. Miller, 1904. **R., 04,** 1329.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1162.
Capt. S. Cosby, 1906–08. **R., 06,** 1100; (Maj.) **07,** 1174; **08,** 1221.
Maj. J. J. Morrow, 1909. **R., 09,** 1224.
Capt. W. T. Hannum, 1910. **R., 10,** 1352.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1458; **12,** 1677.

OBSTRUCTIONS.

Description of, **99,** 1433.

OPERATIONS.

1880-81. Derrick, derrick boat, quarter-boat, and scows constr., **81,** 969.
1881-82. 2,016 snags, 1,378 logs and trees, and 4 wrecks removed, cleaning 13 m. of R., **82,** 1034.
1882-83. 94 snags, 279 logs and trees, and 1 wreck removed, **83,** 818.
1886-87. 242 l. f. of dike built, **77,** 941.
1887-88. 1,179 l. f. of pile dike built, and 430 logs, snags, trees, and stumps removed, 29 mats built and sunk, **88,** 827.
1888-89. 79 round piles and 2,400′, b. m., sheet piles driven, and 102 l. f. wall pieces fastened by hired labor, **89,** 1012.

*Allotments.
[1] Part of an allot. of $10,000; remainder returned to Treas.
[2] Trans. from Occoquan Creek.
[3] Trans. from Carters Creek.
[4] Trans. from York R.
[5] Trans. from Pamunkey R.

1889-90. Dikes already in process of constr. finished, and 243 l. f. of addl. work built by hired labor, **90,** 1072.
1891-92. 165 snags, 27 logs, and 270 overhanging trees removed, **92,** 1060.
1892-93. Work of removing snags and similar obstr. in progress, **93,** 1307.
1893-94. 66 snags, 41 drift logs, and 16 overhanging trees removed, **94,** 967.
1894-95. 29 snags, 14 logs, and 5 overhanging trees removed, **95,** 1247.
1899-00. 24 snags, 4 logs, and a sunken ferry scow removed, **00,** 1723.
1901-02. 10,285 c. y. dr., **02,** 1098.
1903-04. 61 snags and other obstr. removed, **04,** 1329.
1905-06. 27 snags and other obstr. removed, **06,** 1100.
1906-07. 1,873 c. y. dr.; contractor's dr. libeled and removed from work, **07,** 1174.
1907-08. 3,552 c. y. dr., **08,** 1221.
1908-09. 53,903 c. y. dr. and wreck and 54 snags removed, **09,** 1224. 148 snags, etc., and 355 trees removed by snagboat, **09,** 1225.
1909-10. 168 snags, etc., 117 trees, and 1 wreck removed by snagboat; 37,812 c. y. dr., 18 logs and 2 small wrecks removed, **10,** 1352.
1910-11. Repairs to snagboat under way, **11,** 1459.
1911-12. U. S. snagboat removed 107 snags, 18 drift logs, and 102 overhanging trees; rebuilding dr. *Dalecarlia*, **12,** 1677.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 166, 167, 168, 169; **80,** 771; **98,** 1206; **02,** 214.
List of obstr., **75,** ii, 167, 168; **80,** 771.
Rises in Va., flows se. for 120± m., to empty into York R. at West Pt., Va.; navigable to Aylett, 39 m. above, and 16 m. more for lighters and rafts, to Mundy Br., **12,** 379, 380.

PROJECTS.

By S. T. Abert, 1875, removal of snags and wrecks, and excavation of chan: from head of navigation to Line Tree Bar, having 5½′ at l. w.; est., $34,059, **75,** ii, 169, 170.
In 1884 S. T. Abert proposed, in addition, dikes at Robinson and Latané Bars; est., $38,000, **85,** 979; **86,** 143, 916; **87,** 941.
Congress, 1892, au. that $1,500 of the $4,000 app. 1892 should be expend. between Ayletts and Guineas Brs., **93,** 1307. Similar provision made in 1894, **95,** 1247; making cost of extended proj. $72,100, **12,** 379.
By Maj. Davis, 1894, expend. of available funds in making such sur. as might be required, in dr. and removing obstr., and in repairing dikes, the dr. to be done by contract, other work by hired labor and the use of U. S. plant, **95,** 1247.
Maj. Morrow, 1909, did not consider R. worthy of imp. further than contemplated by existing proj., **10,** 308.

SURVEYS.

By Col. Crozet, 1828, **75,** ii, 166.
Ex., 1874, **75,** 95.
Sur. made, 1895–96, by Maj. Davis, **95,** 1247; **96,** 1060.
Ex. of Line Tree and Latané Bars by Lt. Col. Allen, 1897, **97,** 1342.
Ex. at various bars, **05,** 1162.
Ex. au. act Mar. 3, 1909; made, 1909, by Maj. Morrow,[1] **10,** 308.
Between Aylett and Latané Bars, **10,** 1352.
Maps. **85,** 980; **87,** 941; **88,** 827; **90,** 1075; **10,** 1356.

K-311 PAMUNKEY RIVER, VA.

APPROPRIATIONS.

1880,	$2,500.00,	**80,** 775.
1881,	2,500.00,	**81,** 971.
1882,	2,500.00,	**82,** 1038.
1886,	5,000.00,	**86,** 918.
1888,	3,000.00,	**88,** 830.
1890,	3,000.00,	**90,** 1075.
1892,	3,000.00,	**92,** 1063.
1894,	2,000.00,	**94,** 145; **95,** 1251.
1896	2,000.00,	**96,** 1063.
1903,	*1,000.00,	**03,** 1065.
1905,	*3,400.00,	**05,** 1164.
1907,	*5,500.00,	**07,** 1176.
1909,	*[2] 6,700.00,	**09,** 1229.
1910,	10,000.00,	**10,** 1358.
1911,	*5,000.00,	**11,** 1463.
	[3] 1,220.37,	**12,** 1682.
Total,	58,320.37 (incl. misc., $58,820.37, **12,** 1682).	

COMMERCE.

Important, **75,** ii, 163, 165.
1894, 42,250 t., the greater part of which was RR. ties and lumber, **97,** 1345.
Scarcely any on 5 m. immediately below Hanovertown, **02,** 216.
Shipments facilitated and rates somewhat reduced by imp., **05,** 213.
1911, 52,000 t., **12,** 1683.

CONTRACTS.

1887. F. A. Smith, dike constr., $3.55 l. f., **87,** 943.
1900. John Miller, dr., 23¢ c. y., **01,** 1422.
1906. C. P. Grim, dr., 29½¢ c. y., **06,** 1102.
1907. Miner Engineering Co., dr., 29½¢ c. y., **08,** 1224.
1908. Andrew Miller, piles, 5⅝¢ l. f., **09,** 1229.
1909. Miner Engineering Co., dr., 19¢ c. y., **10,** 1358.
1911. W. H. French, dr. about 45,000 c. y. 18½¢ c. y., **12,** 1682.

ENGINEERS.

Chief of Engineers. R., 75, 95; **79,** 95; **80,** 115, 125; **81,** 155; **82,** 150; **83,** 156; **84,** 158; **85,** 148; **86,** 144; **87,** 110; **88,** 112; **89,** 130; **90,** 117; **91,** 145; **92,** 146; **93,** 157; **94,** 145; **95,** 166; **96,** 151; **97,** 187; **98,** 189; **99,** 219; **00,** 250; **01,** 288; **02,** 215; **03,** 215; **04,** 213; **05,** 212; **06,** 223; **07,** 237; **08,** 249; **09,** 258; **10,** 296; **11,** 319; **12,** 381.

In charge:
S. T. Abert, U. S. C. E., 1875; **75,** 95. **R., 75,** ii, 162.
Capt. C. B. Phillips, 1879–80; **79,** 88. **R., 80,** 904.
S. T. Abert, U. S. agent, 1880–91. **R., 80,** 773; **81,** 970; **82,** 1036; **83,** 819; **84,** 992; **85,** 982; **86,** 917; **87,** 942; **88,** 828; **89,** 1013; **90,** 1074.
Lt. Col. P. C. Hains, 1891–92. **R., 91,** 1275.
Maj. C. E. L. B. Davis, 1892–95. **R., 92,** 1062; **93,** 1308; **94,** 968; **95,** 1249.
Maj. C. J. Allen, 1896–1903. **R., 96,** 1062; (Lt. Col.) **97,** 1344; **98,** 1208; **99,** 1435; **00,** 1724; **01,** 1421; **02,** 1099; **03,** 1064.
Col. A. M. Miller, 1904. **R., 04,** 1330.
Lt. Col. S. S. Leach, 1905. **R., 05,** 1163.
Capt. S. Cosby, 1906–08. **R., 06,** 1101; (Maj). **07,** 1176; **08,** 1223.
Maj. J. J. Morrow, 1909. **R., 09,** 1228.
Capt. W. T. Hannum, 1910. **R., 10,** 1357.
Lt. Col. W. C. Langfitt, 1911–. **R., 11,** 1462; **12,** 1681.

Assistant. J. M. Wolbrect. **R., 80,** 904.

* Allotment.
[1] H. D. 311, 61st, 2d.
[2] $7,500 less $800 trans. to Mattaponi R.
[3] Trans. from app. for York R.

OPERATIONS.

1880-81. 600 logs and snags removed from the chan., **81,** 971.

1881-82. 1,721 logs, snags, and trees, and 8 wrecks removed, imp. 20 m. of R., **82,** 1037.

1886-87. 298 l. f. of dike built, **87,** 943.

1887-88. 673 l. f. of dike built; 310 logs, snags, stumps, and trees removed; 12 mats built and sunk, **88,** 829.

1889-90. 90 trees, logs, and snags removed; repairs made to dikes at Skidmores and Spring Bars; 566 l. f. pile and brush dike built at Skidmores Bar by hired labor; 8,076 c. y. dr. under contract, **90,** 1074.

1891-92. 140 snags removed from chan., and 103 trees cleared from banks, **92,** 1063.

1893-94. 51 snags, 23 logs, and 80 overhanging trees removed, **94,** 969.

1894-95. 76 snags, 35 sunken logs, and 35 overhanging trees removed, **95,** 1251.

1899-00. 94 snags, 9 logs, and 41 trees removed from chan., **00,** 1724.

1901-02. 7,546 c. y. dr., **02,** 1099.

1903-04. 281 snags and other obstr. removed, **04,** 1331.

1905-06. 115 snags and other obstr. removed, **06,** 1101.

1908-09. 8,885 c. y. dr. and 4 snags removed; 14 dikes, aggregating 2,332 l. f., built; 100 snags, etc., 208 trees, and 1 wreck removed by snagboat, **09,** 1228.

1909-10. 22,193 c. y. dr., **10,** 1357.

1910-11. 14 snags and 5 overhanging trees removed between New Castle Ferry and Whitehouse by U.S. plant and hired labor, **11,** 1462.

1911-12. 20,004 c. y. dr. under contract; U.S. snagboat *York* removed 185 snags and other obstr. from R. as far up as New Castle Ferry, **12,** 1681.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 163, 164, 165; **80,** 773; **88,** 828; **96,** 1062; **02,** 215.

List of obstr., **75,** ii, 163, 164, 166.

Rise in R. in spring of 1912, reached 11′ m. l. w., **12,** 1681.

Through Bassetts Bar a chan. 1,620′ l. has been dr., while part of chan. through Hogans Bar, 660′ l., in process of completion, **12,** 1681.

PLANS.

By S. T. Abert, U.S. agent, 1875, removing obstr., such as wrecks, snags, and bars; est., $17,508, **75,** ii, 163, 164, 166.

PRIVATE WORK.

10,000 c. y. dr. by Southern Ry. Co. at West Pt., **03,** 1064.

PROJECTS.

By Capt. Phillips, 1880, imp. R. by dr. through sand and gravel bars, and removal of snags, logs, and similar obstr., forming a chan. 5′–6′ x 40′ l. w.; est., $19,541, **80,** 905, 906. Increased in 1885 to provide for addl. work on lower bars to $28,300, **85,** 983; **87,** 943; **91,** 1275.

By Maj. Davis, 1894, use of available funds in dr. and removing obstr., the former by contract and the other work by hired labor and use of U.S. plant, **95,** 1250. Orig. proj. modified to provide for the rectification of the bank near Skidmores Bar, **95,** 1251.

Amended, 1908, to provide only for securing chan. 7′ x 100′, Bassett Ferry to mouth, by dr., dikes, and snagging; est., $55,000, and about $1,000 an. mainten., **08,** 250.

SURVEYS.

By C. B. Shaw, 1836, **76,** ii, 163.

Ex., 1874, **75,** 95, ii, 162.

Au. act Mar. 3, 1879; made, 1880, by Capt. Phillips, **79,** 95; **80,** 904.

Sur. made, 1894–95, by Maj. Davis, **95,** 1250.

Ex., 1897, by Lt. Col. Allen, **97,** 1345.

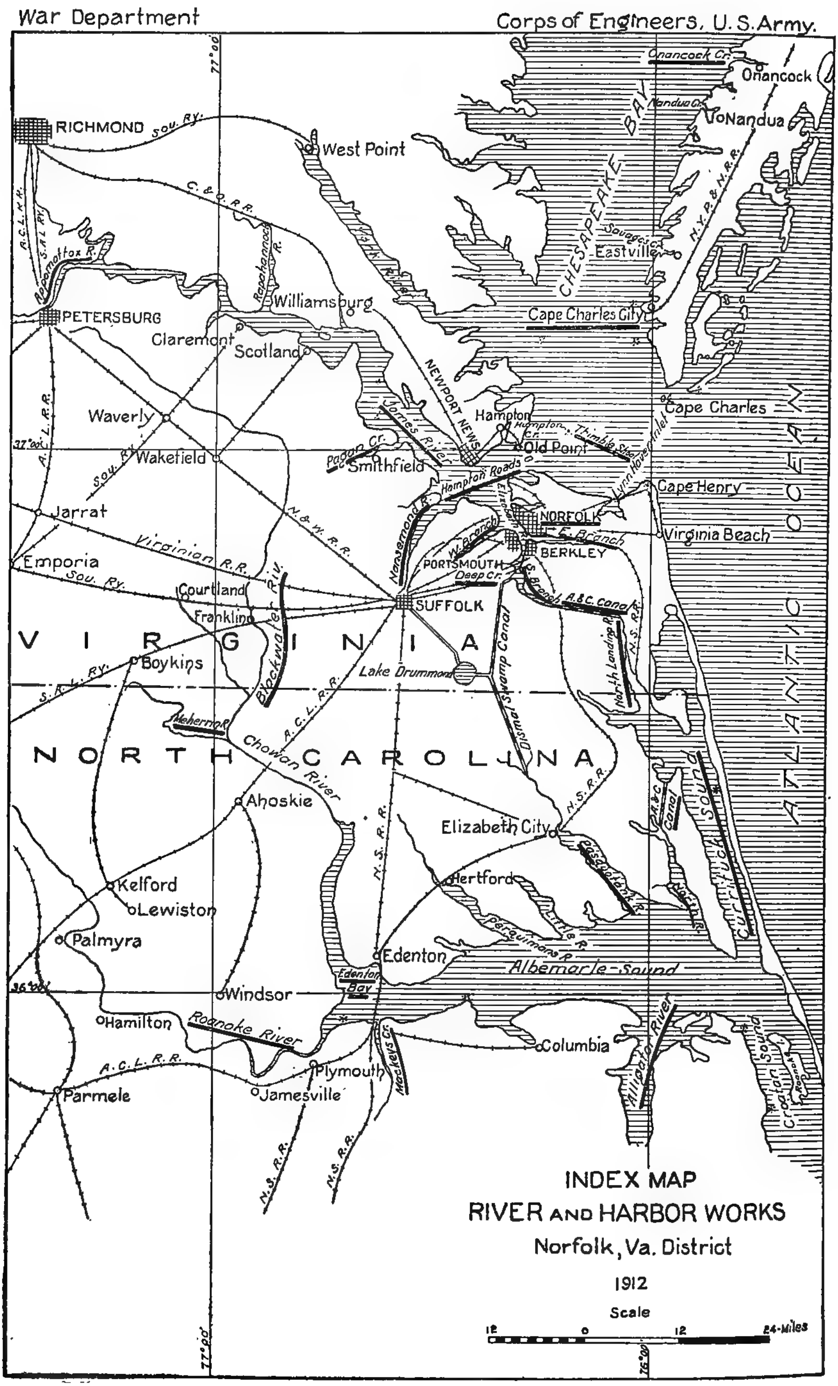
Ex. of Buckland, Hogan, and Spring Bars, **05,** 1163.

Minor, at Bassett, Hogan, and Buckland Bars, **12,** 1681.

Maps:
Skidmores and Foxes Bars, **85,** 982; **87,** 942. **88,** 828; **90,** 1074.

RIVER AND HARBOR WORKS—SOUTH ATLANTIC.

L.—NORFOLK, VA., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Norfolk, Va. District
1912
Scale
12 0 12 24 Miles
VIRGINIA
NORTH CAROLINA
CHESAPEAKE BAY
ATLANTIC OCEAN
RICHMOND
PETERSBURG
West Point
Williamsburg
Claremont
Scotland
Waverly
Wakefield
Jarrat
Emporia
Courtland
Franklin
SUFFOLK
Boykins
Lake Drummond
NORFOLK
BERKLEY
PORTSMOUTH
Hampton
Old Point
Newport News
Smithfield
Cape Charles City
Cape Charles
Cape Henry
Virginia Beach
Onancock
Nandua
Eastville
Ahoskie
Elizabeth City
Hertford
Kelford
Lewiston
Palmyra
Edenton
Windsor
Hamilton
Plymouth
Jamesville
Parmele
Columbia
Albemarle Sound
Roanoke River
Chowan River
Alligator River
Dismal Swamp Canal
Blackwater Riv.
James River
Nansemond R.
Hampton Roads
Pagan Cr.
Appomattox R.
Meherrin R.
Pasquotank R.
Perquimans R.
Little R.
Currituck Sound
Croatan Sound
Edenton Bay
Mackeys Cr.
North Landing R.
A. & C. Canal
Deep Cr.
W. Branch
E. Branch
S. Branch
Lynnhaven Inlet
Thimble Shoal
Onancock Cr.
Nandua Cr.
Savages Cr.
Virginian R.R.
N. & W. R.R.
A. C. L. R.R.
S. A. L. Ry.
Sou. Ry.
C. & O. R.R.
N. S. R.R.
N. Y. P. & N. R.R.
77° 00'
76° 00'
37° 00'
36° 00'

L.—NORFOLK, VA., DISTRICT.

In charge of U. S. Engineer Office,
Norfolk, Va.

NOTE.—The following list of waterways begins with waterways that follow directly after the end of District I list. The waterways of District J begin at the end of a short line which, beginning where District I list ends, proceeds across the peninsula to the waters of Chesapeake Bay. By this plan is preserved the geographical listing which experience proves the most convenient.

L 1 Metomkin Inlet, Va. (*)
L 2 Metomkin B., Va. (1)
L 3 Parker Cr., Va. (2)
L 4 Folly Cr., Va. (2)
L 5 Cross Cr., Va. (4)
L 6 Longboat Cr., Va. (1)
L 7 Wachapreague Inlet, Va. (*)
L 8 Hummock Chan., Va. (7)
L 9 Great Chan., Va. (8)
L 10 Floyds B., Va. (8)
L 11 Finney Cr., Va. (8)
L 12 Brandford Chan., Va. (7)
L 13 Horseshoe Lead, Va. (7)
L 14 Millstone Cr., Va. (13)
L 15 Little Machipongo Inlet, Va. (*)
L 16 The Swash, Va. (15)
L 17 Polk Cr., Va. (16)
L 18 Revel Cr., Va. (15)
L 19 Little Sloop Chan., Va. (15)
L 20 Sloop Chan., Va. (15)
L 21 North Inlet, Va. (15)
L 22 Curger Chan., Va. (21)
L 23 North Chan., Va. (21)
L 24 Great Machipongo Inlet, Va. (*)
L 25 Great Machipongo R., Va. (24)
L 26 Castle Ridge Cr., Va. (25)
L 27 The Deeps, Va. (25)
L 28 Point Cr., Va. (27)
L 29 The Buckhorn, Va. (27)
L 30 The Outlet, Va. (27)
L 31 Goulds Marsh Chan., Va. (24)
L 32 Rowes Hole Chan., Va. (24)
L 33 Second Chan., Va. (24)
L 34 Sand Shoal Inlet, Va. (*)
L 35 Lone Chan., Va. (34)
L 36 Mittigy Chan., Va. (34)
L 37 Eckichy Chan., Va. (34)
L 38 Sand Shoal Chan., Va. (34)
L 39 Cockle Point Cr., Va. (38)
L 40 The Thoroughfare, Va. (38)
L 41 Indiantown Cr., Va. (40)
L 42 New Marsh Chan., Va. (38)
L 43 Running Chan., Va. (38)
L 44 Man and Boy Chan., Va. (38)
L 45 Mike Chan., Va. (34)
L 46 New Inlet, Va. (*)
L 47 Great Drum Drain, Va. (46)
L 48 Ship Shoal Inlet, Va. (*)
L 49 Main Ship Shoal Chan., Va. (48)
L 50 Thoms Cr., Va. (49)
L 51 Cut-off Cr., Va. (49)
L 52 Black Rock Chan., Va. (48)
L 53 Little Inlet, Va. (*)
L 54 Mink Island B., Va. (53)
L 55 Muddy Cr., Va. (53)
L 56 Smith Island Inlet, Va. (*)
L 57 Magothy B., Va. (56)
L 58 The Thoroughfare, Va. (57)
L 59 Chesapeake B., Va. (*)
L 60 Fisherman's Inlet, Va. (59)
L 61 Old Plantation Cr., Va. (59)
L 62 Cape Charles City H., Va. (59)
L 63 Kings Cr., Va. (59)
L 64 Cherrystone Inlet, Va. (59)
L 65 Old Castle Cr., Va. (64)
L 66 The Gulf, Va. (59)
L 67 Mattawoman Cr., Va. (59)
L 68 Hungers Cr., Va. (59)
L 69 Jacobus Cr., Va. (68)
L 70 Nasawaddox Cr., Va. (59)
L 71 Church Cr., Va. (70)
L 72 Warehouse Cr., Va. (70)
L 73 Occohannock Cr., Va. (59)
L 74 Maps Cr., Va. (73)
L 75 Craddock Cr., Va. (59)
L 76 Nandua Cr., Va. (59)
L 77 Curratuck Cr., Va. (76)
L 78 Back Cr., Va. (76)
L 79 Butchers Cr., Va. (59)
L 80 Pungoteague Cr., Va. (59)
L 81 Tarkill Cr., Va. (80)
L 82 Machotank Cr., Va. (59)
L 83 Onancock Cr., Va. (59)
L 84 Finneys Cr., Va. (83)
L 85 Chesconnessex Cr., Va.[1] (59)

WESTERN SHORE, CHESAPEAKE BAY.

L 86 Poquoson R., Va. (59)
L 87 Cheeseman Cr., Va. (86)

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*Empties into Atlantic Ocean.
[1] This point is the northern limit of the Norfolk District on the Eastern Shore of Chesapeake Bay. Crossing to the Western Shore, the list of this district continues from No 86.

L 88 Partridge Cr., Va. (86)
L 89 Lambs Cr., Va. (86)
L 90 Roberts Cr., Va. (86)
L 91 Bennett Cr., Va. (86)
L 92 Lloyd B., Va. (86)
L 93 Back R., Va. (59)
L 94 Northwest Branch, Va. (93)
L 95 Tabbs Cr., Va. (94)
L 96 Southwest Branch, Va. (93)
L 97 Newmarket Cr., Va. (96)
L 98 Harrison Cr., Va. (93)
L 99 Hampton Roads, Va. (59
L 100 Mill Cr., Va. (99)
L 101 Johns Cr., Va. (99)
L 102 Hampton Cr., Va. (99)
L 103 Salters Cr., Va. (99)
L 104 Newport News Cr. and H., Va. (99)
L 105 James R., Va. (99)
L 106 Watts Cr., Va. (105)
L 107 Deep Cr., Va. (105)
L 108 Warwick R., Va. (105)
L 109 Potash Cr., Va. (108)
L 110 Chintholm Cr., Va. (105)
L 111 Skiff Cr., Va. (105)
L 112 Grices Run, Va. (105)
L 113 College Cr., Va. (105)
L 114 The Thoroughfare, Va. (105)
L 115 Back R., Va. (105)
L 116 Archers Hope, R., Va. (105)
L 117 Powhatan Cr., Va. (105)
L 117 (a) Jamestown Isld., James R. Va. (105)
L 118 Chickahominy R., Va. (105)
L 119 Gordons Cr., Va. (118)
L 120 Nettles Cr., Va. (118)
L 121 Blackstump Cr., Va. (118)
L 122 Yarmouth Cr., Va. (118)
L 123 Shipyard Cr., Va. (118)
L 124 Uncles Neck Cr., Va. (118)
L 125 Hog Neck Cr., Va. (118)
L 126 Diascond Cr., Va. (118)
J 127 Johnsons Cr., Va. (118)
L 128 Laceys Cr., Va. (118)
L 129 Old Neck Cr., Va. (118)
L 130 Parsons Cr., Va. (118)
L 131 Morris Cr., Va. (118)
L 132 Horse Bridge Cr., Va. (118)
L 133 Kennon Cr., Va. (105)
L 134 Kittewan Cr., Va. (105)
L 135 Mapsco Cr., Va. (134)
L 136 Courthouse Cr., Va. (105)
L 137 Herring Cr., Va. (105)
L 138 Kimages Cr., Va. (105)
L 139 Eppes Cr., Va. (105)
L 140 Curles Swamp Cr., Va. (105)
L 141 Four Mile Cr., Va. (105)
L 142 Cornelius Cr., Va. (105)
L 143 Almond Cr., Va. (105)
L 144 Gillis Cr., Va. (105)
L 145 Albro Cr., Va. (105)
L 146 Falling Cr., Va. (105)
L 147 Kingsland Cr., Va. (105)
L 148 Rockdale Cr., Va. (105)
L 149 The Brook, Va. (105)
L 150 Appomattox R., Va. (105)
L 151 Swift Cr., Va. (150)
L 152 Bailey Cr., Va. (105)
L 153 Powells Cr., Va. (105)
L 154 Flor de Hundred Cr., Va. (105)
L 155 Wards Cr., Va. (105)
L 156 Chippoak Cr., Va. (105)
L 157 Grays Cr., Va. (105)
L 158 Cobham Cr., Va. (105)
L 159 Lawns Cr., Va. (105)
L 160 Pagan Cr., Va. (105)
L 161 Cypress Cr., Va. (160)
L 162 Jones Cr., Va. (160)
L 163 Ragged Island Cr., Va. (105)
L 164 Chuckatuck Cr., Va. (105)
L 165 Nansemond R., Va. (99)
L 166 Western Branch, Va. (165)
L 167 Shingle Cr., Va. (165)
L 168 Burnetts Mill Cr., Va. (165)
L 169 Bennett Cr., Va. (165)
L 170 North Cr., Va. (165)
L 171 Streeter Cr., Va. (99)
L 172 Hoffler Cr., Va. (99)
L 173 Elizabeth R. (and Norfolk H.), Va. (99)
L 174 Western Branch, Va. (173)
L 175 Drum Point Cr., Va. (174)
L 176 Scott Cr., Va. (173)
L 177 Southern Branch, Va. (173)
L 178 Back Cr., Va. (177)
L 179 Paradise Cr., Va. (177)
L 180 St. Julian Cr., Va. (177)
L 181 Deep Cr., Va. (177)
L 182 Dismal Swamp Canal, Va. (181)
L 183 New Mill Cr., Va. (173)
L 184 Sampsons Cr., Va. (173)
L 185 Stuarts Cr., Va. (173)
L 186 Pauls Cr., Va. (173)
L 187 Old Mill Cr., Va. (173)
L 188 Albemarle & Ches. Canal., Va. (177)
L 189 Main Cr., Va. (177)
L 190 Hodges Cr., Va. (177)
L 191 Newtons Cr., Va. (177)
L 192 Tatems Cr., Va. (177)
L 193 Eastern Branch, Va. (173)
L 194 Pescara Cr., Va. (193)
L 195 Steamboat Cr., Va. (193)
L 196 Indian Cr., Va. (193)
L 197 Broad Cr., Va. (193)
L 198 Ohio Cr., Va. (193)
L 199 Smith Cr., Va. (173)
L 200 Tarrant Cr., Va. (173)
L 201 Lambert Cr., Va. (173)
L 202 Tanners Cr., Va. (99)
L 203 Willoughby B., Va. (99)
L 204 Boush Cr., Va. (203)
L 205 Mason Cr., Va. (203)
L 206 Little Cr., Va. (59)
L 207 Lynnhaven Inlet, Va. (59)
L 208 Lynnhaven R., Va. (207)
L 209 Pleasure House Cr., Va. (208)
L 210 Western Branch Lynnhaven R., Va. (208)
L 211 Eastern Branch Lynnhaven R., Va. (208)
L 212 Broad B., Va. (208)
L 213 Linkhorn B., Va. (212)
L 214 Rudy Inlet, Va. (*)
L 215 Owl Cr., Va. (214)

L 216 Oregon Inlet, N. C. (*)
L 217 Roanoke Sound, N. C. (216)
L 218 Rockhall Cr., N. C. (217)
L 219 Albemarle Sound, N. C. (217)
L 220 Kittyhawk B., N. C. (219)
L 221 Currituck Sound, N. C. (219)
L 222 Jean Guites Cr., N. C. (221)
L 223 Beasleys B., N. C. (221)
L 224 Wells Cr., N. C. (223)
L 225 Jarvis Chan., N. C. (221)
L 226 Lone Oak Chan., N. C. (221)
L 227 Fosters Cr., N. C. (221)
L 228 Strate Cr., N. C. (221)
L 229 Whale Head B., N. C. (221)
L 230 Raccoon B., N. C. (221)
L 231 Jenkins Cove, N. C. (221)
L 232 Knott Island Chan., N. C. (221)
L 233 Back B., Va. (232)
L 234 North B., Va. (233)
L 235 Hell Cr., Va. (234)
L 236 Muddy Cr., Va. (234)
L 237 Nanneys Cr., Va. (233)
L 238 Indian Cr., N. C. (221)
L 239 Bellows B., N. C. (221)
L 240 North Landing R., Va. and N. C. (221)
L 241 West Neck Cr., Va. (240)
L 242 Ball Cr., Va. (240)
L 243 Albemarle & Chesapeake Canal, Va. Cut. (240)
L 244 Godfreys Cr., Va. (240)
L 245 Blackwater Cr., Va. (240)
L 246 Northwest R., Va. and N. C. (240)
L 247 The Launch, N. C. (240)
L 248 Tull B., N. C. (247)
L 249 Coinjock B., N. C. (221)
L 250 Piney Island B., N. C. (249)
L 251 Albemarle & Chesapeake Canal, N. C. Cut. (249)
L 252 Cedar Island B., N. C. (221)
L 253 Cedar B., N. C. (221)
L 254 Mary Sanders Cr., N. C. (221)
L 255 Poplar Branch B., N. C. (221)
L 256 Websters Cr., N. C. (221)
L 257 North R., N. C. (219)
L 258 Barnett Cr., N. C. (257)
L 259 Deep Branch, N. C. (257)
L 260 Bump Landing Cr., N. C. (257)
L 261 Albemarle & Chesapeake Canal, N. C. Cut. (260)
L 262 Indian Town Cr., N. C. (257)
L 263 Broad Cr., N. C. (257)
L 264 Pasquotank R., N. C. (219)
L 265 Raymonds Cr., N. C. (264)
L 266 Portohonk Cr., N. C. (264)
L 267 Areneuse Cr., N. C. (264)
L 268 Glovers Cut, N. C. (264)
L 269 Coopers Cr., N. C. (264)
L 270 Turners Cut, N. C. (264)
L 271 Dismal Swamp Canal, N. C. (270)
L 272 Joes Island Cr., N. C. (264)
L 273 Possum Quarter Cr., N. C. (264)
L 274 Knobbs Cr., N. C. (264)
L 275 Poindexter Cr., N. C. (264)
L 276 Tiber Cr., N. C. (264)
L 277 Charles Cr., N. C. (264)
L 278 Newbegun Cr., N. C. (264)
L 279 Paling Cr., N. C. (278)
L 280 Little Flatty Cr., N. C. (264)
L 281 Flatty Cr., N. C. (219)
L 282 Little R., N. C. (219)
L 283 Symonds Cr., N. C. (282)
L 284 Deep Cr., N. C. (282)
L 285 Perquimans R., N. C. (219)
L 286 Owasoke Cr., N. C. (285)
L 287 Canaan Cove, N. C. (285)
L 288 Sutton Cr., N. C. (285)
L 289 Mill Cr., N. C. (285)
L 290 Raccoon Cr., N. C. (285)
L 291 Minns Cr., N. C. (219)
L 292 Yeopim R., N. C. (219)
L 293 Yeopim Cr., N. C. (292)
L 294 Bethel Cr., N. C. (292)
L 295 Middleton Cr., N. C. (292)
L 296 Edenton B., N. C. (219)
L 297 Pembroke Cr., N. C. (296)
L 298 Chowan R., N. C. (219)
L 299 Rockyhock Cr., N. C. (298)
L 300 Dillard Cr., N. C. (298)
L 301 Stumpy Cr., N. C. (298)
L 302 Catherine Cr., N. C. (298)
L 303 Warwick Cr., N. C. (302)
L 304 Trotman Cr., N. C. (302)
L 305 Bennett Cr., N. C. (298)
L 306 Sarem Cr., N. C. (298)
L 307 Island Cr., N. C. (298)
L 308 Barnes Cr., N. C. (298)
L 309 Spikes Cr., N. C. (298)
L 310 Buckhorn Cr., N. C. (298)
L 311 Mud Cr., N. C. (298)
L 312 Blackwater R., Va. (298)
L 313 Shaddocks Cr., Va. (312)
L 314 Nottoway Cr., Va. (298)
L 315 Rowanty Cr., Va. (314)
L 316 Stony Cr., Va. (314)
L 317 White Oak Cr., Va. (316)
L 318 Butterwood Cr., Va. (316)
L 319 Sappony Cr., Va. (316)
L 320 Waqua Cr., Va. (314)
L 321 Three Cr., Va. (314)
L 322 Meherrin R., N. C. (298)
L 323 Liverman Cr., N. C. (322)
L 324 Darbys Cr., N. C. (322)
L 325 Carters Mill Cr., N. C. (322)
L 326 Cat Tail Cr., N. C. (322)
L 327 Reedy Cr., N. C. (322)
L 328 Potecasi Cr., N. C. (322)
L 329 Dead Cr., N. C. (322)
L 330 Catherine Cr., N. C. (298)
L 331 Hodges Cr., N. C. (298)
L 332 Wiccacon Cr., N. C. (298)
L 333 Chinkapin Cr., N. C. (332)
L 334 Goose Cr., N. C. (298)
L 335 Taylor Pond, N. C. (298)
L 336 Deep Swamp Branch, N. C. (335)
L 337 Keel Cr., N. C. (298)
L 338 Mare Branch, N. C. (337)
L 339 Willow Branch, N. C. (298)
L 340 Salmon Cr., N. C. (298)

* Empties into Atlantic Ocean.

L 341 Batchelor B., N. C. (219)
L 342 Cashal R., N. C. (341)
L 343 Coshoke R., N. C. (342)
L 344 Sutton Cr., N. C. (342)
L 345 Mill Cr., N. C. (342)
L 346 Rocktwist Cr., N. C. (342)
L 347 Honey Cr., N. C. (342)
L 348 Broad Cr., N. C. (342)
L 349 Nine Mile Cr., N. C. (342)
L 350 Horse Thoroughfare, N. C. (342)
L 351 Eastmost R., N. C. (341)
L 352 Roanoke R., N. C. (341)
L 353 Middle R., N. C. (352)
L 354 Thoroughfare, N. C. (352)
L 355 Broad Cr., N. C. (352)
L 356 Conine Cr., N. C. (352)
L 357 Coniot Cr., N. C. (352)
L 358 Appletree Gut, N. C. (352)
L 359 Wire Gut, N. C. (352)
L 360 Pigeon Roost Cr., N. C. (352)
L 361 Poplar Cr., N. C. (352)
L 362 Great Cr., Va. (352)
L 363 Flat Cr., Va. (352)
L 364 Allen Cr., Va. (352)
L 365 East Lynne Cr., Va. (352)
L 366 Butcher Cr., Va. (352)
L 367 Staunton R., Va. (352)
L 368 Blue Stone Cr., Va. (367)
L 369 Little Roanoke R., Va. (367)
L 370 Cub Cr., Va. (367)
L 371 Falling Cr., Va. (367)
L 372 Seneca Cr., Va. (367)
L 373 Otter R., Va. (367)
L 374 Goose Cr., Va. (367)
L 375 Back Cr., Va. (367)
L 376 Blackwater, Va. (367)
L 377 Difficult Cr., Va. (367)
L 378 Dan R., Va., and N. C., (352)
L 379 Bannister Cr., Va. (378)
L 380 Hycootet R., Va., and N. C. (378)
L 381 Blue Cr., Va. (352)
L 382 Grassy Cr., Va. (352)
L 383 Island Cr., Va. (352)
L 384 Tarry Cr., Va. (352)
L 385 Teets Cr., Va. (352)
L 386 Dockery Cr., Va. (352)
L 387 Three Hill Cr., Va. (352)
L 388 Hub Quarter Cr., N. C. (352)
L 389 Pittard Cr., N. C. (352)
L 390 Allens Cr., N. C. (352)
L 391 Deep Cr., N. C. (352)
L 392 Looking Glass Cr., N. C. (352)
L 393 Conlho Cr., N. C. (352)
L 394 Diggons Cr., N. C. (352)
L 395 Devils Gut, N. C. (352)
L 396 Gardiners Cr., N. C. (395)
L 397 Conoby Cr., N. C. (352)

L-62 CAPE CHARLES CITY HARBOR, VA.

APPROPRIATIONS.

1890,	$25,000,	**91,** 1200.
1892,	10,000,	**92,** 979.
1899,	20,000,	**99,** 1478.
1902,	20,000,	**02,** 1119.
1905,	25,000,	**05,** 1194.
1907,	25,000,	**07,** 1211.
1910,	20,000,	**10,** 1389.
Total,	145,000	(incl. $250 received by annulment of contract, $145,250, **12,** 1721).

COMMERCE.

Increased in 1909 to 1,965,777 t. above that of 1901, **02,** 223; **10,** 321.

Effect of imp. on freight rates unknown, **10,** 321. 1911, 2,460,301 t., **12,** 411.

CONTRACTS.

1890. American Dredging Co., dr., 18¢ c. y., **91,** 1199.

1896. Sandford & Brooks, dr., 13.9¢ c. y., p. m. ($3,000), **97,** 1372. J. Keller & Son, mattresses, $1.40 c. y., and st., $2.55 c. y. ($7,355.85), **97,** 1372.

1899. C. W. Johnston, j. constr.: Brush mattress, $1.49 c. y.; st., $2.50 short t.; brush in place of mattress for shore end of s. j., $1.25 c. y. ($39,246.50), **00,** 1770.

1903. McLean Contracting Co., dr., 32¢ c. y., **03,** 1082.

1905. John L. Grim, dr., 19⅜¢ c. y., **06,** 1133.

1908. L. M. Lewis, dr., 21½¢ c. y., s. m., **08,** 1268.

ENGINEERS.

Chief of Engineers. R., 89, 112; **90,** 102; **91,** 130; **92,** 130; **93,** 142; **94,** 131; **95,** 149; **96,** 136; **97,** 194; **98,** 197; **99,** 227; **00,** 259; **01,** 294; **02,** 222; **03,** 224; **04,** 223; **05,** 230; **06,** 244; **07,** 257; **08,** 273; **09,** 281; **10,** 321; **11,** 343; **12,** 410, 421.

In charge:

Maj. W. F. Smith, U. S. agent, 1888–96. **R., 90,** 971, 973; **91,** 1199; **92,** 979; **93,** 1227; **94,** 904; **95,** 1145; **96,** 971.

Capt. T. L. Casey, 1897–99. **R., 97,** 1370; **98,** 1229; (Maj.) **99,** 1478.

Maj. J. B. Quinn, 1900–02. **R., 00,** 1768; **01,** 1453; **02,** 1118.

Capt. E. E. Winslow, 1903–06. **R., 03,** 1081; **04,** 1373; **05,** 1194; (Maj.) **06,** 1133.

Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1211; **08,** 1267; **09,** 1263.

Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1388; **11,** 1500; **12,** 1721.

Assistant. A. Stierle. **R., 90,** 972.

OPERATIONS.

1890–91. 107,079 c. y. dr. from the H. proper, H. entrance, and Cherrystone Inlet, **91,** 1200.

1898–99. 14,457 c. y., p. m., dr., and 723 c. y. brush mattress and 2,648 c. y. st. deposited to make 400′ of j. at Cherrystone Inlet, **97,** 1371.

1899–00. 3,141 t. st. placed in n. j. and 200 c. y. brush and 195 t. st. placed on s. j., **00,** 1769.

1900–01. 209 t. st. placed on extension to n. j., 170 c. y. brush and 699 t. large st. placed in s. j.; **01,** 1453.

1902–03. 3,163 c. y. dr., **03,** 1081.

1903–04. 53,677 c. y. dr.; proj. 70% completed, **04,** 1373.

1905–06. 35,177 c. y. removed, **06,** 1133.

1906–07. 285 c. y. removed, contractors stopped operations, and contract annulled June 17, 1907, **07,** 1211.

1907–08. 59,566 c. y., s. m., removed, **08,** 1267.

1908–09. 3,964 c. y., s. m., removed from inner H., 17,965 c. y., s. m., from point at the turn into Cherrystone Inlet, and 53,487 c. y., s. m., from the chan. of Cherrystone Inlet; the work last mentioned was to maintain chan. previously dr.; contract completed, **09,** 1263.

1909-10. Further imp. to the extent required by the adopted proj. considered worthy, **10,** 1388.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 976; **91,** 1199.
Vessels drawing 12′ could enter H. at m. l. w., **12,** 411.
Locality, 37 m. ne. of Norfolk, Va., **12,** 410.

PRIVATE (CORPORATE) WORK.

In 1896-97 the Philadelphia & Norfolk RR. constr. 750′ of the j. at Cherrystone Inlet in addition to what the U. S. built, **97,** 1371.

PROJECTS.

By Maj. Smith, 1890, dr. H. and entrance thereto to 14′ below m. l. t.; also dr. chan. in Cherrystone Inlet and across Cherrystone Bar to a w. of 100′ and 200′, resp., and d. 16′ at m. l. t., with constr. of st. contractive works at H. entrance; est., $142,340, **90,** 979; **91,** 1199.

Act July 13, 1892, provided that no money should be expend. for the imp. of this H. until its owners should, in a manner satisfactory to the Sec. of War, grant vessels free entry except for the payment of reasonable wharf charges, and should provide an approach to the wharves not less than 40′ w. from the nearest public highway, **93,** 1227; this proviso was repealed by act of June 3, 1896, **96,** 971.

By Maj. Casey, 1899, expend. of available funds to complete n. j. and commencement of the one proposed on the s. side of the entrance, **99,** 1478.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Maj. Smith, **90,** 975.

H. and approach chan. sur. by Maj. Kuhn, **08,** 1267.

Ex. and sur. au. act Feb. 27, 1911, with view to straightening chan. and increasing w. (**R.** to come), **12,** 421.

L-62(b) OYSTER HARBOR, VA.

COMMERCE.

Description of local oyster and fish industry, etc., **04,** 1277.

ENGINEERS.

Chief of Engineers. **R., 04,** 193, 1275.
Boards. BERH. **R., 04,** 1277.
In charge. Col. J. A. Smith. **R., 04,** 1275.
Assistant. C. A. Miner. **R., 04,** 1277.

PHYSICAL CHARACTERISTICS.

Description of: "Oyster," a small village on e. shore of peninsula, about 11½ m. n. of lighthouse at Cape Charles, and somewhat n. of e. from Cape Charles City, the terminal of the N. Y., P. & N. RR., on Chesapeake B., **04,** 1277.

SURVEYS.

Ex. au. act June 13, 1902. **R.** by Col. Smith (unfav.),[1] **04,** 1275.

L-64(a) CHERRYSTONE CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 84,** 151.
In charge. Capt. T. Turtle. **R., 84,** 953, 955.
Assistants:
W. H. Kimberly. **R., 84,** 955.
I. L. Seager. **R., 84,** 954.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Capt. Turtle (**R.** unfav.), **84,** 953, 955.

L-70 NASSAWADDOX (Creek) RIVER, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 112.
In charge. W. F. Smith, U. S. agent, 1888. **R., 89,** 915.
Assistant. A. Stierle. **R., 89,** 915.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 915.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by W. F. Smith (**R.** unfav.), **89,** 915.

L-73 OCCOHANNOCK (Creek) RIVER, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 112.
In charge. Maj. W. F. Smith, U. S. agent, 1888. **R., 89,** 913.
Assistant. A. Stierle. **R., 89,** 914.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 914.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Smith (**R.** unfav.), **89,** 913.

L-76 NANDUA CREEK, VA.

APPROPRIATIONS.

1896,	$3,000,	**96,** 1077.
1899,	3,000,	**99,** 1479.
1902,	*50,	**03,** 1055.
1903,	*75,	**04,** 1319.
1905,	*25,	**05,** 1166.
Total,	[2] 6,150	

COMMERCE.

In 1891 the trade in the creek amounted to between $125,000 and $150,000. 2 addl. wharves constr. since, **95,** 1304.

CONTRACT.

1899. J. Caller, dr., 27¢c. y. ($5,500), **00,** 1772.

* Allottment
[1] H. D. 202, 58th, 2d.
[2] Unexpended balance of $12.38 app. trans. to Carters Creek, Va.

ENGINEERS.

Chief of Engineers. **R., 91,** 146, 1283; **95,** 170, 177; **96,** 156; **97,** 195; **98,** 198; **99,** 228; **00,** 260; **01,** 295; **02,** 209; **03,** 207; **04,** 204; **05,** 214.

In charge:
Lt. Col. P. C. Hains, 1891. **R., 91,** 1284.
Capt. T. L. Casey, 1894–99. **R., 95,** 1302; **96,** 1076; **97,** 1373; **98,** 1229; (Maj.) **99,** 1479.
Maj. J. B. Quinn, 1900–02. **R., 00,** 1771; **01,** 1454; **02,** 1119.
Lt. Col. Chas. J. Allen, 1903. **R., 03,** 1054.
Col. A. M. Miller, 1904. **R., 04,** 1319.
Lt. Col. Smith S. Leach, 1905. **R., 05,** 1166.

Assistant. J. P. White. **R., 95,** 1303.

OPERATIONS.

1899–00. 10,950 c. y. dr., **00,** 1772.
1900–01. 8,185 c. y. dr., **01,** 1454.

PHYSICAL CHARACTERISTICS. (See Surveys.)

Description of, **91,** 1284; **95,** 1302.

PROJECTS.

Capt. Casey in 1895 est. cost of dr. chan. across the bar at the mouth, 8′ x 100′ m. l. w., would be $6,000, **96,** 1076.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Hains (**R.** unfav.), **91,** 1284.
Sur. au. act Aug. 17, 1894; made, 1894, by Capt. Casey, **95,** 1302.
Ex. by Lt. Col. Allen showed much shoaling, **03,** 1054.
Reconnois. by Col. Miller showed that chan. had shifted bodily s.; expend. useless unless regulating works are constr.; cost out of proportion to interests involved, **04,** 1319. Creek regarded as unworthy of further imp. by the U. S., **05,** 1166.
Maps. **95,** 1304.

L-80 PUNGOTEAGUE CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 84,** 151.
In charge. Lt. Col. W. P. Craighill. **R., 84,** 952.
Assistant. J. L. Seager. **R., 84,** 952.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Lt. Col. Craighill (**R.** unfav.), **84,** 952.

L-83 ONANCOCK (Harbor and) RIVER, VA.

APPROPRIATIONS.

1879,	$3,000,	**79,** 77.
1880,	5,000,	**80,** 646.
1890,	6,000,	**91,** 1198.
1892,	6,511,	**92,** 978.
1910,	13,500,	**10,** 1390.
Total,	34,011	

COMMERCE.

Important, **79,** 511, 717; **79,** 717.
Advantages consequent upon imp., **80,** 647.
1911, 48,057 t., **12,** 1723.
Vessels of 7′ draft can reach Onancock, Va., at m. l. w., **12,** 412.

CONTRACTS.

1879. D. Constantine, dr., 17¼¢ c. y., **80,** 646.
1880. American Dredging Co., dr., 20¢ c. y., **81,** 890.
1891. F. C. Somers, dr., 18.9¢ c. y., **91,** 1198.
1892. C. T. Caler, dr., 13¢ c. y., s. m., **93,** 1226.
1910. Norfolk Dredging Co., dr., 23 9/10¢ c. y., s. m., **11,** 1502.

ENGINEERS.

Chief of Engineers. **R., 78,** 76; **79,** 77, 95; **80,** 105; **81,** 141; **82,** 137; **83,** 140; **89,** 112; **90,** 102; **91,** 129; **92,** 129; **93,** 141; **94,** 130; **08,** 280; **10,** 322; **11,** 344; **12,** 411.

In charge:
Capt. C. B. Phillips, 1878–79, **78,** 76. **R., 79,** 716.
Maj. W. P. Craighill, 1879–83, **79,** 77. **R., 79,** 510; (Lt. Col.) **80,** 645; **81,** 889; **82,** 859; **83,** 683.
Maj. W. F. Smith, U. S. agent, 1888–94. **R., 90-**968; **91,** 1197; **92,** 977; **93,** 1225; **94,** 902.
Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1390; **11,** 1502; **12,** 1722.

Assistants:
J. M. Wolbrect. **R., 79,** 717.
A. Stierle. **R., 90,** 968.

OPERATIONS.

1879–80. 9,727 c. y. dr., **80,** 646.
1880–81. 20,297 c. y. dr., **81,** 890.
1891–92. 26,778 c. y. dr. through the outer and inner bars, **92,** 977.
1893–94. 41,154 c. y., s. m., dr. and the proj. completed, **94,** 902.
1910–11. 48,715 c. y. dr., making chan. 8′ x 200′ m. l. w. across outer bar for about 1,000′, and cutting off projecting shoals to 7′, completing proj., **11,** 1502.

PHYSICAL CHARACTERISTICS.

Sand bar at mouth of H., **79,** 717.
Description of the locality; no H., a river; is a trib. of Chesapeake B., in Accomac Co., e. shore of Va., **90,** 969.

PROJECTS.

By Capt. Phillips. 1879, dr. a chan. through the bar at mouth of H. and near the wharves 8′ x 300′ m. l. w.; est., $10,000, **79,** 511, 716, 717, 718; **80,** 645.
By Maj. Smith, U. S. agent, 1889, imp. of the H. entrance by excavation of a chan. 8′ x 300′ through the outer bar, and one 8′ x 200′ through the R. bar; est., $12,511, **90,** 971; **91,** 1198.
By Maj. Kuhn, 1907, chan. 8′ x 200′ across outer bar and straightening chan. to 7′; est., $13,500, and $1,000 an. mainten.,[1] **08,** 280; au. act June 25, 1910, **10,** 322.
Considered completed, but redr. required from time to time to maintain proj. d., **11,** 1502.

SURVEYS.

By J. M. Wolbrect, 1878–79. **R., 79,** 717.
Resur., 1882, **82,** 859.
Au. act Aug. 11, 1888; made, 1889, by Maj. Smith, U. S. agent, **90,** 969.
Between Chesapeake B and Onancock, au. act Mar. 2, 1907; made, 1907, by Maj. Kuhn,[1] **08,** 280.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 412.
Maps. **94,** 902.

[1] H. D. 652, 60th, 1st.

L-85 CHESCONNESSEX CREEK, VA.

COMMERCE.

Purely local, but large increase expected from oyster industry, **01,** 1481.

ENGINEERS.

Chief of Engineers. **R., 01,** 299, 1478.
In charge. Maj. J. B. Quinn, 1901. **R., 01,** 1479, 1481.

PHYSICAL CHARACTERISTICS.

Details; an estuary of Chesapeake B., w. side of Accomac Co., Va., **01,** 1479.

PROJECT.

Maj. Quinn, 1900, proposed chan. 8′ x 130′ x 500′ through bar below wharf, and a turning basin at wharf; est., $5,204,[1] **01,** 1481.

SURVEY.

Au. act June 6, 1900; made, 1900, by Maj. Quinn [1] **01,** 299, 1478.

L-85(b) HUNTING CREEK (Accomac Co.), VA.

COMMERCE.

Description, **95,** 1157, 1158.

ENGINEERS.

Chief of Engineers. **R., 84,** 151; **95,** 151.

In charge:
Capt. T. Turtle, **R., 84,** 961.
Maj. W. F. Smith, U. S. agent, 1895. **R., 95,** 1156.

Assistants:
J. L. Seagor. **R., 84,** 961.
A. Stierle. **R., 95,** 1157.

SURVEYS.

Ex., au. act Aug. 2, 1882; made by Capt. Turtle (unfav.), **84,** 961.
Ex. au. act Aug. 17, 1894; made by Maj. Smith (unfav.), **95,** 1156.

L-91 BENNETT CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 120.
In charge. Lt. G. J. Fiebeger, 1889. **R., 89,** 971.
Assistant. T. I. George. **R., 89,** 972.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 972.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Fiebeger (**R.** unfav.), **89,** 971.

L-98 HARRIS (Harrison) CREEK (Prong of Back River), VA.

COMMERCE.

Est. at 10,000 t. an. of coal, farm produce, and oysters, **95,** 1266.

ENGINEERS.

Chief of Engineers. **R., 95,** 167.
In charge. Maj. C. E. L. B. Davis, 1892–95. **R., 95,** 1265.

PHYSICAL CHARACTESRITICS.

Description of, **95,** 1266.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Maj. Davis, 1894 (**R.** fav.), **95,** 1265.

L-99 HAMPTON ROADS, VA. (Middle Ground Bar.)

APPROPRIATIONS.

1902,	$10,000,	**02,** 1114.
1903,	215,000,	**03,** 1077.
1907,	12,500,	**07,** 1205.
Total,	237,500	

COMMERCE.

Description of, **00,** 1789.
1902, 2,664,000± t.; in 1909, 7,691,404 t., coal and grain, **10,** 317.

CONTRACTS.

1903. Coastwise Dredging Co., dr., 9¢ c. y., s. m., **03,** 1077; supple. contract making change in dumping place, 5½¢ c. y. in addition to above price, **04,** 1367.
1908. L. M. Lewis Dredging Co., dr., 14.3¢ c. y., s. m., **10,** 1383.

ENGINEERS.

Chief of Engineers. **R., 99,** 233; **00,** 265; **02,** 220; **03,** 221; **04,** 220; **05,** 227; **06,** 240; **07,** 253; **08,** 269; **09,** 277; **10,** 316, 329.

In charge:
Maj. T. L. Casey, 1900. **R., 00,** 1785, 1788.
Maj. J. B. Quinn, 1902. **R., 02,** 1114.
Capt. E. E. Winslow, 1903–06. **R., 03,** 1076; **04,** 1366; **05,** 1189; (Maj.) **06,** 1128.
Maj. J. E. Kuhn, 1907–09. **R., 07,** 1205; **08,** 1261; **09,** 1255.
Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1382.

OPERATIONS.

1903–04. 894,846 c. y. dr., **04,** 1367.
1904–05. 548,391 c. y. dr., **05,** 1189.
1908–09. 32,208 c. y. dr., **09,** 1255.
1909–10. 38,642 c. y. dr., **10,** 1382.

[1] H. D. 87, 56th, 2d.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1786.

Doubt as to stability of upper end of imp. chan. on account of cross currents, **05,** 227; shoaling, **10,** 317.

PROJECTS.

Maj. Casey est., 1899, $225,000 to make desired imp., **00,** 1789.

Act June 14, 1902, au. dr. chan. through Middle Ground Bar 30′ x 500′ m. l. w.; est., $225,000, **03,** 221.

SURVEYS.

Ex. and sur. chan. Middle Ground Bar for 20′ x 500′, au. act Mar. 3, 1899; made, 1899, by Maj. Casey (**R.** fav.; see Projects), **00,** 1786, 1788.

Of chan. across Newport News Middle Ground Bar, au. act Mar. 3, 1909; made, 1909, by Maj. Kuhn and Lt. Col. Patrick, resp.,[1] **10,** 329.

Cong. docs., etc., relating to exs., surs., plans, etc., **10,** 317.

Map.[1]

L-99(b) HAMPTON ROADS, VA.—PIERS, JAMESTOWN EXPOSITION.

APPROPRIATIONS.

1906,	$400,000	**07,** 1197.
1907,	65,000	
Total,	465,000	($17,330.56 reverted to Treas. on turning over completed work to Exposition Co., Sept. 14, 1907, **09,** 272).

CONTRACTS.

1906. Scofield Co., constr. of ps., $385,000; Scofield Co. (supple.), dr. and changes in plans of ps., **07,** 1198.

ENGINEERS.

Chief of Engineers. **R., 07,** 247; **08,** 261; **09,** 271.

In charge:

Maj. Spencer Cosby, 1907–08. **R., 07,** 1195; **08,** 1248.

Maj. Jay J. Morrow, 1909. **R., 09,** 1248.

LEGISLATION.

Ps. transferred to Jamestown Exposition Co., terms of act of Congress, **09,** 272.

OPERATIONS.

1906–07. Basin in Bush Creek dr., ps. and basin about 84% completed, and chan. of approach 68% completed, **07,** 1196.

1907–08. Chan. of approach and basin dr.; all work completed, **08,** 1249.

1908–09. Slight repairs made in roof work, **09,** 1248.

PHYSICAL CHARACTERISTICS.

Description of location, **07,** 248.

PROJECT.

For 2 ps., each 150′ x 1,200′, inclosing basin 547′ x 1,100′, with boat landings along inside and between ps., wooden bulkhead 1,900′ l., concrete arch over entrance, and temporary ornamental structures; also chan. of approach 200′ w., and basin in Bush Creek 12′ d.; est., ps., $400,000; chan. of approach and Bush Creek basin, plans furnished by Exposition Co., $65,000, **07,** 248, 1195. Act Feb. 9, 1907, au. addl. dr. chan. from d. w. in H. Rds. to US. ps. at Exposition, and dr. in Bush Creek for life-saving exhibit; cost not to exceed $65,000, **09,** 271.

SURVEY.

For chan. and basin, **07,** 248.

L-102 HAMPTON RIVER (Creek) AND BAR, VA.

APPROPRIATIONS.

1878,	$10,000,	**78,** 72.
1879,	2,000,	**79,** 86.
1890,	10,000,	**91,** 1297.
Total,	22,000	

COMMERCE.

Important, **75,** ii, 153, 155.

CONTRACTS.

1878. Brainard & Rice, dr., 12¢ c. y. (contract annulled), **79,** 618. H. E. Culpepper, dr., 15¢ c. y., **79,** 618.

1891. Atlas Dredging Co., dr., 11¢ c. y., **91,** 1298.

ENGINEERS.

Chief of Engineers. **R., 75,** 95; **78,** 72; **79,** 85; **80,** 115; **89,** 120; **91,** 148; **92,** 150.

In charge:

S. T. Abert, U. S. C. E., 1874–80. **R., 75,** ii, 152; **78,** 513; **79,** 617; **80,** 779.

Capt. G. J. Fiebeger, 1888–92. **R., 89,** 974; **91,** 1297.

Lt. E. Burr, 1892. **R., 92,** 1089.

Assistants:

A. K. Michler. **R., 75,** ii, 154.

W. H. Powless, **75,** ii, 152.

T. T. George. **R., 89,** 975.

OPERATIONS.

1878–79. Dr. in progress, **79,** 618.

1879–80. 66,328 c. y. dr.; proj. completed, **80,** 780.

1891–92. 84,321 c. y. dr., **92,** 1090.

PHYSICAL CHARACTERISTICS.

Description, **75,** ii, 154; **78,** 513; **89,** 976.

PROJECTS.

By S. T. Abert, 1875, chan. 9′ x 150′ through bar at mouth; est., $15,757.50, **75,** ii, 153; **78,** 72. Proj. completed, 1880, **80,** 780.

By Lt. Fiebeger, 1888, chan. 9′ x 200′ m. l. w., mouth of creek to Hampton Br.; also chan. of same d. through bar, with a w. of 200′ at mouth of creek and 300′ at the turning buoy; est., $10,000, **89,** 975.

SURVEYS.

By A. K. Michler, 1874, **75,** 95, ii, 152, 154.

Sur. of bar by S. T. Abert, 1878, **79,** 618.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Fiebeger (see Projects), **89,** 975.

[1] H. D. 550, 61st, 2d.

L-104(a) NEWPORT NEWS CREEK, VA.

ENGINEERS.

Chief of Engineers. R., 11, 350.
In charge. Lt. Col. M. M. Patrick, **11,** 330.

SURVEY.

Pre. ex. au. act June 25, 1910, with view to securing 8′. **R.** by Lt. Col. Patrick, Nov. 7, 1910[1] (unfav.), **11,** 350.

L-104(b) NEWPORT NEWS HARBOR, VA.

ENGINEERS.

Chief of Engineers. R., 12, 420.
In charge. Lt. Col. M. M. Patrick, **12,** 390.

SURVEY.

Pre. ex. au. act Feb. 27, 1911, with view to securing increased anchorage area for small craft. **R.** by Lt. Col. Patrick, June 10, 1911[2] (unfav.), **12,** 420.

L-105 JAMES RIVER, VA.[3]

APPROPRIATIONS.

1836,	$500 (sur.), act July 4.
1852,	[4] 22,500, act Aug. 30.
1870,	50,000, **70,** 68; **71,** 73, 597; **74,** ii, 39.
1871,	50,000, **71,** 73, 597, 605; **74,** ii, 39.
1872,	50,000, **72,** 70, 691; **74,** ii, 39.
1873,	75,000, **73,** 75; **74,** ii, 39.
1874,	50,000, **74,** 86, ii, 39; **77,** 285.
1875,	50,000, **75,** 88, ii, 73; **77,** 285.
1876,	60,000, **76,** 65, 140, 291; **77,** 60, 285.
1878,	70,000, **78,** 66, 454.
1879,	75,000, **79,** 78, 513.
1880,	75,000, **80,** 648.
1881,	60,000, **81,** 892.
1882,	75,000, **82,** 860.
1884,	75,000, **84,** 905.
1886,	112,500, **86,** 890.
1888,	225,000, **88,** 762.
1890,	200,000, **90,** 992.
1892,	200,000, **92,** 1013.
1894,	100,000, **95,** 1183.
1896,	120,000, **96,** 1008.
1899,	150,000, **99,** 1438.
1902,	300,000, **02,** 1101.
1905,	200,000, **05,** 1178.
1907,	200,000, **07,** 1194.
1909,	*10,000, **09,** 1246.
1910,	250,000, **10,** 1370.
1911,	150,000, **11,** 1478.
1912,	70,000, **12,** 1715.

Total, 3,125,500 (incl. misc., $3,125,834.46, **12,** 1715).

COMMERCE.

Importance of imp., **73,** 778; **74,** ii, 43, 45; **75,** ii, 83; **77,** 290.

Imp. condition of R., **74,** 85, ii, 45; **75,** ii, 81, 83; **76,** 293; **77,** 60, 284, 288; **79,** 513.

Previous condition of, **76,** 293; **79,** 513.

Vessels to Richmond obliged to transfer part of cargoes, **74,** ii, 45.

Time saved by use of Dutch Gap and other cut-offs, **73,** 75, 774, 776, 777; **76,** 305; **79,** 513.

RR. rates reduced, and cost of R. transportation lowered also, **09,** 270; **12,** 405. Terminal facilities unsatisfactory, **12,** 406.

"The channel length of the James River from Hampton Roads to the head of navigation at Richmond, Va., for steamers and other craft, is 103.8 miles. The river is navigable for rafting and logging for about three-fourths mile above the head of navigation for steamers.

"The commerce of the river for the calendar year 1911 amounted to 472,537 short tons, having an estimated value of $27,004,595. Of the above, 285,126 short tons, having an estimated value of $25,095,183, represent the part of the commerce and its value for the port of Richmond, Va.

"The above statistics, as compared with those for the calendar year of 1910, show a decrease in the total of James River tonnage of about 9.8 per cent and in increase in value of about 6 per cent. A comparison of the statistics for the port of Richmond, Va., for the above periods shows an increase in tonnage of about 4.3 per cent and an increase in value of about 9.1 per cent.

"The principal articles of commerce comprised general merchandise, logs, lumber, cordwood, railroad ties, brick, coal, coal oil, fertilizer, and fertilizer material.

"The work done has been beneficial in reducing the cost of water transportation of lumber, fertilizer material, coal, and other articles carried principally in sailing vessels and barges. In many instances the freight rates on commodities transported by steamers are the same as rail rates. At present the berthing and terminal facilities at Richmond are inadequate even for vessels of a draft that could now navigate the river. The city of Richmond proposes to deepen the part of the channel situated between the improved channel and the site of a public wharf, on which work has been begun." **12,** 405.

CONTRACTS.

1870-71. B. Maillefert, removing wrecks, remains of military brs., and other obstr., **71,** 73, 597; successful work of, **72,** 69, 690. Kalmback & Barton, excavating r. at Rockett's Reef, **71,** 73, 598; failure to complete work, and contract annulled February, 1872, and carried on by hired labor, **72,** 69, 691; **73,** 776.

1871-72-75. American Dredging Co., dr., Dutch Gap cut-off, **71,** 73, 598; **72,** 69, 690; **75,** ii, 73; **79,** 516.

1875. R. T. Hieston, dry excavation at Dutch Gap cut-off and constr. of dikes, **75,** ii, 73, 83; **76,** 291; contract completed February, 1876, **76,** 292.

1876. M. Meehan, dr. Dutch Gap cut-off, **75,** ii, 73, 83; **76,** 291; contract completed February, 1876, **76,** 292.

1878. M. C. Heggarty, for excavation at Dutch Gap, **79,** 515. Comparison of prices by contract and hired labor, **74,** ii, 42.

1879. J. Caler, dr., 16 and 14$\frac{7}{10}$¢ c. y., **80,** 649.

1880. G. H. Ferris, dr., 23¢ c. y. J. Caler, dr., 15 and 17¢ c. y., **81,** 892.

1884. D. Constantine, dr., 11¢ c. y., **85,** 945.

1886. J. Caler & Son, dr., 12½¢ c. y., **87,** 868.

1887. J. F. Gaynor, constr. of js. and dikes. G. E. Ward, dr. J. L. Wilson, r. removal, **87,** 870.

1888. American Dredging Co., dr., 16¢ c. y. Alabama Dredging & Jetty Co., r. removal, $1.50 c. y. for disintegrated and $6.33 c. y. for solid r., **89,** 935. John F. Gaynor, mattress-dike constr., $2.47 and $1.75 l. f.; j. constr., $2.47 l. f. H. T. Morrison, constr. of 4 scows, $4,385. H. T. Mor-

*Allotment
[1] H. D. 5, 62d, 1st.
[2] H. D. 456, 62d, 2d.
[3] Sur.—**R.,** Jan. 25, 1837; est., $115,200. Ex.—**R.** (fav.), Nov. 26, 1852. (H. D. 482, 55th, 2d.)
[4] Half of $45,000 for James and Appomattox Rs. below Richmond and Petersburg.

rison, constr. of lighter, $1,476.50, **89,** 936. J. F. Bradley, brush-dike constr., 95¢ l. f., **89,** 937.

1889. Wm. T. Gaynor, brush-dike constr., $1.50 l. f., **90,** 993.

1890. H. Brusstar & Bro., constr. of scow, $1,305, **90,** 994. W. H. Curtis, mattress constr., $1.79 l. f.; j. constr., $2.49 l. f. C. D. Langhorne, removal of disintegrated r., 45¢ and $1.45 c. y.; removal of solid r., $1.10 and $6.15 c. y.; gravel excavation, 16¢ and 25¢ c. y., **91,** 1236. C. T. Caler, dr., 38¢ c. y. for disintegrated r., 16½¢ for sand, and $1.04 c. y. for solid r. removal, **91,** 1237.

1891. J. T. Vaughan, dr., 44¢ c. y. for sand, $3 for bowlders, and $1 l. f. for logs, **91,** 1237. C. D. Langhorne, constr. of R.R. track, $5,350, and transfer slip, $3,000; Tredegar Co., constr. of 1 car, $325; H. T. Morrison & Co., caisson constr., $2,476, **92,** 1013.

1892. Brusstar Shipbuilding Co., 1 scow, $971.50, **93,** 1255. J. A. Curtis, excavating, 16¢ to $5.50 c. y.; dike and dam constr. ($137,061), **93,** 1252–1254.

1894. P. Sanford Ross, excavation, 12¢ to $5 c. y. ($59,736.05), **95,** 1184–1186.

1895. J. A. Curtis, excavation, 20¢ to $2 c. y.; furnishing, driving, and fastening piles and piling; brush and brush mats; st. or coarse gravel ($20,-233.76), **96,** 1009.

1897. P. S. Ross, dr., 25¢ to $4.70 c. y.; piles and sheet piling ($21,003), **98,** 1212.

1899. P. S. Ross, earth excavation and removal of cobbles and yard r., 25¢ to $4.45 c. y ($84,459.19), **00,** 1727.

1903. J. Clements Shafer, dr., removing r., dike and j. work, etc., unit prices, **04,** 1334.

1906. P. S. Ross (Inc.), dr., removing r., and constr. and repairing js., unit prices given; Submarine Signal Co., for steamer *Chipeta*, $5,500, **06,** 1120.

1907. P. S. Ross, dr., removing r., constr. js., and removing piles, **08,** 1247.

1910. Miner Engineering Co., dr., unit prices, **10,** 1371. Coastwise Dredging Co., dr.; prices listed, **11,** 1478.

1911. The W. B. Bradley Cons. Co., j. work; prices listed, **11,** 1478. Maryland Dredging & Contracting Co., dr.; prices listed, **12,** 1715.

1912. P. Sanford Ross, dr. and r. excavation; prices listed, **12,** 1716.

DEFENSE.

Operations at Dutch Gap Canal by Gen. Butler, **71,** 603; **72,** 691; **75,** ii, 82; **79,** 516.

Obstructions placed in R. during the rebellion, **70,** 68; **71,** 603, 605; **76,** 293; **77,** 287; **79,** 512, 515.

DOCUMENTS. (Not printed in reports.)

S. Doc. 1, 33d Cong., 1st sess., **71,** 603.

ENGINEERS.

Chief of Engineers. R., 70, 68; **71,** 73, 76; **72,** 70; **73,** 75, 78; **74,** 85, 89; **75,** 88; **76,** 64; **77,** 60; **78,** 65; **79,** 77; **80,** 105; **81,** 141, 150; **82,** 137, 144; **83,** 141; **84,** 146; **85,** 142; **86,** 137; **87,** 100; **88,** 97; **89,** 113; **90,** 103, 333; **91,** 134; **92,** 134; **93,** 145; **94,** 133; **95,** 154; **96,** 139; **97,** 187; **98,** 190; **99,** 220, 223; **00,** 251, 255; **01,** 289; **02,** 216; **03,** 216; **04,** 214; **05,** 222; **06,** 233; **07,** 245; **08,** 259; **10,** 304; **11,** 327; **12,** 403.

Boards. Convened, Mar. 17, 1890, at Richmond, to consider and **R.** upon the estab. of H. lines in James R. **R., 90,** 1013, 1016. H. lines as estab. by the board, **90,** 1016. (Col. Craighill, Lt. Col. Hains, and Lt. Fiebeger.)

In charge:

Maj. W. P. Craighill, 1870–84; **70,** 68. **R., 71,** 597, 624; **72,** 690; **73,** 774, 828; **74,** ii, 38; **75,** ii, 72; **76,** 290; **77,** 284; **79,** 512; (Lt. Col.) **80,** 647; **81,** 891; **82,** 860; **83,** 683; **84,** 904.

Capt. C. B. Phillips, temporarily in charge, **78,** 63, 445. **R., 78,** 453.

Lt. Col. P. C. Hains, 1884–87. **R., 85,** 944; **86,** 887.

Col. W. P. Craighill, 1887–94. **R., 87,** 867; **88,** 761; **90,** 992, 1013; **91,** 1234; **92,** 1012; **93,** 1251; **94,** 915.

Capt. Thos. Turtle, 1889–90. **R., 89,** 934.

Lt. Col. P. C. Hains, 1895–96. **R., 95,** 1182; (Col.) **96,** 1007.

Lt. Col. Chas. J. Allen, 1897–1903. **R., 97,** 1346; **98,** 1209; **99,** 1436; **00,** 1725, 1754, 1757; **01,** 1423; **02,** 1100; **03,** 1065.

Col. A. M. Miller, 1904. **R., 04,** 1332.

Lt. Col. Smith S. Leach, 1905. **R., 05,** 1177.

Capt. Spencer Cosby, 1906–08. **R., 06,** 1115; (Maj.) **07,** 1188; **08,** 1241.

Maj. Jay J. Morrow, 1909. **R., 09,** 1242.

Capt. W. T. Hannum, 1910. **R., 10,** 1368.

Lt. Col. W. C. Landfitt, 1911. **R., 11,** 1473.

Lt. Col. M. M. Patrick, 1912–. **R., 12,** 1709.

Assistants:

W. G. Turpin. **R., 73,** 776; **74,** ii, 41.

H. D. Whitcomb. **R., 75,** ii, 80, 82; **76,** 291; **77,** 285; **78,** 455; **79,** 515; **80,** 648, 649; **81,** 892; **82,** 887; **92,** 1014; **93,** 1255; **94,** 916; **95,** 1187; **96,** 1010; **98,** 1213.

W. Popp. **R., 75,** ii, 74.

G. R. Talcott, **76,** 301.

Capt. T. Turtle. **R., 82,** 861, 872; **83,** 684.

C. P. E. Burgwyn. **R., 82,** 878; **84,** 905; **85,** 948; **87,** 870; **88,** 762; **89,** 937; **90,** 994; **91,** 1237.

S. H. Yonge. **R., 99,** 1439; **00,** 1729, 1759; **01,** 1426; **02,** 1103; **03,** 1069; **04,** 1335.

ESTIMATES. (See Projects.)

Maj. Craighill, 1870, imp. from canal locks (Richmond) to and below Goose Hill Flats, by dr., diking, and r. excavation, as follows, d. (at high tide): Via Trents R., each, chan. 15′ x 180′, $125,000 via Trents R. chan. 18′ x 180′, $270,000; via Dutch Gap Canal, chan. 15′ x 180′, $120,000; via Dutch Gap Canal, chan. 18′ x 180′, $250,000, **71,** 73, 604, 606; **72,** 691; **74,** ii, 39, 41.

Increased prices required, 1874, est. to be revised: For chan. 15′ x 180′, via Dutch Gap, $117,000; chan. 18′ x 180′, via Dutch Gap, $408,925, **74,** 85, ii, 39, 41; **75,** ii, 72; **76,** 65, 291; **77,** 285.

Revised, 1876, for chan. 15′ x 180′ m. l. w. from canal locks (Richmond) as far as Harrisons Bar, with partial imp. thereon, $293,808, **76,** 65, 291, 300.

Foregoing revised, 1877; amount required to complete existing proj., $258,024, **77,** 60, 285, 289.

H. D. Whitcomb, 1879, revised to include enlarging and deepening Dutch Gap Cut-off, and increasing d. over shoals below and over Varina or Aikens Bar, $161,000, exclusive of app. for 1879, **79,** 78, 513, 520.

OBSTRUCTIONS.

Wrecks, remains of military brs., etc., placed during the war, **70,** 68; **71,** 73, 597, 603; **76,** 293; **79** 512.

Part of shoaling in Richmond H. attributed to cofferdam belonging to shipbuilding co., **03,** 1067.

OPERATIONS.[1] (See Private and corporate work.)

1870–71. Removal of wrecks; remains of military brs.; opening Dutch Gap Cut-off to 18′ x 100′ (h. w.); r. excavation Rocketts Reef 18′ x 125′ (h. w.), **71,** 73, 597, 598, 600. Operations required, **71,** 603, 605.

1871–72. Removal of obstr. at Drewry Bluff; Dutch Gap Cut-off opened to w. of 135′; failure of contractor on Rocketts Reef (Feb., 1872); work thereafter done by hired labor; dr. by city of Richmond, **72,** 69, 690; **73,** 776.

1872–73. Continuation of r. excavation at Rocketts Reef and vicinity by hired labor; details of drilling and blasting at; constr. of dikes; dr. by U. S. and city of Richmond, **73,** 75, 774, 776. Transferment Jan. 1, 1872, by city of dr. plant to U. S., **73,** 777. Details of transfer, **74,** ii, 41.

1873–74. Removal of r. from chan. near Richmond, especially at Rocketts Reef; dr. on bars and depositing material behind rectifying and contracting dikes, **74,** 85, ii, 38, 41. All work done by hired labor; advantages of, **74,** ii, 42. Success of work-done, **74,** ii, 43.

[1] Previous to 1870 consisted of dr. and removal of bowlders, cooperating with city of Richmond; defect in previous dr., **71,** 603.

1874-75. Removal of r. from chan. near Richmond, and especially at Rocketts Reef; dr. on bars and depositing material behind rectifying and contracting dikes, **75,** 88, ii, 72, 81. Arrangement between city of Richmond and U. S. (as to use by latter of dr. plant) canceled May 1, 1875, **75,** ii, 81. Cooperation of city with U. S. in dr., **75,** 88. General progress of work, **75,** ii, 81. Present d., **75,** ii, 83. All work done by hired labor, **75,** 88, ii, 81, 83.

1875-76. Excavation of Dutch Gap Cut-off and constr. of dikes by contract; removal of r. on Rocketts Reef and elsewhere; dr. from bars and depositing behind dikes by hired labor, **76,** 64, 291. Rental from city of Richmond of part of machinery and dr. plant; rent not to exceed cost of repairs to city, **76,** 64, 291. Cooperation of city with U. S.; amount of work done, **76,** 292.

1876-77. R. excavation; dr. and deposition of material behind dikes; constr. of dikes carried on by hired labor; timber for dikes furnished by contract; continued use by U. S. of machinery belonging to city of Richmond on basis of previous year; cooperation of city; general progress, **77,** 60, 284, 285. Cost of dr., 33½¢ c. y.; of r. removed, $7.54 c. y.; constr. of timber groins (dike), $1.46 per l. f., **77,** 286. Present min. d. from above Rocketts Reef to sea, 14.2′, **77,** 288.

1877-78. Continuation of work by hired labor and use of dr. machinery belonging to city of Richmond on basis of rental of previous year; cooperation of city of Richmond with U. S. in dr. operations, **78,** 65, 453, 455. Present condition of chan., **78,** 457, 458.

1878-79. Continuation of work by hired labor in r. removal, dr., and constr. of wing dams; history of past operations; present condition of chan., **79,** 78, 512, 515, 516, 517.

1879-80. 175,593 c. y. removed and 4,621 l. f. wing dams built by U. S.; 48,999 c. y. removed and 1,396 l. f. wing dam built by city of Richmond, **80,** 647.

1880-81. R. removal and 190,424 c. y. dr. by U. S. and 57,847 c. y. by city of Richmond; 4,463 l. f. wing dams built by U. S., **81,** 894.

1881-82. 126,826 c. y. removed, 2,005 l. f. wing dams and 350 l. f. fascine work constr., **82,** 863.

1882-83. 44,340 c. y. sand and 227 c. y. r. removed by city of Richmond, **83,** 685.

1883-84. R. removal continued, **84,** 905.

1884-85. 307 l. f. of j. and 2,609 l. f. brush dike built, 1,100 c. y. solid r. blated and dr., **85,** 949, 950; 46,750 c. y. dr., **85,** 951; 153,191 c. y. dr., **85,** 945; 16,400 c. y. removed by city of Richmond and RR. cos., **85,** 954.

1885-86. 122,320 c. y. sand and 1,240 c. y. r. and gravel dr. from chan., **86,** 889.

1886-87. 20,670 c. y. sand and gravel and 97 bowlders removed from Kingsland Reach; 862 c. y dr. at Randolph Flats and 981 l. f. of j. built; 635 c. y. r. removed at Goodes Rocks, **87,** 870, 872.

1887-88. 120,566 c. y. of sand and gravel, 220 bowlders, and 1,764.7 c. y. solid r. removed; 10,047 l. f. of training wall, 2,066 l. f. of new wing dam, and 1,016 l. f. of old wing dam built, **88,** 762–765.

1888-89. 509,078 c. y. dr., 4,380 c. y. r. removed, and 8,379 l. f. of training wall built, **89,** 938.

1889-90. 8,860 c. y. r. removed; 78,336 c. y. dr.; 9,340 l. f. training wall built, **90,** 994, 997.

1890-91. 66,700 c. y. r. removed; wing dam built at Wilton; 39,970 c. y. dr. at Kingsland, and 2,900′ of training wall built, **91,** 1241.

1891-92. 101,825 c. y. dr.; 20,058 c. y. loose r. and 6,265 c. y. solid r. removed, **92,** 1016.

1892-93. 18,217 c. y. earth excavated, 1,286 c. y. cobbles, 33,164 c. y. soft r., 3,073 c. y. loose st., 447 l. f. brush wall constr., and 2,824 l. f. of wing dams constr. and extended, **93,** 1257.

1893-94. 15,590 c. y. earth excavated, 130 c. y. cobbles, 13,234 c. y. soft r. and 4,302 c. y. solid r. removed; 7,140 l. f. of wing dams constr. and 531 l. f. repaired, **94,** 920.

1894-95. Model of R. and adjacent country sent to Willets Pt. school of application, **95,** 1187. 179,671 c. y. earth excavated, 530 c. y. of cobbles, 3,770 c. y. soft r., and 6,963 c. y. solid r. removed **95,** 1190.

1895-96. 44,778 c. y. earth excavated, 2,289 c. y. cobbles, 7,512 c. y. soft r., 10,392 c. y. solid r. removed; 1,296 l. f. new dams constr. and 486 l. f. extended; over 698 l. f. dike constr., **96,** 1013.

1896-97. 24,037 c. y. earth excavated, 1,827 c. y. cobbles, 26,498 c. y. soft r., and 6,878 c. y. solid r. removed; 2,738 l. f. wing dams constr., **97,** 1347.

1897-98. 2,926 c. y. earth excavated, 362 c. y. cobbles, 7,024 c. y. soft r., and 3,387 c. y. solid r. removed,, and about 1,690 l. f. of wing dams constr., extended, and repaired, **98,** 1210.

1899-00. 11,048 c. y. earth excavated, 1,409 c. y. cobbles, 4,349 c. y. soft r., and 6,386 c. y. hard r. removed, **00,** 1726. Dike built below Dutch Gap Cut-off and 24 js. repaired, **00,** 1729, 1730.

1900-01. 27,472 c. y. r., earth, etc., removed, and dikes and js. repaired, **01,** 1423.

1902-03. 13,883 c. y. dr. from chan., and 533 c. y. earth and 182 c. y. r. removed in degrading js., **03,** 1069.

1903-04. 128,540 c. y. earth, soft r., etc., and 1,546 c. y. hard r. removed from chan.; 3,760 c. y. earth and 893 c. y. r. removed in degrading old js.; training dike and 7 js. built and 5 old js. extended, aggregating 1,108′ new j. work, **04,** 1332.

1904-05. 147,114 c. y. dr. and 4,692 c. y. r. removed, **05,** 1177.

1905-06. 39,456 c. y. earth, etc., dr., 5,421 c. y. r. removed, and training dikes and js. revet., **06,** 1116, 1118.

1906-07. 66,244 c. y. earth, etc., dr., 10,172 c. y. r. removed, 13 js. built, 3 extended and 2 repaired, **07,** 1189, 1190.

1907-08. 118,127 c. y. earth dr. and 7,957 c. y. r. removed, **08,** 1241, 1242, 1244; 3,340 l. f. j. constr., **08,** 1245.

1908-09. 88,609 c. y. dr., 4,362 c. y. r. removed, and 167 piles removed, **09,** 1243, 1244; 7,600 l. f. js. built, **09,** 1245.

1909-10. 23,712 c. y. earth dr., and 2,951 c. y. r. removed, **10,** 1368.

1910-11. 26,789 c. y. dr. from Varina and Deep Bottom Shoals, completing contract; 1,624,700 c. y. dr. from Swans Pt., Dancing Pt., Rocklanding and Deep Bottom Shoals under contract; wrecks removed, **11,** 1477.

1911-12. 468,353 c. y. dr. from Dancing Pt., Swans Pt., Rocklanding, Deep Bottom and Warwick Reach Shoals; work on Deep Bottom, Kingsland, and Varina js. in progress; 395,108 c. y. dr. from City Pt., Harrison Bar, and Goose Hill Flats; repairs to plant, **12,** 1714.

PHYSICAL CHARACTERISTICS.

James R., an estuary below Richmond Bar, **75.** ii, 78; **76,** 296.

Tides, **73,** 778, 779; **74,** ii, 42; **75,** ii, 75, 76, 78, 81, 82; **76,** 292, 293, 296; **77,** 288; **78,** 456; **79,** 518.

Tide gauge, registry of, **76,** 293; **77,** 288; **78,** 460.

Tides lowered by removal of obstr., **75,** ii, 82; **76,** 292.

Bed of R., character of, **75,** ii, 80, 81.

Stable regimen produced by proper contraction of w., **75,** ii, 80; **76,** 298, 299; **77,** 284, 286, 287; **78,** 458; **79,** 515.

L.-w. slope, **75,** ii, 78, 81; **76,** 296, 298, 301.

Comparison of, measured and calculated, **76,** 298.

H.-w. slope, **78,** 456.

H. w. and effects of, **75,** ii, 82; **76,** 293, 300; **77,** 286; **78,** 456; **79,** 517.

Discharge of R., **75,** ii, 79; **76,** 296.

Sediments transported by R., **76,** 300.

Tides at Richmond, **80,** 650; **81,** 896; **82,** 866, 879.

Cross-sectional areas of R. bottom near Richmond, **82,** 866.

List of freshets and h. of rise of each since 1847 **82,** 868.

Float observations, 1882, **82,** 868.

R. of sur. showing conditions of R. and proposed imp., 1837, **82,** 888.

Cross sections, **85,** 955.

Comparative cross sections of R., **87,** 873.

Freshets in the James R., 1888–89, **89,** 941.

Comparison of freshet slopes, **89,** 941.

Table showing the available draft of w. at h. t. throughout the imp. portions, **90,** 997.

W. and d. and range of areas, **93,** 1259, 1260; **94,** 922; **95,** 1191; **96,** 1014; **98,** 1216.

Tidal observations, **93,** 1255; **94,** 916; **95,** 1187; **96,** 1010, 1011; **98,** 1213, 1216.

Effect of works of direction, **94,** 921; **95,** 1190.
General description of, **98,** 1216; **99,** 1437.
Tides and freshets, **01,** 1432; **02,** 1104.
Chan. obstr. by sliding bank, **02,** 1105.
Freshets **03,** 1070; **12,** 1714.
Description of, **10,** 304.
As a result of imp. work, a chan. now exists from Hampton Roads to about 100′ near wharf at Richmond, 100′ x 18′, **12,** 405.
R. in Allegheny Mtns., Va., near W. Va. State line, mouth at S. end of Hampton Roads, near Newport News, Va. R. formed by confluence of Cow Pasture and Jackson Rs.; l. from confluence to mouth 320± m. Proj. portion 103.8 m. from Hampton Roads to head of navigation at Richmond, Va. R. navigable for rafting and logging for about ¾ m. above Richmond, **12,** 403, 405.
For general character of obstr., depths, etc., see Operations and Projects.

PLANS.

James R. and Kanawha Canal, **71,** 624; **73,** 828; **74,** ii, 86.

PRIVATE AND CORPORATE WORK.
(See Operations.)

Up to 1875 city of Richmond had app. $250,000, to be expend. under direction of common council in dr. on w. bars, **70,** 68; **71,** 73, 598, 603; **75,** ii, 83; progress of work, in cooperation with U. S., in 1871–72, **72,** 69, 691; in 1872–73, **73,** 75, 774, 776. Transferment Jan. 1, 1873, of dr. plant to U. S., at rental not exceeding cost of repairs, **73,** 777; **74,** ii, 41; arrangement canceled May 1, 1875, **75,** ii, 81; progress of dr. in 1875–76, **75,** 88. Transferment of part of dr. outfit to U. S. on previous basis, **76** 291; cooperation of city with U. S., **76,** 292.
1876–77. Continued use by U. S. of dr. outfit and cooperation of city with U. S., **77,** 60, 284, 285. Necessity of city owning dr. outfit, **75,** ii, 84. Report of commission acting for city, **75,** ii, 83.
1877–78. Continued use by U. S. of dr. outfit belonging to city of Richmond and cooperation of city with U.S. in dr. operations, **78,** 65, 453, 455, 461.
1878–79. Continued cooperation of city of Richmond, **79,** 512, 515.
Assistance given by city of Richmond by money app., work done, placing machinery at disposal of U. S., **80,** 647; **81,** 891, 894; **83,** 685; **85,** 954.
Total expend. by city of Richmond, $444,696.45, **86,** 138; **87,** 867.
Wreck and cargo of schooner *Melvin Phillips* removed by owners, **03,** 1070.
At 1912, Richmond proposed d. part of chan. between imp. chan. and site of public wharf on which work has begun, **12,** 406.

PROJECTS. (See Estimates.)

Orig. proj. of 1870, together with its modifications to 1882, proposed to secure between Richmond and the sea a chan. 18′ x 180′ full tide, or about 15′ m. l. w., to be secured by the removal of r. and bowlders, dr. on bars, and deposition of material behind rectifying dikes; excavation through Dutch Gap Cut-off and cut-offs near Jones Neck and Bermuda Hundred, **71,** 604; **72,** 691; **76,** 298; **79,** 516, 520; **86,** 138. Aggregate of the app. 1870 to 1882, incl., $740,000.
By Col. Craighill, 1882, increasing previous w. and d. of chan. so as to secure 25′ full tide, or 22′ at half tide, between Richmond and the sea. The w. of chan. to be as follows: From mouth to City Pt., 400′; from thence to Drewry Bluff, 300′, and thence to the city of Richmond, 200′; est., $4,500,000, **82,** 871, 876; **85,** 947; **86,** 138; **87,** 867; **91,** 1234.
Lt. Col. Allen est., 1899, $724,943.15 to continue imp., and if a turning area be included an additional cost of from $150,000 to $200,000, **00,** 1758, 1759.
For extension of imp. au. act June 13, 1902, from lower city line to docks; giving chan. 22′ x 200′ x 3,300′; est., $724,943.15 addl.,[1] **02,** 1101; **03,** 217.
Extended by act Mar. 3, 1905, to include excavation of turning-basin at Richmond 22′ x 400′ x 600′; est., $150,000, **05,** 222.
Maj. Cosby recom., 1907, that plant be secured to carry on work; est., $228,000, and from $80,000 to $100,000 an. for operating, **07,** 1193.
Total est. for foregoing proj. in 1912, $5,374,943.15, **12,** 404. Proj. 40±% done, **12,** 405.

SURVEYS.

Detailed sur. made, 1852, **70,** 68; **71,** 603.
Ex. shows but slight changes since, 1870, **70,** 68; **71,** 603.
In progress, connecting James R. with Kanawha Canal, 1870–73, **70,** 69; **71,** 76, 624; **72,** 74; **73,** 78, 828.
From ship lock (Richmond) to below Trents Reach, 1874, **74,** 86, ii, 39; **75,** ii, 74. Details and methods used, **75,** ii, 74; **76,** 295; bench marks, **75,** ii, 78; gauging discharge, methods and discussion of, **75,** ii, 79; analysis of sur., **76,** 295.
Au. act Mar. 3, 1881; made, 1881, by Lt. Col. Craighill, **82,** 870, 878.
Comparison made in 1884 and 1887, **84,** 906; **87,** 873.
Miscellaneous sur. and ex., **93,** 1255; **94,** 916; **95,** 1187; **96,** 1010; **97,** 1347; **99,** 1437.
Ex. and sur., to determine what expend. would be necessary to continue imp. to the head of navigation at the docks, au. act of Mar. 3, 1899; made, 1899, by Lt. Col. Allen. (**R.** fav.) (See Projects.) (Maps, **00,** 1736), **00,** 1754, 1755, 1757.
Various local surs. and exs., **01,** 1433; **06,** 1119; **07,** 1192; **08,** 1245; **09,** 1245; **10,** 1369.
Of Dutch Gap Canal, **03,** 1065.
Of shoals, **07,** 1192.
Of Rocklanding Shoal, **08,** 1245.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 404.

Maps:
Maps and sections at Dutch Gap Canal and Rocketts Reef, Richmond Bar, etc., **76,** 294, 298; **77,** 286. Map of Dutch Gap Cut-off, **79,** 520; **00,** 1736.
Showing progress of imp. on 3d and 5th sections, **04,** 1338.

L-108 WARWICK RIVER, VA.

ENGINEERS.

Chief of Engineers. **R., 06,** 237.
In charge. Lt. Col. S. S. Leach, **06,** 215.

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.** by Lt. Col. Leach[2] (unfav.), **06,** 237.

L-116 ARCHERS HOPE RIVER, VA.

APPROPRIATIONS.

1881, $5,000, **81,** 990.
1882, 5,000, **82,** 155, 1074.
Total, 10,000

COMMERCE.

See Operations.
Unimportant, **85,** 1034.

CONTRACTS.

1882. G. W. Ferris, dr., 37½¢ c. y., **82,** 1075.
1883. J. Caler & Son, dr., 27½¢ c. y., **83,** 841.

ENGINEERS.

Chief of Engineers. **R., 80,** 125; **81,** 159; **82,** 155; **83,** 161; **84,** 165; **85,** 157; **86,** 152; **87,** 117; **88,** 101; **12,** 390.

[1] H. D. 234, 56th, 1st.

[2] H. D. 149, 59th, 1st.

In charge:
Capt. C. B. Phillips, 1880–81. **R., 80,** 906.
Capt. J. Mercur, 1881–84. **R., 81,** 989; **82,** 1074; **83,** 841.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1031; **85,** 1034; **86,** 962; **87,** 977.
Col. W. P. Craighill, 1888. **R., 88,** 768.

Assistants:
J. M. Wolbrect. **R., 80,** 907.
G. H. Elliott. **R., 82,** 1075.

OPERATIONS.

1881–82. 12,283 c. y. removed by dr.; no great advantage to C. resulting from work done, **82,** 1075.

1882–83. 16,524 c. y. removed at mouth of R. by dr.; limited extent of work of small value to C., **83,** 841.

PHYSICAL CHARACTERISTICS.

Described; small stream rising bet. James and York Rs., flows se. through James City Co. and empties into the James about 3 m. bel. Jamestown Isld., **80,** 906.

PROJECTS.

By Capt. Phillips, 1880, chan. not less than 6′ x 50′, mouth to Williamsburg, 5 m.; est., $19,400.70, **80,** 907; **85,** 157; **87,** 117.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 95; made by J. M. Wolbrect. (See Projects.) **80,** 907.

Ex. and sur. au. act June 25, 1910, with view to securing increased d., mouth to Williamsburg (**R.** to come), **12,** 390.

L-117(a) JAMESTOWN ISLAND, JAMES RIVER, VA.

APPROPRIATIONS.

1894,	$10,000,	**95,** 1192.
1896,	15,000,	**96,** 1016.
1904,	15,000,	**04,** 1341.
Total,	40,000.	

CONTRACTS.

1895. Eggleston & Montague, excavation, 25¢ c. y.; paving, $3.50 c. y.; rough st., $1.03 t.; piles in groins, 25¢ l. f.; capping, 24¢ l. f.; turfing, 15¢ s. y.; brush mats, 5¢ c. f. ($14,808.50), **95,** 1193.

1900. Lane Bros. & Co., constr. shore protection, $14,000, **01,** 1437.

1904. Richard Parrott, building shore protection, unit prices given, **05,** 1180.

ENGINEERS.

Chief of Engineers. **R., 95,** 156; **96,** 140; **97,** 189; **98,** 191; **99,** 222; **00,** 253; **01,** 291; **02,** 218; **03,** 218; **04,** 216; **05,** 223; **06,** 235.

In charge:
Lt. Col. P. C. Hains, 1895–96. **R., 95,** 1192; (Col.), **96,** 1016.
Lt. Col. C. J. Allen, 1897–1903. **R., 97,** 1349; **98,** 1219; **99,** 1440; **00,** 1736; **01,** 1437; **02,** 1105; **03,** 1071.
Col. A. M. Miller, 1904. **R., 04,** 1340.
Lt. Col. Smith S. Leach, 1905. **R., 05,** 1179.
Capt. Spencer Cosby, 1906. **R., 06,** 1121.

Assistant. S. H. Yonge. **R., 01,** 1437; **02,** 1106.

OPERATIONS.

1894–95. A wall of granite was built along threatened portion of the isld., **95,** 1192.

1900–01. Work commenced on shore protection, **01,** 1437.

1901–02. 1,348 l. f. revêt. built, **02,** 1106.

1904–05. Work continued on shore protection, **05,** 1179.

1905–06. Work continued on shore protection, **06,** 1121.

PHYSICAL CHARACTERISTICS.

Erosion of banks, **01,** 1437.

PROJECTS.

Congress, 1894, au. protecting the isld., from the encroachments of the James R., **95,** 1192.

By Lt. Col. Hains, 1894–95, building a wall faced with granite in front of the isld., grading and turfing the bluff behind it, and adding several groins in front of the wall, **95,** 1192.

By Lt. Col. Allen, 1896–97, regrading the bank and levee where necessary, and covering it with a slope wall of st. laid in hydraulic mortar, protected by riprap and concrete blocks as far as funds would admit, **97,** 1350; revised, 1900, to provide for a revet. of concrete blocks or flagstones, with macadam backing1′ thick, laid against the graded bank of the isld., the toe of the slope to rest against a a strong low line of sheet piling, to be protected against wave action, if necessary, by st. riprap, **00,** 1737, 1738.

By Col. Miller, expend. of app. of $15,000, 1904, by extending sea wall downstream not more than 1,352′, and shoreward from 10 to 40′, **04,** 216, 1340.

SURVEYS.

Ex., 1896–97, by Lt. Col. Allen, **97,** 1349.
Ex. by Col. Miller, **04,** 1340.

L-117(b) JAMESTOWN ISLAND, VA. (Permanent Landing Pier.)

APPROPRIATIONS.

1906, $15,000, **07,** 1198.

ENGINEERS.

Chief of Engineers. **R., 07,** 249; **08,** 262.
In charge. Maj. Spencer Cosby. **R., 07,** 1198; **08,** 1250.

OPERATIONS.

1906–07. Failure of negotiations for purchasing p. of Mrs. L. J. Barney; constr. of new p. held up by delay of Assn. for the Preservation of Virginian Antiquities in donating necessary land; efforts made by Assn. to secure use of ps. from Mrs. Barney during exposition, **07,** 1198.

1907–08. Project abandoned on recom. of Chief of Engineers, indorsed by Sec. of War, **08,** 1250.

PROJECT.

Congress, 1906, app. au. erecting permanent p. on frontage owned by Assn. for the Preservation of Virginian Antiquities, or for purchase or lease of suitable wharf and land necessary to give access to grounds of Assn. and to monument being erected by the U. S., **07,** 249.

L-118 CHICKAHOMINY RIVER, VA.

APPROPRIATIONS.

1878, $5,000, **78,** 73.
1879, 1,000, **79,** 86.
1880, 2,000, **80,** 779.
1881, 2,000, **81,** 975.
1882, 5,000, **82,** 1043.
1886, 4,000, **86,** 145.
1888, 2,500, **88,** 834.
1890, 2,500, **90,** 1080.
1892, 5,000, **92,** 1092.

Total, 29,000

COMMERCE.

Not unimportant, **75,** ii, 171.
Imp. above Windsor Shades not warranted, **79,** 620.

CONTRACTS.

1878. H. E. Culpepper, dr., 14¢ c. y., **79,** 619.
1880. H. E. Culpepper, dr., 15¢ c. y., **81,** 974.
1882. J. Caler & Son, dr., 22½¢ c. y., **83,** 823.
1886. H. E. Culpepper, dr., 14⅝¢ c. y., **87,** 948.
1889. American Dredging Co., dr., 14¢ c. y., **89,** 1019.
1891. C. T. Caler, dr., 15½¢ c. y., **91,** 1300.
1893. C. T. Caler, dr., 13¢ and 23¢ c. y. ($4,700), **93,** 1332.

ENGINEERS.

Chief of Engineers. R., 75, 95; **78,** 73; **79,** 86; **80,** 115; **81,** 156; **82,** 151; **83,** 157; **84,** 159; **85,** 150; **86,** 145; **87,** 111; **88,** 114; **89,** 132, 135; **90,** 119, 121; **91,** 149, 153; **92,** 151; **93,** 162; **94,** 149; **95,** 171.

In charge:
S. T. Abert, U. S. C. E., 1874–91. **R., 75,** ii, 170; **78,** 521; **79,** 619; **80,** 778; **81,** 973; **82,** 1041; **83,** 823; **84,** 996; **85,** 987; **86,** 920; **87,** 947; **88,** 832; **89,** 1018; **90,** 1079, 1085, 1086.
Capt. G. J. Fiebeger, 1891–92. **R., 91,** 1299, 1305.
Lt. E. Burr, 1892–94. **R., 92,** 1091; **93,** 1331; **94,** 980.
Capt. T. L. Casey, 1895. **R., 95,** 1282.

Assistant. J. P. White. **R., 91,** 1306.

OPERATIONS.

1878–79. Chan. through Binns Bar dr. to 8′ x 100′; chan. through Old Fort and Windsor Shades bars dr. to 8′ x 60′, **79,** 619.
1880–81. 16,933 c. y. dr. from chan., **81,** 974.
1882–83. 19,859 c. y. dr., **83,** 824.
1886–87. 18,299 c. y. dr. from bars, **87,** 948.
1888–89. 10,321 c. y. dr., **89,** 1019.
1889–90. 777 c. y. dr., **90,** 1079.
1891–92. 13,000 c. y. dr., **92,** 1092.
1893–94. 17,446 c. y. dr., **94,** 980.
1894–95. 18,188 c. y. dr., and proj. completed, **95,** 1283.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 170.
Obstr.: Bars, snags, trees, etc., **75,** ii, 170, 171.
Products of the adjacent country, **75,** ii, 172.
Deterioration of d. as compared with other Rs., **75,** ii, 171, 172.
Character of bars, **79,** 619.
Obstr. in chan. of R., **82,** 1041.
Description of orig. condition of R., **86,** 920.
Description of the locality, **90,** 1085.

PLANS.

By S. T. Abert, 1888, Windsor Shades to Ropes Neck, removal of snags, trees, stumps, and similar obstr.; est., $4,000, **90,** 1089.

PROJECTS.

By S. T. Abert, U. S. C. E., dr. and removal of logs, snags, trees, etc.; est., $10,380, **75,** ii, 172; **78,** 73.
By S. T. Abert, 1878, excavation of chan. 100′ x 100′–150′ w. through Binns, Old Fort, and Windsor Shades Bars, to 8′ l. w.; est., $15,000, **79,** 619; **80,** 115. Increased in 1882 for a chan. through the bar at the mouth to $18,000, **82,** 1043. Increased in 1885, $1,000, **85,** 988. In 1887 it was est. that $10,000 would be required to complete the proj., **87,** 947.
By S. T. Abert, 1890, chan. from 100′–150′ w. and at least 8′ d. at l. w. through the bar at the mouth; est., $7,500, **91,** 149, 1299.

SURVEYS.

Under direction of S. T. Abert, 1874–78, ex. in general, and a special sur. of Binns, Old Fort, and Windsor Shades Bars, **75,** ii, 170; **79,** 619.
Au. act of Aug. 11, 1888; made, 1889, by S. T, Abert, **90,** 1086.
Ex. Holly Landing to Long Br. au. act Sept. 19. 1890; made, 1891, by Lt. Fiebeger (**R.** unfav.), **91,** 1306.
Maps. **87,** 948; **89,** 1018.

L-144(a) WILLIS RIVER, VA.

ENGINEERS.

Chief of Engineers. R., 11, 330 (H. D. 16, 62, 1st).

SURVEY.

Ex. au. act June 25, 1910, made by Lt. Col. W. C. Langfitt, (**R.,** unfav.)—H. D. 16, 62, 1st.

L-150 APPOMATTOX RIVER, VA. (From Petersburg to mouth.)[1]

APPROPRIATIONS.

1852, $22,500, **66,** 7.
1871, 50,000, **71,** 74, 606.
1872, 40,000, **72,** 70, 692.
1873, 30,000, **73,** 76, 782.
1874, 30,000, **74,** 86, ii, 47.
1875, 30,000, **75,** 89, ii, 84.
1876, 30,000, **76,** 65, 306; **77,** 61, 292.
1878, 30,000, **78,** 67, 465.
1879, 20,000, **79,** 79, 522.
1880, 20,000, **80,** 657.
1881, 20,000, **81,** 901.
1882, 35,000, **82,** 901.
1884, 25,000, **84,** 913.
1886, 18,750, **86,** 959.
1888, 15,000, **88,** 768.
1890, 15,000, **90,** 1025.
1892, 15,080, **92,** 1094.
1894, 5,000, **95,** 1286.
1896, 5,000, **96,** 1076.

[1] Ex.—**R.** (fav.), Nov. 26, 1852. (H. D. 482, 55th, 2d.)

1899, 5,000, **99,** 1477.
1900, *[1] 5,000, **04,** 1372.
1902, 32,500, **02,** 1117.
1903, 175,000, **03,** 1081.
1904, *[1] 12,000, **05,** 1193.
1905, 10,000, **05,** 1193.
1907, 50,000, **07,** 1209.
1907, *[1] 10,000, **09,** 1261.
1909, *[2] 5,000, **09,** 1261.
1910, 93,000, **10,** 1387.

Total, [3]853,830 ($831,330, omitting app. of 1852, **12,** 1719.

COMMERCE.

Description of industries of Petersburg, **01,** 1473.
Decreasing since 1901, **10,** 319.
Effect on rates unknown, **10,** 320.
Description of, **12,** 408, 409.
Imp. has resulted in more fav. rates, **12,** 409.
Traffic 1900, 155,000+ t.; 1905, 53,000+ t.; **1911,** 24,430 t., **12,** 1721.

CONTRACTS.

1871. G. H. Ferris, dr. 150,000 c. y., **72,** 692. B. S. Burch, dr. 50,000 c. y., **72,** 692; **73,** 784.
1872. Albany Dredging Co., dr., **73,** 784.
1873. G. H. Ferris, dr., 24¾¢ c. y., **74,** ii, 47.
1874. G. H. Ferris, dr., 20¢ c. y., **75,** ii, 85.
1875. G. H. Ferris, dr., 21½¢ c. y., **75,** ii, 86.
1876. G. H. Ferris, dr., 15 7/10¢ c. y., **76,** 307; **77,** 291. W. H. Beard, dr., 30¢ c. y., **77,** 291, 292.
1881. S. West, dr., 20¢ and 23¢ c. y., **81,** 902.
1882. G. H. Ferris, dr., 32¢ c. y., **82,** 901.
1884. B. A. Davis, piles, G. V. Scott & Sons, lumber, W. F. Gatling, brush and poles, **84,** 914. A. F. Hull, dr., 13½¢ c. y., **85,** 1029, 1031.
1886. West Point Engine & Machine Co., boiler of towboat, **87,** 978.
1889. Cline & Isaac, j. constr., **89,** 953.
1890. W. Jameson, constr. of wattle j., 79¢ l. f.; timber j. with mattress protection, $3.24; Dike A $1.06 and Dike B 98¢ l. f., **91,** 1302.
1903. C. P. E. Burgwyn, dr., 36¢ c. y., **04,** 1372.
1904. Atlantic Dredging Co., dr. and building embankments, dam, highway br., R.R. br., ps., and flume; unit prices given, **04,** 1372.
1905. Atlantic Dredging Co., dr., 37¢ c. y., **05,** 1193.
1906. W. H. French, dr., 44.8¢ c. y., p. m., **07,** 1210.
1908. Atlantic Dredging Co., dr., rehandling and placing in levees, 41¢ c. y., p. m.; material deposited in levees, 31½¢ c. y., p. m.; material deposited behind dikes, 19½¢ c. y., p. m., **08,** 1266. Atlantic Dredging Co. (supple.) dr., 40¢ c. y., p. m., **09,** 1261. Atlantic Dredging Co. (supple.), laying addl. pipe, $7.50 f.; Atlantic Dredging Co. (supple.), changes in provisions as to laying pipe $150, **09,** 1262.
1909. Atlantic Dredging Co. (supple.), dr., 41¢ c. y.; Atlantic Dredging Co., dr., 25¢ c. y., p. m., **09,** 1261. Atlantic Dredging Co. (supple.), addl. r. in dam, $1.70 per t. for large and medium, and $1.90 for crushed st.; Atlantic Dredging Co. (supple.) certain changes in dam and method of disposal of surplus material, 45¢ c. y., p. m., **09,** 1262. L. M. Lewis Dredging Co., excavating, removing r., building levee, etc., unit prices given, **10,** 1387, contract annulled, **11,** 1499.
1910. W. H. French, dr. (general imp.), 17½¢ c. y., **11,** 1499.
1911. Edward M. Harris, work at Petersburg, unit prices given, **11,** 1499.
1912. Maryland Dredging & Contracting Co., dr. (general imp.), 23,000 c. y., p. m., 17¢ c. y., **12,** 1720.

ENGINEERS.

Chief of Engineers. R., 66, 7; **70,** 31, 68; **71,** 73; **72,** 70; **73,** 76; **74,** 86; **75,** 89; **76,** 65; **77,** 60; **78,** 66; **79,** 78; **80,** 106; **81,** 143; **82,** 139, 903; **83,** 143; **84,** 147; **85,** 155; **86,** 150; **87,** 117; **88,** 101; **89,** 118; **90,** 106; **91,** 150; **92,** 152; **93,** 163, 166; **94,** 149; **95,** 171; **96,** 155; **97,** 193; **98,** 196; **99,** 226; **00,** 258, 265; **01,** 294, 299, 1467; **02,** 222; **03,** 223; **04,** 222; **05,** 229; **06,** 243; **07,** 255; **08,** 271, 280; **09,** 279, 280; **10,** 319; **11,** 342; **12,** 407.

Boards:

Commission, appointed 1852, reported a plan for imp. S. D. 1, 35, 1, Part ii, 394.
Convened Aug. 29, 1870. Recom. adoption of much of the work done by private and corporate au., under plan of H. D. Bird. Modified plan in regard to future work. **R., 74,** ii, 50. Reconvened, Baltimore Nov. 19, 1870. **R., 74,** ii, 53.
(Col. J. H. Simpson, Lt. Col. John Newton, and Maj. W. P. Craighill.)

In charge:

Maj. Wm. P. Craighill, 1878–90. **R., 73,** 784; **74,** ii, 47; **75,** ii, 86; **76,** 307; **77,** 292; **78,** 463; **79,** 521; (Lt. Col.) **80,** 655; **81,** 898; **82,** 898, 907; **83,** 687; **84,** 913; (Col.) **88,** 768; **89,** 955.
Capt. Chas. B. Phillips, in temporary charge. **R., 78,** 463.
Capt. F. A. Hinman, 1884–87. **R., 85,** 1029; **86,** 959; **87,** 978.
Lt. G. J. Fiebeger, 1889–92. **R., 89,** 952, 957; **90,** 1025; **91,** 1300.
Lt. E. Burr, 1892–94. **R., 92,** 1093; **93,** 1333, 1345; **94,** 981.
Capt. T. L. Casey, 1895–99. **R., 95,** 1284; **96,** 1074; **97,** 1369; **98,** 1227; **99,** 1476.
Maj. J. B. Quinn, 1900–1902. **R., 00,** 1766; **01,** 1452, 1468, 1471; **02,** 1117.
Capt. E. E. Winslow, 1903–06. **R., 03,** 1080; **04,** 1371; **05,** 1192; (Maj.) **06,** 1131.
Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1208; **08,** 1264; **09,** 1258.
Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1386; **11,** 1497; **12,** 1718.

Assistants:

H. D. Bird. **R., 72,** 693; **73,** 784; **74,** ii, 47; **75,** ii, 86; **76,** 307; **77,** 292; **78,** 465; **80,** 659.
Capt. James W. Cuyler. **R., 79,** 522, 524, 525, 526; **80,** 657.
Capt. T. Turtle. **R., 82,** 898, 907, 911; **83,** 687.
Lt. C. McD. Townsend. **R., 83,** 688; **84,** 914.
H. J. Gielow. **R., 87,** 981.

ESTIMATES. (Plans and Projects.)

By B. of E., for chan. 12′ x 60′, $250,000; $125,000 addl. to make the work permanent; and $10,000 for an. repairs and dr., **74,** ii, 54.
By Maj. Craighill, to complete chan. 10′ x 80′, $153,000, and $20,000 for an. dr. and repairs, **74,** ii, 46, 47.
By Maj. Craighill and Capt. Cuyler, revised, completion of existing proj., $42,000, **79,** 522.

LEGAL PROCEEDINGS.

Land purchased for works of imp., **05,** 1193.
$10,703.28 expend. for purchase of land; all necessary land vicinity of Petersburg acquired, **06,** 1131.

LEGISLATION.

A joint-stock company incorporated in 1824 by Virginia for imp. of the R., **74,** ii, 54.
The assent of the U. S. given by act of Mar. 3, 1825.

OPERATIONS.

1870–71. Preliminary operations, ex. made, **71,** 608.
1871–72. Removal of 150,000 c. y. from s. chan.; dr. through Puddledock Marsh, **72,** 70, 692.
1872–73. Completion of s. chan., 60′–80′ x 10′; dr. in Puddledock Cut, and completion of deflector 250′ l., **73,** 76, 782, 784.
1873–74. Dr. in and above Puddledock Cut; 123,095 c. y. removed, **74,** 86, ii, 46, 48.
1874–75. Dr. between upper end of Puddledock Cut and Petersburg, **75,** 89, ii, 84.
1875–76. Removal of 129,270 c. y. by contract, **76,** 65, 306–308.

*Allotment.
[1] Emer. R. and H.
[2] Pres. and mainten. R. and H.
[3] $7,131.70 of this amount repaid to app. for Emer. in R. and H. works, **09,** 1261.

1876-77. Dr. and constr. of embankment by contract. (Chan. of sufficient d. for vessels drawing 11′ of w. to reach the city.) **77,** 292.

1877-78. Removal of 421 c. y. of rock by blasting; constr. of 812 l. f. of longitudinal dikes and 13 wing dams, **78,** 66, 464, 465.

1878-79. Dr. 15,248 c. y.; repairs, protection, and extension of wing dams; constr. of dams, training walls, and dikes, **79,** 78, 523.

1879-80. Dr. 9,305 c. y.; repair and constr. of wing dams and dike, **80,** 657.

1880-81. Dr., constr., and repair of wing dams in progress, **81,** 898.

1881-82. Dr. and repairs to dikes, **82,** 898.

1882-83. (Imp. condition of R., **83,** 143, 687, 694.) Constr. of js., and their cost, **83,** 143, 688.

1883-84. 26,727 c. y. dr.; constr. and repairs of dikes, **84,** 147, 914. (Imp. condition of R., **84,** 913.) Cost of work, **84,** 915.

1884-85. 51,300 c. y. dr. by contract from Puddledock Cut; extension and repair of dikes by hired labor, **85,** 1029.

1885-86. 70,124 c. y. dr. by contract from Puddledock Cut; 940 l. f. pile and brush revetments built by hired labor, **86,** 958.

1886-87. 25,047 c. y. dr. from chans.; repair of js., dams, and training walls; 348 l. f. revetment built at Puddledock Cut; constr. of training wall at Rushmore's commenced, **87,** 979.

1888-89. 15,175 c. y. dr., js. repaired, and closuredike to Jetty No. 20 prolonged, **89,** 952.

1889-90. 10,435 c. y. dr., **90,** 1025.

1890-91. 13,512 c. y. dr. from Puddledock Shoal and deposited behind closure dike; 2,200 l. f of j. built; Rushmore Dam, etc., built, **91,** 1301.

1891-92. 892 l. f. of brush and pile dike built at Magazine Bend and at Lieutenant Run Dike, and 583 l. f. of the latter dike backed with brush; dam built at Steins Cut and repairs to closure dike at head of Puddledock Cut; 7,867 c. y. gravel used in constr. of bank behind the cut, **92,** 1093.

1892-93. 31,325 c. y. dr., 1,475 l. f. of brush dike at Magazine Bend refilled with brush, a new wale piece was placed on the closure dike, and 1,243 l. f. of timber dam at the closure dike constr. and 350 l. f. rebuilt, **93,** 1334.

1893-94. 17,150 c. y. dr., and 6,850 c. y. of it placed behind closure dike to strengthen it, **94,** 982.

1894-95. 7,200 c. y. dr. and placed behind closure dike, **95,** 1285.

1895-96. 18,000 c. y. dr., and 6,050, 2,800, and 4,750 c. y. of it were wheeled ashore at Bradway, Rushmores Dike, and at closure dike, respectively, **96,** 1075.

1898-99. 10,250 c. y. dr. from vicinity of Rushmores Dike, **99,** 1476.

1899-00. 7,200 c. y. dr. from vicinity of Rushmores Dike, 12,550 c. y. at Sunken Isld.; 3,150 c. y. at Mills Bar; and closure dike repaired, **00,** 1766, 1767.

1902-03. 4,261 c. y. dr., **03,** 1080.

1903-04. 22,687 c. y. dr., **04,** 1371.

1904-05. 4,400 c. y. dr.; highway br. built over new chan. at Petersburg, **05,** 1192.

1905-06. 24,160 c. y. dr. below Petersburg; 46,031 c. y. removed from new chan. at Petersburg and placed on main levee, and 704 c. y. deposited on Pocahontas Levee, **06,** 1131.

1906-07. 19,784 c. y. dr. below Petersburg, 108,300 c. y. dr. from new chan. at Petersburg, 2,860 c. y. from RR. embankment, 185 c. y. placed on Pocahontas Levee and 911 c. y. behind s. abutment, 16.8 c. y. r. removed from p. foundations, and 901.6 c. y. concrete placed in ps., **07,** 1209.

1907-08. 51,047 c. y. removed from new chan. at Petersburg, 5,862 t. r. placed on dam, 1,390 c. y. fill behind abutment, 10.3 c. y. r. removed from p. foundations, and 579.85 c. y. concrete placed in ps.; flume constr., **08,** 1265.

1908-09. 39,547 c. y., p. m., dr., rehandled and placed on levee, 28,752 c. y., p. m., dr., and placed in levee, 12,912 c. y., p. m., pumped ashore, 27,578 c. y., p. m., dr., and pumped into washout of dam, 150 l. f. trestle built, 855 c. y. r. and 1,238 c. y. slag placed in break of rear bank, 62,937 c. y., p. m., removed from new chan. at Petersburg, and 4,131 t. r. placed on dam, **09,** 1258, 1259, 1260.

1909-10. 15,977 c. y. dr., 300 c. y. earth and 200 c. y. r. removed, and 18,027 c. y. earth placed in levee, **10,** 1386.

1910-11. 47,803 c. y., p. m., excavated at Lieutenant Run Shoal and dumped below Point-of-Rocks, **11,** 1497. Quantity and cost of work done by L. M. Lewis Dredging Co. at Petersburg given in tables; 230 c. y., p. m., earth, and 425.7 c. y. r. excavated at Petersburg, **11,** 1498.

1911-12. 21,300 c. y., p. m., dr. at shoals from Petersburg to Point-of-Rocks, **12,** 1718. 8,000 c. y., p. m., removed at and below Petersburg; 3,568 c. y., p. m., earth, and 1,031 c. y. r. excavated, **12,** 1719.

(See Physical characteristics, last paragraph.)

PHYSICAL CHARACTERISTICS. (See Operations, 1876–77, 1882–83, 1883–84.)

Described, **71,** 606–608; **74,** ii, 50–56; **79,** 529. Sketch showing current observations at Magazine Bend, **78,** 464.

Description of the various divisions of the R., **93,** 1336.

Description of; impossible to maintain chan. on account of sand carried down by freshets, **01,** 1468, 1469.

Unusual freshets overflowing banks, cutting new chan. around end of dam, completely filling navigable chan. below dam, **09,** 1259.

Stream 137 m. l.; navi. l. only 11 m., **12,** 437.

Freshets, 1912, broke incomplete diversion dam, Petersburg, **12,** 460.

PLANS. (See Estimates and Projects.)

By Capt. Cuyler, change in direction of js. to oblique instead of perpendicular to the shore, **79,** 524.

By. Lt. G. J. Fiebeger, 1889, for diversion of the waters of the Appomattox R. into the old North Channel, involving dr., dam, embankment, and br. constr., and the purchase of overflowed lands; est., $387,926.21, **89,** 960.

PRIVATE (CITY AND CORPORATE) WORKS.

History from 1824 to 1870, **74,** ii, 54–57; **77,** 293.

Est. by H. D. Bird, engineer for Lower Appomattox Co., for a 12′ chan., $173,004.15, **74,** ii, 57.

Dr., etc., by the city of Petersburg, **71,** 73, 606–608; **72,** 692; **75,** ii, 86; **78,** 464; **79,** 521. The Lower Appomattox Co. expend., in 1870, $75,186.70, **74,** ii, 57.

Constr. of a dr., 1884, by city of Petersburg, Va., **84,** 914; work done by city of Petersburg, **86,** 960.

Dr. done by the city near Petersburg, **88,** 768.

History of imp. carried on by the city of Petersburg, **89,** 957, 961.

PROJECTS.

By BE., 1870, chan. 12′ h. w. and a w. as great as the R. would bear, the imp. to be accomplished by regulating works, aided by dr.; est., $428,000, **71,** 73, 606; **74,** ii, 53; **85,** 155; **87,** 117.

In 1887 a revision of the est. cost for the completion of the proj. was $33,810, **87,** 978, 983. This was increased in 1889, to $45,890, or $30,080 for completion, **89,** 953.

Lt. Burr in 1893 submitted a revised est. of cost of the imp., making a total of $68,090, **93,** 1336.

By. Capt. Burr in 1894 retaining the app. of 1894 until dr. be necessary, app. not being considered sufficient to warrant the undertaking of any extension of the contracting works, **95,** 1285.

Deflection of the R. in the old chan. just above the br. at Petersburg recom. by Maj. Casey, 1899 (see Plan of 1889), **99,** 1477.

By Maj. Quinn, 1899, expend. of funds in dr. at Sunken Island Mills Bar, and Magazine Bend, **00,** 1767.

By Maj. Quinn, 1900, proposes diverting R. at Petersburg and providing for excavating chan. 200′ x 2½ m., and constr. dam, dike, brs., and other necessary work; est., $266,915, with $6,000 an. mainten., **01,** 1471. Act 1902 limited cost to $200,000; act 1907 au. increase to $260,000, **12,** 409 Col. P. C. Hains, Div. Eng., est. it would cost $400,000 to divert R., **01,** 1473.

Existing proj., 1912, attainment and mainten. of chan., 12′ x 80′ m. h. w., Point-of-Rocks to Petersburg, 7½ m., **12,** 408.

SURVEYS.

Elaborate sur. made a short time before the civil war, **70,** 68.

By Maj. Craighill, 1870, **70,** 68.

By Maj. Craighill, 1873–74, **74,** ii, 46.

By. Lt. Col. W. P. Craighill, 1881–82, **82,** 904.

Au. act of Aug. 11, 1888; made, 1889, by Lt. Fiebeger, **89,** 957.

Ex. and sur. of H. at Petersburg and Appomattox R. au. act of July 13, 1892; made, 1892, by Lt. Burr (**R.** unfav.), **93,** 1347, 1348.

Ex. and sur. au. act 1900, with a view to deflection of the R. at Petersburg (see Project), **01,** 299, 1467,

Made in compliance with act Mar. 2, 1907; est.. $23,000,[1] **08,** 280, 1264.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 408, 409.

Maps.[1] **89,** 960; **93,** 1340.

L-159 LYONS (Lawns) CREEK, VA.

COMMERCE.

Merchandise, brick, and peanuts, valued at $28,000, shipped 1894. Limited interests would not justify expend. by U. S., **95,** 1298.

ENGINEERS.

Chief of Engineers. **R., 95,** 177.

In Charge. Capt. T. L. Casey, 1894. **R., 95,** 1297.

PHYSICAL CHARACTERISTICS.

Description of; has been called "Lawns" Cr., **95,** 1297.

SURVEY.

Ex. au. act Aug. 17, 1894; made by Capt. Casey, 1894 (**R.** unfav.), **95,** 1297.

L-160 PAGAN RIVER (Creek), VA.

APPROPRIATIONS.

1880,	$5,000,	**80,** 821.
1881,	5,000,	**81,** 991.
1902,	[2] 10,870,	**02,** 1116.
1910,	4,600,	**10,** 1385.
1912,	1,000,	**12,** 1717.

Total, 26,470 (less $198.99 returned to Treas., $26,271.01, **12,** 1717).

COMMERCE.

Important, **75,** ii, 158.

R. is only practical direct outlet from Smithfield and neighboring country, **01,** 1475.

Description of, **01,** 1477.

Dependent on peanut and oyster crops, **05,** 229.

No rail route to points below head of navigation, **10,** 319.

Average per year about 100,000 t., mostly peanuts and oysters, **11,** 341.

C. handled by numerous small schooners and sloops, and 2 regular steamers, **12,** 407.

Effect of imp. on rates not ascertainable, **12,** 407.

CONTRACTS.

1880. H. E. Culpepper, dr., 16½¢ c. y., **81,** 991.
1881. J. Caler & Co., dr., 23¢ c. y., **82,** 1077.
1905. L. M. Lewis, dr., 10¢ c. y., s. m., **06,** 1130.
1910. Norfolk Dredging Co., dr., 17$\frac{3}{10}$¢ c. y., **11,** 1496.

ENGINEERS.

Chief of Engineers. **R., 75,** 95; **80,** 119; **81,** 159; **82,** 155; **83,** 162; **01,** 299, 1474; **02,** 221; **03,** 222; **04,** 221; **05,** 228; **06,** 242; **07,** 254; **08,** 270, 280; **09,** 278; **10,** 318; **11,** 341; **12,** 406, 421.

In charge:

S. T. Abert, U. S. C. E., 1875. **R., 75,** ii, 156.

Capt. C. B. Phillips, 1880–81. **R., 80,** 820.

Capt. J. Mercur, 1881–83. **R., 81,** 990; **82,** 1076; **83,** 842.

Maj. J. B. Quinn, 1901–02. **R., 01,** 1475, 1477; **02,** 1116.

Capt. E. E. Winslow, 1903–06. **R., 03,** 1079; **04,** 1370; **05,** 1191; (Maj.) **06,** 1130.

Maj. J. E. Kuhn, 1907–09. **R., 07,** 1207; **08,** 1263; **09,** 1257.

Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1385; **11,** 1496; **12,** 1717.

Assistants:

A. K. Michler and W. H. Powless, **75,** ii, 157.

OPERATIONS.

1880–81. 6,662 c. y. dr. from bars at Smithfield, **81,** 991.

1881–82. 34,631 c. y. dr. from bars at mouth of creek, **82,** 1076.

1905–06. 81,672 c. y. dr., **06,** 1130.

1910–11. Proj. completed Nov. 22, 1910; 23,117 c. y. dr. under contract, **11,** 1496.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 156.

Obstructions, bars, etc., **75,** ii, 156.

Description of, **01,** 1477.

PLANS.

By S. T. Abert, U. S. C. E., dike 4,500′; est., $13,500, **75,** ii, 157.

PROJECTS.

By S. T. Abert, U. S. C. E., 1875, chan. 6½′–7′ x 60′ through 4 bars, Smithfield to mouth of creek, 5 m.; est., $28,380, **75,** ii, 157; **80,** 820.

By Maj. Quinn, 1900, chan. 8′ x 80′ from Smithfield, Va., to James R.; est., $28,870 (for 10′, $36,088),[3] **01,** 1477.

Act 1905 au. expend. of balance in securing chan. 40′ w. and of such d. (probably 10′) as might be obtained, **05,** 228, 1191.

By Maj. Kuhn, 1907, w. chan. at Smithfield and at bends farther downstream; est., $4,600, and $1,000 an. mainten.,[4] **08,** 280; **10,** 318.

Act June 25, 1910, au. w. chan. at Smithfield and at bend ½ m. below Smithfield, and dr. off points of abrupt bends in existing chan. farther downstream **11,** 341.

SURVEY.

By A. K. Michler and W. H. Powless, under the direction of S. T. Abert, U. S. C. E. **R., 75,** ii, 156.

From Smithfield, Va., to James R., au. act June 6, 1900; made, 1900, by Maj. Quinn,[3] **01,** 1474.

Ex., **04,** 1370.

Ex. au. act Mar. 2, 1907; made, 1907, by Maj. Kuhn,[4] **08,** 280.

Pre. ex. and sur. au. act Feb. 27, 1911, with view to securing 12′, and turning-basin at Smithfield, **12,** 421.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 407.

[1] H. D. 952, 60th, 1st.
[2] $198.99 of this amount returned to Treas., **09,** 1258.
[3] H. D. 88, 56th, 2d.
[4] H. D. 397, 60th, 1st.

L-164 CHUCKATUCK CREEK, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 120.

In charge. Lt. G. J. Fiebeger, 1889. **R., 89,** 968.

Assistants:
J. Riddle. **R., 89,** 969.
T. I. George. **R., 89,** 970.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 969.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Lt. Fiebeger (**R.** unfav.), **89,** 968.

L-165 NANSEMOND RIVER, VA.

APPROPRIATIONS.

1873	$15,000,	**73,** 76, 787.
1874,	10,000,	**74,** 87, ii, 63.
1875,	5,000,	**75,** 94, ii, 129.
1876,	5,000,	**76,** 68, 352; **77,** 65, 365.
1878,	2,000,	**78,** 75, 541.
1888,	10,000,	**88,** 98.
1890,	10,000,	**90,** 1024.
1892,	10,000,	**92,** 1091.
1894,	10,000,	**95,** 1281.
1896,	5,000,	**96,** 1073.
1899,	5,000,	**99,** 1476.
1907,	5,000,	**07,** 1206.
1910,	5,000,	**10,** 1384.
1911,	3,000,	**11,** 1495.
Total,	100,000	

COMMERCE.

Importance, **72,** 725; **73,** 787; **74,** ii, 63; **75,** ii, 129; **77,** 365; **79,** 682.
Decreasing, **01,** 1450.
Not possible to ascertain what effect, if any, imp. has had on rates, **07,** 254.
In 1911, 78,000 t., **12,** 403.

CONTRACTS.

1874. Morris & Cummings, dr., 20¢ c. y., **74,** ii, 63. H. E. Culpepper, dr., 23¢ c. y., **75,** ii, 128. H. E. Culpepper, building dike, $3.45 per l. f., **75,** ii, 128. H. E. Culpepper, removal of wreck, **75,** ii, 128.
1875. H. E. Culpepper, removal of wreck, and dr., **76,** 352.
1877. G. H. Ferris, dr., and repairing dike, **77,** 365.
1889. C. Bliven, dike repair, $2,940, **89,** 950. C. T. Caler, dr., 29¼¢ c. y., **89,** 951.
1891. Alabama Dredging & Jetty Co., dr., 20¢ c. y., **91,** 1299.
1893. Rittenhouse Moore Dredging Co., dr., 25¢ c. y. ($9,500), **93,** 1331.
1894. C. T. Caler, dr., 18½¢ c. y., s. m., **95,** 1281.
1903. Smith & Robinson, dr., 24½¢ c. y., s. m., **03,** 1078.
1904. Coastwise Dredging Co., dr., 25¢ c. y., s. m., **04,** 1369.
1908. Dr., 15.4¢ c. y., **09,** 1256.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 72; **73,** 76, **74,** 87; **75,** 94; **76,** 68; **77,** 65; **78,** 75; **79,** 89; **80,** 118; **87,** 123; **88,** 98; **89,** 117; **90,** 106; **91,** 148; **92,** 150; **93,** 161; **94,** 148; **95,** 170; **96,** 154; **97,** 192; **98,** 195; **99,** 225; **00,** 257; **01,** 293; **02,** 220; **03,** 222; **04,** 220; **05,** 228; **06,** 241; **07,** 254; **08,** 269, **09,** 278; **10,** 317, 329; **11,** 340; **12,** 402.

In charge:
Maj. Wm. P. Craighill, 1871–74. **R., 72,** 723; **73,** 787; **74,** ii, 63.
S. T. Abert, U. S. agent, 1874–78. **R., 75,** ii, 127; **76,** 352; **77,** 365; **78,** 541.
Capt. C. B. Phillips, 1878–80. **R., 79,** 681; **80,** 820.
Capt. F. A. Hinman, 1887. **R., 87,** 995, 1001.
Lt. G. J. Fiebeger, 1888–92. **R., 89,** 950; **90,** 1024; **91,** 1298.
Lt. E. Burr, 1892–94. **R., 92,** 1090; **93,** 1329; **94,** 978.
Capt. T. L. Casey, 1895–99. **R., 95,** 1280; **96,** 1072; **97,** 1367; **98,** 1226; (Maj.) **99,** 1475.
Maj. J. B. Quinn, 1900–1902. **R., 00,** 1765; **01,** 1450; **02,** 1115.
Capt. E. E. Winslow, 1903–06. **R., 03,** 1078; **04,** 1368; **05,** 1190; (Maj.) **06,** 1129.
Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1206; **08,** 1262; **09,** 1256.
Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1384; **11,** 1494; **12,** 1708.

Assistants:
William Popp. **R., 72,** 723.
H. J. Gielow. **R., 87,** 1002.

ESTIMATES. (See Projects.)

By William Popp, 1872, chan. 8′ x 100′, $30,000; if increased to 200′ w., $20,000 addl., **72,** 72, 723.
By S. T. Abert, 1878, increased to $37,000 owing to small apps. and repairs, **78,** 541.

OPERATIONS.

1872-73. Preparatory only, **73,** 76, 787.
1873-74. Snags and artificial obstr. removed, and 2,156 l. f. of dikes built; dr. by contract in progress, **74,** 87, ii, 63.
1874-75. 1,333 l. f. of dike built; 20,819 c. y. dr. and wreck removed, **75,** 94, ii, 128.
1875-76. Chan. 7½′ x 60′ dr. through Suffolk Bar, **76,** 68, 352.
1877-78. 8,340 c. y. dr. from Suffolk Bar Chan., making it 8′ x 80′; dikes repaired, **78,** 75, 541.
1879-80. 1,120 l. f. of dike built; further operations not required, **80,** 820.
1888-89. Dike repair completed under contract, and snags removed from the chan. by hired labor, **89,** 950.
1889-90. 16,150 c. y. and 28 saw logs removed from the chan., **90,** 1024.
1892-93. 37,458 c. y. dr., **93,** 1330.
1894-95. 48,220 c. y. s. m. dr., **95,** 1281.
1896-97. 5 small and 3 large trees removed, **97,** 1367.
1899-00. 1 tree removed from chan., **00,** 1765.
1902-03. 45 logs and other obstr. removed, **03,** 1078.
1903-04. 31,385 c. y. dr., **04,** 1368.
1908-09. 23,797 c. y. dr., **09,** 1256.
1909-10. 55 logs and other obstr. removed by the snag boat *Roanoke*, **10,** 1384.
1911-12. U. S. snag boat *Roanoke* removed 18 trees from chan. and banks, **12,** 1708.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 724.
Chans. in Hampton Roads injured by dr. deposits from this stream, **04,** 1368.

PROJECTS. (See Estimates.)

By W. Popp, 1872, chan. 8′ x 100′ by removing obstrs., dr., and dikes, **72,** 723.
By Maj. Craighill, 1872, chan. 8′ x 100′ to be secured by removal of obstr., dr., and dike constr.; est., $20,000, **72,** 723. Increased by S. T. Abert, U. S. agent, in 1878, to $37,000, **78,** 541. Completed in 1880, **80,** 820.

By Capt. Hinman, 1887, excavating a chan., by dr., 12′ x 100′ m. l. w. head of navigation to mouth of W. Branch, including a turning basin at Suffolk Br. 200′ sq.; spur dam and training-wall constr.; also for a chan. of same l. and from 200 to 400′ w. from Town Pt. to W. Branch by dr. and training-wall constr.; est., $152,500, **87,** 1001; **88,** 98.

By Capt. Burr, 1894, dr. such shoals as might be found to have less than the proj. d., **95,** 1280.

By Capt. Casey, 1896, holding app. of 1896 until sufficient funds were available to warrant operations having in view the completion of the approv. proj. unless it became evident that the immediate relief of navigation demanded its expend., **97,** 1367.

Recom. by Maj. Quinn, 1901, that existing proj. be modified to limit chan. to 80′ w., **01,** 1450.

SURVEYS.

Under direction of Maj. Craighill, by W. Popp, 1871. **R., 72,** 723; **73,** 787.

By S. T. Abert, 1877, **78,** 541.

By Capt. Phillips, 1878–79, **79,** 681.

Au. act Aug. 5, 1886; made, 1887, by Capt. Hinman, **87,** 1001.

Sur. by Capt. Burr, 1893, **94,** 979.

Chan. sounded, **08,** 1262.

Au. act Mar. 3, 1909; made, 1909 (**R.** unfav.),[1] **10,** 329. **R.** by BERH. Oct. 17, 1910, and Lt. Col. Patrick, Oct. 4, 1910, reviewing former ex. Concur in unfav. opinion rendered heretofore.[2]

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 402.

Maps. **87,** 1002.

L-173 ELIZABETH RIVER, VA.

APPROPRIATIONS.

1829,	[3] $80 (sur.), act Mar. 2.
1873,	[4] 15,000, **73,** 76, 785.
1874,	[4] 10,000, **74,** 87, ii, 58.
1875,	[4] 5,000, **75,** 94, ii, 127.
1876,	[4] 5,000, **76,** 68, 351; **77,** 362.
1878,	[4] 5,000, **78,** 73, 515.
1896,	[5] 45,000, **96,** 1071.
1898,	[6] 360,000, **99,** 1473.
1909,	*5,000, **09,** 1255.
1911,	5,000, **11,** 1493.

Total, 455,080 (total, **12,** 1707, is $55,000 but this is only for Western Branch; see footnotes below).

COMMERCE.

Shipments of lumber from W. Norfolk, 1894, amounted to $225,000, and freight amounting to about 600,000,000 lbs. was received, 1893 and 1894, by the Atlantic & Danville Rwy. for shipment from W. Norfolk by water; during the same period about 42,000,000 lbs. were received by water for shipment by this rwy. from W. Norfolk, **95,** 1301.

1911, 1,700,00± t., **12,** 401.

Increasing in importance, **12,** 1707.

CONTRACTS.

1873. G. H. Ferris, dr. 29,500 c. y., **74,** 87, ii, 58.

1874. Marshall Parks, dr. 11,855 c. y., **74,** 87, ii, 58. H. E. Culpepper, dr. 27,709. 75 c. y., **75,** 93, ii, 127.

1875. H. E. Culpepper, dr., **76,** 351.

1877. T. P. Morgan, dr., **77,** 361.

1878. H. E. Culpepper, dr., 27¢ c. y., **79,** 680.

1896. P. S. Ross, dr., 8.4¢ c. y. s. m. ($40,500), **97,** 1366.

1898. American Dredging Co., dr. 2,241,380 c. y. in Elizabeth R., 14½¢ c. y., s. m., **99,** 1474.

1909. Norfolk Dredging Co., dr., 10.3¢ c. y., s. m., **10,** 1381.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 71, 72; **73,** 76; **74,** 86; **75,** 93; **76,** 67; **77,** 65; **78,** 72; **79,** 89; **91,** 153, 1307; **95,** 177; **96,** 154; **97,** 191; **98,** 195; **99,** 224, 225, 232; **00,** 256; **01,** 293; **02,** 220; **03,** 220; **04,** 219; **05,** 227; **06,** 239; **07,** 252; **08,** 268; **09,** 276; **10,** 316; **11,** 339; **12,** 400, 421.

In charge:

Maj. W. P. Craighill, 1871–74. **R., 71,** 585; **72,** 715; **73,** 785; **74,** ii, 57.

S. T. Abert, U. S. C. E., 1874–78, **75,** ii, 110. **R., 75,** ii, 125; **76,** 351; **77,** 361; **78,** 514.

Capt. C. B. Phillips, 1878–1879. **R., 79,** 679.

Lt. G. J. Fiebeger, 1890. **R., 91,** 1308.

Capt. T. L. Casey, 1894–99. **R., 95,** 1298, 1300; **96,** 1071; **97,** 1365; **98,** 1225; (Maj.) **99,** 1473, 1474, 1485.

Maj. J. B. Quinn, 1900–1902. **R., 00,** 1765; **01,** 1449; **02,** 1113.

Capt. E. E. Winslow, 1903–06. **R., 03,** 1076; **04,** 1366; **05,** 1188; (Maj.) **06,** 1128.

Maj. J. E. Kuhn, 1907–09. **R., 07,** 1204; **08,** 1260; **09,** 1254.

Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1381; **11,** 1493; **12,** 1706.

Assistants:

Capt. C. B. Phillips. **R., 72,** 718.

J. E. Weyss, **72,** 718, 720.

G. Thompson, **72,** 718, 720.

G. H. Elliott. **R., 79,** 681.

ESTIMATES. (See Projects.)

By Capt. Phillips, 1872, dr. 7′ chan. to the lock of the Albemarle & Chesapeake Canal, $18,000, **72,** 716, 720; increased to $25,000 by Maj. Craighill, **72,** 716, 718; **73,** 785; in 1874 increased $5,000, **74,** ii, 58.

By S. T. Abert, 1875, increased $8,500, **75,** 87, ii, 127; **76,** 351; increase from $25,000 to $40,000 owing to increase of traffic, **78,** 514; **79,** 679.

OPERATIONS.

1872–73. Dr. by contract, **73,** 76, 785.

1873–74. 5,400 y. chan. dr. 7½′ x 60′, **74,** 86, ii, 57.

1874–75. Dr. through Nicaragua and Deep Creek Bars; 27,709¾ c. y. removed, **75,** 93, ii, 126.

1875–76. Dr. chan. 7½′ x 60′ from canal lock to near Parks Gap, **76,** 67, 351.

1877–78. A cut-off dr. near the lock and the gap w., **78,** 72, 514.

1878–79. 14,914 c. y. dr.; a wreck and snags removed, **79,** 89, 679, 681.

1896–97. 378,037 c. y., s. m., dr. from the W. Branch, **97,** 1366.

1897–98. 103,996 c. y., s. m., dr. from the W. Branch and proj. completed, **98,** 1225.

1898–99. 2,361,775 c. y. dr. from Elizabeth R., **99,** 1473.

1909–10. 39,900 c. y. dr., **10,** 1381.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 716, 718; **75,** ii, 127, **91,** 1308.

Distance from the Deep Creek Lock to the Gilmerton Lock via the system in use in 1894 2 m. shorter than by the Deep Creek route, **95,** 1299. Description of the W. Branch, **95,** 1301.

PRIVATE (CORPORATE) WORK.

Considerable amount expend. from time to time by the Albemarle & Chesapeake Canal Co., **72,** 719.

PROJECTS. (See Estimates.)

By Capt. Phillips, 1872, for 7′ chan. to the lock of the Albemarle & Chesapeake Canal, **72,** 716.

By S. T. Abert, 1875, for chan. 8½′ x 80′, **75,** ii, 126; and d. the approaches to Parks Gap, **75,** 94, ii, 127.

By Capt. Casey, 1896, dr. a chan. 20′ x 200′, m. l. w. 20′ contour in Norfolk H. for a distance of about 1 m.

*Allotment.
[1] H. D. 395, 61st, 2d.
[2] R. and H. C. D. 52, 61st, 3d.
[3] Deep Creek.
[4] South Branch.
[5] Western Branch.
[6] Reported later years under Norfolk H.

in the W. Branch of the Elizabeth R.; est., $45,000, **96,** 1072.

Deficiency act of July 7, 1898, provided $360,000 for 28′ x 450′ chan., m. l. w., Hampton Roads to Norfolk Navy Yard, **99,** 1473.

Maj. Casey est., 1899, $85,000 to imp. Deep Creek, **99,** 1485.

Au. June 3, 1896, chan. 20′ x 200′ d., m. l. w., from 20′ contour, Norfolk H., for 1 m. up the R. from that point; est., $45,000, **01,** 293.

SURVEYS.

Under direction of Maj. Craighill, by Capt. Phillips, assisted by J. E. Weyss and G. Thompson, **72,** 715, 718.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Fiebeger (**R.** unfav.), **91,** 1308.

Ex. Deep Creek Branch for depth equal to that of the Lake Drummond Canal and the S. Branch of the Elizabeth R. au. act Aug. 17, 1894; made, 1894, by Capt. Casey (**R.** unfav.), **95,** 1298.

Ex. W. Branch of the Elizabeth R. au. act Aug. 17, 1894; made, 1895, by Capt. Casey (**R.** fav.) (see Projects), **95,** 1301.

Sur., **96,** 1071.

C. Resoln. Dec. 20, 1898, called for est. of w. and d. Deep Creek, Va., S. Branch of the Elizabeth R. to the new lock at the Dismal Swamp Canal (see Projects), **99,** 1485.

Ex. made, 1900, by Maj. Quinn, **00,** 1765.

Pre. ex. au. act Feb. 27, 1911. **Rs.,** Col. Patrick, June 10 and Aug. 26, 1911; est., $82,000, and $2,000 an. mainten.,[1] **12,** 421.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 401.

Map.[1]

L-173(b-f) NORFOLK HARBOR, VA.

NOTE.—The city of Norfolk, Va., lies on the Elizabeth R. (q. v., L-173) and its branches, about 9 m. from its mouth in Hampton Roads. The improvement of its H. has included the imp. of the chan. of the main R. for this 9 m., and, in addition, the imp. of each of its three branches for a distance of about 1 m. from their junction with the main R., and also the dr. of an anchorage basin at the mouth of the W. Branch.

Part.	Title.	Period.	Appropriations.
b	Norfolk H. and its approaches (see also c, d, e, f)	1871–1912	$2,260,282
c	Norfolk H. and its approaches (Hampton Roads to Portsmouth; see also b)	1909–1912	555,000
d	Thimble Shoals (see also b)	1909–1912	235,000
e	So. Br. Elizabeth R. (see b)	1909–1912	185,000
f	Chan. to Newport News (see b)	1909–1912	475,000
	Total		3,710,282

Part (b), L-173 Norfolk Harbor, Va., and Approaches.

APPROPRIATIONS.

1876,	$35,000,	**77,** 65, 363.
1878,	50,000,	**78,** 73, 517.
1879,	75,000,	**79,** 89, 675.
1880,	50,000,	**80,** 817.
1881,	75,000,	**81,** 988.
1882,	75,000,	**82,** 1073.
1884,	25,000,	**84,** 1029.
1884,	[2] 50,000,	**85,** 1018.
1886,	[2] 187,500,	**86,** 957, 962.
1888,	[2] 60,000,	**88,** 766, 768.
1890,	[2] 150,000,	**90,** 1022.
1892,	150,000,	**92,** 1086.
1894,	100,000,	**95,** 1277.
1896,	100,000,	**96,** 1070.
1898,[3]		
1902,	30,000,	**02,** 1112.
1903,	183,957,	**03,** 1075.
1904,	*30,000,	**05,** 1187.
1905,	40,000,	**05,** 1187.
1907,	319,825,	**07,** 1203.
1908,	125,000,	**08,** 1259.
1909,	200,000,	**09,** 1253.
1910,	145,000,	**10,** 1376.
1912,	4,000,	**12,** 1698.

Total, 2,260,282 (incl. misc., less amount returned to Treas., $2,619,928.76, **12,** 1698).

COMMERCE.

Growth of Norfolk C., **85,** 1009.

Receipts and shipments of cotton for 1885, **86,** 953.

Increased since imp., **07,** 251; **12,** 1699, 1700.

"For the calendar year 1911, the water-borne shipments aggregated 14,445,112 short tons, value not known. The chief products handled are coal, cotton, fertilizer, forest and agricultural products, and general merchandise. The improvement has made Norfolk an important shipping point for bituminous coal from the West Virginia fields.

"It has not been found practical to ascertain what effects, if any, the improvement has had on freight rates."

Approximate amount of freight handled by water during various years.

	Short tons.		Short tons.
1888	1,914,506	1900	5,538,051
1889	2,243,087	1901	7,761,356
1890	2,384,841	1902	7,853,108
1891	2,931,751	1903	9,478,900
1892	3,427,189	1904	10,780,972
1893	3,584,727	1905	10,914,378
1894	4,545,049	1906	15,662,080
1895	5,013,185	1907	13,643,849
1896	5,086,636	1908	11,746,749
1897	9,430,526	1909	10,972,991
1898	6,510,201	1910	12,477,506
1899	6,260,284	1911	14,445,112

CONTRACTS.

1876-77. S. F. Shelbourne, dr., 9½¢ c. y., **77,** 363.

1878. F. B. Colton, dr., 7.7¢ c. y., **79,** 676.

1879. Morris & Cumings Dredging Co., dr., 12½¢ c. y., **80,** 817.

* Allotment.
[1] H. D. 566, 62d, 2d.
[2] Imp. of Norfolk H. approach and navy yard.
[3] See Appro. L-173.

1880. Pardessus & Anthony, dr., 9½¢ c. y., **81,** 988.
1881. T. P. Morgan, dr., 14¢ c. y., **82,** 1071.
1882. National Dredging Co., dr., 17¢ c. y., **83,** 840.
1884. National Dredging Co., dr., 17½¢ c. y., **85,** 1010.
1885. S. P. Ross, dr. (Norfolk H. approach), 9¢ c. y., **86,** 958.
1886. Morris & Cumings Dredging Co., dr., 15½¢ c. y., **87,** 964. E. J. Codd & Co., constr. of steam tender, **87,** 967. Morris & Cumings Dredging Co. dr., 13¢ c. y., **87,** 967.
1888. Morris & Cumings, dr., 13¢ c. y., **89,** 946. P. S. Ross, dr., 12½¢ c. y., **89,** 949.
1891. National Dredging Co., dr., 10.7¢ c. y., **91,** 1292.
1892. J. Cahill, repairs to steam tender, $5,450, **93,** 1326.
1893. Morris & Cumings Dredging Co., dr. 13¾¢ c. y., s. m. ($135,000), **93,** 1326.
1894. Alabama Dredging & Jetty Co., dr., 9¢ c. y., s. m., **95,** 1278.
1896. Morris & Cumings Dredging Co., dr., 8¾¢ c. y., s. m. ($87,500), **97,** 1364.
1904. Sanford & Brooks Co., dr., 9¾¢ c. y., s. m., and removing wharf, buildings, sea wall and rebuilding same, removing trees and repairing drives and walks, $10,690, **04,** 1365.
1905. Coastwise Dredging Co., dr., 7.7¢ c. y., s. m., **05,** 1187. Norfolk Dredging Co., dr. Pinner Pt., 8.3¢ c. y., s. m., E. Branch 8.89¢ c. y., s. m.; removing wreck, $500, **06,** 1127.
1907. Norfolk Dredging Co., dr. and removing old br. approach; sec. A, 9.4¢ c. y., s. m.; B, $1.75 c. y., p. m.; C, 10.4¢ c. y., s. m.: D, 21.5¢ c. y., s. m., Coastwise Dredging Co., dr., 7.3¢ c. y. s. m., **08,** 1259.
1908. Norfolk Dredging Co., dr., 10.7¢ c. y., s. m., **09,** 1253.
1910. Maryland Dredging & Contracting Co., dr., 9.95¢ c. y., s. m., on general imp. and at Hospital Pt., **11,** 1486.

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 71; **75,** 95; **77,** 65; **78,** 73; **79,** 88; **80,** 118; **81,** 158; **82,** 154; **83,** 160; **84,** 163; **85,** 153, 154, 1018, 1019; **86,** 148, 149; **87,** 114, 115; **88,** 98, 99; **89,** 115, 116, 366; **90,** 104, 105, 333; **91,** 146, 147; **92,** 147, 149; **93,** 159, 160; **94,** 146, 147; **95,** 168; 169; **96,** 152; **97,** 190; **98,** 193; **99,** 223; **00,** 255; **01,** 292, 299, 1463, 1465; **02,** 219; **03,** 219; **04,** 218; **05,** 225; **06,** 237, 251; **07,** 250; **08,** 265; **09,** 273; **10,** 308, 329; **11,** 330; **12,** 390.

Boards:
U. S. advisory board to the H. comrs. of Norfolk and Portsmouth, recom. dr. the outer bar and the bar opposite the mouth of W. Branch to 25′ x 500′, **78,** 517–519.
Convened, Norfolk, Va., Sept. 2, 1884, by S. O. No. 110, C. of E., to consider a proj. for imp. of the approach to Norfolk H. and U. S. navy yard. **R., 85,** 1020, 1021. (Lt. Col. Craighill, Maj. Hains, and Capt. Hinman.)
Report of U. S. advisory board upon estab. of port wardens' lines in Norfolk H., **85,** 1026. (Commodore Truxtun, Capt. Mercur, and C. Boutelle.)
Convened, S. O. Nos. 110 and 137, to consider the constr. of the Pinners Pt. Dike. **R., 87,** 974. (Col. Craighill, Lt. Col. Hains, and Capt. Hinman.)
Convened, Baltimore, Mar. 26, 1889, by S. O. No. 13, to estab. H. lines in Norfolk and Portsmouth Hs. **R., 89,** 979; **90,** 1030. (Col. Craighill, Lt. Col. Hains, and Lt. Fiebeger.)

In charge:
Maj. W. P. Craighill, 1871. **R., 72,** 715, 717.
S. T. Abert, U. S. C. E., 1874–78. **R., 75,** ii, 146; **77,** 363; **78,** 515.
Capt. Chas. B. Phillips, 1878–81. **R., 79,** 673; **80,** 815; **81,** 985.
Capt. J. Mercur, 1881–84. **R., 81,** 985; **82,** 1070; **83,** 837; **84,** 1028.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1028; **85,** 1008, 1011, 1015, 1017, 1026; **86,** 951, 956; **87,** 963, 969.
Col. W. P. Craighill, 1888–89. **R., 88,** 766, 767.
Capt. G. J. Fiebeger, 1889–91. **R., 89,** 945, 949; **90,** 1021, 1023; **91,** 1291, 1295, 1296.
Lt. E. Burr, 1892–94. **R., 92,** 1085, 1089; **93,** 1323, 1328; **94,** 973, 977.
Capt. T. L. Casey, 1895–99. **R., 95,** 1275, 1279; **96,** 1067; **97,** 1353; **98,** 1223; (Maj.) **99,** 1471.
Maj. J. B. Quinn, 1900–1902. **R., 00,** 1763; **01,** 1447, 1463, 1466; **02,** 1111.
Capt. E. E. Winslow, 1903–06. **R., 03,** 1074; **04,** 1364; **05,** 1185; (Maj.) **06,** 1125.
Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1201; **08,** 1255; **09,** 1251.
Lt. Col. Mason M. Patrick, 1910–. **R., 10,** 1375; **11,** 1483; **12,** 1697.

Assistants:
Capt. Phillips. **R., 72,** 720.
J. E. Weyss, **72,** 716, 720.
G. Thompson, **72,** 716, 720.
Mr. Michler, **75,** ii, 146.
G. H. Elliott. **R., 75,** ii, 146; **79,** 677; **80,** 818.

ESTIMATES. (See Plans.)

By Capt. Phillips, in 1879, completion of existing proj., $218,000, **79,** 675.

OBSTRUCTIONS.

U. S. in 1896–97 asked for bids for the removal of an abutment of the old toll br., which 2 claimants to ownership, the Norfolk & Western Ry. and the estate of T. Hardy, failed to remove after due notice, **97,** 1355.

OPERATIONS.[1]

1877. 284,898 c. y. dr. by contract, **78,** 515.
1878–79. 302,490 c. y. dr. by contract, **79,** 88, 674, 677.
1879–80. 540,000 c. y. dr., increasing w. of chan. from 115′ to 265′, and cutting off Portsmouth Flats to 20′; 72,995 c. y. dr. from chan. in W. Branch Bar, **80,** 816, 818.
1880–81. 64,385 c. y. dr., and 150 scow loads of débris and ballast removed from vicinity of wharves and Portsmouth Flats; 236,815 c. y. dr. from W. Branch and Sewalls Pt. Bar, **81,** 986.
1881–82. 119,147 c. y. dr. from Sewalls Pt. Bar; 218,466 c. y. dr. from E. and S. Branches of Elizabeth R., and from Sewalls Pt. Bar, **82,** 1070, 1071.
1882–83. 118,191 c. y. dr. in completion of Morgan's contract; 424,010 c. y. removed from bar opposite Sewalls Pt. and E. Branch, **83,** 838, 839.
1883–84. 137,752 c. y. dr. from S. Pass, E. Branch, and vicinity of Town Pt., **84,** 1028.
1884–85. 116,399 c. y. dr. from E. and S. Branches, **85,** 1008.
1885–86. 469,944 c. y. dr. from Elizabeth R. Chan. (Norfolk H. approach), **86,** 957.
1886–87. 265,570 c. y. dr. from S. Branch, and steam tender built, **87,** 964. 179,992 c. y. dr. from vicinity of Lambert Pt., Light, **87,** 969.
1888–89. 360,957 c. y. dr. in H., and 796,955 c. y. dr. from approach, **89,** 946, 949.
1889–90. 20,000 c. y. dr. from approach, **90,** 1023.
1890–91. 273,032 c. y. dr. from the bar at Sewalls Pt., **91,** 1292.
1891–92. 991,704 c. y. dr., **92,** 1086.
1892–93. 917,170 c. y., s. m., dr., **93,** 1325.
1893–94. 56,131 c. y., s. m., dr., **94,** 975.
1894–95. 381,515 c. y., s. m., dr., **95,** 1276.
1895–96. Table of amounts dr. from the chans., 574,067 c. y., s. m., dr., **96,** 1069.
1896–97. 961,162 c. y., s. m., dr., **97,** 1354.
1903–04. 216′ seawall rebuilt and 202,088 c. y. dr. at Hospital Pt., **04,** 1364.
1904–05. 344,455 c. y. dr. from Sewall Pt. Chan., **05,** 1186. 957,904 c. y. dr. and 262′ seawall rebuilt at Hospital Pt., **05,** 1187.
1905–06. 197,521 c. y. dr. from Sewall Pt. Chan., **06,** 1125. 167,041 c. y. dr. at Pinner Pt., 166,669 c. y. from E. Branch, and 405,925 c. y. from Hospital Pt.; wharves, buildings, drives, and walks rebuilt, **06,** 1126.
1907–08. 84,726 c. y. dr. from Berkley Flats, 2,309 c. y. removed from old br. approach on E. Branch, 153,974 c. y. dr. from E. Branch, **08,** 1256.

[1] History of, **79,** 673.

202,565 c. y. dr. from mouth of E. Branch, **08,** 1257. 914,535 c. y. dr. from new 30′ chan. in vicinity of Lambert Pt., **08,** 1258.

1908-09. 55,978 c. y. dr. near Hospital Pt., 2,425,468 c. y. from 30′ chan., **09,** 1252.

1909-10. 2,762,982 c. y. dr. from 30′ chan., **10,** 1376.

1910-11. 24,108 c. y. dr., from work of general imp.; 44,924 c. y. dr. from shoal between Hospital Pt. and Seaboard Air Line RR. Co.'s property at Portsmouth, Va.; 2,128,910 c. y. dr. from junction of S. and E. Branches of Elizabeth R. to Lamberts Pt., and from Bush Bluff Lightship to d. w. at Hampton Roads, making chan. 30′ x 800′; and 217,674 c. y. dr. for anchorage at and near Lamberts Pt., completing work, **11,** 1484, 1485.

PHYSICAL CHARACTERISTICS.

Described, **72,** 717, 722; **75,** ii, 146–149; **78,** 517; **07,** 250.

PLANS. (See Estimates.)

By Maj. Craighill, 1872, imp. approaches from the sea, $30,000, **72,** 72, 717, 718.

By S. T. Abert, 1875, 3 plans for dr. main chan. and between the chan. and the wharves; est. for 1st, $95,095; 2d, $86,790; 3d, $39,600; **75,** ii, 148.

By U. S. advisory board, 1878, chan. 25′ x 500′, 700,000 c. y., **78,** 518, 519.

By S. T. Abert, 1878, chan. 25′ x 500′, $317,955, **78,** 73, 516.

PROJECTS. (See Plan.)

By U. S. advisory board, 1878, excavation of chan. 25′ d. m. l. w. and 500′ w. from the dw. of Hampton Roads to Norfolk H., and to the Gosport navy yard above on the S. Branch of the Elizabeth R.; also for imp. of the H. proper by dr. at mouth of E. Branch, and by dr. off the fore slopes of Portsmouth and Berkley Flats; est., $378,000, **78,** 73, 518; **79,** 673; **80,** 815.

Revised proj., 1885, provided for a chan. 25′ l. w. and 500′ w. by dr. from dw. at Hampton Roads to Norfolk and the navy yard on the S. Branch; also a chan. on the E. Branch 22′ x 300′ at the Norfolk & Western RR. br., increasing to 700′ at its mouth; a bulkhead 3,000′ in l., bounding Berkley Flats, to be built to receive the dr. material and maintain the dr. chan.; est., $507,744, **85,** 155, 1016. Increased in 1889 by $50,000, **89,** 116.

By Capt. Hinman, 1885, imp. of approach to Norfolk H. and U. S. navy yard, by advancing port wardens' line from Pt. Norfolk to Lamberts Pt., to 12′ curve by const. 4,000 l. f. of diking, and dr. chan. to 25′ m. l. w.; est., $255,600, **85,** 1026.

BE. 1887 considered Pinners Pt. Dike should not be built until the port wardens' line from Lamberts Pt. became an actuality, **87,** 974.

In 1890 Lt. Fiebeger reported chan. of the desired w. and d. having been secured through the Norfolk approach, the const. of the dike was unnecessary and no further app. were needed for this part of the H., **90,** 1023.

By Capt. Casey, 1894, completion of anchorage, the redr. of chan. between Fort Norfolk and Lambert Pt., the chan. over Sewell Pt. Bar, and dr. between Fort Norfolk and the mouth of the S. Branch, the work to be done by contract, **95,** 1276.

By Capt. Casey, 1896–97, removal of 400′ from Hospital Pt. (see correspondence on the subject between the State board of health, the Navy, and the War Dept.), **97,** 1355.

By Maj. Quinn, 1900, dr. to 28′ between chan. and ps. of Southern Rwy. Co. at Pinners Pt.; est., $20,000,[1] **01,** 1466.

Adopted Aug. 9, 1902, for cutting 400′ off Hospital Pt., rebuilding sea wall and wharf and dr. on sides of old pt., all dr. to be to 25′; est., $193,957, **03,** 220.

By Maj. Winslow, 1905, chan. 30′ d. and w. varying from 470′–800′, from Hampton Roads to Norfolk navy yard; est., $1,272,000,[2] **06,** 251.

By Maj. Winslow, 1905, for imp., including E. and S. Branches, and from Norfolk Chan. of Elizabeth R. to drawbr. of W. Branch; est., $552,000,[3] **06,** 251.

Act Mar. 2, 1907, au. dr. to 30′ x 600′ from Hampton Roads to Lambert Pt., and 800′ w. from Lambert Pt. to junction of E. and S. Branches of Elizabeth R.; also dr. mouth of E. Branch to 25′ x 500′; est., $1,132,000, **07,** 252.

By Lt. Col. Patrick, 1909, chan. 35′ d.; est., $1,712,500,[4] **10,** 329.

Adopted, 1910, dr. area of 22 acres abreast and n. of Lamberts Pt. to 30′ for anchorage; est., $30,000,[4] **10,** 311.

SURVEYS.

Under direction of Maj. Craighill, by Capt. Phillips, J. E. Weyss, and G. Thompson, 1871. **R.,** **72,** 716, 717, 720.

Under direction of S. T. Abert, by Mr. Elliott and Mr. Michler, 1874. **R.,** **75,** ii, 146.

Ex. of chan. through bar at W. Branch and at Portsmouth Flats, 1880, **80,** 819.

Of H. from Pt. Norfolk to U. S. navy yard on S. Branch, and to Campostella Br. over the E. Branch, 1885, **85,** 1008.

Resur. of the chan. between Lambert Pt. and Fort Norfolk made by Lt. Burr, 1893, **94,** 978.

Ex. vicinity of Pinner Pt., au. act June 6, 1900; made, 1900, by Maj. Quinn,[1] **01,** 299, 1463.

Of Smith Creek, **02,** 1111.

For estab. of H. lines, **03,** 1074; **04,** 1364.

Ex. vicinity of Hospital Pt., **03,** 1074.

Minor sur., **07,** 1202.

Ex. including E. and S. Branches, and from Norfolk Chan. of Elizabeth R. to drawbr. of W. Branch, au. act Mar. 3, 1905; made, 1905, by Maj. Winslow,[2] **06,** 251.

Ex. from d. w. in Hampton Roads to Norfolk navy yard, au. act Mar. 3, 1905; made, 1905, by Maj. Winslow,[2] **06,** 251.

Ex. and sur., au. act Mar. 3, 1909; made, 1909, by Lt. Col. Patrick,[4] **10,** 329.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 391.

Maps: [2 3 4]

Map of the H., **79,** 674.

Mouth of Elizabeth R., **80,** 816.

Portsmouth Flats, **80,** 816.

Elizabeth R., E. Branch, **82,** 1072.

E. Branch of H., **85,** 1008.

Norfolk H. approach, **85,** 1026; **87,** 970.

S. Branch, **87,** 966; **89,** 946; **91,** 1297; **93,** 1324; **97,** 1364.

Part (c), L-173 Harbor at Norfolk and approaches thereto, Va.

APPROPRIATIONS.

1910,	*$150,000,	**10,** 1378.
1911,	240,000,	**11,** 1488.
1912,	165,000,	**12,** 1701.
Total,	555,000 (incl. sales, $555,063.03, **12,** 1701).	

COMMERCE.

Description of, **12,** 395.

CONTRACTS.

1910. Maryland Dredging & Contracting Co., dr., 9.95¢ c. y., s. m., **11,** 1488.

1911. Coastwise Dredging Co., dr., 11¢ c. y., s. m., **12,** 1701.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 312; **11,** 334; **12,** 394.

*Allotments.
[1] H. D. 74, 56th, 2d.
[2] H. D. 381, 59th, 1st.
[3] H. D. 373, 59th, 1st.
[4] H. D. 551, 61st, 2d.

In charge. Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1378; **11,** 1488; **12,** 1700.

OPERATIONS.

1910-11. 700,565 c. y. dr., making a chan. of proj. dimensions from junction of E. and S. Branches of Elizabeth R., to above Dry Dock No. 3, at navy yard, 1¾ m.; proj. 18% completed, **11,** 1488.

1911-12. 2,470,492 c. y. dr. **12,** 1700.

PROJECTS.

Act June 25, 1910, au. dr. chan. 35′ x 400′ x 11 m. Hampton Roads to navy yard at Portsmouth; est., $800,000,[1] **10,** 312.

SURVEY.

Ex. and sur., au. act Mar. 3, 1909; made, 1909, by Lt. Col. Patrick,[1] **10,** 329.

Part (d), L-173 Thimble Shoals, Va.

APPROPRIATIONS.

1910, *$235,000, **10,** 1379.

COMMERCE.

C. passing to and from the ocean between the Virginia capes, bound to and from Norfolk, Va., and Newport News, Va., uses this Thimble Shoal Chan., **12,** 397.

CONTRACTS.

1910. Maryland Dredging & Contracting Co., dr., 13 1/10¢ c. y., **11,** 1489.

ENGINEERS.

Chief of Engineers. R., 10, 313; **11,** 335; **12,** 396.

In charge. Lt. Col. M. M. Patrick, 1910–. **R. 10,** 1379; **11,** 1489; **12,** 1701.

OPERATIONS.

1910-11. 534,206 c. y. dr. over entire l. of cut to 31½′; proj. about 27% completed, **11,** 1489.

1911-12. 794,190 c. y. dr.; proj. about 63% completed, **12,** 1701.

PROJECTS.

Act June 25, 1910, au. dr. chan. 35′ x 500′ x 5 m. through Thimble Shoal; est., $660,000,[1] **10,** 313.

SURVEY.

Ex. and sur., au. act Mar. 3, 1909; made, 1909, by Lt. Col. Patrick,[1] **10,** 329.

Maps. **11,** 1489.

Part (e), L-173 South Branch of Elizabeth River, Va.

APPROPRIATIONS.

1910,	*$100,000,	**10,** 1379.
1911,	35,000,	**11,** 1490.
1912,	50,000,	**12,** 1703.
Total,	185,000	

COMMERCE.

In 1911, 695,706 t.; in addition, the traffic by way of the two inland waterways, of which the R. chan. forms a part, in 1911 aggregated 674,447 t., **12,** 398.

CONTRACTS.

1910. Atlantic, Gulf & Pacific Co., dr., 11.47¢ c. y., p. m., **11,** 1491.

1911. Atlantic, Gulf & Pacific Co., dr., 11.3¢ c. y., p. m., **12,** 1703.

ENGINEERS.

Chief of Engineers. R., 10, 313; **11,** 336; **12,** 397.

In charge. Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1379; **11,** 1490; **12,** 1702.

OPERATIONS.

1910-11. 585,074 c. y. dr., completing chan. from Belt Line br. to 1½ m. above, 25′ x 300′, m. l. w., thence to Norfolk & Western Ry. Co., a farther distance of about 2 m., 22′ x 200,′ m. l. w.; material pumped behind bulkheads by contractor, **11,** 1490.

1911-12. 233,172 c. y. dr., completing contract; under subproj. of Mar. 10, 1911, 669,318 c. y. dr., **12,** 1702, 1703.

PRIVATE WORK.

Bulkheads provided by property owners to fill dr. material behind them, **11,** 1490.

PROJECTS.

Act June 25, 1910, au. dr. chan. 25′ x 300′ x 1½ m., and 22′ x 200′ x 2 m. Belt Line RR. br. to Norfolk & Western Rwy. br.; est., $222,500,[1] **10,** 314.

SURVEY.

Ex. and sur., au. act Mar. 3, 1909; made, 1909, by Lt. Col. Patrick,[1] **10,** 329.

Part (f), L-173 Channel to Newport News, Va.

APPROPRIATIONS.

1910,	*$115,000,	**10,** 1380.
1911,	150,000,	**11,** 1493.
1912,	210,000,	**12,** 1705.
Total,	475,000	

COMMERCE.

Diagram, Newport News Chan., statistics and apps., **12,** 1705.

CONTRACTS.

1910. Morris & Cumings Dredging Co., dr., 9.4¢ c. y., **11,** 1492.

1911. Morris & Cumings Dredging Co., dr., 16.89¢ c. y., **12,** 1705.

ENGINEERS.

Chief of Engineers. R., 10, 315; **11,** 338; **12,** 399.

In charge. Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1380; **11,** 1492; **12,** 1704.

OPERATIONS.

1910-11. 1,128,849 c. y., dr., **11,** 1492.

1911-12. 1,884,424 c. y. dr., in w. and d. chan. n. of Newport News Middle Ground; proj. about 99% completed, **12,** 1704.

PROJECTS.

Act June 25, 1910, au. dr. chan. 35′ x 400′ x 3¼ m. through shoal n. of Middle Ground Light; est., $465,000,[2] **10,** 315.

SURVEY.

Of chan. across Newport News Middle Ground Bar, au. act Mar. 3, 1909; made, 1909, by Maj. Kuhn and Lt. Col. Patrick,[2] **10,** 329.

Maps. Hampton Roads, Va., chan. to Newport News, **12,** 1704.

* Allotment. [1] H. D. 551, 61st, 2d. [2] H. D. 550, 61st, 2d.

L-173(g) HOSPITAL POINT, VA.

ENGINEERS.

Chief of Engineers. **R., 89,** 120.

In charge. Lt. G. J. Fiebeger, 1888. **R., 89,** 964.

PHYSICAL CHARACTERISTICS.

Description of; a natural sand spit which projects into Norfolk H. from U. S. Naval Hospital grounds, **89,** 964.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Lt. Fiebeger (**R.** unfav.), **89,** 964.

L-173(h) NORFOLK TO CAPE FEAR RIVER, N. C.

(See also Beaufort, N. C., in District M.)

NOTE.—From time to time efforts have been made looking to the making of an inside water route from Norfolk, Va., to Cape Fear River, N. C., or to points and waterways between, that the open-sea voyage around Cape Hatteras might be avoided. Data concerning these waterways is arranged as follows:

Part.	Title.	Period.	Appropriation.
i	To Neuse R., and to Cape Fear R.	1837–1879	$70,000
j	To Atlantic Ocean, south of Hatteras	1878–1880	.....
k	To Beaufort Inlet	1902–1912	600,000
l	To Albemarle Sound, via Albemarle & Chesapeake Canal	1878–1912	249,400
m	To sounds of N. C	1899–1912	267,870
n	Chesapeake to Charleston, S. C	1837	10,000
o	Dismal Swamp Canal, waterway connecting sounds of N. C	1895–96	5,000
p	Dismal Swamp Canal, N. C. and Va	1826–1845	230,000

Part (i), L-173 Norfolk, Va., to Neuse River, N. C., to Cape Fear River, N. C. (Survey for water communication from Norfolk, Va., to the Atlantic Ocean south of Hatteras.)

APPROPRIATIONS.

1852, $50,000 app. for reopening Old Roanoke Inlet, **76,** 387. (By the constr. of break'r across Croatan Sound—Treas Doc. 373, 1882.)

1878, $20,000, act June 18. Between Norfolk H. and the Atlantic Ocean s. of Cape Hatteras.

COMMERCE.

Imp. of Core Sound justifiable as early as 1838, **76,** 416.

Imp. of Currituck Sound justifiable, **76,** 377.

C. importance and advantages of a line of continuous navigation between Florida and the Northern Lakes, **76,** 377, 410, 412, 414.

DEFENSE.

Proposed imp. of Core Sound, connected with a general system for the protection of the coasting trade of the U. S., **76,** 419.

ENGINEERS.

Chief of Engineers:

Chief of Topographical Engineers, in 1838, submitted a **R.** on Core Sound by Lt. Col. Kearney, **76,** 416.

R., 76, 69; **78,** 76; **79,** 94.

In charge:

Lt. Col. J. Kearney, 1837. **R., 76,** 411 (extract), **76,** 416.

Col. Turnbull, Lts. Woodbury and Whiting, 1856–59, in charge of reopening Old Roanoke Inlet, **76,** 387.

S. T. Abert, U. S. C. E., 1875. **R., 76,** 376.

Capt. C. B. Phillips, 1878. **R., 79,** 714.

Assistants:

A. K. Michler. **R.** (extracts), **76,** 398, 403.

J. H. Harrison and T. S. Flood, **76,** 397.

J. B. Shinn, F. W. Frost, and W. G. Williamson **79,** 716.

OPERATIONS.

Under the app. of 1852 an attempt to reopen Old Roanoke Inlet was made; subsequent failure, **76,** 387.

PHYSICAL CHARACTERISTICS.

General character of seacoast, **76,** 378.

General description of sounds, **76,** 385–389, 398–400.

Of Rs., peat bogs, swamps, and soil, **76,** 392–397.

Of route of Kearney sur., **76,** 404, 405.

Contour of the coast of the Carolinas, **76,** 379. To what due, **76,** 379. Forces modifying contour, **76,** 379, 380.

Movements of sand, **76,** 380–382.

History of changes in inlet, **76,** 382–384, 419.

Geological description of seacoast, **76,** 389, 392.

Tides, near large inlets, **76,** 388; along Kearney route, **76,** 404, 405.

Absence of tides in Core Sound, **76,** 398.

Bars in Core Sound, **76,** 388, 398, 416.

Peculiar character of banks of the Alligator R., **76,** 395.

Shoals and marshes in Bogue Sound, **79,** 399.

Gradual closing of inlets, **76,** 416.

Character of sounds, w. of Beaufort, **76,** 418.

Table of distances and drafts from Norfolk, Va., to Harbor Isld., **76,** 398. From Norfolk, Va., to Wilmington, N. C., **76,** 401. Memorandum of distances, **76,** 418.

PLANS.

By Lt. Col. Kearney, 1838, chan. through Core Sound, 7′ d. and 50 y. w., est., $80,000; 250 y. w., est., $300,000, **76,** 416, 417.

By S. T. Abert, canal from Clubfoot Creek to Harlow Creek, 40′ w., as a substitute for the imp. of Core Sound, est., $411,000, **76,** 397. For chan. 40′ w. and 8′ d. through Core and Bogue Sounds, and a canal from Hewlets Creek to Cape Fear R., total est., $3,685,517.82, **76,** 402. For a through-cut canal at tide level, 40′ w. at the bottom and 8′ d., from Neuse to Cape Fear Rs., est., $7,642,204.79, **76,** 405, 406. For canal, with summit level, fed by steam pumps, and with 6 locks, from the Neuse to the Cape Fear Rs., est., $3,909,455, **76,** 406, 407, 408.

PRIVATE (PRIVATE, CORPORATE, AND STATE) WORK.

1770. Company formed by Josiah Collins, for the purpose of draining Scuppernong Lake; $30,000 expend. in making a cut to Scuppernong R., **76,** 395.

1820. Plan proposed by Hamilton Fulton for canal between Clubfoot and Harlow Creeks, with a w. on the bottom of 14′, and d. of 4′; subsequently constr. by the State, **76,** 397.

1838. N. C. made app. for the drainage of Mattamuskeet Lake by cutting a canal from it to Wysocking B., **76,** 394.

1840. Ex. by W. Gwynn and C. B. Shaw (as ordered by the State), who devised a system of canal and ditches leading s. into Pungo R.; $200,000 expend. by the State in these operations, **76,** 395. Correspondence relating to the Chesapeake & Albemarle Canal, **76,** 423, 424.

PROJECTS.

By Lt. Woodbury, 1852, reopening Old Roanoke Inlet, for which U. S. made app., **76,** 387.

SECRETARY OF WAR.

1838. Letter to the Hon. C. Shepard, transmitting a report from the Chief of Topographical Engineers, **76,** 416.

SURVEYS.

By Lt. Col. J. Kearney, 1837, from the s. debouche of the Dismal Swamp Canal, down the Pasquotank R., through Croatan, Pamlico, and other sounds to Winyaw B., S. C., **76,** 398. **R., 76,** 411.

Sur. of Core Sound included in C. Sur., 1866, **76,** 398.

By A. K. Michler, 1875, reports on "Sur. of coast line from the head of Core Sound to Wilmington, N. C.," **76,** 398. On "Sur. of 'The Kearney Route,'" **76,** 403.

Under direction of Capt. Phillips, 1878–79, sur. for an interior water communication between Norfolk, Va., and the Atlantic Ocean, s. of Hatteras. **R.** of progress, **79,** 714.

Maps. Of proposed canal routes, **76,** 410.

Part (j), L-173 Norfolk Harbor, Va., to Atlantic Ocean, south of Hatteras. (Water communication.)

ENGINEERS.

Chief of Engineers. **R., 80,** 125.

In charge. Capt. C. B. Phillips. **R., 80,** 851.

Assistants:
F. W. Frost. **R., 80,** 862.
J. B. Shinn. **R., 80,** 876.

PHYSICAL CHARACTERISTICS.

Description of Albemarle & Chesapeake, and Dismal Swamp Canals; of North Landing R., North R., Pasquotank R.; from Neuse to Cape Fear R.; and of Albemarle, Pamlico, and Core Sounds, N. C., and various outlets therefrom to the ocean s. of Hatteras, **80,** 857–891.

PLANS.

By Capt. Phillips, 1880, imp. of the Albemarle & Chesapeake Canal by reconstr. and by excavation of Virginia and North Carolina cuts; est., $509,701, **80,** 869.

Imp. of Dismal Swamp Canal, 2 est., of $1,483,646 and $1,098,379, respectively, **80,** 875.

For a chan. 9′ x 80′, Norfolk H. to Albemarle Sound via Dismal Swamp Canal; total l., 73 m.; est., $1,492,622, **80,** 888.

For tide-water connection between the Neuse and Cape Fear Rs.; chan. w., 80′; d., 9′, and 4 guard locks; 102 m.; est., $5,694,734, **80,** 896.

SURVEY.

Au. act June 18, 1878; made, 1880, by Capt. Phillips, **80,** 851.

Maps. **80,** 896.

Part (k), L-173 Norfolk Harbor, Va., to Beaufort Inlet, N. C. (Waterway.)

APPROPRIATION.

1912, $600,000, **12,** 1726.

COMMERCE.

The barge system of trans. has been unsuccessful, owing to the difficulties and dangers due to Capes Hatteras and Lookout. An inland route such as proposed would overcome these obstacles and create a considerable change in methods of navigation with resultant decrease in rates. Would be of great importance from a military point of view, **04,** 1417.

The est. raw material of the South as a cash resource, 1903–4 season, over $1,512,000,000, **04,** 1421.

Letters and com. statistics from interested parties, **04,** 1419.

ENGINEERS.

Chief of Engineers. **R., 04,** 227; **07,** 263; **12,** 415.

Boards:

Special board appointed to make pre. ex. and sur. of waterway from Norfolk, Va., to Beaufort Inlet, N. C., for chan. of not less than 16′; est., $10,000,000, with $150,000 an. mainten. (Lt. Cols. Chas. J. Allen and Jas. B. Quinn, and Capt. E. E. Winslow, **04,** 1387.)

BERH. does not consider constr. of water advisable, **04,** 1387.

Special. **R.** on ex. and sur., May 9, 1906. Two plans presented, one at est. cost of $2,900,425, and other at $3,378,055, with mainten. amounting to $290,000 first cost of plant, and $72,000 per annum for operation,[1] **07,** 263.

In charge. Lt. Col. M. M. Patrick, 1912–. **R., 12,** 1726.

PHYSICAL CHARACTERISTICS.

Description of proposed route, **04,** 1394.

[1] H. D. 84, 59th, 2d.

PROJECTS.

Act July 25, 1912, au. 12′ waterway, m. l. w.; est., $5,400,000,[1] **12,** 415.

SURVEYS.

Ex. and sur. au. act June 13, 1902, for waterway from Norfolk, Va., to Beaufort Inlet, N. C., view to constr. chan. not less than 16′ d., upon most advantageous route between points named. **R.,** by BE., 1902 and 1903; est., $10,000,000, with $150,000 an. mainten.[2] (not deemed advisable for U. S. to undertake imp.), **04,** 227, 1415.

Report on intercoastal waterway, Boston, Mass., to Beaufort, N. C., Norfolk-Beaufort section, p. 100 of H. D. 391, 62d, 2d.

Ex. and sur. au. act Mar. 3, 1905, with view to chan. 10′ and 12′, resp. **R.** by BE.; alternate plans presented at est. costs of $2,900,425 and $3,378,055, with ests. for mainten. of $290,000 for first cost of plant and $72,000 per an. for operation,[3] **07,** 263.

Maps.[2 3]

Part (1), L-173 Norfolk Harbor, Va., to Albemarle Sound, N. C., through Currituck Sound. (Waterway.)[4]

(Elizabeth River, Southern Branch, Va., q. v.; North Landing River, q. v. Currituck Sound, Coanjock Bay, North River Bay, and Albemarle and Chesapeake Canal.)

APPROPRIATIONS.

1878,	$20,000,	**79,** 91.
1879,	25,000,	**79,** 91.
1880,	25,000,	**80,** 828.
1881,	30,000,	**81,** 998.
1882,	20,000,	**82,** 1082.
1884,	5,000,	**84,** 1035.
1886,	10,000,	**86,** 965.
1888,	7,500,	**88,** 772.
1890,	10,000,	**92,** 1095.
1892,	9,000,	**92,** 1095.
1894,	10,000,	**95,** 1288.
1896,	10,000,	**96,** 1079.
1899,	8,000,	**99,** 1481.
1902,	23,400,	**02,** 1123.
1905,	22,000,	**05,** 1197.
1907,	3,000,	**07,** 1214.
1909	*1,500,	**09,** 1266.
1910,	5,000,	**10,** 1393.
1911,	2,000,	**11,** 1506.
1912,	3,000,	**12,** 1725.

Total,[5] 249,400 (incl. misc., $40,000 app. for S. Branch of Elizabeth R. from 1873 to 1878, and $55,500 app North Landing R. from 187· to 1882, $347,317.19, **12,** 1725).[9]

COMMERCE.

Traffic passing through Coanjock B., etc., for 1889 and 1890, **89,** 963; **90,** 1029.

Larger vessels navigating the waterway since imp. by the U. S., **93,** 1341.

Gradual decrease due to depletion of forests, and consequent decrease in timber shipments, **06,** 247.

Canal, and North Carolina cut, controlled by a private corporation, **10,** 324, 1393.

1911, 100,439 t., **12,** 1726.

Comparison of for last 11 years, **12,** 1726.

CONTRACTS.

1878. With G. H. Ferris, dr., 9¾¢ c. y., **79,** 693.
1879. G. H. Ferris, dr., 15⅞¢ c. y., **80,** 827.
1880. National Dredging Co., dr., 14¢ c. y., **81,** 997.
1881. J. Caler & Co., dr., 17½¢ c. y., **82,** 1081. V. Freeman, dr., 25¢ c. y., **83,** 847.
1884. G. E. Ward, dr., 14¼¢ c. y., **85,** 1039.
1886. J. Caler & Son, dr., 13.9¢ c. y.; failure to complete contract, **87,** 986.
1889. P. S. Ross, dr., 28½¢ c. y., **90,** 1027.
1891. C. T. Caler, dr., 24¾¢ c. y., **92,** 1095.
1893. C. T. Caler, dr., 13½¢ and 29¢ c. y. ($8,800), **93,** 1342.
1895. C. T. Caler, dr. 51,852 c. y., 13½¢ c. y., s. m. **95,** 1288.
1897. C. T. Caler, dr., 23¢ and 33¢ c. y. ($7,000), **97,** 1375.
1903. Norfolk Dredging Co., dr., 42 3/10¢ c. y., s. m., **04,** 1376, 1377.
1905. Charles P. Grim, dr., 39¢ c. y., s. m., in North R., 34¢ c. y., s. m., in Currituck Sound, and 24¢ c. y., s. m., in Elizabeth R., **06,** 1137.

ENGINEERS.

Chief of Engineers. **R.,** **79,** 90; **80,** 120; **81;** 161; **82,** 157; **83,** 163; **84,** 167; **85,** 159; **86,** 154; **87,** 119; **88,** 102; **89,** 119; **90,** 108; **91,** 152; **92,** 152; **93,** 164; **94,** 151; **95,** 173; **96,** 156; **97,** 195; **98,** 198; **99,** 229; **00,** 262; **01,** 297; **02,** 224; **03,** 226; **04,** 224; **05,** 232; **06,** 246; **07,** 258; **08,** 275; **09,** 284; **10,** 324; **11,** 346; **12,** 414.

In charge:

Capt. C. B. Phillips, 1878–81. **R.,** **79,** 693; **80,** 827; **81,** 999.
Capt. J. Mercur, 1881–84. **R.,** **81,** 996; **82,** 1080; **83,** 846.
Capt. F. A. Hinman, 1884–88. **R.,** **84,** 1034; **85,** 1039; **86,** 965; **87,** 986.
Col. W. P. Craighill, 1888–89. **R.,** **88,** 770.
Lt. G. J. Fiebeger, 1889–92. **R.,** **89,** 961; **90,** 1027; **91,** 1305.
Lt. E. Burr, 1892–94. **R.,** **92,** 1095; **93,** 1341; **94,** 983.
Capt. T. L. Casey, 1895–99. **R.,** **95,** 1286; **96,** 1077; **97,** 1374; **98,** 1230; (Maj.) **99,** 1481.
Maj. J. B. Quinn, 1900–02. **R.,** **00,** 1778; **01,** 1457; **02,** 1122.
Capt. E. Eveleth Winslow, 1903–06. **R.,** **03,** 1084; **04,** 1376; **05,** 1196; (Maj.) **06,** 1135.
Maj. Joseph E. Kuhn, 1907–09. **R.,** **07,** 1213; **08,** 1269; **09,** 1266.
Lt. Col. Mason M. Patrick, 1910–. **R.,** **10,** 1392; **11,** 1505; **12,** 1725.

Assistant. G. H. Elliott. **R.,** **79,** 695; **80,** 829.

OBSTRUCTIONS.

Difficulty experienced in keeping waterway free from logs dropped from rafts, due to improper const. of rafts and absence of any adequate laws, **07,** 259.

OPERATIONS.

1878–79. 138,522 c. y. dr., **79,** 694, 695.
1879–80. 47,893 c. y. dr., **80,** 828.
1880–81. 188,624 c. y. dr., **81,** 997–999.

*Allotment.
[1] H. D. 391, 62d, 2d.
[2] H D. 563, 58th, 2d.
[3] H. D. 84, 59th, 2d.
[4] Sur. inland waterway. **R.,** Nov. 5, 1816. (H. D. 482, 55th, 2d.)
[5] 1878–1888, app. for Currituck Sound, Coanjock B., and North R. B., N. C. See also Elizabeth R. (S. Branch) app., and those for North Landing R.

1881-82. 93,083 c. y. dr.; 92,000 l. f. of bank constr.; piles driven for bulkhead, **82,** 1081, 1082.
1882-83. 37,441 c. y. dr.; 26,826 bushels of oyster shells placed in shell dike, **83,** 847.
1883-84. 10,079 c. y. dr., **84,** 1034.
1884-85. 35,000 c. y. dr., **85,** 1039.
1886-87. 1,037 c. y. dr. from North R. Bar, **87,** 986.
1887-88. Dr. on North R. Bar completed, **88,** 770.
1889-90. 21,494 c. y. dr. and 71 logs removed from the chan., **90,** 1027.
1891-92. 32,308 c. y. dr., **92,** 1095.
1893-94. 65,000 c. y. dr. and 34 saw logs removed, **94,** 985.
1894-95. 38,812 c. y., s. m., dr., **95,** 1287.
1895-96. 13,038 c. y., s. m., dr., **96,** 1078.
1896-97. 738 logs removed, also 3 trees, 2 stumps, and 1 long pile, **97,** 1374.
1897-98. 29,062 c. y., s. m., dr., **98,** 1230.
1898-99. 160 logs removed, **99,** 1481.
1899-00. 243 logs removed, **00,** 1778.
1900-01. 312 c. y. sand and clay removed by snag boat, **01,** 1458.
1901-02. 3,608 c. y. removed by the snag boat *Roanoke* from North R. Bar; under its written offer, the Albemarle & Chesapeake Co. removed 3,013 c. y., s. m., from North R. Bar, at 65¢ c. y., s. m., **02,** 1122.
1902-03. 557 snags and other obstr. removed from North Landing R., Currituck Sound, and North R., **03,** 1084.
1903-04. 34,072 c. y., s. m., removed from North R. Bar; 269 snags and other obstr. removed from North Landing R. and Elizabeth R. by U.S. snag boat *Roanoke;* proj. considered 95% completed, **04,** 1376.
1904-05. 1,125 snags and other obstr. removed by US. snag boat *Roanoke,* **05,** 1196.
1905-06. 8,674 c. y., s. m., removed from Currituck Sound, **06,** 1135. 18,922 c. y., s. m., removed from North R. Bar, and 12,418 c. y., s. m., removed from the S. Branch of the Elizabeth R.; U.S. snag boat removed 506 logs and other obstr. from North Landing R., Currituck Sound, North R., and S. Branch of the Elizabeth R., **06,** 1136.
1906-07. 1,212 obstr. removed from S. Branch of Elizabeth R., North Landing R., Currituck Sound, Coanjock B., and North R.; proj. considered completed, **07,** 1213.
1907-08. 150 obstr. removed from S. Branch of Elizabeth R., North Landing R., North R., and Albemarle Sound, **08,** 1269.
1908-09. U.S. snag boat *Roanoke* removed 300 obstr. from different portions of the route, **09,** 1266.
1909-10. 410 logs and other obstr. removed; cost, $1,842.49, **10,** 1392.
1910-11. 741 logs and stumps removed from route, **11,** 1505.
1911-12. 407 snags, logs, and other obstr. removed from route, **12,** 1725.

PHYSICAL CHARACTERISTICS.

Shell ridge, obstr. navigation, **79,** 694.
Description of, **93,** 1341.
Route orig. had a 5′ m. l. w. chan. obstr. by snags, logs, and overhanging trees, **01,** 297.
No lunar tide, except in the S. Branch of Elizabeth R.; rise and fall 2.7′, **02,** 224.
The chans. through the various portions of the route 9′ x 60′–80′, m. l. w., **04,** 225.

PROJECTS.

By Capt. Phillips, 1878, to secure through Currituck Sound, by dr., chan. 9′ x 80′ at ordinary winter stage of water; est., $90,000, **79,** 693; **80,** 827.
By Capt. Phillips, 1880, imp. of Coanjock B. by dr. chan. same dimensions as above, to be protected on w. side by an oyster-shell dike 9,200′ l.; est., $50,213.95, **81,** 1000.
By Capt. Hinman, 1886, imp. of North R. Bar by excavation of a chan. 9.4′ x 150′ x 7,150′ ordinary l. w.; also constr. of 2 range lights to mark chan.; est., $55,122, **85,** 86, 155.
Prior to act of Sept. 19, 1890, imp. carried on under separate projs. for each part of the route (see Title). These projs. were for a 9′ chan. 80′ w.; combined est., $306,667.08, **00,** 262.
By Capt. Casey, 1895, expend. of $7,000 dr. between Long Pt. Wharf and Chutch Isld., Coanjok B., and $1,000 in the removal of sunken logs, **95,** 1287.
Capt. Casey, 1895–96, est., while the primitive method employed in rafting was continued on the R., $500 would be required an. to keep the chans. reasonably clear, **96,** 1078.
By Capt. Casey, 1897, expend. of $7,000 in w. and d. chan. between the canal locks and Nicaragua Bar, and the S. Branch of the Elizabeth R., Va., $2,000 for removal of sunken logs, etc., **97,** 1374.
See Surveys.

SURVEYS.

Included in "Survey of water routes s. from Norfolk, Va., 1878," **79,** 693, 715, 716.
Of Coanjok B., made, 1880, by Capt. Phillips, **81,** 999.
Ex. North R. Bar, made by Lt. Burr, 1894, **94,** 984.
Sur. of the waterway, made by Capt. Casey, 1894, to determine the part most in need of imp., **95,** 1287.
Act June 25, 1910, au. Sec. War to negotiate purchase either of the Albemarle and Chesapeake Canal, or of the Dismal Swamp Canal, provided the purchase be recommended after a sur., au. act Mar. 3, 1909. BE, subsequent to the sur., recom. purchase of A. & C. Canal for $500,000, Contract made Feb. 17, 1912, with C. & A. Canal Co., successor to A. & C. Canal Co., subject to ratification and appn. by Congress. Copy of contract and other details. H. D. 589, 62, 2d.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 414.
Maps. **89,** 962.

Part (m), L-173 Norfolk Harbor, Va., to the sounds of North Carolina. (Waterway.)

APPROPRIATIONS.

1899,	$25,000,	**99,** 1480.
1900,	200,000,	**00,** 1775.
1901,	29,870,	**01,** 1456.
1905,	3,000,	**05,** 1195.
1907,	5,000,	**07,** 1212.
1910,	5,000,	**10,** 323, 1391.
Total,	267,870	

COMMERCE.

In last 4 months of 1899 C. valued at $285,884 passed through the route, **00,** 261.
Vessels drawing 10′ can navigate from Norfolk Va., through all the imp. sections of the route a m. l. w., **04,** 224.
C. increasing slowly, **06,** 246; **10,** 323.
1911, 574,008 t., **12,** 413.

CONTRACTS.

1899. Virginia Dredging Co., dr., 15¢ to 30¢ c. y.; bank protection, $1.50 to $2.50 l. f., $224,200, **00,** 1777.
1902. Sanford & Brooks Co., dr. in chan. of Deep Creek, 19¢ c. y., s. m., **03,** 1083.
1906. C. A. Minor, dr. in Deep Creek, 29¢ c. y., p. m., **07,** 1213.
1909. Atlantic Dredging Co., dr., 17¢ c. y., p. m., **09,** 1265.

ENGINEERS.

, **Chief of Engineers. R.,** **99,** 228; **00,** 261, t265, 277; **01,** 296, 299, 309, 1511, 1517; **02,** 223; **03,** 225; **04,** 223; **05,** 231; **06,** 245; **07,** 258; **08,** 274; **09,** 282; **10,** 323, 329; **11,** 345; **12,** 412.

In charge:
Maj. T. L. Casey, 1899. **R., 99,** 1480.
Maj. J. B. Quinn, 1900. **R., 00,** 1773; **01,** 1455; **02,** 1120.
Capt. E. Eveleth Winslow, 1903–06. **R., 03,** 1083; **04,** 1374; **05,** 1195; (Maj.) **06,** 1134.
Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1212; **08,** 1268; **09,** 1264.
Lt. Col. Mason M. Patrick, 1910–. **R., 10,** 1391; **11,** 1503; **12,** 1723.

OPERATIONS.

1899-00. 199,364 c. y. dr. from Deep Creek, and 57,060 c. y. dr. from Turners Cut and Pasquotank R., **00,** 1773, 1774.

1900-01. 80,292 c. y. dr. from Deep Creek, 205,671 c. y. dr. from Turners Cut, 43,607 c. y., s. m., dr. from Pasquotank R., 12,872 c. y. dr. from chan. across the bar off Croatan Light in Croatan Sound, and arrangements completed for driving sheet piling in Turners Cut, **01,** 1455, 1456.

1901-02. 263,562 c. y. removed from Turners Cut, and 17,775 l. f. of sheet piling driven at various points on both sides of the cut; 36,266 c. y. excavated from 8 projecting points on the Pasquotank R., **02,** 1120.

1902-03. 37,319 c. y., p. m., dr. from Deep Creek, **03,** 1083.

1903-04. 108 logs, 20 piles, 33 stumps, 53 snags, and 4 trees removed from Pasquotank R. and Turners Cut, and 8 logs removed from Deep Creek; proj. considered about completed, **04,** 1374.

1904-05. U. S. snag boat *Roanoke* removed from Deep Creek 4 logs, and from Turners Cut 31 logs, 2 piles, 13 snags, and 91 stumps; all work of imp. has been completed, **05,** 1195.

1906-07. 9,217 c. y., p. m., removed from Deep Creek and pumped ashore; proj. completed, but mainten. required from time to time, **07,** 1212.

1907-08. 40 l. f. of bank revet. rebuilt in Turners Cut, **08,** 1268.

1908-09. 15,816 c. y., p. m., removed from the Deep Creek section in maintaining the adopted proj.; work done by hydraulic dr.; material pumped ashore; 20 logs, 12 stumps, 2 piles, and 30 snags removed from Pasquotank R., **09,** 1264.

1909-10. 271 c. y., p. m., removed from Deep Creek section, **10,** 1391.

1910-11. U. S. snag boat *Roanoke* removed 256 logs and stumps from the route, **11,** 1503.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 228.

Route comprises Deep Creek, Dismal Swamp Canal (the property of a company), Turners Cut, and the Pasquotank R., **00,** 261.

Deep Creek the only tidal portion of the imp. where rise and fall averages 3′; in other sections w. l. changes according to direction and velocity of wind, **04,** 224.

PRIVATE (CORPORATE) WORK.

Canal from Deep Creek to South Mills imp. by a private corporation, to accommodate 10′, **04,** 224.

Canal from Deep Creek to South Mills mainten. by a private corporation, **08,** 274.

PROJECTS.

By Maj. Casey, 1899, dr. chan. with a least w. of 80′ on bottom, 10′ d., m. l. w., and protecting banks, where required, by sheet piling or other means, in Deep Creek, from the S. Branch of the Elizabeth R. to the new lock at the Dismal Swamp Canal, in Turners Cut Level, Croatan Sound, and Pasquotank R.; also removal of Shipyard Bar, and cutting off of some points in the Pasquotank R. to straighten its course; est., $274,310, **99,** 229; **00,** 1773.

SURVEYS.

Pre. ex. and sur. of waterway from South Mills to Albemarle Sound, N. C., au. act June 6, 1900; made by Maj. Quinn; est., $1,935,893.62,[1] **01,** 299, 1511.

Pre. ex. and sur. of waterway from Albemarle Sound to Beaufort Inlet, via Croatan, Pamlico, and Core Sounds, au. act June 6, 1900; made by Capt. Lucas; est., via Ocracoke Inlet, $1,611,500, via Beaufort Inlet, $3,597,000,[1] **01,** 309, 1517.

Inspection made by the district officer and subcommittee of the R. and H. Committee of the H. R., **06,** 1134.

Pre. ex. of Pasquotank R., au. act Mar. 3, 1909, with view to providing chan. to conform to d. of au. waterway to connect waters of Pamlico Sound with ocean at Beaufort. **R.** by Lt. Col. Patrick, May 6, 1909.[2] Chan. up to Elizabeth nowhere less than 10½′ d.; further **R.** and recom. unnecessary, **10,** 329, 361.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 412.

Map.[2]

Part (n), L-173 Chesapeake Bay to Charleston, S. C. (via Dismal Swamp Canal, Pasquotank River, Croatan, Pamlico, and other sounds, to Winyah Bay).[3]

APPROPRIATION.

Act Mar. 3, 1837, $10,000 (surs.).

Part (o), L-173 Dismal Swamp Canal, Va., waterway connecting with sounds of North Carolina.

APPROPRIATION.

1894, $5,000, **95,** 1297.

COMMERCE.

In 1895 est. that 695 craft of all kinds passed through the Dismal Swamp Canal, with an est. t. of 16,000 t., carrying merchandise amounting to 22,105 t., and that 6,339 craft of all kinds passed through Albemarle & Chesapeake Canal in 1895, with an est. t. of 458,602 t., carrying merchandise amounting to 324,866 t., **96,** 1092.

ENGINEERS.

Chief of Engineers. **R., 95,** 177; **96,** 159.

In charge. Capt. T. L. Casey, 1894–96. **R., 95,** 1296; **96,** 1086.

Assistant. F. W. Frost. **R., 96,** 1088.

PHYSICAL CHARACTERISTICS.

List of levels and locks of the Dismal Swamp Canal, and their sizes, **96,** 1088.

Water supply sufficient to maintain a canal 9′ d.

Table showing rainfall at Norfolk, Va., from 1885 to 1895, **96,** 1890.

Table of distances from Norfolk to Albemarle Sound via the canal, and list of connecting waters' **96,** 1093.

[1] H. D. 202, 56th, 2d. [2] H. D. 391, 61st, 2d. [3] Sur.—**R.,** May 21, 1838. (H. D. 482, 55th, 2d.)

PROJECTS.

By Capt. Casey, 1895, sur. of the canal from Elizabeth R., Va., to Pamlico Sound, N. C., in such a manner as to give the necessary data for obtaining the cost of excavation for a 9′ waterway, **95,** 1296.

Capt. Casey, 1896, est. cost a 10′ waterway, $1,711,380, and a 9′ waterway, $1,364,930. Attention called to the fact that the canal is the property of a private corporation. **96,** 1087.

SURVEY.

Sur. of Dismal Swamp Canal and connections au. act Aug. 17, 1894; made, 1895, by Capt. Casey, **96,** 1086. (See Projects.)

Part (p), L-173 Dismal Swamp Canal, N. C. and Va.[1]

APPROPRIATIONS.

1826,	$150,000,	act May 18.[2]
1829,	50,000,	act Mar. 2.[2]
1836,	15,000,	act July 4.
1838,	10,000,	act Apr. 20.
1845,	5,000,	act Feb. 26.[2]
Total,	230,000	

COMMERCE.

Important, **72,** 751.
Revenue from canal insignificant, **72,** 751.
Tolls during the war, **72,** 751.
Interest of the U. S. in the canal, **72,** 751.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 74.

In charge. Maj. W. P. Craighill, **72,** 74. **R.,** **72,** 750.

Assistant. W. R. Hutton. **R.,** **72,** 750.

ESTIMATES. (See Plans.)

PHYSICAL CHARACTERISTICS.

Description of, **72,** 750, 751; **76,** 392.

PLANS.

By W. R. Hutton, to suppress 2 locks, leaving only one at each end; also for the enlargement of the canal and the lowering of the summit level; est., $480,000, **72,** 751.

SURVEYS.

Sur. made, 1872, **72,** 74, 750.

(See sur. for an interior water communication between Norfolk, Va., and the Atlantic Ocean, **79,** 94, 714; **76,** 392.)

L-181 DEEP CREEK BRANCH OF ELIZABETH RIVER, VA.

SURVEY.

R., Nov. 12, 1829; est., $29,000. (H. D. 482, 55th, 2d.)

L-207(a) LYNN HAVEN, LINK HORN, AND BROAD BAYS, VA.

COMMERCE.

Oyster industry important, **80,** 900.

ENGINEERS.

Chief of Engineers. **R.,** **79,** 95; **80,** 125.

In charge. Capt. C. B. Phillips, 1880. **R.,** **80,** 900.

Assistant. F. W. Frost, **80,** 900.

PHYSICAL CHARACTERISTICS.

The Bs. might be available as links in a line of water communication between Chesapeake B. and the sounds of North Carolina, **80,** 900.

SURVEY.

Sur. au. act Mar. 3, 1879; made, 1880, by Capt. Phillips (**R.** unfav.), **80,** 900.

L-207(b) LYNN HAVEN BAY, VA. (Harbor of Refuge.)

ENGINEERS.

Chief of Engineers. **R.,** **91,** 146; **92,** 147.

In charge. Lt. Col. P. C. Hains, 1892. **R.,** **92,** 1076.

PHYSICAL CHARACTERISTICS.

Description of, near Cape Henry at the foot of Chesapeake B., Va., **92,** 1077.

PLANS.

By Lt. Col. Hains, 1891, break'r 4,500′ l., of concrete blocks laid close and bonded together; est., $1,555,538, **92,** 1079.

SURVEY.

Sur. H. of refuge au. act Mar. 3, 1891; made, 1891, y Lt. Col. Hains, **92,** 1076.

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[1] Sur.—**R.,** Aug. 2, 1826. (H. D. 482, 55th, 2d.)

[2] H. D. 482, 55th, 2d.

L-207(c) LYNN HAVEN BAY, TO EASTERN BRANCH OF ELIZABETH RIVER, VA. (Waterway.)

ENGINEERS.
Chief of Engineers. **R., 91,** 153, 1310.

In charge. Lt. G. J. Fiebeger, 1890. **R., 91,** 1310.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 1313.

SURVEY.
Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Fiebeger (**R.** unfav.), **91,** 1310.

L-216 OREGON INLET, N. C.

ENGINEERS.
Chief of Engineers. **R., 81,** 168; **82,** 164.

In charge. Capt. J. Mercur. **R., 82,** 1127.

PHYSICAL CHARACTERISTICS.
Unstable character of the bar covering the inlet would render reasonable imp. futile, **82,** 1128.

SURVEY.
Ex. au. act Mar. 3, 1881; made, by Capt. Mercur, **82,** 1127.

L-216(b) NAGS HEAD, N. C. (See p. 459.)

L-221(a) POINT HARBOR CHANNEL, N. C.

ENGINEERS.
Chief of Engineers. **R., 09,** 289.

In charge. Maj. J. E. Kuhn, **09,** 273.

PHYSICAL DATA.
Point H. is at s. extremity of peninsula bet. Albemarle and Currituck Sounds.[1]

SURVEY.
Pre. ex. au. act Mar. 3, 1909. **R.,** by Maj. Kuhn, May 12, 1909 [1] (unfav.), **09,** 289.

L-240 NORTH LANDING RIVER, N. C. AND VA.

APPROPRIATIONS.

1879,	$25,000,	**79,** 90.
1880,	15,000,	**80,** 825.
1881,	7,500,	**81,** 995.
1882,	8,000,	**82,** 1079.
Total,	55,500	

COMMERCE.
Important, **79,** 686, 687, 692, 693.

CONTRACTS.
1879. G. H. Ferris, dr., 15⅞ ¢. c. y., **80,** 825.

ENGINEERS.
Chief of Engineers. **R., 78,** 76; **79,** 90, 95; **80,** 120; **81,** 160; **82,** 156; **83,** 163; **84,** 166; **85,** 158; **86,** 153; **87,** 119; **90,** 107; **91,** 151; **92,** 153; **93,** 165; **94,** 152; **95,** 174; **96,** 157; **97,** 196.

In charge:
Capt. C. B. Phillips, 1878–81; **78,** 76. **R., 79,** 683; **80,** 824; **81,** 993.
Capt. J. Mercur, 1881–84. **R., 81,** 993; **82,** 1078 **83,** 844.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1032; **85,** 1035; **86,** 962; **87,** 984.
Col. W. P. Craighill, 1888–90. **R., 88,** 770.
Lt G. J. Fiebeger, 1890–92. **R., 90,** 1027; **91,** 1304.
Lt. E. Burr, 1892–94. **R., 92,** 1096; **93,** 1343; **94,** 986.
Capt. T. L. Casey, 1895–98. **R., 95,** 1289; **96,** 1079; **97,** 1376.

Assistants:
J. B. Shinn. **R., 79,** 687.
F. W. Frost, C. P. E. Burgwyn, and R. U. Goode, **79,** 686.
G. H. Elliot. **R., 80,** 825.

OPERATIONS.
1879-80. 110,000 c. y. dr. from 3 shoals in the R.; stumps, logs, and similar obstr. removed, **80,** 824.
1880-81. 64,354 c. y. dr. from the chan.; removal of obstr. continued, **81,** 994.
1882-83. 13,310 c. y. dr. from chan.; removal of obstr., 720 stumps, trees, etc., **82,** 1079.
1883-84. 7,011 logs, stumps, and obstr. removed from chan., **84,** 1032.
1884-85. 497 logs and stumps removed; constr. of combined steam hoister and pile driver commenced, **85,** 1035.
1889-90. 732 logs and stumps cleared from the R. by hired labor, **90,** 1027.

[1] H. D. 78, 61st, 1st.

1892-93. 624 saw logs, 25 stumps, 6 trees, and 3 piles removed, **93,** 1343.
1895-96. 314 sunken logs and an old wreck removed, **96,** 1080.
1896-97. 747 logs, 2 stumps, 3 trees, and 2 long piles removed, **97,** 1376.

PHYSICAL CHARACTERISTICS.
General, **79,** 686, 689.
Obstr., sand bars, abrupt bends, and submerged logs and stumps, **79,** 687, 689.
Cut-offs, **79,** 690.

PROJECTS.
By Capt. Phillips, 1879, chan. 80′ w., and 9′ d. above, ordinary stage of water for its entire l. of 17 m. by straightening upper R. at abrupt bends by dr, and by removal of stumps, snags, and similar obstr.; est., $88,000, **79,** 691; **80,** 824. Not considered susceptible of permanent imp., **86,** 153.

SURVEYS.
By J. B. Shinn and F. W. Frost, 1878–79. **R. 79,** 686.
Ex., 1885, **85,** 1035.

L-241 WEST NECK (Creek) RIVER, VA.

ENGINEERS.
Chief of Engineers. **R., 91,** 153.

In charge. Capt. G. J. Fiebeger, 1891. **R., 91,** 1324.

Assistant. J. P. White. **R., 91,** 1326.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 1325.

PLANS.
In 1891 Capt. Fiebeger considered the R. worthy of imp. as far as Owens Br. Imp. proposed contemplated straightening and enlarging chan., removing snags and similar obstr., and formation of a turning basin; est., $9,000. The R. above Owens Landing not considered worthy of imp., **91,** 1325.

SURVEY.
Ex., 1891, by Capt. Fiebeger (see Plans), **91,** 1324.

L-246 NORTHWEST RIVER, VA. AND N. C.

ENGINEERS.
Chief of Engineers. **R., 91,** 153.

In charge. Capt. G. J. Fiebeger, 1891. **R., 91,** 1321.

Assistant. J. P. White. **R., 91,** 1323.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 1323.

SURVEY.
Ex. au. act Sept. 19, 1890; made, 1891, by Capt Fiebeger (**R.** unfav.), **91,** 1321.
Maps. **91,** 1322.

L-264 PASQUOTANK RIVER, N. C.[1]

APPROPRIATIONS.

1829,	$80 (sur.), act Mar. 2.	
1890,	3,000,	**91,** 1337.
1892,	3,000,	**92,** 1113.
1894,	1,000,	**95,** 1294.
Total,	7,080	

COMMERCE.
C. importance of Pasquotank R., **76,** 360.
Existing and prospective C. in 1892 above Moccasin Tract very unimportant, **93,** 1355. Est. 30,000 t. of all kinds of craft go through the Dismal Swamp Canal an., **93,** 1357.

ENGINEERS.
Chief of Engineers. **R., 76,** 68; **85,** 164; **89,** 148; **91,** 155; **92,** 156; **93,** 168; **94,** 154; **95,** 175; **96,** 158; **97,** 197; **98,** 200; **99,** 232.

In charge:
S. T. Abert, U. S. C. E., 1875. **R., 76,** 360.
Capt. F. A. Hinman. **R., 85,** 1049.
Capt. W. H. Bixby, 1888–92. **R., 89,** 1135; **91,** 1335.
Maj. W. S. Stanton, 1892–94. **R., 92,** 1111; **93,** 1354; **94,** 994.
Capt. T. L. Casey, 1894–99. **R., 95,** 1293; **96,** 1083; **97,** 1378; **98,** 1233; (Maj.) **99,** 1484.

Assistant. C. Schuster. **R., 91,** 1337.

OPERATIONS.
1890-91. 1,614 snags and 1 wreck removed from the chan., and 65 overhanging trees cleared from the banks, **91,** 1336.
1982-93. 31 trees, 393 snags, 33 stumps, 21 cords of small snags, 13 cords of small brush, and 104 trees removed, and 47 trees on banks trimmed, **93,** 1355.
1897-98. 167 cords brush cut, 32 logs, 5 trees, 6 piles, and 8 stumps removed, **98,** 1233.

PHYSICAL CHARACTERISTICS.
Description of, **76,** 360; **89,** 1136; **93,** 1354.

PROJECTS.
By Capt. Bixby, 1889, imp. for SS. between the ends of Turners Cut, and the barges from the Moccasin Tract up about 5 m. to the Lebanon Br.; est., $9,000, **89,** 1137; **91,** 1335.
In 1892 Maj. Stanton recom. further imp. above the mouth of Moccasin Tract be discontinued, **92,** 1112.
By Maj. Stanton, 1892, restriction of work to below the lower mouth of Turners Cut and removal from the chan. and banks of those obstr. which interfere with boats of the draft that can pass through the Dismal Swamp Canal, **93,** 1355.
By Capt. Casey, 1897, expend. of available balance of funds in trimming trees on points and removal of obstr. from the chan. between the lower terminus of Turners Cut and a point 3½ m. below, **98,** 1233.

SURVEYS.
Ex. by S. T. Abert, U. S. C. E., 1875. **R., 76,** 360.
Ex. of R. above mouth of canal au. act July 5, 1884; made by Capt. Hinman, **85,** 1050.
Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1135.
Maps. **91,** 1337; **92,** Atlas, 19; **93,** 1356.

[1] Sur.—**R.,** Nov. 12, 1829; est., $2,500. (H. D. 482, 55th, 2d.)

L-266 POTOHUNK (Portohunk Creek) RIVER, N. C.

COMMERCE.

Description of; about 400 t. of freight besides 20,000 bushels of corn shipped in 1892–93; C. not considered large enough to warrant an imp. of the stream, **93,** 1453.

ENGINEERS.

Chief of Engineers. **R., 93,** 183.

In charge. Maj. W. S. Stanton, 1892–93. **R., 93,** 1451.

PHYSICAL CHARACTERISTICS.

Description of; R. flows into the Pasquotank R. **93,** 1452.

SURVEYS.

Ex. au. act of July 13, 1892; made by Maj. Stanton, 1893 (**R.** unfav.), **93,** 1452.

L-270 TURNERS CUT, N. C.

COMMERCE.

In 1895 it was considered adequate for the traffic that could enter or leave the Dismal Swamp Canal, and for that reason it was not considered worthy of imp. at that time, **95,** 1360.

ENGINEERS.

Chief of Engineers. **R., 95,** 191.

In charge. Maj. W. S. Stanton, 1892–95. **R., 95,** 1357.

PHYSICAL CHARACTERISTICS.

Stream is a branch of the Pasquotank R. and also a portion of the old Dismal Swamp Canal, **95,** 1357.
Description of, **95,** 1357.

SURVEY.

Ex. au. act Aug. 17, 1894; made by Maj. Stanton, 1895 (**R.** unfav.), **95,** 1357.

L-285 PERQUIMANS RIVER, N. C.

APPROPRIATIONS.

1876,	$2,500,	**77,** 66.
1905,	11,250,	**05,** 1198.
Total.	13,750	

COMMERCE.

C. importance of vicinity, **76,** 361.
Description of, **04,** 1384.

CONTRACTS.

1905. L. M. Lewis, dr., 47½¢ c. y., s. m., **06,** 1137.

ENGINEERS.

Chief of Engineers. **R., 76,** 68; **77,** 66; **78,** 74; **79,** 87; **80,** 116; **85,** 164; **04,** 227, 1380; **05,** 233; **06,** 247; **07,** 260; **08,** 276; **09,** 285; **10,** 325.

Boards. BERH. **R., 04,** 1383, 1384.

In charge:
S. T. Abert, U. S. C. E., 1875–80. **R., 76,** 361; **77,** 367; **78,** 538; **79,** 626; **80,** 790.
Capt. F. A. Hinman. **R., 85,** 1045.
Capt. E. E. Winslow, 1904–06. **R., 04,** 1385; **05,** 1198; (Maj.) **06,** 1137.
Maj. J. E. Kuhn, 1907–09. **R., 07,** 1215; **08,** 1271; **09,** 1267.
Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1394.

Assistant. G. H. Elliott. **R., 85,** 1045.

OPERATIONS.

1877–78. 79 stumps, cypress knees, and logs removed, **78,** 539; **79,** 626.
1905–06. 20,882 c. y. dr., **06,** 1137.

PHYSICAL CHARACTERISTICS.

General, **76,** 361. Character of R. bed, **78,** 539.
Description of, **04,** 1384.
No lunar tides, only variation of water surface caused by winds, **06,** 248.

PROJECT.

By A. S. Abert, U. S. C. E., removing logs and débris; est., $2,000, **76,** 361; **77,** 66.
By Capt. Winslow, 1903, chan. 9′ x 200′ through reach just below county br. at Hertford and 60′ w. through shoal near Wards Landing, by dr. and removing obstr.; est., $12,500,[1] **04,** 1386.
Modified to include only reach below Hertford; revised est., $11,250, **04,** 1384; au. act Mar. 3, 1905, **05,** 233.

SURVEYS.

Ex. by S. T. Abert, 1875. **R., 76,** 361.
Ex. of R. above Hertford au. act July 5, 1884; made, 1884, by Capt. Hinman (**R.** unfav.), **85,** 1045.
Ex. and sur. at and near Hertford, au. act June 13, 1902; made, 1903, by Maj. Quinn and Capt. Winslow, resp.,[1] **04,** 1380.

L-296 EDENTON BAY AND HARBOR, N. C.

APPROPRIATIONS.

1878,	$4,000,	**78,** 175; **79,** 696.
1879,	1,000,	**79,** 92, 696.
1884,	10,000,	**84,** 1036.
1886,	2,000,	**86,** 964.
1902,	6,000,	**02,** 1124.
Total,	23,000	

COMMERCE.

Requirements, **76,** 359.
In 1898, 160,000; 1903, 186,000; 1905, 186,000, tons, **06** 1159.

[1] H. D. 302, 58th, 2d.

CONTRACTS.

1878. G. H. Ferris, dr., 15¢ c. y., **79,** 697.
1885. T. P. Morgan, dr., 14¢ c. y., **85,** 1039.
1899. J. Caller, dr., 21¢ c. y. ($2,000), **1900,** 1781.
1903. W. H. French, dr., 29½¢ c. y., p. m., **04,** 1378.

ENGINEERS.

Chief of Engineers. R., 73, 79; **76,** 68; **78,** 175; **79,** 91; **80,** 121; **84,** 168, 177, 1074; **85,** 159; **86,** 154; **87,** 122; **99,** 230; **00,** 263; **01,** 297; **02,** 225; **03,** 227; **04,** 226; **05,** 233; **06,** 248; **12,** 421.

In charge:
Maj. W. P. Craighill, 1872. **R., 73,** 854.
S. T. Abert, U. S. C. E., 1875. **R., 76,** 358.
Capt. C. B. Phillips, 1879–80. **R., 79,** 696; **80,** 830.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1035, 1071; **85,** 1038; **86,** 963; **87,** 989.
Col. W. P. Craighill, 1888. **R., 88,** 773.
Maj. T. L. Casey, 1899. **R., 99,** 1482.
Maj. J. B. Quinn, 1900–1902. **R., 00,** 1780; **01,** 1460; **02,** 1124.
Capt. E. E. Winslow, 1903–06. **R., 03,** 1086; **04,** 1378; **05,** 1199; (Maj.) **06,** 1138.
Lt. Col. M. M. Patrick, **12,** 390.
Lt. Col. W. C. Langfitt, **12,** 390.

Assistant. G. H. Elliott. **R., 73,** 856; **79,** 697; **84,** 1074.

ESTIMATES. (See Projects.)

By G. H. Elliott, 1872, dr. chan., 9′ x 100′, wharves to d. w. in the B., $10,000, **73,** 855, 857.
By S. T. Abert, 1875, dr. chan., 2,500′ to 9′ x 100′ x 2,600′ and d. approach to the wharves, $12,650, **76,** 360.

OPERATIONS.

1878–79. Chan. 9′ x 100′ x 850, y. dr.; 21,360 c. y. removed; dr. turning-basin begun, **79,** 91, 696, 697.
1879–80. 3,260 c. y. dr. and 5 cypress stumps removed, **80,** 830.
1884–85. 29,000 c. y. dr. from chan. and basin, **85,** 1039.
1885–86. 17,043 c. y. dr. from chan. and basin, **86,** 963.
1899–00. 10,005 c. y. dr., **00,** 1780.
1903–04. 15,233 c. y. dr., **04,** 1378.

PHYSICAL CHARACTERISTICS.

Description, **76,** 358, 359; **78,** 857.
Water level varies only with the wind, **06,** 248.

PROJECTS. (See Estimates.)

By S. T. Abert, 1875, imp. of Edenton H. and B. by excavation of chan. 9′ x 100′ x 850; y. also a. turning-basin at the wharves; est. cost, $12,650, **79,** 91, 696; **80,** 121.
From 1878–84 $5,000 was app. and expen. on, this proj.
In 1883 Capt. Mercur proposed w. chan. to 150 at the outer and 200′ at the inner end; also completion of the turning-basin with an area of about 12 acres; est., $18,000, **84,** 1073, 1074; **87,** 122.
In 1888 Col. Craighill recom. no further app., the H. being amply sufficient for C., **88,** 774.
Au. Chief of Engineers obtained, 1899, for completing proj. under which operations were previously carried on, by dr. from Town Wharf to the first beacon outward, **99,** 1482.

SURVEYS.

Under direction of Maj. Craighill, by George H. Elliott, 1872. **R., 73,** 854, 856.
By S. T. Abert, 1875. **R., 76,** 358.
Au. act Aug. 2, 1882; made, 1883 by Capt. Mercur, **84,** 1072.
Ex. of chan., **02,** 1124.
For H. lines, **06,** 1138.
Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 421.

Maps. **86,** 964.

L-298 CHOWAN RIVER, N. C.

COMMERCE.

Would not justify cost of improving R., **79,** 727, 728.

ENGINEERS.

Chief of Engineers. R., 78, 76; **79,** 95; **12,** 421.

In charge:
Capt. C. B. Phillips, **78,** 76; **79,** 88. **R., 79,** 726.
Lt. Col. M. M. Patrick, **12,** 390.
Lt. Col. W. C. Langfitt, **12,** 390.

Assistant. W. G. Williamson. **R., 79,** 728.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 727, 728.
Obstr., **79,** 728.

PLANS.

Capt. Phillips, 1879, recom. both e. and w. chans. be marked with buoys, **79,** 728.
By W. G. Williamson, 1879, removing obstr., **79,** 728, 729. Not approved, **79,** 728, 729.

SURVEYS.

1878. Au. and in progress, **78,** 76. Completed by W. G. Williamson (see Commerce), **79,** 95, 727,
Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come). **12,** 421.

L-305 BENNETTS RIVER (Creek), N. C.

ENGINEERS.

Chief of Engineers. R., 06, 251.

SURVEY.

Ex. at and above Gatesville, N. C., au. act Mar. 3, 1905; made, 1905; Capt. Winslow's **R.** unfav.[1] **06,** 251.

[1] H. D. 179, 59th, 1st.

L-312 BLACKWATER RIVER, VA.

APPROPRIATIONS.

1878, $5,000, **78,** 74.
1879, 2,500, **79,** 90.
1880, 3,500, **80,** 822.
1881, 1,500, **81,** 992.
1882, 1,500, **82,** 1077.
1907, 8,000, **07,** 1217.

Total, 22,000 (22,015, inc. sales, **12,** 1725).

COMMERCE.

C. advantages of tributary country, **75,** ii, 161.
1906, value, $832,000; produce, timber, fertilizer, etc., **07,** 261; 1909, 5,413 t., value, $866,080, **10,** 326.
Traffic, 1911, 4,126 t., **12,** 1727.

ENGINEERS.

Chief of Engineers. **R., 75,** 95; **78,** 73; **79,** 90; **80,** 119; **81,** 160; **82,** 156; **83,** 162; **84,** 165; **85,** 157; **86,** 152; **87,** 120; **06,** 251; **07,** 260; **08,** 277; **09,** 286; **10,** 326; **11,** 347; **12,** 416.

In charge:
S. T. Abert, U. S. C. E., 1875–79. **R., 75,** ii, 161; **78,** 522; **79,** 620.
Capt. C. B. Phillips, 1879–81. **R., 79,** 682; **80,** 821.
Capt. J. Mercur, 1881–84. **R., 81,** 991; **82,** 1077; **83,** 843.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1031; **85,** 1033; **86,** 961; **87,** 987.
Col. W. P. Craighill, 1888. **R., 88,** 772.
Maj. Joseph E. Kuhn, 1907–09. **R., 07,** 1216; **08,** 1272; **09,** 1268.
Lt. Col. Mason M. Patrick, 1910–12. **R., 10,** 1395; **11,** 1506; **12,** 1727.
Lt. Col. W. C. Langfitt, 1912–. **12,** 390.

Assistants. G. H. Elliott, W. H. Powless, and C. A. Turrill, 1874–75, **75,** ii, 162.

OBSTRUCTIONS.

Bars of deposited sawdust, **75,** ii, 161.

OPERATIONS.

1878–79. 1,233 snags, logs, and fallen trees and 144 overhanging trees removed with hired labor, **79,**; 90, 621, 683.
1879–80. Removal of wreck, 161 snags, and 205 trees; also 5,910 c. y. dr. from bar at mouth and Georges Bend, **80,** 822.
1880–81. 18,000 c. y. dr. at Franklin and Littletown Bend, and 90 l. f. of revet. built at Franklin **81,** 992.
1882–83. Dr. at Littletown Bend, **83,** 843.
1883–84. Removing 515 snags, logs, and trees, **84,** 1031.
1907–08. 697 logs, snags, and stumps removed, **08,** 1272.
1908–09. 286 logs and other obstr. removed, **09,** 1268.
1909–10. Plant repaired, **10,** 1395.
1910–11. Snag boat *Roanoke* removed 17 snags and other obstr., **11,** 1507.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 161; **79,** 620. Obstr.: Snags, piles, trees, and crooked bends, **75,** ii, 161; **78,** 522; **79,** 620.
Description of, **11,** 348.

PROJECTS.

By S. T. Abert, U. S. C. E., 1875, for dr. and removing snags and trees, mouth to Franklin. Est., $14,850. **75,** ii, 162; **78,** 74; **87,** 120.
By Maj. Kuhn, removal of obstr.; est., $8,000, **07,** 260.

SURVEYS.

By S. T. Abert, U. S. C. E., 1874–75. **R., 75,** ii, 161.
Pre. ex. and sur. au. by R. and H. A., Mar. 3, 1905; **R.,** Aug. 3, 1905; est., $8,000, **06,** 251.[1]
Cong. docs., etc., relating to exs., surs., plans, etc., **07,** 261; **11,** 347; **12,** 417.

L-314 NOTTOWAY (Creek) RIVER, VA.

APPROPRIATIONS.

1880, $5,000, **80,** 823.
1881, 2,000, **81,** 993.

Total, 7,000

COMMERCE.

Important, **79,** 721.
Products of the country, **79,** 721.
Imp. not followed by any increase in C., **83,** 844; **86,** 152.

ENGINEERS.

Chief of Engineers. **R., 78,** 76; **79,** 95; **80,** 119; **81,** 160; **82,** 156; **83,** 162; **84,** 165; **85,** 156; **86,** 151; **87,** 121; **88,** 103; **91,** 153.

In charge:
Capt. C. B. Phillips, 1878–81. **78,** 76. **R., 79,** 719; **80,** 823.
Capt. J. Mercur, 1881–84. **R., 81,** 992; **82,** 1077; **83,** 843.
Capt. F. A. Hinman, 1884–87. **R., 84,** 1031; **85,** 1033; **86,** 961; **87,** 988.
Col. W. P. Craighill, 1888. **R., 88,** 773.
Capt. G. J. Fiebeger, 1891. **R., 91,** 1315.
Capt. C. B. Phillips, 1891. **R., 91,** 1318.

Assistants:
W. G. Williamson. **R., 79,** 720; **91,** 1319.
Messrs. Moncure and Blow, **79,** 719.

OBSTRUCTIONS.

Obstr. at the mouth of the R. placed there by the Confederates, **79,** 720.

OPERATIONS.

1881–82. 2,941 snags, logs, and similar obstr. removed from chan., **82,** 1078.

PHYSICAL CHARACTERISTICS.

General, **79,** 719, 720, 721.

PLANS.

By W. G. Williamson, removing snags, leaning trees, and Confederate obstr.; also constr. low brush and stake dams; est. orig., $6,708, subsequently increased to $9,000, **79,** 720, 722.
By Capt. Fiebeger, 1890, imp. R., Courtland to mouth, by removing obstr. and dr., giving a chan. from 7′–8′ d. for 15 m. from mouth, and above that point a chan. 2′–3′ at its lowest stage for 50 m. from its mouth; est., $9,000, **91,** 1316.

PROJECTS.

By Capt. Phillips, 1878, chan. mot less than 60′ x 9′, mouth to RR. br., thence to Peters Br., 50 m. above the mouth, 2′ d., by removing logs, snags, and sunken vessels; est., $9,000, **79,** 720, 722; **80,** 823.
In 1887 Capt. Hinman said there was no demand for the completion of the proj., **87,** 988.

SURVEYS.

By W. G. Williamson, 1878–79. **R., 79,** 720.
Ex., 1883, **83,** 844.
Ex. of lower R., **85,** 1033.
Ex., mouth to Courtland au. act of Sept. 19, 1890 made, 1890, by Capt. Fiebeger, **91,** 1316.

[1] H. D. 177, 59th, 1st.

L-322 MEHERRIN RIVER, N. C.

APPROPRIATIONS.

1882, $5,000, **83,** 846.
1907, 6,000, **07,** 1217.

Total, [1]11,000 (incl. misc., $11,010, **12,** 1728).

COMMERCE.

In 1906, 8,900 t., **07,** 261; 1911, 14,000 t.; effect of imp. on rates unknown, **12,** 418.

ENGINEERS.

Chief of Engineers. **R.,** **81,** 168; **82,** 163; **83,** 163; **84,** 166; **85,** 160; **86,** 155; **87,** 121; **06,** 251; **07,** 261; **08,** 278; **09,** 286; **10,** 326; **11,** 348; **12,** 417.

In charge:
Col. W. P. Craighill, 1888. **R.,** **88,** 773.
Capt. J. Mercur, 1881–84. **R.,** **82,** 1114; **83,** 846.
Capt. F. A. Hinman, 1884–87. **R.,** **84,** 1034; **85,** 1041; **86,** 965; **87,** 989.
Maj. J. E. Kuhn, 1907–09. **R.,** **07,** 1217; **08,** 1273; **09,** 1269.
Lt. Col. M. M. Patrick, 1910–. **R.,** **10,** 1396; **11,** 1507; **12,** 1728.

Assistant. C. M. Yeates. **R.,** **82,** 1115.

OPERATIONS.

1882–83. Removing obstr. begun, **83,** 846.
1883–84. 1,072 trees, logs, snags, and piles, and 296 overhanging trees removed between mouth and Murfreesboro, **84,** 1034.
1884–85. 119 snags, log, and trees removed, **85,** 1041.
1907–08. 287 logs and other obstr. removed, **08,** 1273.
1908–09. 255 logs and 1 tree removed, **09,** 1269.
1910–11. 8 logs and 1 tree removed, **11,** 1507.
Rises in Va., flows e. to empty into Chowan R., N. C., 50 m. l.; proj. section for 11 m. from mouth, **12,** 417.

PROJECTS.

By Capt. Mercur, 1882, removing snags and similar obstr. to secure a 9′ x 80′ chan., mouth to Murfreesboro; est., $125,500, **82,** 1115.
In 1888, no permanent benefit to be derived from the imp., **88,** 773.
By Maj. Winslow, 1905, imp. by removal of obstr.; est., $6,000,[2] **06,** 251; au. act Mar. 2, 1907, **07,** 261.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. Mercur, **82,** 1114.
Ex. mouth to Murfreesboro au. act Mar. 3, 1905; made, 1905, by Maj. Winslow,[2] **06,** 251.
Soundings in Darden Reach, **09,** 1269.
Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 418.

L-328 POTECASI CREEK, N. C.

COMMERCE.

Limited and of no importance, **97,** 1384.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 199.

In charge. Capt. T. L. Casey, 1895. **R.,** **97,** 1383.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1383.

SURVEYS.

Ex. au. act June 3, 1896; made, 1896, by Capt. Casey (**R.** unfav.), **97,** 1383.

L-352 ROANOKE RIVER, N. C. AND VA.[3]

APPROPRIATIONS.

1871, $20,000, **71,** 74, 608, 621.
1872, 10,000, **72,** 70, 697.
1873, 10,000, **73,** 77.
1874, 5,000, **74,** 88, ii, 65.
1882, 5,000, **83,** 831.
1884, 3,000, **84,** 1001.
1886, 20,000, **86,** 928.
1888, 40,000, **88,** 843.
1890, 25,000, **90,** 1109.
1892, 50,000, **92,** 1107.
1894, 30,000, **95,** 1292.
1896, 10,000, **96,** 1083.
1905, 10,000, **05,** 1200.
1907, 3,000, **07,** 1218.
1910, 5,000, **10,** 1397.

Total, 246,000.

COMMERCE.

Development of, consequent upon imp., **89,** 1040.
Above Weldon, **90,** 1178.
Freight transportation upon the Roanoke, 1871 to 1891, **92,** 1110.
List of SS. navigating the R., **92,** 1110.
Shipments of freight by R. apparently decreasing, **93,** 1352. Shippers regard the mainten. of a navigable chan. beneficial in controlling rates of the RR., **94,** 992. In 1897 only 2 of the 8 boats that formerly navigated the R. in service, **97,** 1377.
Decreasing since 1891, **06,** 249.
Depletion of forests and development of RRs. has served to reduce volume of water-borne freight in recent years, **10,** 328.

CONTRACTS.

1871. J. M. Foote, removal of wrecks, **71,** 609; **72,** 696; **73,** 787.
1872. J. M. Foote, removal of rs., **72,** 696; **76,** 353.
1873. J. M. Foote, removal of wrecks, **73,** 788; **74,** ii, 64.
1875. T. P. Morgan, building dikes, $2.95 l. f., **75,** ii, 131.
1894. C. T. Caler, dr., 16¢ c. y., s. m., **94,** 992.
1895. Petersburg Iron Works Co., snag boat, $15,424, reduced later to $15,322.02, **95,** 1292.
1901. C. J. Colonna, rebuilding snag boat Roanoke, $5,420, **01,** 1462.

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[1] Of this, $415.47 was carried to surplus fund.
[2] H. D. 137, 59th, 1st.
[3] Roanoke and Kanawha Canal: Sur.—**R.,** Mar. 24, 1828. Roanoke Inlet and Sound, N. C.: Ex.—**R.** (fav.), Dec. 15, 1820. Sur.—**R.,** Feb. 12, 1829; est., $327,734.10. (H. D. 482, 55th, 2d.)

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 69; **71,** 74, 76; **72,** 70, 72; **73,** 76; **74,** 88; **75,** 94; **76,** 68; **77,** 66; **78,** 74; **79,** 87; **81,** 157, 158; **82,** 153, 154; **83,** 159; **84,** 161, 163; **85,** 152; **86,** 147; **87,** 113, 114; **88,** 115; **89,** 135, 149; **90,** 121, 133; **91,** 154; **92,** 155; **93,** 167; **94,** 153; **95,** 174; **96,** 158; **97,** 196; **98,** 199; **99,** 231; **00,** 264; **01,** 298; **02,** 225; **03,** 227; **04,** 226; **05,** 234; **06,** 249; **07,** 261; **08,** 278; **09,** 287; **10,** 327; **11,** 349; **12,** 418.

In charge:

Maj. W. P. Craighill, 1871–74. **R., 71,** 608, 620; **72,** 696, 726; **73,** 787; **74,** ii, 64, 65.

S. T. Abert, U. S. agent, 1874–89. **R., 75,** ii, 129; **76,** 352; **77,** 367; **78,** 539; **79,** 624; **80,** 794; **81,** 980; **82,** 1059, 1060; **83,** 831; **84,** 1001, 1020; **85,** 995; **86,** 927; **87,** 955, 960; **88,** 840.

Capt. W. H. Bixby, 1889–92. **R., 89,** 1040, 1175; **90,** 1106; **91,** 1330.

Maj. W. S. Stanton, 1892–94. **R., 92,** 1103; **93,** 1351; **94,** 989.

Capt. T. L. Casey, 1895–1900. **R., 95,** 1290; **96,** 1080; **97,** 1377; **98,** 1232; (Maj.) **99,** 1483.

Maj. J. B. Quinn, 1900–02. **R., 00,** 1782; **01,** 1461; **02,** 1125.

Capt. E. E. Winslow, 1903–06. **R., 03,** 1086; **04,** 1379; **05,** 1199; (Maj.) **06,** 1139.

Maj. J. E. Kuhn, 1907–09. **R., 07,** 1218; **08,** 1274; **09,** 1270.

Lt. Col. M. M. Patrick, 1910–. **R., 10,** 1397; **11,** 1508; **12,** 1729.

Assistants:

G. H. Elliott. **R., 72,** 728.

C. Schuster. **R., 89,** 1042; **90,** 1110; **91,** 1333; **92,** 1108.

E. D. Thompson. **R., 90,** 1109.

ESTIMATES. (See Plans and Projects.)

By G. H. Elliott, 1871, 156,000 l. f. of dikes or js., $234,000, **72,** 732; chan. 60′ w. by dr. and removal of r., $78,702, **72,** 732, 733.

By Maj. Craighill, 1871, 5′ chan. 60′ w., $120,000, **72,** 696, 727; removing obstr. and constr. dikes, $269,000; addl. for 8′ chan., $250,000, **72,** 697, 727.

By S. T. Abert, 1874, dr., removing snags, etc., at Taylors Ferry and other bars to make a chan. 8′ x 100′, $42,460, **75,** ii, 132; in 1879, for completion of existing proj., $222,000, **79,** 626.

OPERATIONS.

1870-71. Removal of wrecks by contract, **72,** 696, 726.

1871-72. Removal of wrecks and other obstr., **72,** 70, 696, 726.

1872-73. Removal of rs.; 1 steamer, 7 schooners, 1 floating battery, 1 double-ender, and 300 piles removed from chan., **73,** 76, 788.

1873-74. Wrecks removed and rs. blasted, **74,** 88, ii, 64.

1874-75. Building dikes by contract, **75,** 94, 95, ii, 130, 131.

1875-76. 986 l. f. of dikes completed, **76,** 68, 355.

1876-77. Work on dike, **77,** 66, 366.

1882-83. Dike built at McRaes Landing and old dike repaired, **83,** 831.

1886-87. Removal of obstr. in the Thoroughfare and Coshoke Creek begun and in progress, **87,** 956.

1887-88. 2,272 logs, snags, and stumps and 2,911 overhanging trees removed, **88,** 841.

1888-89. 1,200 logs, snags, and stumps and 153 cords small snags removed from the chan., and 1,652 trees pulled back on the banks, **89,** 1041.

1889-90. 26,948 c. y. mud, gravel, and bowlders removed; 5,500 trees, stumps, and snags removed from the banks, **90,** 1108.

1890-91. 6,531 snags and stumps and 110 cords of small snags removed from the chan., and 2,939 trees cleared from the banks, **91,** 1332.

1891-92. 5,530 snags, 606 stumps, and 199 cords of small snags cleared from the chan., **92,** 1108.

1893-94. 1,410 snags, 383 stumps, and 35 logs removed, **94,** 991.

1894-95. 31,250 c. y., s. m., dr., 2,091 snags, 100 stumps, and 148 trees removed from the chan. and banks, **95,** 1291.

1896-97. 45 trees, 4 logs, 9 stumps, and 7 snags removed from the chan. and banks, **97,** 1377.

1897-98. 116 trees, 13 logs, 19 stumps, and 11 snags removed from chan. and sides of the R., and 13 overhanging trees trimmed, **98,** 1232.

1898-99. 64 trees, 5 snags, 50 stumps, and 6 logs removed from chan., **99,** 1483.

1899-1900. 204 trees, 30 logs, 23 snags, and 2 stumps removed from chan., **00,** 1782.

1900-01. 17 trees and other obstr. and an old wharf removed, snag boat rebuilt, and attempt made to dr. bar at North R., **01,** 1461.

1901-02. 67 trees, logs, and stumps removed and 14 trees trimmed, **02,** 1125.

1902-03. 28 snags and other obstr. removed, 111 trees felled, and 4,576 c. y. dr., **03,** 1086.

1904-05. 157 trees and other obstr. removed, 165 trees felled, and 7,065 c. y. dr., **05,** 1199.

1905-06. 5,097 c. y. dr., and 10 snags, 111 trees, and 361 overhanging trees removed, **06,** 1139.

1906-07. 50 trees, snags, and stumps removed and 28 trees felled, **07,** 1218.

1907-08. 22 snags and 4 trees removed and 19 trees felled, **08,** 1274.

1908-09. 25 trees, logs, and snags removed and 13 trees felled, **09,** 1270.

1910-11. 54 trees, 2 snags, 1 pile, and 1 log removed from chan., and 51 overhanging trees cut down; piping system of snag boat overhauled and renewed, **11,** 1508.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 608, 609; **72,** 696, 726, 727–732; **74,** ii, 64; **75,** ii, 129–132; **82,** 1060; **84,** 1023; **90,** 1176.

Water-gauge record for 1892, **93,** 1352.

Bar forming at mouth, due to deposits by freshets, **08,** 279.

PLANS. (See Estimates and Projects.)

By Maj. Craighill, 1871, chan. 8′ d.; est., $519,000; **72,** 697, 727.

By S. T. Abert, 1882, Clarksville, Va., to Eaton Falls, N. C., chan. 35′ x 2½′ m. l. w.; est., $181,316, **82,** 1065; **87,** 961.

By S. T. Abert, 1885, plant for snag removal, **85,** 996; **86,** 928; **87,** 956.

PROJECTS. (See Estimates and Plans.)

By Maj. Craighill, 1871, imp. of the R. by removal of wrecks, snags, and dangerous rs., and the contraction of the chan. way by js. so as to give throughout the year an unobst. 10′ navigation from Albemarle Sound up to Hamilton, and 5′ navigation up to Weldon; est., $269,000, **71,** 609, **79,** 624, 626; **89,** 1040; **91,** 1331.

In 1884 S. T. Abert recom. the an. removal of wrecks and snags and the imp. of Big and Little Rocky Bars, **85,** 996; **87,** 955.

1886, est. for completion, $41,000, **87,** 113.

SURVEYS.

Under direction of Maj. Craighill, **70,** 69, 71, 76, by G. H. Elliott, **71,** 608, 621. **R., 74,** ii, 65; **72;** 726–733; **72,** 72, 696.

Au. act Mar. 3, 1881; made, 1882, by S. T. Abert, **82,** 1060; **87,** 960.

Au. act Aug. 2, 1882; made, 1883, by S. T. Abert, **84,** 1022.

Clarksville, Va., to Eaton Falls, N. C., au. act Aug. 5, 1886; made by S. T. Abert, **87,** 960.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **90,** 1176.

Ex. of rocky bar made, 00, by Maj. Quinn, **00,** 1782.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 419.

Maps. **87,** 956; **88,** 842; **90,** 1110; **92,** Atlas, 18.

L-352(b) CASHIE RIVER, N. C.

COMMERCE.

About $80,000 worth of merchandise carried on the R. an.; not of such a character as to warrant imp. of the stream, **97,** 1382.

ENGINEERS.

Chief of Engineers. **R., 85,** 164; **97,** 199.

In charge:
Capt. F. A. Hinman. **R., 85,** 1053, 1054.
Capt. T. L. Casey, 1897. **R., 97,** 1381.

Assistant. H. C. Collins. **R., 85,** 1053, 1055.

PHYSICAL CHARACTERISTICS.

Description of; one of the tortuous fresh water affluents of Albemarle Sound, forming one of the mouths of the Roanoke, **85,** 1056; **97,** 1381.

PLANS.

By Capt. Hinman, 1885, removal of snags, wrecks, and similar obstr., mouth to Windsor, 25 m.; est., $30,000; **85,** 1055, 1058.

SURVEYS.

Ex. au. act July 5, 1884; made by Capt. Hinman, **85,** 1053, 1054.
Ex. au. act June 3, 1896; made, 1896, by Capt. Casey (**R.** unfav.), **97,** 1381.

L-367 STAUNTON RIVER, VA.

Part.	Title.	Period.	Appropriations.
a	Brook Neal to Pig R	1878–1887	$12,000
b	Randolph Station to Brook Neal	1880–1887	27,500
c	Staunton R	1888–1893	13,000
	Total		52,500

Part (a), L-367 Staunton River, Va. (Brook Neal to mouth of Pig River.)

APPROPRIATIONS.

1879, $5,000, **79,** 86.
1882, 2,000, **83,** 828.
1886, 5,000, **86,** 925.

Total, 12,000

COMMERCE.

Important, **79,** 624.

ENGINEERS.

Chief of Engineers. **R., 78,** 75; **79,** 86, 88; **81,** 158; **82,** 154; **83,** 158; **84,** 160; **85,** 151; **86,** 146; **87,** 112.

In charge. S. T. Abert, U. S. agent; 1879–91; **78,** 75. **R., 79,** 621; **82,** 1047; **83,** 826; **84,** 999; **85,** 992; **86,** 924; **87,** 951.

OPERATIONS.

1883–84. 535 c. y. r. removed from the chan., **84,** 999.
1886–87. Chan. 1½′ x 14′ opened through Pocket Shoal No. 3, **87,** 952.

PHYSICAL CHARACTERISTICS.

General, **79,** 622; **82,** 1047.
Floods, **79,** 623.
Bars, **79,** 623.

PRIVATE WORK.

About $10,000 expend. by C. Bruce for imp. of navigation, **79,** 623.

PROJECTS.

By S. T. Abert, dr., r., excavation, and constr. of lateral or spur dams of cribwork or st., est., $35,160, **79,** 86, 623, 624.
By S. T. Abert, 1882, imp. of Staunton R., Brook Neal to mouth of Pig R., 52 m., by constr. of spur dikes and r. excavation, chiefly to reduce the slope of the R. for batteau navigation; est. $40,087, **82,** 1048, 1052; **87,** 952.

SURVEYS.

By S. T. Abert, U. S. C. E., 1878–79, ex., Brook Neal to Roanoke Station, on the Richmond & Danville R.R. **R., 79,** 622.
Of Staunton R., Brook Neal to mouth of Pig R., au. act Mar. 3, 1881; made, 1882, by S. T. Abert, **82,** 1047.
Maps. Profile from Brook Neal to Roanoke Station, **86,** 923.

Part (b), L-367 Staunton River, Va. (Randolph Station to Brook Neal.)

APPROPRIATIONS.

1880, $7,500, **80,** 787.
1881, 5,000, **81,** 977.
1882, 5,000, **82,** 1046.
1884, 5,000, **84,** 998.
1886, 5,000, **86,** 923.

Total, 27,500

COMMERCE.

Trade and C., **80,** 787.

CONTRACTS.

1879. Mosely & Canada, timber, **80,** 787.

ENGINEERS.

Chief of Engineers. **R., 80,** 116; **81,** 156; **82,** 152; **83,** 158; **84,** 160; **85,** 150; **86,** 145; **87,** 111.

In charge. S. T. Abert, U. S. agent, 1878–87. **R., 80,** 780; **81,** 976; **82,** 1044; **83,** 824; **84,** 998; **85,** 989; **86,** 922; **87,** 950.

Assistant. J. H. Gill. **R., 80,** 781.

OPERATIONS.

1879–80. Derrick boat, derrick, quarter boat, and 2 st. scows built, **80,** 787.

1880–81. 1,306 c. y. r. blasted from the chan. **81,** 977.

1881–82. 4,625 c. y. blasted and loose r. removed; 12 crib dams built of an aggregate l. of 522′, **82,** 1045.

1882–83. 307 c. y. l., 7 snags, and 35 trees removed, **83,** 825.

1884–85. 18 m. of R. placed in navigable condition, **85,** 990.

1885–86. 757 c. y. l. removed from chan., **86,** 923.

1886–87. 194 c. y. solid r. and 112 c. y. of loose r. and gravel removed from chan., **87,** 950.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1047.

PROJECTS.

By S. T. Abert, 1879, imp. of Staunton R., Brook Neal to Roanoke Station, 32 m., by r. removal and spur dike and dam constr., to give l. w. chan. of 2′ and not less than 35′ w.; est., $68,708.40, **80,** 783, 786; **87,** 950.

SURVEYS.

Brook Neal to Roanoke Station, **87,** 950.
Maps. **80,** 786.

Part (c), L-367 Staunton River, Va.

APPROPRIATIONS.

1888,	$5,000, **88,** 836.
1890,	8,000, **90,** 1082.
Total,	13,000

ENGINEERS.

Chief of Engineers. R., 88, 114; **89,** 132, 133; **90,** 119, 120; **91,** 153; **92,** 154; **93,** 166.

In charge:
S. T. Abert, U. S. agent, 1878–91. **R., 88,** 834, 836; **89,** 1020, 1022; **90,** 1081, 1082.
Capt. W. H. Bixby, 1891–92. **R., 91,** 1328.
Maj. W. S. Stanton, 1892–93. **R., 92,** 1099; **93,** 1350.

OPERATIONS.

1887–88. (P. R. to B. N.) 250 c. y. loose and 550 c. y. blasted r. removed from the chan.; (B. N. to R. Sta.) 1,200 c. y. r. removed from the chan.; 308 c. y. r. quarried, and 182 c. y. placed in wing dams, **88,** 835.

1888–89. (P. R. to B. N.) 175 c. y. r. removed from the chan., **89,** 1022. (B. N. to R. Sta.) 341 c. y. granite quarried, and 437 l. f. of riprap dam built, **89,** 1021.

1889–90. (B. N. to R. Sta.) 144 c. y. st. blasted and 30 c. y. removed from the chan.; repairs to dams, **90,** 1081.

1892–93. Plant and property pertaining to the imp. sold to other works of imp. in the district, **93,** 1350.

PROJECTS.

By S. T. Abert, 1879, imp. of Staunton R., Brook Neal to Randolph Station, 32 m., by r. removal and spur dike and dam constr., so as to give a l. w. chan. of 2′ x 35′; est., $68,708, **80,** 783, 786; **87,** 950.

By S. T. Abert, 1882, imp. of Staunton R., Brook Neal to the mouth of Pig R., 52 m., by constr. of spur dikes and r. excavation, chiefly to reduce the slope of the R. for batteau navigation; est., $40,087, **82,** 1048, 1052; **87,** 952.

Reduced to $34,000 in 1889, **89,** 1023.

The 2 works consolidated, 1890, and $50,200 est. as required for completion of projs. for imp. of the upper and lower R., **91,** 1328; **92,** 1103.

In 1892, after total expend. upon both sections of the R. of $44,700, recom. that further work be discontinued, **92,** 1103.

L-378 DAN RIVER, N. C. AND VA.

APPROPRIATIONS.

1880,	$10,000, **80,** 790.
1881,	8,000, **81,** 978.
1882,	7,500, **82,** 1056.
1884,	5,000, **84,** 1000.
1886,	20,000, **86,** 927.
Total,	50,500

COMMERCE.

C. importance of R. and adjacent country, **79,** 653.

ENGINEERS.

Chief of Engineers. R., 78, 75; **79,** 88; **80,** 116, 117; **81,** 157; **82,** 152; **83,** 159; **84,** 161; **85,** 151; **86,** 146; **87,** 112; **88,** 115; **89,** 133; **90,** 120.

In charge. S. T. Abert, U. S. C. E., 1878–90; **78,** 75. **R., 79,** 652; **80,** 788, 794; **81,** 977; **82,** 1053; **83,** 830; **84,** 1000; **85,** 993; **86,** 925; **87,** 95; **88,** 838; **89,** 1023; **90,** 1083.

Assistant. S. W. Evans. **R., 79,** 654.

OPERATIONS.

1880–81. Two derrick boats and 2 scows built; 281 c. y. solid r. blasted, 115 c. y. loose r., sand, and gravel removed, **81,** 978.

1881–82. 2,590 c. y. solid r. blasted; 482 loose r., sand, and gravel removed; 774 c. y. r. used in dams, **82,** 1054.

1882–83. 1,055 c. y. l. quarried for spur dams, **83,** 830.

1883–84. 680 c. y. r. and 28 c. y. gravel removed; 124 c. y. of r. quarried; **84,** 1000.

1884–85. 421 c. y. r. excavated; 789 c. y. l. quarried; 649 c. y. placed in dams, **85,** 994.

1885–86. 125 c. y. r. removed, **86,** 926.

1886–87. Imp. shoals in progress between Long and Adams Isld. Shoals, **87,** 954.

1887–88. 1,900 c. y. loose and blasted r. removed; 981 c. y. sand and gravel dr. from the chan.; 497 l. f. spur dams completed, **88,** 839.

1888–89. 174 l. f. cribwork built, 208 l. f. brush mats sunk, and 140 c. y. r. used in dam constr., **89,** 1023.

PHYSICAL CHARACTERISTICS.

General, **79,** 652.
Floods, **79,** 652.
Agricultural interests, **79,** 653.
Minerals in vicinity, **79,** 654.
Description of obstr., **79,** 655–665; **80,** 797.

PLANS.

By S. T. Abert, imp. R., batteau navigation Hairston's Ford to Danville, by dr., r. excavating, and with dams, est., $32,718, **79,** 666–671.

PROJECTS.

By S. T. Abert, 1879, chan. 3′ x 35′ l. w., for 77 m. by dr., r. excavating, and locks and dams; est., $658,579.20, **79,** 666, 671; **80,** 788. Revised in 1880 for a chan. 1½′ x 35′ in pools and 2′ in rapids, without locks and dams; est., $52,000, **80,** 788. Increased $5,500 in 1886–87, **86,** 147; **87,** 954.

SURVEYS.

By S. W. Evans, 1878–79. **R. 79,** 652, 654.
From Danville to Clarksville, au. act Mar. 3, 1879; made, 1880, by S. T. Abert, **80,** 794.
Resur. of Seven Shoals made, **86,** 926.

Maps:
Profile, **86,** 927.
Madison to Danville, **87,** 954.

L-397 CONOBY CREEK, N. C.

ENGINEERS.

Chief of Engineers. R., 12, 421.

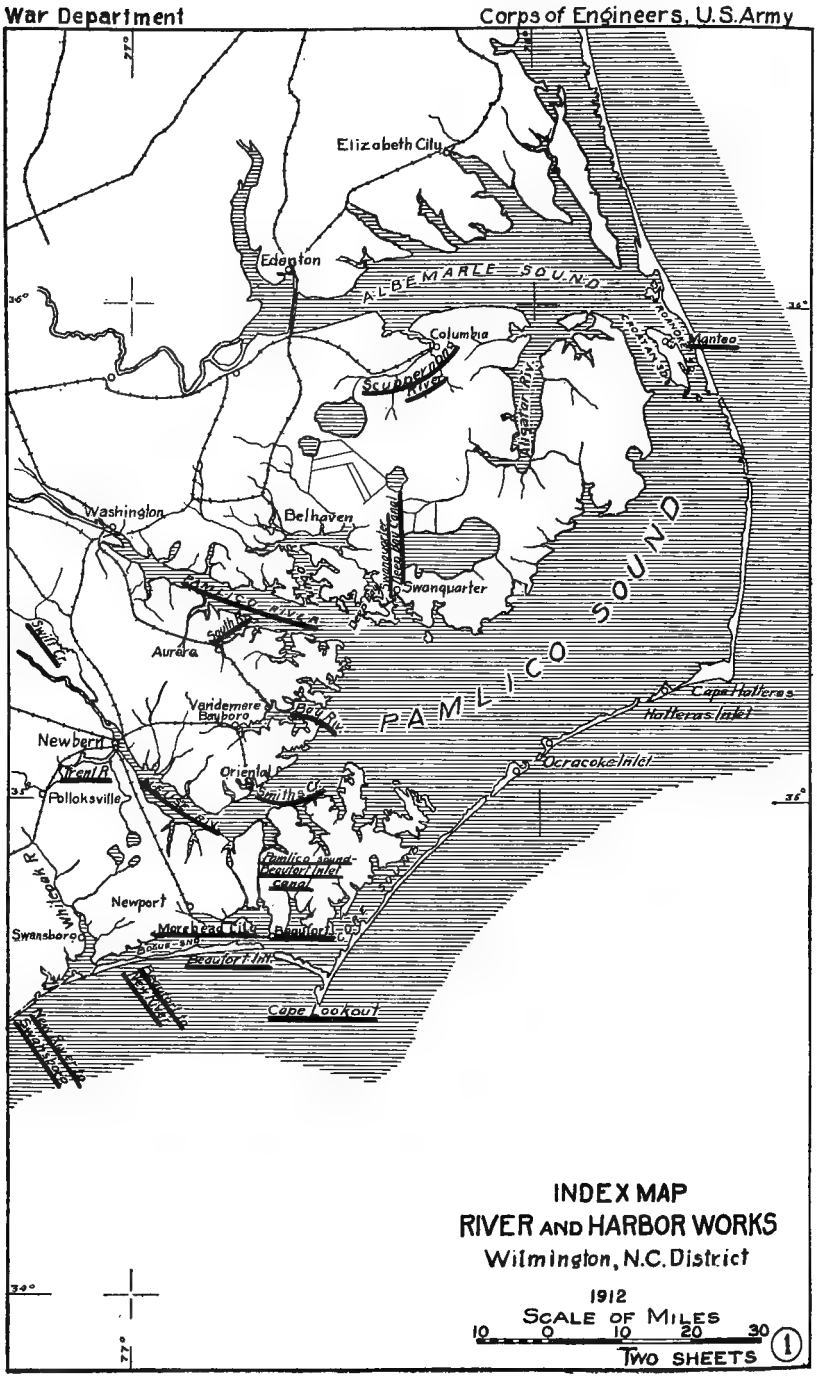
In charge:
Lt. Col. M. M. Patrick, **12,** 390.
Lt. Col. W. C. Langfitt, **12,** 390.

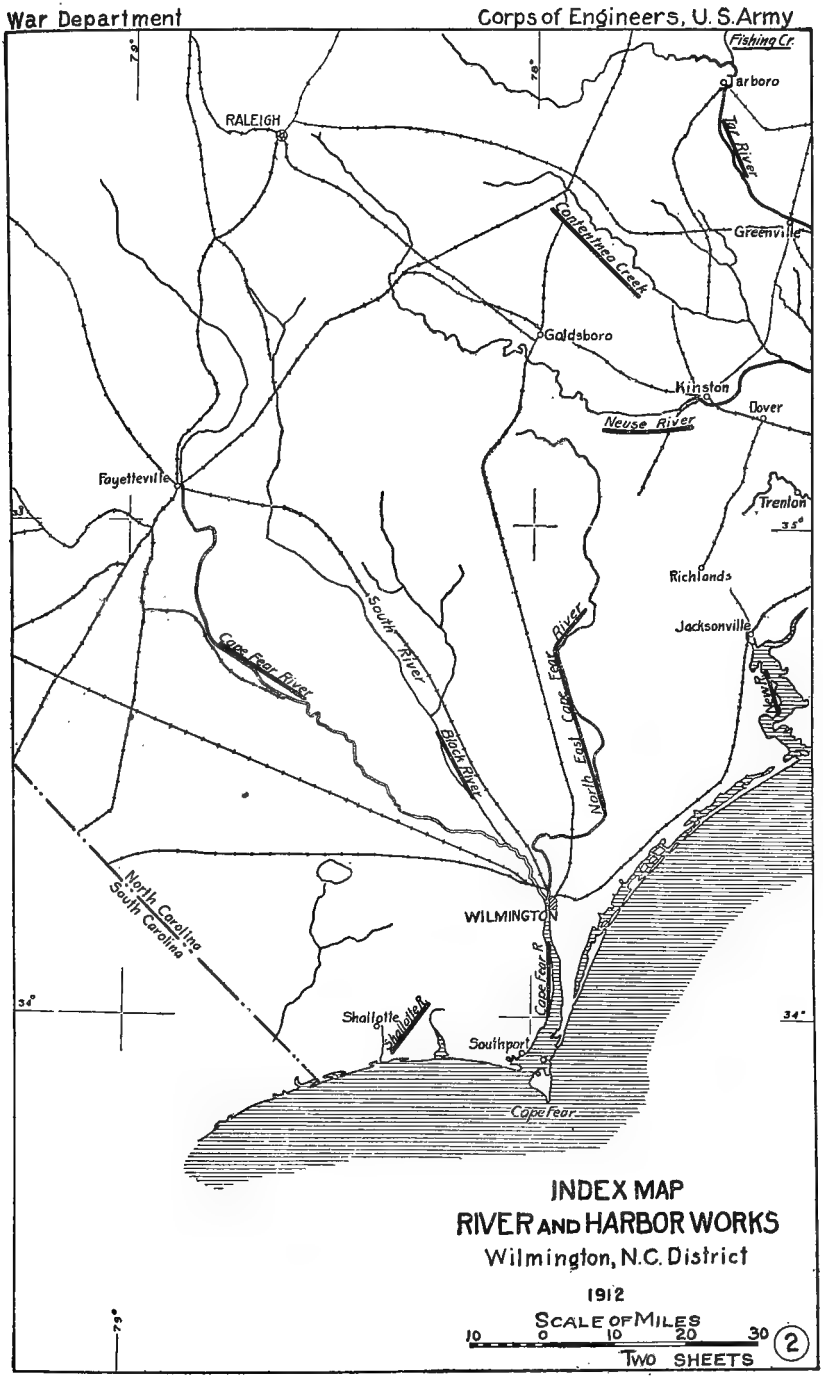
SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, **12,** 421.

RIVER AND HARBOR WORKS—SOUTH ATLANTIC.

M.—WILMINGTON, N. C., DISTRICT.


War Department
Corps of Engineers, U.S.Army
Elizabeth City
Edenton
ALBEMARLE SOUND
Columbia
Scuppernong River
Alligator Riv.
Manteo
Washington
Belhaven
Swanquarter
Swanquarter Deep Bay Canal
PAMLICO RIVER
South Riv.
Aurora
Swift Cr.
PAMLICO SOUND
Cape Hatteras
Hatteras Inlet
Ocracoke Inlet
Vandemere
Bayboro
Bay Riv.
Newbern
Trent R.
Pollocksville
Oriental
Smiths Cr.
Pamlico sound-Beaufort Inlet Canal
Newport
Swansboro
Morehead City
Beaufort
Beaufort Inlet
Cape Lookout
INDEX MAP
RIVER AND HARBOR WORKS
Wilmington, N.C. District
1912
SCALE OF MILES
10 0 10 20 30
TWO SHEETS
1


War Department
Corps of Engineers, U. S. Army
Fishing Cr.
Tarboro
Tar River
RALEIGH
Contentnea Creek
Greenville
Goldsboro
Kinston
Dover
Neuse River
Fayetteville
Trenton
Richlands
Jacksonville
South River
Cape Fear River
Black River
North East Cape Fear River
WILMINGTON
North Carolina
South Carolina
Cape Fear R.
Shallotte
Shallotte R.
Southport
Cape Fear
INDEX MAP
RIVER AND HARBOR WORKS
Wilmington, N.C. District
1912
SCALE OF MILES
10 0 10 20 30
TWO SHEETS
2

M.—WILMINGTON, N. C., DISTRICT.

In charge of U. S. Engineer Office,
Wilmington, N. C.

M 1 Albemarle Sound, N. C.[1]
M 2 Mackays Cr., N. C. (1)[1]
M 3 Bull Bay and Cr., N. C. (1)
M 4 Deep Cr., N. C. (1)
M 5 Bunton Cr., N. C. (1)
M 6 Scuppernong R., N. C. (1)
M 7 Alligator R., N. C. (1)
M 8 Little Alligator R., N. C. (7)
M 9 Second Cr., N. C. (7)
M 10 Goose Cr., N. C. (7)
M 11 The Frying Pan, N. C. (7)
M 12 Swan Cr., N. C. (7)
M 13 Whipping Cr., N. C. (7)
M 14 Milltail Cr., N. C. (7)
M 15 South Lake, N. C. (7)
M 16 East Lake, N. C. (7)
M 17 Tom Manns Cr., N. C. (1)
M 18 Haulover, N. C. (1)
M 19 Peter Mashews Cr., N. C. (1)
(M 23 Croatan Sound, N. C.)
M 20 Roanoke Sound, N. C. (1) (28)
M 21 Dough Cr. (Shallowbag B.), N. C. (20)
M 22 Broad Cr., N. C. (20)
M 23 Croatan Sound, N. C. (1) (28) (See following M 19.)
M 24 Oyster Cr., N. C. (23)
M 25 Baums Cr., N. C. (23)
M 26 Ashbys Cr., N. C. (23)
M 27 Callaghans Cr., N. C. (23)
M 28 Pamlico Sound, N. C. (20) (23)
M 29 Long Shoal R., N. C. (28)
M 30 Far Cr., N. C. (28)
M 31 Middle Cr., N. C. (28)
M 32 Middle Cr. No. 2, N. C. (28)
M 33 Juniper B., N. C. (28)
M 34 Swan Quarter B., N. C. (28)
M 35 Caffee B., N. C. (34)
M 36 Oyster Cr., N. C. (34)
M 37 Waterway connecting Swan Quarter B. with Deep B., N. C. (34)
M 38 Rose B., N. C. (28)
M 39 Deep B., N. C. (38)
M 40 Bells B., N. C. (38)
M 41 Germantown B., N. C. (38)
M 42 Abels B., N. C. (28)
M 43 Pungo R., N. C. (28)
M 44 Fortescues Cr., N. C. (43)
M 45 Slades Cr., N. C. (43)
M 46 Smiths Cr., N. C. (43)
M 47 Broad Cr., N. C. (43)
M 48 Tarkiln Cr., N. C. (43)
M 49 Galloways Cr., N. C. (43)
M 50 Dips Cr., N. C. (43)
M 51 Wilkinsons Cr., N. C. (43)
M 52 Rutmans Cr., N. C. (43)
M 53 Queens Cr., N. C. (43)
M 54 Upper Dips Cr., N. C. (43)
M 55 Crooked Cr., N. C. (43)
M 56 Upper Dowrey Cr., N. C. (43)
M 57 Lower Dowrey Cr., N. C. (43)
M 58 Pantego Cr., N. C. (43)
M 59 Broad Cr., N. C. (58)
M 60 Pungo Cr., N. C. (43)
M 61 Little Cr., N. C. (43)
M 62 Jordans Cr., N. C. (43)
M 63 Tarkiln Cr., N. C. (43)
M 64 Warners Cr., N. C. (43)
M 65 Wrights Cr., N. C. (43)
M 66 Pamlico R. (Tar R. above Washington, N. C.), (28)
(Hatteras Inlet opens from Atlantic Ocean to Pamlico Sound almost opposite Pamlico R. The next opening on the outer barrier, farther south, is Ocracoke Inlet.)
M 67 North Cr., N. C. (66)
M 68 Sinclairs Cr., N. C. (66)
M 69 Mixons Cr., N. C. (66)
M 70 Bath Cr., N. C. (66)
M 71 Back Cr., N. C. (70)
M 72 Duck Cr., N. C. (66)
M 73 Upper Goose Cr., N. C. (66)
M 74 Broad Cr., N. C. (66)
M 75 Runyon Cr., N. C. (66)
M 76 Windmill Cr., N. C. (66)
M 77 Kennedys Cr., N. C. (66)
M 78 Tranters Cr., N. C. (66)
M 79 Grindool Cr. (Grindle Cr.), N. C. (66)
M 80 Broad Cr., N. C. (66)
M 81 Barber Cr., N. C. (66)
M 82 Parker Cr., N. C. (66)
M 83 Bryan Cr., N. C. (66)
M 84 Conetoe Cr., N. C. (66)
M 85 Fishing Cr., N. C. (66)
M 86 Swift Cr., N. C. (66)
M 87 Hardee Cr., N. C. (66)
M 88 Chicod Cr., N. C. (66)
M 89 Bear Cr., N. C. (66)
M 90 Rodman Cr., N. C. (66)
M 91 Chocowinity Cr., N. C. (66)
M 92 Silas Cr., N. C. (66)

* Atlantic Ocean.

[1] Follows after L, 397, p. 414.

M 93 Rices Cr., N. C. (66)
M 94 Calf Cr., N. C. (66)
M 95 Hills Cr., N. C. (66)
M 96 Blounts Cr., N. C. (66)
M 97 Jacks Cr., N. C. (66)
M 98 Nevils Cr., N. C. (66)
M 99 Durhams Cr., N. C. (66)
M 100 Porters Cr., N. C. (99)
M 101 Lees Cr., N. C. (66)
M 102 South Cr., N. C. (66)
M 103 Tooleys Cr., N. C. (102)
M 104 Jacobs Cr., N. C. (102)
M 105 Whitehursts Cr., N. C. (102)
M 106 Baileys Cr., N. C. (102)
M 107 Beaver Dam Cr., N. C. 102)
M 108 Short Cr., N. C. (102)
M 109 Long Cr., N. C. (102)
M 110 Schooner Cr., N. C. (102)
M 111 Bonds Cr., N. C. (102)
M 112 Muddy Cr., N. C. (102)
M 113 Goose Cr., N. C. (66)
M 114 Lower Spring Cr., N. C. (113)
M 115 Modes Cr., N. C. (113)
M 116 Campbells Cr., N. C. (113)
M 117 Upper Spring Cr., N. C. (113)
M 118 Easthams Cr., N. C. (113)
M 119 Dixons Cr., N. C. (113)
M 120 Oyster Cr., N. C. (66)
M 121 James Cr., N. C. (66)
M 122 Middle Prong, N. C. (66)
M 123 Clarks Cr., N. C. (66)
M 124 Mouse H., N. C. (28)
M 125 Big Porpoise B., N. C. (28)
M 126 Little B., N. C. (28)
M 127 Jones B., N. C. (28)
M 128 Drum Cr., N. C. (127)
M 129 Ditch Cr., N. C. (127)
M 130 Bay R., N. C. (28)
M 131 Gales Cr., N. C. (130)
M 132 Deep Cr., N. C. (131)
M 133 Bear Cr., N. C. (130)
M 134 Vandemere Cr., N. C. (130)
M 135 Smiths Cr., N. C. (130)
M 136 Chapel Cr., N. C. (130)
M 137 Racoon Cr., N. C. (130)
M 138 Trent R., N. C. (130)
M 139 Moores Cr., N. C. (130)
M 140 Balls Cr., N. C. (130)
M 141 Cabin Cr., N. C. (130)
M 142 Spring Cr., N. C. (130)
M 143 Swans Cr., N. C. (28)
M 144 Neuse R., N. C. (28)
M 145 Broad Cr., N. C. (144)
M 146 Green Cr., N. C. (145)
M 147 Pitmans Cr., N. C. (145)
M 148 Buxton Cr., N. C. (145)
M 149 Browns Cr., N. C. (145)
M 150 Gittings Cr., N. C. (145)
M 151 Tar Cr., N. C. (145)
M 152 Cedar Cr., N. C. (145)
M 153 Brights Cr., N. C. (144)
M 154 Orchard Cr., N. C. (144)
M 155 Pierces Cr., N. C. (144)
M 156 Whitakers Cr., N. C. (144)
M 157 Smiths Cr., N. C. (144)
M 158 Kershaw Cr., N. C. (157)
M 159 Chapel Cr., N. C. (158)
M 160 Dawsons Cr., N. C. (144)
M 161 Tarkiln Cr., N. C. (160)
M 162 Mill Cr., N. C. (144)
M 163 Mill Cr., No. 2, N. C. (144)
M 164 Beards Cr., N. C. (144)
M 165 Lower Duck Cr., N. C. (144)
M 166 Goose Cr., N. C. (144)
M 167 Upper Broad Cr., N. C. (144)
M 168 Northwest Cr., N. C. (144)
M 169 Duck Cr., N. C. (144)
M 170 Swift Cr., N. C. (144)
M 171 Little Swift Cr., N. C. (170)
M 172 Contentnia Cr., N. C. (144)
M 173 Little Contentnia Cr., N. C. (172)
M 174 Mosleys Cr., N. C. (144)
M 175 Half-moon Cr., N. C. (144)
M 176 Village Cr., N. C. (144)
M 177 Core Cr., N. C. (144)
M 178 Turkey Quarter Cr., N. C. (144)
M 179 Bachelder Cr., N. C. (144)
M 180 Trent R., N. C. (144)
M 181 Lawson Cr., N. C. (180)
M 182 Bridge Cr., N. C. (180)
M 183 Wilson Cr., N. C. (180)
M 184 Hayward Cr., N. C. (180)
M 185 Island Cr., N. C. (180)
M 186 Brice Cr., N. C. (180)
M 187 Otter Cr., N. C. (144)
M 188 Slocums Cr., N. C. (144)
M 189 Andersons Cr., N. C. (188)
M 190 Tuckers Cr., N. C. (188)
M 191 Hancocks Cr., N. C. (144)
M 192 Kahookee Cr., N. C. (191)
M 193 Kings Cr., N. C. (144)
M 194 Clubfoot Cr., N. C. (144)
M 195 Nitchells Cr., N. C. (194)
M 196 Waterway between Newbern and Beaufort, N. C. (194)
M 197 Guldens Cr., N. C. (194)
M 198 Long Cr., N. C. (144)
M 199 Courts Cr., N. C. (144)
M 200 Adams Cr., N. C. (144)
M 201 Godfreys Cr., N. C. (200)
M 202 Delamars Cr., N. C. (200)
M 203 Kellums Cr., N. C. (200)
M 204 Kearneys Cr., N. C. (200)
M 205 Pamlico Sound to Beaufort Inlet (inland waterway), N. C. (200)
M 206 Isaacs Cr., N. C. (200)
M 207 Back Cr., N. C. (200)
M 208 Cedar Cr., N. C. (200)
M 209 Joaquim Cr., N. C. (208)
M 210 Duncan Cr., N. C. (200)
M 211 Sandy Huss Cr., N. C. (200)
M 212 Garbacon Cr., N. C. (144)
M 213 South R., N. C. (144)
M 214 Big Cr., N. C. (213)
M 215 Southwest Cr., N. C. (213)
M 216 Eastmans Cr., N. C. (213)
M 217 Mulberry Cr., N. C. (213)
M 218 Browns Cr., N. C. (144)
M 219 Turnagain B., N. C. (144)
M 220 Pitmans Cr., N. C. (219)
M 221 Cedar B., N. C. (144)
M 222 Rattan B., N. C. (144)
M 223 Cedar Island B., N. C. (28)
M 224 Long B., N. C. (223)

M 225 North B., N. C. (223)
M 226 Core Sound, N. C. (28)
M 227 Oyster Cr., N. C. (226)
M 228 Big Ditch, N. C. (226)
M 229 Hog Island B., N. C. (226)
M 230 Lewis Cr., N. C. (226)
M 231 Thoroughfare B., N. C. (226)
M 232 Clover Cr., N. C. (226)
M 233 Cedar Cr., N. C. (226)
M 234 Nelsons B., N. C. (226)
M 235 Salters Cr., N. C. (234)
M 236 Broad Cr., N. C. (234)
M 237 Lewis Cr., N. C. (234)
M 238 Willis Cr., N. C. (226)
M 239 Huffs Cr., N. C. (226)
M 240 Oyster Cr., N. C. (226)
M 241 Jarretts B., N. C. (226)
M 242 Smyrna Cr., N. C. (241)
M 243 Frowlands Cr., N. C. (241)
M 244 Willistins Cr., N. C. (241)
M 245 Willis Cr., N. C. (241)
M 246 Maddins Cr., N. C. (226)
M 247 Wolferts Cr., N. C. (226)
M 248 Sleepy Cr., N. C. (226)
M 249 Chadwicks Cr., N. C. (226)
M 250 North R., N. C. (226)
M 251 Wards Cr., N. C. (250)
M 252 Leopards Cr., N. C. (251)
M 253 Deep Cr., N. C. (250)
M 254 Turners Cr., N. C. (250)
M 255 Taylors Cr., N. C. (250)
M 256 North R. to Beaufort, N. C. (waterway) (226, 250, 257)
M 257 Beaufort H., N. C. (226)
M 258 Beaufort Inlet, N. C. (*, 226) (opposite M 257)

M 259 Cape Lookout, N. C. (on outer barrier, outside M 258 and 10 miles or so east of it). The next two important openings northward are—
M 260 Ocracoke Inlet, N. C. (See M 66)
M 261 Hatteras Inlet N. C. (See M 66)

Returning to M 257 as a starting point, the list of waterways proceeds as follows:

M 262 Newport R., N. C. (226)
M 263 Town Cr., N. C. (256)
M 264 Russells Cr., N. C. (256)
M 265 Ware Cr., N. C. (256)
M 266 Core Cr., N. C. (256)
M 267 Bells Cr., N. C. (266)
M 268 Inland waterway from Pamlico Sound to Beaufort Inlet, N. C. (266)
M 269 Oyster Cr., N. C. (262)
M 270 Harlowe Cr., N. C. (262)
M 271 Waterway between Newbern and Beaufort, N. C. (270)
M 272 Mill Cr., N. C. (262)
M 273 Deep Cr., N. C. (262)
M 274 Calico Cr., N. C. (262)
M 275 Bogue Sound (just below 257)
M 276 Morehead City, N. C. (275)
M 277 Bogue Inlet, N. C. (275)
M 278 Pelletiers Cr., N. C. (275)
M 279 Spooners Cr., N. C. (275)
M 280 Gales Cr., N. C. (275)
M 281 Broad Cr., N. C. (275)
M 282 Sanders Cr., N. C. (275)
M 283 Goose Cr., N. C. (275)
M 284 Deer Cr., N. C. (275)
M 285 White Oak R., N. C. (275)
M 286 Waterway from New R. to Swansboro, N. C. (275)
M 287 Queens Cr., N. C. (286)
M 288 Saunders Cr., N. C. (286)
M 289 Bear Cr., N. C. (286)
M 290 New R., N. C. (286)
M 291 Traps Cr., N. C. (290)
M 292 Frenchs Cr., N. C. (290)
M 293 Wallace Cr., N. C. (290)
M 294 Northeast Branch, N. C. (290)
M 295 Chaney Cr., N. C. (290)
M 296 Mill Cr., N. C. (290)
M 297 Muddy Cr., N. C. (290)
M 298 Hankins Cr., N. C. (290)
M 299 Three Cr., N. C. (290)
M 300 Halfmoon Cr., N. C. (290)
M 301 Blue Cr., N. C. (290)
M 302 Southwest Branch, N. C. (290)
M 303 Stones Cr., N. C. (290)
M 304 Fullards Cr., N. C. (290)
M 305 Cape Fear R., N. C. (*)
M 306 North East R., N. C. (305)
M 307 Smiths Cr., N. C. (306)
M 308 Island Cr., N. C. (306)
M 309 Harrison Cr., N. C. (306)
M 310 Shelter R., N. C. (306)
M 311 Lillington R., N. C. (306)
M 312 Black R., N. C. (305)
M 313 Moores Cr., N. C. (312)
M 314 Six Runs, N. C. (312)
M 315 Big Cohasie R., N. C. (312)
M 316 South R., N. C. (312)
M 317 Haw R., N. C. (305)
M 318 Deep R., N. C. (305)
M 319 Rockfish Cr., N. C. (305)
M 320 Livingston Cr., N. C. (305)
M 321 Hoods Cr., N. C. (305)
M 322 Indian Cr., N. C. (305)
M 323 Redmond Cr., N. C. (305)
M 324 Brunswick R., N. C. (305)
M 325 Town Cr., N. C. (305)
M 326 Dutchmans Cr., N. C. (305)
M 327 Elizabeth R., N. C. (305)
M 328 Lockwoods Folly R., N. C. (*)
M 329 Shallotte R., N. C. (*)

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*Atlantic Ocean.

M(a) NEWBERN, N. C. (Wilmington, N. C., District.) (Dredge for Neuse River and adjacent waters.)

ENGINEERS.

Chief of Engineers. **R.,** **11,** 382.
In charge. Capt. E. I. Brown, **11,** 350.

OPERATIONS.

1910-11. Specifications for constr. of 2 15″ hydraulic pipe-line dr. prepared in office of Chief of Engineers. 3 bids received; DO. recom. rejection of bids, **11,** 382.

M–2 MACKAYS CREEK, N. C.

APPROPRIATION.

1890, $15,000, **91,** 1340.

COMMERCE.

Not unimportant, **73,** 858.
C. interests, **89,** 1138.

CONTRACTS.

1891. Alabama Dredging & Jetty Co., dr., 26¢ c. y., **91,** 1340.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 74; **73,** 78; **89,** 149; **91,** 155; **92,** 156; **93,** 169; **94,** 155; **95,** 176.

In charge:
Maj. W. P. Craighill, 1872–73. **R.,** **73,** 858.
Capt. W. H. Bixby, 1888–92. **R.,** **89,** 1137; **91,** 1339.
Maj. W. S. Stanton, 1892–94. **R.,** **92,** 1113; **93,** 1357; **94,** 995.
Capt. T. L. Casey, 1895. **R.,** **95,** 1294.

Assistant. G. H. Elliott. **R.,** **73,** 857.

OPERATIONS.

1890-91. Surs. made preparatory to dr. under contract, **91,** 1339.

1891-92. 41,359 c. y. dr., **92,** 1114.
1892-93. 5,851 c. y. dr., and an old wreck removed. Proj. completed. **93,** 1358.

PHYSICAL CHARACTERISTICS.

Described, **73,** 858; **89,** 1137.

PLANS. (See Projects.)

By G. H. Elliott, and concurred in by Maj. Craighill, removal of wreck, and dr. chan. 7′ x 60′, mouth to the 7′ curve in Albemarle Sound; est., $4,290, **73,** 858; increased by Maj. Craighill to $5,000, **73,** 855.

PROJECTS. (See Plans.)

By Capt. Bixby, 1889, creek entrance, excavation of a straight chan. of 9′ x 100′ l. w., mouth of the creek, across the bar, to Albemarle Sound; est., $15,000, **89,** 1139; **91,** 1339.

SURVEYS.

Under the direction of Maj. Craighill by G. H. Elliott, 1872. **R.,** **73,** 854, 857.
Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1137.
Sur. made, 1893, by Maj. Stanton, **94,** 995.
Maps. **91,** 1340.

M–4 DEEP CREEK, N. C.

ENGINEERS.

Chief of Engineers. **R.,** **12,** 463.
In charge:
Capt. E. I. Brown, **12,** 421.
Capt. L. H. Rand, **12,** 421.
Maj. H. W. Stickle, **12,** 421.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, mouth on Albemarle Sound to head of navigation, **12,** 463.

M–6 SCUPPERNONG RIVER, N. C.

APPROPRIATIONS.

1878,	$2,000,	**79,** 92
1879,	2,000,	**79,** 92.
1880,	1,000,	**80,** 833.
1881,	1,000,	**81,** 1001.
1884,	2,000,	**84,** 1035.
1902,	10,000,	**03,** 1092.
1905,	5,000,	**05,** 1202.
1907,	2,000,	**07,** 1222.
1909,	2,500,	**09,** 1274.
1910,	2,500,	**10,** 1400.
1912,	2,000,	**12,** 1734.

Total, 32,000 (incl. misc., $32,250, **12,** 1734).

COMMERCE.

C. interests of the adjacent country, **79,** 699
1895 it was roughly est. that 5,000,000′ of lumber in logs, 1,500,000′ of manufactured lumber, and about 5,200,000 shingles were shipped down the R., and about 800 t. of fertilizers and merchandise shipped up. The local engineer of opinion, 1895, that because of certain conditions the stream was not worthy of imp., **95,** 1364, 1365.
Description, **95,** 1365; **01,** 1543.
Considerable, and increasing, but handicapped by lack of water, **01,** 1544.
Decrease largely due to completion of Norfolk & Southern Ry. to Columbia, and to discontinuance of SS. line between Columbia and Edenton, **09,** 290.
1911, 37,658 t., **12,** 422.
Reduction in rates to Columbia and other points on stream, **12,** 422.

CONTRACT.

Bid received but rejected, **79,** 699.

ENGINEERS.

Chief of Engineers. **R.,** **79,** 92; **80,** 121; **81,** 162; **82,** 157; **83,** 164; **84,** 167; **85,** 163; **86,** 158; **95,** 191; **00,** 277; **01,** 309, 1541; **02,** 226; **03,** 229; **04,** 228; **05,** 235; **06,** 252; **07,** 263; **08,** 280; **09,** 289; **10,** 329; **11,** 350; **12,** 421.

In charge:
Capt. C. B. Phillips, 1878–81. **R., 79,** 698; **80,** 831.
Capt. J. Mercur, 1881–84. **R., 81,** 1000; **82,** 1083; **83,** 848.
Capt. F. A. Hinman, 1884–86. **R., 84,** 1035; **85,** 1044; **86,** 969.
Maj. W. S. Stanton, 1892–95. **R., 95,** 1360.
Capt. E. W. Van C. Lucas, 1901. **R., 01,** 1541, 1543.
Capt. E. E. Winslow, 1903. **R., 03,** 1091.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1476; **05,** 1201; **06,** 1143.
Capt. E. I. Brown, 1907–11. **R., 07,** 1222; **08,** 1277; **09,** 1273; **10,** 1400; **11,** 1513.
Maj. H. W. Stickle, 1912–. **R., 12,** 1733.

Assistant. Lt. E. W. Van C. Lucas. **R., 95,** 1363.

OPERATIONS.

1879–80. 206 logs and stumps removed; 4,380 c. y. dr. from the bar, **80,** 832.
1880–81. 1,800 c. y. dr. at the "Devil's Elbow," **81,** 1000.
1881–82. Cut-off commenced through "Rattlesnake Bend," **82,** 1083.
1884–85. Completion of imp. recommenced, **85,** 1044.
1885–86. Cut-off No. 4 excavated to 9′ x 136′ x 40′; the "Thoroughfare" and Cut-off No. 3 w.; 8 points rounded off; turning-basin at head of navigation enlarged; shoal at mouth of Collins Canal removed; all dr. to 9′ l. w., **86,** 969.
1902–03. 32,751 c. y. dr., **03,** 1091.
1906–07. 24,727 c. y. dr., **07,** 1222.
1909–10. 42,687 c. y. dr., **10,** 1400.

PHYSICAL CHARACTERISTICS.

Sharp bends and sunken stumps obstr. navigation, **79,** 699.
The stream situated in the peninsula between Albemarle and Pamlico Sounds, **95,** 1361.
Description of, **95,** 1361; **01,** 1541.
Nontidal, no slope, variations of w. l. controlled by winds, **03,** 229.
Some shoaling has occurred, **12,** 422.

PROJECTS.

Capt. Phillips, 1879, imp. by formation of chan. 9′ x 80′ at ordinary stage by dr., cutting off projecting points at bends, and removal of stumps, snags, and similar obstr.; est., $8,000, **79,** 698, 699.
By Capt. Lucas, 1900, dr. chan. 9′ x 150′ across bar at mouth; est., $14,000 if by U. S. plant, $30,000 by contract,[1] **01,** 1544. Au. act June 13, 1902, work to be done by U. S. plant, **02,** 226.

SURVEY.

1878. Ex. by Capt. Phillips, **79,** 698.
Ex. au. act Aug. 17, 1894; made, 1895, by Maj. Stanton (**R.** unfav.), **95,** 1361.
Au. act June 6, 1900; made, 1900, by Capt. Lucas,[1] **01,** 1541.
Pre. ex. and sur. au. act June 25, 1910, of Scuppernong R. to the town of Cherry, N. C., **12,** 463.
Maps. Upper portion, **86,** 969; **12,** 1734.

M–7 ALLIGATOR RIVER, N. C.

COMMERCE.

Greater part carried in a SS. of 105 t., making 2 round trips during the week, except for a short time in the summer, during which time it makes but 1 trip, **95,** 1387.

ENGINEERS.

Chief of Engineers. **R., 84,** 177; **87,** 123; **95,** 192.

In charge:
Capt. J. Mercur, 1884–87. **R., 84,** 1059; **87,** 992.
Capt. F. A. Hinman, 1887. **R., 87,** 991.
Maj. W. S. Stanton, 1892–95. **R., 95,** 1384.

Assistant. Lt. E. W. Van C. Lucas. **R., 95,** 1385.

PHYSICAL CHARACTERISTICS.

Description of; stream rises in Hyde Co., flows ne. to Albemarle Sound, entering it about opposite the mouth of Pasquotank R., **95,** 1386.

PROJECT.

In 1895 Maj. Stanton est. beneficial imp. could be made for $6,000, **95,** 1385.

SURVEYS.

Ex. au. acts Aug. 2, 1882, and Aug. 5, 1886; made by Capt. Mercur, 1882 (**R.** unfav.), **84,** 1059, and Capt. Hinman, 1886 (**R.** unfav.), **87,** 991.
Sur. au. act Aug. 17, 1894; made by Maj. Stanton, 1894 (see Projects), **95,** 1384.

M–21 SHALLOWBAG (MANTEO) BAY, N. C.

APPROPRIATIONS.

1910,	$13,750,	**10,** 1410.
1912,	1,000,	**12,** 1735.
Total,	14,750	

CONTRACTS.

1910. Miner Engineering Co., dr. 40,000 c. y., 25¢ c. y., p. m., **11,** 1515.

ENGINEERS.

Chief of Engineers. **R., 08,** 306; **10,** 330; **11,** 352; **12,** 422.

In charge:
Capt. E. I. Brown, 1910–11. **R., 10,** 1401; **11,** 1515.
Maj. H. W. Stickle, 1912–. **R., 12,** 1735.

OPERATIONS.

1911–12. 18,576 c. y removed from section and 15,837 c. y. from 1′ outside; 559 hours spent in removing logs, snags, etc. Proj. completed, **12,** 1735.

PHYSICAL CHARACTERISTICS.

Description of; town of Manteo is at head of B., about 2 m. from entrance B. trib. to Roanoke Sound on ne. of Roanoke Isld., **10,** 330.

PROJECT.

By Capt. Brown, 1908, chan. 6′ x 100′ from entrance to wharves at Manteo; est., $13,750, and $2,000 an. mainten.,[2] **08,** 306; adopted by act June 25, 1910, **10,** 330.

SURVEY.

Au. act Mar. 2, 1907; made, 1907–08, by Capt. Brown,[2] **08,** 306.
Maps.[2] **12,** 1734.

[1] H. D. 131, 56th, 2d.

[2] H. D. 906, 60th, 1st.

M-22(a) NAGS HEAD, N. C.

(See p. 440.)

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 70, 421; **71,** 77.
In charge. Col. J. H. Simpson, 1871. **R., 71,** 655.

PHYSICAL CHARACTERISTICS.

Description of; there was formerly an inlet at Nags Head, which is 9 m. above Oregon Inlet, through to ocean, **71,** 657.

PROJECTS.

Discussion of previous plans and proj., **71,** 655.

SURVEYS.

Ex. for reopening of Roanoke Inlet au. act July 11, 1870; made, 1870, by Col. Simpson (**R.** unfav.), **71,** 655.

M-22(b) ALBEMARLE SOUND, N. C., AND ATLANTIC OCEAN. (Communication between.)[1] (Croatan Sound.)

(See p. 440.)

APPROPRIATIONS.

1843,	$15,000, act Mar. 1.
1852,	50,000, act Aug. 30.
Total,	65,000

ENGINEERS.

Chief of Engineers. **R., 66,** 7.

SURVEYS.

R., Feb. 12, 1829 (est., $327,734.10).
Au. Mar. 1, 1843, the expenses to be paid from an app. of $15,000 for sur. relating to the military defenses of the frontier, inland, and Atlantic; est. $2,083,037.77.[1]

M-28(a) PAMLICO SOUND, N. C.

Swash near Ocracoke Inlet: Sur.—**R.** Dec. 20, 1827; est. $15,958 and $43,257. (H. D. 482, 55th, 2d.)

M-28(b) PAMLICO SOUND (Old-House Channel), N. C.

ENGINEERS.

Chief of Engineers. **R., 73,** 79; **74,** 89.
In charge. Maj. W. P. Craighill, 1873. **R., 74,** ii, 84.
Assistant. G. H. Elliott. **R., 74,** ii, 85.

PHYSICAL CHARACTERISTICS.

Obstructed by a shifting sand bulkhead, and connected with the ocean by Oregon Inlet, which is constantly shifting its location, **74,** ii, 84.

SURVEY.

Under direction of Maj. Craighill, ex. by G. H. Elliott, 1873. **R.** (unfav.), **74,** ii, 84, 85.

M-37 SWAN QUARTER BAY AND DEEP BAY, N. C. (Waterway connecting.)

APPROPRIATIONS.

1910, $14,575, **10,** 1403.

COMMERCE.

In 1911, 3,752 t., **12,** 425.
Imp. renders navigation safer, **12,** 425.

CONTRACTS.

1910. Miner Engineering Co., dr. 53,000 c. y., 19½¢ c. y., **11,** 1518.

ENGINEERS.

Chief of Engineers. **R., 08,** 306; **10,** 332; **11,** 353; **12,** 425.

In charge:
Capt. E. I. Brown, 1910–11. **R., 10,** 1403; **11,** 1517.
Maj. H. W. Stickle, 1912–. **R., 12,** 1738.

OPERATIONS.

1910–11. 29,377.4 c. y. removed from prescribed cross sections, and 5,769.3 c. y. from 1′ outside, completing proj. and securing chan. 5,500′ x 50′ x 6′, **11,** 1518.

PHYSICAL CHARACTERISTICS.

Imp. has shortened distance to points on Pamlico and Pungo Rs. about 5 m., **12,** 425.

PROJECT.

By Capt. Brown, 1907, dr. chan. 6′ x 50′ x 5,500′; est., $14,575, and $900 an. for mainten.,[1] **08,** 306; au. act June 25, 1910, **10,** 332.

SURVEY.

Au. act Mar. 2, 1907; made, 1907, by Capt. Brown,[2] **08,** 306.

[1] H. D. 482, 55th, 2d.

[2] H. D. 445, 60th, 1st.

M–43(a) PUNGO RIVER TO SLADESVILLE, N. C. (Waterway.)

ENGINEERS.

Chief of Engineers. **R., 91,** 170, 1418.
In charge. Capt. W. H. Bixby, 1890. **R., 91,** 1418.
Assistant. Lt. M. M. Patrick. **R., 91,** 1420.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1418.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Bixby (**R.** unfav.), **91,** 1418.

M–45 SLADES CREEK, N. C.

ENGINEERS.

Chief of Engineers. **R., 12,** 463.

In charge:
Capt. E. I. Brown, **12,** 421.
Maj. H. W. Stickle, **12,** 421.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come) **12,** 463.

M–58(a) BELHAVEN, N. C.

ENGINEERS.

Chief of Engineers. **R., 12,** 463.

In charge:
Capt. E. I. Brown, 1912. **12,** 421.
Capt. L. H. Rand, 1912. **12,** 421.
Maj. H. W. Stickle, 1912. **12,** 421.

SURVEY.

Ex. and sur. au. act June 25, 1910, of H. and entrance thereto, **12,** 463.

M–66 PAMLICO RIVER,[1] N. C.

Part.	Title.	Period.	Appropriations.
a	Pamlico R., N. C.	1836–1879	$82,000
b	Tar R., N. C.	1878–1879	3,000
c	Pamlico and Tar R.	1880–1912	267,063
d	Washington, N. C.	1852–1873	5,000
e	Tar R.—Tarboro to Rocky Mount. N. C.	1889–1889	.....
	Total	.....	303,063

Total in **12,** 1740, gives in addition $297.75 received from sales, etc.

Part(a), M–66 Pamlico River, N. C.

APPROPRIATIONS.

1836, $5,000, act July 4.
1838, 5,000, act July 7.
1876, 15,000, **77,** 66.
1879, 3,000, **79,** 93.

Total, 28,000

COMMERCE.

Obstr. placed in chan. by rebels, **73,** 856; **76,** 362.
Important, **79,** 652.

CONTRACTS.

1877. G. H. Ferris, dr., 15¢ c. y. Swindell & Sparrow, removing piles, **77,** 366.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **72,** 74; **73,** 78; **76,** 69; **77,** 66; **78,** 75; **79,** 92.

In charge:
Maj. W. P. Craighill, 1872–73. **R., 73,** 854.
S. T. Abert, U. S. C. E., 1876–79. **R., 76,** 361; **77,** 366; **78,** 540; **79,** 649.

Assistant. G. H. Elliott. **R., 73,** 855.

ESTIMATES. (See Projects.)

By G. H. Elliott, removing obstr., building dikes, and dr.. $35,000, **73,** 855, 856; **76,** 362.

OPERATIONS.

1877–78. 895 piles and 312 tree stumps removed; also dr. in the chan., **78,** 540; **79,** 651.

PHYSICAL CHARACTERISTICS.

Description of site, **73,** 855; **76,** 362.
Formation of shoals, etc., **73,** 856; **76,** 362.
Tides, **76,** 362.

[1] Called Tar R. above Washington.

PROJECTS. (See Estimates.)

By S. T. Abert, U. S. C. E., dr., and removal of piles and obstr.; est., $28,050, **76,** 363.

SURVEYS.

By G. H. Elliott, 1872. **R., 73,** 855.

Under direction of S. T. Abert, U. S. C. E., 1875, **76,** 361; 1878, **78,** 75, 540.

Part (b), M–66 Tar River, N. C.

APPROPRIATION.

1879, $3,000, **79,** 92, 700.

COMMERCE.

Requirements, **79,** 701.

ENGINEERS.

Chief of Engineers. **R., 78,** 76; **79,** 92, 95.

In charge. Capt. C. B. Phillips, 1878; **78,** 76. **R., 79,** 700.

Assistant. W. G. Williamson. **R., 79,** 701.

ESTIMATES. (See Projects.)

By W. G. Williamson, 1878, removing obstr. that impede navigation, without dr. or constr. of js. or other works, $7,500, **79,** 703. Increased by Capt. Phillips, 1879, to $10 000, **79,** 92, 700.

By Capt. Phillips, 1879, completion of existing proj., $7,000, **79,** 700.

PHYSICAL CHARACTERISTICS.

General description, **79,** 700, 702.

PROJECTS.

By W. G. Williamson, 1879, removing snags, trees, piles, wrecks, etc., without dr. or building js. or dikes, **79,** 700, 702.

SURVEY.

By W. G. Williamson, 1878, under direction of Capt. Phillips. **R., 79,** 700, 701.

Part (c), M–66 Pamlico and Tar Rivers, N. C.[1]

APPROPRIATIONS.

1880,	$9,000,	**80,** 838.
1881,	8,000,	**81,** 1002.
1882,	10,000,	**82,** 1084.
1884,	5,000,	**84,** 1036.
1886,	5,000,	**86,** 967.
1888,	10,000,	**88,** 856.
1890,	10,000.	**90,** 1114.
1892,	10,000,	**92,** 1120.
1894,	10,000,	**95,** 1313.
1896,	5,000,	**96,** 1102.
1899,	15,000,	**99,** 1491.
1902,	35,500,	**02,** 1132.
1905,	8,000,	**05,** 1205.
1907,	11,563,	**07,** 1225.
1909,	*5,000,	**09,** 1276.
1910,	5,000,	**10,** 1404.
1911,	5,000,	**11,** 1520.
1912,	100,000,	**12,** 1740.
Total,	267,063	

COMMERCE.

Increase in shipments, **83,** 850.

Development of, under imp., **88,** 857; **89,** 1045.

Lowering of rates consequent upon imp., **91,** 1348.

List of SS. and statistics of freight transported, 1892, **92,** 1123.

Of the 4 SS. that used to ply between Washington and Tarboro only 2 were in service, 1892–93, **93,** 1383. Mainten. of a chan. permitting draft of 4′ at ordinary l. w. up to Greenville would facilitate the transportation of freight in that part of the R., and the mainten. of a clear chan. up to Tarboro would serve in keeping down rates by rail, **93,** 1383.

Description of, **94,** 1020; **95,** 1313; **00,** 1799.

About 80% of C. comes through the Albemarle & Chesapeake Canal, which limits draft of vessels to 7′, **97,** 1426.

Probable decrease, 1909, **10,** 333.

1911, 339,522 t., **12,** 428.

ENGINEERS.

Chief of Engineers. **R., 80,** 123; **81,** 162; **82,** 158; **83,** 164; **84,** 168; **85,** 161; **86,** 156; **87,** 123; **88,** 117; **89,** 136; **90,** 122; **91,** 157; **92,** 158; **93,** 171; **94,** 156; **95,** 179,191; **96,** 161; **97,** 201, 212; **98,** 203; **99,** 234; **00,** 267; **01,** 301; **02,** 228; **03,** 231; **04,** 231; **05,** 237; **06,** 254; **07,** 265, 288; **08,** 283; **09,** 291; **10,** 332, 361; **11,** 354, 383; **12,** 426.

In charge:

Capt. C. B. Phillips, 1880–81. **R., 80,** 836, 838.

Capt. J. Mercur, 1881–84. **R., 81,** 1001; **82,** 1083; **83,** 848.

Capt. F. A. Hinman, 1884–86. **R., 84,** 1036; **85,** 1041; **86,** 966.

Capt. W. H. Bixby, 1886–92. **R., 87,** 1010; **88,** 854; **89,** 1044, 2796; **90,** 1112; **91,** 1347.

Maj. W. S. Stanton, 1892–95. **R., 92,** 1118; **93,** 1380; **94,** 1019; **95,** 1312, 1365.

Lt. Col. D. P. Heap, 1896. **R., 96,** 1101.

Capt. W. E. Craighill, 1897–98. **R., 97,** 1388, 1425; **98,** 1240.

Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1490; **00,** 1798; **01,** 1487; **02,** 1131.

Capt. E. E. Winslow, 1903. **R., 03,** 1094.

Capt. R. P. Johnston, 1904–06. **R., 04,** 1479; **05,** 1204; **06,** 1146.

Capt. E. I. Brown, 1907–11. **R., 07,** 1224; **08,** 1280; **09,** 1275; **10,** 1403; **11,** 1519.

Maj. H. W. Stickle, 1912–. **R., 12,** 1739.

Assistants:

W. H. James. **R., 80,** 837.

J. P. Darling. **R., 81,** 1002; **82,** 1084; **83,** 849; **84,** 1036.

E. D. Thompson. **R., 87,** 1012.

J. D. Whitford. **R., 88,** 856.

R. Ransom. **R., 89,** 1046; **90,** 1114; **91,** 1349.

W. H. Chadbourn, jr. **R., 92,** 1121; **96,** 1102.

S. F. Burbank. **R., 97,** 1426.

OBSTRUCTIONS.

Bridges obstr. Upper Pamlico R., **89,** 2796.

OPERATIONS.

1879–80. Chan. 9′ x 70′ formed through Stumpy Shoal by removing snags and logs, **80,** 836.

1880–81. 1,197 stumps and 2,235 c. y. of material removed from the dr. chan. in the Pamlico; 22 pile and brush js. aggregating 3,233 l. f. built in Tar R.; also 3,088 stumps and snags removed from same locality, **81,** 1001.

1881–82. 6,503 c. y. dr. and 1,215 stumps removed from the Pamlico; 12 js. aggregating 1,436 l. f. built in the Tar R., **82,** 1084.

*Allotment.

[1] The Pamlico and Tar Rs. are different portions of a single stream, the upper portion being called the Tar.

1882-83. Logs and stumps removed from Tar R.; 160 l. f. of j. built at Red Bank on the Pamlico; working plant repaired, **83,** 848, 849.

1883-84. 1,855 l. f. of j. built on Tar R.; 1,224 logs, stumps, trees, and snags removed, **84,** 1037.

1884-85. 1,373 logs, stumps, and snags, 5 pile brs., and 149 trees removed from Tar R., **85,** 1041.

1885-86. 681 logs, trees, snags, and similar obstrs. removed from Tar R., **86,** 966.

1886-87. 2,923 logs, snags, stumps, and j. piles removed from the R. chan., 700 trees cut, and 2 flatboat wrecks removed, and 145 cords brush cut from banks, **87,** 1011.

1887-88. 355 logs, snags, and stumps, 122 j. piles, and 45 cords of brush and small snags removed, clearing a chan. 2.5′ x 60′ x 5 m., **88,** 855.

1888-89. 2,480 trees, logs, and stumps and 16 cords of snags removed from the R., and 1,270 trees and logs and 202 cords brush removed from the banks, **89,** 1045.

1890-91. Repairs to plant, **91,** 1349.

1891-92. 4,548 snags and logs and 40 cords of small snags cleared from the chan., and 4,202 trees and 623 cords brush cut on the banks, **92,** 1121.

1892-93. 146 logs, 82 trees, 836 stumps, 127 snags removed from the chan., and 12 logs and 157 overhanging trees removed from the banks, **93,** 1381.

1893-94. 167 stumps, 9 logs, and 2 snags removed from the chan., **94,** 1019. Dike 653′ l. built at Red Bank shoal of piles, 5 and 8′ apart, **94,** 1020.

1895-96. 306 logs, 1,077 snags, 367 trees, and 382 stumps removed from the chan., and 323 trees removed, 6 trees trimmed, 26 logs, 85 snags, 22 stumps, and 10 trees rolled back on the banks; minor repairs made to the j. at Red Bank, **96,** 1101.

1896-97. 653 snags, 20 logs, 90 stumps, and 188 trees removed from the chan., and 109 trees hauled back and 1 cord of brush cut on the banks, **97,** 1388.

1897-98. 1,575 snags, 86 logs, 328 stumps, 539 trees, 32 cords small snags removed from the chan., and 201 trees hauled back, 52 trees trimmed, and 14 cords brush cut on the banks, **98,** 1240.

1898-99. 348 snags, 46 logs, 68 stumps, 93 trees removed from the chan., and 99 trees hauled back, 10 trees trimmed, and 4 cords of brush cut, **99,** 1490.

1899-00. 167 snags, 115 logs, 134 stumps, 35 trees, and 16,339 c. y. of material removed from chan. and abandoned pier partly removed, **00,** 1798, 1799.

1900-01. 3,023 c. y. dr., 124 snags, etc., removed from chan., and 52 trees from banks, **01,** 1487.

1902-03. 2,168 c. y. dr., 520 snags and other obstr. and 6¾ cords small snags removed from chan., and 149 trees and 4¾ cords brush cut, and 2 trees trimmed, on banks, **03,** 1095.

1903-04. 597 snags, logs, stumps, etc., removed from chan., 10 trees from bank, and 62,048 c. y. dr., **04,** 1479.

1904-05. 84,502 c. y. dr., 649 snags, etc., removed from chan., and 54 trees and 8¼ cords brush from banks, **05,** 1204.

1905-06. 349 snags and other obstr. removed from chan. and 78 trees and 1½ cords brush from banks; 1,919 c. y. dr., **06,** 1146.

1906-07. 129,307 c. y. dr., and 309 logs and stumps removed, **07,** 1224.

1907-08. 58,019 c. y. dr., and 184 logs and stumps removed, **08,** 1280.

1908-09. 139 snags and other obstr. and 3 cords small snags and brush removed from chan. and 34 trees and 2½ cords brush from banks, **09,** 1275.

1909-10. 593 snags and other obstr., 1¼ cords small snags and 1 wreck removed from chan. and 1 cord brush and 52 trees from bank, **10,** 1403.

1910-11. 515 snags, stumps, logs, etc., removed from chan.; 5½ cords brush, etc., and 2 old scows hauled out; 137 trees hauled back; 3 cords brush cut, **11,** 1519.

1911-12. 4,078 c. y. dr. by snag boat *Trent;* 702 snags and other obstr. removed from chan., and 337 trees, 5½ cords brush removed from banks, and 8 trees trimmed, **12,** 1739.

PHYSICAL CHARACTERISTICS.

Orig. condition of the Rs., **88,** 854.

Water gauge record for 1892, **93,** 1384; for 1893, and mean of water-gauge readings, **95,** 1312.

List of shoals between Washington and Tarboro, **93,** 1382.

By clearing the chan. of snags from Tarboro to Rocky Mount the water is lost for feeding the chan. at the shoals below Tarboro during the receding and lower stages, so that the mainten. of 40 m. of clear chan. above Tarboro, used to a limited degree for only 3 m., is detrimental to navigation up to that town, **93,** 1383.

Wind effects, **95,** 1312.

Nontidal w. l. in lower portion effected only by winds, and in upper portion by freshets, **05,** 238.

Stream in good condition, **12,** 1740.

PROJECTS.

Previous to 1880 the Pamlico and Tar Rs. were under separate app.; aggregate, $31,000, **80,** 838.

Proj. for imp. proposes removal of obstr. in both Rs. and w., d., and straightening of the Pamlico to Washington to obtain 9′ l.-w. chan., thence a 3′ chan. to Greenville, and thence 20″ to Tarboro; est., $75,000, **76,** 363; **79,** 700, 702; **87,** 1010.

These 2 Rs. have been considered by Congress separately prior to 1880, but jointly ever since then. The orig. proj. of 1876 (for the Pamlico) and of 1879 and 1889 (for the Tar), as since slightly modified and continued to date, proposed to secure a clear and safe chan. 9′ d. l. w. up to Washington; thence a chan. 3′ x 60′ l. w. for 23 m. farther to Greenville; thence chan. 20″ x 60′ l. w. for 26 m. farther to Tarboro and Rocky Mount Little Falls. Total final cost of this work est., 1889, $92,200, **90,** 1112.

In 1897 Lt. Col. Heap est. cost of chan. 10′ x 200′ m. l. w. would be $156,040.28, **97,** 1425; but recom. chan. 9′ x 100′ m. l. w.; est., $39,202, **97,** 1426.

By Maj. Kuhn, 1906, increasing proj. d. between Washington and Greenville from 3′ to 4′; est., $3,800, and $1,000 an. mainten.,[1] **07,** 266, 288; **08,** 283.

Act July 25, 1912, modified proj. to secure available chan. of 10′ x 200′ up to Washington, and 6′ x 75′, thence to Greenville; est., $94,050, and $3,500 an. mainten.,[2] **12,** 427.

SURVEYS.

Sur. of all the shoals between Washington and Tarboro made by Maj. Stanton, 1892–93, **93,** 1382.

Ex. of Tar R. with a view to 3′ au. act Aug. 17, 1894 report, showing that that d. already existed made by Maj. Stanton, 1894, **95,** 1365.

Ex. of chan. below Washington made, 1896, by Lt. Col. Heap, **96,** 1101.

Sur. of the Pamlico R. with a view to 10′ up to Washington, and necessary imp. in H. of Washington au. act June 3, 1896; made, 1897, by Lt. Col. Heap (see Projects), **97,** 1425.

Ex. and sur. au. act Mar. 3, 1905. **R.** by Capt. Johnston and Maj. Kuhn, resp.,[1] **07,** 288.

Of shoals below Greenville, **09,** 1275.

Au. act Mar. 3, 1909, with view to obtaining greater d. and w. up to Tarboro, **10,** 361; **11,** 383. **R.** by Capt. Brown, 1909 and 1910; est., $94,050, and $3,500 an. mainten.,[2] **12,** 462.

Ex. and sur. au. act Feb. 27, 1911, of Pamlico R., with view to imp. inner chan., **12,** 463.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 427.

Maps.[2] **80,** 836; Tar R., **87,** 1012; **90,** 1114; **91,** 1348; **92,** Atlas, 22; **93,** 1384; **94,** 1020; **00,** 1800.

[1] H. D. 342, 59th, 2d.

[2] H. D. 270, 62d, 2d.

Part (d), M–66 Washington Harbor, N. C.

APPROPRIATION.

1852, $5,000, act Aug. 30.

ENGINEERS.

Chief of Engineers. **R., 72,** 74; **73,** 78, 79, **91,** 170.

In charge:
Maj. W. P. Craighill, 1872. **R., 73,** 854.
Capt. W. H. Bixby, 1890. **R., 91,** 1429, 1433.

Assistants:
G. H. Elliott. **R., 73,** 855.
Lt. M. M. Patrick. **R., 91,** 1431.

ESTIMATES. (See Plans.)

By G. H. Elliott, 1872, 9′ chan. by dr., dikes, removal of piles and other obstr., $35,000, **73,** 79, 855, 856.

PHYSICAL CHARACTERISTICS.

General description, **73,** 855, 856, **91,** 1429.

PLANS.

By Capt. Bixby, 1890, excavating chan. 9′ x 200′ into Washington H.; est., $45,000, **91,** 1434.

SURVEYS.

By G. H. Elliott, 1872, under direction of Maj. Craighill. **R., 73,** 854, 855, 859. Resur. au. act Mar. 3, 1873, **73,** 127.

Ex au. act Sept. 19, 1890; made, 1890, by Capt. Bixby (see Projects), **91,** 1429.

Part (e), M–66 Tar River (from Tarboro to Rocky Mount), N. C.

COMMERCE.

Reduction in freight charges due to imp., **89,** 1131.

ENGINEERS.

Chief of Engineers. **R., 89,** 148.
In charge. Capt. W. H. Bixby, 1888. **R., 89,** 1130.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1130.

PLANS.

By Capt. Bixby, 1889, removing snags and similar obstr. from Tarboro up to Rocky Mount Little Falls; est., $16,200, **89,** 1131.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1130.

M–70 TOWN (Bath) CREEK, BEAUFORT COUNTY, N. C.

ENGINEERS.

Chief of Engineers. **R., 84,** 177.
In charge. Capt. J. Mercur, 1883–84. **R., 84,** 1063.

PHYSICAL CHARACTERISTICS.

Description of. Empties into Pamlico R., 16 m. below Washington, **84,** 1063.

SURVEY.

Au. act Aug. 2, 1882; made, 1883, by Capt. Mercur (**R.** unfav.), **84,** 1063.

M–85 FISHING CREEK, N. C.

APPROPRIATIONS.

1890,	$10,000,	**91,** 1346.
1892,	5,000,	**92,** 1118.
1899,	7,750,	**99,** 1489.
1902,	2,000,	**02,** 1130.
1905,	500,	**05,** 1203.
1910,	1,500,	**10,** 1402.
1912,	1,500,	**12,** 1737.
Total,	28,250	

COMMERCE.

R. affords only outlet, except by wagons, **06,** 253.
1911, 1,729 t.; increase of 1,489 t. over 1910, **12,** 424.

ENGINEERS.

Chief of Engineers. **R., 89,** 149; **90,** 133; **91,** 156; **92,** 157; **93,** 170; **94,** 156; **95,** 178; **96,** 161; **97,** 200; **98,** 202; **99,** 234; **00,** 266; **01,** 300; **02,** 227; **03,** 230; **04,** 230; **05,** 236; **06,** 253; **07,** 264; **08,** 282; **09,** 290; **10,** 331; **11,** 352; **12,** 423, 462.

In charge:
Capt. W. H. Bixby, 1888–92. **R., 90,** 1179, 1181; **91,** 1345.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1117; **93,** 1377; **94,** 1018; **95,** 1311.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1100.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1387; **98,** 1239.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1489; **00,** 1796; **01,** 1485; **02,** 1130.
Capt. E. E. Winslow, 1903. **R., 03,** 1093.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1477; **05,** 1203; **06,** 1145.
Capt. E. I. Brown, 1907–11. **R., 07,** 1223; **08,** 1279; **09,** 1274; **10,** 1402; **11,** 1516.
Maj. H. W. Stickle, 1912–. **R., 12,** 1737.

OBSTRUCTIONS.

Brs. obstr. navigation, **91,** 1346.
1895–96, all (8) brs. below Wilmington & Weldon RR. br. were unreasonable obstr. to navigation; alterations completed, 1896, **96,** 1100; **97,** 1387.

OPERATIONS.

1890–91. Postponed pending alteration of brs., **91,** 1345; **92,** 1117.
1896–97. 4,085 large snags, 456 stumps, 256 logs, 1,044 trees, and 50 cords of small snags removed, 634 trees hauled back, 178 trees trimmed, and 117 cords of brush cut from the banks, **97,** 1387.

1897-98. 6,653 large snags, 346 stumps, 560 trees, and 45 cords of small snags removed; and 623 trees hauled back, 91 trees trimmed, and 134 cords of brush cut on the banks, **98,** 1239.

1898-99. 2,096 large snags, 198 stumps, 330 trees, 55 logs, and 10 cords small snags removed; 260 trees and 8 stumps hauled back, 44 trees trimmed, and 64 cords of brush cut from bank, **99,** 1489.

1899-00. 31 logs, 3,386 snags, 275 stumps, and 948 trees removed; 81 cords brush and 456 trees from the banks, and 65 trees trimmed, **00,** 1797.

1900-01. 1,397 obstr. removed; 32 trees from banks, **01,** 1485.

1902-03. 313 snags and other obstr. removed; 212 from banks, **03,** 1093.

1904-05. 87 snags, etc., removed; 9 trees and 1 cord brush from banks, **05,** 1203.

1905-06. 62 snags and other obstr. removed; 2 trees from banks, **06,** 1145.

1908-09. 57 snags and other obstr. and ½ cord brush removed; 15 trees and 1¾ cords brush from banks, **09,** 1274.

1910-11. U. S. snag boat *Trent* removed 427 snags and other obstr.; 140 trees hauled back from bank, 6 trees trimmed, and 15 cords brush cut, **11,** 1516.

1911-12. 352 snags and other obstr. removed; 6 trees trimmed by U. S. hoister *Contentnia,* **12,** 1737.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1180; **93,** 1377; **12,** 424.

Navigation restricted to section below Beach Swamp; work above hindered by l. w., **01,** 1485.

Stream reported to be in very bad condition, 1907, from trees, logs, snags, etc.; 2′ less available d. than when first cleared, **08,** 282.

Empties into Tar R., 8± m. above Tarboro. Length, 120± m. Proj. part, mouth to RR. br., 40 m. l., **12,** 423.

PROJECTS.

By Capt. Bixby, 1889, mouth up to Bellamy's mill, removal of logs, snags, and similar obstr.; est., $25,000, **90,** 1181; **91,** 1345.

In 1896, by Lt. Col. Heap, proj., 1889, modified to provide for clearing out the natural obstr. to the Wilmington & Weldon RR. br.; est., $22,750; and mainten. est., $2,000 an., **96,** 1100.

Capt. Lucas recom., 1901, further work be confined to section below Beach Swamp, **01,** 1485.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **90,** 1179.

Pre. ex. au. act June 25, 1910. **R.,** Capt. Brown, 1911 (unfav.),[1] **12,** 462.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 424.

Maps. **93,** 1378.

M–99 DURHAMS (Creek) ESTUARY, N. C.

COMMERCE.

Small and not of sufficient importance to warrant imp. of stream, **93,** 1455, 1456.

ENGINEERS.

Chief of Engineers. **R., 93,** 183.

In charge. Maj. W. S. Stanton, 1892–93. **R., 93,** 1455.

PHYSICAL CHARACTERISTICS.

The estuary a branch of Pamlico R., entering it 16½ m. below town of Washington, **93,** 1455.

Description of, **93,** 1455.

SURVEY.

Ex. au. act July 13, 1892, of the estuary, mouth to village of Edwards Mill; made, 1892, by Maj. Stanton (**R.** unfav.), **93,** 1455.

M–102 SOUTH RIVER (Creek), N. C.

APPROPRIATIONS.

1910, $16,000, **10,** 1406.

COMMERCE.

In 1895 C. est. at about $400,000 an. On account of the inconsiderable traffic and the difficulty of keeping the stream free from obstr., and existing conditions, the district engineer did not believe the stream worthy of imp. **95,** 1369.

Description of, **95,** 1370, 1371.

1911, 44,350 t., **12,** 430.

Imp. has had beneficial effect on rates, **12,** 430.

CONTRACTS.

1910. Miner Engineering Co., dr. 75,000 c. y., 14¢ c. y., **11,** 1524.

ENGINEERS.

Chief of Engineers. **R., 95,** 191; **08,** 306; **10,** 335; **11,** 357; **12,** 429, 463.

In charge:

Maj. W. S. Stanton, 1892–95. **R., 95,** 1366.

Capt. E. I. Brown, 1910–11. **R., 10,** 1406; **11,** 1523.

Maj. H. W. Stickle, 1912–. **R., 12,** 1743.

Assistant. Lt. E. W. Van C. Lucas. **R., 95,** 1369.

OPERATIONS.

1910-11. 14,788 c. y. removed from prescribed cross section, 15,384 c. y. from 1′ outside, and 58 hours spent in removing logs, etc. Proj. completed, **11,** 1524.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1367.

Stream a tributary of Pamlico R., entering it about 28 m. below Washington, N. C., **95,** 1369.

PROJECTS.

By Capt. Brown, 1908, for chan. 7′ x 100′, Aurora to head of existing 7′ chan., and w. at bends; est., $16,000, and $800 an. mainten.,[2] **08,** 306; au. act June 25, 1910, **10,** 335.

SURVEY.

Ex., mouth to head of navigation au. act Aug. 17, 1894; made by Maj. Stanton, 1895 (**R.** unfav.), **95,** 1366.

From mouth to Aurora, au. act Mar. 2, 1907; made 1907–08, by Capt. Brown,[2] **08,** 306.

Pre. ex. and sur. au. act Feb. 27, 1911, with view to obtaining increased d. above Aurora, **12,** 463.

Maps.[2]

[1] H. D. 356, 62d, 2d.

[2] H. D. 954, 60th, 1st.

M–102(a) INDIAN ISLAND SLOUGH, N. C.

COMMERCE.

Of South R., 80,000 t., cotton, lumber, and truck produce, **04,** 1514.

ENGINEERS.

Chief of Engineers. R., 04, 244, 1511.

Boards. BERH. **R.,** "Not worthy of imp.," **04,** 1513.

In charge:
Capt. E. W. Van C. Lucas. **R., 04,** 1512.
Capt. E. E. Winslow. **R., 04,** 1514.

PHYSICAL CHARACTERISTICS.

A shallow depression connecting Pamlico and South Rs., **04,** 1514.

PROJECT.

By Capt. Winslow, 1903, chan. 7′ x 200′; est., $8,000,[1] **04,** 1515.

SURVEY.

Ex. au. act June 13, 1902, Pamlico R. to mouth of South R.; made, 1902–03, by Capts. Lucas and Winslow, resp.,[1] **04,** 1511.

M–123(a) PAMLICO R. TO BAY R., N. C. (Waterway.)

ENGINEERS.

Chief of Engineers. R., 91, 170, 1421.
In charge. Capt. W. H. Bixby, 1890. **R., 91,** 1422.
Assistant. Lt. M. M. Patrick. **R., 91,** 1423.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1422.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Bixby (**R.** unfav.), **91,** 1422.

M–130 BAY RIVER, N. C.

APPROPRIATIONS.

1910,	$21,000,	**1910,** 1405.
1912,	1,000,	**12,** 1742.
Total,	22,000	

COMMERCE.

Description of, **11,** 356.
Decrease in rates due to imp., **12,** 429; traffic, 1911, 18,747 t., **12,** 1743.

CONTRACTS.

1910. Miner Engineering Co., dr., 140,000 c. y., p. m., 12¾¢ c. y., **11,** 1522.

ENGINEERS.

Chief of Engineers. R., 84, 177; **10,** 334, 360; **11,** 356; **12,** 428.

In charge:
Capt. J. Mercur, 1884. **R., 84,** 1064.
Capt. E. I. Brown, 1910–11. **R., 10,** 1405; **11,** 1521.
Capt. L. H. Rand, 1912–. **12,** 421.
Maj. H. W. Stickle, 1912–. **R., 12,** 1742.

OPERATIONS.

1910–11. Material removed and cost given in table; operations suspended June 2, 1911; proj. 98% completed, **11,** 1522.

PHYSICAL CHARACTERISTICS.

R., 1883, afforded easy navigation to all existing C., **84,** 1064.
Description of, **10,** 334; **11,** 356.

PROJECT.

By Capt. Brown, 1909, dr. chan. 10′ x 150′ from 3,500′ below Stonewall to dw., and 100′ w. above same point to Bayboro; est., $21,000, and $1,000 an. mainten.,[2] **10,** 334, 360.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Mercur (**R.** unfav.), **84,** 1064.
Au. act Mar. 3, 1909; made, 1909, by Capt. Brown,[2] **10,** 360.

M–144 NEUSE RIVER, N. C.

APPROPRIATIONS.

1878,	$40,000,	**79,** 94, 705.
1879,	45,000,	**79,** 94, 705.
1880,	45,000,	**80,** 843.
1881,	30,000,	**81,** 1005.
1882,	[3]30,000,	**82,** 1087.
1884,	20,000,	**84,** 1038.
1886,	22,500,	**86,** 982.
1888,	15,000,	**88,** 868.
1890,	20,000,	**90,** 1125.
1892,	15,000,	**92,** 1131.
1894,	7,000,	**95,** 1320.
1896,	7,000,	**96,** 1110.
1899,	10,000,	**99,** 1495.
1902,	*13,500,	**02,** 1134.
1904,	*2,000,	**04,** 1483.
1905,	*17,000,	**05,** 1208.
	*500,	**05,** 1208.
1907,	*[4]19,750,	**07,** 1228.
1910,	*21,000,	**10,** 1409.
1911,	*4,000,	**11,** 1529.
1912,	*2,000,	**12,** 1749.
Total,	386,250 (incl. misc., $387,208.33, **12,** 1749).	

[1] H. D. 113, 58th, 2d.
[2] H. D. 583, 61st, 2d.
[3] Part of $35,000, of which $5,000 was for waterway from Newbern to Beaufort.
[4] Increased by $1,750 trans. from Trent R., **10,** 1409.
* Allotment.

COMMERCE.

Important, **72,** 740, 741; **76,** 365; **79,** 705.
Increase in traffic due to imp., **83,** 852.
Development of, under imp. transportation facilities, **88,** 870; **89,** 1057.
Decrease in freight and transportation charges, **89,** 1060.
List of SS. navigating the R. 1892, **92,** 1134.
Description of, **93,** 1390; **94,** 1027, 1028; **95,** 1319; **96,** 1111; **97,** 1395, 1429; **00,** 1805.
Mainten. of navigable chan., Newbern to Kinston, would doubtless help to control rates by rail, **94,** 1028.
Rates lessened by imp., **10,** 338.
1911, over 400,000 t., **12,** 434.

CONTRACTS.

1885. B. W. Canady, lumber and iron, **85,** 1066.
1886. B. W. Canady, lumber and iron, **87,** 1023.
J. S. Mundy, hoisting engine, $1,050, **87,** 1023.
1888. B. W. Canady, timber and iron, **88,** 869.

ENGINEERS.

Chief of Engineers:
R., 71, 76; **72,** 73; **76,** 69; **78,** 76; **79,** 93, 95; **80,** 123; **81,** 163; **82,** 158; **83,** 165; **84,** 169; **85,** 166; **86,** 162; **87,** 126; **88,** 119; **89,** 138; **90,** 124; **91,** 159; **92,** 160; **93,** 173; **94,** 159; **95,** 181; **96,** 163; **97,** 203, 212; **98,** 205; **99,** 237; **00,** 269; **01,** 302; **02,** 229; **03,** 233; **04,** 233, 245, 1525; **05,** 240; **06,** 257; **07,** 268; **08,** 285; **09,** 294; **10,** 337, 361; **11,** 359; **12,** 432.

Boards:
BERH., **04,** 1529, 1531.

In charge:
Maj. Wm. P. Craighill, 1871. **R., 71,** 621; **72,** 734.
S. T. Abert, U. S. agent, 1875. **R., 76,** 363.
Capt. C. B. Phillips, 1879–81. **R., 79,** 704, 708; **80,** 841.
Capt. J. Mercur, 1881–84. **R., 81,** 1003; **82,** 1086; **83,** 850.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1037.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1065; **86,** 979; **87,** 1020; **88,** 866; **89,** 1056; **90,** 1122; **91,** 1358.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1129; **93,** 1390; **94,** 1027; **95,** 1319.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1109.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1393, 1427; **98,** 1245.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1495; **00,** 1804; **01,** 1492; **02,** 1133; **04,** 1527.
Capt. E. E. Winslow, 1903. **R., 03,** 1097.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1481, 1530, 1533; **05,** 1207; **06,** 1149.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1228; **08,** 1283; **09,** 1278; **10,** 1408; **11,** 1529.
Maj. H. W. Stickle, 1912–. **R., 12,** 1748.

Assistants:
W. Popp, **71,** 621. **R., 72,** 735.
J. M. Wolbrect. **R., 79,** 709.
R. Ransom. **R., 79,** 706; **80,** 843; **81,** 1005; **82,** 1087; **83,** 851; **84,** 1038; **85,** 1066; **86,** 982; **87,** 1024; **88,** 869; **89,** 1059; **90,** 1125; **91,** 1361.
W. H. Chadbourn, jr. **R., 92,** 1131; **96,** 1110; **97,** 1394, 1428.

ESTIMATES. (See Plans and Projects.)

By Capt. Phillips, 1879, to complete existing proj., $68,000, **79,** 705.

OPERATIONS.[1]

1878-79. Removal of wrecks, snags, logs, "Yankee catchers," etc. Dr., and building js. between Goldsboro and mouth of R., by hired labor, **79,** 93, 704–706.

1879-80. 31 m. of R. above Kinston cleared of logs, snags, and obstr.; blockade of Linkfield Chan. above Newberne removed; R. cleared for 22 m. below Kinston; 2 steam hoisters constr. and 9 sheet-pile js. averaging 100′ in l. built below Kinston, **80,** 841, 842.

1880-81. Snags, logs, and obstr. removed from R. for 12 m. above Goldsboro; 5,000 l. f. brush and log js. built between Pitch Kettle and Deer Neck; 2 pile and log dams built of 600′ l., **81,** 1004.

1881-82. 20 m. of upper R. between Goldsboro and Smithfield cleaned of snags and obstr.; bank protection and 14,550 l. f. plank j. built on Lower Neuse; chan. connecting Neuse and Trent dr. to 9′ x 100′ x 660′, **82,** 1086.

1882-83. Work of clearing the R. completed to Smithfield; 4,550 trees and stumps removed from chan.; 13,731 trees cut from banks; 3,812 l. f. of js. built between Kinston and "Becton's Old Field," **83,** 850, 851.

1883-84. 246 logs and stumps removed; 4,450 l. f. j. constr., **84,** 1038.

1884-85. 121 js. (12,402 l. f.) built, and 214 logs and snags removed, **85,** 1065.

1885-86. 41 js. (3,896 l. f.) built; 1,125′ of old j. work and 167 logs and snags removed, **86,** 981.

1886-87. 1,767 l. f. of pile and plank j. completed; 6,725 logs, trees, stumps, and similar obstr. removed, **87,** 1022, 1024.

1887-88. 1,450 logs, trees, stumps, and snags removed from the R. chan.; 1,082 l. f. of pile and plank j. built, **88,** 867.

1888-89. 3,121 l. f. of j. built and 31 brush mats laid; 438 l. f. old j. and 1,155 logs, stumps, and trees, with 14 cords of small snags, removed from the chan., **89,** 1058.

1889-90. 1,660 trees, logs, and snags, 295 l. f. of old j., and 15 cords of small snags removed from the R.; 2,673 trees and stumps cut and pulled back on the banks, and 336 c. y. material excavated, **90,** 1124.

1890-91. 1,361 l. f. of sheet-pile j. built, and 325 l. f. of old j. removed; 2,367 snags and trees and 27 cords of small snags cleared from the chan., **91,** 1360.

1891-92. 1,882 snags and logs and 23 cords of small snags cleared from the chan., and 3,194 trees and logs and 96 cords of brush removed from the banks, **92,** 1132.

1893-94. About 1,000 stumps, trees, etc., and 215 l. f. old js. removed from the R. and banks, **94,** 1027.

1894-95. 3 decayed js. and 4 new js. under constr., **95,** 1319.

1895-96. Js. under constr. in previous year completed, a line of levels run from Newbern to Kinston and gauges established every 3 m., and about 3,500 snags, trees, logs, etc., and 48 cords small snags removed from the R., and 348 trees, etc., from the banks, **96,** 1110.

1896-97. 4 js. constr. and 2 commenced; 2 bank protectors built and repairs made to old works where needed, and about 600 snags, logs, trees, etc., and 5,500 c. y. of material removed from the R., **97,** 1393, 1394.

1897-98. About 200 logs, snags, trees, etc., removed from the R.; 2 js. commenced in previous year were completed, 2 were built, and repairs made to several others, **98,** 1245.

1899-00. 9 logs, 15 stumps, 15 snags, and 87 trees removed from the chan., and 29 trees and 4 stumps from the banks, **00,** 1804.

1900-01. 9,000 c. y. dr., and 238 snags and other obstr. removed, **01,** 1492.

1902-03. 6,570 c. y. dr., and 118 snags and other obstr. removed, **03,** 1098.

1903-04. 36,059 c. y. dr., and 1,531 logs, stumps and other obstr. removed, **04,** 1482.

1904-05. 19,359 c. y. dr.; chan. cleared of snags, logs and stumps; obstr. trees and brush on banks either cut or trimmed, **05,** 1207.

1905-06. 63,119 c. y. dr., and 293 logs, stumps and other obstr. removed, **06,** 1149.

1906-07. 44,397 c. y. dr., and 239 logs and stumps removed, **07,** 1228.

1907-08. 1,225 snags, stumps, logs, and trees removed, banks cleared of obstr. brush and trees, and cut-off near 64th m. post cleared out, **08,** 1283.

1908-09. 70,288 c. y. dr., 378 snags and other obstr. removed, and 67 trees cut on banks, **09,** 1278.

1909-10. 39,750 c. y. dr., 219 snags and other obstr. removed, and 38 trees on bank hauled back, **10,** 1408.

1910-11. 40,387 c. y. dr. from Hampton Shoal and 1,030 c. y. from coal dock; logs, snags, and other obstr. removed, **11,** 1529.

1911-12. 59,062 c. y. dr., aggregating l. of 9,310′; 461 snags and other obstr. removed from chan.; 290

[1] History of operations, **79,** 93, 704.

trees and 15 cords brush removed from banks and 4 trees trimmed, **12,** 1748.

PHYSICAL CHARACTERISTICS.

Description, below Goldsboro, **72,** 735, 736; **76,** 364; **79,** 706; above Goldsboro, **79,** 708, 710.

A good navigable chan. for boats of 8′ draft up to Newbern, 1892–93, **93,** 1390. Water gauge record for 1892, **93,** 1392; for 1893 and 1894, and mean of water-gauge readings, **95,** 1320. Tidal observations, **97,** 1428.

Description of, **95,** 1319; **96,** 1109.

PLANS. (See Estimates and Projects.)

By W. Popp, 1871, removing obstr. to make a 4½′ chan. below Goldsboro; also 2 cut-offs; est., $153,191, **72,** 734, 740, or without the cut-offs, $50,341 less, **72,** 734, 740.

By S. T. Abert, 1875, adopted est. of Maj. Craighill for removal of obstr. from Goldsboro to the mouth, $51,000, **76,** 366, 367.

By Mr. Wolbrect, 1879, removing snags and solid rock between Smithfield and Goldsboro, and constr. of dikes; est., $20,761.44, **79,** 709, 710.

PRIVATE (STATE) WORK.

Snags removed and wing dams constr. by N. C. before the war, **72,** 734, 735.

PROJECTS. (See Estimates and Plans.)

Maj. Craighill, 1871, adopted plan proposed by W. Popp, for removal of obstr., **72,** 734.

S. T. Abert, 1875, also adopted the above proj., **76,** 365.

By Capt. Phillips, 1879, removing obstr., making cut-offs, and building j., by hired labor, mouth as far up the R. as the funds would allow, **79,** 93, 704, 705.

Projs., 1871 to 1883, proposed removal of obstr. placed in the R. during the Civil War, and the removal of logs and snags; also the contraction of the chan. to secure during the entire year unobstr. 8′ for 40 m. to Newbern, 4′ 50 m. farther to Kinston, and during 9 months of the year 3′ 108 m. farther to Smithfield, **79,** 93, 704, 705; **85,** 166; **86,** 973, 983; **87,** 1020.

Total amount app. 1878 to 1886, incl., $237,500, when $142,000 was est. for completion of proj., **86,** 981. 982; **87,** 1023; **91,** 1359.

In 1897 Lt. Col. Heap est. 8′ chan. at and below Newbern would cost $59,081.25, **97,** 1428.

Proj. extended, 1902, to include dr. chan. 8′ x 200′ at, and 300′ w. below, Newbern; est., $24,000, **02,** 230.

Plan by Capt. Johnston, 1903; securing 3′ Newbern to Goldsboro, by snagging, dr., and canalization; est., concrete locks, $1,285,000; timber locks, $757,000, **04,** 1535.

Recom. by BE., 1904, that proj. for Neuse R. be modified to provide only for 8′ chan. below Newbern, and imp. above as C. might demand, with initial app. of $20,000 and $6,000 an. mainten., **04,** 1529, 1531, 1533.

Est. by Capt. Johnston, 1904, for completing imp. below Newbern, $14,100, and $1,500 an.; between Newbern and Kinston, $125,000, and $6,500 an., **04,** 1530.

SURVEYS.

By A. D. Bache, 1862, below Newbern, **76,** 363.

By Prof. Pierce, 1872, below Newbern, **76,** 363.

By W. Popp, 1871, under direction of Maj. Craighill, from Goldsboro to the mouth. **R., 72,** 734, 735.

By S. T. Abert, 1875. **R., 76,** 363.

By J. M. Wolbrect, 1878, under direction of Capt. Phillips, from Smithfield to Goldsboro. **R., 79,** 708, 709.

Eight of the worst shoals between Newbern and the mouth of the Contentnia sur. 1892–93 for js. by Maj. Stanton, **93,** 1390. Four shoals sur. 1895–96 by Lt. Col. Heap, **96,** 1110.

Sur. at and below Newbern for 8′ at dead l. w. au. act June 3, 1896; made, 1897, by Lt. Col. Heap (**R.** fav.), (see Projects), **97,** 1427.

Sur. of the Newbern water front made, 1900, by Capt. Lucas, **00,** 1804.

From Goldsboro to Newbern, with view to 3′, au. act June 13, 1902; made, 1902 and 1903, by Capt. Lucas and Capt. Johnston,[1] **04,** 1527, 1533.

Pre. ex. and sur. au. act Mar. 3, 1909, Pamlico Sound to Newbern. **R.** by Capt. Brown, 1909 and 1910[2] (unfav.), **10,** 361; **11,** 382.

Ref. to pre. ex. and sur. reports, etc., **12,** 433.

Maps:

Sketch showing "Yankee catchers," **72,** 738. Sketch showing js. constr. near Kinston, **79,** 706. **80,** 842; **89,** 1058; **90,** 1126; **92,** Atlas, 26; **96,** 1112; **97,** 1394.

M–157 SMITHS CREEK, N. C.

APPROPRIATIONS.

1910, $16,250, **10,** 1408.

COMMERCE.

In 1911, 17,168 t., **12,** 432.

Decrease in C. due to shipment of much lumber by rail, formerly shipped by water, **12,** 432.

CONTRACTS.

1911. Mitchell & Co., dr. 130,000 c. y., 10½¢ c. y., **11,** 1528. Annulled Nov. 18, 1911, **12,** 1746. D. C. Mackey, dr., 10½¢ c. y., **12,** 1747.

ENGINEERS.

Chief of Engineers. R., 10, 336; **11,** 359; **12,** 431.

In charge:

Capt. E. I. Brown, 1910–11. **R., 10,** 1408; **11,** 1527.
Maj. H. W. Stickle, 1912–. **R., 12,** 1746.

OPERATIONS.

1910–11. Preparing for work of dr., **11,** 1527.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 336.

PROJECT.

By Capt. Brown, 1910, excavating basin 10′ d. in B. at Oriental, and removing lumps and points from entrance chan.; est., $16,250, and $1,000 an. for mainten.; providing bulkhead, est. cost $7,500, be built by local interests,[3] **10,** 337, 360. Au. act June 25, 1910, **10,** 336.

SURVEY.

From confluence with Neuse R. to head of navigation, au. act Mar. 3, 1909; made, 1909–10, by Capt. Brown,[3] **10,** 360.

Map.[3]

M–170 SWIFT CREEK, N. C.

APPROPRIATIONS.

1910,	$1,600, **10,** 1413.
1912,	500, **12,** 1754.
Total,	2,100

COMMERCE.

1911, 22,458 t., **12,** 438.

Imp. has a beneficial effect on rates, **12,** 438.

[1] H. D. 648, 58th, 2d. [2] H. D. 1093, 61st, 3d. [3] H. D. 774, 61st, 2d.

ENGINEERS.

Chief of Engineers. **R., 89,** 148; **10,** 340; **11,** 363; **12,** 437, 463.

In charge:
Capt. W. H. Bixby, 1888. **R., 89,** 1116.
Capt. E. I. Brown, 1910–11. **R., 10,** 1413; **11,** 1534.
Maj. H. W. Stickle, 1912–. **R., 12,** 1754.

OPERATIONS.

1910–11. Snag boat *Trent* removed one wrecked flat, 524 snags, stumps, etc., and trees hauled back, trimmed and cut between mouth and Vanceboro, N. C., **11,** 1534.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1117; **10,** 340.

PROJECT.

By Capt. Brown, 1909, clear chan. mouth to Vanceboro by removal of obstr.; est., $1,600, and $500 an. for mainten.;[1] au. act June 25, 1910, **10,** 341, 359.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby (**R.** unfav.), **89,** 1116.
Ex. au. act Mar. 3, 1909; made, 1909, by Capt. Brown,[1] **10,** 359.
Pre. ex. au. act Feb. 27, 1911, and view to dr. chan. through Horseshoe Bend and Poplar Branch. **R.** by Capt. Brown, June 22, 1911[2] (unfav.), **12,** 463.

M–172 CONTENTNIA CREEK, N. C.

APPROPRIATIONS.

1881,	$10,000,	**81,** 1010.
1882,	10,000,	**82,** 1092.
1884,	5,000,	**84,** 1042.
1886,	15,000,	**86,** 975.
1888,	5,000,	**88,** 860.
1890,	7,000	**90,** 1117.
1892,	7,000,	**92,** 1124.
1894,	10,000,	**95,** 1315.
1899,	2,000,	**99,** 1492.
1903,	*500,	**03,** 1097.
1905,	1,000,	**05,** 1206.
	*500,	**05,** 1206.
1907,	2,000,	**07,** 1227.
1909,	*1,000,	**10,** 1407.
1910,	2,000,	**10,** 1407.
1911,	1,000,	**11,** 1526.
1912,	2,000,	**12,** 1745.
Total,	81,000 (including $302, sales, rents, etc. $81,302, **12,** 1745).	

COMMERCE.

Important, **81,** 1012; **83,** 855.
Development of C. due to imp.; reduction in transportation and insurance rates, **88,** 862; **90,** 1118.
In 1893 it did not appear to be in any way useful to C. to continue the imp. above Snow Hill, 31 m. from the mouth, **93,** 1385.
Chan. in good navigable condition for the boats plying on the creek, 1894, **94,** 1023.
Description of, **00,** 1802.
45% increase, 1905, over 1904, **06,** 256.
Tonnage, 1911, 16,000 t., **12,** 431.

ENGINEERS.

Chief of Engineers. **R., 81,** 164; **82,** 159; **83,** 166; **84,** 172; **85,** 164; **86,** 159; **87,** 124; **88,** 117; **89,** 137; **90,** 123; **91,** 158; **92,** 158; **93,** 172; **94,** 157; **95,** 180; **96,** 162; **97,** 202; **98,** 204; **99,** 235; **00,** 268; **01,** 301; **02,** 229; **03,** 232; **04,** 232; **05,** 239; **06,** 256; **07,** 267; **08,** 284; **09,** 293; **10,** 335, 359; **11,** 357; **12,** 430.

In charge:
Capt. C. B. Phillips. **R., 81,** 1010.
Capt. J. Mercur, 1881–84. **R., 81,** 1009; **82,** 1091; **83,** 854.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1042.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1060; **86,** 973; **87,** 1013; **88,** 858; **89,** 1048; **90,** 1115; **91,** 1351.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1123; **93,** 1385; **94,** 1022; **95,** 1314.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1103.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1389; **98,** 1242.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1492; **00,** 1801; **01,** 1488; **02,** 1132.
Capt. E. E. Winslow, 1903. **R., 03,** 1096.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1480; **05,** 1205; **06,** 1147.
Capt. E. I. Brown, 1907–11. **R., 07,** 1226; **08,** 1282; **09,** 1276; **10,** 1406; **11,** 1525.
Maj. H. W. Stickle, 1912–. **R., 12,** 1744.

Assistants:
R. Whitford. **R., 81,** 1010.
J. D. Whitford. **R., 88,** 860.
R. Ransom. **R., 82,** 1092; **83,** 855; **84,** 1042; **85,** 1061; **86,** 975; **87,** 1015; **89,** 1050; **90,** 1117; **91,** 1353.
W. H. Chadbourn, jr. **R., 96,** 1104; **97,** 1390.

OPERATIONS.

1881–82. Lower 25 m. of R. cleared of obstr.; 750′ of diking built, **82,** 1072; **86,** 976.
1882–83. Obstr. cleared to a point 45 m. above the mouth, **83,** 854; **86,** 976.
1883–84. 250 stumps removed, **84,** 1042.
1884–85. Removal of obstr. continued, **85,** 1060; **86,** 976.
1885–86. Removal of obstr. from lower half of R.; constr. of 420 l. f. of pile dike and 400 l. f. brush and log dam; repair of old dikes, and 230 l. f. old dikes removed, **86,** 974, 976.
1886–87. Removal of obstr. from lower half of R. continued; dike and dam constr. near the mouth, **87,** 1014, 1015.
1887–88. 3,455 logs, snags, and stumps, 2,513 leaning trees, and 740 cords of brush and small snags removed from the chan., **88,** 859.
1888–89. 1,176 logs, stumps, and snags, removed from the chan., and 905 trees removed along shore, **89,** 1049.
1890–91. 728 trees, 490 logs, and 245 cords of brush cleared from the banks, and 1,224 snags and logs and 132 c. y. of mud removed from the chan., **91,** 1352.
1892–93. 556 large snags, 11 cords small snags, 328 stumps, 401 trees, 304 logs removed from the chan., and 186 stumps, 57 cords small brush, and 861 trees and logs were cut and hauled back on the banks, **93,** 1386.
1893–94. 14 snags, 6 stumps, 36 trees, and 11 logs removed from the chan., and 6 trees removed on the banks. A plank dike 176′ l. built at Spring Slough, and connected through the swamp with the left bank by an earth dike 440′ l. Old earth dike 370′ l. repaired by raising it 18″ and then capping it with logs, **94,** 1023.
1894–95. 411 snags, 369 logs, 107 stumps, and 218 trees removed from the chan., and 263 trees cut and hauled back on the banks, **95,** 1315.
1895–96. 175 trees, 118 logs, 248 snags, 142 stumps, and 2 piles removed from the chan., and 52 logs hauled back, 80 trees cut and hauled back, 2 trees trimmed, and 62 stumps pulled on the banks; 44 cords of brush placed to repair a break in the bank above Hookerton. A line of levels run from the 3d to the 32d m. post and gauges estab. every 3 m., **96,** 1104.
1896–97. 4,051 c. y. dr., including 76 stumps and 15 logs, snags, and trees; 2 flats, 68 trees, 26 logs, 118 snags, and 98 stumps removed from chan., and 96 trees cut and hauled back; 6 logs, 33 snags, and 46 stumps hauled back on the banks, **97,** 1390, 1391.
1897–98. 162 large snags, 78 logs, 95 stumps, and 48 trees and 29 cords small brush removed from the chan., and 10 stumps hauled back, 16 trees trimmed and 13 cords brush cut on the banks, **98,** 1242.

[1] H. D. 360, 61st, 2d. H. D. 279, 62d, 2d. * Allotment.

1898-99. 41 snags, 2 stumps, 14 trees removed from chan. and 4 trees from the banks, **99,** 1492.
1899-00. 5 logs, 25 snags, 10 stumps, and 69 trees removed from chan. and 85 trees from the banks, **00,** 1801.
1900-01. 179 logs, snags and other obstr. removed, **01,** 1488.
1901-02. Mainten. and care of plant, **02,** 1132.
1902-03. 127 snags and other obstr. removed, **03,** 1096.
1903-04. 43 snags and other obstr. removed, **04,** 1480.
1904-05. 35 snags and other obstr. removed, **05,** 1205.
1905-06. 167 snags and other obstr. removed, **06,** 1147.
1906-07. 234 snags and other obstr. and 6 cords snags and brush removed, **07,** 1226.
1908-09. 638 snags and other obstr. and 25 cords snags and brush removed, work being carried above Snow Hill to Fools Br., **09,** 1277.
1909-10. 390 snags and other obstr. and 26 cords brush and small snags removed, **10,** 1406.
1910-11. Snags and other obstr. removed by U.S. snag boat *Trent;* summaries of quantities and cost given; small hoister constr., **11,** 1525, 1526.
1911-12. Snagging operations continued, **12,** 1744.

PHYSICAL CHARACTERISTICS.

Water-gauge record, 1889, **91,** 1352; for 1892, **93,** 1386. Mean of water-gauge readings, **95,** 1314.

Subject to freshets, rising to 15′ above l. w., **12,** 431.

Flows into Neuse R. 32 m. above Newbern; 144 m. l. Proj. section, mouth to Stantonsburg, 63 m., **12,** 430.

PROJECTS.

By Capt. Phillips, 1881, clearing creek of obstr., and by dr. and diking to secure 3′ during 9 months of each year, from mouth to Stantonsburg, 70 m.; est., $40,000, **81,** 1010, 1012. Est. increased to $78,000, **85,** 1060, 1062; **87,** 1013; **91,** 1351; **92,** 1123.

By Maj. Stanton, 1892–93, dike at head of Spring Slough across the main chan. to increase the d. in the former, **93,** 1385.

Proj. of 1881 amended in 1894 to include mainten. below Snow Hill, **96,** 1103; and in 1899, to include mainten. to Stantonsburg, **00,** 268.

SURVEYS.

Au. act June 14, 1880; made by Capt. Phillips, 1880, **81,** 1010.

Minor. sur.—**87,** 1013; **96,** 1103; **01,** 301.

Sur. Grifton to mouth of the creek, made, 1897–98, by Capt. Craighill, **98,** 1242.

Of shoal, mouth of Woods Slough, **05,** 1206.

Ex. au. act Mar. 3, 1909; made by Capt. E. I. Brown; stream unworthy of supple. imp.,[1] **10,** 359.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 430.

Maps. **87,** 1014; **90,** 1118; **92,** Atlas, 23.

M-173 LITTLE CONTENTNIA RIVER, N. C.

ENGINEERS.

Chief of Engineers. **R., 10,** 359.
In charge. Capt. E. I. Brown, **10,** 329.

SURVEY.

Ex. au. act Mar. 3, 1909. **R.,** Capt. Brown, unfav. except as to snagging operations in connections with similar work on Contentnia Creek,[2] **10,** 359.

M-180 TRENT RIVER, N. C.

APPROPRIATIONS.

1879,	$7,000,	**79,** 94.
1880,	10,000,	**80,** 840.
1881,	5,000,	**81,** 1007.
1882,	10,000,	**82,** 1089.
1884,	10,000,	**84,** 1041.
1886,	3,500,	**86,** 978.
1888,	5,000,	**88,** 864.
1890,	5,000,	**90,** 1120.
1892,	5,000,	**92,** 1127.
1894,	4,000,	**95,** 1318.
1896,	2,000,	**96,** 1108.
1899,	2,500,	**99,** 1493.
1902,	*6,500,	**02,** 1135.
1904,	*1,000,	**04,** 1484.
1905,	23,000,	**05,** 1210.
1907,	*[3]10,250,	**07,** 1230.
1910,	*15,000,	**10,** 1411.
1911,	*1,000,	**11,** 1532.
1912,	*8,000,	**12,** 1752.

Total, 133,750 (incl. misc., $134,585, **12,** 1752).

COMMERCE.

Important, **79,** 712, 714.

Navigability of the Trent, **79,** 712.

Decrease in transportation and insurance rates consequent upon imp., **89,** 1055, 1141.

If the R. were imp. above Trenton there would probably be little or no navigation, **93,** 1388.

The Wilmington, Newbern & Norfolk RR. parallels the R. to Newbern and much diminishes the traffic, **95,** 1317.

Description of, **00,** 1802.

R. affords only means of transportation to Trenton, except by wagons, **09,** 297.

1911, 164,808.5 t., **12,** 436.

CONTRACTS.

1911. J. A. Wilkinson, lease of dr. No. 1, $900 per mo., **12,** 1751.

ENGINEERS.

Chief of Engineers. **R., 78,** 76; **79,** 94, 95; **80,** 123; **81,** 163; **82,** 158; **83,** 165; **84,** 171; **85,** 165; **86,** 160; **87,** 125; **88,** 118; **89,** 137, 149; **90,** 124; **91,** 158; **92,** 159; **93,** 172; **94,** 158; **95,** 180; **96,** 162; **97,** 202; **98,** 204; **99,** 236; **00,** 268, 277; **01,** 302, 310, 1545; **02,** 230; **03,** 234; **04,** 234; **05,** 241; **06** 258; **07,** 270; **08,** 287; **09,** 296, 315; **10,** 339; **11,** 361; **12,** 434.

In charge:

Capt. C. B. Phillips, 1878–81. **R., 78,** 76; **79,** 711; **80,** 838.

Capt. J. Mercur, 1881–84. **R., 81,** 1007; **82,** 1088; **83,** 853.

Capt. F. A. Hinman, 1884–85. **R., 84,** 1041.

Capt. W. H. Bixby, 1885–92. **R., 85,** 1062; **86,** 976; **87,** 1016; **88,** 862; **89,** 1052, 1140; **90,** 1119; **91,** 1355.

Maj. W. S. Stanton, 1892–95. **R., 92,** 1125; **93,** 1387; **94,** 1025; **95,** 1316.

Lt. Col. D. P. Heap, 1896. **R., 96,** 1106.

Capt. W. E. Craighill, 1897–98. **R., 97,** 1391; **98,** 1243.

Capt. E. W. Van C. Lucas, 1899–01. **R., 99,** 1493; **00,** 1802; **01,** 1490, 1546, 1550; **02,** 1134.

Capt. E. E. Winslow, 1903. **R., 03,** 1099.

Capt. R. P. Johnston, 1904–06. **R., 04,** 1483; **05,** 1209; **06,** 1150.

Capt. Earl I. Brown, 1907–11. **R., 07,** 1229; **08,** 1284; **09,** 1279; **10,** 1410; **11,** 1531.

Maj. H. W. Stickle, 1912–. **R., 12,** 1751.

[1] H. D. 322, 61st, 2d. [2] H. D. 208, 61st, 2d. [3] Reduced by $1,750 trans. to Neuse R., **10,** 1411. * Allotted.

Assistants:
J. M. Wolbrect. **R., 79,** 713.
R. Ransom. **R., 80,** 840; **81,** 1008; **82,** 1089; **83,** 853; **84,** 1041; **85,** 1063; **86,** 978; **87,** 1018; **88,** 864; **89,** 1054; **90,** 1121; **91,** 1357.
E. D. Thompson. **R., 87,** 1019; **89,** 1054.
W. H. Chadbourn, jr. **R., 96,** 1107.

OBSTRUCTIONS.

The br. of the Atlantic and North Carolina RR. Co. considered an obstr. to navigation, and orders issued by the War Dept. for its alteration in 1894–95, **95,** 1317; made, 1896, **96,** 1107.

OPERATIONS.

1879-80. 2 cut-offs opened and w. and snags, logs, and similar obstr. removed from Quaker Br. to Trenton, **80,** 840.

1880-81. Logs, snags, stumps, and similar obstr. removed between Quaker Br. and Polloksville, and 25,000 c. y. of material dr. from chan., **81,** 1007, 1008.

1881-82. 18,000 c. y. dr. from chan., **82,** 1089.

1882-83. 1,800 trees removed from the banks, and 73 logs from chan., **83,** 853.

1883-84. 25,000 c. y. dr. from basin and chan. 460 logs, snags, and stumps and 278 trees removed, and 44 piles for revet. driven, **84,** 1041.

1884-85. Turning-basin at Trenton completed by solid revet. wall, and by redr. of basin to 6′ l. w.; 617 logs and stumps and 11,825 c. y. of material removed from R., **85,** 1062.

1886-87. Minor obstr. removed, **87,** 1017.

1887-88. 270 logs, trees, and snags removed from R. chan., and 107 trees trimmed on the banks, **88,** 864.

1888-89. 1,008 trees, snags, and stumps, 49 cords small snags, and 14,677 c. y. removed from the chan., **89,** 1053.

1890-91. 1,273 snags and stumps removed from the chan., and 796 trees and 187 cords of brush cleared from the banks, **91,** 1356.

1893-94. Chan. 2,085′ l. dr. below Trenton, and 400 c. y. dr. from the turning-basin at Trenton. Repairs made to the revet. of the banks. 529 logs, 353 snags, 77 trees, 39 stumps removed from the chan., and 80 overhanging trees from the banks. **94,** 1025.

1894-95. Cut 10′ x 18′, and 3′–4′ d. dr. through the shoals below Trenton, **95,** 1317.

1895-96. 4,837 c. y. dr., 306 snags, and 187 logs removed from the chan., and 58 overhanging trees and 3 logs removed from the banks, **96,** 1107.

1897-98. 40 large snags, 27 logs, 4 stumps, and 12 trees removed from the chan., and 18 trees hauled back and 3 stumps pulled and hauled back on the banks, **98,** 1243.

1899-00. 28 logs, 36 trees, 25 snags, 11 stumps, and 121 piles removed from chan., and 32 trees from banks, **00,** 1802.

1900-01. Chan. d. to Trenton restored by dr.; 44 snags and other obstr. removed, **01,** 1490.

1902-03. 189 snags and other obstr. removed, **03,** 1099.

1903-04. 574 obstr. removed, brush cut and other work of mainten. done, **04,** 1483. 2,486 c. y. dr., **04,** 1484.

1904-05. 939 c. y. dr.; 48 snags and other obstr. removed, **05,** 1209.

1905-06. 90,031 c. y. dr. and 168 stumps and logs removed, **06,** 1150. Walls of turning-basin at Trenton repaired with 36 piles and 89 l. f. sheet piling, **06,** 1151.

1906-07. Proj. completed excepting that portion inserted in compliance with public resol. No. 22, approved Mar. 4, 1907, au. chan. 6′ d. over Foys Flats, above Newbern; 39,436 c. y. dr., 333 logs, snags and other obstr. removed, and obstr. trees and brush removed from banks, **07,** 1229, 1230.

1907-08. 1,343 c. y. dr., 78 snags, stumps, logs and trees removed, and banks cleared of obstr. brush and trees, **08,** 1284.

1908-09. 23,456 c. y. dr., 135 snags and other obstr. removed, 209 trees on banks cut or trimmed. and 40 cords brush removed, **09,** 1281. 6′ chan. over Foys Flats completed, **09,** 1279.

1909-10. 963 c. y. dr., 165 snags and other obstr. removed, and 62 trees and 3½ cords brush cut from banks, **10,** 1410.

1910-11. U. S. dr. *Scuppernong* removed 20,264 c. y. of material and 107 logs, securing chan. 4′ x 40′ for 10 m. Proj. about 80% completed, **11,** 1531–32.

1911-12. Dr. No. 1 removed 15,108 c. y. r., 10 stumps, and 119 logs, completing 83% of chan. Snag boat *Trent* removed 1,274 c. y. mud, 7 logs, 13 stumps, and 2 saw logs, restoring chan. to 9.3′ m. l. w., **12,** 1751.

PHYSICAL CHARACTERISTICS.

General description, **79,** 713; **89,** 1140. Obstr., snags, sand bars, fallen and overhanging trees, etc., **79,** 712, 713.

Water-gauge record for 1892, **93,** 1388. If the chan. above Trenton were cleared out, as much benefit would be obtained from the increased drainage as by navigation. **93,** 1388. In 1895 the l. of the shoals over which there was not a practicable w. 3′ deep had increased to 3,400′, **95,** 1317.

Description of, above Trenton, **95,** 1317. Available d. 1898 in the next m. below Trenton, 18″ at l. w., **98,** 1243.

PROJECTS.

By Capt. Phillips, 1879, imp. below Trenton, to secure 3′ at the extreme low summer stage of the R., by removal of snags, fallen and leaning trees, by dr., and by dike and dam constr.; est., $22,000, **79,** 711, 714. Est. increased in 1885 and 1887 to $59,000, **87,** 1017.

By Capt. Bixby, 1889, imp. of the R. from Trenton to Upper Quaker Br. by clearing out natural obstr., from Trenton upward; for small SS. over the first 30 m., and for pole boats over the remaining 13 m. up to Upper Quaker Br.; est., $13,000. This, together with the amount required for completion of the prior proj., made a total for completion in 1890, of $16,500. **89,** 1140; **90,** 1120; **92,** 1126.

Proj., 1892, amended by Maj. Stanton to include mainten. below Trenton, **96,** 1106.

Proj. of 1879 amended by Lt. Col. Heap in 1896 to provide only for mainten. of a chan. 3′ x 30′ below Trenton, **96,** 1106.

In 1896 Lt. Col. Heap est. an. mainten. would cost $2,500, **96,** 1107.

Extended, 1902, to provide for dr. below the Atlantic & North Carolina RR. br. to 8′; est. $24,000 **01,** 1551; **02,** 230.

Letter of Mr. C. E. Foy in favor of imp., **01,** 1549.

Act June 25, 1910, au. dr. chan. 4′ Newbern to Trenton, and removing obstr. stumps, snags, etc.; est., $15,000, and $2,000 an. mainten., **10,** 339.

SURVEYS.

By J. M. Wolbrect, 1878, an ex. **R., 79,** 713.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1140.

Minor ex., etc. (Shoals below Trenton; Trenton to Upper Quaker Br., **93,** 1388), **97,** 1391. (Vicinity of wagon br. at Trenton, **00,** 1802.)

Mouth to Trenton, with view to 8′, m. l. w. to wharves at Newbern; chan. 8′ x 50′, Newbern through Foys Flats to Polloksville, and chan. 30′ x 4′ m. l. w. from Polloksville to Trenton; considered worthy of imp. at Newbern only,[1] **01,** 1545, 1546, 1550, 1551.

Pre. ex. and sur. au. act Mar. 2, 1907, with view to 8′, Newbern to Trenton. **R.** by Capt. Brown, 1907 and 1908; est., $15,000 for 4′ up to Trenton,[2] **09,** 315.

Pre. ex. au. act Mar. 3, 1909. **R.** by Capt. Brown (not considered advisable to extend scope of existing proj.,[3] **11,** 382.

Cong. docs., etc., relating to exs., sur., plans, etc., **12,** 435.

Maps:
89, 1054; **92,** Atlas, 24, 25; **95,** 1318.

[1] H. D. 121, 56th, 2d. [2] H. D. 1471, 60th, 2d. [3] H. D. 1092, 61st, 3d.

M–205 PAMLICO SOUND TO BEAUFORT INLET, N. C. (Inland waterway via Adams Cr.)

APPROPRIATIONS.

1907,	$200,000,	**07,** 1232.
1908,	170,000,	**08,** 1286.
1909,	135,000,	**09,** 1283.
1910,	10,000,	**10,** 1415.
1912,	2,000,	**12,** 1756.
Total,	517,000 (incl. misc., $517,001.50, **12,** 1756).	

COMMERCE.

In 1911, 40,828 t., **12,** 1757.

CONTRACTS.

1908. Maryland Dredging & Contracting Co., dr., 10¾¢ c. y., **09,** 1283.
1909. G. & W. Mfg. Co., constr. highway br. over Core Creek, **09,** 1283.
1910. Blalock & Hartsfield, constr. fender ps. for Core Creek Br., prices given, **11,** 1539.

ENGINEERS.

Chief of Engineers. **R., 07,** 271; **08,** 289; **09,** 298; **10,** 341; **11,** 364; **12,** 438.
In charge:
Capt. E. I. Brown, 1907–11. **R., 07,** 1231; **08,** 1286; **09,** 1281; **10,** 1413; **11,** 1535.
Maj. H. W. Stickle, 1912–. **R., 12,** 1755.

LEGAL PROCEEDINGS.

Addl. land was acquired for right of way, viz: 5 tracts of land (317.53 acres) acquired by condemnation proceedings for sum of $4,767.22, **11,** 1536.

OPERATIONS.

1907–08. Condemnation proceedings, etc., for necessary land carried on, **08,** 1286.
1908–09. 227.45 acres land bought, timber felled and ground partly cleared, **09,** 1281. 1,250,827 c. y. dr.; work started on highway br., **09,** 1282.
1909–10. 38.3 acres land bought, **10,** 1413. 2,201,412 c. y. dr.; work continued on Core Creek Br., **10,** 1414.
1910–11. 1,115,137 c. y. dr.; br. across Core Creek completed; fender ps. constr. for br., **11,** 1537.
1911–12. Constr. of concrete fender piles completed; entire waterway completed, **12,** 1755.

PROJECTS.

By Capt. Brown, 1907, for chan. 10′ d., with bottom w. of 90′, through land portion and 125′ through water portion; est., $550,000,[1] **07,** 271.

SURVEYS.

For location of route, **07,** 1231; **08,** 1286.
Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 438.
Maps.[1] Beaufort Inlet, **12,** 1760.

M–226 CORE SOUND, N. C.[2]

COMMERCE.

Principally in fish, oysters, clams, etc., to Beaufort and Newbern, **93,** 1374.

ENGINEERS.

Chief of Engineers. **R., 95,** 191, **00,** 265, 277.

In charge. Maj. W. S. Stanton, 1892–95. **R., 95,** 1373.

PHYSICAL CHARACTERISTICS.

Sound is 25 m. l. between Pamlico Sound on the ne. and the "Straits" on the sw., **95,** 1374.
Description of, **95,** 1374.

PROJECTS.

After sur. of 1837, est. that $55,000 would be required for imp. H. D. 482, 55th, 2d.

SURVEYS.

Sur., 1837. H. D. 482, 55th, 2d.
Ex. au. act Aug. 17, 1894; made, 1895, by Maj. Stanton (**R.** unfav.), **95,** 1373.

M–226(a) DRUM INLET, N. C.

ENGINEERS.

Chief of Engineers. **R., 91,** 170, 1425; **95,** 191.

In charge:
Capt. W. H. Bixby, 1890. **R., 91,** 1425.
Maj. W. S. Stanton, 1892–95. **R., 95,** 1372.
Assistant. Lt. M. M. Patrick. **R., 91,** 1427.

PHYSICAL CHARACTERISTICS.

Description of; one of several inlets which formerly crossed the narrow strip of sand beach lying between the Atlantic Ocean and Core Sound at a point about 50 m. s. of Cape Hatteras, 25 m. s. of Ocracoke Inlet, and 25 m. n. of Cape Lookout, **91,** 1426.
In 1895 they were exactly as described in **R.** of 1890, an unbroken beach 3,000′ to 4,000′ across from ocean to sound, and 6½′ above m. l. w., **95,** 1372.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Bixby (**R.** unfav.), **91,** 1426.
Ex. Portsmouth to Cape Lookout au. act Aug. 17, 1894; made by Maj. Stanton, 1895 (**R.** unfav.), **95,** 1372.

M–226(b) CORE SOUND TO NEWPORT RIVER, N. C.

COMMERCE.

Value, 1909, $1,227,000;[3] 1,000 small boats traverse water.

ENGINEERS.

Chief of Engineers. **R., 12,** 462.

Boards:
BERH. **R.,** fav. to 1911 est.[3]
Division Engineers. **R.,** unfav. to 1911 est.[3]

In charge:
Capt. E. I. Brown, **12,** 421.
Capt. L. H. Rand, **12,** 421.
Maj. H. W. Stickle, **12,** 421.

[1] H. D. 84, 59th, 2d. [2] Sur.—**R.** Jan. 6, 1837; est. $55,000. (H. D. 482, 55th, 2d.) [3] H. D. 546, 62d, 2d.

PLANS AND PROJECTS.

Protected chan., Core Sound to Beaufort and vicinity for small vessels, 5′ x 40′.[1]

SURVEY.

Pre. ex. chan. via Taylors Creek or Carrot Isld Slough, au. act June 25 1910; **Rs.** by Capt. Brown, 1910 and 1911; est., $30,000, with $2,000 an. mainten., local cooperation to pay one-third,[1] **12,** 462.
Map.[1]

M–230(a) CARROT ISLAND SLOUGH, AND LEWIS THOROUGHFARE, N. C.

ENGINEERS.

Chief of Engineers. R., 04, 244, 1505.
Boards. BERH. **R., 04,** 1508, 1509.

In charge:
Capt. E. W. Van C. Lucas. **R., 04,** 1505.
Capt. E. E. Winslow. **R., 04,** 1509.

PHYSICAL CHARACTERISTICS.

Details: Waterway part of proposed inland waterway to Beaufort, etc. The 1st part of the route, Carrot Isld. Slough, is a shallow passage between Bird Isld. and Carrot Isld.; the 2d part of the route begins at the waterfront of Beaufort and extends to Bulkhead chan.; the 3d part of the route from Bulkhead chan. through Lewis' Thoroughfare runs between a number of nearby islds., **04,** 1509.

SURVEY.

Ex. and sur., Middle Marshes to Newport R., au. act June 13, 1902; made, 1902–03, by Capt. Lucas and Capt. Winslow, resp.; est., $45,000. (**R.** unfav. to immediate imp.),[2] **04,** 244, 1505).

M–231(a) THOROUGHFARE BAY, AND THOROUGHFARE LEADING FROM CORE SOUND INTO CEDAR ISLAND BAY, THENCE TO NEUSE RIVER AND PAMLICO SOUND, N. C.

ENGINEERS.

Chief of Engineers. R., 10, 360.
In charge. Capt. Earl I. Brown. **10,** 329.

SURVEY.

Pre. ex. au. act Mar. 3, 1909, with view to securing chan. 6′ x 60′, **R.** by Capt. Brown (unfav.),[3] **10,** 360.

M–257(a) BEAUFORT HARBOR, N. C.

APPROPRIATIONS.

1836,	[4]$5,000	
1881,	30,000,	**81,** 1013.
1882,	[5]25,000,	**82,** 1093.
1884,	20,000,	**84,** 1039.
1886,	15,000,	**86,** 989.
1888,	35,000,	**88,** 878.
1890,	15,000,	**90,** 1134.
1892,	10,000,	**92,** 1139.
1896,	5,000,	**96,** 1116.
1902,	3,000,	**02,** 1137.
1904,	*1,000,	**05,** 1213.
1905,	2,000,	**05,** 1213.
1907,	22,000,	**07,** 1234.
1910,	32,676,	**10,** 1418.
1911,	5,000,	**11,** 1541.
1912,	5,000,	**12,** 1760.
Total,	230,676 ($231,402.50, inc. sales,	**12,** 1760.

COMMERCE.

Draft of vessels seeking entrance, **81,** 1015.
Importance of the H., **81,** 1014; **82,** 1096; **85,** 1079; **87,** 1036.
Description of, **00,** 1808; **11,** 367.
Of 1901, about 72,000 t., increase of 32,000 over 1899; oysters, fish, lumber, and produce, **02,** 232.
C. valued at about $2,500,000, 1898, **08,** 292; $2,430,000, **12,** 443.
Imp. tends to prevent rise in rates, **10,** 344.
Traffic, 1911–12, 74,085 t., **12,** 1761.

CONTRACTS.

1888. P. Linehan & Co., st., $2.95 per t., **87,** 1034.
1889. C. T. Caler, dr., 37½¢ c. y. F. H. Smith, st., $2.19 per t., **89,** 1070.
1890. Alabama Dredging & Jetty Co., dr., 33⅓¢ c. y., **91,** 1370.
1910. Mitchell & Co., dr. 221,408 c. y. at 10½¢ c. y., **11,** 1542. Annulled Nov. 18, **12,** 1760.
1911. D. C. Mackey, dr., 10½¢ c. y., **12,** 1761.

ENGINEERS.

Chief of Engineers. R., 80, 125; **81,** 164; **82,** 159, 1095; **83,** 166; **84,** 169; **85,** 168, 1082; **86,** 164; **87,** 128; **88,** 121; **89,** 140; **90,** 126; **91,** 161; **92,** 161; **93,** 174; **94,** 160; **95,** 183; **96,** 165; **97,** 204; **98,** 206; **99,** 238; **00,** 271; **01,** 304, 1511; **02,** 231; **03,** 236, **04,** 236; **05,** 244; **06,** 261; **07,** 273; **08,** 291; **09,** 300; 315; **10,** 343; **11,** 366; **12,** 441.

Boards:
BERH. **R., 82,** 1096. (See Projects.)
(Cols. Tower, Newton, and Lt. Col. Abbot.)

In charge:
Capt. C. B. Phillips, 1880–81. **R., 81,** 1013.
Capt. J. Mercur, 1881–84. **R., 82,** 1093, 1094; **83,** 855.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1039.
Capt. W. H. Bixby, 1885–91. **R., 85,** 1076, 1080; **86,** 986; **87,** 1030; **88,** 875; **89,** 1066; **90,** 1131; **91,** 1367.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1137; **93,** 1395; **94,** 1031; **95,** 1323.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1115.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1396; **98,** 1247.

[1] H. D. 546, 62d, 2d.
[2] H. D. 210, 58th, 2d.
[3] H. D. 405, 61st, 2d.
[4] H. D. 482, 55th, 2d.
[5] Part of $30,000, $5,000 of which was applied to the inland navigation from Beaufort H. to Newbern, **83,** 166, 855.
*Allotment.

Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1498; **00,** 1808; **01,** 1495, 1517, 1529; **02,** 1137.
Capt. E. E. Winslow, 1903. **R., 03,** 1102.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1486; **05,** 1212; **06,** 1153.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1233; **08,** 1288; **09,** 1285; **10,** 1417; **11,** 1540.
Maj. H. W. Stickle, 1911–. **R., 12,** 1759.

Assistants:
C. M. Yeates. **R., 81,** 1014.
R. Ransom. **R., 82,** 1094; **83,** 856; **84,** 1040; **85,** 1077; **86,** 985; **87,** 1034; **88,** 878.
H. F. Price. **R., 85,** 1078.
E. D. Thompson. **R., 87,** 1035; **88,** 879; **89,** 1070; **90,** 1134.
W. H. Chadbourn, jr. **R., 91,** 1370; **92,** 1139.

OPERATIONS.

1881-82. 2 scows built by hired labor; 30 l. f. of j. built, **82,** 1093, 1094; **86,** 989.

1882-83. J. at Shackleford Pt. extended to 535′. 2 scows and temporary wharf and tramway built. Work done by hired labor, **83,** 855, 856. Cost of j., and satisfactory action of, **83,** 857; **86,** 989.

1883-84. Repairs by hired labor to j., sand fences, and wharf, **84,** 1039.

1884-85. J. 400′ l., built on n. side of Shackleford Pt., 2,300′ e. of main j. Main j. covered with concrete; superstr. 3′ x 6′ x 444′. Repairs to sea end of main j.; 721 l. y. of shore revet. laid between main and e. j. At Macon Pt. a breach was closed by 420 l. f. of cribwork, small receiving wharf constr. and a j. started ne. of the fort. Work done by hired labor and purchase in open market. **85,** 1076, 1077; **86,** 990.

1885-86. Strengthening js. at Shackleford Pt. and placing 100 l. f. of shore protection between the js. Extension of J. No. 1 at Fort Macon Pt. 120′; commencement of J. No. 2, and rebuilding landing wharf, **86,** 165, 987, 990.

1886-87. 1,119 t. st. placed in works at Fort Macon Pt., Cove Sound, and Shackleford Pt., **87,** 1032, 1034.

1887-88. 271 t. st. placed along 40′ of surface of main j.; 8 blocks of concrete and 2,400 bus. oyster shells added to same; 10 t. st. placed on middle j.; 595 t. st. added to e. j.; repairs to landing wharf, field quarters, tramroad trestles, and derricks; 31 t. st. and 7cords brush built into 138 l. f. of shore revet.; 44 t. st. and 22 cords brush built into 488 l. f. of shore revet.; 25 t. st. placed at main js.; **88,** 877.

1888-89. 1,443 t. st. placed in js.; 10,480 c. y. dr., **89,** 1071.

1889-90. 1,800 c. y. dr.; 5,190 t. rubblest. placed in js.; 5,724 l. f. sand fences built; 2,924 l. f. shore revet. raised, **90,** 1134, 1135.

1890-91. 280 l. f. of brush and st. revet. built at Shackleford Pt., **91,** 1369.

1891-92. 9,989 c. y. sand dr. from bar; repairs to sand fences at Fort Macon and Shackleford Pts., **92,** 1140.

1892-93. 20,585 c. y. dr., and minor repairs to sand fences in progress, **93,** 1395.

1893-94. 7 js. of brush and st. aggregating 688′ built, 2,384 l. f. sand fences built, 1,328 l. f. repaired, 4,378 l. f. raised, 21,548 l. f. filled under, and refilled under with sand; and 150′ of oyster-shell dike built, **94,** 1032.

1894-95. 5,038 c. y. dr.; 2 js. of brush aggregating 110′ built; 16 low groins of board palings aggregating 537′ constr.; 9,210 l. f. sand fences built, 15,714 l. f. filled in, and 8,032 l. f. repaired, **95,** 1324.

1895-96. 1,056 l. f. sand fences built, 23,332 l. f. raised, and 46,814 l. f. filled in, and 24 l. f. brush j. constr. in extension of brush js. and minor repairs made to the latter, **96,** 1116.

1896-97. 2,036 l. f. sand fences built, 8,390 l. f. raised, 56,676 l. f. filled in, 3,267 l. f. repaired, and minor repairs made to brush js., **97,** 1396.

1897-98. 3,041 l. f. sand fences built, 6,865 l. f. raised, 42,984 l. f. filled in, and 5,300 l. f. repaired, **98,** 1247.

1898-99. 3,069 l. f. sand fences built, 8,025 l. f. raised, 41,675 l. f. filled under, and 5,680 l. f. repaired, **99,** 1498.

1899-00. 12,376 l. f. sand fences built, 16,626 l. f. raised, 22,916 l. f. filled under and 5,768 l. f. repaired, and 32 l. f. brush j. repaired, **00,** 1808.

1900-01. 766 l. f. sand fences built, 19,276 l. f. raised, 15,955 l. f. filled under, and 937 l. f. repaired, **01,** 1495.

1902-03. 772 l. f. sand fences built, 18,892 l. f. built higher, 2,023 l. f. repaired, 18,086 l. f. filled under, and Bermuda grass planted, **03,** 1102.

1903-04. 532 l. f. sand fences built, 15,252 l. f. raised, 2,334 l. f. repaired, 28,821 l. f. filled under, 1,712 l. f. banked with sand, 132 l. f. low groins built, and Bermuda grass planted to prevent sand drifting away, **04,** 1486.

1904-05. 12,227 c. y. dr., grass and trees planted at Fort Macon, 2,832 l. f. sand fences constr., 4,152 l. f. raised, 2,768 l. f. repaired, 11,586 l. f. filled under, and 452 l. f. plank groins constr., **05,** 1212.

1905-06. 1,356 l. f. sand fence built, 6,448 l. f. raised, 3,686 l. f. repaired, 13,492 l. f. filled under, and 290 l. f. groins built, **06,** 1153.

1906-07. 383.83 t. st. removed from old j. and 303.83 t. used in constr. 2 new js.; 65.6 cords brush cut for use in js., **07,** 1234.

1907-08. 1,890 t. st. removed from old j., 1,970 t. placed in 2 new js., 50 cords of brush cut and bundled, 1,088 l. f. sand bag groins built and 842 l. f. repaired, **08,** 1288.

1908-09. 2,080 l. f. sand bag js. and 4,800 l. f. sand fences built, 7,038 l. f. sand bag fences raised, 6,665 l. f. sand fences filled under, and 27,976 c. y. dr., **09,** 1285.

1909-10. 594 l. f. sand fences built, 1,694 l. f. filled under, 684 l. f. raised, 362 l. f. repaired, and 424 sand bags filled and placed, **10,** 1417.

1910-11. Sand fence at Fort Macon and Shackleford Pt. built and repaired, **11,** 1540, 1541. Dr. of Bulkhead Shoal abandoned, and st. and oyster shell training wall au.; quantities of material placed in training wall given, **11,** 1541.

1911-12. 810′ sand fence built, 214.59 t. st. placed in j. at Shackleford Pt.; 152,927 c. y. dr. by contract, and 4,094 c. y. dr. by U.S., **12,** 1759.

PHYSICAL CHARACTERISTICS.

Recession of Shackleford Pt., **81,** 1016; **82,** 1094, 1097; **84,** 170; **85,** 168; **86,** 987.
Direction of tidal currents, **82,** 1097.
Change effected by j. built in 1883, **83,** 856.
Orig. condition of the H., **88,** 875.
Description of, **94,** 1032, 1033; **95,** 1323; **96,** 1115.
Chan. 1′ less over Bulkhead Shoal, 1901, **01,** 304.
Js. have prevented inlet winding and shifting, but d. deterioration in main chan. quite rapid from lack of scour—inlet too w., **11,** 367.

PROJECTS.

By Capt. Phillips, 1880, 3 js. of random st. to prevent further abrasion of Shackleford Pt., and dr. of 2 chans. and a turning-basin near Beaufort; est., $82,103.38, **81,** 1013, 1017.

In 1881 Capt. Mercur recom. system of js. for protection of Shackleford Pt., of random st., about 300′ l., and spaced about 300′ apart, **82,** 1095. Plan approv. by BE., with recom. that js. should be founded upon mattresses, **82,** 1098. Concurred in by the Chief of Engineers, and approv. by Sec. War, **82,** 1096.

In 1884 Capt. Bixby recom. expansion of the proj. to cover the protection of Fort Macon Pt. from erosion, by shore protection and js., **85,** 168, 1081. After an. expend. of $75,000 on previous projs., est., 1886, $84,000 would be required for the complete protection of Shackleford and Fort Macon Pts., and the formation of a dr. chan. 5′ x 100′ m. l. w. from Bulkhead Chan. to Beaufort, **86,** 989; **87,** 1030; **91,** 1368; **97,** 205.

Immediate proj., 1896, held to be mainten. of js. and sand fences at Fort Macon and Shackleford Pts., **96,** 1115.

R. and H. act, Mar. 2, 1907, au. j. repaired and new js. and shore protection, **09,** 361.

R. and H. act, June 25, 1910, au. expend. of $27,676 for chan. to Beaufort from Norfolk-Beaufort waterway, by way of Gallants Chan.; and $1,500 an. for mainten., **10,** 344.

Proj. of 1910, 66% done, **12,** 443.

SURVEYS.

Au. act June 14, 1880, **80,** 125; made by Capt. Phillips, 1880, **81,** 1013.
Sur. of Shackleford Banks, 1881, **82,** 1094.
List of surs., **81,** 1015; **82,** 1096; **86,** 989.
Bulkhead Shoal (Map), **01,** 1495.
Sur. of bar chan. (See Beaufort Inlet—waterway from South Mills, N. C., etc.)
Of shore lines, **07,** 1233.
Of entire H., **08,** 1288.
Ex. and sur. au. by R. and H. act, Mar. 2, 1907, with view to 25′ chan. across bar, reported 1907 and 1908. Imp. to extent of 25′ not recom., [1] **09,** 315.
Ex. for chan. 10′ x 60′, Beaufort, thence to and through Bulkhead Chan., au. by R. and H. act, Mar. 3, 1909.[2] Est., $27,676, **10,** 360.
H. R. doc., etc., referring to exs., sur., etc., **03,** 236; **09,** 315; **10,** 344, 360; **11,** 367; **12,** 442.

Maps.[1 2] **83,** 856; **85,** 1076; **89,** 1072; **90,** 1136; **92,** Atlas, 27, 28, 29, 30; **93,** 1396; **94,** 1032; Bulkhead Shoal, **01,** 1495; **12,** 1760.

M–257(b) BEAUFORT, N. C. (Breakwater at.)

COMMERCE.

In 1893 anchorage appeared to be sufficient for the small C. of Beaufort with its 2,000 inhabitants, **93,** 1460.

ENGINEERS.

Chief of Engineers. R., 93, 183.
In charge. Maj. W. S. Stanton, 1892–93. **R., 93,** 1457.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1457.
The breakw'r desired by the inhabitants of Beaufort to protect the town against the sea, and to arrest the destruction of the chan. along its front, **93,** 1458.

SURVEYS.

Ex. for breakw'r au. act July 13, 1892; made by Maj. Stanton, 1893 (**R.** unfav.), **93,** 1457.

M–257(c–f) BEAUFORT HARBOR, N. C. (Waterways to or from.)

Part.	Title.	Period.	Appropriations.
c	Beaufort, N. C., to Boston, Mass.	1909–1912	
d	Beaufort, N. C., to North R. N. C.	1894–1895	See p. 476.
e	Beaufort, N. C., to New R., N. C.	1882–1912	See p. 476.
f	Beaufort, N. C., to Newbern, N. C.	1880–1912	See p. 477.

Part (c), M 257 Beaufort, N. C., to Boston, Mass. (Intracoastal Waterway.)[3]

(Part of proposed continuous inland waterway from Boston, Mass., to the Rio Grande, Tex.)

COMMERCE.

(See Engineers. Contents of **Rs.** of board dated Oct. 4, 1911.)
Diagram showing traffic of leading coastwise canals, 1880–1910.

DEFENSE.

General remarks on military value of the proposed waterways.

ENGINEERS.

Chief of Engineers. R., forwards report of special board, Jan. 2, 1912. Concurs with views expressed by BERH. (see Projects), H. D. 391, 62d, 2d.

Boards:

S. O. No. 10, Mar. 8, 1909, O. C. E., as amended by S. O. No. 34, July 13, 1909; No. 5 of Feb. 12, 1910, and No. 24 of May 31, 1910, appointed BE. to make a sur. for a continuous inland waterway from Boston, Mass., to Beaufort, N. C., and to submit a **R.** thereon in compliance with act Mar. 3, 1909.
Members: Col. W. M. Black, Col. F. V. Abbot, Lt. Col. J. C. Sanford, Lt. Col. M. M. Patrick, Maj. R. R. Raymond, Corps of Engineers.
R. dated Oct. 4, 1911.
BERH. **R.,** Dec. 12, 1911.

Contents of foregoing reports:

I. Acts of Congress and special orders.

II. Conclusions concerning the different sections of the route, Boston to Beaufort.

[1] H. D. 1454, 60th, 2d. [2] H. D. 511, 61st, 2d. [3] H. D. 391, 62d, 2d.

III. General remarks on freight transportation.

IV. Military value of the proposed waterways.

V. General remarks. RR. and highway crossings—w. of cross sections at curves—reasons for B.'s recommendations to be found in detail **R.** for each section—conditions which lead the B. to recommend the immediate constr. of the southern sections.

VI to X. Report on the various sections or links in detail.

XI. Report of the commission on inland waterways on a free ship canal connecting Boston and Narragansett B. (Appendix A1.)

XII Report of transportation committee of the Providence board of trade on the commercial value of the proposed intracoastal waterway to Rhode Island. (Appendix B1.)

Letter of the Gov. of Rhode Island, relating thereto.

XIII. Formula deduced from experiments for increased w. necessary on curves in canal constr. (Appendix C1.)

Table of commercial statistics on the navigable waterways and the population and manufacturing statistics of the principal cities tributary to the New York B.-Delaware R. section of the proposed intracoastal waterway. (Appendix C2.)

Report of the committee on traffic of the proposed intracoastal waterway connecting New York and Delaware Bs. (Appendix C3.)

Resolutions of the State of N. J. (Appendix C4.)

Statement from commercial bodies interested in the constr. of the proposed intracoastal waterway. (Appendix C5.)

Special report, board of trade, Camden, N. J. (Appendix C6.)

Special report, New York produce exchange (Appendix C7.)

Special report, Trenton chamber of commerce (Appendix C8.)

Special report, board of trade, city of Newark, N. J. (Appendix C9.)

XIV. Letters from Chesapeake & Delaware Canal Co. (Appendix D1–2.)

Letters from Baltimore & Philadelphia Steam boat Co.; River & Harbor Improvement Co.; J. B. Blodes Lumber Co.

XV. Stenographic report of public hearing held at Norfolk, Va.

PHYSICAL CHARACTERISTICS.

See Engineers. Contents of **Rs.** of board dated Oct. 4, 1911.

Plate showing New Jersey during the Pensauken geological period.

PROJECTS.

Chief of Engineers, 1912, concurred in general with the views of the BERH., and deemed advisable "at the present time" the adoption of projects as follows:

1st. Constr. of 12′ waterway, Norfolk, Va., to Beaufort Inlet, N. C., costing $5,400,000, embracing the following items:

Norfolk to Albemarle Sound: Albemarle and Chesapeake Canal routex	$2,735,000
Albemarle Sound to Pamlico Sound: Rose B. route	2,215,000
Brant Shoal Cut	55,000
Pamlico Sound to Beaufort Inlet, via Adams Creek Canal	395,000
Total for 12′ plan	5,400,000

2nd. Purchase of the existing Chesapeake & Delaware Canal, connecting Chesapeake B. with Delaware R., est., $2,514,290. Then its progressive change to tide level canal of 25′ m. l. w.; est., $9,910,210. Total initial cost, $12,424,500, $3,000,000 to be available immediately.

The special BE. recommended constr. of sea level canal 25′ d. across N. J. bet. Delaware R. and Raritan B.; est., $45,000,000. Understood that State of N. J. would provide not to exceed $500,000 for purchase of right of way. BE. recom. deferring work on this part of the proposed continuous waterway until the two immediate southern sections had been constr., "and until the necessary plant now at work on the Panama Canal shall be made available." Much less d. than 25′ might do to meet the demands of C. Orders given for est. for a 12′ d., upon completion of which further recoms. may be made. Believed that local benefit to N. J. such that that State might defray more than the cost of the right of way.

With respect to the section bet. Fishers Isld. and New York B., this waterway section already of ample capacity save for some obstr. at western end being removed under other projs. (local).

For the section bet. Narragansett B. and Long Isld. Sound, BE. recom. constr. of a canal 18′ d. bet. Fishers Isld. Sound and Bissels Cove, Narragansett B., with an addl. entrance 18′ d. just n. of Narragansett Pier; est., $12,322,000. Initiation of this work, on this section, should follow that on the N. J. section. State of R. I., it is understood, will provide free right of way so far as it can with $500,000. BE. doubted whether this inside section would be used sufficiently to warrant the large expend. required for its constr. and mainten.; Chief of Engineers concurred that "it is not advisable for the U. S. to undertake the constr. of this link of the proposed waterway at the present time."

For the section bet. Boston and Narragansett B. the BE. prepared approx. est. for canals starting at Narragansett B.—one for a canal 18′ d. via Taunton and Plymouth to cost about $17,500,000, and another for a canal 25′ d. via Taunton and Hingham to cost about $40,000,000. There was considered also the advisability of the U. S. buying the canal works under way connecting Buzzards B. with Cape Cod B. Mass. appointed a commission, "to consider in what manner the commonwealth may best cooperate with the Federal Government and certain other States in the development of inland waterways;" reported as follows: "The conditions of transportation may so change in the future as to make such a canal desirable and necessary, but the facts as they now appear do not warrant this commission in advocating the present constr. of the proposed canal." The Chief of Engineers concurred with the BE. and the BERH that "at the present time there is no commercial necessaity sufficient to justify the constr. of a canal over either of the inland routes above mentioned, and that it is not considered by me advisable for the U. S. to undertake at this time the constr. of such a canal or to enter into negotiation for acquisition of the Cape Cod Canal now in course of constr. by private parties."

The Chief of Engineers, in forwarding the **R.** of the BE., invited attention to its remarks concerning the desirability of such legislative or municipal action as would insure the preservation of suitable sites for terminal facilities free from the adverse actions of monopolies or transportation companies. "* * * in many cases railways have been so operated as to throw obstacles in the way of dividing a long-distance carriage bet. rail and water, and to make an all-rail carriage most advantageous * * * it is certain that a policy of this kind * * * must eventually be changed. * * * Until action has been taken by the Nation and States which will insure cooperation between transportation companies operating by rail and by water * * * the full benefits to be obtained from the imp. of waterways can not be had, and the benefits received must be measured mainly by the lowering of rail freight rates to favored communities located on water routes."

H. D. 391, 62d, 2d.

SURVEYS.

Act March 3, 1909, au. sur. of a continuous waterway, inland where practicable, from Boston, Mass., to Long Isld. Sound, including a waterway from the protected waters of Narragansett B. through the ponds and lagoons lying along the southern coast of Rhode Island to Watch Hill and Fishers Isld.; thence to New York B.; thence across the State of N. J. to a suitable point on Delaware R. or B.; thence to Chesapeake B.; thence from Norfolk, Va., to the sounds of N.C. and Beaufort Inlet, N. C., to ascertain cost of chan. 25′ d., or much lesser d. along any section or sections, for commercial, naval, or military purposes—the sur. to include ex. of all practicable routes, the preparation of plans and est. along the most available route, and a report on the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same. **R.**, special board of Engineer officers. H. D. 391, 62d, 2d.

Maps:

General map. Boston to the Rio Grande.

Index maps. 35′ level proj., Taunton R. to Hingham H., Mass.; Taunton R. and Plymouth H., Mass.; sea-level proj., Bissells Cove to Little Narragansett B., R. I.; sea-level proj., Philadelphia to New York B.; waterway between Delaware City and Pooles Isld.; sea-level proj., Norfolk to Albemarle Sound; Albemarle Sound to Pamlico Sound.

General map. Sea-level proj., Pamlico Sound to Beaufort Inlet.

Part (d), M–257 Beaufort Harbor, N. C., North River to. (Water route.)

COMMERCE.

Est., 1895, 935 t. Owing to the probable cost of the imp., unimportant interests, and the small locality that would be benefited, route considered unworthy of imp., **95,** 1383.

ENGINEERS.

Chief of Engineers. R., 95, 192.

In charge. Maj. W. S. Stanton, 1894–95. **R., 95,** 1380.

PHYSICAL CHARACTERISTICS.

Description of; 2½ m. e. from Beaufort is mouth of North R., a broad shallow estuary, **95,** 1381.

SURVEYS.

Ex., mouth of North R. to Beaufort, N. C., au. act Aug. 17, 1894; made, 1895, by Maj. Stanton (**R.** unfav.), **95,** 1380.

Part (e), M–257 Beaufort Harbor, N. C., New River to. (Waterway.)

APPROPRIATIONS.

1886,	$10,000,	**87,** 1038.
1888,	5,000,	**88,** 883.
1890,	15,000,	**90,** 1139.
1892,	10,000,	**92,** 1143.
1894,	2,500,	**95,** 1326.
1896,	1,000,	**96,** 1118.
1902,	9,500,	**02,** 1138.
1907,	*3,000,	**07,** 1240.
1909,	*1,000,	**09,** 1289.
1910,	*12,000,	**10,** 351, 1424.
1912,	*6,000,	**12,** 1768.
Total,	[1]75,000	(given as $71,500, 1912, C. of E. **R.**; $3,500 trans. to "New R.-Swansboro," **12,** 1768).

COMMERCE.

Important, **85,** 1134, 1135; **87,** 1037.

Description of, **93,** 1398; **94,** 1034, 1035; **95,** 1325; **00,** 1810.

Of 1901, 34,000 t. (lumber, fish, and produce), **02,** 232; about 56,000 t., 1911, valued at $956,000, **12,** 450.

CONTRACTS.

1886. R. Moore, dr., 32½¢ c. y., **87,** 1038.

1889. Alabama Dredging & Jetty Co., dr., 40¢ c. y., **89,** 1075.

1890. Alabama Dredging & Jetty Co., dr., 25¢ c. y., **91,** 1374.

1894. Cordes & Bochman, dr., 35¢ c. y., p. m. ($8,500), **95,** 1326.

ENGINEERS.

Chief of Engineers. R., 84, 177; **85,** 177; **87,** 129; **88,** 122; **89,** 141; **90,** 127; **91,** 162; **92,** 1621 **93,** 175; **94,** 161; **95,** 183; **96,** 165; **97,** 205; **98,** 207; **99,** 239; **00,** 271; **01,** 304; **02,** 232; **03,** 236; **04,** 237; **05,** 245; **06,** 263; **07,** 279; **08,** 297; **09,** 306; **10,** 350; **11,** 373; **12,** 449.

In charge:

Capt. J. Mercur, 1884. **R., 84,** 1055.

Capt. W. H. Bixby, 1885–92. **R., 85,** 1133, 1135; **87,** 1037; **88,** 882; **89,** 1073; **90,** 1138; **91,** 1373.

Maj. W. S. Stanton, 1892–95. **R., 92,** 1141; **93,** 1397; **94,** 1034; **95,** 1325.

Lt. Col. D. P. Heap, 1896. **R., 96,** 1117.

Capt. W. E. Craighill, 1897–98. **R., 97,** 1398; **98,** 1249.

Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1499; **00,** 1810; **01,** 1496; **02,** 1138.

Capt. E. E. Winslow, 1903. **R., 03,** 1103.

Capt. R. P. Johnston, 1904–06. **R., 04,** 1488; **05,** 1214; **06,** 1156.

Capt. Earl I. Brown, 1907–11. **R., 07,** 1239; **08,** 1294; **09,** 1289; **10,** 1423; **11,** 1549.

Capt. L. H. Rand, 1912. **12,** 421.

Maj. H. W. Stickle, 1911–. **R., 12,** 1768.

Assistants:

J. P. Darling. **R., 84,** 1055; **85,** 1138.

R. Ransom. **R., 85,** 1134.

E. D. Thompson. **R., 87,** 1038; **88,** 884; **89,** 1075; **90,** 1140.

W. H. Chadbourn, jr. **R., 91,** 1375; **92,** 1144.

OPERATIONS.

1887–88. 17,672 c. y. dr., **88,** 883.

1888–89. 35,896 c. y. dr., **89,** 1074.

1891–92. 23,785 c. y. dr., **92,** 1144.

1895–96. 14,650 c. y., p. m., dr., **96,** 1118.

1896–97. 11,041 c. y., p. m., dr., **97,** 1398.

* Allotment.

[1] $3,500 of this amount trans. to New River-Swansboro portion of waterway, **09,** 1289.

1902-03. Constr. of dr. plant, and collection of C. statistics, **03,** 1103.
1903-04. 6,939.6 c. y. dr., at cost of 49¢ c. y.; proj. 75% completed, **04,** 1488.
1904-05. 12,873 c. y. dr., at 23.728¢ c. y.; work suspended, **05,** 1214.
1905-06. Proj. 85% completed, **06,** 1156.
1906-07. Plant repaired, and C. statistics collected, at cost of $293.02, **07,** 1239.
1907-08. Plant purchased for mainten. work; cost, $850, **08,** 1294.
1909-10. 5,444 c. y. removed by U. S. dr. *Scuppernong* from Stakes Slough, at 30.6¢+ per c. y.; work stopped Feb. 28, 1910; at close of year proj. d. prevailed between Beaufort H. and Swansboro, **10,** 350, 1423.
1911-12. 101,823 c. y. dr., the proj. d. and w. having been obtained through 15,315 l. f. of shoals in the first 16½ m. of the waterway, **12,** 1768.

PHYSICAL CHARACTERISTICS.

Description of route, **84,** 1055; **85,** 1133, 1136; **94,** 1034; **96,** 1117.
Orig. condition of the waterway, **88,** 882.
Dr. cuts deteriorated, **01,** 305; **02,** 237.
Considerable shoaling, **10,** 350; **11,** 373.
Proj. d. of 3′ prevails, Beaufort to New R., **11,** 373.

PLANS. (See Projects.)

By Capt. Bixby, 1885, dr. chans. from 3′ to 9′ d. from White Oak to New Rs. Est., $78,000 to $540,000. Cost considered incommensurate with benefit to be derived, **85,** 1137.

PROJECTS. (See Plans.)

By Capt. Bixby, 1885, imp. chan. by dr., 3′ d. l. w., and extending from Beaufort to Swansboro on the White Oak R.; est., $50,000, **85,** 1138; **87,** 1037.
Aggregate cost of completed proj. est., 1892, at $71,040, **92,** 1142.
By Maj. Stanton, 1892, withholding $10,000 app. 1892 until experience should show whether it would be needed, **93,** 1398. In 1893–94, this money applied to dr. chan. 60′ x 2,000′ near Sanders Creek Cut and Turtle Slough, **94,** 1035.
Immediate proj., 1901, to get chan. 3′ x 60′ from Beaufort to Swansboro, **01,** 304.
Act 1890 au. spending $5,000 on waterway "between New R. and Swansboro." Sur. only made pending repeal of N. C. legislative act granting private parties exclusive navigation privileges. Latter charter seemed void, 1904, **91,** 1376; **04,** 237; relinquished, **05,** 246.
Whole proj. about 80% done, **12,** 450.

SURVEYS.

Au. act Aug. 2, 1882, made by Capt. Mercur, 1882, **84,** 1055.
Also by act July 5, 1884, made by Capt. Bixby, **85,** 1133, 1135.
Minor surs., **94,** 1035.
Ex., 1900, by Capt. Lucas, **00,** 1810.
Cong. Docs., etc., relating to ex., surs., etc., **12,** 450.

Maps.
Bogue Sound and vicinity, **80,** 896; **89,** 1074.

Part (f), M–257 Newbern to Beaufort, N. C. (Inland line of navigation between, via Clubfoot, Harlowe, and Newport Rivers.)

APPROPRIATIONS.

1882,	[1]$10,000,	**84,** 1040.
1886,	10,000,	**86,** 985.
1888,	15,000,	**88,** 873.
1907,	2,000,	**07,** 1232.
Total,	37,000	

COMMERCE.

Important, **87,** 1027, 1028, 1030.
Value of the imp., **88,** 873.
Description of, **94,** 1030; **95,** 1322; **00,** 1807. In 1894 freight valued at about $80,000 passed through the waterway, **95,** 1322.
Decreased since 1903, **05,** 243.
Decreased below that of 1908, **10,** 343.
1910, 37,000 t., **11,** 1540.
1911, 15,000 t.; C. now using waterway from Pamlico Sound to Beaufort Inlet, **12,** 1759.

CONTRACTS.

1884. T. P. Morgan, dr., $4.98 per hour, **85,** 1070. Annulment of contract, **85,** 1071, 1073; **86,** 986.
1886. R. Moore, dr., 33¢ c. y., **87,** 1029.
1889. Alabama Dredging & Jetty Co., dr., 33¢ c. y., **89,** 1064.

ENGINEERS.

Chief of Engineers. **R., 84,** 171, 177; **85,** 167; **86,** 163; **87,** 127; **88,** 120; **89,** 139; **90,** 125; **91,** 160; **82,** 161; **93,** 174; **94,** 159; **95,** 182; **96,** 164; **97,** 204; **98,** 206; **99,** 237; **00,** 270; **01,** 303; **02,** 231; **03,** 235; **04,** 235; **05,** 243; **06,** 260; **07,** 272; **08,** 290, **09,** 299; **10,** 342; **11,** 365; **12,** 439.

In charge:
Capt. F. A. Hinman. **R., 84,** 1040.
Capt. J. Mercur. **R., 84,** 1065, 1067.
Capt. W. H. Bixby, 1884–92. **R., 85,** 1070; **86,** 983; **87,** 1026; **88,** 871; **89,** 1060; **90,** 1127; **91,** 1363.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1134; **93,** 1393; **94,** 1030; **95,** 1321.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1113.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1395; **98,** 1246.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1497; **00,** 1806; **01,** 1493; **02,** 1136.
Capt. E. E. Winslow, 1903. **R., 03,** 1101.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1485; **05,** 1210; **06,** 1152.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1232; **08,** 1287; **09,** 1284; **10,** 1416; **11,** 1539.
Maj. H. W. Stickle, 1912–. **R., 12,** 1758.

Assistants:
J. P. Darling. **R., 84,** 1068.
R. Ransom. **R., 85,** 1074; **86,** 985; **87,** 1029.
E. D. Thompson. **R., 87,** 1029; **88,** 874; **89,** 1064; **90,** 1130.
W. H. Chadbourn, jr. **R., 91,** 1366.

OBSTRUCTIONS.

The failure of the canal company not only to maintain a greater d., but also to keep the existing chan. clear, a serious hindrance to navigation, **94,** 1030; **95,** 1322; **96,** 1113.
Imp. handicapped by private canal between Clubfoot and Harlowe Creeks, **05,** 1211.

OPERATIONS.

1884-85. 1,500 c. y. dr. from Harlowe Creek, **85,** 1070, 1073.

[1] Derived from apps. from Neuse R. and Beaufort H., N. C., **84,** 1040.

1886-87. Removal of logs and stumps from upper end of Harlowe Creek, **87,** 1027, 1029.
1887-88. 4,924 c. y. dr., **88,** 873.
1888-89. 81,932 c. y. dr., and 90 logs and stumps removed from chan., **89,** 1062.
1889-90. 8,654 c. y. dr., **90,** 1130.
1890-91. 60 l. f. of j. built, and 3,390 l. f. of j. riprapped with oyster shells, **91,** 1365.
1892-93. 141 logs, etc., removed from the stream, **93,** 1394.
1895-96. About 30 logs, snags, etc., removed, **96,** 1113.
1897-98. About 43 snags, logs, etc., removed **98,** 1246.
1904-05. 26,357 c. y. dr.; 42 logs and other obstr. removed, **05,** 1211.
1905-06. 1,617 c. y. dr. by U. S. snag boat *Trent* at cost of 37½¢ c. y., and 44 logs and other obstr. removed, **06,** 1152.
1906-07. 2,758 c. y. dr. and 1 log removed at cost of $403.53, **07,** 1232.
1907-08. 120 snags, stumps, and other obstr. removed, **08,** 1287.
1908-09. 149 snags, logs, and other obstr., and 4½ cords small snags removed; 54 trees hauled back and 11¼ cords brush cut on banks, **09,** 1284.
1909-10. Waterway not worthy of further imp., will not be required after inland waterway from Pamlico Sound to Beaufort Inlet is completed, **10,** 1416.

PHYSICAL CHARACTERISTICS.

Route described, **84,** 1065, 1068.
Dr. cut deteriorated; controlling d. 2′ to 2½′ m. l. w., **10,** 343.

PLANS.

By Capt. Phillips, 1880, as part of a water route s. from Norfolk, Va., **80,** 857–897; **84,** 1066.
By Capt. Mercur, 1883, chan. 9′ x 80′, Newbern to Beaufort, via the Clubfoot R., Clubfoot and Harlowe Canal, Harlowe and Newport Rs.; est., $480,000 to $883,580, **84,** 1067–1071.

PRIVATE (CORPORATE) WORK.

Work done by the New Berne & Beaufort Canal Co., **87,** 1028.

PROJECTS.

Proj. of 1885 proposed dr. chan. 5′ x 30′, Newbern to Beaufort, via Clubfoot, Harlowe, and Newport Rs., 42 m.; est., $92,000, **85,** 1074; **86,** 984; **87,** 1027.
Route not deemed worthy of further imp. since completion of inland waterway from Pamlico Sound to Beaufort Inlet; present route via Clubfoot and Harlowe Canal not required, **11,** 1539.

SURVEYS.

Earliest surs., **80,** 857–897; **84,** 1066.
Au. act Aug. 2, 1882; made by Capt. Mercur, 1883, **84,** 1065, 1067.
By Capt. Lucas, 1901, for est. cost of proj. d., **01,** 1493.
Ref. to ex. and sur. reports, etc., **12,** 440.
Maps. **80,** 896; **89,** 1062; **90,** 1130.

M-258 Beaufort Inlet, N. C., and waterways to or from.

NOTE.—The inlet is an opening in the barrier which separates the ocean from the waterways, such as Core Sound, Pamlico Sound, etc., behind the barrier. It is in front of Beaufort, N. C., and a few miles west of Cape Lookout.

Part.	Title.	Period.	Appropriation.
a	Beaufort Inlet	1902–1912	$82,500
b	Beaufort Inlet to South Mills, N. C.	1900–1901	
	Total		82,500

Part (a), M-258 Beaufort Inlet, N. C.

APPROPRIATIONS.

1905,	$45,000,	**05,** 1214.
1907,	5,000,	**07,** 1236.
1909,	*15,000,	**09,** 1286.
1910,	7,500,	**10,** 1419.
1912,	10,000,	**12,** 1762.
Total,	82,500,	**12,** 1762.

COMMERCE.

Increased nearly 400% in one year, **06,** 263.
Description of; imp. would lessen rates; work designed to provide dw. outlet to ocean for inland waterway Pamlico Sound to Beaufort Inlet, N. C., **11,** 368.
Traffic, 1911, 32,000 t., **12,** 444.

ENGINEERS.

Chief of Engineers. R., 04, 227, 1387; **05,** 245; **06,** 263; **07,** 275; **08,** 293; **09,** 302, 315; **10,** 345; **11,** 368; **12,** 443.

Boards:
Constituted by S. O. 19 (Col. P. C. Hains, Maj. J. B. Quinn, Lt. Col. Chas. J. Allen, later Capt. E. E. Winslow in place of Col. Hains), convened Norfolk, Va., to consider plans for 16′ waterway, Norfolk, Va., to Beaufort, N. C.,[1] **04,** 1388, 1392.
BERH. **R., 04,** 1465.

In charge:
Capt. R. P. Johnston, 1905–06. **R., 05,** 1214; **06,** 1155.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1235; **08,** 1290; **09,** 1286; **10,** 1419; **11,** 1543.
Maj. H. W. Stickle, 1911–. **R., 12,** 1762.

OPERATIONS.

1905-06. 204,778 c. y. dr. U. S. dr., **06,** 1155.
1906-07. 221,852 c. y. dr., **07,** 1235.
1909-10. 51,997 c. y. dr., **10,** 1419.
1910-11. U. S. dr. *Cape Fear* removed, 237,003 c. y. from ocean bar, and obtained chan. 20′ x 300′; cost of dr., 7¢ c. y., **11,** 1543.

*Allotment.

[1] H. Doc. 563, 58th, 2d.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 1404.
Shoaling, **12,** 444.

PROJECTS.

By BE., for dr. chan. 20′ x 300′ across bar at the inlet; est., $45,000 (in connection with an inland waterway from Norfolk to Beaufort; the portion of the proj. embracing Beaufort Inlet au. by Congress 1905), [1]**04,** 1415.

SURVEYS.

For waterway 16′ d., Norfolk to Beaufort Inlet au. act June 13 1902; made, 1904, by BE.,[1] **04,** 1404, 1415.
Of bar, **05,** 1214; **10,** 1419.
Of inlet and H., au. act Mar. 2, 1907, for 25′ across bar, made, 1907; Capt. Brown's **R.** unfav.,[2] **09,** 315.
Cong. docs., etc., relating to exs., surs., plans, etc. **12,** 444.
Maps.[2]

Part (b), M–258 Beaufort Inlet to South Mills, N. C. (Waterway via.)

COMMERCE.

C. to be benefited by this waterway of general character and would probably include traffic to and from all ports s. of Norfolk. Route valuable aid in time of war, **01,** 1514.
Letters from interested parties giving their views and opinions on proposed imp., **01,** 1536–40.

ENGINEERS.

Chief of Engineers. R., 01, 299, 309.
In charge:
Maj. J. B. Quinn, 1901. **R., 01,** 1513, 1523.
Capt. E. W. Van C. Lucas, 1901. **R., 01,** 1519, 1529.

PHYSICAL CHARACTERISTICS.

Details of, **01,** 1513.

SURVEY.

Pre. ex. and sur., South Mills, N. C., to Albemarle Sound, N. C., via Pasquotank R., to obtain 16′ m. l. w., au. act June 6, 1900; **Rs.** by Maj. Quinn, Aug. 10 and Nov. 17, 1900; est. $1,935,893.62,[3] **01,** 299, 1511, 1512, 1513, 1523.
Pre. ex. and sur. au. act June 6, 1900, Albemarle Sound to Beaufort Inlet, N. C., via Croatan, Pamlico and Core Sounds, to obtain 16′ and Beaufort and Ocracoke Inlets to obtain 18′; **Rs.,** Capt. Lucas, Aug. 8 and Nov. 22, 1900; est., $1,611,500 via Ocracoke Inlet, $3,597,000 via Beaufort Inlet, operation of 2 dr., $50,000,[3] **01,** 309, 1511, 1517, 1529.

M–259(a) CAPE LOOKOUT, N. C. (Harbor of refuge at.)

APPROPRIATIONS.

1912, $300,000, **12,** 441.

COMMERCE.

During the 9 years ending 1897 about $2,600,000 worth of vessels and cargoes lost in vicinity of Cape Lookout, **97,** 1431; **00,** 1833.

ENGINEERS.

Chief of Engineers. R., 95, 191; **97,** 212; **00,** 276; **10,** 359; **12,** 440, 462.

Boards. Convened, Wilmington, N. C., Nov. 8, 1899, by S. O., No. 14, to make ex., sur., plan, and est. for H. of refuge at or near Cape Lookout, N. C. **R., 00,** 1830 (Majs. E. H. Ruffner, T. L. Casey, and Capt. E. W. Van C. Lucas).

In charge:
Maj. W. S. Stanton, 1895. **R., 95,** 1375.
Capt. W. E. Craighill, 1897–1900. **R., 97,** 1430. **00,** 1834.
Capt. E. I. Brown, 1910. **10,** 329.
Capt. L. H. Rand, 1912. **12,** 421.
Maj. H. W. Stickle, 1912. **12,** 421.

Assistants:
Lt. E. W. Van C. Lucas. **R., 95,** 1379.
W. H. Chadbourn, jr. **R., 97,** 1432; **00,** 1835.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1379; **00,** 1832. The only refuge for vessels engaged in trade from Cape Fear to the capes of Virginia, **97,** 1433.
Comparative advantages at Cape Lookout and Cape Hatteras for a H. of refuge, **00,** 1831, 1832.
Details, **12,** 440.

PROJECTS.

Capt. Craighill submitted an est., 1897, for st. break'r sheltering an area of 540 acres, 30′ d., cross section the same as that for the break'r, Delaware B., Del.; est., $3,700,000, **97,** 1430; **00,** 1835.
BE., 1899, est. $3,526,600 to constr. break'r on the line and general position as selected by Capt. Craighill, 1897, modified with regard to its exact location and the direction of the short outer tangent, **00,** 1831.
Act July 25, 1912, au. H. of refuge inclosing 575 acres, 30′ d. or more,[4] **12,** 441.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1895, by Maj. Stanton (**R.** fav.), **95,** 1376.
Sur. with view to making locality capable of sheltering the largest vessels, au. act June 3, 1896; made by Capt. Craighill, 1897 (see Projects), **97,** 1430.
Pre. ex. for H. of refuge for coastwise vessels au. act Mar. 3, 1909; **R.** by Capt. E. I. Brown, 1909 (unfav.), [5]**10,** 359.
Pre. ex., to determine value as site for H. of refuge, and availability as a C. H., au. act June 25, 1910; **R.** by Capt. Brown, 1910; constr. of C. H. not warranted, but plan for H. of refuge presented; est., $3,526,600[4] (see Projects), **12,** 462.
Cong. docs., etc., relating exs., surs., plans, etc., **12,** 441.
Map. **97,** 1432.

[1] H. D. 563, 58th, 2d.
[2] H. D. 1454, 60th, 2d.
[3] H. D. 202, 56th, 2d.
[4] H. D. 528, 62d, 2d.
[5] H. D. 315, 61st, 2d.

M–260 OCRACOKE INLET, N. C.[1]

APPROPRIATIONS.

1826,	$1,000, act May 20 (sur.)
1828,	20,000, act May 23.
1829,	21,000, act Mar. 2.
1831,	17,000, act Mar. 2.
1832,	22,000, act July 3.
1833,	16,700, act Mar. 2.
1834,	15,000, act June 28.
1836,	9,000, act July 2.
1837,	12,050, act Mar. 3.
1890,	90,000, **91,** 1342.
1892,	15,000, **92,** 1116.
Total,	238,750

COMMERCE.

C. interests of the locality, **89,** 1120; **91,** 1344.

Large trade in cotton, timber, and produce, **93,** 1364–1366. In 1894 it was est. that 7,500,000′ of lumber go through the inlet an., **94,** 1016.

1900, 4,900 t., **01,** 1484.

Practically no C. since opening of Dismal Swamp Canal. Inlet principally used by shallow draft vessels to avoid Hatteras Shoals, **03,** 230.

CONTRACTS.

1891. Alabama Dredging & Jetty Co., dr., 17¢ c. y., **92,** 1117.

1894. Contract with the Alabama Dredging & Jetty Co., dr., 17¢ c. y., annulled by supple. agreement ($75,000), **94,** 997.

1895. C. T. Caler, dr., 31¢ c. y., s. m. ($55,800), **95,** 1311.

1896. Roberts Safety Water Tube Boiler Co., boiler, wheel and accessories, etc., for SS. Gen. Thom, $3,105, **97,** 1386.

ENGINEERS.

Chief of Engineers. **R., 89,** 148; **91,** 156; **92,** 157; **93,** 169; **94,** 155; **95,** 178; **96,** 160; **97,** 199–212; **98,** 201; **99,** 233; **00,** 265, 277; **01,** 299; **02,** 226; **03,** 229; **04,** 229; **05,** 236.

In charge:

Capt. W. H. Bixby, 1888–92. **R., 89,** 1118; **91,** 1341.

Maj. W. S. Stanton, 1892–95. **R., 92,** 1115; **93,** 1359; **94,** 996; **95,** 1306.

Lt. Col. D. P. Heap, 1896. **R., 96,** 1097.

Capt. W. E. Craighill, 1897–98. **R., 97,** 1385, 1423; **98,** 1237.

Capt. E. W. Van C. Lucas, 1899–1903. **R., 99,** 1487; **00,** 1793; **01,** 1484; **02,** 1129; **03,** 1093.

Capt. R. P. Johnston, 1904–05. **R., 04,** 1477.

Assistants:

Lt. M. M. Patrick. **R., 91,** 1342.

Lt. E. W. Van C. Lucas. **R., 93,** 1369; **94,** 1005, 1016.

S. F. Burbank. **R., 97,** 1424.

OPERATIONS.

1894–95. 21,803 c. y., s. m., dr., **95,** 1310.
1895–96. 84,022 c. y., s. m., dr., **96,** 1098.
1896–97. 96,597 c. y., s. m., dr., **97,** 1386.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1119; **93,** 1360.

Tidal observations, **93,** 1367; **94,** 999, 1007; **95,** 1310.

Current velocities, **94,** 1010.

Comparative reach of tidal influence, **94,** 1012.

Chan. changes from 1830 to 1892 and conditions covering such changes, **93,** 1372, 1374.

Sand movement, **94,** 1013.

Soundings, **94,** 1014.

Borings, **94,** 1013.

Wind effects, **94,** 1012.

Levels, **94,** 1008.

Slopes, **94,** 1007.

PLANS. (See Projects.)

By Capt. Bixby, 1889, imp. of the inlet to form a direct ocean outlet for the C. of Albemarle and Pamlico Sounds by dr. a chan. 10′–15′ x 300′ through the s. bar passage (called Portsmouth Straightway), and d. its s. inside chan.; also to dr. an inlet to a H. of refuge; est. dr. for a 10′ d., $100,000; for a 15′ d., $280,000. Also for constr. (if necessary) of training and protecting dikes, at a cost of $320,000; total est. for dr. and diking, $600,000, **89,** 1123, 1124; **91,** 1341.

PROJECTS.

By Maj. Stanton, 1894, dr. at Teachs Hole Swash Chan. through the inner shoals at est. of $29,339.38, or, if that chan. shoaled so rapidly as to make its abandonment advisable, for imp. of Blairs Chan. at an est. of $28,000, **94,** 997. This proj. superseded, 1894, by another for dr. Wallace Chan. to d. 9′ for l. of 5,000′ more or less on Royal Shoal, to obtain a chan. with a bottom w. of 300′ and a d. of 9′ for a l. of 700′ at Beacon Isld. Slough; est., $51,513.39, **95,** 1307.

In 1897, Lt. Col. Heap est. cost of obtaining 14′ m. l. w. would be $17,250, **97,** 1424.

Proj. completed. Sec. 7, R. & H. act Mar. 3, 1905, requires unexpended balance to be turned into Treas., **05,** 236.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1118.

Sur. made, 1891, by Capt. Bixby, **91,** 1342.

Supple. sur. of the inner shoals made, 1892, by Maj. Stanton, **93,** 1369. Completed in the following year, **94,** 997.

Surs. made, 1895–96, by Lt. Col. Heap, **96,** 1099.

Sur. made, 1897, by Capt. Craighill of Royal Shoal cut and Beacon Isld. Slough cut, **97,** 1386.

Sur. with a view to chan. 14′ d. au. act June 3, 1896, made by Lt. Col. Heap, 1897 (**R.** unfav.) (see Projects), **97,** 1423.

Sur. of Royal Shoal cut and Beacon Isld. Slough cut made, 1897–98, by Capt. Craighill, **98,** 1237.

Ex., 1899, by Capt. Lucas, **99,** 1488.

Sur. made, 1900, by Capt. Lucas, **00,** 1794.

See sur. South Mills to Beaufort Inlet, **01,** 1511.

Maps. **91,** 1344; **92,** Atlas. 21; **93,** 1376; **94,** 1016; **95,** 1310; **96,** 1098; **97,** 1386: **00,** 1796.

M–266 CORE CREEK, N. C.

ENGINEERS.

Chief of Engineers. **R., 12,** 463.
In charge. Maj. H. W. Stickle, **12,** 421.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, for imp. of navigation, to Core Creek Landing, **12,** 463.

[1] Sur.—R. Dec. 24, 1828; est. $55,000. (H. D. 482, 55th, 2d.)

M-276(a) MOREHEAD CITY, N. C. (Harbor at.)

APPROPRIATIONS.

1910, $19,000, **10,** 1420.
1912, 1,000, **12,** 1763.

Total, 20,000

COMMERCE.

In 1911, 9,000 t., **12,** 445.

CONTRACTS.

1910. Mitchell & Co., dr. approx. 152,000 c. y., 10½¢ c. y., **11,** 1545.
1911. D. Clinton Mackey, dr. approx. 152,000 c. y., 10½¢ c. y., **12,** 1763.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 177; **10,** 346; **11,** 369; **12,** 444.

In charge:
Capt. J. Mercur, 1883. **R.,** **84,** 1062.
Capt. Earl I. Brown, 1910–11. **R.,** **10,** 1420; **11,** 1544.
Maj. H. W. Stickle, 1912–. **R.,** **12,** 1763.

OPERATIONS.

1910-11. Repairs to plant, and laying out work, **11,** 1544.

1911-12. 121,464.6 c. y. dr. from prescribed cross section, and 16,113.7 c. y. from 1′ outside, **12,** 1763.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 346.
Max. draft to wharves at Morehead City, June, 1912, 10′; prior to imp. 2½′, **12,** 445.

PLANS.

Capt. Mercur **R.** ex. might be included in that of one of the neighboring sounds not yet ex.; submits no opinion as to the necessity for its imp., **84,** 1063.

PROJECTS.

For dr. chan. 10′ d.; au. act June 25, 1910; est., $19,000, and $2,000 an. mainten.; also bulkhead to be built by private interests, **10,** 346.

SURVEYS.

Ex. au. letters of Aug. 11 and Sept. 27, 1882, **84,** 1062.
Ex. and sur. of Bogue Sounds near Morehead City, N. C., au. act Mar. 3, 1909,[1] **10,** 360.
Maps.[1]

M-276(b) MOREHEAD CITY, N. C. (Sound near.)

ENGINEERS.

Chief of Engineers. **R.,** **84,** 177; **10,** 360

In charge:
Capt. J. Mercur, 1883. **R.,** **84,** 1062.
Capt. E. I. Brown, 1910. **10,** 329.

PLANS.

Capt. Mercur stated that ex. of this locality might be included in that of one of the neighboring sounds not yet ex.; therefore submits no opinion as to the necessity for its imp., **84,** 1063.

SURVEYS.

Ex. au. letters of Aug. 11 and Sept. 27, 1882, **84,** 1062.
Pre. ex. and sur., au. act Mar. 3, 1909, contiguous to the town of Morehead City; **R.** by Capt. Brown, Apr. 19, 1909, and Jan. 20, 1910; est., $19,000,[1] **10,** 360.
Maps.[1]

M-277 BOGUE INLET, N. C.

COMMERCE.

Description of. The desired imp., 1896, would be a benefit apparently to only 2 firms, and for a short time only. **97,** 1419.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 211.

In charge:
Lt. Col. Heap, 1896–97. **R.,** **97,** 1418, 1421.
Capt. W. E. Craighill, 1897. **R.,** **97,** 1418, 1421.

Assistants:
Lt. E. Jadwin. **R.,** **97,** 1419.
W. H. Chadbourn, jr. **R.,** **97,** 1422.

PHYSICAL CHARACTERISTICS.

Description of. Locality is at the first inlet s. of Beaufort Inlet, 25 m. distant. **97,** 1419.

PROJECTS.

In 1897, Lt. Col. Heap est. constr. of a j. to remove the sand bar at the inlet would cost $16,818.75, **97,** 1421.

SURVEYS.

Ex. for j., and sur. at the discretion of the Sec. of War for est. au. act Aug. 3, 1896; made by Lt. Col. Heap (**R.** unfav.) (see Projects), **97,** 1418.

[1] H. D. 649, 61st, 2d.

M–285 WHITE OAK RIVER, N. C.

ENGINEERS.

Chief of Engineers. **R., 81,** 168; **82,** 163; **84,** 177; **89,** 148; **90,** 170; **08,** 306.

In charge:
Capt. J. Mercur, 1881–84. **R., 82,** 1113; **84,** 1055.
Capt. W. H. Bixby, 1888–91. **R., 89,** 1127; **91,** 1434.
Capt. E. I. Brown, **08,** 280.

Assistant. J. P. Darling. **R., 82,** 1113; **84,** 1055.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1113; **89,** 1127.

PLANS.

By Capt. Bixby, 1889, navigation for SS., ocean to Sabistons Br., 29 m., thence chan. for flats about 21 m. farther to Collins Ford; est., $45,000, **89,** 1129.

By Capt. Bixby, 1890, SS. navigation, Roberts Landing to Sabistons Br., and flatboat navigation thence to Collins Crossing; est., $4,550, **91,** 1435.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. J. Mercur (**R.** unfav.), **82,** 1113.
Ex. White Oak R. to Smiths Mills, au. act Aug. 2, 1882; made, 1883, by Capt. J. Mercur (**R.** unfav.), **84,** 1055.
Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby (see Plans), **89,** 1127.
Ex., Roberts Landing to Collins Crossing, au. act Sept. 19, 1890; made, 1890, by Capt. Bixby (see Plans), **91,** 1434.
Pre. ex. from mouth to Maysville, au. act Mar. 2, 1907. **R.** by Capt. Brown[1] (unfav.), **08,** 306.

M–286 NEW RIVER TO SWANSBORO, N. C. (Inland Waterway.)

APPROPRIATIONS.

1890,	$5,000.00,	**91,** 1378.
1907,	*12,000.00,	**07,** 1238.
1909,	[2]3,500.00,	**09,** 1288.
	*4,000.00,	**09,** 1288.
	[2]1,330.80,	**10,** 1422.
1910,	5,000.00,	**11,** 1548.
1911,	5,000.00,	**11,** 1548.
1912,	*1,000.00,	**12,** 1767.
Total,	36,830.80 (incl. misc., $37,955.80,	**12,** 1767).

COMMERCE.

Prospective increase in, to result from imp., **89,** 1125.
Description of, **93,** 1399. A RR. operating from New R. to Wilmington had diminished or totally destroyed regular navigation of the stream in 1893, **93,** 1400; **95,** 1327.
C. developed has not been commensurate with cost of imp., **10,** 349.
1911, 16,598 t., mostly brick, hay, grain, fertilizer, lumber, machinery, cotton seed, cotton, shellfish, wood, eggs, etc., **12,** 1767.

ENGINEERS.

Chief of Engineers. **R., 89,** 148; **91,** 162; **92,** 163; **93,** 176; **94,** 161; **95,** 184; **05,** 246; **06,** 265. **07,** 277; **08,** 295; **09,** 304; **10,** 348; **11,** 371; **12,** 447.

In charge:
Capt. H. W. Bixby, 1888–92. **R., 89,** 1124; **91,** 1376.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1146; **93,** 1399; **94,** 1037; **95,** 1327.
Capt. R. P. Johnston, 1905–06. **R., 05,** 1216; **06,** 1157.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1238; **08,** 1292; **09,** 1288; **10,** 1422; **11,** 1547.
Maj. W. H. Stickle, 1912–. **R., 12,** 1766.

Assistant. H. W. Chadbourn, jr. **R., 91,** 1378.

OPERATIONS.

1894–95. No work done up to this time on account of a claim of a private corporation to control of the stream, **95,** 1327.
1904–05. Franchise granted a corporation by act of N. C. in 1889, surrendered and abandoned, **05,** 247.
1905–06. 920 c. y. dr., **06,** 1157.
1906–07. 19,849 c. y. dr., **07,** 1238.
1907–08. 80,411 c. y. dr., **08,** 1293.
1908–09. 51,724 c. y. dr., **09,** 1288.
1909–10. 31,488 c. y. dr., **10,** 1422.
1910–11. U. S. dr. *Scuppernong* excavated 18,735 c. y. from New R. Inlet and Salliers B., from w. of Dudleys Ditch, completing proj., **11,** 1547.

PHYSICAL CHARACTERISTICS.

Description of. The ocean is a few hundred yards distant on one side, and a RR. runs on the other side, **89,** 1125; **95,** 1327.

PRIVATE WORK.

See Operations. 1904–05.

PROJECTS.

By Capt. Bixby, 1889, 3′ or 4′ navigable chan. from Swansboro to New R.; est., $43,000, **89,** 1127; **91,** 1377.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1124.
Sur. made, 1891, by Capt. Bixby, **92,** 1146.
By Capt. Johnston, 1905, to determine conditions, **05,** 1216.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 448.
Maps. **91,** 1378.

[1] H. D. 401, 60th, 1st. [2] Transfer. *Allotment.

M–290 NEW RIVER, N. C.[1]

APPROPRIATIONS.

1836, $5,000,
1837, [2]20,000, Treas. Doc., No. 373, 1882.
1838, [2]25,000,
1882, 5,000, **83,** 865.
1884, 5,000, **84,** 1046.
1886, 10,000, **86,** 993.
1888, 3,000, **88,** 887.
1890, 5,000, **90,** 1143.
1892, 5,000, **92,** 1151.
1907, *[3]2,000, **07,** 1237.
1910, *6,700, **10,** 1421.
1912, *500, **12,** 1765.

Total, 92,200 (incl. misc., and less $1,330.80 trans., $90,869.30, **12,** 1765).

COMMERCE.

C. decreasing, **93,** 1402; **94,** 1039; **95,** 1329.
Slight increase over preceding years, **99,** 1501; **00,** 1812.
Imp. has had little effect on rates, **10,** 347.
1911, 36,257 t., **12,** 447.

CONTRACTS.

1886. R. Moore, dr., 25¢ c. y., **86,** 992. Dr., 28½¢ c. y., **87,** 1041.
1890. Alabama Dredging & Jetty Co., dr., 49¢ c. y., **91,** 1381; expired by limitation, **93,** 1402.

ENGINEERS.

Chief of Engineers. **R., 81,** 168; **82,** 163; **83,** 169; **84,** 174; **85,** 169; **86,** 165; **87,** 129; **88,** 123; **89,** 142; **90,** 128; **91,** 163; **92,** 163; **93,** 176; **94,** 162; **95,** 184; **96,** 166; **97,** 206; **98,** 208; **99,** 239; **00,** 272; **01,** 305; **02,** 233; **03,** 237; **04,** 238, 245, 1537; **05,** 247; **06,** 266; **07,** 276; **08,** 294; **09,** 303, 315; **10,** 346; **11,** 369; **12,** 445.

Boards. BERH. Recom. expend. of balance of funds in rebuilding dike at Cedar Bush Marsh, **04,** 1540.

In charge:
Capt. J. Mercur, 1881–84. **R., 82,** 1117; **83,** 865.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1046.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1082; **86,** 991; **87,** 1039; **88,** 885; **89,** 1078; **90,** 1141; **91,** 1379.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1149; **93,** 1400; **94,** 1037; **95,** 1328.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1120.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1399; **98,** 1250.
Capt. E. W. Van C. Lucas, 1899–1904. **R., 99,** 1501; **00,** 1812; **01,** 1497; **02,** 1139; **04,** 1538.
Capt. E. E. Winslow, 1903. **R., 03,** 1104; **04,** 1540.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1489; **05,** 1217; **06,** 1158.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1236; **08,** 1291; **09,** 1287; **10,** 1420; **11,** 1546.
Maj. H. W. Stickle, 1912–. **R., 12,** 1765.

Assistants:
J. P. Darling. **R., 82,** 1118.
E. D. Thompson. **R., 87,** 1041; **88,** 887; **89,** 1079; **90,** 1143.
W. H. Chadbourn, jr. **R., 91,** 1381.

OPERATIONS.

1885–86. 34,991 c. y. dr. from cut through marsh at Cedar Bush Cove, **86,** 992.
1887–88. 29,282 c. y. dr., **88,** 886.
1890–91. 530 l. f. oyster-shell dike built, **91,** 1380.
1894–95. 1,495 l. f. training dike built at Cedar Brush Marsh, **95,** 1328.
1895–96. Repairs made to dike at Cedar Brush Marsh, **96,** 1120.
1905–06. Dike, 1,800′ l., around Cedar Brush Marsh rebuilt of oyster shells, **06,** 1158.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 885; **93,** 1400.
Tidal observations, **94,** 1038, 1039.
L. w. d. about 3′, through a tortuous chan. around Cedar Bush Marsh; timber dike destroyed by teredo; chan. deteriorated to orig. conditions, **04,** 1540.
Description of R., **04,** 1540.

PROJECTS.

By Capt. Mercur, 1882, chan. 5′x150′x7,000′ m. l. w. through bar at New R. Inlet, connecting the upper R. with the ocean. Est., $40,000, **82,** 117; **91,** 1381.
In 1885 location of the proposed chan. slightly changed, **85,** 1082; **87,** 1040.
By Maj. Stanton, 1892, modification of existing proj. to provide for restriction of the w. of 2 cuts to be made to w. of those existing, 40′ through Cedar Bush Marsh and 100′ through Wrights Isld., **93,** 1401.
In 1893 Maj. Stanton est. $13,000 to dr. 10,000 c. y. to restore d. of 4′ through 4 shoals at the ends of 2 cuts above mentioned, and to constr. regulating works, 3,750 l. f. of revet. along the upper part of Cedar Bush Marsh to be included, **93,** 1401.
In 1893 abandonment of dr. cut through Cedar Bush Marsh au. by Chief of Engineers, it being apparent that its mainten. would require continual redr., **94,** 1038.
By Maj. Stanton, 1894, training dikes of piles and sheet piling at Cedar Bush Marsh for mainten. of 4′ by dr.; est., $5,000, **94,** 1038.
In 1897 Capt. Craighill, est. $1,000 required an. for mainten., **98,** 1250.
By Capt. Winslow, 1903, restoring chan. by rebuilding dike around Cedar Bush Marsh of oyster shells; est., $2,500,[4] **04,** 1541.
By Capt. Brown, 5′ x 200′, mouth to Jacksonville; est., $6,700, and $800 an. mainten., [5]**09,** 315; au. act June 25, 1910, being a modification of former proj., **10,** 347.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. Mercur, **82,** 1117.
Sur. from Cedar Bush Marsh to the Ocean Bar made, 1890, by Capt. Bixby, **90,** 1142.
Sur. of Cedar Bush Marsh and Wrights Isld. chans. by Maj. Stanton, 1893, **93,** 1401.
Ex. 1900, by Capt. Lucas, **00,** 1812.
Au. act June 13, 1902; made, 1902 and 1903, by Capt. Lucas and Capt. Winslow, resp.,[4] **04,** 1538, 1540.
To ascertain effect of imp., **07,** 1236.
Au. act Mar. 2, 1907; made, 1907–08, by Capt. Brown;[5] est., $6,700, **09,** 315.
Ref. to ex. and sur. docs., etc., **12,** 446.
Maps. **90,** 1144; **91,** 1381; **93,** 1402; **95,** 1328.

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[1] Sur.—**R,** Jan. 6, 1837; est. $25,000. (H. D. 482, 55th, 2d.)
[2] For opening a passage from Beaufort H. to Pamlico Sound and for imp. New R.
[3] $1,330.80 trans. to waterway between New R. and Swansboro, N. C., **10,** 1421.
[4] H. D. 239, 58th, 2d.
[5] H. D. 1085, 60th, 2d.
*Allotment.

M–305 CAPE FEAR RIVER, N. C.

NOTE.—R. is formed by confluence of Deep and Haw Rs., at Haywood, N. C. It flows se. to Atlantic at Cape Fear, near s. extremity of N. C. Its total l. is 400 m. Imp. is in 2 parts mainly—above and below Wilmington, N. C. Proj. portion above Wilmington is 115 m. l. up to Fayetteville. Wilmington to ocean is 30 m.

Part.	Title.	Period.	Appropriations.
a	At and below Wilmington	1829–1912	$5,528,228.92
b	Above Wilmington	1881–1912	169,750.00
c	Above Wilmington (lock and dam)	1902–1912	350,000.00
d	Deep R. and Cape Fear R	1871–1872	.....
e	Above Fayetteville	1871–1896	.....
	Total	.....	6,047,978.92

Part (a), M–305 Cape Fear River, N. C. (At and below Wilmington.)[1]

APPROPRIATIONS.

1829, $20,000.00, act Mar. 2.
1830, 25,688.00, act Apr. 23.
1831, 25,705.00, act Mar. 2.
1832, 28,000.00, act July 3.
1833, 28,000.00, act Mar. 2.
1834, 5,234.00, act June 28.
1835, 20,000.00, act Mar. 3.
1836, 20,000.00, act July 2.
1837, 10,000.00, act Mar. 3.
1838, 20,000.00, act July 7.
1847, 601.92, act Mar. 2.
1852, 20,000.00, act Aug. 30.
1854, 140,000.00, act July 22.
1870, 100,000.00, **70,** 70, 421.
1871, 75,000.00, **71,** 75, 610.
1872, 100,000.00, **72,** 71, 699.
1873, 100,000.00, **73,** 77.
1874, 150,000.00, **74,** 89, ii, **71.**
1875, 150,000.00, **75,** 90, ii, 99.
1876, 132,500.00, **76,** 66, 309; **77,** 63, 333.
1878, 160,000.00, **78,** 69, 476.
1879, 100,000.00, **79,** 81, 557.
1880, 70,000.00, **80,** 697.
1881, 140,000.00, **81,** 919.
1882, 225,000.00, **82,** 934.
1884, 200,000.00, **84,** 938.
1886, 157,500.00, **86,** 1004.
1888, 245,000.00, **88,** 900.
1890, 170,000.00, **90,** 1156.
1892, 200,000.00, **92,** 1169.
1894, 200,000.00, **95,** 1340.
1896, 195,000.00, **96,** 1133.
1899, 150,000.00, **99,** 1508.
1902, 150,000.00, **02,** 1145.
1904, *30,000.00, **04,** 1496.
1905, 150,000.00, **05,** 1226.
1906, 200,000.00, **06,** 1166.
1907, { 165,000.00, 100,000.00, } **07,** 1248.
1908, 150,000.00, **08,** 1303.
1909, { *300,000.00, 100,000.00, } **09,** 1296. **09,** 1296.
1910, 400,000.00, **10,** 1435.
1911, 100,000.00, **11,** 1564.
1912, 300,000.00, **12,** 1782.

Total, 5,528,228.92 (incl. $36,730.02 received from rents, sales, etc., $5,564,958.94, **12,** 1782).

COMMERCE.

80, 712; **84,** 947; **86,** 1059.
Advantages resulting from imp., **82,** 946.
Large and important trade in cotton, lumber, etc., **93,** 1423; **94,** 1052; **95,** 1340; **12,** 1785.
Description of, **00,** 1822.
As a result of imp. large vessels now trade at port; rates reduced, **07,** 287; **12,** 461.
Description of, **10,** 358; **12,** 461.
1869, 220,000 t.; 1890, 347,000±; 1895, 618,000±; 1900, 699,000±; 1905, 871,000±; 1909, 872,000±; 1911, 1,064,000±t., **12,** 1785.

Freight transported.

	Tons.		Tons.
1869	220,000	1900	699,356
1889	325,512	1901	727,359
1890	346,557	1902	841,631
1891	344,443	1903	843,337
1892	341,468	1904	856,011
1893	392,965	1905	871,106
1894	437,623	1906	814,291
1895	618,054	1907	870,556
1896	673,208	1908	864,071
1897	595,426	1909	872,426
1898	627,899	1910	944,657
1899	621,852	1911	1,063,908

Cotton steamers loaded at port of Wilmington, N. C., during year ending Dec. 31, 1911.

Name of steamer.	Tonnage.	Draft loaded. Ft.	Draft loaded. In.	Number of bales.
Lovaine	1,998	18	8	11,249
Soutra	1,771	16	0	10,483
Clara	1,022	16	0	4,500
Eretza Mendi	2,578	18	9	13,991
Potomac	688	14	3	2,000
Anglo Chilian	2,442	19	6	13,078
Annette Furness	1,151	15	0	5,632
Blythswood	2,243	19	7	11,700
Hermai	1,305	16	6	6,467
Wilston	1,626	16	6	8,442
Mariner	1,523	17	0	8,295
Dunolly	2,127	18	6	10,492
Stanfield	2,192	18	6	10,483
Gretavale	2,009	18	0	10,143
Vizcaina	1,370	15	7	6,435
Cape Antibes	1,616	17	4	10,088

[1] Sur. below Wilmington—**R.,** Dec. 10, 1827; est., $39,818.80. **R.,** July 11, 1829; est., $154,588.12. **R.,** Mar. 30, 1853; est., $958,200. **R.,** Mar. 18, 1858; est., $443,400. (H. D. 482, 55th, 2d.)
*Allotment.

Cotton steamers loaded at port of Wilmington, N. C., during year ending Dec. 31, 1911—Continued.

Name of steamer.	Tonnage.	Draft loaded.		Number of bales.
		Ft.	*In.*	
Bengrove	2,389	18	3	13,225
Border Knight	2,393	20	7	12,277
King George	2,480	18	6	12,886
Shira	2,401	21	8	13,290
Ballochmyle	2,040	18	10	10,800
Putney Bridge	2,147	19	1	11,864
Reigate	2,504	18	4	12,065
Winnie	1,583	15	0	8,209
Parklands	1,885	16	10	11,332
Nessfield	2,380	18	0	12,750
Foreric	2,557	18	1	12,718
Auchencrag	2,539	20	7	14,241
Benpark	2,390	19	2	13,850
Beechley	2,466	19	4	12,482
Oceana	3,155	21	4	17,300
Burbo Bank	1,818	17	7	9,886
Pentwyn	2,165	19	2	13,652
Appenine	2,306	18	3	13,250
Vizcaina	1,370	16	0	6,708
Glenmay	1,571	18	6	9,626
Total	72,200	.....		385,889

"As a result of the improvement, vessels coming to Wilmington are much larger than formerly, the average tonnage in 1886 being 421, while in 1911 the average was 1,259. This increase in tonnage has caused a corresponding decrease in freight rates on shipments by water." **12,** 461, 1785.

CONTRACTS.

1874. Curtis, Fobes & Co., dr., 14¢, 15¢, and 16¢ c. y., **75,** ii, 102; **76,** 308.

1875. Curtis, Fobes & Co., dr., 17¾¢ c. y., **75,** ii, 102; **76,** 308. Bangs & Dolby, material and labor, **76,** 308, 314.

1876. Bangs & Dolby, st., $1.89 c. y., **77,** 332, 335.

1877. W. H. French, st., $1.63¾ c. y., **78,** 476.

1878. French & Dolby, st., $1.75 c. y., **79,** 557.

1879. Ross & Pennypacker, st., $2.24 and $2.29 t., **80,** 697; completed, **80,** 699.

1881. G. H. Ferris, dr., 14⅞¢ c. y., **81,** 921; completed, **83,** 719.

1883. National Dredging Co., dr., 16.7¢ c. y.; annulled, **83,** 719. New York Steam Dredging Co., dr., 14¾¢ c. y., **83,** 718; completed, **83,** 720. New York Steam Dredging Co., dr., 14¾¢ c. y., **84,** 938. Ross & Lara, brush and cane, $3.60 and $2.60 cord, resp., **84,** 938; completed, **84,** 942. J. C. Springer, ratline and spun yarn, 10¾¢ and 9½¢ lb., resp., **84,** 938; completed, **84,** 942. G. M. Summerell, scows, $1,150, $600, $580, $566, and $550, resp., **84,** 938; completed, **84,** 941. Ross & Lara, st., $1.35 t., **84,** 939; completed, **85,** 1087.

1884. Ross & Lara, st., $1.48 t., completed, **85,** 1087. G. Z. French, st., $1.55 and $1.48 t.; extended **85,** 1088; completed, **86,** 1012. J. C. Froehlich & Co., steam boiler, $1,240; completed, **85,** 1088. R. Moore, dr., 14½¢ c. y., **85,** 1089; extended, **86,** 1012; completed, **85,** 1093.

1886. W. A. Martin, j. st., $1.52½ t., **87,** 1052.

1887. Atlas Dredging Co., dr., 9¢ c. y., **87,** 1052. R. Moore, dr., 9¢ c. y., **87,** 1052.

1888. T. Smith, steam boiler, $3,045, **88,** 900. G. Z. French, st., $1.66¾ t.; R. Moore, dr., 13.7¢ c. y., **88,** 900.

1889. Atlas Dredging Co., dr., 12¢ c. y., **89,** 1092.

1890. P. S. Ross, dr., 13¼¢ c. y., **91,** 1398.

1892. C. P. E. Burgwyn, dr., 12.49¢ and 12.44¢ c. y., s. m., $125,000, **93,** 1424. This contract curtailed by supple. agreement 1894 to provide funds for purchase of a new U. S. dr., **94,** 1048.

1894. Charles Hillman Ship & Engine Building Co., dr. steamer, $53,000, **95,** 1342.

1895. Fowler & Morrison, coal, $2.60 l. t., **95,** 1342.

1896. Cordes & Bochman, dr. plant, $27,550, **97,** 1407.

1898. J. A. Springer & Co., 750 t. coal, $2.85 and $2.95; Davis Coal & Coke Co., 500 t. coal, $2.59 t., **98,** 1256. Theo. Smith & Bro., i. gear-wheel friction for dr., $3,830, **98,** 1256.

1899. The Columbian Iron Works & Dry Dock Co., tugboat, $26,500, **00,** 1823.

1905. Linehan, Carroll & Co., st., $1.60 t., **05,** 1226.

1906. F. C. Blackmer, 2 dump scows, $16,500, **06,** 1166.

1907. Theo. Smith & Sons, clamshell dr., $61,350; Winnsboro Granite Corporation, 20,000 t. st., **07,** 1248.

1908. Sanford & Brooks Co., 2 dump scows, **08,** 1304.

1909. Winnsboro Granite Corporation, st., **09,** 1296.

1910. Bowers Southern Dredging Co., dr., $0.0795 c. y. in section, and $0.03975 c. y. 1 foot outside section, **11,** 1560; **12,** 1782.

DOCUMENTS. (Not printed in **Rs.**)

Numerous docs. referred to by Lt. Col. Foster, **73,** 804–815.

R. of Capt. Hartman Bache, H. Doc. 127, 20th Cong., 1st sess.

R. of commission, 1853, H. Doc. 1, 33d Cong., 1st sess., part 2, **73,** 807, 814.

R. of commission, 1858, Ex. Doc. 2, 36th Cong., 1st sess., part 3, p. 829, **73,** 809.

R., Col. J. H. Simpson, S. Doc. 27, 41st Cong., 3d sess., **71,** 610.

R. of Engrs. in charge prior to 1870.

ENGINEERS.

Chief of Engineers. Rs., 66, 3; **70,** 32, 70; **71,** 74; **72,** 70; **73,** 77; **74,** 88; **75,** 90; **76,** 65; **77,** 62; **78,** 68; **79,** 80; **80,** 125, 109; **81,** 148; **82,** 143, 941; **83,** 147; **84,** 150; **85,** 171; **86,** 168; **87,** 132; **88,** 125; **89,** 144, 148; **90,** 130; **91,** 166; **92,** 165; **93,** 179; **94,** 164; **95,** 187; **96,** 169; **97,** 209; **98,** 210; **99,** 242; **00,** 274; **01,** 307, 310, 1552; **02,** 235; **03,** 240; **04,** 242; **05,** 251; **06,** 272, 275; **07,** 284; **08,** 302; **09,** 311; **10,** 356; **11,** 379; **12,** 458, 462.

Boards:

Commission convened Mar. 30, 1853, and reported in favor of the imp. at and below Wilmington by js., fences, revets., etc., **73,** 807; **76,** 323. **R.,** H. Doc., 33d Cong., 1s sess. (Prof. A. D. Bache, U. S. C. S.; Maj. I. I. Stevens, U. S. E.; Capt. D. P. Woodbury, U. S. E., and Lt. C. H. Davis, U. S. N.)

BERH., to which was referred the **R.** of the aforesaid commission, **R.** Apr. 18, 1853, approv. part of the plan, but substituting a plan of imp. by dr., wing dams, js., etc., **73,** 809. (Col. De Russy and others.)

Commission convened Dec. 30, 1858, to ex. condition of entrances of Cape Fear R. Recom. imp. by constr. of st. js., **73,** 899, 810. **R.,** Ex. Doc. 2, 36th Cong., 1st sess. (Prof. A. D. Bache, U. S. C. S.; Hon. I. I. Stevens, M. C.; Lt. J. N. Maffit, U. S. N.; Capts. A. A. Humphreys and W. B. Franklin, and Lt. W. H. C. Whiting.)

Board convened at Wilmington, Dec. 12, 1871, and Jan. 12, 1872. Recom. continuation of the work, **73,** 797–799. (Lt. Cols. Tower, Wright, and Foster, and Majs. Gillmore and Craighill.)

Reconvened at New York City, Dec. 6, 1872. Recom. dr. at Baldhead Chan., that the work of closing be continued to Zekes Isld., and closing New Inlet with pile work. **R., 73,** 799–815. (Lt. Cols. Tower, Wright, and Foster, and Majs. Gillmore and Craighill.)

Constituted by S. O., No. 129, C. of E., 1881, **82,** 942. (See Projects.) (Lt. Cols. Gillmore, Craighill, and Comstock, and Capt. Turtle.)

In charge:

Lts. J. K. Mansfield and John H. Winder, in 1835. Inspection, **73,** 814.

Lt. A. J. Swift, 1836–38, **73,** 814.

Capt. McClellan, 1839, **73,** 814.

Capt. D. P. Woodbury, 1853–55, **70,** 422; **73,** 804, 809, 810.

Lt. Whiting, 1856, **73,** 810.
Col. Turnbull, 1857, **73,** 810.
Col. J. H. Simpson, 1870, **70,** 421.
Maj. W. P. Craighill, 1870. **71,** 74–77. **Rs., 71,** 609; **72,** 698; **73,** 789; **74,** ii, 68; **75,** ii, 98; **76,** 308; **77,** 332.
Capt. C. B. Phillips, 1878, in temporary charge. **R., 78,** 475, 492.
Lt. Col. W. P. Craighill, 1878–85. **R., 79,** 556; **80,** 695; **81,** 918, 919, 920; **82,** 934; **83,** 717; **84,** 937.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1087; **86.** 1000; **87,** 1047; **88,** 895; **89,** 1089, 1132; **90,** 1152; **91,** 1394.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1164; **93,** 1419; **94,** 1047; **95,** 1335.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1131.
Capt. W. E. Craighill, 1897–98. **R., 97,** 1406; **98,** 1255.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1507; **00,** 1818; **01,** 1504, 1557; **02,** 1144.
Capt. E. E. Winslow, 1903. **R., 03,** 1109.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1495; **05,** 1224; **06,** 1165.
Capt. E. I. Brown, 1907–11. **R., 07,** 1246; **08,** 1300; **09,** 1293; **10,** 1432; **11,** 1560.
Maj. H. W. Stickle, 1912–. **R., 12,** 1778.

Assistants:
Lt. W. R. Livermore, **70,** 422.
W. Griswold, **70,** 422; **71,** 610.
Capt. C. B. Phillips, **76,** 309. **R., 74,** ii, 69, 71; **75,** ii, 99. Historical sketch of work, **76,** 321–331.
H. Bacon. **R., 76,** 314; **77,** 335; **78,** 477, 493; **79,** 557; **80,** 698; **81,** 922; **82,** 937; **83,** 718; **84,** 939; **85,** 1091; **86,** 1011; **87,** 1053; **88,** 902; **89,** 1093; **90,** 1156.
R. C. Merritt. **R., 91,** 1398.
E. D. Thompson. **R., 92,** 1169; **93,** 1424.
C. Humphreys. **R., 88,** 901; **94,** 1053; **95,** 1341; **96,** 1133; **97,** 1410; **98,** 1259; **99,** 1511.
R. C. Merritt. **R., 04,** 1500; **05,** 1229.

ESTIMATES. (See Projects.)

By Col. Simpson, break'r connecting Zekes and Smiths Islds., $256,415.53, **70,** 70.
By Maj. Craighill, increased, **71,** 610.
By Capt. Phillips, dr. 12′ chan. to Wilmington, $260,000, **74,** ii, 69, 70. Afterwards reduced to $120,000, **75,** ii, 101.
By Maj. Craighill, work at Smiths Isld. and extension of Federal Pt. j., etc., $90,000, **74,** ii, 70.
By Maj. Craighill and Capt. Phillips, completing the work of closing New Inlet, $420,000, **75,** ii, 99.
By Maj. Craighill, completing existing proj., $50,000, **79,** 557; increased to $75,500 on account of damage by storm, **79,** 81.
By H. Bacon, to complete existing proj., $199,375; and $15,000 for an. dr., **79,** 561.

EXPENDITURES.

Total to Oct. 11, 1856, at Baldhead and Zekes Isld., $138,750, **73,** 810.

OPERATIONS.[1]

1829–38. Js. built by U. S., **73,** 813.
1853. Work begun at mouth of R., **73,** 809.
1870–71. Closing inlets by cribwork, **70,** 70, 422; 607′ break'r and superstr. built, **71,** 75, 610.
1871–72. Break'r extended nearly 1,200′, **72,** 70.
1872–73. Extension of break'r to 4,403′ and protection to Smiths Isld. beach, **73,** 789, 790.
1873–74. The deflecting j. from Federal Pt. extended to 500′; dr. at Baldhead Bar, and at the "Logs," **74,** 88, 89, ii, 71, 72.
1874–75. Dr. at Baldhead Bar, removing stumps at the "Logs," dr. at Horseshoe Shoals, and repairs to Federal Pt. j., and the works between Smiths and Zekes Islds., **75,** 90, ii, 99.
1875–76. An apron of timber, brush, and st., from Federal Pt. j. to Zekes Isld. (initial closing New Inlet), distance of 4,352′; dr. at Horseshoe Shoals continued, cut increased from 100′ to 200′ w., and from 9′ to 12′ d.; dr. at Baldhead Chan., removal of obstr. placed by Confederates in the R. chan., **76,** 65, 308, 309, 314, 315.
1876–77. 20,304 c. y. st. placed by contract between Zekes Isld. and Federal Pt. to continue work of closing the inlet, **77,** 62, 333, 335. Repairs to the works between Smiths and Zekes Islds., **77,** 336.
1877–78. 40,440 c. y. st. deposited on the dike closing New Inlet, **78,** 68, 475, 477, 492.
1878–79. Placing st. on New Inlet Dike and dr. on Baldhead Bar, **79,** 80, 556, 558, 560.
1879–80. 28,398 c. y. riprap placed in dam and 70,245 c. y. sand removed by suction dr. from Baldhead Chan., **80,** 696; 2 lighters and scows constr., **80,** 698; repairs to pumping apparatus, **80,** 701.
1880–81. 5,427 t. contract st. for coping, 2,367 t. rough, heavy st., and 12,880 c. y. riprap delivered in dam, **81,** 923; 218 t. st. ballast placed in dam, **81,** 922; 62,044 c. y. dr. in Baldhead Chan., **81,** 924; small trees transplanted at Federal Pt., Zekes and Smiths Islds., **81,** 925.
1881–82. 303,535 c. y. dr. from Snows Marsh Chan., **82,** 937; 21,967 c. y. dr. from Baldhead Chan., **82,** 939; flanks of dam strengthened with 238 c. y. and 486 t. st. riprap, **82,** 938. Unsuccessful attempt to close n. swash by pile work, **82,** 938.
1882–83. 896,661 c. y. dr. from Snows Marsh Chan., **83,** 719; repair of steam tug, **83,** 721.
1883–84. 333,129 c. y. dr. from Snows Marsh Chan. and Midnight Shoal, **84,** 940; 4,605 cords brush, 191 cords cane, and 11,861 t. st. delivered on dam, **84,** 941; 1,338 t. st. ballast purchased and 417 cords brush, **84,** 941; wharf built, **84,** 941; 53,350 s. y. mattress laid, at an average cost of 66.2¢ s. y., **84,** 942; repairs to suction dr. *Woodbury*, **84,** 943.
1884–85. 39,235 t. st. delivered, **85,** 1091; 2 scows built by hired labor, **85,** 1088; 321,925 c. y. dr., **85,** 1089.
1885–86. 325,449 c. y. dr., and 644 t. heavy st. placed in new dam, **86,** 1012; removal of stumps by dynamite, **86,** 1012.
1886–87. 332,112 c. y. dr. from the shoals; 11,630 t. st. placed in dike; 10,125 c. y. dr. from bar; sur. of R. shoals, **87,** 1049, 1053.
1887–88. 282,068 c. y. dr.; 14,551 t. st. placed upon the dike, **88.** 898.
1888–89. 243,826 c. y. dr.; top and slopes of new dam for 2,468′ faced with st., **89,** 1093.
1889–90. 1,347,206 c. y. dr. from chan. and shoals, **90,** 1155.
1890–91. 356,224 c. y. dr., **91,** 1397.
1891–92. 105,503 c. y. dr., **92,** 1171.
1892–93. 148,398 c. y., s. m., dr. under contract, and 101,991 c. y. dr. by U. S. plant. A small number of obstr. removed. **93,** 1425, 1426.
1893–94. 537,681 c. y., s. m., dr. by contract, and 47,608 c. y. dr. by U.S. dr., **94,** 1048. Design and specification for dr. steamer prepared, **94,** 1051. Gauges on the R. connected by a line of levels, Wilmington to Burbank Pt., **94,** 1051.
1894–95. 475,829 c. y., s. m., dr. under contract, and 32,839 c. y. dr. by U.S. dr. Training dike, 5,692 l. f. l. built. Wharf 45′ x 125′ built at old Fort Johnson. Repairs made to banks. **95,** 1339. Suction dr. steamer built, **95,** 1337.
1895–96. 473,886 c. y. dr. by U.S. dr. Snows Marsh Dike extended 2,992′ upstream and 556′ down; 1,788 piles driven and 1,533 cords brush fascines being used; 1,419 cords brush fascines used in repairs to dike. Minor repairs made to Swash Defense Dam and New Inlet Dam; about 200 t. st. and 1,822 bags sand, etc., being used. **96,** 1132.
1896–97. Repairs to New Inlet Dam completed. Training dike, Snows Marsh, extended 228′ at upper end and 496′ at lower, and 2,470 l. f. of this dike repaired; 550,524 c. y. dr. by U.S. dr., 25 stumps and 1 log removed, 97, 1406.
1897–98. 851,181 c. y. dr. by U.S. dr., 100 stumps and 4 logs removed, **98,** 1255.
1898–99. 936,765 c. y. dr., **99,** 1512.
1899–00. 1,085,528 c. y. dr., 329 logs and 256 stumps removed, **00,** 1818, 1819.
1900–01. 571,849 c. y. dr., and 234 snags and 42 logs removed by U.S. dr., **01,** 1504, 1505.
1901–02. 15,624 c. y. dr. from ocean bar and 22,121 c. y. from Snows Marsh Chan. by dr. *Cape Fear*, **02,** 1144.

[1] History of operations 1761 to 1886, **86,** 1004; past operations, **86,** 943, 1006, 1008; 1872, by Lt. Col. Foster, **73,** 805–815; by Capt. Phillips, to 1876, **76,** 321–331.

1902-03. 329,679 c. y. dr. by *Cape Fear;* 428,226 c. y., 50 stumps and logs, and 1,607 t. large st. from old Woodbury J. removed by dr. *Ajax;* repairs made to New Inlet Dam and Swash Defense Dam; obstr. removed at mouth of Brunswick R., **03,** 1109.

1903-04. 192,230 c. y. dr. by dr. *Cape Fear* and 496,820 c. y. by dr. *Aiax;* New Inlet and Swash Defense Dams repaired, **04,** 1495, 1496.

1904-05. 481,180 c. y. dr. by dr. *Cape Fear,* and 486,927 c. y., 71 stumps and 44 logs by dr. *Ajax;* repairs made to New Inlet and Swash Defense Dams, **05,** 1225.

1905-06. 110,638 c. y. dr. by dr. *Cape Fear,* 328,673 c. y. by dr. *Delaware,* and 752,395 c. y., 92 stumps and 22 logs by dr. *Ajax;* New Inlet and Swash Defense Dams repaired, **06,** 1165.

1906-07. Repairs to New Inlet and Swash Defense Dams continued until Sept. 17, 1906, when a violent storm greatly injured and wholly destroyed dams in several places; 8,600 l. f. fill at Swash Defense Dam replaced after storm; 172,638 c. y. dr. by dr. *Cape Fear* and 428,740 c. y. by dr. *Ajax,* **07,** 1246.

1907-08. 301,808 c. y. dr. by dr. *Cape Fear,* 352,665 c. y. by dr. *Jacksonville,* 660,255 c. y. by dr. *Hercules,* 589,128 c. y., 95 stumps and 42 logs by dr. *Ajax;* 19,677 t. riprap st. placed on Swash Defense Dam and 100 t. at New Inlet Dam, **08,** 1301.

1908-09. 473,078 c. y. dr. by dr. *Cape Fear,* 834,067 c. y. by dr. *Jacksonville,* 675,451 c. y. by dr. *Hercules,* and 794,207 c. y. by dr. *Ajax;* 10,813 t. st. placed on Swash Defense Dam, **09,** 1294.

1909-10. 268,626 c. y. dr. by dr. *Cape Fear,* 1,014,003 c. y. by dr. *Jacksonville,* 899,504 c. y. by dr. *Hercules,* 587,411 c. y. by dr. *Ajax,* and 49,172 c. y. by dr. *Gen. C. B. Comstock;* repairs made to dams, **10,** 1433.

1910-11. 3,679,130 c. y. dr. by U. S. plant (5 dr.); 1,050,070 c. y. dr. under contract; repairs made to New Inlet and Swash Defense Dams; bulkhead at Wilmington completed and fill made; U. S. dr. *Jacksonville* rehandled 431,121 c. y. from 2 other dr., **11,** 1561, 1562. Results obtained from year's work, **11,** 1563.

1911-12. 1,811,666 c. y. dr. by U. S. plant (5 dr.); 2,098,009 c. y. dr. under contract; repairs made to dams, **12,** 1778–80.

PHYSICAL CHARACTERISTICS.

Described, **72,** 698, 699; **73,** 789, 790, 805–815; **74,** ii, 68–72; **11,** 379, 381.

Tidal observations, with diagram, **76,** 318–321; **77,** 339; tidal observations, **80,** 699; **81,** 925, 927; **82,** 940; **83,** 723; **84,** 945; **85,** 1096.

See also historical sketch, **76,** 321–331.

Table of prevailing direction of wind at Smithville and Federal Pt., **80,** 703.

Table showing greatest differences of the water level between the R. and sea sides of the dam at the New Inlet during flood and ebb tides, **80,** 710.

Effect of storms, **82,** 944.

Advance of shore lines of Federal Pt. and Zekes Isld.; extension of beach, **83,** 720; **84,** 940.

Condition of shore line 1886, **86,** 1014.

Geographical description of R., **86,** 1000.

Changes, 1852 to 1885, **85,** 1090.

Description of, Wilmington to mouth, **89,** 1132.

Description of vicinity of outer bar, **94,** 1049; **95,** 1339.

Current observations, **94,** 1051, **95,** 1337.

Deterioration occurring at various points by shoaling, storm damage, and decay; est. for repairs, $128,000, **01,** 308.

Violent storm. (See Operations, 1906–7.)

PRIVATE (STATE) WORK.

Imp. Campbells Isld. to Wilmington, by embankments, j., and dr., commenced by the State in 1823; continued to 1829, under the direction of State Engineer Hamilton Fulton, **73,** 813; **76,** 323, 326.

App. by State, 1822 to 1829, **86,** 1007.

Works carried on under State, **82,** 943; **86,** 1008.

PROJECTS. (See Estimates.)

History and description of, commencement to 1872, by Lt. Col. Foster, **73,** 805, 815. By Capt. Phillips, commencement to 1876, **76,** 321–331. (For the orig. proj., see Private Work.)

By Capt. Hartman Bache, 1827. Modifies plans of Mr. Fulton and proposes sheet-pile j. at Eagle Isld., the NW. Branch, and 6 other places below Wilmington, **73,** 813, 814.

By Commission and BRH imp., 1853, for protection of Baldhead Pt. by js., closing of openings through the beach at Smiths Isld., and a j. at n. end of Zekes Isld., **76,** 323.

By Board of Commissioners, 1858, restoration of the old works and js. at Zekes Isld., protection of Smiths Isld. Beach by js., and provisional closing of New Inlet, **76,** 324.

By BE., 1871–72, dr. in Baldhead Chan., continuation of work at Zekes Isld. on present plan, continuing it across the isld. and into the R., and closing New Inlet by pile work filled with brush and loaded with st.; suspension of work on j. and beach protection at Baldhead Pt., **73,** 802.

History of past projs. and operations, **82,** 943; **86,** 168, 1006; **87,** 1047.

The BE., 1881, in pre. **R.,** recom. existing works between Zekes and Smiths Islds. be strengthened and that upon a threatened break in the low beach s. of Smiths Isld. a mattress and riprap sill be placed to prevent such break, **82,** 947. (Lt. Cols. Gillmore, Craighill, and Comstock, and Capt. Turtle.)

Projs. of 1872 to 1882 proposed extension of New Inlet Dam 2 m. downstream to prevent further erosion of Smiths Isld. Proj., 1875, proposed occasional dr. in the outer bar; and the projs., 1874 to 1881, for the imp. of the 20 m. above New Inlet, proposed dr. wherever necessary to secure a chan. eventually 16′ x 270′ m. l. w. App., 1829 to 1886, $2,223,228.92. Est. to complete proj., 1886, $245,000, **82,** 947; **86,** 168, 1006. Increased, 1887, to $265,000, **87,** 1048, 1051, 1058.

Projs., 1874 to 1881, for the 20 m. above New Inlet, as outlined to 1888, proposed dr., with occasional diking when necessary, across the shoals, to secure, 1st, a 12′ x 200′, and afterwards 16′ x 270′ l. w., over entire l. Total final cost of this work under projs., 1870 to 1885, est., 1886, at $2,110,000. On account of inadequate yearly app. these est. raised, 1888, to $2,125,000.

By Capt. Bixby, 1889, obtaining a 20′ x 270′ l. w., Wilmington to mouth, 18′ to 20′ on bar, by dr. and if necessary a st. j. to prevent swinging and shoaling of the chan.; est., $1,800,000 with an. mainten. of from $18,000 to $25,000, **89,** 1134; **93,** 1419.

By Maj. Stanton, 1894, training dike of piles, brush, and st. to be built in connection with dr. at Snows Marsh Shoal, **94,** 1051.

Lt. Col. Heap, 1894, est. $25,000 an. for mainten., **96,** 1132.

Of Oct. 6, 1890, for 20′ x 270′ l. w., Wilmington to ocean; modified, June 13, 1902, to include mooring dolphins at Wilmington, at cost $30,000, and the removal of obstr. at mouth of Brunswick R., at cost of $1,000, **03,** 240.

Of 1890, modified, 1902, again modified act Mar. 2, 1907, completion of the 20′ proj. to the proj. w., and the excavation of a mooring basin in lieu of mooring dolphins at Wilmington, reducing the est. to $1,392,750; including obstr. removal at mouth of Brunswick R.; act also au. imp. to such d. in excess of 20′ as app. will permit, and repairs to New Inlet and Swash Defense Dams,[1] **07,** 285.

Act June 25, 1910, au. expend. of addl. $400,000 in securing such d. in excess of 20′ as app. would permit, and provide that if prices received under advertisement for bids for dr. are not satisfactory, that suitable dr. plant be constr. for use on the R., **10,** 357.

Act Feb. 27, 1911, au. clearing to d. of 10′, chan. between main chan. of R. and Carolina Beach Pier; dr. during 1911, **11,** 381.

Act July 25, 1912, modified proj. to secure an available d. of 26′ x 300′ m. l. w., w. to 400′ across the bar,[2] **12,** 459, 460.

[1] H. D. 545, 59th, 1st.

[2] H. D. 287, 62d, 2d.

SURVEYS.

Summary and history of, 1733 to 1872, by Lt. Col. Foster, **73,** 804–815, and by Capt. Phillips to 1876, **76,** 321–331.

Under direction of Maj. Craighill by Henry Bacon, at various places, **77,** 337; **79,** 475, 479.

Snows Marsh to Wilmington, **82,** 937.

Prices Creek to Wilmington, **82,** 939; **83,** 721.

Baldhead Chan., **84,** 943; **85,** 1095.

Beaches in vicinity, **85,** 1096.

Entrance to Reeves Pt., **86,** 1013.

Ex. 20′ chan., Wilmington to ocean, au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **89,** 1132.

Ex. and sur. of all dr. places made, 1892–93, by Maj. Stanton, **93,** 1426, 1427.

Sur. of the bar and shore lines at the R. mouth made, 1893–94, by Maj. Stanton, **94,** 1051.

Sur. in progress, 1894–95, by Maj. Stanton, **95,** 1336, 1340.

Sur. estab. of H. lines for Wilmington, hydrographic sur. of the ocean bar and Snows Marsh Chan., made by Lt. Col. Heap, 1895–96, **96,** 1132.

Sur. by Capt. Craighill, 1898, and by Capt. Lucas, 1899, **99,** 1507.

Sur. 1900, Capt. Lucas, **00,** 1821.

Ex. and sur., Wilmington H., N. C., for w. and d. to permit vessels to turn and swing around therein, au. act June 6, 1900; made, 1900, by DO.; est. $291,500; alternate, $30,000,[1] **01,** 310, 1552–69.

Ex. at and below Wilmington to determine if any modification of the imp. were desirable, au. act Mar. 3, 1905; made, 1906, by Capt. Johnston; plan presented to complete proj. without js.; cost $100,000, in add. to funds on hand; and for 24′ chan. with mooring basin; cost $1,050,000 addl., with $65,000 an. mainten.,[2] **06,** 275.

Pre. ex. and sur. for suitable d. and w. au. act Mar. 3, 1909; **Rs.,** Capt. Brown, 1909 and 1911; est., $572,940 1st constr., and $80,000 an. mainten., subject to condition that local au. expend $200,000 for terminal imp.,[3] **12,** 462.

Cong. docs. (see Documents), etc., relating to exs., surs., plans, etc., **12,** 460.

Maps:[3]

History and list of, from 1733 to 1872, **73,** 804–815.

Sketch of obstr. placed in the R. by Confederates, **76,** 330.

Showing chan. near New Inlet and the proposed new cut, **78,** 476.

Sketches of the dam, **78,** 478.

81, 922; **83,** 722; **84,** 940; **85,** 1090, 1094; **86,** 1002, 1016; **87,** 1050.

Cape Fear R. below Wilmington, **88,** 900; **89,** 1092; **90,** 1156; **91,** 1398; **93,** 1428; **94,** 1052; **95,** 1344; **96,** 1138; **97,** 1416; **99,** 1514; **00,** 1822; **12,** 1779.

Part (b), M-305 Cape Fear River, N. C. (Above Wilmington.)

APPROPRIATIONS.

1881,	$30,000,	**81,** 1018.
1882,	30,000,	**82,** 1099.
1884,	5,000,	**84,** 1043.
1886,	11,250,	**86,** 998.
1888,	12,000,	**88,** 895.
1890,	15,000,	**90,** 1150.
1892,	15,000,	**92,** 1161.
1894,	14,000,	**95,** 1334.
1896,	5,000,	**96,** 1130.
1899,	5,000,	**99,** 1505.
1902,	*6,000,	**02,** 1143; **11,** 1557; **12,** 1775.
1905,	*5,000,	**05,** 1223.
1907,	*5,000,	**07,** 1245.
1910,	*3,000,	**10,** 1430.
1911,	3,500,	**11,** 1557.
1912,	5,000,	**12,** 1775.

Total, 169,750 (incl. $414.33 from rents, sales, etc., $170,164.33, **12,** 1775).

COMMERCE.

Decrease in freight and insurance rates, **89,** 1088.

RR. parallels the R. and takes much of the freight that formerly went by w., but the mainten. of a chan. in the R. helps to control freight rates by the RR., **93,** 1413; **94,** 1045; **95,** 1334.

Description of, **00,** 1816; **11,** 377.

1911, 198,000±t., **12,** 455.

RR. rates reduced to Fayetteville, **12,** 455.

ENGINEERS.

Chief of Engineers. **R., 81,** 168; **82,** 160; **83,** 167; **84,** 172; **85,** 170; **86,** 166; **87,** 131; **88,** 124; **89,** 143; **90,** 129, **91,** 165; **92,** 165; **93,** 178; **94,** 164; **95,** 186; **96,** 168; **97,** 208; **98,** 210; **99,** 241; **00,** 274; **01,** 307, 310, 1552; **02,** 234; **03,** 239; **04,** 240; **05,** 250; **06,** 270; **07,** 282; **08,** 300, 306; **09,** 310; **10,** 3;54 **11,** 376; **12,** 454.

In charge:

Maj. W. P. Craighill, 1870–80. **R., 80,** 695.

Capt. C. B. Phillips, 1880–81, **81,** 985.

Capt. J. Mercur, 1881–85. **R., 81,** 1017, 1018; **82,** 1098; **83,** 858; **84,** 1042.

Capt. W. H. Bixby, 1885–92. **R., 85,** 1083; **86,** 995; **87,** 1044; **88,** 893; **89,** 1083; **90,** 1148; **91,** 1390.

Maj. W. S. Stanton, 1892–95. **R., 92,** 1158; **93,** 1411; **94,** 1044; **95,** 1333.

Lt. Col. D. P. Heap, 1896. **R., 96,** 1128.

Capt. W. E. Craighill, 1897–98. **R., 97,** 1404; **98,** 1253.

Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1505; **00,** 1816; **01,** 1502, 1554, 1557; **02,** 1142.

Capt. E. E. Winslow, 1903. **R., 03,** 1105.

Capt. R. P. Johnston, 1904–06. **R., 04,** 1493; **05,** 1222; **06,** 1162.

Capt. E. I. Brown, 1907–11. **R., 07,** 1244; **08,** 1298; **09,** 1292; **10,** 1430; **11,** 1556.

Maj. H. W. Stickle, 1912–. **R., 12,** 1774.

Assistants:

W. H. James. **R., 82,** 1099; **83,** 859; **84,** 1043.

C. Humphreys. **R., 85,** 1084; **86,** 999; **89,** 1086; **90,** 1151; **91,** 1393.

E. D. Thompson. **R., 92,** 1161; **93,** 1414.

C. Schuster. **R., 96,** 1128; **97,** 1405.

LEGISLATION.

$10,000 paid to Cape Fear Navigation Co. for deed extinguishing right to collect tolls for navigation, Wilmington to Fayetteville, **81,** 1017.

OPERATIONS.

1881-82. 811 trees, logs, snags, and stumps removed, clearing 23 m. of R., **82,** 1100.

1882-83. 14,287 trees, stumps, logs, and snags removed, **83,** 859.

1883-84. 6,712 trees, stumps, logs, and snags, removed, **84,** 1043.

1884-85. 12,590 c. y. dr. from chan. at Fayetteville, McCarters Cross, and Old Jetties; 1,442 l. f. timber j. and 300 l. f. of r. j. built; 301 l. f. old log js. sheeted; 8,644 trees, stumps, and snags removed, **85,** 1085.

1885-86. 874 trees, logs, and snags removed; 680 c. y. hard mud and 1,438 c. y. r. and hardpan dr., **86,** 999.

1886-87. Small amount of work by hired labor, **87,** 1046.

1887-88. 127 logs, stumps, and piles removed from R. bed; 900 stumps and trees removed from R. bank; 2,385 c. y. r. quarried, **88,** 894.

1888-89. 2,570 c. y. st. quarried; 80 logs and trees and 50 l. f. of old pile j. removed from the chan., and trees and brush from the banks, **89,** 1085.

1889-90. 1,277 c. y. st. quarried; 184 logs and snags removed from the chan.; 222 trees cut and 106 cords brush removed from banks; 620 l. f. j. (st. and brush) built, **90,** 1149.

*Allotment. [1] H. D. 180, 56th, 2d. [2] H. D. 545, 59th, 1st. [3] H. D. 287, 62d, 2d.

1890-91. 1,791 c. y. of st. quarried and 1,060 c. y. placed in dikes at McCarters, McRaes, and Thames Shoals; 119 trees and 105 cords brush cleared from the banks, and 126 snags and stumps and 126 cords small snags from the chan., **91,** 1391.

1891-92. 793 l. f. of brush and st. j. built at McRaes Shoal; 228 snags and trees cleared from the chan., **92,** 1160.

1892-93. 33 new js. of brush and st., aggregating 3,619 l. f., constr., 740 l. f. js. raised, 100 l. f. repaired, and 13 m. of chan. cleared of snags, **93,** 1412.

1893-94. 11 js. of brush and st., aggregating 1,277 l. f., constr., **94,** 1044.

1894-95. About 700 logs and other obstr. removed from the chan. and banks, 570 l. f. js. built, and 2 js. commenced, **95,** 1334.

1895-96. About 700 logs and other obstr. removed from chan. and banks, repairs made to js., and constr. of js. commenced in previous year continued, **96,** 1129, 1130.

1896-97. 8 js. constr. and obstr. removed from the chan. and banks, **97,** 1406.

1897-98. About 900 logs and other obstr. removed from chan. and banks, **98,** 1254.

1898-99. 190 snags and other obstr. removed from chan., **99,** 1505.

1899-00. Obstr. removed, Kellys Cove to Fayetteville, **00,** 1816.

1900-01. 1,174 logs, 91 trees, 1,436 snags, 345 stumps, and 1 wreck removed, **01,** 1502.

1902-03. 1,313 snags, 7 stumps, and 3 logs removed, **03,** 1105.

1903-04. 1,345 snags, 248 stumps, and 26 logs removed, **04,** 1493.

1904-05. 834 snags and 2 trees removed, **05,** 1222.

1905-06. Mainten. work continued by removal of obstr.; j. repaired at Walkers Bluff, **06,** 1163.

1906-07. Mainten. work continued; site purchased for lower dam, **07,** 1244.

1907-08. Title to land needed for lower lock site approv. and land purchased; purchase of other land delayed on account of possible modification of proj., **08,** 301.

1908-09. Mainten. work continued, **09,** 1292.

1909-10. J. repaired at Walkers Bluff and sunken scow removed, **10,** 1430.

1910-11. 2,905 snags and other obstr. removed from chan., and 5,726 trees, stumps, etc., removed from banks, **11,** 1556.

1911-12. 793 stumps, snags, etc., removed from chan., and 614 trees hauled back from banks, **12,** 1774.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 893; **11,** 377.

Tidal observations, **93,** 1412, 1415; **94,** 1045; **95,** 1334.

List of shoals, **93,** 1416.

Water-gauge record for 1892, **93,** 1418; for 1893 and 1894, and m. of water-gauge readings, **95,** 1334.

PROJECTS.

By Capt. Phillips, 1881, clearing snags, trees, etc., 75 m.; dr. chan. at Thames Shoal, 5′ x 60′ x 1,900; l. w., and constr. of 5,000 l. f. of experimental dike, est., $55,775, **81,** 1018. Modified, 1885, by Capt. Bixby, to secure a 4′ chan., Wilmington to Elizabethtown; thence a similar 3′ chan. to Fayetteville, at an increased cost of $200,000, **85,** 1084. Modified, 1886, by Capt. Bixby, removal of snags, logs, and stumps, and constr. of 84,000 l. f. r. j., cost, $480,000, inclusive of $65,000 previously app., **86,** 996; **87,** 1045; **91,** 1392.

Lt. Col. Heap in 1896 est. mainten. would cost $3,000 an., **96,** 1128.

Of 1902, to obtain by canalization a l. w. d. of 8′, Wilmington to Fayetteville; est, $1,350,000; mainten. of existing chan. to be continued pending constr. of locks and dams, **02,** 234.

Proj. Jan. 26, 1881, abandoned except for mainten. of natural chan., pending constr. of locks and dams as au. act June 25, 1910, **10,** 354. (See Cape Fear R., part 3.)

SURVEYS.

Haywood, N. C., to 20 m. bel. Wilmington, **72,** 742.

Au. act June 14, 1880; made, 1880, by Capt. Phillips, **81,** 1018.

Above Fayetteville, **84,** 1064; **96,** 1144.

Sur. of 16 shoals, **85,** 1083.

All the shoals were sur., 1893, by Maj. Stanton, **93,** 1412.

Pre. ex. for navigable chan., Wilmington to Fayetteville, of 4′, 6′, and 8′ m. l. w., au. act June 6, 1900; made, 1900, by DO.; est., $1,320,000 for 4′ chan. and $1,350,000 for 8′ chan.,[1] **01,** 310, 1552–69.

R. by BERH. req. by R. and H. C. BERH. believes $1,320,000 est. not justifiable, but recom. stream worthy of careful consideration and further sur.[2]

For determining lock and dam sites under the canalization proj. of 1902, **04,** 1493; **05,** 1222.

Of lock sites; borings, **06,** 1163.

Ex. for modification of existing proj., au. act Mar. 2, 1907; made, 1908, by Capt. Brown; plan, at cost of $615,000, presented,[3] **08,** 306.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 455.

Maps. **85,** 1086; **89,** 1086; **90,** 1150; **91,** 1392; **93,** 1418; **96,** 1130.

Part (c), M-305 Cape Fear River, N. C. (Above Wilmington. Locks and dams.)

APPROPRIATIONS.

1902,	[4]$50,000,	**10,** 1432.
1910,	100,000,	**10,** 1432.
1911,	200,000,	**11,** 1560.
Total,	350,000,	**12,** 1778.

ENGINEERS.

Chief of Engineers. **R., 10,** 355; **11,** 378; **12,** 456.

In charge:

Capt. E. I. Brown, 1910–11. **R., 10,** 1431; **11,** 1558.

Maj. H. W. Stickle, 1912–. **R., 12,** 1777.

LEGAL PROCEEDINGS.

Purchase of land for lock and dam at Browns Landing partly concluded; 2 parcels (20.5 acres) acquired, and negotiations for 3d (8 acres) completed, **11,** 1559.

Site for Lock and Dam No. 2 acquired, **12,** 457.

OPERATIONS.

1909-10. Previous operations under proj. of 1902 were in making sur. and selection of sites for locks and dams, preparation of abstracts of title, and purchase of site for lower lock and dam. (See Operations, Part (b), M-305.) **10,** 1431.

[1] H. D. 180, 56th, 2d.
[2] R. and H. C. 16, 59th, 2d.
[3] H. D. 890, 60th, 1st.
[4] $35,317.77 of this amount withdrawn and turned into the surplus fund.

1910-11. Plans for locks and fixed timber and st. dams, and for lock tender's dwellings at Kings Bluff prepared, and drilling operations at Browns Landing under way, **11,** 1559.

1911-12. The site at Kings Bluff cleared and grubbed; camp buildings constr. and preparations made for starting work on Lock and Dam No. 1 **12,** 1777.

PHYSICAL CHARACTERISTICS.

During 7 months freshets occurred raising water levels from 15′ to 50′, **12,** 456.

PROJECTS.

By Capt. E. W. Van C. Lucas, 1902, slack water navigation above Wilmington, and constr. of 3 locks and dams; est., $1,350,000.[1] Act June 13, 1902, app. $50,000 for purchase of sites for locks and dams, **10,** 355.

Act June 25, 1910, au. new proj. for navigable d. of 8′ up to Fayetteville, by 2 locks and dams; est. $615,000, with $8,000 an. mainten.,[2] **10,** 355.

SURVEYS.[3] (See Part(b), M–305.)

Land at King Bluff resur., corners monumented, gauge estab., borings made, check levels run, bench marks estab., readings made, and stream measurements taken, **11,** 1558, 1559.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 457.

Sur. of shoals at Kings Bluff made to determine amount of dr. necessary, **12,** 1777.

Part (d), M–305 Cape Fear and Deep Rivers, N. C. (Reeves Point to La Grange.)

ENGINEERS.

Chief of Engineers. **R., 71,** 76; **72,** 73, 74.
In charge. Maj. W. P. Craighill, 1871–72. **R., 71,** 621; **72,** 741.
Assistant. G. H. Elliott. **R., 72,** 742.

PLANS.

First division, La Grange to Fayetteville, 85 m. Imp. of falls that occur at intervals throughout its extent by the constr. of 19 R. dams and 2 slough dams, varying from 7½′ to 17′ in height, of rubble masonry, and 23 locks of masonry, with gravel banks when needed; 5′ d. of water on miter sills, lock chambers 20′ x 120′.

Second division, Fayetteville to Hungry Neck, 66 m. 60 m. of longitudinal dikes, and 15,000 c. y. dr.

Third division, Hungry Neck to Wilmington, 46 m., no imp.

Fourth division, Wilmington to Reeves Pt., 19 m. Removing wreck, *North Heath;* removing timber obstr.; removing shoal called "The Logs;" dr. 112,000 c. y.

Est. cost, $2,316,711, **72,** 742–749.

PRIVATE (CORPORATE) WORK.

Companies organized for imp. Cape Fear, Deep, and Haw Rs. in 1796 and 1849, received liberal aid from the State, and spent much money (the latter company $350,000) to constr. dams, canals, and locks. Work practically an utter failure. **72,** 744.

SURVEY.

Under direction of Maj. Craighill, by G. H. Elliott, 1871; **R., 71,** 621 (**R.** unfav.—"too expensive") **72,** 741–749.

Part (e), M–305 Cape Fear River, N. C. (Above Fayetteville.)

COMMERCE.

Description of, **96,** 1146.

ENGINEERS.

Chief of Engineers. **R., 84,** 177; **96,** 171; **00,** 277.

In charge:
Maj. W. P. Craighill. **R., 72,** 741, 749.
Capt. J. Mercur. **R., 84,** 1064.
Maj. W. S. Stanton, 1894–96. **R., 96,** 1144.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1144.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 742; **96,** 1145.

The R. is formed by the confluence of the Deep and Haw Rs. at Haywood, N. C., **96,** 1145.

PROJECTS.

Maj. Stanton in 1895 est. imp. of the R. by means of locks and dams would cost from $2,555,000 to $3,000,000, **96,** 1146.

SURVEYS.

Au. act Mar. 3, 1871; made by Maj. Craighill, **72,** 742.

Ex. au. act Aug. 2, 1882; made by Capt. Mercur, **84,** 1064. (**R.** unfav.)

Sur. au. act Aug. 17, 1894; made by Maj. Stanton in 1895 (see Projects), **96,** 1144.

M–305(f) CAPE FEAR RIVER TO WACCAMAW RIVER, N. C. (Waterway.)

ENGINEERS.

Chief of Engineers. **R., 81,** 168.
In charge. Capt. J. Mercur. **R., 82,** 1119.
Assistant. J. P. Darling. **R., 82,** 1120.

PHYSICAL CHARACTERISTICS.

Route described, **82,** 1121.

PLANS.

Capt. Mercur est. $1,500,000 to $8,250,000, **82,** 1120.

SURVEY.

Au. act Mar. 3, 1881; made by Capt. Mercur (**R.** unfav.—"cost virtually prohibitive"), **82,** 1119.

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[1] H. D. 180, 56th, 2d. [2] H. D. 890, 60th, 1st. [3] See Cape Fear R., above Wilmington.

M–306 NORTHEAST CAPE FEAR RIVER, N. C.

APPROPRIATIONS.

1890, $5,000, **91,** 1385.
1892, 5,000, **92,** 1153.
1894, 5,000, **95,** 1331.
1899, 2,000, **99,** 1504.
1902, *2,000, **02,** 1140.
1902, 500, **04,** 1491.
1905, *2,000, **05,** 1219.
1907, *2,000, **07,** 1241.
1909, *6,000, **09,** 1290.
1910, *[1] 2,000, **10,** 1426.
1912, *3,500, **12,** 1771.

Total, 35,000 (less $800 trans. to Black R., and incl. misc., $34,443.33, **12,** 1771).

COMMERCE.

Obstr. br., **85,** 1128, 1130, 1131.
Description of, **93,** 1404; **94,** 1041; **95,** 1330; **00,** 1815; **10,** 1427.
In 1894 1 factory on the R. received about 20,000 t. and shipped about 5,000 t., and another shipped about 14,000 t. of lumber, etc., **95,** 1390.
Limited to a few small boats, and a large number of rafts, flats, etc., **12,** 452.
1911, 150,019 t., **12,** 1772.

ENGINEERS.

Chief of Engineers. R., 85, 177; **89,** 149; **90,** 133; **91,** 164; **92,** 164; **93,** 177; **94,** 163; **95,** 185, 192; **96,** 167; **97,** 207; **98,** 209; **99,** 241; **00,** 273; **01,** 306; **02,** 233; **03,** 238; **04,** 239; **05,** 248; **06,** 268, 275; **07,** 280; **08,** 298; **09,** 307; **10,** 351, 360; **11,** 374; **12,** 451, 463.

In charge:
Capt. W. H. Bixby, 1884–92. **R., 85,** 1128, 1130; **90,** 1181; **91,** 1383.
Maj. W. S. Stanton, 1892–96. **R., 92,** 1152; **93,** 1403; **94,** 1040; **95,** 1330, 1389.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1122.
Capt. W. E. Craighill, 1897–99. **R., 97,** 1400; **98,** 1252.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1504; **00,** 1815; **01,** 1500; **02,** 1140.
Capt. E. E. Winslow, 1903. **R., 03,** 1105.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1490; **05,** 1218; **06,** 1159.
Capt. E. I. Brown, 1907–11. **R., 07,** 1240; **08,** 1296; **09,** 1290; **10,** 1425; **11,** 1551.
Maj. H. W. Stickle, 1912–. **R., 12,** 1770.

Assistants:
C. Humphreys. **R., 85,** 1131; **91,** 1385.
E. D. Thompson. **R., 93,** 1405.
C. Schuster. **R., 96,** 1123; **97,** 1401.

OBSTRUCTIONS.

From brs. without draws, **85,** 1129, 1130.

OPERATIONS.

1890-91. 528 snags and stumps and 90 cords of small snags removed from the chan., and 216 trees and 145 cords of brush cleared from the banks, **91,** 1386.

1891-92. 33 snags and 1 SS. wreck removed from the chan., **92,** 1153.

1892-93. About 150 snags and other obstr. removed, **93,** 1405.

1893-94. Over 3,000 snags and other obstr. removed, **94,** 1041.

1895-96. About 800 snags and other obstr. removed, **96,** 1123.

1896-97. About 2,000 snags and other obstr. removed, **97,** 1402.

1899-00. R. cleared of obstr. and made navigable 88 m. to Hallsville, **00,** 1815.

1900-01. 1,631 snags, 528 stumps, and 704 trees removed, **01,** 1500.

1902-03. 230 snags, 81 stumps, and 1,084 trees removed, **03,** 1105.

1903-04. 356 snags, 8 stumps, 1 log, and 1 wreck removed, **04,** 1490.

1904-05. 836 snags and 822 trees removed, **05,** 1218.

1905-06. 97 snags and 463 trees removed, **06,** 1159.

1906-07. 33 snags, 10 stumps, 51 logs, and 64 trees removed, **07,** 1241.

1908-09. 3 log rafts, 136 snags, 9 stumps, 91 logs, and 89 trees removed, **09,** 1290.

1909-10. Mainten. continued in the removal of obstr.; new hull for snag boat *Gen. H. G. Wright* completed, house built, and machinery installed at cost to this R. of $2,323.52, **10,** 1425.

1910-11. 2,951 snags and other obstr. removed from chan.; 2,298 trees hauled back, 27 trees trimmed, and 10 cords brush cut on banks, **11,** 1551.

1910-11. 344 snags and other obstr. removed from chan., and 260 trees hauled back from banks and 1 tree trimmed, **12,** 1770.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1182.
Tidal observations, **93,** 1405.
Water-gauge record for 1892, **93,** 1406.
Mean of water-gauge readings, **95,** 1330.
Description of, between old county ferry and Juniper Swamp, **95,** 1389.
Stage of water very low, **11,** 1551.
Bad obstr. of chan. by snags, **12,** 451.

PLANS.

By Capt. Bixby, 1885, removing old br. ps.; est., $700, **85,** 1130, 1131.

PRIVATE WORK.

Upper part of the R. from Kornegays br. to Deep Bottom is kept clear of obstr. by the county commissioners of Duplin Co., **96,** 1123.

PROJECTS.

By Capt. Bixby, 1889, imp. from Wilmington up to Hallsville for light draft SS. and to Kornegays br. for pole boats, by removal of snags, logs, and similar obstr.; est., $30,000, **91,** 1384.
In 1895 Maj. Stanton est. $10,000 to dr. chan. for boats of 17′ draft from the old county ferry to Juniper Swamp, **95,** 1389.
In 1896 Lt. Col. Heap est. $2,000 an. for mainten., **96,** 1123.

SURVEYS.

Ex. au. act July 5, 1884, made by Capt. Bixby, **85,** 1128, 1130.
Au. act Aug. 11, 1888; made, 1888, by Capt. Bixby, **90,** 1181.
Sur. from the old county ferry to Juniper Swamp, with view to obtaining increased d., au. act Aug. 17, 1894; made by Maj. Stanton, 1895 (see Projects), **95,** 1389.
Au. act Mar. 3, 1905. **R.** by Capt. Johnston; locality not considered worthy of further imp. other than "now provided" for,[2] **06,** 275.
Pre. ex. and sur. of the NE. branch of Cape Fear R., N. C., from its mouth for 2½ m. with a view to 20′, made, 1909–10, by Capt. Brown; locality not considered worthy of imp. further than the existing proj.,[3] **10,** 360.
Pre. ex. and sur. au. act Feb. 27, 1911, from mouth of R. to Hallsville. **R.** to follow, **12,** 463.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 452.
Maps. **92,** Atlas, 32, 33, 34, 35, 36.

[1] $800 trans. to Black R., N. C. [2] H. D. 229, 59th 1st. [3] H. D. 867, 61st, 2d. *Allotment.

M–311 LILLINGTON RIVER, N. C.

APPROPRIATIONS.

1881, $3,000, **81,** 1021.
1882, 3,000, **82,** 1101.

Total, 6,000

ENGINEERS.

Chief of Engineers. **R., 80,** 125; **81,** 165; **82,** 160; **83,** 168; **84,** 173.

In charge:
Capt. C. B. Phillips, 1880–82. **R., 81,** 1020, 1021.
Capt. J. Mercur, 1882–84. **R., 82,** 1101; **83,** 860.
Capt. F. A. Hinman, 1884. **R., 84,** 1044.

Assistants:
J. P. Darling. **R., 81,** 1022.
W. H. James. **R., 83,** 861; **84,** 1044.

OPERATIONS.

1882–83. R. cleaned of snags and obstr. from mouth to Lillington; cut-off dr., **83,** 861.

1883–84. Dr. of cut-offs completed to 6′–10′ at l. w.; projecting points cut off and a small isld. removed; completing imp. purposed, **84,** 1044.

PROJECTS.

By Capt. Phillips, 1881, removing snags, logs, and trees, mouth to Lillington, 11 m., and 3 projecting points of land, and dr. cut offs to give navigable d. of 5′. Est., $6,003, **81,** 1022. Completed in 1884, **84,** 1044.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Capt. Phillips, **81,** 1020.
Maps. **83,** 860.

M–312 BLACK RIVER, N. C.

APPROPRIATIONS.

1886, $3,000, **87,** 1044.
1892, 10,000, **92,** 1157.
1894, 2,000, **95,** 1332.
1896, 1,000, **96,** 1126.
1899, 2,000, **99,** 1503.
1902, *2,000, **02,** 1141.
1904, *500, **04,** 1492.
1905, *2,000, **05,** 1221.
1907, *2,000, **07,** 1243.
1909, *4,000, **09,** 1291.
1910, *[1]2,800, **10,** 1428.
1912, *3,500, **12,** 1773.

Total, 34,800 (incl. rents, sales, etc., $35,043.34, **12,** 1773.

COMMERCE.

Important, **85,** 1147; **87,** 1043.
Value of imp. to R. navigation, **89,** 1083.
An active trade in naval stores, lumber, etc., and logs are rafted down in considerable quantities; R.R. parallels the stream, but rates are lower by water, **93,** 1408.
Description of, **00,** 1813; **10,** 353; **11,** 375, 376.
Increasing, **10,** 353.
Over 60,000 t. 1902, **02,** 234; over 48,000 t. 1912; value, $850,991, **12,** 1774.
Imp. affords outlet for freight which otherwise could use wagon only, **12,** 454.

ENGINEERS.

Chief of Engineers. **R., 84,** 177; **85,** 177; **87,** 130; **88,** 123; **89,** 143; **90,** 128; **91,** 164; **92,** 164; **93,** 177; **94,** 163; **95,** 186; **96,** 167; **97,** 207; **98,** 208 **99,** 240; **00,** 273; **01,** 306; **02,** 234; **03,** 238; **04,** 240; **05,** 249; **06,** 269; **07,** 281; **08,** 300; **09,** 308; **10,** 353; **11,** 375; **12,** 453.

In charge:
Capt. J. Mercur. **R., 84,** 1061.
Capt. W. H. Bixby, 1884–92. **R., 85,** 1145, 1148; **87,** 1042; **88,** 889; **89,** 1081; **90,** 1145; **91,** 1387.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1154; **93,** 1407; **94,** 1042; **95,** 1331.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1125.
Capt. W. E. Craighill, 1897. **R., 97,** 1402; **98,** 1251.
Capt. E. W. Van C. Lucas, 1899–1902. **R., 99,** 1502; **00,** 1813; **01,** 1499; **02,** 1141.
Capt. E. Eveleth Winslow, 1903. **R., 03,** 1105.
Capt. R. P. Johnston, 1904–06. **R., 04,** 1492; **05,** 1220; **06,** 1161.
Capt. Earl I. Brown, 1907–11. **R., 07,** 1242; **08,** 1297; **09,** 1291; **10,** 1427; **11,** 1553.
Maj. H. W. Stickle, 1911–. **R., 12,** 1772.

Assistants:
G. H. Elliott. **R., 84,** 1061.
C. Humphreys. **R., 85,** 1151; **88,** 891; **90,** 1147; **91,** 1388.
E. D. Thompson. **R., 93,** 1409.
C. Schuster. **Rs., 96,** 1126; **97,** 1403.

LEGISLATION.

Act of N. C. incorporating the Black River Navigation Co., **85,** 1153.
Repeal of State act, **87,** 1043.

OBSTRUCTIONS.

List of brs. obstr. the stream, **93,** 1409. County br. at Pt. Caswell rebuilt in 1896 with a clear w. of draw of 27½′, **96,** 1125.

OPERATIONS.

1887–88. 438 logs and stumps removed from R. chan., and 472 trees and 98 cords of brush removed from the banks, **88,** 890.

1889–90. 30 piles and snags removed from the chan., and 155 trees and 573 cords of brush removed from the banks, **90,** 1146.

1892–93. Over 3,000 logs and other obstr. removed from chan. and banks, **93,** 1409.

1893–94. About 1,200 logs and other obstr. removed from the chan. and banks, **94,** 1043.

1894–95. About 800 logs and other obstr. removed from the chan. and banks, **95,** 1332.

1895–96. About 1,800 logs and other obstr. removed from the chan. and banks, **96,** 1125.

1896–97. About 600 logs and other obstr. removed from the chan. and banks, **97,** 1403.

1898–99. 48 snags and other obstr. removed from chan., **99,** 1502.

1899–00. 577 snags, 35 trees, 206 stumps removed from chan., and 409 trees from the banks, **00,** 1813.

1900–01. 268 stumps, 353 snags, and 561 trees removed, **01,** 1499.

1902–03. 1,190 snags, 18 logs removed, and 995 trees cut, **03,** 1105.

1903–04. 249 snags and 12 logs removed; mile boards placed between Clear Run and the mouth, **04,** 1492.

1904–05. 568 snags removed and 698 trees cut; repairs to snag boat, **05,** 1220.

1905–06. 92 snags, 13 stumps, 21 logs, and 9 trees removed, **06,** 1161.

1906–07. 15 snags, 3 stumps, 5 logs, and 33 trees removed, **07,** 1242.

1908–09. 158 snags, 5 stumps, 61 logs, 107 trees, and 3 cords brush removed, **09,** 1291.

1909–10. 62 snags, 3 stumps, 16 logs, and 47 trees removed; 176 trees hauled back, 4 trimmed

[1] Increased by $800 trans. from Northeast Cape Fear, R., **12,** 1773 *Allotment.

and 3 cords brush cut; snag hoister and snag boat building, **10,** 1427–28.

1910-11. 2,271 snags and other obstr. removed; 1,900 c. y. dr. from cut 25′ w., 5½′ d., and 225′ l.; several sharp points cut off and mouths of small sloughs filled up, **11,** 1554.

1911-12. 5,674 snags and other obstr. removed, **12,** 1772.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1061; **85,** 1146, 1149, 1151; **11,** 376.

Orig. condition of the R., **88,** 889.

Water-gauge record for 1891, **91,** 1388.

Present l.-w. d., 5′ to Pt. Caswell, 2½′ to Hawes Narrows, and 1½′ to Clear Run; R. navigable to Clear Run during high stages, averaging about 8 months in the year, **01,** 1499.

Chan. badly obstr. by snags, 1903–4, **04,** 240.

PRIVATE (CORPORATE) WORK. (See Projects, second par.)

PROJECTS.

By Capt. Bixby, 1884, thoroughly cleared natural chan. over the 70 m. of R. between its mouth and Lisbon, to dr. or dike the so-called Narrows, and afterwards a 4′ l.-w. chan. below Pt. Caswell; est., $33,500, **85,** 1148; **87,** 1043.

Part of the R. controlled by a corporate company, whose rights should be ceded to the U. S. before expend. are made, **85,** 1149; **87,** 1043.

By Maj. Stanton, 1895, modification of proj. of 1885 to exclude the 7 m. of R. above Clear Run br. from imp., and to clear obstr. from the R. mouth to Clear Run br. at a cost not to exceed a total of $13,000, any balance remaining to be used for keeping the R. clear of obstr., **93,** 1407.

In 1896 Lt. Col. Heap est. an. mainten. $2,000, **96,** 1125.

Proj., 1894, to maintain natural chan. to Clear Run; est., $2,000 yearly; Capt. Lucas recom. yearly app. of $3,000, **02,** 234, 1141.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Mercur (**R.** unfav.), **84,** 1061.

Sur., 1884, by Capt. Bixby, **85,** 1148.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 453.

M-320 LIVINGSTON CREEK, N. C.

COMMERCE.

1902, 14,000±t. an., expected to increase through estab. of fiber plant, **04,** 1517.

Description of, **04,** 1517, 1520.

ENGINEERS.

Chief of Engineers. **R., 04,** 244, 1516.

Boards. BERH. **R.** (favors snagging), **04,** 1518, 1519.

In charge:

Capt. E. W. Van C. Lucas. **R., 04,** 1517.

Capt. E. E. Winslow. **R., 04,** 1519.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 1520; dr. and snagging would be of doubtful permanency, **04,** 1521; a small trib. of Cape Fear R., entering it about 30 m. above Wilmington, **04,** 1520; imp. by snagging recom. in conjunction with Cape Fear R.; est., $2,000,[1] **04,** 1521.

SURVEY.

Ex. and sur. au. act June 13, 1902. **R.,** Capts. Lucas and Winslow, resp.,[1] **04,** 1516.

M-324 BRUNSWICK RIVER, N. C.

ENGINEERS.

Chief of Engineers. **R., 01,** 310, 1569.

ESTIMATE.

Capt. Lucas est., **01,** in compliance with resolu. adopted by Senate Jan. 25, 1901, concurred in by H. of R. same date, $1,000 to remove obstr. from mouth of R.,[2] **01,** 310, 1569, 1570. (Proj. for Cape Fear R. modified act June 13, 1902, to include removal of this obstr., **03,** 240.)

M-325 TOWN CREEK, BRUNSWICK COUNTY, N. C.

APPROPRIATIONS.

1881, $1,000, **81,** 1023.
1899, 8,500, **99,** 1516.

Total, 9,500

COMMERCE.

Description of, **97,** 1435; **00,** 1827.

Apparent decrease probably due in some measure to inaccuracy of statistics, **01,** 1510.

Benefits not sufficient to warrant further expend., **03,** 242.

ENGINEERS.

Chief of Engineers. **R., 80,** 125; **81,** 165; **83,** 168; **97,** 213; **99,** 244; **00,** 275; **01,** 308; **02,** 236; **03,** 242.

In charge:

Capt. C. B. Phillips, 1880–83. **R., 81,** 1023, 1024.

Capt. J. Mercur, 1883–84. **R., 83,** 862.

Lt. Col. D. P. Heap, 1896. **R., 97,** 1434.

Capt. W. E. Craighill, 1897. **R., 97,** 1434.

Capt. E. W. Van C. Lucas, 1899–02. **R., 99,** 1515; **00,** 1827; **01,** 1509; **02,** 1147.

Capt. E. E. Winslow, 1903. **R., 03,** 1113.

Assistants:

J. P. Darling. **R., 81,** 1024.

W. H. James. **R., 83,** 863.

C. Humphreys. **R., 97,** 1435.

OPERATIONS.

1882-83. 2 sunken flats blown up and removed from the chan.; also 385 snags, stumps, and trees taken out and dr. done, **83,** 863.

1899-00. 38,363 c. y. dr.; 3,290 snags, 708 stumps, 264 logs, and 245 trees removed from chan. and 1,932 trees from the banks, **00,** 1827.

1900-01. 1,703 snags, etc., removed from chan. and 2,095 trees from bank, **01,** 1510.

1902-03. 61 snags removed, **03,** 1113.

[1] H. D. 249, 58th, 2d.

[2] Sen. D. 130, 56th, 2d.

PHYSICAL CHARACTERISTICS.

Description of. The creek empties into the Cape Fear R. at the head of Big Isld., about 7½ m. below Wilmington, N. C., **97,** 1435.

PROJECTS.

By Capt. Phillips, 1881, imp. of Town Creek from its mouth to Saw Pit Landing, by excavation of a chan. 4′ x 60′ l. w., through 4 shoals, and removal of snags, logs, and similar obstr.; est., $9,078.48, **81,** 1024.

By Lt. Col. Heap, 1897, chan. 5′ x 40′ m. l. w. from mouth to Upper Br., and removal of obstr. from mouth of creek up to the Rocks; est., $8,500, **97,** 1435; **99,** 1515.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Capt. Phillips, **81,** 1024.

Sur. with view to strengthening the R. and obtaining 8′ au. act June 3, 1896; made by Lt. Col. Heap, 1896–97 (**R.** fav.) (see Projects), **97,** 1434.

Maps. **83,** 862; **00,** 1828.

M–327 ELIZABETH RIVER, N. C.

ENGINEERS.

Chief of Engineers. **R., 12,** 463.
In charge. Maj. H. W. Stickle, **12,** 421.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come), **12,** 463.

M–328 LOCKWOODS FOLLY RIVER, N. C.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1403.
1892,	3,000,	**92,** 1179.
1894,	10,000,	**95,** 1345.
Total,	18,000	

COMMERCE.

Unimportant and decreasing, **93,** 1433; **95,** 1345.
Est., 1892–93, value, $65,606±, **93,** 1433.
Description of, **93,** 1433, 1434.
About 5,000 t., **04,** 1524.

CONTRACTS.

1891. Atlas Dredging Co., dr., 20¢ c. y., **91,** 1404.

1894. Virginia Dredging Co., dr. from 8,000 to 12,000 c. y., 19¢ c. y., p. m., **95,** 1346.

ENGINEERS.

Chief of Engineers. **R., 80,** 125; **87,** 139; **91,** 167; **92,** 167; **93,** 180; **94,** 166; **95,** 189; **96,** 170; **97,** 211; **04,** 244, 1522.

Boards. BERH. deems existing chan. ample. **R., 04,** 1525.

In charge:
Capt. C. B. Phillips. **R., 80,** 909.
Capt. W. H. Bixby, 1887–92. **R., 87,** 1099; **91,** 1402.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1177; **93,** 1432; **94,** 1056; **95,** 1345.
Lt. Col. D. P. Heap, 1896. **R., 96,** 1140.
Capt. W. E. Craighill, 1897. **R., 97,** 1417.
Capt. E. E. Winslow, 1904. **R., 04,** 1522.

Assistants:
C. W. Forster. **R., 80,** 910.
J. H. Bacon. **R., 87,** 1101.
E. D. Thompson. **R., 92,** 1179.
C. Humphreys. **R., 96,** 1142.

OPERATIONS.

1891–92. 20,777 c. y. dr., **92,** 1178.
1894–95. 9,478 c. y., p. m., dr., **95,** 1345.
1895–96. 51,042 c. y., p. m., dr., **96,** 1141.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1177; **93,** 1433; **04,** 1522.

PLANS.

By Capt. Phillips, 1880, imp. R., 20 m. from its mouth, by dr. a chan. 8′ x 75′ x 2,100 y. through bar at mouth, also closing cut-off below Mercers Landing; est., $17,379.95, **80,** 909.

By Capt. Bixby, 1887, dr. chan. 7′ x 100′, mouth to the head of navigation at Lockwoods Folly Br.; est., $40,000, **87,** 1101.

PROJECTS.

By Capt. Bixby, 1887, excavation of a 6′ l.-w. chan. 100′ w. from the mouth to the head of navigation at Lockwoods Folly Br., 25 m.; est., $40,000, **87,** 1101; **91,** 1402.

In 1892 the Sec. of War au. withholding from expend. the app. of $3,000 made in 1893, no dr. at advantageous prices being possible because of the small app., **93,** 1433.

Lt. Col. Heap, 1896, est. that $500 would be required an. for mainten., **96,** 1141.

SURVEYS.

Au. act Mar. 3, 1879; made, 1880, by Capt. Phillips, **79,** 95; **80,** 909.

Au. act Aug. 5, 1886; made by Capt. Bixby, **87,** 1100.

Ex. au. act June 13, 1902. **R.,** Capt. Winslow (unfav.),[1] **04,** 1522.

Maps. **87,** 1100; **92,** Atlas, 37, 38; **96,** 1142.

M–329 SHALLOTTE RIVER, N. C.

APPROPRIATIONS.

1907, $3,000, **07,** 1252.

COMMERCE.

Small, **07,** 288.

ENGINEERS.

Chief of Engineers. **R., 89,** 149; **90,** 133; **06,** 275; **07,** 287; **08,** 305; **09,** 314; **12,** 462.

In charge:
Capt. W. H. Bixby, 1888. **R., 90,** 1184, 1186.
Capt. R. P. Johnston, **06,** 252.

[1] H. D. 229, 58th, 2d.

Capt. E. I. Brown, 1907–12. **R., 07,** 1252; **08,** 1307; **09,** 1299.
Maj. H. W. Stickle, **12,** 421.

Assistant. H. G. Myrover. **R., 90,** 1187.

OPERATIONS.

1907–08. 9,878 c. y. dr., **08,** 1307.
1908–09. 26,177 c. y. dr., **09,** 1299.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1186; **07,** 287.

PLANS.

By Capt. Bixby, 1889, straightening the chan. and removing oyster-rock shoals for 9,000′; also removing 5 oyster-rock shoals in the upper part of the R., to give a clear chan. 4′ x 60′ l. w.; est., $30,000, **90,** 1187.

PROJECT.

By Capt. Brown, 1907, expend. of $3,000 in dr. chan. 4′ x 35″ along w. shore between points 2½ and 4 m. above inlet, **07,** 288, 1252.

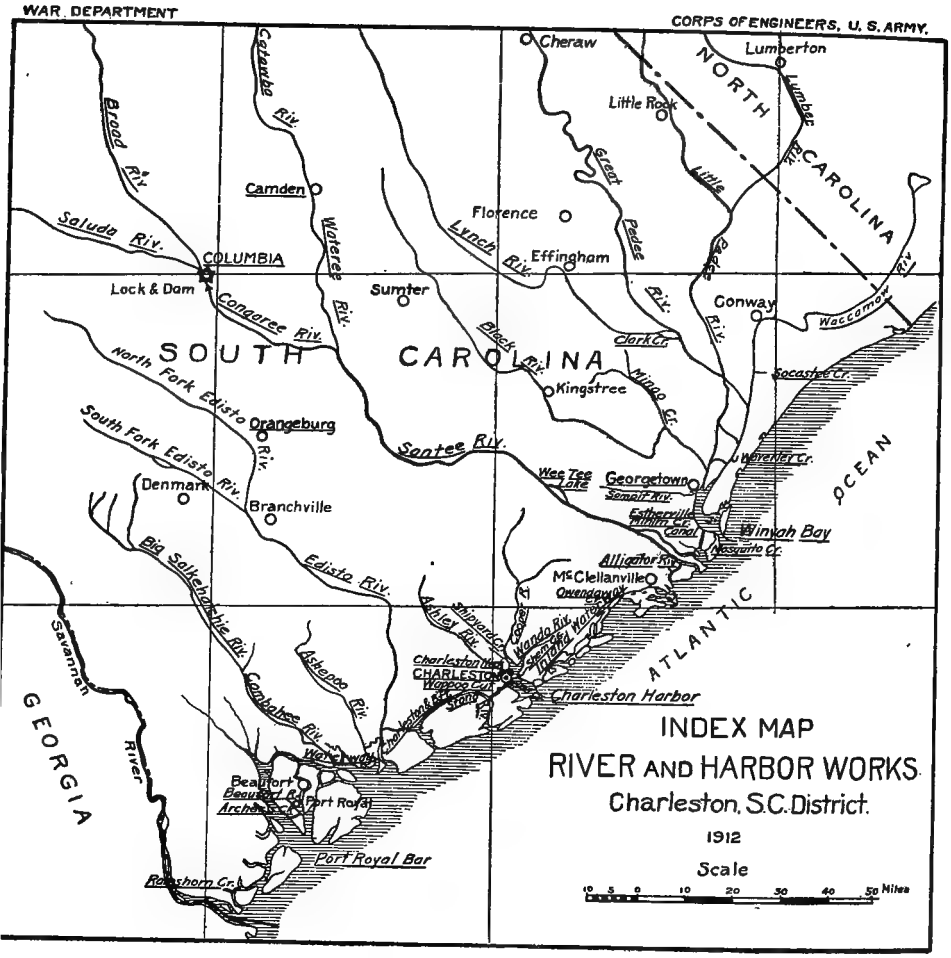
SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Capt. Bixby, **90,** 1186.
Pre. ex., from mouth to town of Shallotte, au. act Mar. 3, 1905. **R.** by Capt. Johnston, Aug. 22, 1905[1] (unfav.), **06,** 275.
R. by BERH. Jan. 23, 1907, requested by R. and H. C. In opinion of BERH., locality not worthy of imp.[2]
Ex., **07,** 1252.
Pre. ex. and sur. au. act June 25, 1910. **R.** by Capt. Brown, 1911, and Capt. Stickle, 1912; est., $9,845, with $1,000 an. mainten.; also that further imp. to 6′ is desirable provided extra first cost be provided by local interests,[3] **12,** 462.

[1] H. D. 146, 59th, 1st. [2] R. and H. C. 13, 59th, 2d. [3] H. D. 721, 62d, 2d.

RIVER AND HARBOR WORKS—SOUTH ATLANTIC.

N.—CHARLESTON, S. C., DISTRICT.


WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY.
INDEX MAP
RIVER AND HARBOR WORKS
Charleston, S.C. District.
1912
Scale
10 5 0 10 20 30 40 50 Miles
SOUTH CAROLINA
NORTH CAROLINA
GEORGIA
ATLANTIC OCEAN
COLUMBIA
Lock & Dam
Camden
Sumter
Florence
Effingham
Kingstree
Orangeburg
Denmark
Branchville
Georgetown
Winyah Bay
McClellanville
CHARLESTON
Charleston Harbor
Beaufort
Port Royal
Port Royal Bar
Cheraw
Lumberton
Little Rock
Conway
Saluda Riv.
Broad Riv.
Catawba Riv.
Wateree Riv.
Congaree Riv.
Lynch Riv.
Great Pedee Riv.
Little Pedee Riv.
Lumber Riv.
Waccamaw Riv.
Black Riv.
Clark Cr.
Minoo Cr.
Socastee Cr.
Santee Riv.
North Fork Edisto Riv.
South Fork Edisto Riv.
Edisto Riv.
Big Salkehatchie Riv.
Combahee Riv.
Ashepoo Riv.
Ashley Riv.
Shipyard Cr.
Cooper R.
Wando Riv.
Wee Tee Lake
Sampit Riv.
Waverley Cr.
Alligator Riv.
Owendaw Cr.
Charleston Harbor
Savannah River
Rainshorn Cr.

N.—CHARLESTON, S. C., DISTRICT.

In charge of U. S. Engineer Office,
Charleston, S. C.

N 1 Atlantic Ocean.
N 2 Little R. Inlet, S. C. (1)
N 3 Little R., S. C. (2)
N 4 Winyah B., S. C. (1)
N 5 Waccamaw R., S. C. and N. C. (4)
N 6 Waverly Cr., S. C. (5)
N 7 Socastee Cr., S. C. (5)
N 8 Sterritt Cr., S. C. (5)
N 9 Juniper Cr., S. C. (5)
N 10 White Marsh Cr., S. C. (5)
N 11 Mooney Swamp, S. C. (5)
N 12 Seven Crks., S. C. (5)
N 13 Bucks Cr., S. C. (5)
N 14 Waccamaw Cr., S. C. (5)
N 15 Bull Cr., S. C. (5)
N 16 Thoroughfare Cr., S. C. (5)
N 17 Schooner Cr., S. C. (5)
N 18 Jericho Cr., S. C. (5)
N 19 Great Pedee R., S. C. and Yadkin R., N. C. (4)
N 20 Jericho Cr., S. C. (19)
N 21 Schooner Cr., S. C. (19)
N 22 Thoroughfare Cr., S. C. (19)
N 23 Big Bull Cr., S. C. (19)
N 24 Brunsons Swamp, S. C. (19)
N 25 Lake Swamp, S. C. (19)
N 26 Little Pedee R., S. C. and N. C. (19)
N 27 Powter Cr., S. C. (26)
N 28 Brunson Swamp, S. C. (26)
N 29 Lake Swamp, S. C. (26)
N 30 Cedar Swamp, S. C.(26)
N 31 Lumber R., S. C. and N. C. (26)
N 32 Cold Camp Cr., N. C. (31)
N 33 Great Bart Cr., N. C. (31)
N 34 Jacobs Swamp, N. C. (31)
N 35 Buck Swamp, N. C. (31)
N 36 Ashpool Swamp, N. C. (31)
N 37 Shoe Heel Swamp, S. C. and N. C. (26)
N 38 Beaverdam Cr., S. C. (26)
N 39 Sweet Swamp, S. C. (26)
N 40 Buck Swamp, S. C. (26)
N 41 Catfish Cr., S. C. (19)
N 42 Three Crks., S. C. (19)
N 43 Crooked Cr., S. C. (19)
N 44 Naked Cr., S. C. (19)
N 45 Phillis Cr., S. C. (19)
N 46 Marks Cr., S. C. (19)
N 47 Mountain Cr., S. C. (19)
N 48 Little R., S. C. (19)
N 49 Yadkin R., N. C. (19) (name for part of Great Pedee in N. C.)
N 50 Abbott Cr., N. C. (49)
N 51 Ararat R., N. C. (49)
N 52 Deep Cr., N. C. (49)
N 53 Fourth Cr., N. C. (49)
N 54 Third Cr., N. C. (49)
N 55 Black Cr., N. C. (49)
N 56 Browns Cr., N. C. (49)
N 57 Thompsons Cr., S. C. (19)
N 58 Buckoltz Cr., S. C. (19)
N 59 Black Cr., S. C. (19)
N 60 Jeffreys Cr., S. C. (19)
N 61 Lynches R., S. C. (19)
N 62 Big Swamp, S. C. (61)
N 63 Lake Swamp, S. C. (61)
N 64 Sparrow Swamp, S. C. (61)
N 65 Rocky Cr., S. C. (61)
N 66 Tillers Fork Cr., S. C. (61)
N 67 Flat Cr., S. C. (61)
N 68 Big Buffalo Cr., S. C. (61)
N 69 Jumping Gulley Cr., S. C. (61)
N 70 Little Lynches Cr., S. C. (61)
N 71 Lynches Lake, S. C. (61)
N 72 Muddy Cr., S. C. (61)
N 73 Clark Cr., S. C. (19)
N 74 Black R., S. C. (19)
N 75 Peters Cr., S. C. (74)
N 76 Mingo Cr., S. C. (74)
N 77 Poplar Hill Cr., S. C. (76)
N 78 Indian Town Cr., S. C. (76)
N 79 Boggy Cr., S. C. (76)
N 80 Cedar Swamp, S. C. (76)
N 81 Turkey Cr., S. C. (76)
N 82 Huffeys Cr., S. C. (76)
N 83 Campbells Swamp, S. C. (76)
N 84 Big Dam Swamp, S. C. (74)
N 85 Brick Cr., S. C. (74)
N 86 Boggy Swamp, S. C. (74)
N 87 Flat Swamp, S. C. (74)
N 88 Claps Swamp, S. C. (74)
N 89 Scape Cr. Swamp, S. C. (74)
N 90 Pocotaligo R., S. C. (74)
N 91 Mill Branch, S. C. (74)
N 92 Laws Swamp, S. C. (74)
N 93 Stony Run Cr., S. C. (74)
N 94 Ox Swamp, S. C. (74)
N 95 Spring Gully Cr., S. C. (74)
N 96 Johnson Swamp, S. C. (74)
N 97 Green Cr., S. C. (74)
N 98 Sampit R., S. C. (4)
N 99 Georgetown Harbor, S. C. (98, 4)
N 100 Estherville-Minim Cr. Canal, S. C. (4, 101)
N 101 Santee R., S. C. (111)
N 102 Lit. Minim Cr., S. C. (101)
N 103 Mosquito Cr., S. C. (4, 101)
N 104 Minim Cr., S. C. (101)
N 105 Duck Cr., S. C. (101)

N 106 Pigeon Cr., S. C. (101)
N 107 Potato Cr., S. C. (101)
N 108 Paw Paw Cr., S. C. (101)
N 109 Little R., S. C. (101)
N 110 Jacks Cr., S. C. (101)
N 111 Halfway Swamp, S. C. (101)
N 112 Mill Cr., S. C. (101)
N 113 Wateree R., S. C. (101)
N 114 Rafting Cr., S. C. (113)
N 115 Beach Cr., S. C. (113)
N 116 Pinetree Cr., S. C. (113)
N 117 Sanders Cr., S. C. (113)
N 118 Flat Rock Cr., S. C. (113)
N 119 Beaver Cr., S. C. (113)
N 120 Catawba R. (name of upper part of Wateree R.). (113)
N 121 Cedar Cr., S. C. (120)
N 122 Camp Cr., S. C. (120)
N 123 Cane Cr., S. C. (120)
N 124 Six Mile Cr., S. C. (120)
N 125 Waxhaw Cr., S. C. (120)
N 126 Twelve Mile Cr., S. C. (120)
N 127 Big Sugar Cr., S. C. (120)
N 128 McAlpin Cr., S. C. (120)
N 129 Johns R., S. C. (120)
N 130 Lit. Catawba R., S. C. (120)
N 131 Crowders Cr., S. C. (120)
N 132 Allisons Cr., S. C. (120)
N 133 Dutchman Cr., S. C. (120)
N 134 Fishing Cr., S. C. (120)
N 135 Rocky Cr., S. C. (120)
N 136 Wateree Cr., S. C. (113)
N 137 Colonels Cr., S. C. (113)
N 138 Sawneys Cr., S. C. (113)
N 139 Rice Cr., S. C. (113)
N 140 Spears Cr., S. C. (113)
N 141 Congaree R., S. C. (101)
N 142 Carters Cr., S. C. (141)
N 143 Cedar Cr., S. C. (141)
N 144 Toms Cr., S. C. (141)
N 145 Mill Cr., S. C. (141)
N 146 Gill Cr., S. C. (141)
N 147 Broad R., N. C. and S. C. (141)
N 148 Crane Cr., S. C. (147)
N 149 Cedar Cr., S. C. (147)
N 150 Little R., S. C. (147)
N 151 Wilkinson Cr., S. C. (147)
N 152 Tirrable Cr., S. C. (147)
N 153 Sandy R., S. C. (147)
N 154 Turkey Cr., S. C. (147)
N 155 Bullocks Cr., S. C. (147)
N 156 Beaverdam Cr., S. C. (147)
N 157 Goin Moores Cr., S. C. (147)
N 158 King Cr., S. C. (147)
N 159 Buffalo Cr., S. C. (147)
N 160 1st Broad Cr., S. C. (147)
N 161 2nd Broad Cr., S. C. (147)
N 162 Cove Cr., S. C. (147)
N 163 Green R., N. C. (147)
N 164 Cherokee Cr., S. C. (147)
N 165 Gilkys Cr., S. C. (147)
N 166 Pacolot R., S. C. (147)
N 167 Brown Cr., S. C. (147)
N 168 Tiger R., S. C. (147)
N 169 Ennoree R., S. C. (147)
N 170 Reedy R., S. C. (147)
N 171 Hellers Cr., S. C. (147)
N 172 Saluda R., S. C. (141)
N 173 Camping Cr., S. C. (172)
N 174 Bush R., S. C. (172)
N 175 Beaverdam Cr., S. C. (172)
N 176 Little R., S. C. (172)
N 177 Raiburns Cr., S. C. (172)
N 178 Goldeb Grove Cr., S. C. (172)
N 179 No. Fk. Saluda R., S. C. (172)
N 180 Mdl. Fk. Saluda R., S. C. (172)
N 181 So. Fk. Saluda R., S. C. (172)
N 182 Oolenoe Cr., S. C. (172)
N 183 Carpenters Cr., S. C. (172)
N 184 Georges Cr., S. C. (172)
N 185 Brushy Cr., S. C. (172)
N 186 Big Cr., S. C. (172)
N 187 Broad Mouth Cr., S. C. (172)
N 188 Turkey Cr., S. C. (172)
N 189 Wilsons Cr., S. C. (172)
N 190 Halfway Cr., S. C. (172)
N 191 Lit. Saluda R., S. C. (172)
N 192 Holly Cr., S. C. (172)
N 193 12 Mile Cr., S. C. (172)
N 194 Congaree Cr., S. C. (141)
N 195 Sandy Run Cr., S. C. (141)
N 196 Big Beaver Cr., S. C. (141)
N 197 High Hill Cr., S. C. (141)
N 198 Outland Cr., S. C. (101)
N 199 Wambraw Cr., S. C. (101)
N 200 So. Santee R., S. C. (101)
N 201 Alligator Cr., S. C. (101)
N 202 Inland Waterways—Charleston H. to Santee R. (including Owendaw Cr.) (1,203)
N 203 Charleston H., S. C. (1)
N 204 Charleston, S. C., to Beaufort, N. C.—waterway (203)
N 205 Cooper R., S. C. (203)
N 206 Shipyard R., S. C. (205)
N 207 Shem R., S. C. (205)
N 208 Wando R., S. C. (205)
N 209 Eastern Branch, Cooper R., S. C. (205)
N 210 Fair Forest Swamp, S. C. (205)
N 211 Western Branch, Cooper R., S. C. (205)
N 212 Black R., S. C. (205)
N 213 Goose Cr., S. C. (205)
N 214 Ashley R., S. C. (203)
N 215 Wappo Cut, S. C. (214, 216)
N 216 Stono R., S. C. (1)
N 217 Town Cr., S. C. (216)
N 218 Wadmelaw R., S. C. (216)
N 219 Edisto R. (Pon Pon), S. C., (1)
N 220 Dawho R., S. C. (219)
N 221 4 Hole Swamp, S. C. (219)
N 222 Indian Field Cr., S. C. (219)
N 223 Polk Cr., S. C. (219)
N 224 Cattle Cr., S. C. (219)
N 225 North Fork Edisto R., S. C. (219)
N 226 Caw Caw Swamp, S. C. (225)
N 227 Big Bull Swamp, S. C. (225)
N 228 Black Cr., S. C. (225)
N 229 Hell Hole Swamp, S. C. (225)
N 230 Giddy Swamp, S. C. (225)
N 231 Big Beaver Cr., S. C. (225)
N 232 Cooper Swamp, S. C. (225)
N 233 South Fork Edisto R., S. C. (219)
N 234 Snake Swamp, S. C. (233)
N 235 Willow Swamp, S. C. (233)

N 236 Rocky Swamp, S. C. (233)
N 237 Goodland Swamp, S. C. (233)
N 238 Dean Cr., S. C. (233)
N 239 Cedar Cr., S. C. (233)
N 240 Rocky Spring Cr., S. C. (233)
N 241 McTyler Cr., S. C. (233)
N 242 Shaws Cr., S. C. (233)
N 243 Mosquito Cr., S. C. (233, 244)
N 244 Ashepoo R., S. C. (1)
N 245 Welches Cr., S. C. (244)
N 246 Chessy Cr., S. C. (244)
N 247 Island Cr., S. C. (244)
N 248 Combahee R., S. C. (1)
N 249 Chehaw R., S. C. (248)
N 250 Cuckolds Cr., S. C. (248)
N 251 Little Salkehatchie R., S. C. (248)
N 252 Buckhead Cr., S. C. (251)
N 253 Lemons Cr., S. C. (251)
N 254 Willow Swamp, S. C. (251)
N 255 Big Salkehatchie R., S. C. (248)
N 256 Whipping Swamp, S. C. (255)
N 257 Coosaw R., S. C. (1)
N 258 Pt. Royal Bar, S. C. (1)
N 259 Beaufort R., S. C. (258)
N 260 Archers Cr., S. C. (259, 261)
N 261 Broad R., S. C. (258)
N 262 Pocotaligo R., S. C. (261)
N 263 Tullifinny R., S. C. (261)
N 264 Coosawhatchie R., S. C. (261)

N–4 WINYAH BAY, S. C.

APPROPRIATIONS.

1886,	$18,750.00,	**87,** 1079.
1888,	100,000.00,	**88,** 931.
1890,	100,000.00,	**90,** 1171.
1892,	100,000.00,	**92,** 1191.
1894,	110,000.00,	**95,** 1355.
1896,	20,000.00,	**96,** 1168.
1897,	350,000.00,	**97,** 1454.
1898,	450,000.00,	**99,** 1529.
1899,	58,500.00,	**99,** 1529.
1900,	285,000.00,	**00,** 1853.
1901,	500,000.00,	**01,** 1582.
1902,	35,000.00,	**02,** 1156.
1903,	100,000.00,	**03,** 1123.
1904,	70,000.00,	**04,** 1550.
1905,	75,000.00, 10,000.00,	**05,** 1242.
1907,	30,000.00, 72,750.00,	**07,** 1259.
1909,	*15,000.00,	**09,** 1306.
1910,	150,000.00,	**10,** 1447.
1907,	*10,000.00,	**12,** 1795.
1909,	*5,991.67,	**12,** 1795.
1912,	162,000.00, 100,000.00,	**12,** 1795.

Total, 2,927,991.67 (incl. misc., $2,936,188.95, **12,** 1795).

COMMERCE.

Present and prospective, **85,** 1154; **87,** 1080.
C. of the B., **88,** 933.
Necessity of further imp., **89,** 1110.
Description of, **93,** 1443–1445; **94,** 1062; **95,** 1352; **96,** 1169; **98,** 1272; **02,** 1158.
Aggregate value of the C., 1896, $6,288,350, **96,** 1169.
Water rate on lumber decreased from $5.50 per M f. in 1892 to $4.12½ in 1905, **06,** 282.
Water rates on lumber advanced to $6, **08,** 314.
"The amount of the commerce for the calendar year 1911 was 314,503 tons, valued at $5,322,569. It consisted mainly of lumber, timber products, cotton, provisions, and general merchandise. There has been little change in the nature of the commerce during the past year.
"This improvement and the operation of ocean-going steamers and sailing vessels appear to secure to Georgetown the usual port differentials which are designed to meet water competition, this particularly on through freight from and to New York and Baltimore. The precise percentage of reduction of rates does not appear to be susceptible of determination." **12,** 470.

CONTRACTS.

1889. J. S. Howell, diking, etc., $96,555, **90,** 1172.
1890. W. T. Gaynor, sheet piling, st., mattress, etc., $192,640, **91,** 1414.
1892. C. G. Bochman, extension of n. j.; mattresses, $1.05 s. y., p. m.; large st., $2.70 short t.; small st., $2.45 short t. ($60,000 to $70,000), **93,** 1446. Rittenhouse Moore Dredging Co., earth dike constr., 24¢ c. y. ($105,000), **93,** 1446. (Annulled, 1893, **94,** 1060.)
1893. C. G. Bochman, earth dike constr., 27¢ c. y., **94,** 1060.
1894. W. E. and E. L. Friday, j. constr.; mattresses, 74¢ s. y., p. m.; small and large st., $2.13½ t. ($77,285), **95,** 1356.
1897. The Bucyrus Co., steam pump dr., $73,800, **97,** 1456. R. G. Ross, j. constr.; large and small st. and ballast, $1.57 t.; mattresses, 57¢ s. y. ($1,241,499.43), **97,** 1455. J. A. Bryan, muck ditch, 25¢ l. f.; sodding, 19¾¢ s. y.; dike filling, 24¢ c. y.; dam, $875 ($21,000), **97,** 1455.
1899. J. I. Hazard, coal, $2.64½ t., **99,** 1529.
1901. J. I. Hazard, coal, **02,** 1156.
1902. J. I. Hazard, coal; Riverside Iron Works, drag, curved pipe and patterns, **02,** 1156. Consumers Coal Co., coal, **03,** 1124.
1903. Thos. W. Brown, bottom-dump lighter, $700. C. B. Colbert, repairs to drs., $3,698.75, **04,** 1551.
1904. Simons-Mayrant Co., constr. cofferdam dike, unit prices given, **04,** 1550. W. C. Reaves, bottom-dump lighter, $2,245; Standard Fuel Supply Co., coal, $3.53 t., **04,** 1551. C. B. Colbert, installing machinery in new drs., $3,513.30, **05,** 1242.
1906. R. G. Ross, constr. mound on s. j.; st., $3.94 t., **07,** 1259.
1909. S. J. Pregnall, an. repairs to dr., $7,139.15, **10,** 1447.
1911. Merrill-Stevens Co., repairing dr. *Winyah Bay;* Atlantic, Gulf & Pacific Co., dr., 9.9¢ c. y., **11,** 1575.

ENGINEERS.

Chief of Engineers. R., 81, 168; **82,** 164; **85,** 177; **87,** 136; **88,** 130; **89,** 147, 1111, 1112; **90,** 132; **91,** 169; **92,** 169; **93,** 182; **94,** 167; **95,** 190; **96,** 173; **97,** 217; **98,** 214; **99,** 247; **00,** 281; **01,** 314; **02,** 241; **03,** 246; **04,** 249; **05,** 258; **06,** 280; **07,** 294; **08,** 312; **09,** 321; **10,** 365; **11,** 387; **12,** 468, 484.

Boards. Convened, New York, Dec. 24, 1888, by S. O. No. 51, to ex. and **R.** upon Capt. Bixby's plan for the imp. Winyah B. **R., 89,** 1114. (Col. Comstock and Lt. Cols. Houston and Robert.)

In charge:
Capt. J. Mercur, 1881–85. **R., 82,** 1122.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1154; **87,** 1078; **88,** 929; **89,** 1106; **90,** 1169; **91,** 1411.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1187; **93,** 1441; **94,** 1059; **95,** 1349.
Capt. F. V. Abbot, 1896–97. **R., 96,** 1165; **97,** 1452.

* Allotment.

Maj. E. H. Ruffner, 1898–99. **R., 98,** 1272; **99,** 1527.
Capt. J. C. Sanford, 1900–02. **R., 00,** 1851; **01,** 1582; **02,** 1154.
Capt. G. P. Howell, 1903–07. **R., 03,** 1122; **04,** 1549; **05,** 1241; **06,** 1174; **07,** 1258.
Capt. E. R. Stuart, 1908. **R., 08,** 1314.
Capt. E. I. Brown, 1909. **R.,** 1305.
Capt. E. M. Adams, 1910. **R., 10,** 1446.
Col. D. C. Kingman, 1911. **R., 11,** 1574.
Maj. G. P. Howell, 1912–. **R., 12,** 1793.

Assistants:
C. M. Yeates. **R., 82,** 1124.
R. Whitford. **R., 85,** 1155, 1165; **87,** 1080; **88,** 931; **89,** 1109; **90,** 1173; **91,** 1414; **96,** 1168; **97,** 1457; **00,** 1855; **01,** 1586; **02,** 1159; **03,** 1126.
C. Humphreys. **R., 91,** 1415; **92,** 1191; **93,** 1446.

OPERATIONS.

1889-90. 1,017 t. riprap placed in j., **90,** 1170.

1890-91. 1,013 s. y. of mattress, 460 c. y. of shell, 2,325 t. small st., and 685 t. of large st. used in j. constr., **91,** 1413.

1891-92. 46,276 t. of st., 141 c. y. of oyster shells, 21,147 s. y. of mattress, and 194,976′, b. m., of sheet piling used in j. constr., **92,** 1188.

1892-93. 15,641 s. y. mattresses and 23,755 t. of st. placed in the n. j., and 553′ of trestle built, **93,** 1441. Mud dike 255′ l. built at South Isld. by hired labor, and work of constr. begun under contract, **93,** 1447.

1893-94. 1,255 s. y. mattresses and 2,089 t. of small st. placed in the n. j., **94,** 1059. 1,800 l. f. earth dike constr. at South Isld., **94,** 1060.

1894-95. 21,344 s. y. mattresses, 12,956 t. of small st. and 9,092 t. of large st. placed in the n. j.; 92,755 c. y. earth placed in South Isld. dike, building 8,100′ to full dimensions, **95,** 1351. 18 spur js., aggregating 1,386 l. f., and 1,225 l. f. of connecting post-and-brush sand catchers built to prevent erosion of South Isld. Beach, **95,** 1352.

1895-96. 5,000 t. of large st. and 3,000 t. of small st. placed in the n. j.; the South Isld. j. completed by the addition of 21,169 c. y. mud, and the dike sodded, **96,** 1166.

1896-97. Sodding of South Isld. Dike in progress and repairs made, **97,** 1453, 1457.

1897-98. 40,313 c. y. mud filling and 48,776 s. y. sod were placed on mud dike; 2,575 l. f. of muck ditch was completed; 10,464 s. y. mattresses, 8,234 t. ballast, and 1,899 t. large st. were placed in j. at South Isld., **98,** 1272.

1898-99. 61,435 s. y. mattress, 45,691 t. small st., and 54,079 t. large st. placed in s. j.; 172,977 c. y. dr. from Bottle Chan. and wharf for use of dr. built at North Isld., **99,** 1527.

1899-00. 94,413 s. y. mattress, 86,526 t. large st., and 47,243 t. small st. placed in s. j.; 5,560 s. y. mattress, 2,444 t. large st., and 1,850 t. small st. placed in n. j.; 337,218 c. y. dr. from Bottle Chan., and dr., wharves, launches, and living quarters repaired, **00,** 1855.

1900-01. Mattress foundation for s. j. completed, superstr. extended 4,635′, mattress placed along j. to prevent undermining, superstr. of n. j. extended 1,289′ and mattress 500′ beyond this, 237,390 c. y. dr. between js. and 23,702 c. y. dr. within B., **01,** 1582, 1586.

1901-02. S. j. extended to outer limit up to h. w. level, 1,240 l. f. raised to 10′ above l. w., mattress placed to prevent further undermining; mattress foundation for n. j. completed, superstr. extended 2,747 l. f. 6′ above l. w. and 2,725 l. f. inner portion raised to same height; 165,376 c. y. dr., **02,** 1154.

1902-03. Jetty constr. completed, and 78,919 c. y. dr., **03,** 1122.

1903-04. 205,981 c. y. dr., 23,894 c. y. material placed in mud dike on South Isld., and 10,236 s. y. sodded; dam built across Sand Creek, **04,** 1549.

1904-05. 98,303 c. y. dr. from e. chan. and 27,593 c. y. from opposite Georgetown; s. j. extended 2,600′ to mud dike by sheet piling and mud structure, and mud dike extended and partly sodded, **05,** 1241.

1905-06. 594,448 c. y. dr., 5,360 c. y. mud placed in repairing mud dike and 6,377 s. y. sodded; 13,438 s. y. sod laid on extension to s. j., **06,** 1174, 1175.

1906-07. 503,752 c. y. dr., 3,960 stumps and logs removed, and mound at end of s. j. rebuilt, **07,** 1258. 1,054 c. y. mud placed in repairs to mud dike and 7,390 s. y. sodded, **07,** 1259.

1907-08. 312,191 c. y. dr., and 809 obstr. removed, **08,** 1314.

1908-09. 311,317 c. y. dr. and 575 stumps removed, completing proj., **09,** 1305.

1909-10. 90,165 c. y. dr., **10,** 1446.

1911-12. 2,014,191 c. y. dr., **12,** 1793. Dr. *Winyah Bay* removed 236,725 c. y., bin meas.; 230 logs, etc., removed; 928 c. y. earth, mud, and poles, and 998 s. y. grass placed in South Isld. Dike, **12,** 1794.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1443, 1444; **95,** 1349; **01,** 314.
Mean of water gauge readings, **95,** 1354.
Various d.; shoaling, **11,** 1574.

PLANS. (See Projects.)

In 1881 Capt. Mercur considered that by a concentration of the tidal currents upon the bar by means of 2 submerged js. a chan. from 12′ to 15′ d. and 1,800′ w. could be obtained over the bar; est., $1,500,000, **82,** 1123; **85,** 1159.

PROJECTS. (See Plans.)

By Capt. Bixby, 1885, approv. by BE., 1888, to secure a permanent chan. of entrance over the bar from 15′–20′ m. l. w. by constr. of 2 converging js., extending from South Isld. and the s. end of North Isld., resp., and running to the 18′ curve of d. These js. to be built of riprap on brush-mattress foundation, with a top w. of from 10′–20′ and a h. of 6′ above m. l. w.; est., $2,500,000, **89,** 1114, 1115; **92,** 1188.

By Maj. Stanton, 1892, constr. of an earth dike about 11,000′ l. on South Isld. to prevent hurtful changes to the tidal regimen of the B. that would be caused by the overflow along about 2 m. of shore line at the immediate entrance to the B. on an extensive marsh on its s. side whose surface is about 1′ below m. h. w., **93,** 1442.

By Chief of Engineers, 1896, constr. of 2 js., the completion of the mud dike, and for constr. of seagoing steam-pump dr., **97,** 1453; modifications of this proj. made by Chief of Engineers, 1897, **97,** 1453–1454.

Extended by act 1902 to permit dr. shoal places between entrance and city of Georgetown, **02,** 1155.

Au. act June 25, 1910, provides for continuing imp. to secure 18′ d.; est., $650,000,[1] **10,** 367.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1881, by Capt. J. Mercur, **82,** 1122.

Of entrance au. act July 5, 1884; made, 1885, by Capt. Bixby, **85,** 1157.

Surs. made, 1892–93 and 1895–96, by Maj. Stanton and Capt. Abbot, **93,** 1446; **96,** 1167–1168.

Sur. of the bar and shore lines at North and South Islds. as far as Santee Pt., made by Capt. Abbot, 1897, **97,** 1454.

Sur. of Bottle Chan. made, 1898, by Maj. Ruffner, **98,** 1272.

Sur. made, 1899, by Maj. Ruffner (maps), **99,** 1527.

Sur. made, 1900, by Capt. Sanford (maps), **00,** 1851.

Of B. and entrances, **01,** 1582; **02,** 1155; **03,** 1123; **04,** 1549; **08,** 1314.

Of the B., **11,** 1574.

Of e. chan. of inner B., **11,** 1575.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 469.

Pre. ex. au. act Feb. 27, 1911, with view to providing uniform d. of 18′, m. l. w., and giving increased H. facilities at Georgetown. **R.** by Col. Kingman, May 29, 1911[2] (unfav.), **12,** 484.

Maps.
85, 1164; **89,** 1114; **90,** 1172; **91,** 1414; **92,** Atlas, 43, 44; **93,** 1448; **94,** 1064; **95,** 1354; **96,** 1170; **97,** 1456; **98,** 1274; **99,** 1528; **00,** 1854; **01,** 1586; **02,** 1160.

[1] H. D., 398, 58th, 2d.

[2] H. D. 278, 62d, 2d.

N–5 WACCAMAW RIVER, N. C. AND S. C.

APPROPRIATIONS.

1880,	$15,000,	**80,** 848.
1881,	10,000,	**81,** 1032.
1882,	4,400,	**82,** 1109.
1884,	6,000,	**84,** 1048.
1886,	15,000,	**86,** 1023.
1888,	15,000,	**88,** 914.
1890,	12,500,	**90,** 1231.
1892,	10,000,	**92,** 1197.
1894,	6,000,	**95,** 1393.
1896,	6,000,	**96,** 1153.
1899,	3,000,	**99,** 1518.
1902,	*9,000,	**03,** 1118.
1905,	*13,800,	**05,** 1236.
1907,	*18,000,	**07,** 1255.
1909,	*4,000,	**09,** 1302.
1910,	50,000,	**10,** 1442.
1912,	25,000,	**12,** 1788.

Total, 222,700 (incl. misc., $223,002.50, **12,** 1788).

COMMERCE.

Increase in, consequent upon imp., **86,** 1022; **88,** 916.

Description of, **80,** 851; **81,** 1032; **93,** 1466; **95,** 1393; **96,** 1153; **04,** 1622.

1892–93, 70,976 t., **93,** 1465; 1893–94, 99,298 t., **94,** 1068; 1894–95, 128,466 t., **95,** 1392; 1895–96, 203,388 t., **96,** 1152.

In 1899, important, **99,** 1518.

Although rates on R. lower, not necessary for RR. to reduce rates, **10,** 362.

1911, 107,811 t., **12,** 464.

CONTRACTS.

1881. T. W. Daggett, furnishing steam-hoisting and pile-driving machinery, $25 per day, **81,** 1031.

ENGINEERS.

Chief of Engineers. **R., 80,** 124, 125; **81,** 166; **82,** 162; **83,** 170; **84,** 175, 177; **85,** 173; **86,** 170; **87,** 134; **88,** 126; **89,** 157; **90,** 140; **91,** 170; **92,** 170; **93,** 184; **94,** 168; **95,** 192; **96,** 171; **97,** 213; **98,** 212; **99,** 245; **00,** 277; **01,** 310; **02,** 237; **03,** 243; **04,** 245, 262, 1614; **05,** 254; **06,** 276; **07,** 289; **08,** 306; **09,** 315; **10,** 361; **11,** 383; **12,** 463.

Boards. BERH. **R., 04,** 1617, 1619.

In charge:

Capt. C. B. Phillips, 1879–81. **R., 80,** 848.

Capt. J. Mercur, 1881–84. **R., 81,** 1030; **82,** 1108; **83,** 868.

Capt. F. A. Hinman, 1884–85. **R., 84,** 1048, 1056.

Capt. W. H. Bixby, 1885–89. **R., 85,** 1105; **86,** 1022; **87,** 1065; **88,** 912.

Capt. F. V. Abbot, 1889–97. **R., 89,** 1198; **90,** 1229; **91,** 1442; **92,** 1195; **93,** 1464; **94,** 1067; **95,** 1391; **96,** 1151; **97,** 1439.

Maj. E. H. Ruffner, 1898–99. **R., 98,** 1265; **99,** 1517.

Capt. J. C. Sanford, 1900–02. **R., 00,** 1841; **01,** 1573; **02,** 1149; **04,** 1615.

Capt. G. P. Howell, 1903–07. **R., 03,** 1117; **04,** 1544, 1624; **05,** 1235; **06,** 1171; **07,** 1253.

Capt. E. R. Stuart, 1908. **R., 08,** 1309.

Capt. E. I. Brown, 1909. **R., 09,** 1301.

Capt. E. M. Adams, 1910. **R., 10,** 1441.

Col. D. C. Kingman, 1911. **R., 11,** 1569.

Maj. G. P. Howell, 1912–. **R., 12,** 1787.

Assistants:

C. W. Forster. **R., 80,** 850.

H. Heth. **R., 81,** 1031; **82,** 1109; **83,** 869; **84,** 1048.

R. Whitford. **R., 85,** 1106; **86,** 1024; **87,** 1068; **88,** 914; **89,** 1200; **90,** 1231; **91,** 1443; **92,** 1197; **93,** 1465; **94,** 1069; **95,** 1393; **96,** 1153; **97,** 1441; **00,** 1844; **04,** 1619, 1626.

OPERATIONS.

1880–81. Brush and pile js. for contracting the chan. built at Needles Eye Shoal and Oat Bed Shoal, **81,** 1031, 1032.

1881–82. Removal of snags, logs, and similar obstr. continued and driving of piles completed on both shoals, securing 12′ throughout, **82,** 1108, 1109.

1882–83. Banks trimmed of overhanging trees between Conwayboro and Georgetown, **83,** 869.

1883–84. Trees, logs, and snags removed from R. between Conwayboro and Needles Eye Shoal, **84,** 1048.

1884–85. 932 snags, stumps, and trees, 1 flatboat and 1 schooner removed from bed of R.; 1,752 trees and stumps and 14,550 l. f. of brush removed from banks, clearing 66 m. of R., **85,** 1105.

1886–87. Obstr. removed from 34 m. of R. extending the imp. to about 96 m. above Georgetown, **87,** 1067, 1068.

1887–88. 462 trees, logs, and snags removed from R.; 710 trees removed from banks; repairs to js. at Big Needles Eye Shoal and Oat Bed Shoal, **88,** 913.

1888–89. 2,411 trees and snags and 6 cords small snags removed from the chan., 5,374 trees cut and trimmed, and 234 cords of brush removed from the banks, **89,** 1200.

1889–90. 991 trees, stumps, and snags and 6 cords small snags removed from the chan., and 1,775 trees cut and trimmed upon the banks, **90,** 1231.

1890–91. 2,739 snags and logs and 10 cords of small snags removed from the chan. and 5,900 trees and 106 cords of brush cleared from the banks, **91,** 1443.

1891–92. 576 snags removed from the chan., and 1,074 trees and 7 cords of brush cleared from the banks, **92,** 1197.

1892–93. Over 4,000 snags and other obstr. removed from the banks and chan., **93,** 1465.

1893–94. Over 2,000 snags and other obstr. removed, **94,** 1069.

1894–95. Over 1,800 snags and other obstr. removed, **95,** 1393.

1895–96. Over 400 snags and other obstr. removed, **96,** 1153.

1896–97. About 2,000 snags and other obstr. removed, **97,** 1441.

1897–98. About 2,000 snags and other obstr. removed, **98,** 1265.

1898–99. Over 838 snags and other obstr. removed, **99,** 1518.

1899–00. About 2,000 snags and other obstr. removed, **00,** 1844.

1900–01. 1,083 logs, stumps, and snags removed and 624 trees and 2 cords brush cut, **01,** 1574.

1903–04. 5,129 obstr. removed and 15,732 c. y. dr., **04,** 1544.

1904–05. 851 obstr. removed, **05,** 1236.

1905–06. 37,633 c. y. dr., **06,** 1172.

1906–07. 41,306 c. y. dr., and 2,984 obstr. removed for imp.; 1,068 obstr. removed from chan. and 892 trees and 102 cords brush from banks for mainten., **07,** 1254.

1907–08. 11,826 logs, trees, stumps, and snags and 620 cords brush removed; 62,284 c. y. dr., **08,** 1309.

1908–09. 23,731 c. y. dr., and 51 stumps removed, **09,** 1301.

1909–10. 46,091 c. y. dr., and 236 stumps removed, **10,** 1441.

1910–11. Dr. *Cheraw* repaired and 2 bank derricks constr.; 98,122 c. y. removed from Thoroughfare cut; work at this cut practically completed, **11,** 1569–70. Derrick crew removed 1,412 obstr., and hoister *Socastee* removed 667 snags and other obstr.; proj. about 25% completed, **11,** 1570.

1911–12. Dr. to provide chan. 8′ x 80′, and making cuts under the 12′ proj. to Conway continued, 112,512 c. y. material and 250 stumps removed, **12,** 1787. The 2 derricks removed total of 13,953 c. y. from Loggy Creek and Burrows Cuts and force

*Allotment.

employed in addition to derrick crews removed 287 trees and other obstr. All cut-offs below Conway made. Work to form 12′ chan. can be done better by pipe line dr.; not intended to operate dr. *Cheraw* any longer on this stream, **12,** 1788.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 849; **81,** 1032; **87,** 1066; **04,** 1616, 1620, 1629.

R. has its outlet into Winyah B. at Georgetown, forming a part of the Winyah B. system of Rs., **84,** 1048; **99,** 1518.

PROJECTS.

By Capt. Phillips, 1880, imp. of Waccamaw R. by formation of chan. 12′ d. at all stages of water, with 80′ bottom w., from mouth of the R. 66 m. upward to Conwayboro; also a chan. 178 m. farther to Lake Waccamaw; est., $29,370, **80,** 848. Est. revised, 1885, to $138,400, **85,** 1105; **86,** 1022; **92,** 1196.

Maj. Ruffner est., 1899, $6,000 per year would be needed to maintain chan. in serviceable condition, **99,** 1518.

By Capt. Howell, 1904, est. for chan. to Conway, 6′, $40,000; 9′, $70,000; 12′, $120,000; 12′ to Bucksville and 6′ to Conway, $50,000; last one recom. if. proj. be modified,[1] **04,** 1625.

Capt. Adams, 1910, recom. adoption of modified proj. and limited snagging above Conway,[1] **10,** 1442.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 95; made, 1880, by Capt. Phillips, **80,** 848.

Between Conwayboro and Waccamaw Lake au. act Aug. 2, 1882. **R.** by Capt. Mercur as unworthy of imp., **84,** 1056.

Ex. and sur. au. act June 13, 1902; made, 1903, by Capt. Sanford and Capt. Howell, resp.,[1] **04,** 1614.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 464.

Maps:
89, 1200.
Drawings for new snag boat, **95,** 1394.

N–6 WAVERLY CREEK, S. C.

ENGINEERS.

Chief of Engineers. R., 09, 333.
In charge. Capt. E. M. Adams, **09,** 315.

SURVEY.

Pre. ex. from mouth to Waverly Mills au. act Mar. 3, 1909. **R.** by Capt. Adams, 1909[2] (unfav.) **09,** 333.

N–7 SOCASTEE CREEK, S. C.

ENGINEERS.

Chief of Engineers. R., 89, 158.
In charge. Capt. F. V. Abbot, 1888. **R., 89,** 1214.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1214.

PLAN.

By Capt. Abbot, 1889, excavating cut 4′ x 40′ l. w. through the Cypress Swamp from the br. at Socastee, for about ¾ of a m.; also clearing out obstr. and w. and d. places below proposed cut; est., $10,000, **89,** 1215.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt Abbot, **89,** 1214.

N–19 GREAT PEDEE RIVER, N. C. AND S. C.

APPROPRIATIONS.

1880,	$7,000,	**80,** 845.
1881,	6,000,	**81,** 1030.
1882,	6,000,	**82,** 1107.
1884,	8,000,	**84,** 1047.
1886,	20,000,	**86,** 1018.
1888,	20,000,	**88,** 923.
1890,	12,500,	**90,** 1217.
1892,	10,000,	**92,** 1205.
1894,	6,000,	**95,** 1402.
1896,	12,000,	**96,** 1162.
1899,	4,000,	**99,** 1524.
1902,	22,500,	**02,** 1153.
1903,	40,000,	**03,** 1121.
1904,	10,000,	**04,** 1547.
1905,	{15,000 / 5,000}	**05,** 1239.
1907,	{20,000 / 30,000}	**07,** 1257.
1908,	11,300,	**08,** 1313.
1909,	*10,000,	**09,** 1304.
1910,	30,000,	**10,** 1445.
1912,	10,000,	**12,** 1792.
Total,	315,300	(incl. misc., $315,563.28, **12,** 1792).

COMMERCE.

Unimportant, **73,** 755; H. Doc. 68, 45th Cong., 3d sess., 17.

Description of, **80,** 847; **81,** 1030; **93,** 1476; **94,** 1078; **95,** 1403; **96,** 1162.

T., 1892–93, 94,661 t., **93,** 1474; 1893–94, 91,025 t., **94,** 1077; 1894–95, 106,115 t., **95,** 1401; 1895–96, 229,964 t., **96,** 1161.

In 1899, C. sufficient to justify continued imp. and mainten., **99,** 1523.

Formerly large; in 1901, practically none except timber rafts, **01,** 1609.

Description of past, present, and prospective, **01,** 1612, 1617.

New line of SS. between Cheraw and Georgetown, **08,** 1312.

SS. navigation on upper R. abandoned almost immediately after completion of imp., **10,** 1445.

1910, 50,000± t., **11,** 1573; 1911, 32,000± t., **12,** 468.

Rates advanced owing to increased operating expenses, **12,** 468, 1792.

R. gives traffic to points not reached by RR., **12,** 468.

[1] H. D. 514, 58th, 2d. [2] H. D. 72, 61st, 1st. *Allotment.

CONTRACTS.

1904. Merritt-Stevens Engineering Co., dr. bucket, $600; Schoellhorn-Albrecht Machine Co., 2 marine engines, $2,150, **04,** 1548. Harlan & Hollingsworth Co., steel hull, $18,000; Harlan & Hollingsworth Co., machinery, etc., for new hull, $10,315, **05,** 1240.

1908. Ellicott Machine Co., machinery and appliances for hydraulic dr., $20,500 (Great Pedee portion, $4,100), **08,** 1313.

1912. Kingsford Foundry & Machine Works, 2 Scotch boilers, $3,150, **12,** 1792.

ENGINEERS.

Chief of Engineers. R., 73, 70; H. Doc. 68, 45th Cong., 3d sess., 1; **80,** 125; **81,** 166; **82,** 162; **83,** 169; **84,** 174; **85,** 172; **86,** 169; **87,** 135; **88,** 129; **89,** 153; **90,** 138; **91,** 172; **92,** 171; **93,** 185; **94,** 170; **95,** 194; **96,** 172; **97,** 216; **98,** 213; **99,** 246; **00,** 279, 292; **01,** 312, 324, 1607; **02,** 239; **03,** 245; **04,** 247; **05,** 256; **06,** 279; **07,** 293; **08,** 310; **09,** 319, 333; **10,** 364, 378; **11,** 386, 398; **12,** 466.

In charge:

Maj. Q. A. Gillmore. **R., 73,** 753.

Capt. C. B. Phillips. **R.,** H. Doc. 68, 45th Cong., 3d sess., 16. 1879–81. **R., 80,** 844.

Capt. J. Mercur, 1881–84. **R., 81,** 1029; **82,** 1107; **83,** 866.

Capt. F. A. Hinman, 1884–85. **R., 84,** 1047.

Capt. W. H. Bixby, 1885–89. **R., 85,** 1100; **86,** 1017; **87,** 1070; **88,** 920.

Capt. F. V. Abbot, 1889–97. **R., 89,** 1179; **90,** 1215; **91,** 1450; **92,** 1203; **93,** 1474; **94,** 1076; **95,** 1401; **96,** 1160; **97,** 1447.

Maj. E. H. Ruffner, 1898–99. **R., 98,** 1269; **99,** 1523.

Capt. J. C. Sanford, 1900–02. **R., 00,** 1847; **01,** 1578, 1608, 1614; **02,** 1152.

Capt. G. P. Howell, 1903–07. **R., 03,** 1120; **04,** 1547; **05,** 1238; **06,** 1173; **07,** 1256.

Capt. E. R. Stuart, 1908. **R., 08,** 1312.

Capt. E. I. Brown, 1909. **R., 09,** 1304.

Capt. E. M. Adams, 1910. **R., 10,** 1445.

Col. Dan C. Kingman, 1911. **R., 11,** 1572.

Maj. G. P. Howell, 1912–. **R., 12,** 1791.

Assistants:

G. Daubeney, **73,** 753.

W. B. Page, H. Doc. 68, 45th Cong., 3d sess., 16, 17.

C. W. Forster. **R., 80,** 846.

H. Heth. **R., 81,** 1029; **82,** 1108; **83,** 867.

R. Whitford. **R., 85,** 1101; **86,** 1019; **87,** 1072; **88,** 923; **89,** 1180; **90,** 1217; **91,** 1452; **92,** 1205; **93,** 1475; **94,** 1078; **95,** 1402; **96,** 1162; **97,** 1449; **00,** 1849; **01,** 1611, 1616.

EXPENDITURES.

For ex., $103.40, **73,** 753.

OBSTRUCTIONS.

Wooden br. near Society Hill declared an obstr. to navigation; fault corrected by owners, **08,** 1312.

OPERATIONS.

1880–81. 286 logs and trees removed from chan. at Pocket Landing, **81,** 1029.

1881–82. Removal of snags, trees, and obstr. continued, **82,** 1107.

1882–83. Removal of sunken trees, logs, and obstr. continued, opening R. for an addl. distance of 50 m., **83,** 866.

1884–85. 604 logs, snags, and stumps cleared from the chan., imp. navigation over 209 m., **85,** 1100.

1886–87. 1,560 snags, logs, and stumps, and 2,023 trees removed from R. and banks, **87,** 1071.

1887–88. 634 logs, trees, and stumps removed; also 1,690 trees from the banks, **88,** 922.

1888–89. 217 trees and stumps and 14 cords small snags removed from the chan.; 49 trees and 6 cords of brush removed from the banks, **89,** 1181.

1889–90. 1,517 logs, trees, and snags removed from the chan., 3,551 trees and 100 cords of brush cut from the banks, **90,** 1217.

1890–91. 1,080 snags removed from the chan., and 1,034 trees cleared from the banks, **91,** 1452.

1891–92. 1,648 snags and 10 cords of small snags removed from the chan., and 1,680 trees and 51 cords brush from banks, **92,** 1205.

1892–93. About 3,500 snags and other obstr. removed from R. and banks, **93,** 1475.

1893–94. About 1,200 snags and other obstr. removed, **94,** 1078.

1894–95. About 900 snags and other obstr. removed, **95,** 1402.

1895–96. About 100 snags and other obstr. removed, **96,** 1162.

1896–97. About 2,500 snags and other obstr. removed, **97,** 1449.

1897–98. About 4,000 snags and other obstr. removed, **98,** 1269.

1898–99. Over 400 snags and other obstr. removed, **99,** 1523.

1899–00. About 2,500 snags and other obstr. removed, **00,** 1849.

1900–01. 32 snags, logs, and stumps removed, **01,** 1578.

1902–03. Obstr. removed, **03,** 1120.

1903–04. 4,400 obstr. removed, **04,** 1547.

1904–05. 2,307 obstr. removed, and 965 c. y. dr., **05,** 1238.

1905–06. 1,183 c. y. dr., **06,** 1173.

1906–07. 105,978 c. y. dr., **07,** 1256.

1907–08. 191,239 c. y. dr. and 3,815 obstr. removed, **08,** 1312.

1908–09. 142,445 c. y. dr. and 3,733 obstr. removed, **09,** 1304.

1909–10. 16,940 c. y. dr. and 2,972 obstr. removed, **10,** 1445.

1910–11. 1,046 snags and other obstr. removed; repairs to steam hoister *Socastee* completed, **11,** 1572.

1911–12. 997 obstr. removed by hoister *Socastee* derrick No. 2, erected on 75-t. lighter, removed 1,605 obstr. from bank; combination dr. and snag boat under constr., **12,** 1791.

PHYSICAL CHARACTERISTICS.

Description, **73,** 754; H. Doc. 68, 45th Cong., 3d sess., 17, 18; **80,** 846; **99,** 1523.

List of obstr., **73,** 755; H. Doc. 68, 45th Cong., 3d sess., 18, **80,** 846.

Discharge, H. Doc. 68, 45th Cong., 3d sess., 19.

Original condition of the R., **88,** 920.

Description of, **01,** 1608, 1616.

Materials (r., pebbles, and hard, sticky clay) difficult to dr., **07,** 1256.

Work delayed by long-continued h. w., **08,** 1312.

R. continuation of Yadkin R. which rises in mtns. of nw. N. C.; flows se. across State. It changes its name to Pedee (or Great Pedee) at mouth of Uwharie R. in N. C., 67 m. above Cheraw, S. C. From latter point to mouth in Winyah B. at Georgetown, S. C., l. is 234 m., of which, portion below Cheraw, 167 m. is proj. section, **12,** 466.

PLANS. (See Projects.)

By W. B. Page, removal of r. and shoals. and constr. 15 locks and dams; est., $1,124.301. Not recom. by Capt. Phillips. H. Doc. 68, 45th Cong., 3d sess., 17, 19, 20.

PROJECTS. (See Plans.)

By Capt. Phillips, 1879, **79,** 723, removal of obstr. natural and artificial, to secure 9′ as high as Smiths Mills, 46 m. above the confluence of the Pedee and Waccamaw Rs., thence a d. of 3½′ as high as the town of Cheraw, 149 m. above the confluence of the 2 Rs.. **80,** 124, 845; **91,** 1450.

From 1880 to 1886, incl., $47,000 was app. when it was est. that $70,000 would be required to complete the proj., $5,000 an. mainten., **86,** 170; **87,** 1071.

By Capt. Sanford, 1900, for chan. 3½′ d. from Cheraw to the W. C. & A. R. R. br., by dr. and removing obstr.; est., $118,300, and $4,000 an. for mainten.,[1] **01,** 1615; au. act June 13, 1902, **02,** 240.

By Capt. Stuart, 1908, plan for imp. between Georgetown and Pedee Station; est., $53,000,[2] **09,** 333.

Capt. Adams, 1910, recom. that existing proj. be modified to snagging below Birches Ferry, **10,** 1445.

[1] H. D. 124, 56th, 2d.

[2] H. D. 1162, 60th, 2d.

SURVEYS.

By G. Daubeney, from Pine Bluff to Cheraw, S. C., **73,** 70, 753.

Ex., by Capt. Phillips and W. B. Page, 1878, Cheraw, S. C., to the mouth of the Uwharie, N. C., H. Doc. 68, 45th Cong., 3d sess., 16, 17; **79,** 723.

Au. act Mar. 3, 1879; made, 1880, by Capt. Phillips, **80,** 845.

Of R., 1886, **86,** 1018.

Between Cheraw and Wilmington, Columbia & Augusta RR. br., au. act June 6, 1900; made, 1900, by Capt. Sandford,[1] **01,** 1607.

Ex. and sur. from Georgetown to Pedee Station, au. act Mar. 2, 1907; made, 1907–08, by Capt. Howell and Capt. Stuart, resp.,[2] **08,** 323; **09,** 333.

Ex. from Cheraw, S. C., to Blewetts Falls, N. C., au. act Mar. 3, 1909; made, 1909, by Capt. Brown (**R.** unfav.),[3] **10,** 378.

Ex. up to Cheraw for increased d., au. act Mar. 3, 1909; made, 1909, by Capt. Adams (**R.** unfav.),[4] **10,** 378.

Ex. au. act. June 25, 1910. **R.,** Capt. Adams, Aug. 31, 1910, for aiding navigation at Gibson Dam, S. C. (**R.** unfav.),[5] **11,** 398, 399.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 467.

Maps. **89,** 1180.

N–26 LITTLE PEDEE RIVER, N. C. AND S. C.

APPROPRIATIONS.

1888,	$5,000,	**88,** 128.
1890,	5,000,	**90,** 1213.
1892,	5,000,	**92,** 1202.
1894,	4,000,	**95,** 1399.
1896,	3,000,	**96,** 1159.
1902,	*1,500,	**03,** 1120.
1905,	*1,200,	**05,** 1238.
1907,	*2,000,	**07,** 1255.
1910,	20,000,	**10,** 1443.

Total, 46,700 (incl. misc., $46,810.40, **12,** 1790).

COMMERCE.

Description of, **87,** 1114; **93,** 1473; **94,** 1076; **95,** 1399.

In 1892–93, 6,153 t., **93,** 1472; in 1893–94, 8,375 t., **94,** 1075; in 1894–95, 12,438 t., **95,** 1398; in 1895–96, 17,050 t., **96,** 1159.

Imp. enables farmers to import fertilizers and supplies at a cost less than RR. rates plus hauling, **10,** 363; water rates reduced 25¢ per t. on fertilizer; 25¢ bale on cotton, **12,** 466.

In 1911, 1,400± t., **12,** 466.

ENGINEERS.

Chief of Engineers. **R.,** **87,** 139; **88,** 128; **89,** 153; **90,** 138; **91,** 171; **92,** 171; **93,** 185; **94,** 169; **95,** 193; **96,** 172; **97,** 215; **98,** 213; **99,** 246; **00,** 278; **01,** 311; **02,** 238; **03,** 244; **04,** 246; **05,** 255; **06,** 277; **07,** 290; **08,** 308; **09,** 317; **10,** 362, 379; **11,** 384; **12,** 465.

In charge:

Capt. W. H. Bixby, 1887. **R.,** **87,** 1111, 1113.

Capt. F. V. Abbot, 1888–97. **R.,** **89,** 1175; **90,** 1212; **91,** 1448; **92,** 1201; **93,** 1471; **94,** 1074; **95,** 1398; **96,** 1158; **97,** 1444.

Maj. E. H. Ruffner, 1898–99. **R.,** **98,** 1267; **99,** 1521.

Capt. J. C. Sanford, 1900. **R.,** **00,** 1845; **01,** 1576; **02,** 1151.

Capt. G. P. Howell, 1903–07. **R.,** **03,** 1119; **04,** 1545; **05,** 1237; **06,** 1172; **07,** 1255.

Capt. E. R. Stuart, 1908. **R.,** **08,** 1311.

Capt. E. I. Brown, 1909. **R.,** **09,** 1302.

Capt. E. M. Adams, 1910. **R.,** **10,** 1443.

Col. Dan. C. Kingman, 1911. **R.,** **11,** 1571.

Maj. G. P. Howell, 1912–. **R.,** **12,** 1789.

Assistant. R. Whitford. **R.,** **89,** 1176; **90,** 1213; **91,** 1449; **92,** 1203; **93,** 1472; **94,** 1075; **95,** 1399; **96,** 1159; **97,** 1446.

OPERATIONS.

1888–89. 883 trees, logs, and snags removed from chan., and 1,771 trees cut and trimmed on the banks, **89,** 1176.

1889–90. 1,476 stumps and snags removed from the chan., and 1,022 trees and 221 cords of brush cut from the banks, **90,** 1214.

1890–91. 1,698 snags and logs and 44 cords of small snags removed from the chan., and 1,896 trees and 110 cords of brush cleared from the banks, **91,** 1449.

1891–92. 1,072 snags and logs and 47 cords of small snags removed from the chan., and 1,252 trees and 91 cords of brush cleared from the banks, **92,** 1203.

1892–93. About 3,400 snags and other obstr. removed from R. and banks, **93,** 1472.

1894–95. About 500 snags and other obstr. removed, **95,** 1399.

1895–96. About 500 snags and other obstr. removed, **96,** 1159.

1896–97. About 4,500 snags and other obstr. removed, **97,** 1446.

1903–04. 4,842 logs, stumps, and snags removed from chan., and 1,326 trees and 152¼ cords brush from banks, **04,** 1545.

1904–05. 1,180 obstr. removed from chan., and 336 trees and 59½ cords brush from banks, **05,** 1237.

1905–06. 1,066 obstr. removed from chan., and 353 trees and 60 cords brush from banks, **06,** 1172.

1906–07. 1,180 obstr. removed from chan., and 241 trees and 57 cords brush from banks, **07,** 1255.

1909–10. 529 obstr. removed, **10,** 1443.

1910–11. Chan. cleared of obstr.; plant repaired, **11,** 1572.

1911–12. 1,774 snags, trees, and other obstr. removed, **12,** 1790.

PHYSICAL CHARACTERISTICS.

Description, **87,** 1111.

R. not subject to severe floods, but was high during working season 1912, **12,** 1790.

Rises in N. C., flows s., and empties into Great Pedee, 34 m. above latter's mouth, in Winyah B., S. C. Is 220± m. l., but only lower 113 m. proj. section, **12,** 465. Head of navigation, 47 m. above mouth. Snagging will always be required, **12,** 466.

PROJECTS.

By Capt. Bixby, 1887, imp. R. by removing snags, trees, and similar obstr., clearing it for a 4′ draft steam navigation from its mouth to the Lumber R., and thence for a 4′ draft pole-boat navigation to Little Rock, S. C.; est., $50,000, **87,** 1114; **91,** 1448.

Capt. Adams, 1910, did not consider R. worthy of imp. further than covered by existing proj.,[6] **10,** 379.

Capt. Adams, 1910, recom. that further imp. be confined to mainten. up to Gallivants Ferry, **10,** 1443.

SURVEYS.

Au. act Aug. 5, 1886; made, 1887, by Capt. Bixby, **87,** 1113.

See also reference under Great Pedee to sur. au. act Mar. 3, 1879, which applies also to Little Pedee.

Ex., mouth, to mouth of Lumber R., au. act Mar. 3, 1909; made, 1910, by Capt. Adams[6] (**R.** unfav.), **10,** 379.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 465.

Maps. **90,** 1214.

[1] H. D. 124, 56th, 2d.
[2] H. D. 1162, 60th 2d.
[3] H. D. 305, 61st, 2d.
[4] H. D. 308, 61st, 2d.
[5] H. D. 23, 62d, 1st.
[6] H. D. 862, 61st, 2d.

*Allotment.

N–31 LUMBER RIVER, N. C. AND S. C.

APPROPRIATIONS.

1888,	$5,000,	**88,** 128.
1890,	5,000,	**90,** 1199.
1892,	5,000,	**92,** 1200.
1894,	4,000,	**95,** 1396.
Total,	19,000	

COMMERCE.

Description of, **93,** 1470; **94,** 1073; **95,** 1397; **96,** 1157.

In 1892–93, 7,154 t., **93,** 1469; in 1893–94, 10,550 t., **94,** 1072; 1894–95, 19,131 t., **95,** 1396; 1895–96, 61,650 t., **96,** 1156.

ENGINEERS.

Chief of Engineers. R., 87, 139; **88,** 128; **89,** 150; **90,** 135; **91,** 171; **92,** 170; **93,** 184; **94,** 169; **95,** 193; **96,** 172; **97,** 214.

In charge:
Capt. W. H. Bixby, 1887. **R., 87,** 1102.
Capt. F. V. Abbot, 1888–97. **R., 89,** 1158, 2795; **90,** 1198; **91,** 1445; **92,** 1199; **93,** 1468; **94,** 1071; **95,** 1395; **96,** 1155; **97,** 1442.

Assistant. R. Whitford. **R., 89,** 1159; **90,** 1199; **91,** 1447; **92,** 1200; **93,** 1469; **94,** 1073; **95,** 1397; **96,** 1156; **97,** 1444.

OBSTRUCTIONS.

Brs. of Carolina Central RR., W. & C. RR., and low br. at Nichols, **89,** 2795.

OPERATIONS.

1890-91. 2,434 snags and logs and 66 cords small snags cleared from the chan., and 3,472 trees and 227 cords brush cut from the banks, **91,** 1447.

1891-92. R. cleared of snags and similar obstr. from mouth to 50 m. above, **92,** 1199.

1892-93. About 8,000 snags and other obstr. removed from chan. and banks, **93,** 1469.

1893-94. About 60 snags and other obstr. removed, **94,** 1073.

1894-95. About 500 snags and other obstr. removed, **95,** 1397.

1896-97. About 1,000 snags and other obstr. removed, **97,** 1444.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1103.

PROJECTS.

By Capt. Bixby, 1887, clearing obstr. to permit 4′–6′ steam navigation, mouth to Lumberton; est., $35,000, **87,** 1106; **92,** 1199.

SURVEYS.

Au. act Aug. 5, 1886; made, 1887, by Capt. Bixby **87,** 1104.

Maps. **90,** 1198.

N–48 LITTLE RIVER, S. C.

ENGINEERS.

Chief of Engineers. R., 08, 306.
In charge. Capt. E. I. Brown, **08,** 280.

SURVEY.

Ex. au. act Mar. 2, 1907. **R.,** Capt. Brown (unfav.),[1] **08,** 306.

N–49 YADKIN RIVER, N. C.

APPROPRIATIONS.

1879,	$20,000,	**79,** 87.
1880,	20,000,	**80,** 791.
1881,	12,000,	**81,** 1027.
1882,	25,000,	**82,** 1103.
1886,	10,000,	**86,** 968.
1888,	10,000,	**88,** 919.
1890,	5,000,	**90,** 1164.
1892,	5,000,	**92,** 1182.
Total,	107,000	

COMMERCE.

C. importance of adjacent country, **79,** 629
Description of, **81,** 1028.

ENGINEERS.

Chief of Engineers. R., 78, 75; **79,** 87, 88; **80,** 117; **81,** 165; **82,** 161; **83,** 168; **84,** 173; **85,** 162; **86,** 157; **87,** 133, 139; **88,** 127, 134; **89,** 145; **90,** 131; **91,** 167; **92,** 168; **93,** 181.

In charge:
S. T. Abert, U. S. agent, 1878–81. **R., 79,** 626; **80,** 790.
Capt. J. Mercur, 1881–84. **R., 81,** 1025; **82,** 1102; **83,** 864.
Capt. F. A. Hinman, 1884–86. **R., 84,** 1045; **85,** 1042; **86,** 967.
Capt. W. H. Bixby, 1886–92. **R., 87,** 1061; **88,** 917; **89,** 1099; **90,** 1161; **91,** 1404.
Maj. W. S. Stanton, 1892–93. **R., 92,** 1181; **93,** 1435.

Assistants:
S. W. Evans. **R., 79,** 629.
Messrs. Burr and Fisher, **79,** 648.
W. H. James. **R., 81,** 1027; **82,** 1103; **83,** 864; **84,** 1045.
E. D. Thompson. **R., 87,** 1063.
F. Brown. **R., 90,** 1164; **91,** 1406.
Lt. H. Taylor. **R., 88,** 954.

ESTIMATES. (See Plans and Projects.)

By S. T. Abert, (1) SS. navigation, $444,653.25, **79,** 627, 640–643; (2) bateau navigation, $102,393.60, **79,** 644–647.

OPERATIONS.

1880-81. 616 c. y. solid r., 150 c. y. bowlders, and 55 trees, logs, and snags removed from R., **81,** 1026.

1881-82. 4,468 c. y. r. blasted and removed; 1,907 l. f. of wing dams and training walls built; 125 c. y. timber and brush put in dams at Clinton and Swicegood Shoals, **82,** 1105.

1882-83. 60 c. y. sand and gravel dr.; 1,163 c. y. r. blasted and removed; 226 l. f. wing walls and js. built, **83,** 865.

1883-84. 1,136 c. y. r. blasted and removed; 368 l. f. wing dams built, **84,** 1045.

1884-85. 2,138 l. f. wing dams and training walls built, **85,** 1043.

1885-86. 476 l. f. of wing dam and 125 l. f. of training wall built; also 150 l. f. of training wall and 498 l. f. of wing dam previously built raised and strengthened, **86,** 967.

[1] H. D. 530, 60th, 1st.

1886-87. 358 l. f. of wing dams built and 227 c. y. r. removed from chan., **87,** 1062.
1887-88. 510 c. y. r. removed from chan., and 1,321 c. y. r. built into 2,489 l. f. of training wall, **88,** 918.
1888-89. 978 c. y. st. quarried and 1,735 l. f. of wing dam and training wall built, **89,** 1100.
1889-90. 120 c. y. st. removed from the chan. and 607 l. f. wing dam and training wall built, **90,** 1162.
1890-91. 197 l. f. of dam work and 73 l. f. of training wall built, **91,** 1407.
1891-92. 392 l. f. of dams built and 216 c. y. of r. removed from the chan., **92,** 1182.

PHYSICAL CHARACTERISTICS.

General, **79,** 628. Floods, **79,** 628.
Description of agricultural characteristics, **79,** 628.
Obstr., etc., **79,** 630–639.
Description, South Carolina to the Narrows, N. C., **88,** 953, 955.

PLANS. (See Estimates and Projects.)

By S. T. Abert, 3′ navigation, Wilkesborough to RR. br. near Salisbury: (1) SS. navigation, by dr., r. excavation, and constr. of locks and dams, and a short canal around Bean Shoal; (2) bateau navigation, by r. excavation, and by constr. of wing dams, **79,** 647.
Capt. Bixby, 1888, did not consider the R., from S. C. to the Narrows, N. C., as worthy of imp., **88,** 952.

PRIVATE AND CORPORATE WORK.

1830-35. Imp. at Bean Shoals, on the part of the Yadkin Navigation Co., **79,** 633.

PROJECTS.

By S. T. Abert, 1879, imp., Salisbury to foot of Bean Shoals, 64½ m., by dr. and r. excavation, to permit of SS. navigation of 2½′–3′ l. w. draft. Est., $81,671, **79,** 87, 647, 648; **83,** 864. 1879 to 1886, incl., $87,000 app.
In 1887, considered that final cost of imp. would be $400,000, **87,** 133, 1063.
In 1889, after an aggregate app. of $97,000, proj. modified to secure only a cleared chan. way of 60′ available w. and 1.5′–3′ clear d. for 8 months, Salisbury RR. br., 35 m., up to Baileys Ferry, at a further cost of $10,000, **89,** 1101; **92,** 1182.
In 1892–93 the imp. stopped by order of the Sec. of War on account of there being no boats on the R. or any expectation of there being any if the imp. were completed, **93,** 1435.

SURVEYS.

By S. W. Evans, 1878–79. **R., 79,** 629.
Ex., State line to the Narrows, au. act Aug. 5, 1886, **87,** 139.
Ex., S. C. to the Narrows, N. C., au. act Aug. 5, 1886; made, 1888, by Capt. Bixby, **88,** 952.
Maps. **83,** 864; **90,** 1164; **91,** 1406; **92,** Atlas, 39, 40.

N–61 LYNCH RIVER, S. C.

COMMERCE.

Description of, **93,** 1533; **00,** 1878.
Considerable trade existing, 1892–93. An. shipments valued at $50,000 would probably be made if the stream were imp., **93,** 1533.

ENGINEERS.

Chief of Engineers. R., 80, 125; **81,** 168; **93,** 190; **99,** 255; **00,** 291.

In charge:
Capt. C. B. Phillips. **R., 81,** 1038.
Capt. F. V. Abbot, 1883. **R., 93,** 1532.
Maj. E. H. Ruffner, 1900. **R., 00,** 1877, 1879.

Assistants:
J. P. Darling. **R., 81,** 1039.
R. Whitford. **R., 00,** 1878, 1880.

OBSTRUCTIONS.

Three wooden brs. which could easily be provided with draw spans, **93,** 1533.
In 1900 there were 5 county brs., without draws, **00,** 1881.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1039; **93,** 1533; **00,** 1879.

PLANS.

By Capt. Phillips, 1881, imp. between the Wilmington, Columbia & Augusta RR. br. and mouth by removal of snags, logs, and fallen trees; est., $45,515.80, **81,** 1039, 1040.

PROJECTS.

Maj. Ruffner est., 1899, it would cost $68,750 to make an imp., **00,** 1879.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Capt. Phillips, **81,** 1038.
Ex. au. act July 13, 1892; made by Capt. Abbot, 1892 (**R.** fav.), **93,** 1533.
Ex. and sur. RR. br. at Effingham to mouth at junction of Great Pedee R., for 3′ m. l. w., au. act Mar. 3, 1899; made, 1899, by Maj. Ruffner (**R.** fav.; see Projects), **00,** 1877, 1879.

N–61(a) LYNCH RIVER AND CLARK CREEK, S. C.

APPROPRIATIONS.

1907, $2,000, **07,** 1256.

COMMERCE.

No navigation, except by rafts, **07,** 292; **12,** 364.

ENGINEERS.

Chief of Engineers. R., 07, 292; **08,** 309; **09,** 319; **10,** 363, 378.

In charge:
Capt. G. P. Howell, 1907. **R., 07,** 1256.
Capt. E. R. Stuart, 1908. **R., 08,** 1311.
Capt. E. I. Brown, 1909. **R., 09,** 1303.
Capt. E. M. Adams, 1910. **R., 10,** 1444.

OPERATIONS.

1907-08. 8 m. of chan. of Clark Creek via Lawrence Cut was cleared, 2,790 obstr. being removed, **08,** 1311.
1909-10. 446 logs and other obstr. removed from Clark Creek and Lawrence Cut, **10,** 1444.

PHYSICAL CHARACTERISTICS.

Description of, **08,** 309.

Lynch R. trib. to Great Pedee R. into which it flows a few miles above Smiths Mills, 65 m. above mouth of Great Pedee R. Shortly above the point a branch of Lynch R., called Clark Creek, leaves it, and, flowing 7± m., empties into Great Pedee, 10½± m. bel. mouth of Lynch R. Orig. the mouth of Lynch R. was filled with drift coming in from Great Pedee, forcing traffic to come down Clark Creek, **10,** 363.

PROJECTS.

Au. act Mar. 2, 1907, for imp. by removal of obstr., to permit passage of rafts through lower end of Clark Creek, through a small connecting stream between Clark Creek and Lynch R., known as Lawrence Cut, and through Lynch R., to extent of $2,000, **08,** 310; **10,** 364.

Capt. Adams recom., 1910, that imp. be abandoned, **10,** 1444.

SURVEY.

Ex. from Effingham to Great Pedee R. au. act Mar. 3, 1909; made, 1909–10, by Capt. Adams (**R.** unfav.)[1] **10,** 378.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 364.

N–73 CLARKS (River) CREEK, S. C.

APPROPRIATIONS.

1888,	$2,500,	**88,** 129.
1890,	2,500,	**90,** 1204.
1892,	2,500,	**92,** 1207.
Total,	7,500	

COMMERCE.

Prospective C. of the creek, **89,** 1166.

Description of, **93,** 1479; **94,** 1080.

The aggregate t. moved on the R., 1892–93, 7,628 t., **93,** 1477; in 1893–94 and 1894–95, 7,000 t., **94,** 1080; **95,** 1405.

ENGINEERS.

Chief of Engineers. R., 87, 139; **88,** 128; **89,** 151; **90,** 136; **91,** 172; **92,** 171; **93,** 185; **94,** 170; **95,** 194.

In charge:

Capt. W. H. Bixby, 1887. **R., 87,** 1109, 1110.

Capt. F. V. Abbot, 1888–95. **R., 89,** 1164; **90,** 1203; **91,** 1453; **92,** 1206; **93,** 1477; **94,** 1079; **95,** 1404.

Assistant. R. Whitford. **R., 89,** 1165; **90,** 1204; **91,** 1454; **92,** 1207; **93,** 1478; **94,** 1080.

OPERATIONS.

1889–90. 1,062 trees and snags and 12 cords of small snags removed from the chan., and 195 trees and 35 cords of brush removed from the banks, **90,** 1204.

1891–92. 4,346 snags and logs and 394 cords of small snags removed from the chan., and 553 trees cut from the banks, **92,** 1207.

1892–93. About 7,000 snags and other obstr. removed from the banks and R., **93,** 1478.

PHYSICAL CHARACTERISTICS.

Description, **87,** 1109.

PROJECTS.

By Capt. Bixby, 1887, removal of snags and leaning trees, and closing the n. mouth of Lynches R. est., $7,500, **87,** 1111; **89,** 1164; **91,** 1453.

SURVEY.

Au. act Aug. 5, 1886; made, 1887 by Capt. Bixby **87,** 1610.

Maps. **90,** 1204.

N–74 BLACK RIVER, S. C.

COMMERCE.

No navigation, **81,** 1041.

Public hearing advertised, but no interested parties appeared, **04,** 1572.

ENGINEERS.

Chief of Engineers. R., 80, 125; **81,** 168; **91,** 170; **04,** 261, 1570; **10,** 378.

Boards. BERH. **R., 04,** 1572.

In charge:

Capt. C. B. Phillips. **R., 81,** 1040.

Capt. W. H. Bixby. **R., 91,** 1435.

Capt. J. C. Sanford, 1904. **R., 04,** 1570.

Assistants:

C. W. Forster. **R., 81,** 1041.

Lt. M. M. Patrick. **R., 91,** 1437.

Reid Whitford. **R., 04,** 1572–74.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1041; **91,** 1436; **04,** 1572.

PLANS.

By Capt. Bixby, 1890, removing snags and obstr. from mouth upward 118 m. to the RR. br. at Kingstree; est., $25,000, **91,** 1436.

PRIVATE WORK.

Indefinite facts of imp. au. by S. C. and by Colonies Govt. of 1738, **04,** 1573.

SURVEYS.

From Kingstree to its mouth, au. act June 14, 1880, **80,** 125; made by Capt. Phillips (**R.** unfav.), **81,** 1040.

Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Bixby, **91,** 1435.

Pre. ex. au. act June 13, 1902; made, 1903; Capt. Sanford's **R.** unfav.,[2] **04,** 261.

Pre. ex. au. act Mar. 3, 1909; made (**R.** unfav. to imp. by U. S.),[3] **10,** 378.

[1] H. D. 695, 61st, 2d.
[2] H. D. 238, 58th, 2d.
[3] H. D. 341, 61st, 2d.

N–76 MINGO CREEK, S. C.

APPROPRIATIONS.

1888,	$5,000,	**88,** 130.
1890,	5,000,	**90,** 1201.
1892,	3,000,	**92,** 1209.
1894,	4,000,	**95,** 1406.
1905,	*300,	**06,** 1176.
1907,	*300,	**08,** 1316.
1910,	1,000,	**10,** 1449.
1911,	1,000,	**11,** 1577.
1912,	22,000,	**12,** 1797.
Total,	41,600	

COMMERCE.

Description of, **93,** 1482; **94,** 1083; **95,** 1407; **96,** 1165.

In 1892–93, 94,665 t., **93,** 1481; in 1893–94, 114,375 t., **94,** 1082; in 1894–95, 136,957 t., **95,** 1406; in 1895–96, 169,125 t., **96,** 1164.

Imp. enables SS. to carry freight to points not reached by rail, **10,** 368.

In 1911, 45,721 t., an increase of 33⅓% over 1910; water rates increased, **12,** 472.

ENGINEERS.

Chief of Engineers. **R., 87,** 139; **88,** 130; **89,** 150; **90,** 135; **91,** 173; **92,** 171; **93,** 186; **94,** 170; **95,** 194; **96,** 173; **97,** 217; **05,** 269; **06,** 282; **07,** 296; **08,** 314; **09,** 323; **10,** 367, 378; **11,** 389; **12,** 471.

In charge:

Capt. W. H. Bixby, 1887. **R., 87,** 1106, 1108.

Capt. F. V. Abbot, 1888–97. **R., 89,** 1161; **90,** 1200; **91,** 1455; **92,** 1208; **93,** 1480; **94,** 1081; **95,** 1405; **96,** 1163; **97,** 1450.

Capt. G. P. Howell, 1906–07. **R., 06,** 1176; **07,** 1260.

Capt. E. R. Stuart, 1908. **R., 08,** 1316.

Capt. E. T. Brown, 1909. **R., 09,** 1306.

Capt. E. M. Adams, 1910. **R., 10,** 1448.

Col. D. C. Kingman, 1911. **R., 11,** 1577.

Maj. G. P. Howell, 1912–. **R., 12,** 1796.

Assistant. R. Whitford. **R., 89,** 1162; **90,** 1201; **91,** 1456; **92,** 1209; **93,** 1481; **94,** 1082; **95,** 1406; **96,** 1164; **97,** 1452.

OPERATIONS.

1888–89. 286 logs, snags, and trees removed from chan., and 1,376 trees and 429 cords of brush cut from the banks, **89,** 1162.

1889–90. 424 logs and snags and 22 cords small snags removed from chan., and 1,309 trees and 796 cords brush cut from banks, **90,** 1201.

1890–91. 1,042 snags and logs and 27 cords small snags removed from the chan., and 2,412 trees and 444 cords of brush cleared from the banks, **91,** 1456.

1891–92. 422 snags and logs removed from the chan., and 2,632 trees and 378 cords of brush cleared from the banks, **92,** 1210.

1892–93. About 900 snags and other obstr. removed from the chan. and banks, **93,** 1481.

1893–94. About 40 snags and other obstr. removed, **94,** 1082.

1894–95. About 200 snags and other obstr. removed, **95,** 1407.

1896–97. About 300 snags and other obstr. removed, **97,** 1452.

1905–06. Obstr. removed, **06,** 1176.

1906–07. Obstr. removed, **07,** 1260.

1907–08. 1,019 obstr. removed, **08,** 1316.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1106; **89,** 1162, 1163.

R. 45± l., rises 12 m. e. of Kingsville, S. C., flows se. and empties into Black R., 25 m. above mouth of latter and 30± m. from Georgetown, S. C. Head of navigation 31 m. above mouth, all in proj., **12,** 471.

PROJECTS.

By Capt. Bixby, 1887, SS. navigation, mouth to Williams Landing, 21 m.; pole boats, at h. w. up to the head of navigation, by removal of snags, logs, trees, and similar obstr.; est., $17,000, **87,** 1108; **89,** 1161; **92,** 1208.

Act July 25, 1912, au. 8′ x 60′ l. w., mouth to Hemmingway Br., 11 m.; est., $22,000, with $1,000 an. mainten.; right of way to be furnished free,[1] **12,** 471.

SURVEYS.

Au. act Aug. 5, 1886; made, 1887, by Capt. Bixby, **87,** 1108.

Ex. and sur., Hemmingway Br. to mouth, au. act Mar. 3, 1909; made, 1909–10, by Capt. Brown and Capt. Adams, resp.,[1] **10,** 378.

Maps. **90,** 1202.

N–98 SAMPIT RIVER, S. C.

COMMERCE.

Description of, **00,** 1886.

ENGINEERS.

Chief of Engineers. **R., 99,** 255; **00,** 291.

In charge:

Maj. E. H. Ruffner, 1900. **R., 00,** 1884, 1887.

Capt. J. C. Sanford, 1900. **R., 00,** 1892.

Assistant. R. Whitford. **R., 00,** 1886, 1889, 1892.

PHYSICAL CHARACTERISTICS.

Description of, 14, m. from mouth, at Georgetown, to Sampit Br., the head of navigation, **00,** 1889.

PROJECTS.

Total cost of imp. as est. by Maj. Ruffner, 1899, with a subsequent est. by Capt. Sanford, 1900, $737,387.90, **00,** 1888, 1892.

SURVEY.

Ex. and sur. of Sampit R., S. C., with view to dr. shoals and removing other obstr. from its mouth, at 20′ d. l. w. in Winyah B., to head of navigation, au. act Mar. 3, 1899; made, 1899, by Maj. Ruffner (**R.** fav.; see Projects), **00,** 1884, 1887.

[1] H. D. 782, 61st, 2d.

*Allotment.

N–99 SAMPIT RIVER, GEORGETOWN HARBOR, S. C.[1]

APPROPRIATIONS.

1836, $1,000 (sur.), act July 4.
1852, 3,000 (sur.), act Aug. 3.
1882, 7,000, **83,** 872.
1884, 5,000, **84,** 1052.
1886, 5,000, **86,** 1028.
1888, 7,500, **88,** 927.
1890, 8,000, **90,** 1166.
1892, 12,000, **92,** 1184.

Total, 48,500

COMMERCE.

Gain from 1880 to 1889, **89,** 1106; **90,** 1168.
In 1893, 272,070 t.; apparently increasing, **93,** 1439.
Description of, present and prospective (about 248,000 t.), **04,** 1599.

CONTRACTS.

1884. C. Gilbert, dr., 12½¢ c. y., **85,** 1115.
1887. C. Gilbert, dr., 30¢ c. y., **87,** 1076.
1889. P. S. Ross, dr., 22.9¢ c. y., **89,** 1104.
1890. P. S. Ross, dr., 29¢ c. y., **91,** 1409.
1892. P. S. Ross, dr., 22.7¢ c. y. ($8,000 to $10,500), **93,** 1438.

ENGINEERS.

Chief of Engineers. R., 80, 125; **81,** 168; **83,** 171; **84,** 177; **85,** 174; **86,** 172; **87,** 135; **88,** 129; **89,** 146; **90,** 132; **91,** 168; **92,** 168; **93,** 181; **94,** 166; **95,** 189; **99,** 247; **00,** 280, 281; **01,** 314; **04,** 262, 1591.

Boards. BERH. Concur in DO.'s recom. of 1903. **R., 04,** 1595, 1597.

In charge:
Capt. C. B. Phillips, 1880–83. **R., 81,** 1036.
Capt. J. Mercur, 1883–84. **R., 83,** 872.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1052.
Capt. W. H. Bixby, 1885–92. **R., 85,** 1114; **86,** 1027; **87,** 1074; **88,** 925; **89,** 1102; **90,** 1165; **91,** 1408.
Maj. W. S. Stanton, 1892–95. **R., 92,** 1183; **93,** 1437; **94,** 1057; **95,** 1347.
Maj. E. H. Ruffner, 1899. **R., 99,** 1526.
Capt. J. C. Sanford, 1900–04. **R., 00,** 1850; **01,** 1581; **04,** 1592.
Capt. G. P. Howell, 1904. **R., 04,** 1603.

Assistants:
C. W. Forster. **R., 81,** 1037.
R. Whitford. **R., 85,** 1116; **86,** 1028; **87,** 1076; **88,** 927; **89,** 1104; **90,** 1167; **91,** 1410; **92,** 1184; **04,** 1598, 1606.
C. Humphreys. **R., 93,** 1438.

OPERATIONS.

1884–85. 20,924 c. y. dr.; snags and stumps removed, **85,** 1115.
1885–86. 2,684 c. y. sand dr.; logs and stumps removed, **86,** 1027.
1886–87. 7,614 c. y. dr. from bar at mouth of Sampit R., **87,** 1075, 1076.
1888–89. 15,563 c. y. dr. from chan. under contract; 120 stumps and logs removed, **89,** 1103.
1891–92. 13,448 c. y. dr. and 142 cypress stumps removed from the chan., **92,** 1184.
1892–93. 31,856 c. y. dr., 44 stumps and 8 logs removed, and proj. completed, **93,** 1438.
1893–94. 40 logs and other obstr. removed, about 36 logs and stumps removed and 4 beacons erected, **94,** 1057.
1900–01. 7,509 c. y. dr., and 89 stumps and logs removed, **01,** 1581.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1037.
Orig. condition of H., **88,** 925.
Winyah B. has area of 25 sq. m.; ruling d., about 12½′. Georgetown on Sampit R., less than m. above its mouth, in Winyah B. Lower portion of R. has been known as Georgetown H., **04,** 1593.

PROJECTS.

By Capt. Phillips, 1881, dr. chan. 12′ x 200′ through shoal across the mouth of Sampit R. ½ m. from Georgetown; est., $14,151.94, **81,** 1038; **87,** 1074.
In 1885 $12,000 had been app.; Capt. Bixby proposed modification of proj. to cover the removal of stumps not provided for in orig. proj. Est., $39,000, **85,** 1117; **86,** 1030. Increased, 1887, $42,000, **87,** 1074. Raised, 1889, to $44,500, **89,** 1103. Amount app. to June 30, 1889, $24,500; amount required, completion, $20,000, **89,** 1103.
By Capt. Howell, 1903, chan. 18′ x 400′, ocean entrance to Winyah B., to 1 m. above Georgetown, by completing js. and dr.; est., $295,000 in addition to $406,000 balance,[2] **04,** 1604. (Later operations under Winyah B.)

SURVEYS.

Au. act June 14, 1880; made, 1881, by Capt. Phillips, **81,** 1036.
Sur. chan. and wharves, mouth of Sampit R. to head of the town limits, for the estab. of H. lines; made, 1892, by Maj. Stanton, **93,** 1438.
Ex. and sur., including Sampit R. and ocean entrance to Winyah B., au. act June 13, 1902; made, 1903, by Capts. Sanford and Howell,[2] resp. (**R.** lav.), **04,** 1591.

Maps.
85, 1114; **86,** 1028; **87,** 1076; **89,** 1104; **92,** Atlas, 41, 42; **93,** 1440.

N–101 SANTEE RIVER (and Estherville-Minim Creek Canal), S. C.[3]

APPROPRIATIONS.

1881, $22,000, **81,** 1033.
1882, 20,000, **82,** 1111.
1884, 15,000, **84,** 1050.
1886, 18,750, **86,** 1035.
1888, 24,000, **88,** 936.
1890, 30,000, **90,** 1220.
1892, 30,000, **92,** 1212.
1894, 40,000, **95,** 1411.
1896, 48,000, **96,** 1173.
1899, 20,000, **99,** 1533.
1902 { *15,000, **03,** 1128.
1902 { *7,000, **04,** 1553.
1905, *25,000, **05,** 1245.
1907, *33,000, **07,** 1261.
1909, *5,600, **09,** 1308.
1910, *2,000, **10,** 1450.
1911, *12,000, **11,** 1578.
1912, *15,000, **12,** 1798.

Total, 382,350 (incl. misc., and less $5,034.97 trans. to Congaree R., $377,549.35, **12,** 1798).

[1] Sur.—**R.** June 10, 1854; est. indefinite. (H. D. 482, 55th, 2d.)
[2] H. D. 398, 58th, 2d.
[3] Between confluence of the Wateree and Congaree Rs. this waterway is known as Wateree R., and above Wateree Creek, as the Catawba.
*Allotment.

COMMERCE.

Importance of, **88,** 938.
Effect of imp. upon timber trade, **89,** 1188.
Description of, **93,** 1486; **94,** 1087; **95,** 1413; **96,** 1175; **00,** 1896.
1892–93, freight, 124,182 t., **93,** 1485; 1893–94, 115,428 t., **94,** 1086; 1894–95, 117,690 t., **95,** 1411; 1895–96, 134,135 t., **96,** 1172.
2 new transportation lines estab., 1897–98, **98,** 1275.
Imp. enables SS. to give lower rates than RRs.; is also link in waterway between Georgetown and Columbia (for effect of which see Congaree R.), **10,** 369.
1911, 62,293 t., mainly logs and lumber, **12,** 473.

CONTRACTS.

1886. R. Moore, dr., 37¢ c. y., **87,** 1085.
1888. C. C. Ely, dr., 35 to 40¢ c. y., **89,** 1187.
1890. L. S. Ehrich, dr., 37½¢ c. y., **91,** 1459.
1906. Cooperative Building & Mfg. Co., 2 boat hulls, $7,000, **06,** 1177. (See Great Pedee River—Santee portion, $3,416.67, **09,** 1308.)

ENGINEERS.

Chief of Engineers. **R., 80,** 125, 132; **81,** 167, 179; **82,** 162; **83,** 170; **84,** 175; **85,** 175; **86,** 173, 1040; **87,** 136; **88,** 131; **89,** 154; **90,** 138; **91,** 173; **92,** 172; **93,** 186; **94,** 170; **95,** 195; **96,** 174; **97,** 219; **98,** 216; **99,** 249, 255; **00,** 283, 291; **01,** 316; **02,** 242; **03,** 248; **04,** 251; **05,** 260; **06,** 282; **07,** 297; **08,** 314; **09,** 323; **10,** 368, 378; **11,** 290; **12,** 472.

In charge:
Capt. C. B. Phillips, 1879–81. **R., 80,** 916.
Lt. Col. Q. A. Gillmore, 1881. **R., 81,** 1148.
Capt. J. Mercur, 1881–84. **R., 81,** 1033; **82,** 1110; **83,** 870.
Capt. F. A. Hinman, 1884–85. **R., 84,** 1049.
Capt. W. H. Bixby, 1885–89. **R., 85,** 1119; **86,** 1030, 1041; **87,** 1081; **88,** 933.
Capt. F. V. Abbot, 1889–97. **R., 89,** 1182; **90,** 1218; **91,** 1458; **92,** 1211; **93,** 1483; **94,** 1084; **95,** 1408; **96,** 1171; **97,** 1458.
Maj. E. H. Ruffner, 1898–1900. **R., 98,** 1275; **99,** 1532; **00,** 1894, 1897.
Capt. J. C. Sanford, 1900–02. **R., 00,** 1856; **01,** 1587; **02,** 1160.
Capt. G. P. Howell, 1903–07. **R., 03,** 1127; **04,** 1552; **05,** 1245; **06,** 1177; **07,** 1260.
Capt. E. R. Stuart, 1908. **R., 08,** 1317.
Capt. E. I. Brown, 1909. **R., 09,** 1307.
Capt. E. M. Adams, 1910. **R., 10,** 1449.
Col. Dan C. Kingman, 1911. **R., 11,** 1578.
Maj. G. P. Howell, 1912–. **R., 12,** 1797.

Assistants:
J. M. Wolbrect. **R., 80,** 918.
Capt. J. C. Post. **R., 81,** 1156.
R. Whitford. **R., 84,** 1050; **85,** 1120; **86,** 1036, 1043, 1052; **87,** 1085; **88,** 936; **89,** 1187; **90,** 1220; **91,** 1460; **92,** 1212; **93,** 1486; **94,** 1087; **95,** 1411; **96,** 1173; **97,** 1463; **00,** 1859, 1896, 1900.

LEGAL PROCEEDINGS.

Suit of Lowndes estate against U. S. for alleged damage to rice-land drainage, discontinued at request of plaintiff, **01,** 1587.

OPERATIONS.

1883-84. 58,317 c. y. dr. and 502 stumps and logs removed from Mosquito Creek, making cut 7,860 l. f., **84,** 1051.
1884-85. 47,625 c. y. dr. from Mosquito Creek, **85,** 1119.
1885-86. Drawbr. built across Mosquito Creek; 13,354 c. y. dr. from canal; also 12 stumps removed, **86,** 1032.
1886-87. 9,923 c. y. dr. from canal, diking and draining ground, **87,** 1082, 1083, 1087.
1887-88. 142 l. f. of U. S. canal banks raised, **88,** 935.
1888-89. 1,356 c. y. dr., **89,** 1184.
1889-90. 47,792 c. y. dr., **90,** 1220.
1890-91. 140 snags and 6,477 c. y. removed from the chan., and 141 trees cleared from the banks, **91,** 1460.
1891-92. 7,468 c. y. dr., **92,** 1212.
1892-93. Constr. of steam dr. in progress, **93,** 1484. 26,694 c. y. dr. and 388 l. f. rice-land drainage restored, **93,** 1486. Preparations made to saw lumber from timber land purchased by the U. S., offering a more satisfactory right of way than the Hopewell plantation, **93,** 1486.
1893-94. 91,230 c. y. dr. and about 800 stumps and other obstr. removed; 4,258 c. y. material placed in embankments, **94,** 1087.
1894-95. 122,179 c. y. material dr. and 1,930 stumps and other obstr. removed, **95,** 1411. 102,065′, b. m., lumber sawed on U. S. land and incidental work done to prevent injury to adjacent rice fields, **95,** 1412.
1895-96. 121,845 c. y. dr. and 1,102 stumps and other obstr. removed; dump scows and a steam wood flat constr. and the Daisy Bank Causeway raised; 289,994′, b. m., lumber were sawed, **96,** 1173.
1896-97. 187,631 c. y. dr. and 700 stumps and other obstr. removed; 216,309′, b. m., lumber sawed, **97,** 1463.
1897-98. 167,305 c. y. dr., and 648 stumps and other obstr. removed; 118,598′, b. m., lumber cut, **98,** 1275.
1898-99. 169,660 c. y. dr., and 527 snags and other obstr. removed, **99,** 1532.
1899-00. 114,765 c. y. dr., and over 1,300 snags and other obstr. removed, **00,** 1859.
1900-01. 79,443 c. y. dr., 264 stumps and logs removed, and sawmill operated, **01,** 1587.
1903-04. 63,195 c. y. dr. and 1,031 obstr. removed, **04,** 1553.
1904-05. 10,978 c. y. dr. and 281 obstr. removed, **05,** 1245.
1905-06. 85,228 c. y. dr., **06,** 1177.
1906-07. 37,500 c. y. dr., 4,650′ line canal dug, and snag boat repaired, **07,** 1260.
1907-08. 73,312 c. y. dr. and 211 stumps and logs removed, **08,** 1317.
1908-09. 34,024 c. y. dr. and 63 obstr. removed, **09,** 1307.
1909-10. 68 obstr. removed and 40,963 c. y. dr., **10,** 1450.
1910-11. 103 logs and 11 stumps removed, **11,** 1578.
1911-12. 28,859 c. y. dr. by contractor, and 38,205 c. y. by U. S. derrick boat; snags, logs, trees, etc., removed, **12,** 1798.

PHYSICAL CHARACTERISTICS.

General features, **86,** 1036; **00,** 1896.

PROJECTS.

Orig. proj. of 1880, by Capt. Phillips, for this R. proposed to provide a good outlet through Mosquito Creek to Winyah B., by d. and straightening this creek to 7′ x 50′, and to secure a safe and unobstr. 7′ navigation in the R. itself from its mouth 154 m. up, and to Wrights Bluff, and thence a similar 5′ navigation 30 m. farther to its head in the Congaree and Wateree Rs.; est., $104,427, **80,** 918, 919; **86,** 1034; **87,** 1081. Modified proj. of 1881 proposed that the first expend. should be to secure a straightened outlet through Mosquito Creek 6′ x 30′ x 7 m; l. w. In 1885 Congress prescribed a reserve of $5,000 for the constr. of a flood gate, if found necessary, to keep out salt water at the upper end of the canal. Total final cost of this work est., 1886, at $271,300 for the outlet through Mosquito Creek, and $75,000 for the Santee R. proper, making $346,500 in all. Aggregate app. to June 30, 1889, $99,750, **89,** 1183.
Revised proj. of 1889 au. leaving the Mosquito Creek Canal, which had been completed, 3′ x 30′, for a timber route; cutting a new canal between Estherville and Minim Creek large enough for R. SS., and snagging entire R.; est., $350,000, **89,** 1185; **92,** 1211.
Maj. Ruffner est., 1899, $59,208.07 or $84,257.35 to make the imp. (see Survey of 1899); preference given to the route calling for the greater first cost, **00,** 1902.

SURVEYS.

Ex. au. act Mar. 3, 1879; made, 1880, by Capt. Phillips, **80,** 916.
For reopening Santee Canal, au. act June 14, 1880; made, 1881, by Lt. Col. Gillmore, **81,** 1148.

Ex. and sur. of the waterways and low-lying marsh lands or rice lands between the North and South Santee Rs., with view to extending the Estherville-Minim Creek Canal s. to Alligator R., au. act Mar. 3, 1899; made, 1899, by Maj. Ruffner (**R.** fav.; see Projects), **00,** 1894, 1897.

Ex., in connection with Wateree and Congaree Rs. and including Estherville-Minim Creek Canal, au. act Mar. 3, 1909; **R.** by Capt. Adams,[1] **10,** 378.

Maps. **84,** 1050; **85,** 1120; **86,** 1039; **89,** 1186; **90,** 1220; **96,** 1174; **97,** 1464.

N–101(b) WEE TEE LAKE, WILLIAMSBURG COUNTY, S. C.

COMMERCE.

Description of, **00,** 1905.

ENGINEERS.

Chief of Engineers. **R.,** **99,** 255; **00,** 291.

In charge. Maj. E. H. Ruffner, 1900. **R.,** **00,** 1903, 1905.

Assistant. R. Whitford. **R.,** **00,** 1905, 1906.

PHYSICAL CHARACTERISTICS.

Description of. Part of the delta of Santee R. **00,** 1905.

PROJECTS.

Maj. Ruffner est., 1899, $12,000 to make imp., **00,** 1906.

SURVEYS.

Ex. and sur. of the lake from its junction with the Santee R. to a point called the Bluff with view to making it navigable for SS., au. act Mar. 3, 1899; made, 1899, by Maj. Ruffner (**R.** of local engineer fav., that of DE., unfav.; see Projects), **00,** 1903, 1905.

N–113 WATEREE RIVER, S. C.[2]

APPROPRIATIONS.

1881,	$8,000,	**81,** 1034.
1882,	15,000,	**82,** 1112.
1884,	5,000,	**84,** 1052.
1886,	7,500,	**86,** 1055.
1888,	12,000,	**88,** 941.
1890,	12,500,	**90,** 1223.
1892,	2,500,	**92,** 1215.
1894,	2,500,	**95,** 1417.
1896,	5,000,	**96,** 1177.
1899,	2,500,	**99,** 1536.
1905,	*25,000,	**05,** 1247.
1907,	*50,000,	**07,** 1262.
1909,	*14,300,	**09,** 1309.
1910,	*14,000,	**10,** 1451.
1912,	*6,000,	**12,** 1800.

Total, [3] 181,800 (incl. misc. ($19.67), and less $1,016.17 trans. to Congaree R., $180,803.50, **12,** 1800).

COMMERCE.

Important, **87,** 1089.

Description of, **93,** 1490; **94,** 1091; **95,** 1417; **96,** 1178.

1892–93, 6,242 t., **93,** 1489; 1893–94, 18,075 t., **94,** 1090; 1894–95, 21,697 t., **95,** 1416; 1895–96, 35,002 t., **96,** 1177.

New line of transportation estab. bet. Columbia and Georgetown; SS. burned, but to be replaced, **04,** 1554.

Practically none; prospective, large; description of, **04,** 1636.

Rafting only, **07,** 299.

None, 1911; proj. has had no effect on rates, **12,** 475.

CONTRACTS.

1906. Cooperative Building & Mfg. Co., 2 boat hulls, $7,000, **06,** 1178.

1909. Georgetown Iron Works, installing machinery on snag boat, $2,122.03, **09,** 1309. (See also Great Pedee R.—Wateree portion, $4,100.)

1912. Kingsford Foundry & Machine Works, 2 Scotch boilers, $3,150, **12,** 1800.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 125; **81,** 167; **82** 163; **83,** 170; **84,** 176; **85,** 176; **86,** 174; **87,** 137 **88,** 132; **89,** 155; **90,** 139; **91,** 174, 179, 1487; **92,** 172; **93,** 186; **94,** 171; **95,** 195; **96,** 174; **97,** 220; **98,** 217; **99,** 250; **00,** 284; **01,** 317; **02,** 243; **03;** 249; **04,** 252, 262, 1629; **05,** 261; **06,** 284; **07,** 298, **08,** 316; **09,** 325; **10,** 370, 378; **11,** 391; **12,** 474.

Boards. BERH. **R.,** **04,** 1633.

In charge:

Capt. C. B. Phillips, 1880–81. **R.,** **80,** 914.

Capt. J. Mercur, 1881–84. **R.,** **81,** 1033, 1034; **82,** 1111; **83,** 871.

Capt. F. A. Hinman, 1884–85. **R.,** **84,** 1051.

Capt. W. H. Bixby, 1885–89. **R.,** **85,** 1123; **86,** 1053; **87,** 1089; **88,** 939.

Capt. F. V. Abbot, 1889–97. **R.,** **89,** 1189; **90,** 1222; **91,** 1462, 1488; **92,** 1214; **93,** 1488; **94,** 1089; **95,** 1415; **96,** 1176; **97,** 1465.

Maj. E. H. Ruffner, 1898–99. **R.,** **98,** 1278; **99,** 1536.

Capt. J. C. Sanford, 1900–02. **R.,** **00,** 1860; **01,** 1590; **02,** 1162; **04,** 1630.

Capt. G. P. Howell, 1903–07. **R.,** **03,** 1128; **04,** 1554; **05,** 1246; **06,** 1178; **07,** 1262.

Capt. E. R. Stuart, 1908. **R.,** **08,** 1318.

Capt. E. I. Brown, 1909; **09,** 1308.

Capt. E. M. Adams, 1910. **R.,** **10,** 1451.

Col. D. C. Kingman, 1911. **R.,** **11,** 1579.

Maj. G. P. Howell, 1912–. **R.,** **12,** 1799.

Assistants:

J. M. Wolbrect. **R.,** **80,** 915.

J. P. Darling. **R.,** **81,** 1035.

H. Heth. **R.,** **82,** 1112.

R. Whitford. **R.,** **85,** 1124; **87,** 1091; **88,** 941; **89,** 1191; **90,** 1223; **91,** 1463; **92,** 1216; **93,** 1490; **94,** 1090; **95,** 1417; **96,** 1178; **97,** 1467; **00,** 1862.

OBSTRUCTIONS.

Obstr. of the **R.** by brs. without drawspans, **82,** 1111; **85,** 1124; **88,** 940; **89,** 1190; **90,** 1222.

OPERATIONS.

1881–82. Removal of snags and trees from the chan. and banks commenced, **82,** 1112.

1882–83. Removal of snags and obstr. continued, **83,** 871.

1883–84. 1,383 logs and snags taken from bed of R. and 2,725 trees removed from the banks, **84,** 1051.

[1] H. D. 608, 61st, 2d.

[2] Above Wateree Creek, S. C., this stream becomes the Catawba; at the confluence of the Wateree and Congaree it becomes the Santee.

[3] $1,016.17 trans. to app. for Congaree R.

*Allotment.

1884-85. 360 logs and snags taken from bed of R. and 385 trees cut from the banks, **85,** 1123.
1886-87. 205 logs and snags removed from R., 5 piles removed from old br. at Camden, and banks cleared of leaning trees, **87,** 1090, 1091.
1888-89. Operations postponed awaiting introduction of drawspans in brs. over the R., **89,** 1190.
1889-90. 268 logs and stumps and 5 cords of snags removed from the R., and 338 trees removed from the banks, **90,** 1223.
1890-91. 2,413 logs and snags and 56 cords of small snags removed from the chan. and 2,108 trees and 80 cords of brush cleared from the banks, **91,** 1463.
1891-92. 1,740 snags and 40 cords of small snags removed from the chan., and 1,806 trees and 29 cords of brush cleared from the banks, **92,** 1216.
1892-93. About 3,000 stumps and other obstr. removed from the chan. and banks, **93,** 1490.
1893-94. About 100 stumps and other obstr. removed, **94,** 1091.
1895-96. About 700 stumps and other obstr. removed, **96,** 1178.
1896-97. About 700 stumps and other obstr. removed, **97,** 1467.
1897-98. About 3,600 stumps and other obstr. removed, **98,** 1278.
1898-99. Over 500 snags and other obstr. removed, **99,** 1536.
1899-00. Over 900 snags and other obstr. removed, **00,** 1862.
1905-06. New snag boat being built, **06,** 1178.
1906-07. 279 stumps and logs and 1 cord small snags removed from chan., and 249 trees and 10 cords brush from banks, **07,** 1262.
1907-08. 722 trees and 9½ cords brush removed from banks, and 1,688 logs, stumps, and snags and 6 cords small snags from chan., **08,** 1318.
1908-09. 217 trees removed from banks and 1,654 logs, stumps, and snags from chan., **09,** 1308.
1909-10. 5,981 obstr. removed, **10,** 1451.
1910-11. Plans prepared for new snag boat, **11,** 1579.
1911-12. Combination dr. and snag boat under constr.; 80% completed; boiler, swinging engine and hoisting engine delivered, **12,** 1799.

PHYSICAL CHARACTERISTICS.
New obstr. continually forming in the stream, **97,** 1467.
Description of, **04,** 1555, 1634.

PLANS. (See Projects.)
After ex. in 1891 to determine advisability of making a cut-off across the neck of a bend in the Wateree R., about 4 m. below Camden, Capt. Abbot reported that the interests of navigation did not demand such an imp., **91,** 1488.

PROJECTS. (See Plans.)
By Capt. Phillips, 1880, 3′ navigation between the mouth and Camden, 68 m., by removal of snags, stumps, and similar obstr., and removal of fallen, and leaning trees from the banks; est., $29,552, **80,** 915, 916. Increased in 1881, 1885, and 1887, on account of inadequate app., to $60,000, **81,** 1034; **85,** 1124; **87,** 1089. 1886, amount est. to complete proj., $24,500, **87,** 1091; **92,** 1214.
Imp. suspended until further action by Congress, by act 1902, **02,** 1162.
Capt. Sanford recom., 1903, chan. be cleared only when there should be an immediate prospect of its being needed for navigation,[1] **04,** 1633.
Capt. Adams recom., 1910, continuing imp. under existing proj.,[2] **10,** 370.

SURVEYS.
Sur. au. act Mar. 3, 1879, **79,** 95; made, 1879, **80,** 915.
Au. act June 14, 1880; made, 1880, by Capt. Phillips, **80,** 914; **81,** 1034.
Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Abbot, **91,** 1488.
Ex., mouth to Camden, au. act June 13, 1902; made, 1903, by Capt. Sanford,[1] **04,** 1629.
Ex., in connection with Santee and Congaree Rs., au. act Mar. 3, 1909; made, 1909, by Capt. Adams,[2] **10,** 378.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 474.
Maps. **89,** 1190.

N–120 CATAWBA RIVER, N. C.[3]

COMMERCE.
Comparatively unimportant, **76,** 372, 373.

ENGINEERS.
Chief of Engineers. R., 76, 69; **79,** 95; **80,** 125; **87,** 139; **88,** 134.

In charge:
S. T. Abert, U. S. C. E., **76,** 68. **R., 76,** 367.
Capt. C. B. Phillips, 1880. **79,** 88. **R., 80,** 911.
Capt. W. H. Bixby. **R., 88,** 958, 961, 962.

Assistants:
J. M. Wolbrect. **R., 80,** 912, 913.
Lt. H. Taylor. **R., 88,** 965.

ESTIMATES. (See Plans.)
By S. T. Abert, 1875, locks, dams, and dr., $1,346,900, **76,** 375.

PHYSICAL CHARACTERISTICS. (See note to title.)
Description of, **76,** 367, 368, 372, 374; **88,** 959, 963, 965.
Distances and levels, **76,** 369, 370.

PLANS. (See Estimates.)
By S. T. Abert, 1876, lateral dams and removal of obstr.; not recom. Slack-water navigation by means of locks and dams; too costly. Recom. sur. before determining plans, **76,** 374, 375.

SURVEYS.
From Moores Shoals to State line, 1824, by H. Fulton, **76,** 368.
Ex. by S. T. Abert, 1875, from South Carolina line to Old Fort, N. C., **76,** 69, 367.
Au. act Mar. 3, 1879; made, 1880, by Capt. Phillips (**R.** unfav.—"costly"), **80,** 911.
Previous ex., 1875, by S. T. Abert, **76,** 374; **80,** 912.
Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Bixby (**R.** unfav.), **88,** 958.

[1] H. D. 185, 58th, 2d.
[2] H. D. 608, 61st, 2d.
[3] Below mouth of Wateree Creek, this stream is known as the "Wateree," and farther down, at confluence of Wateree and Congaree Rs., it becomes the Santee.

N–141 CONGAREE RIVER, S. C.

Part.	Title.	Period.	Appropriations.
a	Congaree R.	1884–1912	$326,076.14
b	Gervais St. Br., Columbia, to Granby	1898–1912	250,000.00
c	Locks and dams—operating and care	1906–1912	44,123.68
	Total		620,199.82

Part (a), N–141 Congaree R., S. C.

APPROPRIATIONS.

1886,	$7,500.00,	**87,** 1095.
1888,	7,500.00,	**88,** 945.
1890,	5,000.00,	**90,** 1225.
1892,	5,000.00,	**92,** 1218.
1894,	4,000.00,	**95,** 1420.
1896,	2,000.00,	**96,** 1180.
1902,	*5,000.00,	**03,** 1130.
1905,	*[1] 25,000.00,	**05,** 1248.
1907,	*67,000.00,	**07,** 1264.
1908	*5,000.00	**09,** 1311.
	*5,125.00	
1909	*1,800.00	
	*28,100.00	
1910,	*79,000.00,	**10,** 1452.
1911,	*36,051.14,	**11,** 1583.
1912,	*43,000.00,	**12,** 1801.
	326,076.14	

COMMERCE.

Important, **85,** 1140, 1142; **87,** 1093, 1096.

Description of, **93,** 1493; **94,** 1094, 1099; **95,** 1420; **96,** 1181, 1185.

Tonnage—1892–93, 2,781 t., **93,** 1492; 1893–94, 7,974 t., **94,** 1093; 1894–95, 8,993 t., **95,** 1419; 1895–96, 18,307 t., **96,** 1180.

Imp. enables merchants in Columbia to import stock from New York, Philadelphia, and Baltimore via Clyde Line and R. SS. at a saving of about 30%, **09,** 328; **10,** 372; **11,** 394.

1911, 1,904,366 t., **12,** 477.

CONTRACTS.

1908. Ellicott Machine Co., machinery and appliances for hydraulic dr., $20,500 (Congaree portion, $8,883.33), **08,** 1320.

1912. Southern Bell Telephone & Telegraph Co., telephone service, $108.96, **12,** 1802. Kingsford Foundry & Machine Co., 2 Scotch boilers, $3,150, **12,** 1802.

ENGINEERS.

Chief of Engineers. R., 85, 177; **87,** 138; **88,** 133; **89,** 156; **90,** 139; **91,** 174; **92,** 173; **93,** 187; **94,** 171; **95,** 196; **96,** 175; **97,** 221; **98,** 218; **99,** 251; **00,** 285; **01,** 318; **02,** 244; **03,** 250; **04,** 253; **05,** 262; **06,** 285; **07,** 299; **08,** 317, 323; **09,** 326; **10,** 371, 378; **11,** 393; **12,** 475.

In charge:

Capt. W. H. Bixby, 1885–89. **R., 85,** 1140, 1143; **87,** 1093; **88,** 943.

Capt. F. V. Abbot, 1889–97. **R., 89,** 1193; **90,** 1224; **91,** 1464; **92,** 1217; **93,** 1491; **94,** 1092; **95,** 1418; **96,** 1179; **97,** 1468.

Maj. E. H. Ruffner, 1898–99. **R., 98,** 1280; **99,** 1539.

Capt. J. C. Sanford, 1900–02. **R., 00,** 1863; **01,** 1592; **02,** 1163.

Capt. G. P. Howell, 1903–07. **R., 03,** 1129; **04,** 1556; **05,** 1247; **06,** 1179; **07,** 1263.

Capt. E. R. Stuart, 1908. **R., 08,** 1319.

Capt. Earl I. Brown, 1909. **R., 09,** 1310.

Capt. E. M. Adams, 1910. **R., 10,** 1451.

Col. Dan C. Kingman, 1911. **R., 11,** 1580.

Maj. G. P. Howell, 1912–. **R., 12,** 1800.

Assistants:

S. McBee. **R., 85,** 1144.

R. Whitford. **R., 85,** 1140; **87,** 1095; **88,** 946; **89,** 1194; **90,** 1226; **91,** 1466; **92,** 1218; **93,** 1493; **94,** 1093; **95,** 1420; **96,** 1181; **97,** 1470.

OPERATIONS.

1886-87. Partial removal of obstr. bet. mouth and Granby to give 3′ d. at l. w., **87,** 1094, 1095.

1887-88. 73 logs and stumps and 5 cords of small snags removed from the chan., **88,** 944.

1888-89. 13 logs and stumps removed from the chan., **89,** 1193.

1889-90. 1,110 trees, logs, and snags removed from the chan., 450 trees and 8 cords brush cut from the banks, **90,** 1226.

1890-91. 1,475 snags and stumps cleared from the chan., and 913 trees and 58 cords of brush removed from the banks, **91,** 1466.

1891-92. 203 snags and logs and 11 cords of small snags cleared from the chan., and 5 trees from banks, **92,** 1218.

1893-94. About 700 stumps and other obstr. removed from the chan. and banks, **94,** 1093.

1895-96. About 1,300 snags and other obstr. removed, **96,** 1181.

1896-97. About 150 snags and other obstr. removed, **97,** 1470.

1897-98. Over 1,200 snags and other obstr. removed, **98,** 1280.

1902-03. Snagging and obstr. removal continued, **03,** 1129.

1903-04. 1,564 obstr. removed, **04,** 1556.

1904-05. 162 obstr. under RR. br. at Fort Motte removed, **05,** 1247.

1905-06. 1,257 obstr. removed over 44 m. of R., **06,** 1179.

1906-07. Snagboat *Pedee* removed 2,378 obstr.; U. S. dr. No. 3 removed 10,859 c. y. sand from Barbours Cut, **07,** 1263.

1907-08. 1,587 snags and other obstr. and 9 cords small snags removed, new orange peel dipper dr. completed, and 4,039 t. r. removed in providing a chan. 4′ d. above the lock, **08,** 1319, 1320.

1908-09. Derrick "A" removed 25 obstr. from chan.; new dr. *Congaree* removed 146,284 c. y. sand; snagboat *Wateree* removed 682 snags and other obstr.; 730 t. st. removed, **09,** 1310. Under special allotments for restoring chan. d. shoaled during extraordinary flood of Aug., 1908, derrick "A" removed snags and drifts, and 393 t. st.; and dr. *Congaree* removed 134,462 c. y. sand; a 6″ pump was operated for 7 days, **09,** 1310.

1909-10. 2,241 snags and other obstr., 82,588 c. y. sand removed, and 13 pontoons constr. for dr. *Congaree*, **10,** 1451, 1452.

1910-11. 3,396 obstr. removed from chan. and banks; 303,761 c. y. sand removed by hydraulic dr. *Congaree* from Granby Shoal, Congaree Creek, Gill

[1] $25,000 omitted from 1912 report, **12,** 1801. Item of 1905, $25,000, apparently a transfer from 1899 appropriation of Gervais Sreet Bridge under authority of act of Mar. 3, 1905; **07,** 1265. It was carried in the A. Rs. for a number of years as an allotment, act Mar. 3, 1905.

* Allotment.

Creek, and Congaree Br. Shoal, and about 3,000 c. y. from the bar at Congaree Br.; 180 c. y. st. removed from edge of chan. below Granby, **11,** 1580, 1581.

1911-12. 101,264 c. y. sand and gravel removed from Gill Creek, Congaree Creek, White House, and Granby; framing of wickets and other woodwork was completed; all cribs for first cofferdam placed and filled with st.; 3 cribs washed away by an unusual flood; 737 obstr. removed, **12,** 1801.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 1140, 1144; **94,** 1096.

Unusually high flood, gauge at lock reading 32′, **12,** 1801.

Sinking of derrick boat; overturning of cribs, **12,** 1801.

Usual variation in water surface 2 m. above mouth, 24′; at Columbia, 33′, **12,** 477.

R. formed by junction of Broad and Saluda Rs., 1 m. above Columbia, S. C. It flows se. about 52 m., where it unites with Wateree R. and forms Santee R. Stretch, Columbia to mouth, 51 m., embraced in proj., **12,** 475.

PROJECTS.

By Capt. Bixby, 1884, 4′ navigation, mouth to Granby Landing, 47 m., by the removal of snags, logs, rocks, and slight shoals, and properly protecting caving banks; est., $30,000, **85,** 1144.

In 1887 the proj. modified by providing for the clearing of obstr. to the natural d. of the R. above Granby; est., $54,500, **87,** 1093; **91,** 1465; **92,** 1217.

In response to resol. by Congress, 1893, Capt. Abbot, 1894, est. cost of lock and dam just below Columbia, S. C., would be $250,000, **94,** 1095; **96,** 1186.

Maj. Ruffner, 1897–98, est. $6,000 would be required an. for mainten., **98,** 1280.

Act Mar. 2, 1907, au. the limits of imp. to be extended to include that part of the R. included in the proj. from Gervais St. br., Columbia, to Granby, S. C., **07,** 299.

Act June 25, 1910, au. expend. of $56,000 in raising dam at Granby 2′, in accordance with plan,[1] **10,** 371.

Col. Kingman recom., 1911, resur. of R. for modification of proj., for necessary bank protection, constr. of regulating works to make chan. more permanent, and diminish cost of an. mainten., **11,** 1582.

SURVEYS.

Au. act July 5, 1884; made by Capt. Bixby, 1885, **85,** 1140, 1143.

Sur. Granby to the foot of Gervais St., made, 1892–93, by Capt. Abbot, **93,** 1492.

From lock and dam, to mouth of R., to determine work required to form a 4′ chan. made, 1905, by Capt. Howell; est., $20,000 to obtain and maintain for 4 years and $10,000 an. thereafter, **06,** 285, 1179.

Ex. au. act Mar. 2, 1907, of Congaree R. and Broad R. from mouth to Ninety-nine Isld. shoals; made, 1907, by DO. (**R.** unfav.),[2] **08,** 323.

Ex. au. act Mar. 3, 1909, of Wateree, Congaree, and Santee Rs.; proposed modification of movable dam at Granby, Congaree R., made, 1909–10, by DO.; est., $55,982,[1] **10,** 378.

Personal ex. made by DO.; recom. Congress au. resur., **11,** 394.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 476.

Maps. **87,** 1094; **89,** 1194.

Part (b) N–141 Congaree River, S. C., Gervais Street Bridge, Columbia, to Granby.

APPROPRIATIONS.

1899,	$50,000.00,	**99,** 1542.
1900,	100,000.00,	**00,** 1865.
1901,	50,000.00,	**01,** 1595.
1902,	50,000.00,	**02,** 1164.
	250,000.00	

COMMERCE.

SS. line estab. between Columbia and Georgetown, S. C., with connection with New York SS.; reduction of from 22 to 30% in rates, Columbia to New York (difference between rail and water transportation) effected by imp., **06,** 287.

CONTRACTS.

1900. G. W. Waring, constr. lock-keeper's house and other necessary buildings, $3,935, **00,** 1866.

1900. Evansville Contract Co., constr. lock and abutment, $77,621, **01,** 1594, 1595.

1901. New Jersey Foundry & Machine Co., steel and cast iron members for lock gates, **02,** 1164.

1902. Evansville Contract Co., Chanoine dam, $65,875, **03,** 1131.

1904. New Jersey Foundry & Machine Co., chain, **04,** 1558.

ENGINEERS.

Chief of Engineers. **R., 99,** 252; **00,** 286; **01,** 319; **02,** 245; **03,** 251; **04,** 254; **05,** 263; **06,** 287; **07,** 301.

In charge:

Maj. E. H. Ruffner, 1899. **R., 99,** 1542.

Capt. J. C. Sanford, 1900–02. **R., 00,** 1864; **01,** 1594; **02,** 1163.

Capt. G. P. Howell, 1903–. **R., 03,** 1130; **04,** 1557; **05,** 1248; **06,** 1179; **07,** 1264.

Assistant. W. A. Leland. **R., 00,** 1866; **01,** 1595; **02,** 1165; **03,** 1131.

LEGAL PROCEEDINGS.

Condemnation proceedings instituted, 1899, for most of the land required, **99,** 1542. Necessary land obtained, **00,** 1865.

OPERATIONS.

1900–01. Lock-keeper's house and other buildings completed; cofferdam constr., grading begun, and plant assembled, **01,** 1594.

1901–02. Cofferdam and abutments completed, and lock gates and valves erected, **02,** 1165.

1902–03. Work of lock and abutment constr. completed except for paving and crib extension; plant prepared for erection of movable dam, **03,** 1131.

1903–04. Lock and abutment completed; cost, $12,239.36. Chanoine movable dam completed; cost, $38,851.43, **04,** 1557.

1904–05. Lock gates hung and maneuvered, and chan. above lock cleared of bowlders and other obstr., **05,** 1248.

1905–06. Bowlders and ledge r. removed from chan. between lock and Columbia, **06,** 1179.

1906–07. Work of clearing chan. between lock and Columbia in progress until funds were exhausted, 2,362 t. st. being removed, **07,** 1264.

NOTE.—For subsequent reports of operations covering this section of R., see Congaree R., S. C., general imp.

PROJECTS.

By Capt. Abbot, 1894, securing d. in the 2 m. of the R. just below Columbia, S. C., equal to that already provided for the rest of the stream, with movable lock and dam; est., $250,000, **94,** 1095; **96,** 1186; **99,** 1542.

Act Mar. 3, 1905, au. unexpend. funds be used in clearing chan. of obstr., **05,** 263, 1248.

SURVEYS.

Sur. made, 1900, by Capt. J. C. Sanford, **00,** 1865.

Both banks of R., lock site to Gervais St. br.; made, 1900, by Capt. Sanford, **01,** 1594, 1597.

[1] H. D. 608, 61st, 2d.

[2] H. D. 650, 60th, 1st.

Part (c) N–141 Congaree River, S. C., Locks and Dams on. (Operating and care.)

APPROPRIATIONS.[1]

1906	$881.27, **06,** 1180.
	4,618.73, **07,** 1265.
1908,	5,303.51, **08,** 1321.
1909,	10,480.68, **09,** 1312.
1910,	6,325.38, **10,** 1453.
1911,	4,892.25, **11,** 1584.
1912,	11,621.86, **12,** 1803.
Total,	44,123.68

ENGINEERS.

Chief of Engineers. R., 06, 287; **07,** 302; **08,** 319; **09,** 329; **10,** 373; **11,** 395; **12,** 478.

In charge:
Capt. G. P. Howell, 1906–07. **R., 06,** 1180; **07,** 1265.
Capt. E. R. Stuart, 1908. **R., 08,** 1321.
Capt. Earl I. Brown, 1909. **R., 09,** 1311.
Capt. E. M. Adams, 1910. **R., 10,** 1453.
Col. Dan C. Kingman, 1911. **R., 11,** 1584.
Maj. G. P. Howell, 1912–. **R., 12,** 1803.

OPERATIONS.

1905–06. Lock placed under o. and c. Apr. 7, 1906, **06,** 1180.

1906–07. General repairs, **07,** 1265.

1907–08. General repairs; dr. in lock chambers; after May 4, 1908, lock operated for regular trips of SS. *Columbia*, etc., **08,** 1321.

1908–09. 510 t. st. and 820 t. sand removed from lock and between cribs, deposited during flood of 1908; repairs made to lower gate and new storehouse constr., **09,** 1311.

1909–10. Heel post of gate replaced, general repairs made, **10,** 1453.

1910–11. Caring for property at lock, painting and storing machinery of snag boat *Camden*, dismantling snag boat *Wateree*, and repairs to pumps, blocks, and chains, **11,** 1584.

1911–12. Maneuvering boat completed, constr. of a stern-wheel, wooden-hull tender begun, besides work around lock and grounds; force employed on the framing of timber for cribs of cofferdam to be used in raising dam, **12,** 1802.

PHYSICAL CHARACTERISTICS.

Destructive flood of Aug. 25, 1908, **09,** 1311.

N–147 BROAD RIVER, N. C. AND S. C.

COMMERCE.

Unimportant, **80,** 1011, 1013, 1026.

ENGINEERS.

Chief of Engineers. R., 80, 132; **84,** 177; **08,** 323.

In charge:
Lt. Col. G. A. Gillmore. **R., 80,** 1010.
Capt. E. R. Stuart, 1908, **08,** 306.
Capt. J. Mercur. **R., 84,** 1058.

Assistant. J. P. Carson. **R., 80,** 1013.

PHYSICAL CHARACTERISTICS.

Described, **80,** 1014.
Head of navigation 28 m. above the N. C. and S. C. boundary line, **80,** 1014.

PLANS.

By Col. Gillmore, 1880, chan. for pole-boat navigation; est., $90,000, **80,** 1013.

SURVEYS.

Ex. mouth near Columbia, S. C., 141 m. upward, au. act Mar. 3, 1879, **80,** 132; made by Col. Gillmore, 1880, **79,** 100; **80,** 1010.

Ex. au. act Aug. 2, 1882; made by Capt. Mercur (**R.** unfav.), **84,** 1058.

Pre. ex. Congaree R.; also Broad R. from its mouth to Ninety-nine Isld. Shoals, au. act Mar. 2, 1907; **R.** by Capt. Stuart, Dec. 20, 1907 (unfav.),[2] **08,** 323.

N–147 (b) BROAD AND SALUDA RIVERS, ABOVE COLUMBIA, S. C.

(See also N–172.)

ENGINEERS.

Chief of Engineers. R., 89, 158.
In charge. Capt. F. V. Abbot. **R., 89,** 1203.

PHYSICAL CHARACTERISTICS.

Descriptions of; Broad and Saluda two distinct streams, the union of which just above Columbia forms the Congaree; this latter flows past Columbia, and uniting with the Wateree 50 m. below forms the Santee, which flows into Atlantic, **89,** 1203.

SURVEY.

Ex. au. act Aug. 11, 1888; made by Capt. Abbot (**R.** unfav.), **89,** 1203.

N–163 GREEN RIVER, N. C.

ENGINEERS.

Chief of Engineers. R., 85, 164.

In charge: Capt. F. A. Hinman. **R., 85,** 1046.

PHYSICAL CHARACTERISTICS.

Details: Rises in Blue Ridge Mtns.; very tortuous; flows into Broad R., near S. C. line.
River discharge, **85,** 1046.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Hinman (**R.** unfav.), **85,** 1046.

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[1] Expends. under the permanent indefinite appro. au. act July 5, 1884, for operating and keeping in repair canals and other public works; amended and reenacted by sec. 6 of act of Mar. 3, 1909.
[2] **H. D. 650, 60th, 1st.**

N–172 SALUDA RIVER, S. C.

(See N–147.)

ENGINEERS.

Chief of Engineers. **R., 08,** 323.
In charge. Capt. E. R. Stuart, **08,** 306.

SURVEY.

Pre. ex., between Columbia and Hollow Creek, au. act Mar. 2, 1907. **R.** by Capt. Stuart[1] (unfav.), **08,** 323.

N–201 ALLIGATOR (Creek) RIVER, S. C.

COMMERCE.

Present and prospective, important, **87,** 1123.

ENGINEERS.

Chief of Engineers. **R., 87,** 139.
In charge. Capt. W. H. Bixby. **R., 87,** 1114, 1117.
Assistant. R. Whitford. **R., 87,** 1118.

PHYSICAL CHARACTERISTICS.

Description; Alligator Cr. and waterways bet. Santee R. and Bulls B. are of importance mainly as forming a portion of the water route bet. the Santee R. and Charleston, S. C., **87,** 1114.

PLANS.

By Capt. Bixby, 1887, imp. of Alligator R. and waters connecting Santee R. and Bulls B. by excavating 6′ chan., 100′ w.; est., $183,240, **87,** 1118.

SURVEY.

Ex. and sur. au. act Aug. 5, 1886; made, 1887, by Capt. Bixby, **87,** 1117.
Maps. **87,** 1118.

N–202(a) OWENDAW AND (N 197) WANDO RIVERS, S. C.

ENGINEERS.

Chief of Engineers. **R., 89,** 158; **90,** 141.
In charge. Capt. F. V. Abbot, 1888. **R., 90,** 1239.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1239.

PLANS.

By Capt. Abbot, 1889, inland waterway connecting Bulls B. and Charleston (1) by the Owendaw and Wando Rs.; est., $1,500,000; (2) by the Sea Isld. route; est., $750,000, **90,** 1243, 1244.

SURVEY.

Au. act Aug. 11, 1888; made, 1888, by Capt. Abbot, **90,** 1243.

N–202(b) CHARLESTON HARBOR, S. C., AND ALLIGATOR CREEK, OPPOSITE McCLELLANVILLE, S. C. (Inland Waterways between.)

APPROPRIATIONS.

1902,	$50,000,	**02,** 1166.
1907,	75,290,	**07,** 1266.
1909,	*5,000,	**09,** 1313.
1910,	25,000,	**10,** 1454.
1911,	41,000,	**11,** 1585.
1912,	15,000,	**12,** 1804.
Total,	211,290,	**12,** 1804.

COMMERCE.

Comparatively small; chan. only practicable for small vessels, **10,** 373.
Tonnage, 1911, 44,000 t., **12,** 479.

CONTRACTS.

1905. Simons-Mayrant Co., dr., 21.4¢ c. y., **06,** 1181.
1907. Savannah Dredging Co., dr., 23⅝¢ c. y., **08,** 1323.
1911. Simons-Mayrant Co., dr., 17.7¢ c. y., **12,** 1804.

ENGINEERS.

Chief of Engineers. **R., 02,** 246; **03,** 252; **04,** 255; **05,** 264; **06,** 288; **07,** 302; **08,** 319; **09,** 329; **10,** 373; **11,** 395; **12,** 478.

In charge:
Capt. J. C. Sanford, 1902. **R., 02,** 1166; **03,** 1133.
Capt. G. P. Howell, 1903–07. **R., 03,** 1132; **04,** 1558; **05,** 1249; **06,** 1180; **07,** 1265.
Capt. E. R. Stuart, 1908. **R., 08,** 1321.
Capt. E. I. Brown, 1909. **R., 09,** 1312.
Capt. E. M. Adams, 1910. **R., 10,** 1453.
Col. Dan C. Kingman, 1911. **R., 11,** 1584.
Maj. G. P. Howell, 1912–. **R., 12,** 1803.

OPERATIONS.

1904–05. Titles secured to required lands, **05,** 1249.
1905–06. 26,000 c. y. dr., **06,** 1180.
1906–07. About 37,000 c. y. dr., **07,** 1265.
1907–08. 284,935 c. y. dr., **08,** 1321, 1322.
1908–09. 113,407 c. y. dr., **09,** 1312.
1910–11. 67,463.6 c. y. dr. from Bull Narrows, 56,655.4 c. y. from Saltpond to Grahams Creek, and 13,030 c. y. from Lelands Cut, **11,** 1584.
1911–12. 12,798 c. y. dr. from Sewee B., **12,** 1803.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 373.
Waterways a series of creeks, sounds, rivers, etc., affording a route sheltered from sea.

PROJECTS.

By Capt. Sanford, 1902; est. for imp., chan. 6′ x 75′, $206,910; 4′ x 75′, $152,570; and 4′ x 60′, $125,290; latter plan au. act June 13, 1902, **02,** 246; **03,** 1133.
Capt. Stuart, 1908, increased est. to $191,290 on account of high cost of dr., **08,** 1322; given as $66,000 add'l to orig. est., **12,** 478.
Modified by act Mar. 2, 1907, to provide for branch to Morrisons Landing in McClellanville, changing proposed route, **08,** 320, 1322.

SURVEYS.

Made preparatory to inviting proposals, **11,** 1585.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 478.
Maps. **11,** 1584.

[1] H. D. 651, 60th, 1st.

*Allotment.

N–203 CHARLESTON HARBOR, S. C.[1]

APPROPRIATIONS.

1852,	$50,000, act Aug. 30.
1871,	13,000, **71,** 69.
1872,	38,700, **72,** 651.
1873,	5,000, **73,** 731.
1874,	18,000, **74,** 77.
1875,	10,000, **75,** 83.
1876,	10,000, **76,** 69.
1878,	200,000, **78,** 77, 544.
1879,	200,000, **79,** 96.
1880,	170,000, **80,** 928.
1880,	[2] 5,000, **80,** 932.
1881,	175,000, **81,** 1053.
1882,	300,000, **82,** 1136.
1884,	250,000, **84,** 1085.
1886,	187,500, **86,** 1073.
1888,	[3] 350,000, **88,** 975.
1890,	370,000, **90,** 1193.
1892,	225,000, **92,** 1223.
1893,	750,000, **93,** 1504.
1894,	450,000, **94,** 1107.
1895,	500,000, **95,** 1427.
1899,	*175,000, **99,** 1543.
1900,	45,000, **00,** 1868.
1900,	175,000, **00,** 1868.
1902,	95,000, **02,** 1167.
1903,	60,000, **03,** 1135.
1904,	73,000, **04,** 1560.
1905,	50,000, **05,** 1252.
1907,	25,000, **07,** 1268.
1909,	*25,000, **09,** 1314.
1910,	150,000, **10,** 1455.
1911,	100,000, **11,** 1587.
1912	50,000; 51,150; 5,000 — **12,** 1807.

Total, 5,356,350 (omitting app. of 1852–76, 1880, 1899; incl. sales, rent, etc., $5,046,400.96, **12,** 1807).

COMMERCE.

71, 584; **78,** 551, 552; **89,** 1155.

Benefited by the work, **71,** 584.

Discussed by the president of the city chamber of commerce, **78,** 551.

C. necessity for imp., **81,** 1052; **87,** 1130, 1137.

From a C. as well as from a military standpoint, the H. should be accessible to the largest vessels, **99,** 1556.

Increasing; new SS. line added, **02,** 248.

Rates lowered 12½¢ t. on coastwise freight, **05,** 267.

Details, **11,** 398.

Exports, 1911, 292,545 t.; imports, 871,187 t.; tonnage, 1,163,732 t., **12,** 482.

Imp. slightly influences rates of marine insurance; otherwise it has had no effect, **12,** 482.

CONTRACTS.

1871. B. Maillefert, removing wrecks of 5 vessels, **72,** 651.

1872. B. Maillefert, removing monitor *Patapsco* to 25′ l. w., **72,** 652. B. Maillefert, removing 3 wrecks, **73,** 727. J. Griffin, removing 3 wrecks and 125′ of j. to 20′ l. w., **73,** 731; **75,** ii, 28; **76,** 430.

1873. B. Maillefert, removing monitor *Keokuk* to 15′ l. w., **73,** 731.

1874. B. Maillefert, removing 1,878 c. y. st. from ruined j., **75,** ii, 28; **76,** 430. D. Symons, removing 2,500 c. y. st. from ruined j., **75,** ii, 28; **76,** 430.

1878. Bangs & Dolbey, foundation apron for n. j., **79,** 736.

1879. Bangs & Dolbey, js., **80,** 928; completed, **81,** 1044.

1880. F. P. Murphy, riprap st., $2.80 c. y., on n. j., **81,** 1053; contract annulled, **81,** 1044. N. A. Devereux, laying courses of logs and brush overlaid with 1′ of riprap st.; price l. f., $10.73, **81,** 1054; annulled, **82,** 1131. M. Dolbey, work upon js., $13.45 l. f.; completed, **81,** 1054. E. T. Bangs, j. constr., **81,** 1067.

1882. A. A. Howlett, mattress, 72¢ s. y., and riprap st., $3.59 c. y., **83,** 879; extension of contract, **83,** 875; completion, **84,** 1080.

1884. A. A. Howlett, constr. of js., 67¢ s. y. for mattress and $3.41 c. y. for st., **85,** 1182; contract completed, **86,** 1068.

1885. H. H. Penny, dr. between js., 30¢ c. y., **85,** 1182; contract completed, **86,** 1069.

1886. A. M. Bangs, mattress, 49¢ s. y., and st., $3.09 c. y., **87,** 1133.

1889. C. McK. Grant and J. W. Egan, j. constr., $213,550, **89,** 1147. B. C. Howell, dr., 17½¢ c. y., **89,** 1147.

1890. J. Friday, riprap st., $1.90 and $2.15 t., **91,** 1471.

1891. H. W. Crouch, break'r constr., $4,300, **92,** 1224.

1892. Egan & Friday, st., $2.25 to $3.20 short t., in place in the js.; mattresses at $1.25 s. y., and dr. at 28¢ c. y. ($1,884,000), **93,** 1504.

1897. Broderick & Ferguson, 1,600 t. steam coal, $2.65 t., **97,** 1473.

1898. Newport News Shipbuilding & Dry Dock Co., repairs to dredger, $2,476.88, **98,** 1284. New York Belting & Packing Co., rubber suctions, $14.14 f. ($114.89). Consumers Coal Co., furnishing wharf $30 month, handling coal 85¢ t., storage room free. Valk & Murdock Iron Works, new dr.-pumping engine, $3,600. Hugh Ferguson & Co., schooner load of coal, $2.45 t. **99,** 1544.

1899. Newport News Shipbuilding & Dry Dock Co., docking, raising hull, and repairing dr. *Charleston*, $32,479.17, **99,** 1544, 1545.

1901. Petersburg Iron Works Co., constr. wooden hull, seagoing suction dr., $144,300, **01,** 1600. Consumers Coal Co., berth for dr., etc., **02,** 1168; **03,** 1135.

1902. Consumers Coal Co., coal, **02,** 1168; **03,** 1135.

1903. E. O. Hall, jr., building launch; Consumers Coal Co., berth for dr., coal, etc., **03,** 1135; **04,** 1561.

1904. Hugh Ferguson, coal; New Jersey Car Spring & Rubber Co., suction hose, $673; Wm. Johnson & Co., coal; Charleston Terminal Co., lease of wharf, **04,** 1561. Riverside Iron Works, cast steel drags, $225; Clement Restein Co., suction hose, $450, **05,** 1252.

1909. Samuel J. Pregnall, an. repairs to dr.; est., $8,000, **10,** 1455.

1910. Charleston Terminal Co., lease of wharf, $3,000, **11,** 1587.

1911. Merrill-Stevens Co., repairing dr. *Winyah Bay*, $5,076, and repairing dr. *Charleston*, $4,356.65, **11,** 1587. Southern Bell Telephone & Telegraph Co., lease of telephone, $246 per annum; Legare & Rhett, lease of warehouse, $180 per annum; Charleston Terminal Co., lease of wharf, $3,000 per annum, **12,** 1807.

ENGINEERS.

Chief of Engineers:

R. to Sec. of War, concurring in views of BE. on Lt. Col. Gillmore's proj. for permanent js., **78,** 553.

R., **66,** 3; **70,** 31, 63; **71,** 69; **72,** 64; **73,** 68; **74,** 76; **75,** 82; **76,** 69; **77,** 66; **78,** 76; **79,** 95; **80,** 126, 127; **81,** 168, 170; **82,** 164; **83,** 171, 882; **84,** 178; **85,** 177; **86,** 176; **87,** 140; **88,** 134; **89,** 149; **90,** 134; **91,** 175; **92,** 173; **93,** 187; **94,** 172; **95,** 196; **96,** 175; **97,** 222; **98,** 219; **99,** 252, 255; **00,** 287; **01,** 320; **02,** 247; **03,** 253; **04,** 256, 261, 1574; **05,** 265; **06,** 289; **07,** 303; **08,** 321; **09,** 330; **10,** 374, 379; **11,** 396; **12,** 479, 483.

Exs.—**R.** (fav.), 1852. **R.** (fav.), June 26, 1854. (H. D. 482, 55th, 2d.)

[2] Sullivans Isld.

[3] From this date Sullivans Isld. is included.

*Allotment.

Boards:
Convened Apr. 24, 1878, presented pre. **R.**, concurring in Lt. Col. Gillmore's views as to the practicability of the j. system, for imp. to 21′ at m. l. w. on the bar; cost, $1,800,000 to $3,000,000. **R.**, **78**, 571. (Col. Tower and Lt. Cols. Wright, Newton, and Gillmore.)
Convened at Washington Nov. 10, 1888, by S. O. No. 50, to ex. and **R.** upon Capt. Abbot's revised proj. for the imp. of Charleston H. **R.**, **89**, 1150. (Lt. Cols. Gillespie and King and Maj. Post.)
BE. Constituted order Sec. War, estab. harbor lines, **97**, 1488. (Col. Hains, Maj. Rossell, Capt. Abbot, and Lt. Stuart.)
BERH. **R.**, **04**, 1578, 1581.

In charge:
Maj. Q. A. Gillmore, 1870–87. **70**, 63; **71**, 69:
Instructions to Capt. Ludlow, **71**, 580.
R. and proj. for permanent js., **78**, 554.
R., **71**, 578; **72**, 651; **73**, 727; (Lt. Col.) **74**, ii, 3; **75**, ii, 28; **76**, 430; **77**, 369; **78**, 543; **79**, 732; **80**, 921, 931; **81**, 1043, 1064; **82**, 1129; (Col.) **83**, 873; **84**, 1077; **85**, 1172; **86**, 1063; **87**, 1125.
Capt. F. V. Abbot, 1888–97. **R.**, **88**, 970; **89**, 1144, 1151, 1153; **90**, 1190; **91**, 1467; **92**, 1219; **93**, 1495; **94**, 1101; **95**, 1421; **96**, 1189; **97**, 1471.
Maj. E. H. Ruffner, 1898–1900. **R.**, **98**, 1283; **99**, 1542, 1551; **00**, 1908.
Capt. J. C. Sanford, 1900–1902. **R.**, **00**, 1867; **01**, 1598; **02**, 1166.
Capt. G. P. Howell, 1903–07. **R.**, **03**, 1134; **04**, 1559, 1579; **05**, 1250; **06**, 1181; **07**, 1267.
Capt. E. R. Stuart, 1908. **R.**, **08**, 1324.
Capt. Earl I. Brown, 1909. **R.**, **09**, 1314.
Capt. E. M. Adams, 1910. **R.**, **10**, 1455.
Col. Dan C. Kingman, 1911. **R.**, **11**, 1585.
Maj. G. P. Howell, 1912–. **R.**, **12**, 1805.

Assistants:
Capt. W. Ludlow, **71**, 69; **73**, 68. **R.**, **71**, 580.
Eppley and Guerrero, **71**, 584.
Capt. D. P. Heap, **73**, 68; **74**, 76.
Lt. F. A. Mahan, **74**, 76.
Capt. J. W. Cuyler, **74**, 76. **R.**, **74**, ii, 4.
Capt. J. C. Post, **74**, 76. **R.**, **77**, 369; **78**, 546; **79**, 736; **80**, 929; **83**, 880, 883.
G. Daubeney, current observations, **78**, 544.
Capt. B. D. Greene. **R.**, **81**, 1055; **82**, 1136.
Lt. T. N. Bailey. **R.**, **83**, 879; **84**, 1085.
Lt. F. V. Abbot. **R.**, **85**, 1182; **86**, 1073; **87**, 1133.
J. P. Allen. **R.**, **88**, 975; **89**, 1147; **90**, 1193; **91**, 1471; **92**, 1224; **93**, 1504; **94**, 1107; **95**, 1427; **96**, 1199; **97**, 1477; **00**, 1870, 1909; **01**, 1601; **02**, 1169; **03**, 1136; **04**, 1581.
E. O. Patterson. **R.**, **93**, 1508.

ESTIMATES. (See Private work.)

Capt. Ludlow, 1871, removing wrecks, 125′ of j., and dr. Beach Chan., $100,750, **71**, 584. Maj. Gillmore, $75,700, **71**, 69, 70, 579.
Maj. Gillmore, 1873, removing wrecks in Beach Chan. and dr., $13,000, **73**, 731; removing 75′ of j. in Beach Chan., $5,000, **73**, 731.
Lt. Col. Gillmore, 1874, removing 50′ more of j. in Beach Chan., $10,000, **74**, ii, 5.
Lt. Col. Gillmore, 1875, add'l dr. in H., $25,000, **75**, ii, 31.
Lt. Col. Gillmore, 1876, add'l for removing new shoals, $10,000, **76**, 431.
Lt. Col. Gillmore, 1877, add'l for removing j., $5,000, **77**, 370.
Lt. Col. Gillmore, 1878, permanent works, low js., $1,800,000; permanent works, js. full height, $4,278,000, **78**, 545, 570.
Orig. est. for removing 9 wrecks and 125′ of j. stated at $74,000 to $76,000, **73**, 68, 727; **74**, ii, 3; **77**, 370. Exceeded in 1875 by $9,700, **75**, ii, 30; in 1878 by $17,000, **79**, 95.
By Capt. Adams, 1909, submitted in response to Senate resolution, 1909, ordering **R.** upon proposed further imp. of H.; est., $350,000, and $50,000 an. mainten.,[1] **10**, 379.

EXPENDITURES.

By S. C., $200,000. By city, $25,000, **78**, 552. By U. S., 1871–78, $93,000, **79**, 95; $93,700, **79**, 731. List of expend. by contractor in removing wreck of monitor *Patapsco*, **73**, 730.

LEGISLATION.

Resolution of US. Senate, 1878, calling for information regarding permanent works, **78**, 553.

OBSTRUCTIONS.

Br. across the cove in rear of Sullivans Isld. partly finished and then abandoned; steps taken by War Dept. to have the obstr. removed, in 1894, **94**, 1106.

OPERATIONS.

Suspended from 1854 to 1870, **66**, 3; **70**, 31, 63.
1869–71. Ex. and sur. made, **70**, 31, 63.
1871–72. 5 wrecks removed, **72**, 651.
1872–73. 4 wrecks, 613 c. y. st. from j., and 150 l. f. j. removed, **73**, 728.
1873–74. 4 wrecks removed; 738 c. y. st. from j. removed, **74**, ii, 4.
1874–75. 1 wreck removed; 3,376 c. y. st. from j. removed, 1,016 c. y. of which were piled on j.; pier head built, **75**, ii, 28, 29.
1875–76. 2,667 c. y. st. from j. removed, 9,632 c. y. dr., **76**, 430.
1876–77. 4,800 c. y. st. from j., and 185 l. f. j. removed; 680 c. y. dr., **76**, 69, 77, 369.
1877–78. 200 c. y. st. from j., and 30 l. f. j. removed; a few c. y. dr., **78**, 543.
1878–79. N. j. laid for 4,096 l. f., h. 4′ to 5′, under a new proj. for imp. entrance, **79**, 96, 731.
1879–80. N. and s. js. in progress, **80**, 927.
1880–81. 35,789 c. y. st. deposited in n. and s. js.; dr. on bar, **81**, 1044, 1046, 1047. 324 l. f. of log j. built and covered with 495 c. y. of riprap st., **81**, 1066.
1881–82. N. j. extended 2,319 l. f., s. j. extended 3,209 l. f.; spur j. built, **82**, 1137; 28,387 c. y. riprap st. deposited upon n. j., **82**, 1131; 23,030 c. y. riprap st. deposited upon s. j., **82**, 1132.
1882–83. Extension of bottom course of granite j. 2,657 l. f., and enlarging foundation course of work, 35,753 c. y. of riprap st. placed, **83**, 876.
1883–84. Bottom course of s. j. extended 816 l. f. seaward and 513 l. f. landward; 33,159 s. y. log and brush placed; 17,299 c. y. riprap st. laid over mattresses, **84**, 178; 183 c. y. of riprap st. distributed over portions of second spur j., Sullivans Isld., **84**, 1081.
1884–85. Bottom course of s. j. extended 2,288 l. f.; 69,398 s. y. log and brush mattress overlaid with 25,183 c. y. of riprap st.; 8,929 c. y. dr. between js.; 952 l. f. of spur dike built, **85**, 1175.
1885–86. Work continued on n. j.; foundation of s. j. extended seaward 43′; ridge of riprap deposited upon existing work; 18,289 s. y. of log and brush mattress and 15,341 c. y. of riprap st. put in the 2 js.; 76,620 c. y. dr. between js., **86**, 176, 177; the outer end of n. j., 14,327′ from Sullivans Isld. and within 1,200′ of the outer 18′ curve; the outer end of s. j., 16440′ from Morris Isld. and 2,500′ from outer 18′ curve, **80**, 176.
1886–87. 19,077 s. y. of mattress and 13,227 c. y. of st. added to n. j.; 18,621 s. y. mattress and 9,508 c. y. of st. added to s. j.; no add'l extension seaward made. Total material used in the constr. of the js., 480,814 s. y. of mattress, 250,959 c. y. of st., **87**, 1128.
1887–88. 7,177 c. y. st. and 926 s. y. log mattress placed in s. j.; 7,613 c. y. st. used on s. j., **88**, 972.
1888–89. 1,291 t. riprap deposited at outer end of s. j., **89**, 1145.
1889–90. 21,353 t. riprap deposited at outer end of n. j., and 34,012 t. upon s. j.; 56,626 c. y. dr., **90**, 1190.
1890–91. 43,264 t. st. deposited on s. j. and in the main ship chan.; 47,626 c. y. dr. from main ship chan., **91**, 1468.

[1] S. D. 300, 61st, 2d.

1891-92. 21,720 t. st. deposited in s. j. under contract, and 52,439 t. by hired labor; 32,966 t. st. deposited in n. j. under contract, and 1,202 t. by hired labor, **92,** 1224.

1892-93. 105,278 t. of st. placed in n. j., 54,278 t. in the s. j., and 325,222 c. y. dr., **93,** 1505.

1893-94. 49,403 t. of st. placed in n. j. and also 4,479 s. y. mattresses; 164,829 t. of st. placed in s. j. and also 23,285 s. y. mattresses; 503,055 c. y. dr., **94,** 1107, 1108.

1894-95. 53,073 t. of st. and 6,142 s. y. mattresses placed in n. j. and 93,251 t. of st. in s. j.; 592,562 c. y. dr., **95,** 1427, 1428.

1895-96. 465 t. of st. placed in n. j. and 4,975 t. in s. j.; 493,735 c. y. dr., **96,** 1200.

1896-97. 2,316 t. of large st. placed in n. j., dredger repaired, and 385,882 c. y. dr., **97,** 1478.

1897-98. 9,348 t. of st. placed in n. j., dredger repaired, and 390,270 c. y. dr., **98,** 1283.

1898-99. 271,000 c. y. dr., **99,** 1542.

1899-00. 253,400 c. y. dr., **00,** 1867.

1900-01. Dr. *Charleston* removed 287,206 c. y., **01,** 1598.

1901-02. Drs. *Charleston*, *Winyah Bay*, and *Cape Fear* removed 256,896 c. y., **02,** 1166.

1902-03. Drs. *Charleston* and *Cape Fear* removed 288,965 c. y., **03,** 1134.

1903-04. New dr. *Gen. Abbot* completed; dr. *Charleston* removed 415,807 c. y., and dr. *Gen. Abbot* removed 101,622 c. y., **04,** 1559.

1904-05. Dr. *Charleston* removed 325,710 c. y., and dr. *Gen. Abbot* 594,258 c. y., **05,** 1250, 1251.

1905-06. Dr. *Gen. Abbot* removed 678,155 c. y., **06,** 1181.

1906-07. Dr. *Gen. Abbot* removed 143,411 c. y., **07,** 1267.

1907-08. Dr. *Winyah Bay* removed 148,280 c. y.; 26′ proj. done, **08,** 1324.

1908-09. Dr. *Winyah Bay* removed 85,591 c. y. in mainten. of 26′ proj.; dr. *Sumter* (formerly *Gen. Abbot*) laid up, **09,** 1314.

1909-10. Dr. *Winyah Bay* removed 22,194 c. y.; tide gauge house built and tide gauge installed, **10,** 1455.

1910-11. Wharf leased, coal crane purchased, coal bins, chutes, and track constr.; handling coal for drs. begun Nov., 1910; drs. *Sumter*, *Charleston*, and *Winyah Bay* removed 1,212,722 c. y., at cost of 10.2, 10.5, and 10.2¢ c. y., resp.; average cost., incl. all expenses, 10.89¢ c. y.; handling coal cost 64c t., **11,** 1586.

1911-12. 813,878 c. y. dred. by dr. *Sumter*, 304,724 c. y. by dr. *Charleston*, and 213,636 c. y. by dr. *Winyah Bay*; drs. *Sumter* and *Charleston* repaired, the former having been injured by hurricane of Aug. 27 and 28; 128,966 c. y. dred. by the 3 drs. from shoals opposite s. part of city; repairs made to damaged wharf, U. S. tracks and coal bins, injured by hurricane; proj. 75% done, **12,** 1805, 1806.

PHYSICAL CHARACTERISTICS.

Of H. described, with list of wrecks forming obstr. to navigation, **71,** 581.

Current observations, Beach Chan., **76,** 431; North Chan., **78,** 544; **79,** 731.

Borings, Charleston Bar, **78,** 543, 546; **79,** 96, 731.

Of Beach Chan., **74,** ii, 4; **76,** 431; **78,** 546, 550.

Chan. and bar, **78,** 544; described and discussed by Lt. Col. Gillmore, **78,** 555.

Table of mean l.-w. d. in chan., 1821 to 1877, **78,** 557.

Capacity of tidal basin, **78,** 557.

Changes in, notes. **82,** 1134.

Reference made to **R.** of commission, headed by Prof. Bache, U. S. C. S., rendered in 1852, **71,** 583; **78,** 554.

Marls from borings, **79,** 737; analysis of same, **79,** 739.

Description of, **93,** 1502; **94,** 1105, 1109; **95,** 1423, 1429; **96,** 1200; **97,** 1478; **98,** 1823; **99,** 1552; **00,** 1871; **11,** 397.

Current measurements, **93,** 1506.

Barometer readings and wind velocities, **94,** 1103.

Tidal observations, **94,** 1103, 1104, 1109; **95,** 1425, 1429; **96,** 1200; **97,** 1478.

Description of Charleston H. to Alligator Creek, **00,** 1910.

Chan. secured at 1912, 28′ x 250′ m. l. w., gain in d. along the central line in past year of about 10′, **12,** 428.

Mean range of tide, 5.2′, **12,** 482.

Deterioration of 28′ chan. from scour, **12,** 1806.

Hurricane of Aug. 27–28, 1912, caused considerable damage, **12,** 1806.

PRIVATE (CITY AND STATE) WORK. (See Estimates.)

City authorities contracted with B. Maillefert to dr. main ship (Pumpkin Hill) chan. to 20′ m. h. w., or 15′ at m. l. w., **74,** ii, 5; **75,** ii, 29. **R.** on this chan., comparing it with Beach Chan., **75,** ii, 30. No perceptible imp. after a year's work, **76,** 431.

By State and city, **78,** 552.

PROJECTS.

By Capt. Ludlow and Maj. Gillmore, in 1870, removing wrecks, 125 l. f. of Bowmans j., and dr. Beach Chan., **72,** 652. Modifications of this proj., **74,** 76, ii, 3, 4, 5; **75,** 82, ii, 29; **77,** 67.

By Lt. Col. Gillmore, 1878, estab. and permanently maintaining a practicable chan. across the bar of not less than 21′ at m. l. w., with 2 converging js. of random st. on brush and log mattresses, an opening between the ends of the js. of about 2,900′; est., $3,000,000, **78,** 558, 572; **86,** 176; **87,** 1135.

Lt. Col. Gillmore, 1880, protection of s. shore of Sullivans Isld. with 3 log and riprap spur js., 150′ to 180′ l., at right angles to the shore line; est., $6,000, **80,** 931.

In 1889, est. that to bring the js. to l. w. level throughout would require $2,548,000 in addition to prior app., making total est., if js. left at m. l. w. level throughout, $4,380,500, **89,** 1144; **90,** 1190; **91,** 1467, 1470; **92,** 1220.

U. S. dr. discontinued and the work ordered to be done by continuing contract, act July 13, 1892, **93,** 1495.

In response to Cong. resol., 1898, Maj. Ruffner est. cost of chan. 26′ m. l. w., Charleston H. to ocean, $2,408,552, **99,** 1555.

Act Mar. 3, 1899, au. dr. 26′ x 600′ chan., entrance to Charleston H., embracing use of seagoing suction drs., to be built, **12,** 480.

Maj. Ruffner est., 1899, $281,600 for a 6′ x 75′ chan., Charleston H. to Alligator Creek, **00,** 1909.

By Capt. Adams, au. act June 25, 1910, entrance chan. 28′ x 1,000′ (beyond js.) and 500′ w. between them m. l. w.; est., $371,616, and $40,000 an. mainten.,[1] **10,** 375.

Act July 25, 1912, au. completing 20′ x 240′ chan., Ashley R., S. C., up to Standard Wharf;[2] est., $51,150, **12,** 481.

Act July 25, 1912, au. imp. Shipyard Creek, dr. chan. 15′ x 100′ through upper mouth of creek; est., $5,000,[3] **12,** 481.

SURVEYS.

Ex. or sur. commenced, **70,** 63; $3,000 all'd, **71,** 580.

Sur., Beach Chan., **78,** 543, 547.

Field work and sur. of outer and inner Hs. and the bar, **82,** 1130.

General sur. of outer H., incl. the bar and its exterior slope, commenced, **83,** 875; completed, **84,** 1085.

Ex. into condition of n. and s. js., **84,** 1081, 1088.

Resur. of area between sea and portions of js., **85,** 1177; **86,** 1076; **87,** 1132.

Sur. made from 1893 to 1898, **93,** 1502; **94,** 1109; **95,** 1425, 1428; **96,** 1200; **97,** 1487; **98,** 1283; **99,** 1543.

Ex. and sur. of waterway, Charleston H. to Alligator Creek, S. C., to ascertain cost of imp., au. act Mar. 3, 1899; ex. only considered necessary; made, 1899, by Maj. Ruffner (**R.** fav.; see Projects), **00,** 1908.

Au. act June 13, 1902, ex. for H. of refuge; made by Capt. Sanford; est., $371,616, and $40,000 an. for mainten.,[1] **04,** 261, 1575.

Made by Capt. Howell, **07,** 1267.

[1] H. D. 499, 58th, 2d. [2] R. and H. Com. Doc. No. 4, 62d, 2d. [3] Sen. D. 350, 62d, 2d.

Sur. of chan. and sur. for readjustment of H. lines made by Capt. Stuart, **08,** 1324.
Sur. made indicated that full chan. of 26′ x 600′ maintained, **09,** 1314.
Made by Capt. Adams to secure data for 28′ proj., **10,** 1455.
Sur. made, 1911, shows chan. 26′ x 600′ across bar of eastern chan., **11,** 1586.
Pre. ex., with plan and est., for securing 30′, au. act June 25, 1910; **R.** by Capt. Adams, Dec. 7 and Dec. 31, 1910[1] (est. latter date, $350,000), and Col. Kingman, 1911, est., $140,000 for further imp. in addition to amount unapp. for 28′ proj.,[2] **12,** 483.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 481.

Maps:[2]
Sketch, approaches to Charleston H., **66.**
Plan and sections of bar, **78,** 570.
Two maps showing site and section of the n. j., **79,** 734.
Sketch showing mattress used in the n. j., **79,** 736.
80, 926; **81,** 1052; **82,** 1136; **83,** 878; **84,** 1088; **85,** 1180; **86,** 1076; **87,** 1132; **88,** 974; **89,** 1146; **90,** 1192; **91,** 1470; **92,** Atlas, 45, 46, 47; **93,** 1504; **94,** 1110; **95,** 1432; **96,** 1204; **97,** 1478; **98,** 1284; **99,** 1546; **00,** 1870; **01,** 1602; **02,** 1170.

N–203(b) CHARLESTON, S. C. (Waterways from Columbia and Camden to.)

ENGINEERS.
Chief of Engineers. **R., 12,** 484.
In charge:
Col. Dan C. Kingman, **12,** 463.
Maj. G. P. Howell, **12,** 463.

SURVEY.
Pre. ex. and sur. au. act June 25, 1910, waterways from Columbia and Camden, to Charleston, S. C. (**R** to come), **12,** 484.

N–203(c) CHARLESTON NECK, S. C., SHIP CANAL ACROSS.

COMMERCE.
Benefits to, from constr. of canal, **81,** 1165.

ENGINEERS.
Chief of Engineers. **R., 80,** 132; **81,** 179.
In charge. Lt. Col. Q. A. Gillmore, 1880. **R., 81,** 1164.

PHYSICAL CHARACTERISTICS.
Charleston Neck and its surroundings; neck a narrow peninsula extending down into Charleston H. in a s. or se. direction—bounded on w. side by Ashley R. and on e. by Cooper R. and a branch of the same called Town Creek, **81,** 1165.

PLANS.
By Capt. Post, canal of 20′ d. at m. l. w., bottom w. of 200′, with tide gates at each end; est., $439,789, **81,** 1167.

PRIVATE (STATE) WORK.
App. of $15,000 by S. C. toward constr. of canal, **81,** 1167.

SURVEYS.
Au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, 1880, **80,** 132.
Location selected for ship chan., **81,** 1165.

N–204 CHARLESTON, S. C., AND BEAUFORT, S. C. (Inland Waterway between.)[3]

APPROPRIATIONS.

1902,	$30,000,	**02,** 1172.
1905,	20,000,	**05,** 1256.
Total,	50,000	

COMMERCE.
C., 1906, did not need add'l work at that time, **06,** 291.

CONTRACTS.
1905. P. S. Ross, dr., 17 and 20¢ c. y., **05,** 1256. P. S. Ross, dr., 17 and 20¢ c. y., **06,** 1184.

ENGINEERS.
Chief of Engineers. **R., 02,** 249; **03,** 255; **04,** 259; **05,** 268; **06,** 290.

In charge (see Mosquito Creek):
Capt. J. C. Sanford, 1902. **R., 02,** 1171.
Capt. G. P. Howell, 1903–06. **R., 03,** 1138; **04,** 1563; **05,** 1255; **06,** 1184.

OPERATIONS.
1904–05. 67,906 c. y. dr., **05,** 1255.
1905–06. 153,213 c. y. dr., **06,** 1184.

PHYSICAL DATA.
Waterway a series of creeks, sounds, bays, etc., with 6′ except in Wappoo Cut, Church Flats, Mosquito Creek, and Brickyard Creek.
Description of, **06,** 290.

PROJECT.
For canal connecting South Edisto and Ashepoo Rs. at or near Fenwicks Isld. to avoid difficult passage through Mosquito Creek; est., $61,600,[4] plan of Col. Gillmore, **02,** 250.
Cong. docs., etc., relating to exs., surs., plans, etc., **06,** 291.

[1] S. Doc. 350, 62d, 2d.
[2] H. D. 288, 62d, 2d.
[3] Including Wappoo Cut in 1906.
[4] H. E. D. 117, 50th, 1st.

N–204(b) ORANGEBURG TO CHARLESTON, S. C. (Waterways.)

ENGINEERS.
Chief of Engineers. **R., 12,** 484.
In charge. Maj. G. P. Howell, **12,** 463.

SURVEY.
Pre. ex. and sur. au. act June 25, 1910, of waterways from Orangeburg to Charleston, S. C., including cut-off or canal from Edisto R. to Ashley R., with view to providing a more direct route between said cities than that afforded by existing chans., **12,** 484.

N–205 COOPER RIVER, S. C.

ENGINEERS.
Chief of Engineers. **R., 10,** 379.
In charge. Capt. E. M. Adams, 1910, **10,** 361.

PROJECT.
Capt. Adams proposed, 1910, imp. for naval purposes up to naval station; est., $175,000,[1] **10,** 379.

SURVEY.
Au. act Mar. 3, 1909; made, 1909–10, by Capt. Adams,[1] **10,** 379.
Maps.[1]

N–206 SHIPYARD RIVER (Creek), S. C.

COMMERCE.
Details.[2]

ENGINEERS.
Chief of Engineers. **R., 08,** 323.
In charge. Capt. G. P. Howell, **08,** 306.

PHYSICAL DATA.
Trib. to Cooper R., Charleston H.; details.[3]

SURVEY.
Pre. ex. au. act Mar. 2, 1907. **R.,** by Capt. Howell[3] (unfav.), **08,** 323.
Supplemental reports requested by sen. comm. on commerce by Capt. Adams, Apr. 27, 1910, concurred in by BERH., Apr. 3, 1911, recom. chan. 15′ x 100′, cost $5,000, to be deferred until local interests are willing to release U. S. from all claims for damage.[2]
Map.[3]

N–207 SHEM RIVER, S. C.

ENGINEERS.
Chief of Engineers. **R., 08,** 323.

In charge:
Capt. G. P. Howell, **08,** 306.
Capt. E. R. Stuart, **08,** 306.

PHYSICAL DATA.
Shem R. or Cr. flows around n. side of village of Mt. Pleasant into Hog Isld. chan., or into Cooper R., in vicinity of Charleston.[4]

SURVEY.
Ex. and sur. au. act Mar. 2, 1907. **R.** by Capts. Howell and Stuart[4] (unfav.), **08,** 323.

N–214 ASHLEY RIVER, S. C.

APPROPRIATIONS.

1880,	$1,000,	**80,** 933.
1881,	1,500,	**81,** 1068.
1884,	2,000,	**84,** 1098.
1886,	1,000,	**86,** 1082.
Total,	5,500	

COMMERCE.
Local, **73,** 756.
C. of the R., **88,** 984.
1892–93, 465,000 t., **93,** 1512; 1893–94, 525,000 t., **94,** 1115.
Details, 1900, 400,000+ t., **01,** 1622.

CONTRACTS.
1882. Charleston Dredging Co., dr., 17¢ c. y., **82,** 1140.
1885. Ross & Sanford, dr., 20¢ c. y., **86,** 1082.

ENGINEERS.
Chief of Engineers. **R., 73,** 70; **80,** 127; **81,** 170; **82,** 166; **83,** 175; **84,** 182; **85,** 180; **86,** 179; **87,** 142; **88,** 136; **89,** 151; **90,** 136; **91,** 176; **92,** 174; **93,** 188; **94,** 172; **95,** 197; **99,** 292; **01,** 324, 1619.

In charge:
Lt. Col. Q. A. Gillmore, 1873–87, **73,** 70. **R., 73,** 756; **80,** 932; **81,** 1067; **82,** 1138; **83,** 892; **84,** 1097; **85,** 1188; **86,** 1080; **87,** 1141.
Capt. F. V. Abbot, 1888–95. **R., 88,** 983; **89,** 1166; **90,** 1205; **91,** 1476; **92,** 1229; **93,** 1512; **94,** 1114; **95,** 1433.
Capt. J. C. Sanford, 1901. **R., 01,** 1620, 1623.

Assistants:
Capt. B. D. Greene. **R., 81,** 1068; **82,** 1140.
Lt. F. V. Abbot. **R., 85,** 1190.
J. P. Allen. **R., 93,** 1513; **01,** 1625.

[1] H. D. 947, 61st, 2d. [2] S. D. 350, 62d, 2d. [3] H. D. 452, 60th, 1st. [4] H. D. 224, 60th, 1st.

ESTIMATES. (See Projects.)

By Maj. Gillmore, for dr. 25,000 c. y., $10,000, **73,** 756.

OPERATIONS.

1881-82. No previous operations; 13,558 c. y. dr., opening a chan. across the shoal at the Wando Phosphate Works 11′ x 100′, **82,** 1139.

1885-86. 8,566 c. y. dr. from shoal near Stono Phosphate Works in the formation of chan. 11′ x 210′ m. l. w., **86,** 1081.

1886-87. Available funds held until condition of imp. chan. requires further expend., **87,** 142, 1141.

1892-93. 4,001 c. y. dr., and the proj. completed, **93,** 1512.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 756; **01,** 1620.

PROJECTS. (See Estimates.)

By Lt. Col. Gillmore, 1873, dr. chan. 11′ d. m. l. w. across shoals of Accabee and the Wando Phosphate Works; est., $16,000, **73,** 756; **86,** 179; **87,** 1141.

By Capt. Sanford, 1900, dr. chan., various d. and w., Charleston H. to Ashley phosphate wharf; and clearing snags from chan., Gregg Mine to Bacons Br.; est., $264,396.29, **01,** 1623.

SURVEYS.

Sur. completed, 1873, **73,** 70, 756.

Stadia sur. of upper R., **88,** 983.

Ex. and sur., Charleston H. to Bacons Br., au. act June 6, 1900; made, 1900, by Capt. Sanford,[1] **01,** 1619, 1626.

Supple. **R.** requested by R. and H. comm. **R.** by BERH., Feb. 12, 1912.

Recom. imp. Standard Wharf to mouth, chan. 20′ x 240′; cost, $51,150.[2]

N–215 WAPPOO CUT, S. C.

APPROPRIATIONS.

1881,	$10,000,	**81,** 1070.
1882,	10,000,	**82,** 1142.
1884,	3,000,	**84,** 1092.
1886,	5,000,	**86,** 1079.
1888,	5,000,	**88,** 982.
1890,	10,000,	**90,** 1228.
1892,	10,000,	**92,** 1232.
1894,	7,000,	**95,** 1435.
1896,	2,500,	**96,** 1206.
1902,	8,000,	**02,** 1171.
1905,	*2,500,	**10,** 1457.
Total,	73,000	

COMMERCE.

C. importance of the cut, **88,** 981.

In 1892–93, 141,000 t., **93,** 1514; 1893–94, 242,000 t., **94,** 1116; 1894–95, 238,350 t., **95,** 1435; 1895–96, 250,230 t., **96,** 1205.

CONTRACTS.

1882. Charleston Dredging Co., dr., 16, 18, and 20¢ c. y., according to distance to which material removed, **83,** 886.

1885. Ross & Sanford, dr., 17, 19, and 21¢ c. y., according to distance to which material removed, **86,** 1079.

1888. A. M. Bangs, revetting banks, $3,274, **89,** 1198.

1890. T. Young, dr., 24¢ c. y., **91,** 1479.

1892. T. Young, dr., 23¢ c. y.; placing st. on bank and in dam, $3.10 c. y.; mattresses in place, $1.10 s. y. ($13,560), **93,** 1515.

1894-95. I. H. Hathaway & Co., revetting banks, **95,** 1436.

1897. Morris & Cummings Dredging Co., dr., 12¢ c. y., **97,** 1480.

1904. P. S. Ross, dr., 22¢ c. y., **05,** 1254.

1910. Simons-Mayrant Co., dr., 19½¢ c. y., **10,** 1457.

ENGINEERS.

Chief of Engineers. **R., 80,** 132; **81,** 171; **82,** 166; **83,** 173; **84,** 180; **85,** 179; **86,** 178; **87,** 141; **88,** 135; **89,** 156; **90,** 140; **91,** 176; **92,** 174; **93,** 188; **94,** 173; **95,** 197; **96,** 176; **97,** 223; **98,** 220; **99,** 253; **00,** 289; **01,** 322; **02,** 249; **03,** 255; **04,** 258; **05,** 267; **10,** 376.

In charge:

Col. Q. A. Gillmore, 1880–87. **R., 81,** 1069, 1070; **82,** 1140; **83,** 884; **84,** 1089; **85,** 1186; **86,** 1077; **87,** 1138.

Capt. F. V. Abbot, 1888–97. **R., 88,** 980; **89,** 1196; **90,** 1227; **91,** 1477; **92,** 1231; **93,** 1514; **94,** 1116; **95,** 1434; **96,** 1205; **97,** 1479.

Maj. E. H. Ruffner, 1898–99. **R., 98,** 1286; **99,** 1546.

Capt. J. C. Sanford, 1900–02. **R., 00,** 1872; **01,** 1603; **02,** 1171.

Capt. G. P. Howell, 1903–05. **R., 03,** 1138; **04,** 1562; **05,** 1254.

Capt. E. M. Adams, 1910–. **R., 10,** 1457.

Assistants:

Capt. B. D. Green. **R., 81,** 1070.

Capt. J. C. Post. **R., 81,** 1072.

Lt. T. N. Bailey. **R., 83,** 886; **84,** 1092.

Lt. F. V. Abbot. **R., 85,** 1188; **86,** 1080.

J. P. Allen. **R., 90,** 1228; **91,** 1479; **93,** 1516; **94,** 1117; **95,** 1436; **96,** 1206; **97,** 1482.

OPERATIONS.

1882-83. 91,210 c. y. dr. from chan. in Elliots Cut, **83,** 887.

1883-84. 10,746 c. y. dr. from Wappoo and Elliots Cut; 44 snags removed from various points in chan., **84,** 1090.

1885-86. Resur. made and 15,000 c. y. dr., **86,** 1078.

1887-88. 20,195 c. y. dr. from Elliot and Marsh Cuts, **88,** 981.

1888-89. 1,300 l. f. of bank of Elliots Cut graded and covered with st., **89,** 1197.

1890-91. 33,514 c. y. dr., 21 trees and stumps and 8 cords of brush removed from bank at Elliots Cut, **91,** 1479.

1892-93. Brush and st. dam 220′ l. built, 800 l. f. bank revetted with st., and 460 l. f. bank protected at the foot of the slope; 13,083 c. y. dr., **93,** 1516.

1894-95. 32,412 c. y. dr., and 2,050 c. y. st. used in revetting, **95,** 1436.

1896-97. 11,909 c. y. dr., **97,** 1482.

1897-98. 472 s. t. of riprap st. used in revetting, **98,** 1287.

1900-01. 2,770 c. y. dr., **01,** 1603.

1904-05. 31,574 c. y. dr., **05,** 1254.

1909-10. 10,871 c. y. dr., **10,** 377.

PHYSICAL DATA.

Narrow, tortuous tidal stream connecting Ashley and Stono Rs., and forms portion of only inland route for navigation bet. Charleston H. and country s. of it; details, **81,** 1070.

PROJECTS.

By Col. Gillmore, 1880, imp. of Wappoo Cut by excavation of a chan. 6′ x 90′ l. w. from the d. w. of the Ashley to that of the Stono R.; also for 1,600 l. f. of j. constr. at either end of the proposed chan. and 700 l. f. of bulkhead to close tidal branch; est., $34,000, **81,** 1073. Increased $4,000 in 1885, **85,** 1187; **87,** 1138, 1139.

[1] H. D. 115, 56th, 2d. [2] R. and H. Comm. Doc. 4, 62d, 2d. *Allotment.

Proj. revised, 1888, as follows: To secure a chan. w. of 60′ bet. l.-w. lines, building 2 training walls at the Stono R. entrance, revetting with st. both banks of Elliots Cut, making a cut through the marsh just e. of Elliots Cut, and constr. 2 closing dams, building a slight dam near the w. end of Marsh Cut, making a cut 7′ x 200′ m. l. w. across Ashley R. Bar; total est., incl. work already done, $88,000, **89,** 1196; **91,** 1477, 1478.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **81,** 1070.

Sur. and ex. made, 1894–97, by Capt. Abbot, **94,** 1117; **95,** 1436; **96,** 1206; **97,** 1482.

Of imp. portions and entrances, **01,** 1603; **03,** 1138.

Maps. **81,** 1072; **84,** 1090; **91,** 1479; **94,** 1118.

N–216 STONO RIVER, S. C.

APPROPRIATION.

1872, unexpend. balance of app. for Town Creek reapp. by act June 10, 1872, $2,845.74, **73,** 68, 733.

CONTRACT.

1872. J. Griffin, removing obstr., $2,243.95, **73,** 732.

ENGINEERS.

Chief of Engineers. R., 73, 68.

In charge. Maj. Q. A. Gillmore. **R., 73,** 732.

OPERATIONS.

1872-73. Removing 3 wooden vessels and 500 t. of sunken logs between Charleston and Port Royal, **73,** 68, 732.

N–216(b) TOWN CREEK, COOPER R, AND STONO RIVER, NEAR CHARLESTON, S. C. (Removing obstructions.)

APPROPRIATION.

1871, $7,500, **71,** 70.

OPERATIONS.

1870-71. Wrecks removed to 9′ water, costing $4,654.26, **71,** 70.

N–219 EDISTO RIVER, S. C.

Part.	Title.	Period.	Appropriations.
a	Edisto River	1880–1906	$33,785
b	North Fork	1888–1908	.....
c	North and South Forks	1889	.....
d	South Fork	1908–1912	.....

Part (a), N–219 Edisto River, S. C.

APPROPRIATIONS.

1882,	$8,000,	**83,** 889.
1884,	5,000,	**84,** 1094.
1886,	3,000,	**86,** 1084.
1888,	5,000,	**88,** 987.
1890,	5,000,	**90,** 1208.
1892,	7,385,	**92,** 1234.
1905,	*400,	**06,** 1185.
Total,	33,785,	**06,** 1185.

In 1895–96 the money remaining, $282.35, was turned into the Treasury, it being apparent that no further imp. was advisable, **96,** 1207.

COMMERCE.

C. materially benefited, **86,** 1084; prospects, **88,** 986; prospective development of timber interests, **89,** 1169.

In 1892–93 the freight carried on the R. amounted to 129,125 t., **93,** 1518; in 1893–94, to 120,870 t., **94,** 1120; in 1894–95, to 177,000 t., **95,** 1438.

Never any, except lumber; considerable C. in prospect, **04,** 1589.

Description of, **04,** 1591.

ENGINEERS.

Chief of Engineers. R., 80, 132; **81,** 179; **83,** 174; **84,** 180; **85,** 181, 191; **86,** 179; **87,** 143, 154; **88,** 136; **89,** 152; **90,** 136; **91,** 177; **92,** 174; **93,** 189; **94,** 173; **95,** 197; **96,** 176; **04,** 261, 1585; **06,** 292.

Boards. BERH. **R., 04,** 1588.

In charge:

Col. Q. A. Gillmore, 1880–87. **R., 81,** 1138; **83,** 887; **84,** 1092; **85,** 1190; **86,** 1082; **87,** 1143.

Capt. F. V. Abbot, 1888–96. **R., 88,** 985; **89,** 1169, 2795; **90,** 1206; **91,** 1480; **92,** 1233; **93,** 1517; **94,** 1119; **95,** 1438; **96,** 1207.

Capt. J. C. Sanford. **R., 04,** 1586.

Capt. G. P. Howell, 1906. **R., 06,** 1185.

Assistants:

Capt. J. C. Post. **R., 81,** 1140.

Capt. T. N. Bailey. **R., 83,** 889; **84,** 1094.

Lt. F. V. Abbot. **R., 85,** 1192; **87,** 1145.

J. P. Allen. **R., 89,** 1170; **90,** 1208; **91,** 1481; **92,** 1234; **93,** 1519; **04,** 1589.

J. D. Ackerman. **R., 04,** 1590, 1591.

*Allotment.

OBSTRUCTIONS.

Brs. obstr. navigation, **89,** 2795.

Efforts made, 1893, to obtain evidence against persons in the habit of throwing tops of trees into the R., **93,** 1521.

OPERATIONS.

1882-83. 77 snags, 124 piles, and 248 overhanging trees removed, **83,** 889.

1883-84. 40 piles, 57 snags, and 101 overhanging trees removed, **84,** 1093.

1884-85. 5,798 overhanging trees cut down, 4.942 snags removed, and banks trimmed, **85,** 1191.

1886-87. 5,131 trees, logs, stumps, and snags removed, 5 outlets closed, and 1 cut-off cleared, **87,** 1144, 1145.

1888-89. 1,815 trees and stumps and 87 cords of snags removed from the chan., and 1,041 trees and 212 cords of brush cut from the banks, **89,** 1169.

1889-90. 1,896 logs and trees and 106 cords of snags removed from the chan., and 1,425 trees removed from the banks, **90,** 1208.

1890-91. 666 stumps and snags cleared from the chan. on the North Fork, and 1,298 snags and 485 trees from the chan. and banks of the South Fork, **91,** 1482.

1891-92. 2,341 snags and 47 cords of small snags removed from the chan., and 1,733 trees and 378 cords of brush cleared from the banks, **92,** 1234.

1892-93. About 12,000 stumps and other obstrs. removed from the chan. and banks, and incidental work due to mainten. performed, **93,** 1519.

1905-06. Worst obstrs. removed, **06,** 1185.

PHYSICAL CHARACTERISTICS.

Description, **81,** 1138, 1141; **04,** 1586, 1589.

PROJECTS.

By Col. Gillmore, 1880, enlarging and clearing chan., forming new chans. across necks and bends, shutting off lateral chans., and removing logs, snags, and pile obstrs.; also removing sand and dry shoals, and constr. deflecting j.; est., $33,385, **81,** 1140; **86,** 180; **87,** 1143; **92,** 1233.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **81,** 1138.

Col. Gillmore charged by act July 5, 1884, with pre. ex. of North Fork of Edisto R. in counties of Orangeburg and Lexington, **85,** 191.

Ex. of North Fork of Edisto R. au. act Aug. 5, 1886, **87,** 154.

Ex. mouth to Aiken and Edgefield line, au. act June 13, 1902; made, 1903, by Capt. Sanford (**R.** unfav.),[1] **04,** 1585.

Part (b), N–219 Edisto River, S. C., North Fork.

ENGINEERS.

Chief of Engineers. **R.,** **88,** 138; **08,** 323.

In charge.
Capt. F. V. Abbot, 888. **R.,** **188,** 991.
Maj. G. P. Howell. **R.,** **08,** 323.

Assistants:
Capt. T. N. Bailey. **R.,** **88,** 993.
Lt. O. M. Carter. **R.,** **88,** 993.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 992, 993.

SURVEYS.

Ex. au. act July 5, 1884; made, 1884, by Col. Gillmore (**R.** unfav.), **88,** 991.

Ex., mouth to Orangeburg, au. act Mar. 2, 1907; made, 1907, by Capt. Howell (**R.** unfav.),[2] **08,** 323.

Part (c), N–219 Edisto River, S. C., North and South Forks.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 158.

In charge. Capt. F. V. Abbot, 1888. **R.,** **89,** 1208.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1208.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Abbot (**R.** unfav.), **89,** 1208.

Part (d), N–219 Edisto River, S. C., South Fork.

ENGINEERS.

Chief of Engineers. **R.,** **08,** 323; **12,** 484.

In charge:
Capt. G. P. Howell, **08,** 306; (Maj.) **12,** 463.
Col. Dan C. Kingman, **12,** 463.

PROJECT.

Capt. Howell, 1907, recom. snagging in connection with other streams in vicinity,[3] **08,** 323.

SURVEY.

Ex., mouth to Scotts Br., au. act Mar. 2, 1907; made, 1907, by Capt. Howell,[3] **08,** 323.

Pre. ex. au. act June 25, 1910, to Guignards Landing, S. C. (**R.** to come), **12,** 484.

[1] H. D. 173, 58th, 2d. [2] H. D. 515, 60th, 1st. [3] H. D. 516, 60th, 1st.

N-243 MOSQUITO CREEK, S. C. (South Edisto to Ashepoo Rivers.)

ENGINEERS.

Chief of Engineers. **R., 87,** 154; **88,** 138.
In charge. Col. Q. A. Gillmore, 1888. **R., 88,** 997, 999.
Assistant. Lt. F. V. Abbot. **R., 88,** 1001.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 997.
Connects S. Edisto R. with Ashepoo R. near their mouths; tortuous tidal stream; n. portion known as "Little Mosquito," and s. portion "Big Mosquito"; forms part of inland waterway bet. Charleston, S. C. and Fernandina, Fla., **88,** 997.

PLANS.

By Col. Gillmore, 1888, dr. Little Mosquito Creek, and making a cut at Fenwicks Isld., both 7′ at m. l. w. and 90′ w. at bottom, the object being to connect the South Edisto and the Ashepoo Rs.; est., $61,600, **88,** 1000.

SURVEYS.

Au. act Aug. 5, 1886; made, 1888, by Col. Gillmore, **88,** 999.
Maps. **88,** 1003.

N-244 ASHEPOO RIVER, S. C.

APPROPRIATION.

1872, $1,300, **73,** 69.

CONTRACT.

1872. With J. Griffin, removing obstr., **73,** 733.

ENGINEERS.

Chief of Engineers. **R., 73,** 69.
In charge. Maj. Q. A. Gillmore, **73,** 69. **R., 73,** 733.

OPERATIONS.

1872–73. Small schooner and a large quantity of logs and piles removed, to give l.-w. d. of 10′, **73,** 69, 733.

PROJECTS.

Removal of obstr. placed in the chan. during Civil War, **73,** 733.

N-244(b) ASHEPOO RIVER, S. C. (Below the Charleston and Savannah Railroad Bridge.)

ENGINEERS.

Chief of Engineers. **R., 89,** 158.
In charge. Capt. F. V. Abbot, 1889. **R., 89,** 1216, 2796.

OBSTRUCTIONS.

Br. obstr. navigation, **89,** 2796.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Abbot (**R.** unfav.), **89,** 1216.

N-248 COMBAHEE RIVER, S. C.

ENGINEERS.

Chief of Engineers. **R., 89,** 158.
In charge. Capt. F. V. Abbot. **R., 89,** 1211.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1211.

SURVEY.

Ex. to determine whether the breaking of Bull R. into Combahee R., near the head of Bull R., would injure the navigation of Combahee R. au. act Aug. 11, 1888; made, 1888, by Capt. Abbot, **89,** 1211.

N-255 SALKEHATCHIE RIVER, S. C.

APPROPRIATIONS.

1882,	$5,000,	**83,** 891.
1884,	3,000,	**84,** 1096.
1886,	2,000,	**86,** 1086.
1888,	3,000,	**88,** 989.
1890,	5,000,	**90,** 1210.
Total,	18,000	

In 1896 the balance on hand, $2,159.27, was returned to the Treasury, as there was no apparent use for further expend., **96,** 1208.

COMMERCE.

Value of timber shipment, **84,** 1096.
Freight rates on lumber reduced, **86,** 1086.
C. of the R., **88,** 989.
In 1892–93 the amount of freight moved on the R. was 16,000 t., **93,** 1522.

ENGINEERS.

Chief of Engineers. **R., 80,** 132; **81,** 179; **83,** 174; **84,** 181; **85,** 182; **86,** 180; **87,** 144; **88,** 137; **89,** 152; **90,** 137; **91,** 178; **92,** 175; **93,** 189; **94,** 173; **95,** 197; **96,** 176; **12,** 483.

In charge:
Col. Q. A. Gillmore, 1880–87. **R., 81,** 1143; **83,** 890; **84,** 1094; **85,** 1192; **86,** 1084; **87,** 1146.
Capt. F. V. Abbot, 1888–96. **R., 88,** 987; **89,** 1171; **90,** 1209; **91,** 1482; **92,** 1235; **93,** 1522; **94,** 1121; **95,** 1440; **96,** 1208.
Capt. E. M. Adams, **R., 12,** 483.

Assistants:
Capt. J. C. Post. **R., 81,** 1146.
Capt. T. N. Bailey. **R., 83,** 891; **84,** 1097.
Lt. F. V. Abbot. **R., 85,** 1195; **87,** 1148.
J. P. Allen. **R., 89,** 1173; **90,** 1210; **91,** 1484; **93,** 1523; **94,** 1122; **95,** 1441.

OPERATIONS.

1883-84. 1,810 snags, roots, trees, and similar obstr. removed from chan., **83,** 891; **84,** 1095.
1884-85. 9,490 snags, stumps, and overhanging trees removed, 100 outlets closed, and 2 shoals removed, **85,** 1194.
1886-87. 600 overhanging trees removed, one dam built to remove local shoal, and 29 outlets closed, **87,** 1147, 1149.
1888-89. 201 snags and logs removed from R. chan., and 249 trees and 14 cords of brush removed from the banks, **89,** 1172.
1889-90. 277 trees and logs removed from chan., and 37 trees and 4 cords brush cut from the banks, **90,** 1211.
1890-91. 83 logs and snags removed from chan., and 66 trees and 10 cords of brush cleared from the banks, **91,** 1484.
1891-92. Imp. reported as meeting the requirements of existing C., **92,** 1236.
1892-93. About 300 snags and other obstr. removed from R. and banks, **93,** 1523.
1893-94. About 700 snags and other obstr. removed, **94,** 1123.
1894-95. About 200 snags and other obstr. removed, **95,** 1442.

PHYSICAL CHARACTERISTICS.

Description; 2 rivers named Salkehatchie—the Big S. and the Little S. They unite at a point 80 m. from seacoast; 24 m. below their junction the name of the stream changes to Combahee. R. discharges into St. Helena Sound bet. Charleston and Savannah, **81,** 1143.

PROJECTS.

By Col. Gillmore, 1880, imp. of the R. by removal of pile obstr. at Hickory Hill, and removal of logs and shoals for a distance of 65 m. to render the R. navigable for rafts and flatboats; est., $18,000, **81,** 1144; **87,** 1146; **92,** 1235.

SURVEYS.

Ex. au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **81,** 1143.
Ex. made by Capt. Abbot, 1893, **93,** 1522.
Pre. ex. to Morris Crossing, S. C., au. act June 25, 1910. **R.** by Capt. Adams, Jan. 12, 1911[1] (unfav.), **12,** 483.

N–258 PORT ROYAL BAR, S. C.

COMMERCE.

1901, 148,547 t.; less in "next few years" due to decline of phosphate industry; Charleston H. in neighborhood, with ample facilities and d. for the demands of the Navy, **04,** 1613.

ENGINEERS.

Chief of Engineers. R., 04, 262.

Boards. BERH. concurs in views of local officer as to undesirability of any imp., **04,** 1613.
In charge. Capt. G. P. Howell, 1904. **R., 04,** 1609.

SURVEY.

Pre. ex. au. act June 13, 1902, view to chan. 25′ x 500′. **R.,** Capt. J. C. Sanford, Apr. 7, 1903[2] (unfav.), **04,** 1609.

N–259 BEAUFORT (Port Royal R.) RIVER, S. C.

APPROPRIATIONS.

1890,	$12,500,	**91,** 1486.
1892,	12,500,	**92,** 1239.
1894,	5,000,	**95,** 1444.
1896,	1,000,	**96,** 1209.
1902,	2,000,	**02,** 1172.
Total,	33,000	

COMMERCE.

In 1892–93, 250,000 t., **93,** 1525; 1893–94, 215,000 t., **94,** 1125; 1894–95, 193,985 t., **95,** 1444; 1895–96, 174,300 t., **96,** 1209; 1904, 8,000 t., **05,** 1257.
Value, 1891, $303,000, **02,** 251.
Principally phosphate rock; decreased greatly since 1896, **04,** 1567.

CONTRACTS.

1890. T. Young, dr., 25¢, and r. excavation, $3 c. y., **91,** 1486.
1892. P. S. Ross, dr., 25 to 34¢ c. y.; r. removal. $2.95 or $3.70 c. y. ($23,600), **93,** 1526.
1904. P. Sanford Ross, dr., 22¢ c. y., **05,** 1257.

ENGINEERS.

Chief of Engineers. R., 80, 132; **89,** 158; **90,** 141; **91,** 178; **92,** 175; **93,** 189; **94,** 174; **95,** 198; **96,** 176; **97,** 224; **98,** 220; **99,** 254; **00,** 289; **01,** 323; **02,** 250; **03,** 256; **04,** 260, 1565; **05,** 269.

Boards. R. on pre. ex. of R. from mouth to Beaufort, **04,** 1568.

In charge:
Lt. Col. Q. A. Gillmore, 1880. **R., 80,** 1032.
Capt. F. V. Abbot, 1889–97. **R., 90,** 1234; **91,** 1485; **92,** 1238; **93,** 1524; **94,** 1125; **95,** 1443; **96,** 1208; **97,** 1482.
Maj. E. H. Ruffner, 1898–99. **R., 98,** 1288; **99,** 1548.
Capt. J. C. Sanford, 1900–02. **R., 00,** 1873; **01** 1604; **02,** 1172.
Capt. G. P. Howell, 1903–05. **R., 03,** 1139; **04,** 1563; **05,** 1256.

Assistants:
G. Daubeney. **R., 80,** 1034.
J. P. Allen. **R., 91,** 1486; **92,** 1239; **93,** 1526; **97,** 1487.
W. D. Niles. **R., 94,** 1127; **95,** 1446; **96,** 1210.

OPERATIONS.

1890-91. 3,754 c. y. dr., **91,** 1486.
1891-92. 28,512 c. y. dr., **92,** 1238.
1892-93. 36,362 c. y. dr., and 1,339 c. y. r. removed, **93,** 1526–7.
1896-97. 3,732 c. y. dr., **97,** 1487.
1904-05. 7,625 c. y. dr.; proj. completed, **05,** 1256.

[1] H. D. 457, 62d, 2d.
[2] H. D. 221, 58th 2d.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1234; **01,** 323.

Considerable deterioration, 1902, of work already done, **02,** 250.

PLANS. (See Projects.)

By Lt. Col. Gillmore, 1880: 1. For dr., Beaufort and at Fort Charlotte, so that a draft of 14′ could be carried from Port Royal Sound to Beaufort, $9,900. 2. For imp. only chan. at Fort Charlotte to 14′ x 200′, $5,100. 3. For imp. chan. at Fort Charlotte to 13′ x 200′, $1,800, **80,** 1033, 1034.

By Capt. Abbot, 1889, to secure 15′ chan. 300′ w. from Beaufort to the ocean, by excavation at Beaufort Shoal, and at shoal near Sea Isld. Chemical Works; est., $116,000, **90,** 1236.

PRIVATE WORK.

Dr. material which had been illegally dumped by contractor, 1899, removed by him, **00,** 1873; **01,** 1604.

PROJECTS.

By Capt. Abbot, imp. of R. at the "Brickyard" near Coosaw mouth, by excavation of a 7′ l.-w. chan. 200′ w.; est., $25,000, **90,** 1236, 1237.

Au. obtained by Capt. Abbot, 1892–93, to increase est. for completion of the proj. by $15,000; due to the discovery of a large amount of r., **93,** 1525, 1529.

Capt. Sanford, 1903, did not consider advisable any further imp., except marking chan. at Cane Shoal,[1] **04,** 1567.

Proj. regarded as completed, **05,** 1256.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 100; made, 1880, by Lt. Col. Gillmore, **80,** 1032.

Au. act Aug. 11, 1888; made, 1889, by Capt. Abbot, **90,** 1235.

Ex. and sur. made, 1900, by Capt. Sanford, **00,** 1873.

Ex., mouth to Beaufort, au. act June 13, 1902; made, 1903, by Capt. Sanford,[1] **04,** 1566.

Of Brickyard Creek, **04,** 1563.

Cong. docs., etc., relating to exs., surs., etc., **02,** 250; **03,** 256; **04,** 260.

N-260 ARCHERS CREEK, S. C.

APPROPRIATIONS.

1912, $25,000, **12,** 1809.

ENGINEERS.

Chief of Engineers. R., 12, 482, 483.
In charge. Maj. G. P. Howell. **R., 12,** 1809.

PHYSICAL CHARACTERISTICS.

Narrow tidal passage bet. Port Royal Isld. and Paris Isld., S. C., connecting Beaufort R. with Broad R., 3 m. long, all covered by proj.; depth, 1.6′, **12,** 482.

PROJECTS.

Act July 25, 1912, au. chan. 6′ x 75′ m. l. w.; est., $25,000,[2] **12,** 483.

SURVEYS.

Ex. au. act June 25, 1910; made by Capt. E. M. Adams. **Rs.,** 1910 and 1911; Maj. Howell submitted supple. **R.** Jan. 5, 1912; plan for imp. submitted; est., $25,000,[2] **12,** 483.

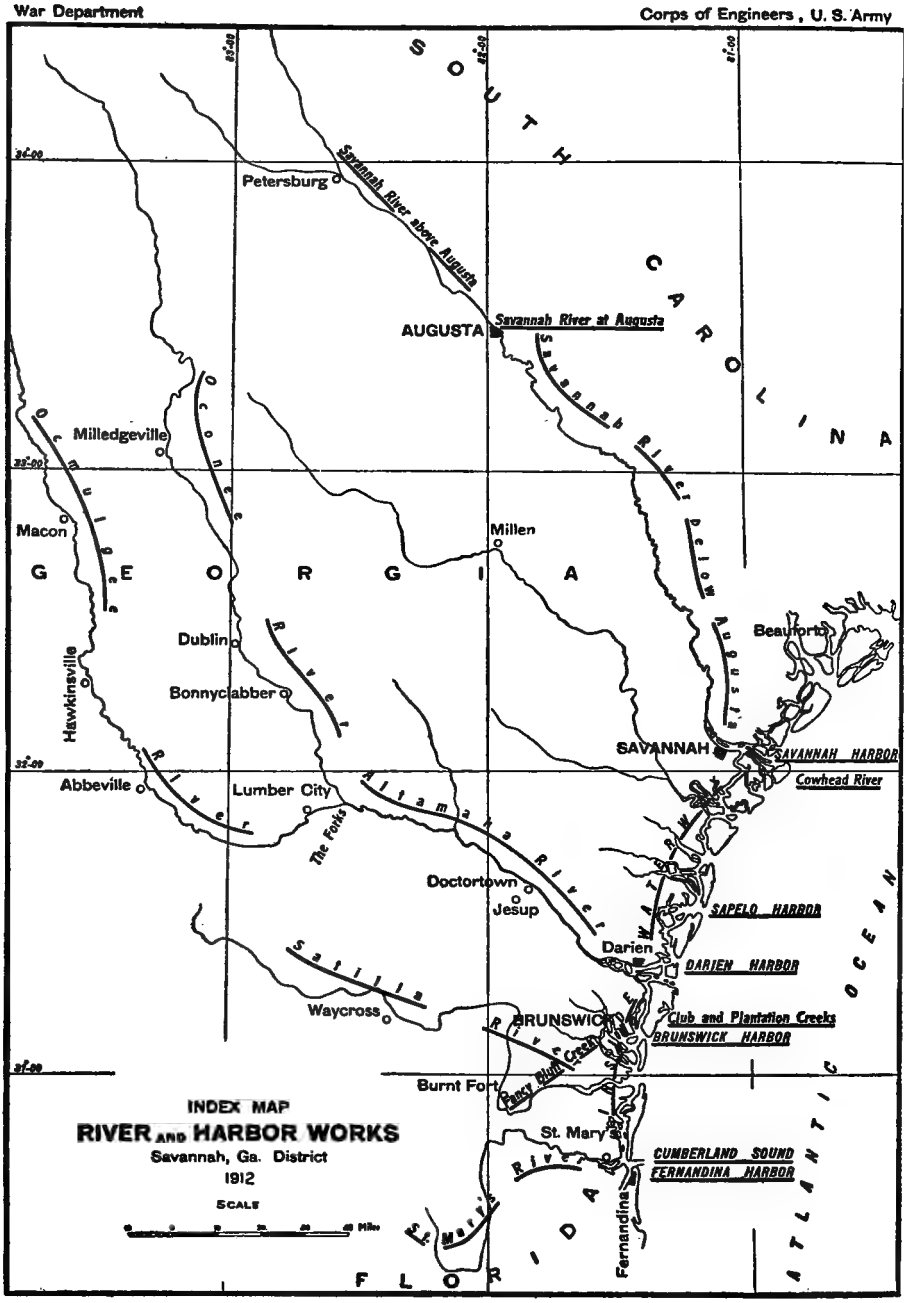
Maps.[2]

[1] H. D. 199, 58th, 2d.

[2] H. D. 513, 62d, 2d.

RIVER AND HARBOR WORKS—SOUTH ATLANTIC.

O.—SAVANNAH, GA., DISTRICT.


War Department
Corps of Engineers, U. S. Army
SOUTH CAROLINA
GEORGIA
FLORIDA
ATLANTIC OCEAN
Petersburg
Savannah River above Augusta
AUGUSTA
Savannah River at Augusta
Savannah River below Augusta
Milledgeville
Macon
Ocmulgee
Oconee
Millen
Dublin
Bonnyclabber
Hawkinsville
Ocmulgee River
Abbeville
Lumber City
The Forks
Altamaha River
Doctortown
Jesup
Beaufort
SAVANNAH
SAVANNAH HARBOR
Cowhead River
SAPELO HARBOR
Darien
DARIEN HARBOR
Saltilla
Waycross
BRUNSWICK
Club and Plantation Creeks
BRUNSWICK HARBOR
Fancy Bluff Creek
Burnt Fort
St. Mary's
CUMBERLAND SOUND
FERNANDINA HARBOR
St. Mary's River
Fernandina
INDEX MAP
RIVER AND HARBOR WORKS
Savannah, Ga. District
1912
SCALE
Miles

O.—SAVANNAH, GA., DISTRICT.

In charge of U. S. Engineer Office,
Savannah, Ga.

O 1 Atlantic Ocean.
O 2 Savannah R. & H., Ga. (1)
O 3 Wrights R., S. C. (2)
O 4 Walls Cut, S. C. (3)
O 5 Mud R., S. C. (2)
O 6 Back R., S. C. (2)
O 7 Upper Three Runs (2)
O 8 Big Horse Cr., S. C. (2)
O 9 Stevens Cr., S. C. (2)
O 10 Little R., S. C. (2)
O 11 Rocky R., S. C. (2)
O 12 Seneca R., S. C. (2)
O 13 Tugaloo R., Ga. (2)
O 14 Chauga R., S. C. (13)
O 15 North Fork, S. C. (14)
O 16 West Fork, S. C. (14)
O 17 War Woman, S. C. (14)
O 18 Stekoa Cr., S. C. (14)
O 19 Chattooga R., Ga. and S. C. (13)
O 20 Tallulah R., Ga. (19)
O 21 Toccoa Cr., Ga. (13)
O 22 Rock Cr., Ga. (13)
O 23 Shoal Cr., Ga. (13)
O 24 Light-wood Log Cr., Ga. (2)
O 25 Big Cedar Cr., Ga. (2)
O 26 Coldwater Cr., Ga. (2)
O 27 Mores Cr., Ga. (26)
O 28 Van Cr., Ga. (2)
O 29 Beaver Dam Cr., Ga. (2)
O 30 Broad R., Ga. (2)
O 31 Falling Cr., Ga. (30)
O 32 North Fork, Ga. (30)
O 33 Noal Cr., Ga. (30)
O 34 Unnamed, Ga. (30)
O 35 Millstone Cr., Ga. (30)
O 36 Macks Cr., Ga. (30)
O 37 Chickasaw Cr., Ga. (30)
O 38 Pistol Cr., Ga. (2)
O 39 Fishing Cr., Ga. (2)
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O 43 Grays Cr., Ga. (41)
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O 45 Diamond Fork, Ga. (41)
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O 47 Uptons Cr., Ga. (right) (41)
O 48 Germany Cr., Ga. (41)
O 49 Klo Kee Cr., Ga. (2)
O 50 Little Klo Kee Cr., Ga. (2)
O 51 Jones Cr., Ga. (2)
O 52 Butlers Cr., Ga. (2)
O 53 Spirit Cr., Ga. (2)
O 54 Boggy Gut Cr., Ga. (2)
O 55 Jobbers Cr., Ga. (2)
O 56 Telfair Mill Cr., Ga. (2)
O 57 Sweet Water Cr., Ga. (2)
O 58 Rocky Cr., Ga. (2)
O 59 McDougalds Cr., Ga. (2)
O 60 Briar Cr., Ga. (2)
O 61 Sandy Run Cr., Ga. (60)
O 62 Boggy Cut, Ga. (60)
O 63 Sweet Water Cr., Ga. (60)
O 64 Reedy Cr., Ga. (60)
O 65 Brustley Cr., Ga. (60)
O 66 Beaver Dam Cr., Ga. (60)
O 67 Walnut R., Ga. (60)
O 68 Sandy Run, Ga. (60)
O 69 Rocky Cr., Ga. (60)
O 70 Boggy Gut Cr., Ga. (60)
O 71 Beaver Dam Cr., Ga. (60)
O 72 Buck Cr., Ga. (2)
O 73 Black Cr., Ga. (2)
O 74 Ebenezer Cr., Ga. (2)
O 75 Turkey Branch, Ga. (74)
O 76 Little Ebenezer, Ga. (74)
O 77 St. Augustine Cr., Ga. (2)
O 78 Habersham Cr., Ga. (77)
O 79 Wilmington R., Ga. (77)
O 80 Richardson Cr., Ga. (79)
O 81 Turners Cr., Ga. (79)
O 82 South Chan., Ga. (2)
O 83 Lazaretto Cr., Ga. (2)
O 84 Oyster Cr., Ga. (83)
O 85 Cowhead Cut, Ga. (83)
O 86 Warsaw Sound, Ga. (1)
O 87 Tybee R., Ga. (86)
O 88 Oyster Cr., Ga. (87)
O 89 Tybee Cr., Ga. (87)
O 90 Shad R., Ga. (87)
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O 101 Old Romerly Marsh, Ga. (79)
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O 105 Rhodes Cr., Ga. (103)
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O 107 Curtis Cr., Ga. (103)
O 108 Vernon R., Ga. (102)

O 109 Delegal Cr., Ga. (108)
O 110 Cornfield Cr., Ga. (108)
O 111 Hazlets Cr., Ga. (108)
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O 115 Back R., Ga. (112)
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O 117 Breakfast Cr., Ga. (108)
O 118 Hellgate, Ga. (108)
O 119 Friday Cr., Ga. (108)
O 120 Ogeechee R., Ga. (102)
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O 122 Charles Cr., Ga. (120)
O 123 Little Ogeechee R., Ga. (120)
O 124 Forrest R., Ga. (123)
O 125 Harveys Cr., Ga. (123)
O 126 Horse Cr., Ga. (120)
O 127 Bark Camp Cr., Ga. (120)
O 128 Bakers Cr., Ga. (120)
O 129 Spring Cr., Ga. (120)
O 130 Dry Cr., Ga. (120)
O 131 Big Cr., Ga. (120)
O 132 Rocky Comfort Cr., Ga. (120)
O 133 Duherts Cr., Ga. (132)
O 134 Long Cr., Ga. (120)
O 135 Dry Cr., Ga. (120)
O 136 Williamson Swamp Cr., Ga. (120)
O 137 Rocky Cr., Ga. (136)
O 138 Long Cr., Ga. (120)
O 139 Deep Cr., Ga. (120)
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O 159 Cane Patch Cr., Ga. (155)
O 160 Buckhead Cr., Ga. (155)
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O 174 Tivoli R., Ga. (171)
O 175 Belfast R., Ga. (171)
O 176 Sunbury Chan., Ga. (171)
O 177 Dickinsons Cr., Ga. (171)
O 178 Sunbury Cr., Ga. (171)
O 179 Jones Cr., Ga. (178)
O 180 Gould Cr., Ga. (178)
O 181 Cedar Cr., Ga. (171)
O 182 Ashley Cr., Ga. (181)
O 183 Dead Cr., Ga. (181)
O 184 North Newport R., Ga. (171)
O 185 Van Dyke Cr., Ga. (184)
O 186 Timmons R., Ga. (184)
O 187 Johnsons Cr., Ga. (184)
O 188 Walburg Cr., Ga. (184)
O 189 Fancy Hall, Ga. (171)
O 190 Sapelo Sound, Ga. (1)
O 191 South New Port R., Ga. (190)
O 192 Bronsons Cr., Ga. (191)
O 193 Johnsons Cr., Ga. (191)
O 194 Moll Clark R., Ga. (191)
O 195 Wahoo R., Ga. (191)
O 196 Barbours Isld. R., Ga. (190)
O 197 Little Mud R., Ga. (190)
O 198 Jullentown R., Ga. (190)
O 199 Sapelo R. and H., Ga. (190)
O 200 Broro R., Ga. (199)
O 201 Back R., Ga. (199)
O 202 Front R., Ga. (199)
O 203 Mud R., Ga. (190)
O 204 Old Tea Kettle, Ga. (203)
O 205 Cedar Cr., Ga. (204)
O 206 Shell Bluff Cr., Ga. (204)
O 207 Dark Cr., Ga. (204)
O 208 Shoal Cr., Ga. (204)
O 209 New Tea Kettle Cr., Ga. (199)
O 210 Doboy Sound, Ga. (1)
O 211 Dean Cr., Ga. (210)
O 212 South End Cr., Ga. (210)
O 213 Dupline Cr., Ga. (210)
O 214 Atwood R., Ga. (210)
O 215 Hudson Cr., Ga. (210)
O 216 Connegan R., Ga. (210)
O 217 Dead R., Ga. (216)
O 218 Folly R., Ga. (210)
O 219 Fox Cr., Ga. (218)
O 220 North R., Ga. (210)
O 221 Buzzard Roost, Ga. (220)
O 222 Snow Cr., Ga. (220)
O 223 May Hall, Ga. (220)
O 224 Catfish Cr., Ga. (220)
O 225 Back R., Ga. (210)
O 226 South R., Ga. (210)
O 227 Wolfs Cr., Ga. (226)
O 228 Beacon Cr., Ga. (210)
O 229 Darien R. and H., Ga. (210)
O 230 Generals Cut, Ga. (229)
O 231 Pico Cr., Ga. (229)
O 232 Altamaha Sound, Ga. (1)
O 233 Little Mud R., Ga. (232)
O 234 South R., Ga. (233)
O 235 Rock DeDundy R., Ga. (233)
O 236 Buttermilk Sound, Ga. (234)
O 237 Altamaha R., Ga. (232)
O 238 Butlers R., Ga. (237)
O 239 Lewis Cr., Ga. (237)
O 240 Big Buzzard Cr., Ga. (237)
O 241 Swan Lake, Ga. (237)
O 242 Game Cock Lake, Ga. (237)

O 243 Smith Lake, Ga. (237)
O 244 Millers Lake, Ga. (237)
O 245 Bluff Lake, Ga. (237)
O 246 Oswells Cut, Ga. (237)
O 247 Ohopee R., Ga. (237)
O 248 Buttle Cr., Ga. (247)
O 249 Thomas Cr., Ga. (247)
O 250 Jacks Cr., Ga. (247)
O 251 Yomarandee R., Ga. (247)
O 252 Dyes Cr., Ga. (247)
O 253 Paidletons Cr., Ga. (247)
O 254 Tiger Cr., Ga. (253)
O 255 Swift Cr., Ga. (253)
O 256 Rocky Cr., Ga. (247)
O 257 Mill Cr., Ga. (237)
O 258 Oconee R., Ga. (237)
O 259 Moses Old R., Ga. (258)
O 260 Old R., Ga. (258)
O 261 Flat Cr., Ga. (258)
O 262 Limestone Cr., Ga. (258)
O 263 Cypress Cr., Ga. (258)
O 264 Jones Old R., Ga. (258)
O 265 Red Bluff Cr., Ga. (258)
O 266 Bass Lake, Ga. (258)
O 267 Old R., Ga. (258)
O 268 Mercer Cr., Ga. (258)
O 269 Annie Smith Lake, Ga. (258)
O 270 Old R., Ga. (258)
O 271 Dead R., Ga. (258)
O 272 Big Cr., Ga. (258)
O 273 Buck Cr., Ga. (258)
O 274 Pues Cr., Ga. (258)
O 275 Catlin Cr., Ga. (258)
O 276 Big Cr., Ga. (258)
O 277 Buffalo Cr., Ga. (258)
O 278 Keg Cr., Ga. (277)
O 279 Bluff Cr., Ga. (258)
O 280 Gum Cr., Ga. (258)
O 281 Sholderbone Cr., Ga. (258)
O 282 Richland Cr., Ga. (258)
O 283 Town Cr., Ga. (258)
O 284 Falling Cr., Ga. (258)
O 285 Shoal Cr., Ga. (258)
O 286 Big Sandy Cr., Ga. (258)
O 287 Candler Cr., Ga. (258)
O 288 Mid Oconee Cr., Ga. (258)
O 289 Pond Cr., Ga. (288)
O 290 Walnut Fork, Ga. (288)
O 291 Mulberry Fork, Ga. (288)
O 292 Barbers Cr., Ga. (288)
O 293 Green Brier Cr., Ga. (258)
O 294 Appalachee R., Ga. (258)
O 295 Jacks Cr., Ga. (294)
O 296 Hard Labor Cr., Ga. (294)
O 297 Big Sandy Cr., Ga. (296)
O 298 Sugar Cr., Ga. (294)
O 299 Lick Cr., Ga. (294)
O 300 Crooked Cr., Ga. (258)
O 301 Rooty Cr., Ga. (258)
O 302 Little R., Ga. (258)
O 303 Indian Cr., Ga. (302)
O 304 Wolf Cr., Ga. (302)
O 305 Cedar Cr., Ga. (302)
O 306 Fishing Cr., Ga. (258)
O 307 Camp Cr., Ga. (258)
O 308 Sweeneys Cut, Ga. (258)
O 309 Spring Lake, Ga. (258)
O 310 Commissary Cr., Ga. (258)
O 311 Fish Trap Cut, Ga. (258)
O 312 Turkey Cr., Ga. (258)
O 313 Poor Robin Spring, Ga. (258)
O 314 Wells Spring, Ga. (258)
O 315 Flat Cr., Ga. (258)
O 316 Bennie Field Lake, Ga. (258)
O 317 White Water Cr., Ga. (258)
O 318 Riffle Cut, Ga. (258)
O 319 Old R., Ga. (258)
O 320 Ockwalkee Cr., Ga. (258)
O 321 Mitchels Lake, Ga. (258)
O 322 Kents Lake, Ga. (258)
O 323 McLeouds Lake, Ga. (258)
O 324 Sappho R., Ga. (258)
O 325 Singletons Cut, Ga. (258)
O 326 Ocmulgee R., Ga. (237)
O 327 Little Ocmulgee R., Ga. (326)
O 328 Possum Cr., Ga. (326)
O 329 Horse Cr., Ga. (326)
O 330 Little R., Ga. (326)
O 331 Lampkins Lake, Ga. (326)
O 332 Georges Cut, Ga. (326)
O 333 Old Fish Lake, Ga. (326)
O 334 Silver Spring, Ga. (326)
O 335 Cow Face Cut, Ga. (326)
O 336 Daniels Mill Cr., Ga. (326)
O 337 Mosquito Cr., Ga. (326)
O 338 Limestone Cr., Ga. (326)
O 339 Jordan Cr., Ga. (326)
O 340 Shellstone Cr., Ga. (326)
O 341 Grahams Lake, Ga. (326)
O 342 Savage Cr., Ga. (326)
O 343 Spring Lake, Ga. (326)
O 344 Ralstons Cr., Ga. (326)
O 345 Stone Cr., Ga. (326)
O 346 Calf Cr., Ga. (326)
O 347 Stone Cr., Ga. (326)
O 348 Boggy Cr., Ga. (326)
O 349 Walnut Cr., Ga. (326)
O 350 Falling Cr., Ga. (326)
O 351 Herds Cr., Ga. (326)
O 352 Alcony R., Ga. (326)
O 353 Rock Cr., Ga. (352)
O 354 Big Flat Cr., Ga. (352)
O 355 Yellow R., Ga. (326)
O 356 Gum Cr., Ga. (355)
O 357 Big Haynes Cr., Ga. (355)
O 358 Brushy Cr., Ga. (357)
O 359 Stone Mountain Cr., Ga. (355)
O 360 Cotton Cr., Ga. (326)
O 361 Factory Wallind Cr., Ga. (326)
O 362 Tussaha Cr., Ga. (326)
O 363 Yellow Water Cr., Ga. (326)
O 364 Sandy Cr., Ga. (326)
O 365 Towaliga R., Ga. (326)
O 366 Indian Cr., Ga. (365)
O 367 Towaliga Cr., Ga. (365)
O 368 Cabin Cr., Ga. (365)
O 369 Beaver Run Cr., Ga. (365)
O 370 South Towaliga Cr., Ga. (365)
O 371 Rum Cr., Ga. (326)
O 372 Walker Cr., Ga. (371)
O 373 Cooks Cr., Ga. (371)
O 374 Deer Cr., Ga. (326)
O 375 Rocky Cr., Ga. (326)
O 376 Tobesofkee Cr., Ga. (326)

O 377 Crooked Cr., Ga. (376)
O 378 South Tobesofkee Cr., Ga. (376)
O 379 Eckeeconree Cr., Ga. (326)
O 380 Horse Cr., Ga. (326)
O 381 Sandy Cr., Ga. (326)
O 382 Beaver River Cr., Ga. (326)
O 383 Grocery Cr., Ga. (326)
O 384 Big Indian Cr., Ga. (326)
O 385 Tusawhochee Cr., Ga. (326)
O 386 Jelks Mill Cr., Ga. (326)
O 387 Bluff Cr., Ga. (326)
O 388 Swift Lake, Ga. (326)
O 389 Cedar Cr., Ga. (326)
O 390 Green Log Cr., Ga. (326)
O 391 Poor Robin Lake, Ga. (326)
O 392 Half Moon Cr., Ga. (326)
O 393 Spring Lake, Ga. (326)
O 394 Tomberlinge Timber Lake, Ga. (326)
O 395 Big Horse Cr., Ga. (326)
O 396 Spring Lake, Ga. (326)
O 397 Bluff Cr., Ga. (326)
O 398 Fodder Stock Cut-off, Ga. (326)
O 399 Sturgeon Cr., Ga. (326)
O 400 Blackshears Lake, Ga. (326)
O 401 Barrow Lake, Ga. (326)
O 402 Rock Cr., Ga. (326)
O 403 Chicken Cr., Ga. (326)
O 404 Dunbars Cut, Ga. (326)
O 405 Bay Cr., Ga. (237)
O 406 10 Mile Cr., Ga. (237)
O 407 5 Mile Cr., Ga. (237)
O 408 Stupping Gum Cut, Ga. (237)
O 409 Bug Suck, Ga. (237)
O 410 Phinholloway Cr., Ga. (237)
O 411 Ellis Cr., Ga. (237)
O 412 South Altamaha R., Ga. (236)
O 413 Friday Cap Cr., Ga. (411)
O 414 Rice Trunk, Ga. (411)
O 415 Woods Cut, Ga. (411)
O 416 Altamaha Canal, Ga. (411)
O 417 Middle R., Ga. (411)
O 418 Hammer Smith Cr., Ga. (411)
O 419 South Branch, Ga. (411)
O 420 Coopers R., Ga. (411)
O 421 Mayners Cr., Ga. (411)
O 422 Mackeys R., Ga. (236)
O 423 Walleys Leg, Ga. (422)
O 424 Grants Cr., Ga. (422)
O 425 Troups Cr., Ga. (422)
O 426 Back R., Ga. (422)
O 427 Belle Point Cr., Ga. (426)
O 428 Frederica R., Ga. (236)
O 429 Hawkins Cr., Ga. (428)
O 430 Dunbars Cr., Ga. (428)
O 431 Hampton R., Ga. (236)
O 432 Mosquito Cr., Ga. (431)
O 433 Wilsons Cr., Ga. (431)
O 434 Jones Cr., Ga. (431)
O 435 Village Cr., Ga. (431)
O 436 Postells Cr., Ga. (431)
O 437 St. Simons Sound, Ga. (1)
O 438 Terry Cr., Ga. (437)
O 439 Clubbs Cr., Ga. (437)
O 440 Brunswick R., Ga. (437)
O 441 Plantation Cr., Ga. (440)
O 442 Parsons Cr., Ga. (440)
O 443 East R. and Brunswick H., Ga. (440)
O 444 Turtle R., Ga. (440)
O 445 Academy Cr., Ga. (440)
O 446 Cedar Hammock, Ga. (440)
O 447 Corpse Cr., Ga. (440)
O 448 Dubignons Cr., Ga. (440)
O 449 Clam Cr. Ga. (440)
O 450 Buzzards Cr., Ga. (444)
O 451 Gilsurs Cr., Ga. (444)
O 452 Hermitage, Ga. (444)
O 453 South Brunswick R., Ga. (444)
O 454 Jointers Cr., Ga. (444)
O 455 Jekyl Sound, Ga. (1)
O 456 Jekyl Cr., Ga. (455)
O 457 Mud R., Ga. (456)
O 458 Lathran R., Ga. (456)
O 459 Little Satilla R., Ga. (455)
O 460 Umbrella Cr., Ga. (455)
O 461 St. Andrews Sound, Ga. (1)
O 462 Satilla R., Ga. (461)
O 463 Dover Cr., Ga. (462)
O 464 Balleys Cut, Ga. (462)
O 465 Sparkmans Cr., Ga. (462)
O 466 White Oak Cr., Ga. (462)
O 467 Pine Island Cr., Ga. (462)
O 468 Armstrong Cr., Ga. (462)
O 469 Blues Lake, Ga. (462)
O 470 Booms Lake, Ga. (462)
O 471 Turner Lake, Ga. (462)
O 472 Knox Suck, Ga. (462)
O 473 Feltons Lake, Ga. (462)
O 474 Doe Lake, Ga. (462)
O 475 Sandy Lake, Ga. (462)
O 476 Cypress Lake, Ga. (462)
O 477 Baxter Lake, Ga. (462)
O 478 Allabaha R., Ga. (462)
O 479 Old Lake, Ga. (462)
O 480 17 Mile Cr., Ga. (462)
O 481 Big Hurrican Cr., Ga. (462)
O 482 Williams Cut, Ga. (462)
O 483 Big Cr., Ga. (462)
O 484 Dick Branch, Ga. (462)
O 485 Maple Suck, Ga. (462)
O 486 Abrahams Bluff Cut-off, Ga. (462)
O 487 Buck Lake, Ga. (462)
O 488 Long Lake, Ga. (462)
O 489 Spring Lake, Ga. 462)
O 490 Old Lake, Ga. (462)
O 491 Buffalo Cr., Ga. (462)
O 492 Tester Lake, Ga. (462)
O 493 Still Lake, Ga. (462)
O 494 Old R., Ga. (462)
O 495 Cut Off, Ga. (462)
O 496 The Basin, Ga. (462)
O 497 Camp Cr., Ga. (462)
O 498 May Bluff Cr., Ga. (462)
O 499 Long Cr., Ga. (462)
O 500 Toods Cr., Ga. (462)
O 501 Cumberland Sound, Ga. (1)
O 502 Cumberland R., Ga. (501)
O 503 Beach Cr., Ga. (502)
O 504 Brick Hill R., Ga. (502)
O 505 Floyds Cr., Ga. (502)
O 506 Shellbine Cr., Ga. (502)
O 507 De Laroche Cr., Ga. (502)
O 508 Crooked R., Ga. (502)

O 509 Kings R., Ga. (502)
O 510 St. Marys R., Ga. and Fla. (501)
O 511 St. Marys, Ga., to St. Johns, Fla.—Inland waterway. (510)
O 512 Point Peter Cr., Ga. (510)
O 513 North R., Ga. (510)
O 514 Major Moore Cr., Ga. (510)
O 515 Burrells Cr., Ga. (510)
O 516 Scrubby Bluff Cr., Ga. (510)
O 517 Catfish Cr., Ga. (510)
O 518 Mules Cr., Ga. (510)
O 519 Pigeon Cr., Fla. (510)
O 520 Little St. Marys R., Fla. (510)
O 521 Cut Off, Fla. (510)
O 522 Upper Sisters Cr., Fla (510)
O 523 Lower Sisters Cr., Fla. (510)
O 524 Bells R., Fla (510)
O 525 Jolly R., Fla. (510)
O 526 Amelia R., Fla. (501)
O 527 South Base Cr., Fla. (526)
O 528 Bells R., Fla (526)
O 529 Lanceford Cr., Fla. (526)
O 530 Kingsleys Cr., Fla. (526)
O 531 Jackson Crs., Fla. (526)

O–2 SAVANNAH RIVER AND HARBOR, GA.

Part.	Title.	Period.	Appropriations.
a	Savannah R. and H	1826–1879	$1,004,563.58
b	At and below Savannah	1879–1912	9,114,000.00
c	Savannah to Augusta	1879–1912	805,000.00
d	Above Augusta	1879–1912	70,000.00
e	Spirit Isld. to C. & S. bridge	1892–1895	
f	At Augusta	1909–1912	125,000.00
	Total		11,118,563.58

Totals in 1912 reports aggregate $11,115,589.01, including misc. receipts, but omitting $10,000 for survey of Savannah, Ocmulgee, Flint, and Chattahoochee Rs., 12, 1818, 1822, 1824, 1825.

Part (a), O–2 Savannah River and Harbor, Ga.

APPROPRIATIONS.

1826, $50,000.00, act May 18.
1832, 25,000.00, act July 3.
1833, 8,430.62, act Mar. 2.
1834, 30,000.00, act June 28.
1835, 20,000.00, act Mar. 3.
1838, 15,000.00, act July 7.
1852, [1] 10,000.00, sur., act Aug. 30.
1852, 40,000.00, act Aug. 30.
1855, 161,000.00, act Mar. 3.
1872, 50,000.00, **72,** 653.
1873, 50,000.00, **73,** 70.
1874, [2] 243,132.96, **74,** 78; **78,** 573; **79,** 742.
1875, 70,000.00, **75,** 83; **78,** 573; **79,** 742.
1876, 62,000.00, **76,** 70; **78,** 573; **79,** 742.
1878, 70,000.00, **78,** 77, 573; **79,** 742.
1879, 100,000.00, **79,** 97, 743.

Total, 1,004,563.58

COMMERCE.

Demands of, **78,** 572; **79,** 746.
Large increase of, **73,** 746.
Benefits of imp. to, **78,** 573, 574.

CONTRACTS.

1855. H. S. Wells, removal of obstr., **73,** 734; **76,** 441.
1872. D. Symons, removal of obstr., **73,** 734, 749.
1873. B. Maillefert, removal of obstr.; city of Savannah, dr., 35 and 75¢ c. y., **73,** 734, 735, 749.
1875. American Dredging Co., dr., 25¢ c. y., **75,** ii, 32.
1876. D. Symons, driving piles, **77,** 374. American Dredging Co., dr., 24¢ c. y., **76,** 433.
1877. City of Savannah, dr., 24¢ c. y.; American Dredging Co., dr., **77,** 373; **78,** 574.
1878. American Dredging Co., dr., 40¢ c. y., **78,** 574. American Dredging Co., dr., 14⅜¢ c. y., **79,** 744.
1879. D. V. Howell, constr. of dam; contract extended, **79,** 741.

ENGINEERS.

Chief of Engineers. R., 66, 3; **71,** 71; **72,** 65, 66; **73,** 69; **74,** 77; **75,** 83; **76,** 69; **77,** 67; **78,** 77; **79,** 96, 99.

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[1] For sur. of Savannah, Ocmulgee, Flint, and Chattahoochee Rs.
[2] $193,132.96 was app. for relief of Henry S. Wells, for work done by him under contract with the Sec. of the Treas., 1866, act Feb. 27, 1874.

Boards:
Convened, Feb. 3, 1853, to consider a proj. for removal of obstr. in the Savannah R. at a place called "The Wrecks" and the imp. of said R. Recom.: (1) To d., w., and straighten the chan. over "The Wrecks;" (2) to close the chan. between Fig and Hutchinsons Islds.; (3) to build j. at the lower end of Fig Isld.; (4) to build deflecting work above King Isld.; (5) to dr. at Tybee Knoll and such other points as might be necessary, **73,** 737. (Prof. Bach, Capt. Bowman, and Lt. Gilmer.)
Convened, New York, June 8, 1875, to take into consideration and report upon the general subject of the imp. of Savannah R. and H. The board coincided with the views expressed by the engineer in charge in his **R.** of Aug. 28, 1873. Board reported that crib dam at the Cross Tides would be preferable to a deflecting j., but the app. being small the j. was recom. as a temporary device. **R., 76,** 437. (Col. Tower and Lt. Cols. Wright, Newton, and Gillmore.)

In charge:
Lt. Mansfield, 1835–37; **73,** 737.
Maj. Q. A. Gillmore, 1872–88. **R., 72,** 653; **73,** 734, 751; **74,** ii, 6; **75,** ii, 32; **76,** 432; **77,** 373; **78,** 572; **79,** 740.

Assistants:
Capt. W. Ludlow. **R., 72,** 655.
Capt. D. P. Heap. **R., 73,** 749.
E. S. Gould, **75,** ii, 34.
Capt. J. C. Post. **R., 77,** 373, 374; **78,** 572.
G. Daubeney, **78,** 572.
S. L. Fremont, **79,** 97. **R., 79,** 746.
J. P. Carson. **R., 79,** 750.
E. A. Gieseler. **R., 91,** 1507, 1513.

ESTIMATES. (See Plans and Projects.)
By Maj. Gillmore, removal of obstr. and dr., $128,700, **72,** 655.
By Capt. Ludlow, removal of obstr., the wreck of the *Georgia*, and dr., $149,800, **72,** 659.
By Maj. Gillmore, dr., $60,000, **73,** 740; j. at Cross-Tides, $36,000, **73,** 741; crib dam, dr., and bulkhead, $481,320, **73,** 747; **76,** 434; **78,** 573.
By Capt. Heap, dr., $9,100, **73,** 749.
By J. P. Carson, imp. of Savannah above Augusta, $188,875 and $285,090, **79,** 749, 762.
By Lt. Col. Gillmore, imp. of Savannah from Augusta to Trotters Shoals, $45,000 and $124,000, **79,** 749.

OPERATIONS.
1804–09. Piles driven in chan. between Hutchinson and Argyle Islds., **73,** 737.
1835–37. D. chan. over "The Wrecks," **73,** 737.
1853–54. Fig Isld. chan. closed, **73,** 737, 738.
1855–56. Obstr. at "The Wrecks" removed, **73,** 737, 738.
1856–57. Deflecting work built from end of King Isld., **73,** 738.
1865–66. Removal of wrecks, cribs, and other obstr., **73,** 734.
1872–73. Removal of obstr. and dr., **73,** 734, 735.
1873–74.[1] 55,369 c. y. dr. at Ft. Pulaski, 57,688 c. y. dr. at Elba Isld., 2,436 c. y. dr. at "The Wrecks," and 2 wrecks and 1 loaded lighter removed, **74,** 77, 622.
1874–75. 99,992 c. y. dr. at Ft. Pulaski, 19,634 c. y. dr. at Elba Isld., 27,103 c. y. dr. at "The Wrecks," 61,054 c. y. dr. at Garden Bank, **75,** 83; **75,** ii, 32, 33.
1875–76. 18,349 c. y. dr. at Ft. Pulaski, 9,850 c. y. dr. at Kings and Hutchinsons Islds., 189,348 c.y. dr. at "The Wrecks," 7,995 c. y. dr. at Garden Bank, **76,** 69, 70, 432.
1876–77. 6,395 c. y. dr. at Ft. Pulaski, 25,047 c. y. dr. at Kings and Hutchinsons Islds., 115,198 c. y. dr. at "The Wrecks," 12,012 c. y. dr. at Oyster Bed, 185 l. f. of temporary dam destroyed, and crib removed, **77,** 67, 68, 373, 374.
1877–78. 17,471 c. y. dr. at Ft. Pulaski, 10,948 c. y. dr. at Oyster Bed, **78,** 574.
1878–79. 27,131 c. y. dr. at "The Wrecks," and 553 l. f. of dam built, **79,** 96, 97, 741, 746.

PHYSICAL CHARACTERISTICS.
General description, **73,** 738, 739; **75,** ii, 36; **79,** 748, 750, 756.
Rise and fall of R., **73,** 736; **79,** 748.
Distance to which salt water ascends the stream, **75,** ii, 34, 35.
Method of gauging described, **78,** 574; **79,** 97, 742.
Freshets, **79,** 748.

PLANS. (See Estimates and Projects.)
By Lt. Mansfield, 1835–37, dam across the Cross-Tides between Hutchinsons and Argyle Islds., **73,** 737.
By Capt. Mackay, 1849, system of piers to be placed to diminish the breadth of the inlet and outlet of Back R., **73,** 737.
By Lt. Smith, 1849, closing the chan. between Fig and Hutchinsons Islds. and constr. of 2 js., **73,** 737.
By Capt. Ludlow, removal of the wreck of the Georgia and other obstr. from the chan., and dr., **72,** 659.
By Maj. Gillmore, dr. at Cross-Tides, and the constr. of a j. from the end of Argyle Isld., **73,** 740.
By Capt. Heap, chan. 12′ x 125′, **73,** 749.
By J. P. Carson, imp. of the Savannah from Augusta to Andersonville, and from Andersonville up the Tugaloo R. to Browns, a distance above Augusta of 150 m., **79,** 749.
By Lt. Col. Gillmore, imp. from Augusta to Tutter's Shoals, 64 m., **79,** 749.

PRIVATE AND CORPORATE WORK.
City of Savannah expend. $200,000 in dr. and removal of obstr. (See Operations.) **72,** 656; **73,** 734.

PROJECTS. (See Estimates and Plans.)
By BE., 1853: (1) to w., d., and st. chan. over "The Wrecks;" (2) to close chan. between Fig and Hutchinsons Islds.; (3) to built a j. at lower end of Fig Isld.; (4) to build deflecting work above Kings Isld.; (5) dr., **73,** 737, 738.
By Maj. Gillmore, removing obstr. from chan. below Ft. Jackson and opposite upper end of Elba Isld., and dr., **72,** 653.
By Maj. Gillmore, closing Cross-Tides by a crib dam, enlarging waterway at city front and Fig. Isld., new bulkhead above Kinsey's Mills, and dr.; est., $481,320, **73,** 741–747. For (1) a temporary j. from lower end of Argyle Islds. 450′ l.; (2) d. waterway between Kings and Hutchinson Islds.; (3) dr. along city front; (4) opening a new chan. near s. bank of R., below Fig Isld.; (5) increasing d. of chan. abreast of Elba Isld.; (6) w. of chan. ne. of Ft. Pulaski; est., $70,000, **75,** ii, 34; **76,** 432, 441. Approv. by BE., **76,** 444.
By Lt. Col. Gillmore, submerged dam, composed of riprap resting on a matress of fascines or a brush and timber foundation, **78,** 77, 573.

SURVEYS.
Included in Coast Sur., 1855, **73,** 740.
By Capt. Ludlow, 1872. **R., 72,** 655.
Resur., 1873, **73,** 748.
Ex. above Augusta by J. P. Carson, 1878. **R., 79,** 747, 750.
Map. Sketch showing cross-section of dam, **79,** 742.

[1] Total amount dr. 1873–74 stated as 166,500 c. y., **79,** 97, 740.

Part (b), O–2 Savannah Harbor, Ga. (Savannah River, at and below Savannah.)

APPROPRIATIONS.

1880,	$65,000,	**80,** 941.
1881,	65,000,	**81,** 1083.
1882,	200,000,	**82,** 1150.
1884,	200,000,	**84,** 1104.
1886,	150,000,	**86,** 1094.
1888,	180,000,	**88,** 1012.
1890,	350,000,	**90,** 1253.
1892,	318,750,	**92,** 1251.
1893,	1,000,000,	**93,** 1544.
1894,	975,000,	**95,** 1459.
1895,	856,250,	**95,** 1459.
1896,	5,000,	**96,** 1224.
1897,	350,000,	**97,** 1499.
1898,	450,000,	**98,** 1295.
1899,	250,000,	**99,** 1563.
1902,	50,000,	**02,** 1180.
1903,	720,000,	**03,** 1144.
1900(1903),	*5,000,	**04,** 1642.
1904,	105,000,	**04,** 1642.
1905	75,000,	**05,** 1265.
	175,000,	**05,** 1265.
	*10,000,	**06,** 1192.
1906,	150,000,	**06,** 1192.
1907	60,000,	**07,** 1277.
	300,000,	**08,** 1334.
1905(1907),	*8,000,	**08,** 1334.
1905(1908),	*1,000,	**08,** 1334.
1908,	300,000,	**08,** 1334.
1909,	400,000,	**09,** 1330.
1910,	400,000,	**10,** 1465.
1911,	400,000,	**11,** 1596.
1912,	540,000,	**12,** 1817.
Total,	9,114,000	

COMMERCE.

Present and prospective, **81,** 1075, 1087.

Increase consequent upon imp., **88,** 1011.

Effect of past imp. upon C. and navigation, **89,** 1225; **90,** 1251, 1252.

Description of, **93,** 1542; **94,** 1135; **95,** 1462 (Beaufort H., **95,** 1523); **96,** 1220; **97,** 1497; **99,** 1562; **00,** 1916.

Increase in the amount of the exports since 1873 proportional to the cube of increased chan. d. during the same period, and the an. saving in rates alone due to the increased d. amounts to more than the total sum spent by the U.S. in imp., **93,** 1543; **94,** 1136; **95,** 1456; **96,** 1221.

Large and increasing, **01,** 1720.

Description of, **01,** 1629, 1720; **09,** 1327.

Rates reduced from 30 to 50% since 1896, **06,** 294.

Description of effects of imp., **09,** 1329.

1911, 2,954,814 t., **12,** 1816.

"The regular line of steamships established between this port and New York, Boston, Baltimore, Philadelphia, and Jacksonville comprise a total of 16 steamers. During the calendar year 1911, 8 of these ran to the two first-named ports and 8 to the last-named three. During the year they carried 1,033,498 short tons of freight, valued at $146,756,716. They also handled in and out of Savannah 53,225 passengers.

"A regular steamboat service is maintained on the Savannah River between Savannah and Augusta, Ga., a distance of 202 miles; a regular freight service is maintained between Savannah and the principal ports of the United Kingdom and Continent of Europe, and in addition there is a fleet of American coastwise sailing vessels which operate between Savannah and northern ports.

"On the inland waters there are a number of small steamers plying between Savannah and adjacent ports, besides numerous schooners and small sailboats. It is estimated that for the year 1911 this portion of the commerce amounted to 100,000 tons, valued at $1,000,000.

"The chief articles of export are cotton, lumber, and naval stores, of which shipments for the year 1911 were as follows: Of cotton, 1,436,101 bales; of lumber, 135,487,693 feet; and of naval stores, 194,032 barrels of turpentine and 682,306 barrels of rosin.

"The total amount of freight received and shipped at the port during 1911 was 2,954,814 short tons, valued at $246,678,077.

"In collecting commercial statistics for this report, information has invariably been obtained from primary sources, and collections and tabulations made by committees or boards have not been adopted. This method prevents duplication, and, while it may give a result that is too small, it can not give inflated figures. For this reason the comparison of the present statistics with those collected in former years would give results that would be wholly misleading." **12,** 1816.

CONTRACTS.

1879. R. C. McKay, dam constr., **80,** 942.

1880. American Dredging Co., dr., 14¢ c. y., **81,** 1083.

1881. M. Bangs, material, **82,** 1148.

1882. Dickerson & Paulson, dr., 15¢ c. y., **82,** 1150. E. T. Bangs, wing-dam and training-wall constr., **83,** 900. Dickerson & Paulson, dr., 16½¢ c. y., **83,** 900.

1884. J. F. Gaynor, training-wall and wing-dam constr., **85,** 1203. P. S. Ross, dr., 17¾¢ c. y., **85,** 1204.

1886. J. F. Gaynor, wing-dam constr., 38¢ s. y.; mattress, $3 c. y. for st.; dr., 19¢ c. y., **87,** 1159.

1888. P. S. Ross, dr., 18½¢ c. y., **89,** 1228.

1889. W. T. Gaynor, training-wall constr., $3.19 c. y. for st., $1.29 c. y. for oyster shells, and 63¢ s. y. for mattress work, **89,** 1228.

1892. P. S. Ross, dr., 16¢ c. y.; revetment, $40 ($1,220,000). Atlantic Contracting Co., j. work; mattresses, 95¢ s. y.; fascines, $1.60 c. y.; pile work, $1.60; cluster piles, $50 cluster; tie piles, $20 group; sawn timber, $30 1,000′ b. m.; iron bolts, 5¢ lb.; riprap st., $2.95 c. y.; large st., $2.60 t. ($1,686,500). **93,** 1545.

1896. Atlantic Contracting Co., j. work; mattresses, 95¢ s. y.; 1st-class st., $3.90 t.; 2d-class st., $3.90 t.; 3d-class st., $3.50 c. y.; and 4th-class st., $2.75 c. y. ($835,000), **97,** 1500 (contract annulled Oct. 3, 1899), **00,** 1915. R. R. Moore, dr., 13¢ c. y. ($162,500), **97,** 1500.

1900. G. T. Warner, dr. inside route, Savannah, Ga., to Beaufort, S. C., 9¢ c. y. ($49,500), **00,** 1919.

1900. George T. Warner, dr., **01,** 1631.

1901. P. S. Ross, dr., 14.9¢ c. y., **02,** 1180.

1902. George T. Warner, dr., 16¢ c. y., **02,** 1180. P. S. Ross, dr., 17½¢ c. y.; Atlantic, Gulf & Pacific Co., dr., 16.9¢ c. y., **03,** 1144. D. Power & Co., repairs to training wall, unit prices given; Egan Smith & Co., constr. mooring dolphin, unit prices given, **03,** 1145.

1904. Simons-Mayrant Co., repairs to training walls; st., $2.68 c. y., **04,** 1643. Riverside Iron Works, constr. new hull for *Angler,* and installing machinery, $10,575, **05,** 1266.

1905. D. Power & Co., constr. coaling wharf, $3,241, **05,** 1266. Geo. W. Catt, dr., 17.4¢ c. y., p. m., **06,** 1192.

1907. D. Power & Co., repairing, raising, and extending dikes and dams, unit prices given, **08,** 1334.

1908. Simons-Mayrant Co., dr., 20¢ c. y., p. m., **08,** 1334. Simons-Mayrant Co., dr., 15¢ c. y., p. m., **08,** 1334. Merrill-Stevens Co., repairing dr. *Cumberland,* $21,529.70, **08,** 1335.

1909. Merrill-Stevens Co., repairing dr. *Savannah,* $10,767.79; R. G. Ross, raising training walls; st., $2.07 t., **09,** 1331.

1910. Merrill-Stevens Co., repairing dr. *Savannah,* $13,361.96, **10,** 1465. P. Sanford Ross, dr. 1,940,400 c. y., 10½¢ for material removed to 26′, and half price between 26′ and 28′, m. l. w., **11,** 1597.

1911. Home Dredging Co., dr. 1,600,000 c. y., 11.6¢ for material removed to 26′, and half price between 26′ and 28′, **12,** 1819.

*Allotment.

ENGINEERS.

Chief of Engineers. **R., 80,** 127; **81,** 171, 180; **82,** 167, 175; **83,** 175; **84,** 183; **85,** 182; **86,** 182; **87,** 145, 154; **88,** 138, 143; **89,** 158, 164, 367, 1286, 1287, 1291; **90,** 142, 1258; **93,** 190; **94,** 174; **95,** 198, 207; **96,** 177; **97,** 224; **98,** 221; **99,** 255; **00,** 292, 306; **01,** 324, 334, 1719; **02,** 251; **03,** 257; **04,** 262; **05,** 270; **06,** 292, 311; **07,** 305; **08,** 324; **09,** 333; **10,** 379; **11,** 399; **12,** 484, 524.

Boards:

Convened, New York, July 25, 1879, by S. O. No. 36, C. of E., to report upon further imp. of Savannah R. and H. **R., 80,** 946. (Cols. Tower and Newton and Lt. Col. Gillmore.)

Convened, Washington, Nov. 10, 1888, by S. O. No. 50, to ex. and report upon proj. by Lt. Carter for imp. of the Savannah R. from dam at Cross Tides to the sea. **R., 89,** 1236. (Lt. Cols. Gillespie and King and Maj. Post.)

Convened, Savannah, Apr. 1, 1889, by S. O. No. 13, to estab. H. lines of Savannah H. **R., 89,** 1289. (Col. Craighill, Capt. Bixby, and Lt. Carter.)

Convened, Savannah, Ga., Sept. 22, 1898, by S. O. No. 21, to critically ex. and report upon the proj. for the imp. of Savannah H. and the SS. chan. between Beaufort, S. C., and Savannah, Ga., and to suggest such changes as, in its opinion, might be necessary to accomplish the imp. desired. **R., 00,** 1922. (Majs. C. B. Sears, W. H. Bixby, and T. W. Symons.)

Constituted, S. O. 46 (Col. P. C. Hains, Capt. J. C. Sanford, and Capt. C. E. Gillette) to revise proj., **01,** 1723.

In charge:

Col. Q. A. Gillmore, 1872–88. **R., 80,** 933, 948; **81,** 1074; **82,** 1142, 1167; **83,** 893; **84,** 1098; **85,** 1195; **86,** 1086; **87,** 1150; **88,** 1057, 1059.

Capt. O. M. Carter, 1888–97. **R., 88,** 1005, 1012; **89,** 1220, 1234, 1282, 1285; **90,** 1245, 1259; **91,** 1491, 1506; **92,** 1243; **93,** 1536; **94,** 1129; **95,** 1449, 1521; **96,** 1211; **97,** 1493.

Capt. C. E. Gillette, 1898–02. **R., 98,** 1291; **99,** 1559; **00,** 1913; **01,** 1628, 1720; **02,** 1177.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1141; **04,** 1639; **05,** 1259.

Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1187; **07,** 1271; (Col.) **08,** 1327; **09,** 1319; **10,** 1459; **11,** 1591; **12,** 1811.

Assistants:

S. L. Fremont. **R., 80,** 944; **81,** 1083; **82,** 1169.

Capt. B. D. Green. **R., 82,** 1150–1167.

Lt. T. N. Bailey. **R., 83,** 900; **84,** 1104.

Capt. J. C. Post. **R., 83,** 904.

Lt. O. M. Carter. **R., 85,** 1204; **86,** 1094; **87,** 1160; **88,** 1058, 1063.

A. S. Cooper. **R., 89,** 1228; **90,** 1253; **03,** 1146; **04,** 1644.

E. A. Giesler. **R., 89,** 1231; **90,** 1265, 1298; **94,** 1138; **96,** 1227.

LEGAL PROCEEDINGS.

$1,000 collected from owners of SS. *Boliviana* by Dept. of Justice for damage done to mooring dolphin, **10,** 1463.

MISCELLANEOUS.

Successful trial of seagoing dr. on R. work, with rehandling dr., **07,** 1272.

Excellence of plan of imp. and faults of methods and materials of constr. (discussed), **07,** 1273; **08,** 1328.

Methods of dr., **08,** 1329.

Complete description of work done under tentative proj. and its results, **09,** 1320.

OPERATIONS.

1879–80. 170,359 c. y. dr. at Front R., Garden Bank, Elba Isld., cut in Old King's Isld. Jetty, and new chan. at "The Wrecks;" 185 l. f. of apron foundation laid and 1,108 c. y. st. placed on Cross Tides Dam superstr.; 425 l. f. of s. chan. apron dam completed, **80,** 936, 939.

1880–81. Cross Tides Dam completed; gap through Old Kings Isld. Jetty w. to 70'; work continued on s. chan. submerged dam; 268,220 c. y. dr. at various localities from Cross Tides to Tybee Roads, **81,** 1081.

1881–82. 2,638 c. y. st. added to Cross Tides Dam; 2 brush and st. wing dams, aggregating 650 l. f., built between city front and Fig Isld.; 113,701 c. y. dr.; 5,000 l. f. of deflecting j. built at Fig Isld.; 3 closing dams built between Elba and Long Islds., aggregating 3,249 l. f., **82,** 1146, 1148.

1882–83. 8,935 l. f. of brush and st. dam built; 73,669 s. y. log and brush mattress and 21,095 c. y. riprap st. used in repairs to old work; 135,456 c. y. dr., **83,** 898.

1883–84. 79,616 c. y. dr. from crossings between Spirit Isld. and Venus Pt., also from chan. at "The Wrecks;" Dam No. 23 strengthened; wing dam No. 25 completed; wing dams No. 14 and 29 commenced; 2,000 l. f. of wing dam No. 13 completed, **84,** 1101.

1884–85. 98,114 c. y. dr. at "The Wrecks" and the Upper Flats; log mattress apron placed upon Cross Tides Dam; Fig. Isld. Jetty raised to 5' above l. w.; 6 wing dams built at Upper and Lower Flats and Long Isld. crossing; 2,700 l. f. of dam built between Quarantine Station and Oyster Bed Beacon, **85,** 1200.

1885–86. 38,474 c. y. dr. from reaches between Savannah and Long Isld.; 1,600' of Dam No. 31 raised to m. l. w. level; Cross Tides Dam repaired; closure dams at Philbricks Cut and Big Gap brought up to m. h. w. level, **86,** 1091.

1886–87. 121,093 c. y. dr. from chans. between Savannah and Tybee Knoll; 40,980 s. y. of mattress, 39,053 c. y. brush, and 17,241 c. y. of st. placed in js. and dams in their extension and repair, **87,** 1152–1154.

1887–88. 818 c. y. brush fascines and 429 c. y. st. placed in the training walls, **88,** 1009.

1888–89. 8,108 c. y. st. and 92,922 s. y. mattress placed in training wall; 187,671 c. y. dr., **89,** 1230.

1889–90. 3,924 c. y. riprap st., 310 c. y. of shells, 495 c. y. of brush fascines, and 17,666 s. y. log and brush mattress placed in Fig Isld. and Oyster Bed training wall; 31,551 c. y. dr., **90,** 1249, 1250.

1890–91. 72,178 s. y. of log and brush mattress and 26,160 c. y. of riprap st. used in constr. of 1,984 l. f. of training wall; 1,245 l. f. of brush and pile spur dam built at Elba and Jones Islds.; 532 l. f. of pile, brush, and st. closing dam built at Duck Puddle; 933 piles and 7,492 c. y. of st. used in s. Elba Isld. training wall; 396,144 c. y. dr. from the chans. at Ocean SS. wharves, Garden Bank, Wrecks Chan., Upper Flats, and Tybee Knoll, **91,** 1495.

1891–92. 683 c. y. of st. placed upon crest of Oyster Bed training wall; 6,818 c. y. of brush and 680 c. y. of st. used in completion of Elba and Jones Islds. spur dams; 35,506 c. y. dr. from the chan. at Tybee Knoll, **92,** 1247.

1892–93. Put into the various works during the year, 63,688 c. y. fascines, 240,708 s. y. mattresses, 8,059 c. y. st., 302,027' b. m., 6" x 10" timber, 33,399 lbs. iron bolts, and 3,128 piles; 488,518 c. y. dr., **93,** 1540.

1893–94. Put into the works during the year, 699,536 s. y. matresses, 99,192 c. y. fascines, 57,633 c. y. st., 325,299' b. m., 6" x 10" timber, and 33,153 lbs. iron bolts; 26,964 l. f. of pile work, or 7,703 piles, constr.; 5 barges were sunk to close openings in Big Gap and Philbricks Dams; 978,096 c. y. dr., 2,400' b. m., of sawed timber, 276 c. y. of riprap st., 3,401 logs and 35 piles removed from dams, wharf at Fort Oglethorpe, and from crib obstr.—all by hired labor. Steam hoister also constr. by hired labor, **94,** 1134.

1894–95. 413,350 s. y. mattresses, 40,289 c. y. fascines, 48,950 c. y. riprap st., 74,356' b. m., 6" x 10" timber, and 9,621 lbs. of iron bolts placed in the works during the year; 644 piles driven, 1,866,723 c. y. dr., 31 day marks, to mark the R. chan., placed, **95,** 1455.

1895–96. 9,976 c. y. mattresses, 4,953 c. y. fascines, 13,125 c. y. riprap st., 3,290' b. m., 6" x 10" timber, and 383 lbs. iron bolts placed in the various works; 38 piles driven, 2,128,067 c. y. dr., old wrecks and crib obstr. removed from the chan., **96,** 1217–1218.

1896–97. 218,320 s. y. mattresses, 17,710 c. y. 4th-class st., 11,850' b. m. sawed timber, 1,632 lbs.

iron bolts, 736 l. f. pile work, and 16 clusters of fender piles constr. and placed in the various works; 143,641 c. y. dr. from the H., and 133,698 c. y. dr. from Ramshorn Creek and Wrights R., **97,** 1495–1496.

1897-98. 46,637 s. y. mattresses and 8,211 c. y. 4th-class st. placed in the detached extension of the Oyster Bed training wall; 306,413 c. y. dr. from Wrights R. and Marsh Isld. chan., **98,** 1293.

1898-99. 427,749 c. y. dr., **99,** 1561.

1899-00. 971,289 c. y. dr. from inside route between Savannah, Ga., and Beaufort, S. C., **00,** 1915.

1900-01. 1,051,793 c. y. dr. and 106 logs removed, **01,** 1628.

1901-02. 198,380 c. y. dr., **02,** 1177.

1902-03. 1,297,229 c. y. dr., mooring dolphin built, and training wall repaired and extended, **03,** 1141. Table showing amount and location of dr. by years from 1873 to 1902, **03,** 1147.

1903-04. 2,658,377 c. y. dr., and 182 logs removed, **04,** 1644. Mooring dolphins completed, **04,** 1646. 10,399 c. y. st. placed in repairs to js., **04,** 1647.

1904-05. 1,730,208 c. y. dr., and new dr. *Savannah* received, **05,** 1260. Coaling wharf built, 1,651 c. y. st. placed in repair to js., and gap in Dam No. 31 closed, **05,** 1261. New hull built for *Angler*, **05,** 1262.

1905-06. 817,533 c. y. dr., **06,** 1187.

1906-07. 980,134 c. y. dr., **07,** 1272.

1907-08. 1,143,811 c. y. dr., **08,** 1329. 31,154 c. y. dr. from chan. between Savannah and Beaufort, **08,** 1330. 16,816 c. y. dr. from chan. into Back R. and new dr. *Morgan* received, **08,** 1331.

1908-09. 1,740,049 c. y. dr., **09,** 1325. 25,091 t. st. and 912 c. y. brush placed in training walls and spur dams, **09,** 1326.

1909-10. 1,916,913 c. y. dr., **10,** 1460. 41,145 t. st. placed in raising and strengthening training walls, **10,** 1462.

1910-11. U. S. dr. 1,642,885 c. y. from ocean bar, Tybee Roads, Tybee Knoll, near quarantine station, and 275,801 c. y. from H. above quarantine station; 934,986 c. y. dr. under contract above Ft. Pulaski; condition of chan. and results from dr., **11,** 401, 1592.

1911-12. U. S. dr. 2,294,017 c. y., and 1,145,557 c. y. dr. under contract; portion of an old submerged wreck removed by U. S. plant; proj. 68% completed, **12,** 1813.

PHYSICAL CHARACTERISTICS.

Description of the R., **88,** 1063.

Table of wind directions and velocities from 1871 to 1886, **88,** 1067.

Physical elements of Front R. and North Chan., 1890, **91,** 1509.

Description of, **93,** 1540; **95,** 1456–1460 (chan. to Beaufort, **95,** 1522); **96,** 1222; **97,** 1497–1498; **98,** 1292–1294; **99,** 1561.

Current observations, **94,** 1141; **96,** 1228–1229.

Tidal observations, **88,** 1067; **94,** 1134–1141; **96,** 1222–1228; **11,** 1594; **12,** 1813.

Ebb and flood volumes gauged, **94,** 1142–1144; **96,** 1229–1236.

Chan. depths, velocities, and sectional areas, **96,** 1237–1242.

Scour due to js., and danger of forming bar outside, **01,** 1724.

Effect of js. on tidal range; chan. across bar moving s. and d., **01,** 1725.

Tables showing controlling d. in H., 1797 to 1903, and movement of material before and after constr. of js., **03,** 1150, 1151.

Tide gauge records, **04,** 1647.

H. and l. w. planes changed by extensive dr., **05,** 1262.

Diagram showing changes in h. and l. w. planes, **05,** 1264.

Scour and fill as shown by sur., **06,** 1189; **07,** 1272; **08,** 1328; **10,** 1460; **11,** 1594; **12,** 1813.

Settlement of training wall, **12,** 1815.

PROJECTS.

From 1826 to 1873, incl., $449,473.68 app., incl. relief claims, and applied to closing chan. between Hutchinsons and Argyle Islds. and Fig Isld., d. chan. over the wrecks, removing obstr., and in dr., **73,** 734, 737.

By Col. Gillmore, 1873, chan., Tybee Roads to Savannah City, with a h.-w. d. of 22′, to be accomplished by crib dam closing the Cross Tides and a short bulkhead on Hutchinsons Isld.; w. waterway at the city front and Fig Isld., and d., w., and strengthening the chan., by dr., at various points between the city and Tybee Roads; est., $481,320, **73,** 741, 747; **80,** 933; **82,** 1142.

Proj. modified, 1879, by a suppl. plan for imp. of the n. chan. of the R. from head of Elba Isld. to the head of Long Isld. by a low dam across the upper end of the s. chan., and by dams closing lateral chan. and providing shore protection where necessary, **80,** 948, 957.

BE., 1879, recom. approv. of proj., **80,** 947.

Est. cost of suppl. proj. covered by est. for proj. of 1879, **80,** 947; **82,** 1143.

From 1874 to 1881, incl., $714,132.96 app. on the proj. of 1873 and 1879, **82,** 1145.

Proj. of 1882 comprised those of 1873–79 and provided for add'l works with view to rendering the imp. permanent by raising the dam at Cross Tides to ordinary h. w.; for dr. in reach of Front R. from Cross Tides to city; increasing w. of chan. opposite city to 600 and 650′; constr. of training wall at Fig Isld.; elevation of s. chan. dam; imp. of shallow reaches between Jones and Elba Islds. by spur js. and wing dams; closing, by dams, the cross chans. between Elba and Cockspur Isld.; j. from Jones Isld., Red Light Beacon, and protection of St. Michaels Chan. by similar work; also shore protection and dr.; est., $730,000, **82,** 1143, 1144, 1145, 1152; **84,** 1099; **86,** 1087; **87,** 1150.

Proj. under which operations conducted, 1887 to 1889, submitted by Col. Gillmore, 1887, and provided for 28′ from the city of Savannah to the sea. Principal features of the proj. were: (1) to enlarge Drakes Cut to 200′; (2) to enlarge chan. s. of Kings Isld. to 400′, and to close the Cross Tides; (3) to build a training wall from the lower end of Marsh Isld. to Kinzeys Pt., to enlarge the R. at the city to 600′ by cutting off a part of Hutchinson Isld., and to connect the ends of the Garden Bank wing dams by a training wall extending from the old dry dock to a point above Fig Isld. Light; (4) to close the South Chan. below the mouth of St. Augustine Creek; (5) to connect the ends of the wing dams between the head of Elba Isld. and the Oyster Beds by training walls, extending about 3 m. eastward from the Oyster Beds, for the imp. of the chan. across Tybee Knoll; (6) to constr. detached break'r, rising to 2′ above m. h. w. and extending from shoal water between the mouths of Calibogue Sound and New R. in a se. direction to d. w. across the bar; to constr. s. j., extending from the n. end of Tybee Isld. in a ne. direction to d. w. across the bar, this j. to be at h. w. at its inner end, sloping down to half tide at 500′ out and retaining that height to the inner 18′ curve of the bar; beyond that point to be an apron course only, w. between the js. at outer 21′ curve to be about 2,500′, at the inner 18′ curve about 5,500′; (7) to dr. a chan. at least 28′ x 300′ m. h. w. from the city to the sea, the dr. material to be deposited on banks or behind training walls; (8) to constr. st. protection at various points; est., $6,660,000, **88,** 1006, 1007.

History of imp., **88,** 1013.

In 1890 operations continued under a revised proj. by Lt. Carter, providing for chan. d. of 26′ m. h. w., city to the sea, to be secured by—Enlargement of Drakes Cut as indicated in the orig. proj.; entire or partial removal of Kings Isld. with a view to turning add'l volumes into Front R. and thereby somewhat increasing the velocities; constr. of a deflecting j. from Argyle Isld.; partial removal of Marsh Isld., and closing up the chan. n. of it, with a view to throwing the entire flow into the enlarged s. chan. and thus doing away with the disadvantages incident upon 2 chans.; training wall from the lower end of Marsh Isld. to Kinzeys Pt., and w. of the unduly contracted region below Kinzeys Pt.; training wall in vicinity of Garden Bank in order to properly contract the R. there; spur js. or bank protection in the lower portion of Wrecks Chan. for the same purpose; dr. chan. 26′ d. at m. h. w. from city waterworks to the sea;

deflecting j. running out toward South Chan. from Mackeys Pt. in order to divert a greater ebb volume into North Chan.; removal of portion of Dam 15; closing of Duck Puddle in order to render permanent the imp. of North Chan. near the lower mouth of Duck Puddle; constr. of training walls and shore protection in concave bend near Spirit Isld., between wing dams in North Chan., and between Lower Flats and Oyster Beds, with view of obtaining strong ebb flow of uniform mean velocity throughout; dr. s. of Oyster Beds with view to cross-sectional areas of about 45,000 s. f. for mean ebb outflow, in order to induce a stronger flow through the s. opening and thence over Tybee Knoll; est., $3,500,000, **90,** 1261, 1263; **91,** 1492; **92,** 1244.

By Capt. Carter, 1894, extension of the Oyster Bed training wall, and constr. of a detached part parallel to the currents along the axis of the shoal between Tybee Roads and Calibogue Sound; est., $992,250, if amount available at once, **95,** 1459; not made available, **96,** 1213.

1896, proj. for imp. of a SS. chan. between Savannah H. and Beaufort, S. C. (dr. 7′ chan., m. l. w., by way of Rams Horn Creek and Wrights R., and constr. of a dam in the latter stream; est., $106,700), included in the proj. for the imp. of the former place, **96,** 1213.

BE. submitted report, 1898, of its ex., with suggestion that action be taken—

To remove Cross Tides Dam; to maintain all other existing training walls, dams, and dikes; to do necessary dr. to obtain and maintain chan., Savannah to the sea, suitable for vessels of 24′ draft m. h. w., depositing all dr. material outside the limits of R.; to establish and maintain 3 mooring stations between Savannah and the sea; to open and maintain a SS. chan. of sufficient w. and 7′ draft l. w. from Beaufort, S. C., to Savannah, Ga., by way of Mud R.; and to open and maintain a small-boat passage of 3′ x 20′ l. w. through the dikes and training walls near the foot of Elba Isld., **00,** 1927.

By BE. (q. v.), 1900, securing chan. 22′ x 350′–500′ by dr. and repairs to j.; also for mooring basins at the Bight and Venus Pt., 1,500′ and 3,000′ l., resp., with mooring dolphins; total est., $1,567,791, **01,** 1726; also est. for removal of Cross Tides Dam, and replacing with new one, above d. w., and for j. work and dr. necessary for substitution of n. chan. for s. chan., $2,880,000,[1] **01,** 1727.

By BERH., 1905, progressively increasing d. to 21′ and upward, by au. of $1,000,000, incl. $250,000 for dr. and $150,000 for permanent works above Tybee Knoll, work to be undertaken in tentative manner with the object of first securing max. d. across bar that could be maintained by dr. alone,[2] **06,** 311; **07,** 306; **10,** 381.

Act July 25, 1912, au. extending imp. to foot of Kings Isld., by chan. 21′ x 300′; est., $140,000; upon condition that city accepts parcel of land near upper end of proposed imp., and gives assurance to Sec. of War that it would provide suitable terminal facilities,[3] **12,** 1816.

SURVEYS.

R. gauging, 1879, **80,** 939.

Tidal observations, 1880, **80,** 940.

Au. act Mar. 3, 1881; made, 1882, by Lt. Col. Gillmore, **82,** 1152.

From Cross Tides to the bar au. act Aug. 5, 1886, **87,** 154.

Ex. au. act Aug. 5, 1886; made, 1886, by Col. Gillmore, **88,** 1057.

Sur. au. act Aug. 5, 1886; made, 1887, by Col. Gillmore, **88,** 1059.

Hydrographic sur. of Savannah R., Cross Tides to the sea, **90,** 1265.

Sur. to determine whether the damage to the Vernezobie Freshet Bank in 1887 was caused by the work at Cross Tides, and whether the mainten. of said bank is essential to the success of the work at Cross Tides, and to determine the cost of so constr. bank as to confine the water of said R. to its bed, au. act Aug. 11, 1888; made, 1889, by Capt. Carter.

Sur. for a chan. 7′ d. m. l. w. au. act Aug. 17, 1894; made by Capt. Carter, 1895 (see Projects), **95,** 1521.

Ex. of chan. made, and a detailed sur. of the R. commenced, 1894, **94,** 1134; sur. completed, 1895, **95,** 1455. Local detailed surs. of the H., 1895, **95,** 1455. Detailed exs. of the chan. made, 1896, by Capt. Carter, **96,** 1218.

Bench marks estab., **96,** 1224.

Sur. made, 1900, by Capt. Gillette, **00,** 1915.

Ex. au. act June 6, 1900; made, 1900, by Capt. Gillette,[1] **01,** 1719.

Of Tybee Knoll, outer bar and shoal places in inner H., **06,** 1189.

Au. act Mar. 3, 1905; made, 1905, by Lt. Col. Quinn,[2] **06,** 311.

Of outer bar, Tybee Roads and Tybee Knoll, **09,** 1327.

Complete, from upper limits of imp. to sea, **10,** 1460; **11,** 1592; **12,** 1815.

Pre. ex. of R. and H. au. act June 25, 1910, for 2 m. above upper limits of city of Savannah, with view to securing imp. navigation. Rs. by Col. Kingman, Sept. 9, 1910, and July 1, 1911; est., $140,000,[3] **12,** 524.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 490.

Maps:[2]

R. from Savannah City to Tybee Roads, **80,** 940.

Chart of Cross Tides, **81,** 1082.

Of R., **82,** 1150; **83,** 898; **84,** 1106; **85,** 1202.

Of R. and H., **86,** 1095; **87,** 1158.

88, 1012, 1072; **89,** 1226, 1284; **90,** 1302; **92,** Atlas, 49–57; **93,** 1546; **94,** 1136, 1152; **95,** 1464; **96,** 1244; **99,** 1566; **02,** 1178; **04,** 1646; **06,** 1192; **09,** 1332.

Part (c), O–2 Savannah River, Savannah to Augusta, Ga.[4]

APPROPRIATIONS.

1881,	$15,000,	**81,** 1090.
1882,	25,000,	**82,** 1173.
1884,	15,000,	**84,** 1109.
1886,	15,000,	**86,** 1100.
1888,	21,000,	**88,** 1029.
1890,	25,000,	**90,** 1327.
1892,	35,000,	**92,** 1256.
1894,	15,000,	**95,** 1467.
1896,	15,000,	**96,** 1247.
1899,	20,000,	**99,** 1570.
1900,	64,000,	**00,** 1930.
1901,	100,000,	**01,** 1636.
1902,	86,000,	**02,** 1184.
1904,	*5,000,	**05,** 1269.
1905	13,000,	**05,** 1269.
	*2,000,	**07,** 1281.
1907,	30,000,	**07,** 1281.
1909,	*25,000,	**09,** 1334.
1910	*4,000,	**10,** 1469.
	70,000,	**10,** 1469.
1911,	100,000,	**11,** 1600.
1912,	105,000,	**12,** 1822.
Total,	805,000	(incl. misc., $808,841.37, **12,** 1822).

* Allotment.

[1] H. D. 123, 56th, 2d. [2] H. D. 181, 59th, 1st. [3] H. D. 563, 62d, 2d.

[4] Sur.—R., June 23, 1854; est. $55,000. (H. D. 452, 56th, 2d.)

COMMERCE.

Increase in C., and saving in rates due to imp., **88,** 1028.

Rail and mill rates on cotton, 1885 to 1890, **91,** 1523.

C. and navigation, **92,** 1255.

Rates reduced about 20% by imp. C., 1892–93, had increased up to that time at the rate of $10 for every dollar spent in imp. by the U. S., **93,** 1550.

The 5 SS. engaged on the R. in 1897–98 carried freight valued at $1,730,000, **98,** 1300.

Value of freight carried, 1898–99, by 4 SS., $2,862,015; and 3,000,000′, b. m., of timber, value $210,000, rafted down the R., **99,** 1569.

Freight valued at $3,500,000 carried, 1899–00, by 3 SS.; and 5,000,000′, b. m., of timber, value $150,000, rafted down the R., **00,** 1929.

Unimportant prior to imp.; increased since, **01,** 326.

Rates reduced 30 to 50% since 1896, **06,** 296.

1911, 40,168 t., **12,** 493.

CONTRACTS.

1883. J. E. Walter, wing-dam constr., **83,** 908.

1884. E. H. Gaynor, wing-dam constr., **85,** 1211.

1886. J. F. Gaynor, wing-dam constr., **87,** 1170.

1888. M. A. Sweeny & Bro., repairing snag boat, $10,400, **89,** 1241.

1889. W. T. Gaynor, riprap st., $2 c. y.; fascines, 70¢ c. y., **90,** 1327.

1891. J. F. Gaynor, constr. and repair of wing dams and shore protection, $1.29 c. y. for mattress and $2.69 c. y. for st., **92,** 1256.

1893. A. J. Twiggs, constr. of wing dams and shore protection; mattresses, 74¢ c. y.; st., $1.74 c. y. ($12,510), **93,** 1551. Part of this work under this contract was done by the U. S. at the contractor's expense, **94,** 1159.

1900. A. J. Twiggs, training dikes, unit prices, **01,** 1636.

1901. Hunter & Frey, training dikes, unit prices, **02,** 1184.

1903. A. J. Twiggs, dike work, unit prices, **03,** 1155.

1905. A. J. Twiggs, constr. dikes; piling, $2.50 each; brush, 60¢ c. y.; st., $2.25 c. y., **06,** 1195.

1906. A. J. Twiggs, dike work; st., $4 c. y.; brush, $1 c. y.; piles, $5 each, driven, **07,** 1281.

1907. A. J. Twiggs, dike work, unit prices, **07,** 1282.

1911. Merrill-Stevens Co., constr. two 10″ pump boats, $17,875; Simons-Mayrant Co., constr. and repair shore protection and training dikes (unit prices given), **11,** 1601.

ENGINEERS.

Chief of Engineers. **R., 80,** 132; **81,** 173; **82,** 168; **83,** 177; **84,** 184; **85,** 184; **86,** 183; **87,** 146; **88,** 139; **89,** 159; **90,** 142; **91,** 180; **92,** 176; **93,** 191; **94,** 176; **95,** 200; **96,** 179; **97,** 227; **98,** 223; **99,** 257; **00,** 294; **01,** 326; **02,** 253; **03,** 260; **04,** 265; **05,** 273; **06,** 295; **07,** 308; **08,** 327, 346; **09,** 337; **10,** 383; **11,** 405; **12,** 491.

In charge:

Col. Q. A. Gillmore, 1872–87. **R., 81,** 1088, 1090; **82,** 1171; **83,** 905; **84,** 1107; **85,** 1207; **86,** 1098; **87,** 1165.

Lt. O. M. Carter, 1888–97. **R., 88,** 1026; **89,** 1237; **90,** 1324, 1328; **91,** 1519; **92,** 1253; (Capt.) **93,** 1547; **94,** 1158; **95,** 1465; **96,** 1245; **97,** 1503.

Capt. C. E. Gillette, 1898–02. **R., 98,** 1299; **99,** 1567; **00,** 1928; **01,** 1634; **02,** 1183.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1152; **04,** 1648; **05,** 1267.

Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1193; **07,** 1279; (Col.) **08,** 1336; **09,** 1333; **10,** 1467; **11,** 1598; **12,** 1819.

Assistants:

S. L. Fremont. **R., 81,** 1094.

Capt. B. D. Greene. **R., 82,** 1173.

Capt. T. N. Bailey. **R., 83,** 909; **84,** 1109.

Capt. J. C. Post. **R., 83,** 910.

Lt. O. M. Carter. **R., 85,** 1212; **87,** 1172.

Lt. F. V. Abbot. **R., 85,** 1211; **87,** 1171.

W. R. Curtis. **R., 88,** 1029.

G. W. Brown. **R., 90,** 1332.

F. C. Armstrong. **R., 90,** 1363; **91,** 1525; **92,** 1257.

R. S. Burnett. **R., 93,** 1551; **94,** 1161; **95,** 1468; **96,** 1248.

OPERATIONS.

1881–82. Snag boat built; 144 snags and logs and 141 trees removed from R. bed, **82,** 1172.

1882–83. 5 wing dams built, averaging 275′ in l.; snags, piles, and flatboat wrecks removed, **83,** 906, 907.

1883–84. 117 snags and piles, and 45 trees removed from the R., **84,** 1108.

1884–85. 2 wing dams built and 2 completed at Courses Bar; 5 wing dams built at Sand Bar, Ferry Bar, and 4 at Blue House Bar; 358 snags, 11 stumps, and 385 trees removed, **85,** 1210.

1886–87. Wing dams built at Blue House Bar and Courses Bar; 259 logs and snags and 596 leaning trees removed from R. between Savannah and Masons Ferry, **87,** 1167, 1171, 1172.

1889–90. 244 snags and stumps removed from the chan., and 120 trees from the bank; 4,572 c. y. fascines and 1,158 c. y. st. placed in spur dams, **90,** 1326.

1890–91. 353 snags removed from the chan., and 3,443 overhanging trees cleared from banks, **91,** 1521.

1891–92. 2,179 c. y. brush fascines and 1,382 c. y. st. used in constr. of spur dams, and 2,682 c. y. brush fascines and 1,969 c. y. st. used in repairs to old work, **92,** 1254.

1892–93. 9,536 logs and other obstr. removed from R. and banks, **93,** 1549.

1893–94. 5,682 c. y. fascines, 5,152 c. y. st. put into the works by contract, and 1,549 c. y. fascines and 1,589 c. y. st. by U. S. About 700 snags and other obstr. removed from R. and banks, **94,** 1160.

1894–95. About 2,800 snags and other obstr. removed; 9,594 c. y. dr.; 956 piles driven; 2,344 l. f. pile work wattled; 3,880 s. y. mattresses and 1,430 c. y. fascines used in the constr. of spur dams, **95,** 1466.

1895–96. About 30 logs and other obstr. removed; 2,825 c. y. dr.; 86 piles driven; 436 l. f. pile work wattled; 332 s. y. mattresses and 56 c. y. st. used in the constr. of spur dams, **96,** 1246.

1896–97. About 2,500 snags and other obstr. removed from the R. and banks; 5 wrecks and 100 c. y. r. removed, **97,** 1504.

1897–98. About 200 logs and other obstr. removed, **98,** 1300.

1898–99. 108 c. y. r. and over 700 snags and other obstr. removed from R. and banks; 260 piling placed in training dike for imp. of Brighams Bar, **99,** 1569.

1899–00. Over 3,700 snags and other obstr. removed; training dikes at Brighams Bar, Flowery Gap Bar, and Half Guinea Bar constr., **00,** 1929.

1900–01. One training dike 700′ finished, 3 aggregating 2,765′ built and 2 partly built, 2 shore-protection dikes aggregating 3,876′ partly built, 47 snags and stumps removed, 467 trees cut, and old dam blown out, **01,** 1634.

1901–02. 11,721′ training dikes, 1,825′ shore-protection dike and 845′ spur dikes completed, 9,864′ dikes partly built, and house boat and snag boat built, **02,** 1182. 392 obstr. removed from chan. and 3,154 from banks, **02,** 1183.

1902–03. 7,280′ dike repaired and refilled, and 4,260′ dike and 5,560′ shore protection built; 1,241 obstr. removed from chan. and 4,544 from banks, **03,** 1153, 1154.

1903–04. 9,137 c. y. brush bundles, 3,715 c. y. st., 11,360′ timber, 568 lbs. iron spikes, and 600 l. f. piling used in repairing and refilling dikes; 1,574 obstr. removed from chan. and 1,554 from banks, **04,** 1648.

1904–05. 3,840 snags and stumps and 4 small barges removed from chan., 1,476 trees and logs cut or girdled, and one clay bank removed, **05,** 1267.

1905-06. 1,900′ dike built, **06,** 1193. 506 obstr. removed from chan. and 1,065 from banks, **06,** 1194.

1906-07. 600′ dike built and 60′ removed, **07,** 1280.

1907-08. 1,935 obstr. removed from chan. and 3,877 from banks, 40′ dam and 100′ dike removed, training wall repaired, several sand bars imp., and point of bank removed, **08,** 1336.

1908-09. 2,318 obstr. removed from chan. and 3,293 from banks, Tweedys Bar impd., machinery removed from sunken SS. *Two States*, and sunken lighter removed, **09,** 1333.

1909-10. 2,884 obstr. removed from chan. and 1,757 from banks, assisted in raising sunken SS. *Katie*, 1,512′ shore-protection dike and 3,619′ training wall built, **10,** 1467.

1910-11. Snag boat *Tugaloo* removed 4,727 snags, 380 stumps, cut 1,342 trees and 198 logs on banks; boat repaired; under contract constr. and repairing shore-protection and training dikes near Augusta; new pump boat completed and delivered, **11,** 1599.

1911-12. 2,199 snags, 204 stumps and sunken lighter removed from chan., and 1,839 overhanging trees and logs cut on banks; protection dike 3,264′ long at Canoe Cut Bar and 150′ spur dam constr.; shore-protection dike at Masons Landing about 85% completed; snag boat *Tugaloo* made minor repairs to regulating works; 93,825 c. y. dr. from four sand shoals, **12,** 1819.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1026; **89,** 1237; **90,** 1328.

Mainten. of chan. would be easy if erosion of banks could be stopped, **03,** 1153.

Unusual number, and prolonged duration of freshets, **12,** 1820.

PRIVATE WORK.

Snag boat made unsuccessful attempt to raise sunken SS. *Swan* at expense of owners, **06,** 1194.

U. S. snag boat removed some interlocking steel piling forming cofferdam at new lift bridge of Seaboard Ait Line Ry. Co., and work paid for by Ry. Co., **11,** 1598; **12,** 1820.

PROJECTS.

By Col. Gillmore, 1880, securing a 5′ l.-w. chan. Savannah to Augusta by dr., contraction of R., bank protection, and the removal of logs, snags, and similar obstr.; est., $91,000, **80,** 1094; **86,** 1098; **87,** 1166.

By Lt. Carter, 1890, estab. of navigable 5′ SS. chan. at ordinary summer l. w. between Augusta and Savannah by removal of sand bars, regulating portions of the R., revetting caving banks, closing incipient cut-offs, and removing snags and logs from the chan. and overhanging trees from the banks of the stream; est., $332,000, **90,** 1324, 1329, 1330; **92,** 1253.

In 1895–96 Capt. Carter est. $3,000 to $5,000 an. for mainten., **96,** 1245.

Lt. Col. Quinn, 1904, est. $75,000 to complete proj.; also recom. sur. with view to imp. by locks and dams just below Augusta, **04,** 1648.

By Col. Kingman, 1908, plan for imp. of entire R.; est., $360,000,[1] **08,** 346; **10,** 384.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Col. Gillmore, **81,** 1090.

Of the R. between Savannah and Augusta; made, 1870, **90,** 1328, 1332.

For 30 m. below Augusta, au. act Mar. 2, 1907; made, 1907–08, by Col. Kingman,[1] **08,** 346.

Maps. **83,** 908; **84,** 1106; **85,** 1210; **86,** 1094; **90,** 1362; **94,** 1160; **02,** 1184.

Part (d), O–2 Savannah River, above Augusta, Ga.

APPROPRIATIONS.

1880,	$16,000,	**80,** 959.
1881,	8,000,	**81,** 1104.
1882,	15,000,	**82,** 1175.
1892,	10,000,	**93,** 1556.
1894,	6,000,	**95,** 1472.
1896,	3,000,	**96,** 1252.
1899,	1,000,	**99,** 1572.
1905,	2,000,	**05,** 1270.
1907,	3,000,	**07,** 1283.
1910,	3,000,	**10,** 1470.
1912,	3,000,	**12,** 1825.
Total,	70,000	

COMMERCE.

1892–93, freight valued at $350,000, **93,** 1555; 1899, freight amounted to 5,570 t., valued at $199,310, **00,** 1032.

Navigation made safer and easier; effect on rates unknown, **06,** 298.

1911, 1,635 t., **12,** 1825.

CONTRACTS.

1880. Anderson & Blaisdell, dam constr. and removal of obstr., **81,** 1104.

1883. W. H. Browne, r. removal and wing-dam constr., **83,** 913.

1892. W. H. Walsh; r. excavation, $4.25 c. y.; fascines, $1.50 c. y.; riprap st., $2.75 c. y.; clearing R., $35 20 m. ($9,950), **93,** 1556.

ENGINEERS.

Chief of Engineers. **R., 80,** 129; **81,** 174; **82,** 169; **83,** 178; **84,** 185; **85,** 185; **86,** 184; **87,** 148; **88,** 140; **89,** 160, 164; **90,** 143, 147; **93,** 192; **94,** 177; **95,** 201; **96,** 180; **97,** 228; **98,** 224; **99,** 259; **00,** 296; **01,** 327; **02,** 255; **03,** 261; **04,** 267; **05,** 275; **06,** 297; **07,** 310; **08,** 329; **09,** 339; **10,** 386; **11,** 408; **12,** 496.

In charge:

Col. Gillmore, 1872–87. **R., 80,** 958; **81,** 1103; **82,** 1174; **83,** 911; **84,** 1110; **85,** 1213; **86,** 1100; **87,** 1172.

Lt. O. M. Carter, 1888–97. **R., 88,** 1031; **89,** 1241; **90,** 1365, 1484; (Capt.) **93,** 1554; **94,** 1164; **95,** 1470; **96,** 1250; **97,** 1506.

Capt. C. E. Gillette, 1898–02. **R., 98,** 1301; **99,** 1571; **00,** 1930; **01,** 1636; **02,** 1184.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1155; **04,** 1650; **05,** 1269.

Lt. Col. Dan C. Kingman, 1906–. **R., 06,** 1195; **07,** 1282; (Col.) **08,** 1338; **09,** 1335; **10,** 1470; **11,** 1603; **12,** 1824.

Assistants:

Capt. B. D. Greene. **R., 81,** 1104; **82,** 1175.
Lt. T. N. Bailey. **R., 83,** 913.
Capt. J. C. Post. **R., 83,** 914.
Lt. F. V. Abbot. **R., 85,** 1214.
W. R. Curtis. **R., 88,** 1032.
G. W. Brown. **R., 90,** 1498, 1526.
R. S. Burnett. **R., 95,** 1472; **96,** 1252.

OPERATIONS.

1880-81. 722 c. y. r. and gravel removed, **81,** 1103.

1881-82. 3,365 c. y. r. and 35 c. y. gravel removed, and 1,800 c. y. riprap dams built, **82,** 1174.

1882-83. 439 c. y. r. excavated and 6,669 s. y. of mattress and 1,726 c. y. of st. employed in wing-dam constr., **83,** 912.

1883-84. 302 c. y. ledge r. removed, **84,** 1110.

1892-93. 2,018 c. y. fascines, 1,186 c. y. riprap st. used in the repair and constr. of dams, 341 c. y. r. excavated, and 48 m. of R. bank cleared, **93,** 1555.

[1] H. D. 962, 60th, 1st.

1894-95. 85 c. y. r. excavated; 2,860 s. y. mattresses laid with 1,310 c. y. riprap st. on works of direction; about 150 obstr. removed from R. and banks, **95,** 1471.

1895-96. 390 s. y. mattresses, 325 c. y. fascines, 462 c. y. riprap st. used in the constr. and repair of dams; 378 c. y. r. removed, **96,** 1251.

1896-97. 6 c. y. r. removed and 30 c. y. st. used in the repair of dams, **97,** 1507.

1899-00. 2,030 c. y. r. and over 4,000 overhanging trees, snags, and other obstr. removed, training dike built at Bush Rock Landing, and repairs made to dikes at Little Rapid Gap, Stephens Falls, Marquarts Hay Landing, Little R., Scotts Shoals, and just above Bush Rock Landing, **00,** 1931.

1900-01. Dams repaired, 41 trees cut and 3 girdled, **01,** 1636.

1905-06. 17 bowlders, 23 c. y. r., and 51 logs removed and 1,281 trees cut; dam at Marquarts repaired, **06,** 1195.

1907-08. 3 bowlders and r. ledge removed, and dam 40′ long built, **08,** 1338.

1908-09. 163 obstr. and 52 c. y. bowlders removed from chan. and 294 obstr. from banks; dams repaired, **09,** 1335.

1909-10, 34 obstr. removed from chan. and 299 from banks; 258 c. y. r. quarried and 276 c. y. placed in repairing dams, **10,** 1470.

1910-11. 73 snags, 18 logs, and 211 c. y. loose r. removed; 257 trees cut; 536 c. y. r. placed in repairing dams, **11,** 1603.

1911-12. 311 c. y. r. used in repairing existing regulating works, cut opened through sand bar, large snag removed from chan., and st. washed from dams replaced, **12,** 1824. Proj. about 64% completed, **12,** 496.

PHYSICAL CHARACTERISTICS.

Heavy freshets fill chan. and block navigation, **12,** 1824.

PRIVATE WORK.

Au. granted to 2 private companies to constr. dams, one 8 m. and the other 27 m. above city, **10,** 387.

PROJECTS.

By Col. Gillmore, 1879, imp. of Savannah R. from Augusta to head of pole-boat navigation on the Tugaloo, 154 m., by formation of a 3′ chan. 30′ w. from Augusta to Trotters Shoal, 64 m., and removal of rs., snags, and similar obstr. for the remaining distance; est., $45,000, **80,** 958, 959; **87,** 1172.

Further app. not recom., because the cost of the permanent imp. of the R. would be disproportionate to the requirements of C., **87,** 1173.

By Lt. Carter, 1890, estab., between Petersburg and The Locks, a downstream chan. 12′–25′ w. and navigable during ordinary summer l. w. for pole boats drawing 2′, and for an upstream chan., navigable under the same conditions, for pole boats drawing 1.3′ of water; this to be obtained by removal of logs and overhanging trees, excavation of r., sand, and gravel, and constr. of training walls to increase the flow of water through the sluices est., $33,000, **90,** 1366.

SURVEYS.

Ex. made above Augusta, 1878, by Col. Gillmore, **79,** 447–450.

Au. act Aug. 11, 1888; made, 1890, by Lt. Carter **90,** 1525.

Ex., 1893–94, by Capt. Carter, **94,** 1165.

Part (e), O–2 Savannah River, Ga., Spirit Island to the Crossing of the Charleston and Savannah Rwy. Co.

COMMERCE.

In 1892 no change had taken place since last **R.,** 1890, **93,** 1610.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 198; **95,** 207.

In charge. Capt. O. M. Carter, 1888–95. **R.,** **93,** 1609; **95,** 1520.

PHYSICAL CHARACTERISTICS.

Description of Spirit Isld., 6 m. below Savannah; the Charleston & Savannah Ry. br., 14 m. above, **93,** 1609.

SURVEYS.

Ex. au. act July 13, 1892; made by Capt. Carter, 1892 (**R.** fav.), **93,** 1609.

Sur. au. act Aug. 17, 1894; **R.** by Capt. Carter, 1894, **95,** 1520.

Part (f), O–2 Savannah River, at Augusta, Ga.

APPROPRIATIONS.

1910, $125,000, **10,** 1469.

CONTRACTS.

1911. Bryan & Co., protection of R. bank along city front at Augusta (prices given), **11,** 1603.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 386, 407; **11,** 407; **12,** 494.

In charge. Col. D. C. Kingman, 1910–. **R.,** **10,** 1469; **11,** 1601; **12,** 1822.

OPERATIONS.

1910-11. 1,466 c. y. dr. toward providing a trench at toe of slope, and 3,567 t. st. placed; contractor did considerable clearing of R. bank, **11,** 1602.

1911-12. 23,112 c. y. excavated toward providing a trench, and in this trench 33,916.12 t. riprap st. placed; for subpavement 7,491 t. st. placed on R. bank and for top pavement 21,937 t. large st.; excavation and filling ahead of paving done; 9,708 c. y. excavated and 9,019 t. st. placed therein, not paid for, **12,** 1823. Proj. 66% completed, **12,** 495.

PHYSICAL CHARACTERISTICS.

Unusual number, and prolonged duration, of freshets, **12,** 1823.

Work already done has withstood severe freshets of 1911–12, **12,** 495.

PRIVATE WORK.

City of Augusta deposited $125,000 as its half of cost of imp. with U. S. Asst. Treas., New York, N. Y., **11,** 407.

PROJECT.

By Col. Kingman, 1909, riprapping 7,900′ bank along city front; est., $250,000, ½ to be paid by city,[1] **10,** 386, 407. Au. act June 25, 1910.

SURVEY.

Au. act Mar. 3, 1909; made, 1909, by Col. Kingman,[1] **10,** 407.

[1] H. D. 487, 61st, 2d.

O–2(g) SAVANNAH, GA., AND FERNANDINA, FLA. (Inside water route between.)

APPROPRIATIONS.

1892,	$15,000,	**93,** 1607.
1894,	20,000,	**95,** 1518.
1896,	14,000,	**96,** 1301.
1902,	15,000,	**02,** 1197.
1905,	41,000,	**05,** 1285.
1907,	30,000,	**07,** 1297.
1909,	*25,000,	**09,** 1350.
1910,	12,500,	**10,** 1485.
1911,	30,000,	**11,** 1621.
1912,	40,000,	**12,** 1842.
Total,	242,500	(incl. $664.40 collected from surety, $243,164.40, **12,** 1842).

COMMERCE.

C. interests to be affected by the imp., **92,** 1323.

Description of, **93,** 1605; **95,** 1517; **99,** 1591; **00,** 1954, 1955.

Route of great value to the coasting trade, **93,** 1605.

1891, 156,000 t.; valued at $2,787,000, and 41,000 passengers, **93,** 1606. 1894, value $2,230,000; 36,000 passengers carried, **95,** 1517. 1896, value of C. $2,000,000, **96,** 1301.

Little through C., but large local; description of, **01,** 1653.

Practically all freight carried over this route is upon detached sections, **12,** 1841.

1911, 167,730 t., **12,** 517.

CONTRACTS.

1893. Atlantic Contracting Co., j. constr.; mattresses, 99¢ s. y.; riprap st., $3.59 c. y. ($19,680), **93,** 1607.

1895. W. T. Gaynor, j. constr.; mattresses, $1 s. y.; fascines, $1.65 c. y.; pile work, $1.50 l. f.; fender piles, $50 cluster; tie piles, $20 group; sawed timber, $25 1,000′ b. m.; iron bolts, 5¢ lb.; riprap st., $3.05 c. y. ($48,000), **95,** 1518.

1896. R. R. Moore, dr., 10¢ c. y. ($7,500), **97,** 1538.

1903. George T. Warner, dr., 16¾¢ c. y., **03,** 1168.

1909. Simons-Mayrant Co., dr., 17.9¢ c. y., p. m., **09,** 1350. Blackstaff Engineering Co., raising j.; st., $2.60 t., **10,** 1485. Annulled Oct. 1, 1910, **11,** 1621.

1910. R. G. Ross, j. work, $2.94 t. for st. in place, and $7.20 t. for st. placed to mark outer end of training wall, **11,** 1618. P. Sanford Ross (Inc.), dr. 55,000 c. y., 17⅓¢ c. y., **11,** 1621.

ENGINEERS.

Chief of Engineers. R., 91, 185; **92,** 181; **93,** 198; **94,** 182; **95,** 206; **96,** 185; **97,** 1236; **98,** 230; **99,** 265; **00,** 303; **01,** 332; **02,** 262; **03,** 269; **04,** 276; **05,** 285; **06,** 307; **07,** 322; **08,** 341; **09,** 353, 358; **10,** 401; **11,** 425; **12,** 515.

In charge:

Capt. O. M. Carter, 1891–97. **R., 92,** 1309, 1311; **93,** 1604; **94,** 1206; **95,** 1515; **96,** 1299; **97,** 1535.

Capt. C. E. Gillette, 1898–02. **R., 98,** 1318; **99,** 1590; **00,** 1953; **01,** 1653; **02,** 1196.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1166; **04,** 1662; **05,** 1283.

Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1207; **07,** 1295; (Col.) **08,** 1352; **09,** 1348; **10,** 1483; **11,** 1618; **12,** 1840.

OPERATIONS.

1892–93. 17,170 s. y. mattresses and 1,252 c. y. riprap st. placed in training wall, **93,** 1605.

1894–95. 29,844 c. y. dr. from Jekyl Creek. 10,616 s. y. matresses, and 1,873 c. y. riprap st. placed in position at the mouth of Jekyl Creek. A cluster of piles driven at the outer end of the training wall, and ranges marking dr. cuts set up, **95,** 1516, 1517.

1897–98. 112,453 c. y. dr., **98,** 1319.

1903–04. 56,629 c. y. dr.; contractor's dr. seized by U. S. marshal, **04,** 1662.

1904–05. 11,830 c. y. dr., **05,** 1283.

1905–06. 85,231 c. y. dr., j. at mouth of Jekyl Creek raised, and old discharge pipe and large log removed from chan., **06,** 1207.

1906–07. 88,730 c. y. dr., and training wall 2,000′ long built in Jekyl Creek, **07,** 1295.

1907–08. Work of raising training wall at Jekyl Creek commenced; chans. marked by Lighthouse Dept., **08,** 1352.

1908–09. 88,401 c. y. dr., raising of training wall at Jekyl Creek completed and extension begun, **09,** 1348.

1909–10. 5,667 c. y. dr.; training wall in Jekyl Creek extended 1,000′ and 800′ j. built at entrance; dam built in Mud Creek, **10,** 1483.

1910–11. Work of raising j. at entrance to Jekyl Creek completed, total of 3,730 t. st. placed; 25,053 c. y. dr. from Jekyl Creek, **11,** 1619.

1911–12. Training wall in Jekyl Creek raised, 1,024.6 t. small st. being placed; 27,744 c. y. material removed. Burning of contractor's dr. delayed work, **12,** 1840.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1311; **96,** 1299.

Proj. d. of 7′ m. l. w. obtained throughout the route, with the exception of the link known as Skidaway Narrows, which was orig. imp. under a separate proj. calling for 6′. This link is now an integral part of the inside water route, **12,** 516.

PLAN.

By Capt. Carter, 1891, continuous chan. not less than 7′ d. m. l. w. between Savannah, Ga., and Fernandina, Fla., by dr., bank revet., and spur-dam constr. at Romerly Marsh, Mud R., Little Mud R., and Jekyl Creek; est., incl. an. cost of mainten. after completion of the Romerly Marsh and Mud R. imp., $195,000, **92,** 1323.

PROJECTS.

By Capt. Carter, 7′ chan. m. l. w., by the imp. of Romerly Marsh, Mud R., Little Mud R., and Jekyl Creek by dr. and closure dams and training walls of brush mattresses loaded with riprap st.; est., $105,000, provided funds should be available at once, **93,** 1605.

Lt. Col. Quinn, 1905, increased est. to complete proj. $50,000, and $10,000 an. mainten., **05,** 1284.

Lt. Col. Kingman recom., 1906, chan. 10′ x 150′–200′, **06,** 1208.

By Col. Kingman, 1909, plan for imp.; est., $237,700,[1] **09,** 358.

Act July 25, 1912, au. continuation of imp. to d. of 7′, with w. of chan. from minimum w. of 50′ to uniform w. of 150′; also for departure from main route (1) from Romerly Marsh to Skidaway Narrows, and (2) from Mud R. to Front R.; also for imp. of auxiliary chans. as follows: Three m. cut, near Darien, on the branch route between Darien and Brunswick, 7′ d.; route around St. Simons and St. Andrews Sounds, affording a l. w. d. of 3′, and a branch route to reach wharves along s. end of Cumberland Isld., affording a l. w. d. of 8′; also includes route by way of Club and Plantation Creeks,[1] **12,** 516.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Carter, **92,** 1311.

Ex., 1894, by Capt. Carter, **94,** 1208.

Of the Dividings, Jekyl Creek, and Mud R., **03,** 1166.

Ex. of Jekyl Creek, Altamaha and Buttermilk Sounds, Little Mud R. and part of Mud R., **05,** 1283.

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* Allotment.

[1] H. D. 1236, 60th, 2d.

Of Mud R., **06,** 1207; **07,** 1295.
Ex. at the Dividings, Little Mud R., Jekyl Creek, and Mud R., **07,** 1295.
Cross-sections, **09,** 1348.
Resur. au. act Mar. 2, 1907; made, 1908, by Col. Kingman,[1] **08,** 1352; **09,** 358.

Ex. dr. chan. at Cumberland Dividings, Jekyl Creek, Frederica R., Little Mud R., and Mud R., **10,** 1484.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 517.
Maps.[1] **99,** 1590; **11,** 1620.

O–2(h) LOUISVILLE, GA., TO SAVANNAH, GA. (Waterway.)

ENGINEERS.
Chief of Engineers. **R.,** **12,** 524.
In charge. Col. D. C. Kingman, **12,** 484.

SURVEY.
Pre. ex. and sur. au. act Feb. 27, 1911, for more direct route between said cities than that afforded by existing chan., including cut-off or canal from Ogeechee R. to Savannah R. or H. (**R.** to come), **12,** 524.

O–2(i) SAVANNAH, OCMULGEE, FLINT, AND CHOCTAWHATCHEE RIVERS.

APPROPRIATION.
1852 (sur.), $10,000, act Aug. 30.

O–2(j) HIWASSEE, TENNESSEE, AND SAVANNAH RIVERS, GA.[2] AND TENN. (Canal connecting the headwaters.)

ENGINEERS.
Chief of Engineers. **R.,** **80,** 190; **81,** 258.
In charge. Maj. W. R. King. **R.,** **81,** 1888.
Assistant. S. Whinery. **R.,** **81,** 1890.

PLANS.
By Maj. King, for sur. costing $15,000, upon which to submit plans and ests., **81,** 1889.

SURVEY.
Au. act June 14, 1880, **80,** 190. **R.,** Maj. King, 1881 (fav.), **81,** 1888.

O–13 TUGALOO RIVER, GA., AND S. C.

ENGINEERS.
Chief of Engineers. **R.,** **12,** 524.
In charge. Col. D. C. Kingman, **12,** 484.

SURVEY.
Pre. ex. and sur. au. act Feb. 27, 1911, from its mouth to Fort Madison, S. C. **R.** by Col. Kingman, July 17, 1911[3] (unfav.), **12,** 524.

O–60 BRIER CREEK, GA.

ENGINEERS.
Chief of Engineers. **R.,** **06,** 311.

SURVEY.
Pre. ex., mouth to Garnett, Ga., au. act Mar. 3, 1905; Col. Quinn's **R.** unfav.,[4] **06,** 311.

O–77 ST. AUGUSTINE CREEK (Thunderbolt River), GA.

APPROPRIATION.
1879, $5,000, **79,** 97.

CONTRACT.
1880. J. G. Smith, partial removal of sunken dry dock, $1,500, **80,** 958.

ENGINEERS.
Chief of Engineers. **R.,** **77,** 69; **78,** 77; **79,** 97; **80,** 129; **81,** 174; **82,** 175; **83,** 185; **84,** 186; **85,** 186; **86,** 185; **87,** 148.
In charge. Lt. Col. Q. A. Gillmore, 1875–87. **R.,** **75,** ii, 37; **77,** 381; **78,** 579; **79,** 763; (Col.) **80,** 957; **81,** 1105; **82,** 1202; **83,** 954; **84,** 1111; **85,** 1214; **86,** 1102; **87,** 1174.

OPERATIONS.
1880–81. Partial removal of sunken dry dock, **81,** 1105.

PHYSICAL CHARACTERISTICS.
Description, **75,** ii, 37; **79,** 763.

PROJECT.
By Lt. Col. Gillmore, 1875, for removing sunken timber dry dock for chan. entrance to d. of 10′ at m. l. w.; est., $5,000, **75,** ii, 37; **77,** 381; **80,** 957.

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[1] H. D. 1236, 60th, 2d.
[2] Hiwassee R., Tenn., to Alabama R., canal. Ex.—**R.** (fav.), Nov. 26, 1828. (H. D. 482, 55th, 2d.)
[3] H. D. 676, 62d, 2d.
[4] H. D. 143, 59th, 1st.

O–85 COW HEAD (Cowhead Cut) RIVER, GA.

APPROPRIATIONS.

1912, $3,000, **12,** 1819.

COMMERCE.

Object of proposed imp. is to provide a sheltered water route, navigable for light-draft boats at all stages of tide, **12,** 491.

ENGINEERS.

Chief of Engineers. **R., 12,** 490, 523.
In charge. Col. Dan C. Kingman, 1912–. **R., 12,** 1819.

PHYSICAL DATA.

R. a very narrow high-water connection between Tybee Creek and Lazaretto Creek, **12,** 491.

PROJECT.

Act July 25, 1912, au. dr. straight cut connecting Tybee Creek and Lazaretto Creek to 6′ x 75′ m. l. w.; local interests will give $3,000 and right of way, **12,** 491.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910; **Rs.** by Col. Kingman, 1910; est., $6,000, of which the local interests are to contribute $3,000 and furnish right of way free,[1] **12,** 523.
Maps.[1]

O–99 SKIDAWAY NARROWS, GA.

APPROPRIATIONS.

1905,	$20,000,	**05,** 1286.
1907,	35,000,	**07,** 1298.
Total,	55,000	

COMMERCE.

Description of, **01,** 1729; **04,** 1683.
Mostly that following inland water route between Savannah and Fernandina, **01,** 1729.
Much restricted by inadequate navigation facilities, **04,** 1682.
Considerable increase expected, following imp., **04,** 1684.
Nearly all traffic takes new route, although available only at h. w., **07,** 1297.

CONTRACTS.

1905. Wayne Cunningham, dr., 14.5¢ c. y., p. m., **06,** 1210.
1907. Savannah Dredging Co., dr., 13¾¢ c. y., p. m., **08,** 1355.

ENGINEERS.

Chief of Engineers. **R., 01,** 335, 1728; **04,** 280, 1680; **05,** 286; **06,** 309; **07,** 323; **08,** 342; **09,** 354; **10,** 403.
Boards. BERH. **R., 04,** 1682, 1683.

In charge:
Capt. C. E. Gillette, 1901. **R., 01,** 1729.
Lt. Col. J. B. Quinn, 1904–05. **R., 04,** 1681, 1683; **05,** 1285.
Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1209; **07,** 1297; (Col.) **08,** 1354; **09,** 1350; **10,** 1486.

OPERATIONS.

1905-06. 105,480 c. y. dr., **06,** 1210.
1906-07. 8,046 c. y. dr., and 50 logs and 25 stumps removed, **07,** 1297.
1907-08. 114,052 c. y. dr., **08,** 1354.
1908-09. 113,633 c. y. dr., completing proj. **09,** 1350.

PHYSICAL CHARACTERISTICS.

Description of, **01,** 1729; **04,** 1681.

PROJECTS.

By Lt. Col. Quinn, 1903, chan. 6′ x 75′ connecting Skidaway and Burnside Rs.; est., $55,000; recom., however, a route to the w. of the Narrows,[2] **04,** 1681; **05,** 1286.
Col. Kingman recom., 1909, imp. thereafter be treated as part of inland water route between Savannah, Ga., and Fernandina, Fla., **09,** 1350.

SURVEYS.

Ex. au. act June 6, 1900; made, 1900, by Capt. Gillette (**R.** unfav.),[3] **01,** 1728.
Au. act June 13, 1902; made, 1903, by Lt. Col. Quinn,[2] **04,** 1680.
Of imp. chan., **08,** 1354.
See Inland Water Route between Savannah, Ga., and Fernandina, Fla., **09,** 1350.

O–101 ROMERLY MARSH, GA. (Water route through.)

APPROPRIATIONS.

1882,	$10,000.00,	**83,** 917.
1884,	10,000.00,	**84,** 1113.
1886,	17,475.00,	**86,** 1105.
1888,	4,633.77,	**88,** 1035.
Total,	42,108.77	

CONTRACTS.

1883. Dickerson & Paulson, dr., 18¢ c. y., **83,** 917.
1884. P. S. Ross, dr., 21½¢ c. y., **85,** 1217.

ENGINEERS.

Chief of Engineers. **R., 80,** 132; **81,** 179; **82,** 179; **83,** 179; **84,** 186; **85,** 186; **86,** 185; **87,** 148; **88,** 140; **89,** 160; **90,** 143.

In charge:
Capt. J. C. Post. **R., 83,** 918.
Col. Q. A. Gillmore, 1880–87. **R., 81,** 1159; **83,** 915; **84,** 1111; **85,** 1215; **86,** 1102; **87,** 1174.
Lt. O. M. Carter, 1888–90. **R., 88,** 1033; **89,** 1243; **90,** 1367.
Assistants:
Capt. T. N. Bailey. **R., 83,** 917; **84,** 1113.
Lt. O. M. Carter. **R., 85,** 1217.

OPERATIONS.

1882-83. 12,718 c. y. dr., **83,** 916.
1883-84. 61,896 c. y. dr., **84,** 1113.
1884-85. 26,485 c. y. dr., **85,** 1216.
1885-86. 99,120 c. y. dr., **86,** 1104.

[1] H. D. 109, 62d, 1st. [2] H. D. 450, 58th, 2d. [3] H. D. 91, 56th, 2d.

PRIVATE WORK.

Cut made by private enterprise across marsh near Shoal No. 1, **86,** 1103; **87,** 1175.

PROJECTS.

By Col. Gillmore, 1880, connecting Romerly Marsh Creek with Wassaw Sound with canal 1,156 y. l., having l. w. chan. 7′ x 48′; est., $38,720, **81,** 1160, 1161.

SURVEYS.

Ex. au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **81,** 1159.
Maps. **83,** 918; **84,** 1112; **86,** 1104.

O–120(a) OGEECHEE AND CANNOUCHEE RIVERS, GA.

ENGINEERS.

Chief of Engineers. **R., 10,** 407.
In charge. Col. D. C. Kingman, **10,** 379.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Col. Kingman, Aug. 3 and Oct. 28, 1909[1] (unfav.), **10,** 407.
Maps.[1]

O–144 CANOOCHEE RIVER, GA.

ENGINEERS.

Chief of Engineers. **R., 80,** 132; **81,** 179.
In charge. Lt. Col. Q. A. Gillmore. **R., 81,** 1157.

PHYSICAL CHARACTERISTICS.

Described, **81,** 1157.

PLANS.

By Lt. Col. Gillmore, 1880, removing snags and leaning trees, partly removing rock bars, and forming cut-offs; est., $46,094.41. If imp. be confined to lower 3½ m., est., $9,405, **81,** 1158.

SURVEY.

Au. act June 14, 1880, **80,** 132; ex. by direction of Lt. Col. Gillmore, **81,** 1157.

O–199 SAPELO (River and) HARBOR, GA.

APPROPRIATIONS.

1910,	$10,000,	**10,** 1473.
1911,	11,000,	**11,** 1607.
Total,	21,000	

COMMERCE.

Shipping place for lumber and timber brought in rafts from Darien and other points, **10,** 390.
1911, 19,062,000′ b. m. lumber and timber shipped from Front R. wharves, **12,** 500.

CONTRACTS.

1910. P. Sanford Ross, dr. 50,000 c. y., 17½¢ c. y., **11,** 1607.
1911. P. Sanford Ross (supple.), dr. 36,000 c. y., 17½¢ c. y., **12,** 1828.

ENGINEERS.

Chief of Engineers. **R., 10,** 390, 407; **11,** 412; **12,** 500.
In charge. Col. D. C. Kingman, 1910–. **R., 10,** 1473; **11,** 1606; **12,** 1828.

OPERATIONS.

1911–12. 98,297 c. y. dr., completing proj., which provided a chan. through the 2 lower shoals in Front R. with 17′ m. l. w., and least w. on bottom of 150′, **12,** 1828.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 1473.

PROJECT.

By Col. Kingman, 1909, for chan. through 2 lower shoals 17′ x 150′ d.; est., $21,000,[2] **10,** 390, 407. Au. act June 25, 1910.

SURVEY.

Of bar and harbor, au. act Mar. 3, 1909. **R.** by Col. Kingman,[2] **10,** 407.
Maps.[2]

O–210(a) DOBOY TO SAPELO, GA. (Inside route.)

COMMERCE.

Important. Amply provided for by existing conditions, **92,** 1298.

ENGINEERS.

Chief of Engineers. **R., 91,** 185; **92,** 181.
In charge. Lt. O. M. Carter, 1890–92. **R., 92,** 1294, 1295.
Assistant. G. W. Brown. **R., 92,** 1299.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1295; 3 possible routes, **92,** 1306.
Character of R. bottom, **92,** 1302.
Progressing changes, **92,** 1303.
Currents, **92,** 1303.

SURVEYS.

Ex. and sur. au. act Sept. 19, 1890, for chan. for seagoing vessels; made by Lt. Carter, 1890 and 1891 (**R.** unfav.; see Commerce), **92,** 1294.

[1] H. D. 681, 61st, 2d.
[2] H. D. 561, 61st, 2d.

O–229 DARIEN HARBOR, GA.

Part.	Title.	Period.	Appropriations.
a	Darien H., Ga.	1878–1902	$113,000.00
b	Doboy Bar, Ga.	1887–1902	75,795.40
c	Darien H. and Doboy Bar.	1902–1912	92,365.96
	Total.		281,161.36

Part (a), O–229 Darien Harbor, Ga.

APPROPRIATIONS.

1878,	$8,000,	**78,** 78.
1890,	25,000,	**91,** 1529.
1892,	25,000,	**92,** 1259.
1894,	25,000,	**95,** 1474.
1896,	20,000,	**96,** 1255.
1899,	10,000,	**99,** 1575.
Total,	113,000	

COMMERCE.

Important, **85,** 1238–1242.

In 1892–93, value $1,500,000, **93,** 1558; 1897, $1,090,000, **98,** 1304; 1898–99, $2,500,000, **99,** 1575; 1899–1900, $920,382, **00,** 1936.

CONTRACTS.

1878. American Dredging Co., dr., 14⅜¢ c. y., **79,** 764.

1891. P. S. Ross, dr., 23¢ c. y., **91,** 1530.

1892. Atlantic Contracting Co., spur-dam work; fascines, 89¢ c. y.; pile work, $1.40 l. f.; fender piles, $50 cluster; sawed timber, $25 1,000′ b. m.; iron bolts, 9¢ lb.; riprap st., $1.30 c. y. ($15,185), **93,** 1559.

1895. W. T. Gaynor, mattresses, $1 s. y.; fascines, $1.65 c. y.; pile work, $1.50 l. f.; fender piles, $50 cluster; tie piles, $20 group; sawed timber, $25 M f. b. m.; iron bolts, 5¢ lb.; riprap st., $3.05 c. y. ($48,000), **95,** 1475.

1896. R. R. Moore, dr., 12¢ c. y. ($9,000), **97,** 1511.

1900. P. S. Ross, dr., 13.7¢ c. y. ($7,535), **00,** 1937.

ENGINEERS.

Chief of Engineers. R., 78, 78; **79,** 97; **85,** 191; **91,** 180; **92,** 177; **93,** 193; **94,** 177; **95,** 202; **96,** 180; **97,** 229; **99,** 260; **00,** 297; **01,** 328; **02,** 256.

In charge:

Lt. Col. Q. A. Gillmore. **R., 78,** 579; **79,** 763; **85,** 1234, 1237.

Capt. O. M. Carter, 1890–97. **R., 91,** 1528; **92,** 1257; **93,** 1556; **94,** 1166; **95,** 1473; **96,** 1253; **97,** 1508.

Capt. C. E. Gillette, 1898–1902. **R., 98,** 1303; **99,** 1574; **00,** 1935; **01,** 1639; **02,** 1185.

Assistants:

S. L. Fremont, **79,** 764.

Capt. T. N. Bailey. **R., 85,** 1236, 1239.

OPERATIONS.

1878–79. Chan. 10′ x 50′ m. l. w., with an aggregate l. of 500 y., dr. through shoals in Darien R. n. of Generals Isld.; chan. 14′ x 75′ x 500 y. in North R. below Union Isld. sawmills; and at the confluence of Darien and North Rs. chan. d. 8′–12′ and w. to 75′. Removal of 51,041 c. y., securing an average increase in d. of from 2′ to 4′, **79,** 97, 764.

1890–91. 13,194 c. y. dr., **91,** 1528.

1891–92. 73,445 c. y. dr., **92,** 1258.

1892–93. 1,200 piles driven; 15,068 c. y. fascines, 59,290′ b. m. sawed timber, and 6,094 lbs. iron bolts used in the constr. of 24 spur dams, **93,** 1557.

1894–95. 400 piles driven; 10,208 c. y. fascines, 683 c. y. riprap st., 18,651′ b. m. sawed timber, and 1,556 lbs. iron bolts used in spur dams, **95,** 1474.

1896–97. 117,143 c. y. dr., **97,** 1509.

1897–98. A wreck and a raft of logs removed from the chan., **98,** 1304. 11,358 c. y. dr., **98,** 1314.

1899–00. 69,790 c. y. dr., **00,** 1936.

PHYSICAL CHARACTERISTICS.

Description, **78,** 579; **85,** 1235, 1237, 1241.

PROJECTS.

By Lt. Col. Gillmore, 1878, removing shoal in Back R. between Commodore and Wolf Islds., **78,** 78, 579.

By Col. Gillmore, 1885, formation of a chan. about 10 m., between Darien and Doboy, through the shoals below Darien, 12′ d. at l. w., the chan. to be obtained by dr. and maintained by the constr. of wing dams at 5 of the shoals; est., $170,000, **85,** 1238, 1242; **91,** 1528.

SURVEYS.

Au. act July 5, 1884; made by Col. Gillmore, **85,** 1237.

Ex. made, 1894, **94,** 1167; and a detailed sur., 1896–97, by Capt. Carter, **97,** 1509.

Maps. **93,** 1560; **95,** 1476; **99,** 1576.

Part (b), O–229 Doboy Bar, Ga.

APPROPRIATIONS.

1886–87,	[1]$5,795.40	
1899,	70,000.00,	**99,** 1574.
Total,	75,795.40	

COMMERCE.

Statistics of Darien port, **87,** 1182.

During 1898 about 143,000,000′ of timber carried on the R., **99,** 1573.

Bulk of the timber passing through Darien from the Altamaha R. would probably cross Doboy Bar

[1] From Altamaha R. app., **87,** 1179.

when the imp. completed. When the timber is gone, which is a matter of comparatively few years, the C. will probably greatly decrease, **00,** 1934; **01,** 1638.

CONTRACTS.

1900. R. Moore, dr., **00,** 1934; annulled July, 1901, **02,** 1187.

ENGINEERS.

Chief of Engineers. **R., 87,** 150, 154; **88,** 141; **97,** 257; **99,** 260; **00,** 297; **01,** 327; **02,** 256.

In charge:
Col. Q. A. Gillmore, 1886–87. **R., 87,** 1179, 1199.
Lt. O. M. Carter, 1888–97. **R., 88,** 1041; (Capt.) **97,** 1538.
Capt. C. E. Gillette, 1899–1902. **R., 99,** 1573; **00,** 1933; **01,** 1638; **02,** 1186.

Assistants:
Lt. Carter. **R., 87,** 1181–1200.
G. W. Brown. **R., 97,** 1542.

OPERATIONS.

1887–88. Removal of Doboy Bar continued by harrowing and hydraulic excavation, **88,** 1042.
1899–00. 47,229 c. y. dr., **00,** 1934.
1900–01. 72,666 c. y. dr., **01,** 1638.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1181–1200; **97,** 1542.
Material composing bar easy to move by hydraulic dr., **97,** 1539.
Tidal observations, **97,** 1542, 1544.

PLANS.

Lt. Carter, 1888, did not consider the present or prospective demands of C. sufficient to warrant further expend., **88,** 1044.

PROJECTS.

By Col. Gillmore, 1887, chan. over the bar by hydraulic excavation and propeller sluicing, **87,** 1181; **88,** 1041.
By Capt. Carter, 1887, dr. 24′ x 300′ m. h. w. across the bar; est., $70,000, **97,** 1541; **00,** 1933.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Col. Gillmore, **87,** 1199.
Sur. for 24′ d. m. h. w., and to ascertain whether obstr. could be removed by dr., au. act June 3, 1896; made by Capt. Carter, 1897; **R.** fav., **97,** 1539 (see Projects).
Ex. made, 1899, by Capt. Gillette, **99,** 1574.
Minor, **02,** 1187.
Maps. **87,** 1180; **88,** 1042; **99,** 1573.

Part (c), O–229 Darien Harbor and Doboy Bar, Ga.

APPROPRIATIONS.

1902,	$26,000.00,	**03,** 1157; **04,** 1653.
1904	[1] 26,865.96	**05,** 1273.
	[2] 28,000.00	
	[3] 1,500.00,	**04,** 1653.
1910,	10,000.00,	**10,** 1472.
Total,	92,365.96	

COMMERCE.

Shipping of lumber from Darien made possible by imp.; rates reduced 15%, **07,** 312.
In 1911, amounted to 55,142,000′ b. m. lumber, **12,** 498.

CONTRACTS.

1903. George T. Warner, dr., 16⅔¢ c. y., **03,** 1157.
1905. P. Sanford Ross, dr., 11.85¢ c. y., **05,** 1273.
1910. P. S. Ross, dr. 45,000 c. y., 17⅓¢ c. y., p. m., **11,** 1606.

ENGINEERS.

Chief of Engineers. **R., 03,** 262; **04,** 268; **05,** 276; **06,** 298; **07,** 311; **08,** 330; **09,** 341; **10,** 388; **11,** 409; **12,** 497.

In charge:
Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1156; **04,** 1651; **05,** 1270.
Lt. Col. Dan C. Kingman, 1906–. **R., 06,** 1196; **07,** 1283; (Col.) **08,** 1339; **09,** 1336; **10,** 1471; **11,** 1604; **12,** 484, 1825.

OBSTRUCTIONS.

Contractor's dr. burnt and sank July 15, 1911; operations suspended until removal of wreck, Nov. 15, 1911, **12,** 1826.

OPERATIONS.

1903–04. 83,357 c. y. dr. and 143 logs removed from Darien H.; 4,000 c. y. brush bundles made for dam repairs, **04,** 1651.
1904–05. 2,340 l. f. dam refilled with brush and st. and 250 l. f. dam built; 96,482 c. y. dr, and 85 logs removed from Darien H., **05,** 1271.
1905–06. 5,120 c. y. dr. and 7 logs removed from Darien H.; proj. completed; 130,953 c. y. removed from Doboy Bar, **06,** 1197.
1910–11. 8,700 c. y. dr., Darien H., **11,** 1604.
1911–12. 45,625 c. y. dr.; contract completed; 178 logs and other obstr. removed, **12,** 1826.

PHYSICAL CHARACTERISTICS.

Difficulty of dr. chan. through bar on account of great littoral drift, **06,** 299; **12,** 499.
D., 1911, 11′ m. l. w., **12,** 497.
D. H. embraces lower 12 m. of Darien R., from Darien to where R. enters Doboy Sound. D. H. is 56 m. n. of Brunswick, Ga., and 99 m. s. of Savannah, **12,** 497.

PROJECTS.

Darien H., adopted, 1885, navigable chan. 12′ d. m. l. w., Darien to Doboy; est., $170,000, **03,** 262.
Doboy Bar, adopted 1899, chan. 24′ d. m. h. w. (17′ m. l. w.), and 300′ w.; est., $70,000, **03,** 263.
Chief of Engineers recom. 1906, that funds be used to maintain 12′ chan. instead of dr. for 17′ chan., **06,** 299.

SURVEYS.

Of Darien H., **05,** 1271.
Of bar, **06,** 1197.
Pre. ex. au. act June 25, 1910, of Darien H. for 18′ across bar; **R.,** Col. Kingman, Sept. 9, 1910 (unfav.),[4] **12,** 523.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 498.

[1] For Darien H.
[2] For Doboy Bar.
[3] Received from app. for Cumberland Sound, Ga. and Fla.
[4] H. D. 277, 62d, 2d.

O–237 ALTAMAHA RIVER, GA.

APPROPRIATIONS.

1881,	$5,000,	**81,** 1105.
1882,	15,000,	**82,** 1177.
1884,	15,000,	**84,** 1116.
1886,	[1] 10,000,	**86,** 1108.
1888,	10,000,	**88,** 1038.
1890,	15,000,	**90,** 1371.
1892,	15,000,	**92,** 1263.
1894,	10,000,	**95,** 1479.
1896,	10,000,	**96,** 1259.
1899,	6,000,	**99,** 1580.
1900,	* [2] 9,000,	**01,** 1644.
1902,	10,000,	**02,** 1189.
1905,	10,000,	**05,** 1275.
1907,	* [3] 17,000,	**07,** 1287.
1909,	* [2] 10,000,	**09,** 1339.
1910,	* [3] 20,000,	**10,** 1475.
1911,	* [3] 6,000,	**11,** 1608.
1912,	* [3] 9,000,	**12,** 1831.
Total,	202,000	($212,151.35 incl. sales and $10,000 for Doboy Bar, not charged above, 1886, **12,** 1831).

COMMERCE.

Importance of imp. to C., **86,** 1107, 1109; **87,** 1177.

Increase in R. trade and reduction in rates consequent upon imp., **88,** 1037; **90,** 1382.

Value of lumber interests, **91,** 1533.

In 1892–93 freight carried valued at $1,614,860, **93,** 1563; 1898, $540,000, not incl. lumber, **98,** 1307.

C., 1898, valued at $1,170,000, **99,** 1579; 1899, at $2,525,000, **00,** 1941.

Principal items, timber and naval stores to supply camps; 2 SS. ply the R., making 1 and 2 round trips per week, resp., **01,** 1643.

Imp. caused reduction of 25 to 40% in rates, **06,** 301; **09,** 344; **10,** 392; **12,** 502.

Details of, **10,** 1474; **11,** 414, 1607; **12,** 1829.

Traffic less than 10,000, 1911, but nearly 34,000,000′ b. m. lumber rafted, **12,** 1830.

CONTRACTS.

1883. R. S. Burnett, removing r., $4.70 c. y., and constr. of wing dams, **83,** 929.

1884. E. H. Gaynor, constr. of wing dams, **85,** 1221.

1888. M. A. Sweeney & Bro., repairing snag boat, $10,000, **89,** 1248.

1895. W. T. Gaynor, mattresses, $1 s. y.; fascines, $1.65 c. y.; pile work, $1.50 l. f.; fender piles, $50 cluster; tie piles, $20 group; sawn timber, $25 M f., b. m.; iron bolts, 5¢ lb.; riprap st., $3.05 c. y. ($48,000), **95,** 1480.

ENGINEERS.

Chief of Engineers. **R., 81,** 175; **82,** 170; **83,** 181; **84,** 187; **85,** 187, 191; **86,** 186; **87,** 149; **88,** 141; **89,** 161; **90,** 144; **91,** 181; **92,** 177; **93,** 193; **94,** 178; **95,** 202; **96,** 181; **97,** 230; **98,** 226; **99,** 261; **00,** 298; **01,** 329; **02,** 257; **03,** 264; **04,** 270; **05,** 278; **06,** 300; **07,** 313; **08,** 332; **09,** 343; **10,** 390; **11,** 413; **12,** 501, 523.

In charge:

Col. Q. A. Gillmore, 1880–87. **R., 81,** 1105, 1107; **82,** 1176; **83,** 926; **84,** 1114; **85** 218, 1234; **86,** 1105; **87,** 1176.

Capt. O. M. Carter, 1888–97. **R., 88,** 1035; **89,** 1245; **90,** 1369, 1372; **91,** 1531; **92,** 1261; **93,** 1561; **94,** 1169; **95,** 1477; **96,** 1257; **97,** 1513.

Capt. C. E. Gillette, 1898–1902. **R., 98,** 1306; **99,** 1578; **00,** 1939; **01,** 1642; **02,** 1188.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1158; **04** 1654; **05,** 1274.

Lt. Col. Dan C. Kingman, 1906–. **R., 06,** 1199; **07,** 1285; (Col.) **08,** 1341; **09,** 1338; **10,** 1473; **11,** 1607; **12,** 1829.

Assistants:

W. G. Williamson. **R., 81,** 1109.

Capt. J. C. Post. **R., 83,** 930.

Capt. T. N. Bailey. **R., 84,** 1116; **85,** 1236.

Lt. O. M. Carter. **R., 85,** 1221; **86,** 1108.

W. R. Curtis. **R., 88,** 1038.

F. C. Armstrong. **R., 90,** 1386; **91,** 1535; **92,** 1264.

R. S. Burnett. **R., 93,** 1565; **94,** 1172; **95,** 1480; **96,** 1260.

OPERATIONS.

1881–82. Constr. of snag boat, **82,** 1176.

1882–83. Ex. of R. preparatory to active operations, **83,** 927.

1883–84. Removal of 1,800 c. y. r. at Town and Piney Bluffs, 323 snags and 185 leaning trees, **84,** 1115.

1884–85. Constr. of training wall for imp. of Beards Bluff Bar, removal of snags, and protecting caving banks, **85,** 1218.

1885–86. Constr. of 4 spur js. at Beards Bluff Bar, **86,** 1106.

1886–87. Removal of snags and trees by snag boat *Toccoa*, **87,** 1177.

1888–89. 157 snags and logs removed from chan. and 221 overhanging trees from banks, **89,** 1247.

1889–90. 170 snags and logs removed from R. and 309 overhanging trees cut from banks, **90,** 1370.

1890–91. 150 snags and 466 trees removed from chan. and banks, **91,** 1532.

1891–92. 521 snags removed from chan. and 1,100 overhanging trees cleared from banks; constr. of wattled pile spur dams begun at Beards Bluff, and repairs made to old training wall at that point, **92,** 1262.

1892–93. 799 piles driven; 4,389 c. y. fascines, 371 c. y. riprap st., 12,502′ b. m. timber, 1,285 lbs. bolts, 1,630 s. y. mattresses used in constr. of spur dams, training wall, etc.; 1,252 l. f. pile work wattled; 79 l. f. shore protection constr.; about 1,400 snags and other obstr. removed, **93,** 1562.

1893–94. About 5,000 logs and other obstr. removed from banks and chan.; 66 fender piles driven; 45 c. y. r. removed, **94,** 1171.

1894–95. 143 piles driven; 3,004 s. y. mattresses sunk with 100 c. y. riprap st.; 4,985′ b. m. timber fastened to pile work by 631 lbs. bolts, **95,** 1478.

1896–97. Over 300 obstr. removed from banks and chan.; 2½ c. y. r. excavated and removed, **97,** 1514.

1898–99. 174 snags and other obstr. removed from banks and chan., **99,** 1579.

1899–00. 160 c. y. r. removed from chan. through Town Bluff Shoals, over 1,000 overhanging trees, snags, and other obstr. removed at Beards Bluff, and constr. of a training dike at Griners Bar in progress, **00,** 1940.

1900–01. Spur dams and training dike at Coupers Bar repaired with brush and st.; 195 c. y. r. quarried for completing dike at Griners Bar; 891 snags and other obstr. removed; small pile driver and 2 barges constr., **01,** 1643.

1901–02. Training dike at Griners Bar completed with piling, brush, and st.; r. removed from Hell Shoal, **02,** 1188.

1902–03. Dike at Griners Bar extended 300′; r. removed from chan. at Town Bluff Shoal; cut-off at Beards Bluff opened and dike repaired; cut-off opened at Jack Williams Suck; piling driven for dike at Oglethorpe Bluff, and brush and st. placed in work; 2,593 snags and other obstr. removed, **03,** 1158, 1159.

1903–04. About 45% of approved proj. completed, **04,** 1654.

1904–05. 113 snags and other obstr. removed; steam hoister and pile driver overhauled, **05,** 1274.

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* Allotment.

[1] Part of $20,000, of which amount $10,000 was to be applied to Doboy Bar, **87,** 1178.

[2] Allotment from emergency appropriation.

[3] Altamaha, Oconee, and Ocmulgee Rs.

1905-06. 616 snags and other obstr. removed; 1,049 c. y. r. and clay (r. about 80%) removed from shoal at Town Bluff, resulting in chan. 50′ x 3′ l. w., **06,** 1199.

1906-07. Between Doctortown and the Forks, 334 snags and other obstr. removed; cut-off at Beards Bluff enlarged; training dike at Oglethorpe Bluff, 635′ l., of piling, brush fascines and st., begun by hired labor with use of U. S. plant, **07,** 1285, 1286.

1907-08. 933 snags and other obstr. and 7 c. y. r. removed; 1,570 c. y. dr. in Beards Bluff cut-off, and 525 c. y. dr. from shoal at Piney Bluff, **08,** 1341, 1342. Quarterboat, hull of snag boat, and 2 barges constr., and pile driver repaired and imp., **08,** 1342.

1908-09. 512 snags and other obstr., and a false point from Buggs Suck by blasting, removed; training wall at Oglethorpe Bluff completed, and drift from the upper side removed, **09,** 1338. Approved proj. about 80% completed, **09,** 343.

1909-10. 1,109 snags and 95 stumps removed from chan.; 505 trees cut from banks, and 10 trees girdled; 895 c. y. st. removed from Town Bluff and 728 c. y. from Hell Shoals; log float removed from chan. at Doctortown, and SS. *Wilmington* raised, **10,** 1473, 1474.

1910-11. 1,947 snags and other obstr. removed, **11,** 1607.

1911-12. Snags and other obstr. removed; the 10″ pump boat *Macon* removed total of 68,320 c. y. from localities stated, securing 90′ x 5′ l. w.; training wall at Oglethorpe Bluff repaired and one constr. at Beards Bluff; spur j. at mouth of Ohoopee R. 20% completed, **12,** 1829.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1372, 1374, 1378; **12,** 501.

Permanent imp. not to be obtained because of the obstr. brought into the R. at every freshet, **93,** 1564.

Coupers Bar only 1′ d. at l. w., increased by the tide to 4′–5′; d. above tidal range, 2′ at l. w.; freshets in upper section, at times 20′ above low summer stage; in lower section freshets rise 5′–10′ over banks, **03,** 1158.

Sur., 1909–11, showed orig. datum plane 1′ too high, so that orig. plans not enough to afford l.-w. depth desired, **12,** 502.

PROJECTS.

Orig. proj. submitted 1875, contemplated chan. 4′ x 80′, Macon to Darien, by removing bars, snags, etc.; est., $162,000, **12,** 501.

By Col. Gillmore, 1880, for l.-w. chan. 3′ x 80′ confluence of the Oconee and Ocmulgee to Darien, 155 m., by removal of r., bars, and snags; est., $60,000, **81,** 1106; **87,** 1176.

By Lt. Carter, 1890, navigable SS. chan. 3′ d. at ordinary summer l. w. bet. junctions of the Oconee and Ocmulgee Rs. and Darien, by removal of r. shoals, sand bars, snags, and logs from the chan. and overhanging trees from banks, constr. of deflecting dikes, closing incipient cut-offs, and revetting caving banks; est., $128,627.50, **90,** 1370, 1380; **92,** 1261.

In 1893–94 Capt. Carter est. $3,000 to $5,000 each year for mainten., **94,** 1172.

Act 1912 adopt. recom. (H. D. 443, 62d Cong., 2d) of further gradual imp., following methods carried on under existing proj., by expend. of $40,000 an. on Altamaha, Oconee, and Ocmulgee Rs., the money to be applied to mainten. of 3′ during ordinary summer l. w. to Milledgeville and Macon, and to gradual increase of chan. d. without sacrificing mainten. work, **12,** 501.

SURVEYS.

Ex., 1880, by W. G. Williamson, **81,** 1107.
By Lt. Carter, 1890, **90,** 1372.
Ex. and sur. prior to 1890, **90,** 1377.
At Oglethorpe and Beards Bluffs, **07,** 1286.
Pre. ex. and sur., Oconee, Ocmulgee, and Altamaha Rs., Ga., au. act Mar. 3, 1909; made, 1909–11, by Col. Kingman (see Projects),[1] **12,** 523.

Maps.[1] **84,** 1116; **85,** 1222; **86,** 1108; **93,** 1562.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 503.

O–247 OHOOPEE RIVER, GA.

ENGINEERS.

Chief of Engineers. R., 10, 407.
In charge. Col. D. C. Kingman, **10,** 379.

PHYSICAL DATA.

Details; trib. of Altamaha R., enters latter 43 m. below forks of Oconee and Ocmulgee Rs., or 87 m. above Darien.[2]

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Col. Kingman[2] (unfav.), **10,** 407.
Maps.[2]

O–258 OCONEE RIVER, GA.

APPROPRIATIONS.

1878,	$10,000,	**78,** 105.
1879,	1,500,	**79,** 142.
1880,	1,500,	**80,** 1704.
1881,	2,500,	**81,** 1877.
1882,	5,000,	**82,** 1861.
1884,	3,000,	**84,** 1659.
1886,	9,000,	**86,** 1162.
1888,	12,500,	**88,** 1172.
1890,	25,000,	**90,** 1391.
1892,	25,000,	**92,** 1268.
1894,	10,000,	**95,** 1483.
1896,	10,000,	**96,** 1263.
1899,	10,000,	**99,** 1582.
1900,	*3,100,	**01,** 1646.
1900,	*650,	**02,** 1190.
1902,	25,000,	**02,** 1190.
1905,	15,000,	**05,** 1277.
1907,	*29,000,	**07,** 1289.
1909,	*15,000,	**09,** 1341.
1910,	*30,000,	**10,** 1476.
1911,	*12,000,	**11,** 1610.
1912,	*7,000,	**12,** 1833.
Total,	261,750	(incl. misc., $262,419.27, **12,** 1833).

COMMERCE.

Important, **75,** ii, 42; **79,** 1274.
Amount of traffic on the R., **83,** 1504.
Reduction in rates since commencement of imp., **91,** 1539; **92,** 1267.
1892–93, value $1,298,130, **93,** 1569; 1898, $1,552,500, **99,** 1581; 1899, $1,205,000, **00,** 1943.
None above Milledgeville, and little or none for about 23 m. below, **04,** 1679.
Rates reduced from 25 to 40%, **06,** 303.
Except timber traffic, mostly local, tributary to RRs. crossing R., **07,** 1288.
1911, 6,213 t. In addition, 9,110,900′ b. m. logs and timber rafted, **12,** 1832.

*Allotment. [1] H. D. 443, 62d, 2d. [2] H. D. 682, 61st, 2d.

CONTRACT.

1887. M. A. Sweeney & Bros., steam snag-boat constr., $8,000, **87,** 1275.

ENGINEERS.

Chief of Engineers. R., 75, 84; **78,** 105; **79,** 142; **80,** 190; **81,** 257; **82,** 251; **83,** 258; **84,** 258; **85,** 200, 207; **86,** 198; **87,** 166; **88,** 154; **89,** 161, 164; **90,** 144, 147; **91,** 181; **92,** 178; **93,** 194; **94,** 179; **95,** 203; **96,** 181; **97,** 231; **98,** 227; **99,** 262; **00,** 299; **01,** 329; **02,** 258; **03,** 265; **04,** 271, 280, 1677; **05,** 279; **06,** 302; **07,** 315, 327; **08,** 334; **09,** 344; **10,** 392, 407; **11,** 415, 430; **12,** 503, 523.

Boards. BERH. **R., 04,** 1678.

In charge:

Lt. Col. Q. A. Gillmore, 1875. **R., 75,** ii, 41.

Capt. W. R. King, 1878–85. **R., 78,** 767; **79,** 1274; (Maj.) **80,** 1703; **81,** 1876; **82,** 1860; **83,** 1505; **84,** 1658.

Capt. R. L. Hoxie, 1885–89. **R., 85,** 1297, 1329, 1331; **86,** 1161; **87,** 1275; **88,** 1170.

Capt. O. M. Carter, 1889–97. **R., 89,** 1250; **90,** 1388, 1430, 1432; **91,** 1536; **92,** 1265; **93,** 1567; **94,** 1175; **95,** 1481; **96,** 1261; **97,** 1516.

Capt. C. E. Gillette, 1898–1902. **R., 98,** 1308; **99,** 1580; **00,** 1942; **01,** 1644; **02,** 1189.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1160; **04,** 1655, 1677; **05,** 1276.

Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1200; **07,** 1287; (Col.) **08,** 1343; **09,** 1339; **10,** 1475; **11,** 1609; **12,** 1831.

Assistants:

E. S. Gould. **R., 75,** ii, 42.

B. W. Frobel, **78,** 768; **79,** 1274; **80,** 1703.

C. A. Locke. **R., 84,** 1658; **85,** 1330, 1332.

F. C. Armstrong. **R., 89,** 1253; **90,** 1392; **91,** 1541; **92,** 1269.

A. S. Cooper. **R., 90,** 1436.

R. S. Burnett. **R., 93,** 1570; **94,** 1178; **95,** 1484; **96,** 1264.

OPERATIONS.

1877–78. 209 snags and logs removed; steam-derrick boat built, **79,** 142, 1274.

1879–80. 813 snags, stumps, and trees removed from R. between Dublin and mouth, **80,** 1703.

1880–81. 236 logs, snags, and trees, and quantities of drift removed, **81,** 1877.

1881–82. 30 c. y. of r. excavated and 489 logs, snags, and trees removed, **82,** 1860.

1882–83. 199 snags, 410 overhanging removed, and 245 c. y. log and brush j. put in, **83,** 1505.

1883–84. 352 c. y. loose r. removed from chan.; 340 c. y. r. placed in dams and slope walls; 95 snags and trees removed, **84,** 1658.

1884–85. Chan. cut through r. reefs at Chaneys Shoal; snags and obstr. removed, **85,** 1297.

1886–87. 129 logs, snags, and trees removed, **87,** 1275.

1887–88. 256 snags and 105 c. y. loose r. removed from the chan., and 691 overhanging trees from banks, **88,** 1172.

1888–89. 920 logs, snags, and stumps removed from the chan., and 952 trees cut from the banks, **89,** 1251.

1889–90. 948 snggs, 358 stumps, and 15,220 trees removed from the chan. and banks, **90,** 1392.

1890–91. 893 snags, 200 stumps, 146 overhanging trees, and 42 logs cleared from the chan.; 600 c. y. of st. quarried and placed in closing dam, **91,** 1537, 1538.

1891–92. 571 snags and 366 cords of drift removed from the chan., and 16,910 trees and logs cleared from the banks; constr. of brush and pile dams in progress, **92,** 1267.

1892–93. About 1,700 logs and other obstr. removed from the chan. and banks, **93,** 1568.

1893–94. Jetties were repaired; over 12,000 obstr. removed; 266 c. y. gravel, etc., removed, **94,** 1176.

1894–95. About 2,700 obstr. removed, **95,** 1482.

1895–96. Over 4,500 obstr. removed, and 103 c. y. r. removed, **96,** 1262.

1896–97. About 300 obstr. removed; 100 c. y. r. removed, **97,** 1517.

1897–98. About 1,200 obstr. removed, **98,** 1309.

1898–99. Over 1,100 snags and other obstr. removed from the banks and chan., and a training dike 450′ l. built at Latimers Reach, **99,** 1581.

1899–00. 170 c. y. r. removed at Dublin Upper and Lower Shoals; over 7,000 overhanging trees, snags, and other obstr. removed from chan., and training dike at Latimers Reach repaired and raised, **00,** 1943.

1900–01. Training dike partly built, 529 snags and stumps removed from chan., and 2,623 trees and logs cut from bank, **01,** 1645.

1901–02. Training dike completed, 6 snags and 4 trees removed, and cut through Fish Trap Dam w., **02,** 1189.

1902–03. 4,032 obstr. removed from chan. and 3,514 from banks, **03,** 1160.

1903–04. 3,043 obstr. removed from chan. and 3,439 from banks; dike 350′ l. built, **04,** 1655, 1656.

1904–05. Snag boat repaired, **05,** 1276.

1905–06. Below Milledgeville.—986 obstr. removed from chan. and 175 from banks; 241 c. y. r. and 6,127 c. y., mostly r., removed; 92′ dike built, **06,** 1200. **Above Milledgeville.**—114 obstr. removed from chan. and 611 from banks, **06,** 1201.

1906–07. Below Milledgeville.—720 obstr. and 4 c. y. r. removed from chan. and 636 obstr. from banks; dike raised and extended 130′, **07,** 1287. **Above Milledgeville.**—17 c. y. r. and 136 obstr. removed from chan. and 127 from banks; 5 spur dams, 50′ each, built, **07,** 1288.

1907–08. Below Milledgeville.—4,605 obstr. removed from chan. and 8,141 from banks; 196 l. f. spur dams and 663′ training wall built; 6,115 c. y. dr. and 30 c. y. r. and 464 c. y. r. and clay removed; snag boat *Oconee* rebuilt, **08,** 1343.

1908–09. 3,281 obstr., 100 c. y. st. and 450 c. y. earth removed from chan. and 8,089 obstr. from banks, 800′ shore protection and 250′ training dike built, and 350 c. y. st. quarried, **09,** 1339.

1909–10. 2,180 obstr. removed from chan. and 3,335 from banks; 1,460 c. y. st., 1,530 c. y. earth, and 540 c. y. clay and st. removed; 2 training walls repaired, **10,** 1475.

1910–11. 229 snags and stumps removed from chan., and 11 overhanging trees and logs cut from banks; r. shoals removed systematically, from point 7 m. above Dublin to 3.3 m. below; chan. imp. for 3,650′; 13,591 c. y. sand, clay, etc., removed from shoals; training wall at Bonnyclabber raised for 250′, and bank revetted for 50′ above head of this training wall, using 225 c. y. st. and 411 c. y. brush fascines, **11,** 1609.

1911–12. 2,015 snags and stumps removed from chan., 3,367 overhanging trees and logs cut from bank, and 88 large trees girdled; old training wall at Fish Trap Shoals refilled, and extended 250′; closing dike having become partly flanked during a prolonged freshet, was protected at upper end by mattress of brush and st., **12,** 1831.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 42, 43, 44; **04,** 1678.

Obstructions, **75,** ii, 42, 43.

Description of the R., **89,** 1253; **90,** 1430, 1432, 1437, 1444.

Permanent imp. can not be effected until freshets stop bringing down large quantities of logs, etc., **93,** 1570.

PLANS. (See Projects.)

By E. S. Gould, 1875, removing obstr., such as logs and points, and making cut-offs from Milledgeville to the Forks; est., $10,150; not recom. by Maj. Gillmore, **75,** ii, 44, 45.

By Capt. Hoxie, 1885, imp. of Oconee R. between Skull Shoals and the Georgia RR. br., to give chan. 20″ d. and having a least w. of 40′ or 50′, by removal of r. obstr., overhanging trees, and snags; est., $1,500, **85,** 1332.

PRIVATE (STATE AND CORPORATE) WORK.

State of Georgia app. $10,000 for imp. from Milledgeville to the Ocmulgee R., 1835. A lock constr. at Milledgeville, 1832, **75,** ii, 44.

App. for imp. of the R. made by State of Georgia and private companies, **89,** 1253, 1254.

PROJECTS. (See Plans.)

By Maj. King, 1878, prevention and formation of cut-offs, removing snags and logs, and cutting through r. reefs where necessary, to secure 3′ l.-w. navigation, mouth to Milledgeville, **78,** 105, 768.

1878 to 1886, incl., $36,500 app.; est. that $17,500 would be required to complete the proj., **86,** 1162.

By Capt. Carter, 1890, estab. of a navigable SS. chan. 3′ d. at ordinary summer l. w. from Milledgeville to the R.'s mouth; this to be accomplished by (1) removing rafts, r. shoals, and sand bars; (2) enlarging portions of the R., revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the chan., and overhanging trees from the banks of the stream; est., $171,000, **90,** 1389; **91,** 1537.

In 1892–93 Capt. Carter est. $1,000 to $5,000 would be required an. for mainten., **93,** 1570.

Lt. Col. Quinn, 1903, did not consider imp. above Milledgeville justified by interests involved,[1] **04,** 1678.

Act Mar. 3, 1905, au. expend. of $3,000 in clearing R. between Georgia RR. br. and n. boundary of Greene Co., Ga., **05,** 280.

By Lt. Col. Kingman, 1906, plan for imp. between Georgia RR. br. and n. boundary of Greene Co.; est., $12,000, and $1,000 an. mainten.,[2] **07,** 327.

Act July 25, 1912, adopts recom. that Oconee, Ocmulgee, and Altamaha Rs. are worthy of further imp. "as now carried on," and funds be applied to mainten. of 3′ d., and to gradual increase of chan. d. as far as practicable without sacrificing mainten. work, **12,** 504.

SURVEYS.

Ex., Ocmulgee to Milledgeville, Ga., by E. S. Gould, 1874, **75,** 84, ii, 42.

Pre. ex., 1878, **78,** 767.

Of Upper Oconee, from Skull Shoals to Georgia RR. br., au. act July 5, 1884; made, 1884, by Capt. Hoxie, **85,** 1329.

Au. act Aug. 11, 1888; made, 1890, by Capt. Carter, **90,** 1432.

Of several sand bars, **04,** 1656.

Ex. from Dublin to Skull Shoals, au. act June 13, 1902. **R.** by Lt. Col. Quinn,[1] **04,** 1677.

Ex. and sur. from Georgia RR. br. to n. boundary of Greene Co., au. act Mar. 3, 1905. **R.** by Lt. Col. Quinn and Lt. Col. Kingman, resp.,[2] **07,** 327.

Ex. from Georgia RR. br. at Milledgeville to Central of Georgia Ry. br. at Oconee station, Washington Co., and sur. below highway br. at Milledgeville, au. act Mar. 3, 1905. **R.** by Lt. Col. Quinn and Lt. Col. Kingman (unfav.),[3] **07,** 327.

Of Fish Trap Shoals and Big Buzzards Bar, **09,** 1340.

Pre. ex. and sur. au. act Mar. 3, 1909, of Oconee, Ocmulgee, and Altamaha Rs., Ga. **R.** by Col. Kingman, 1909 and 1911; est., $40,000 an. mainten. for entire 3 streams,[4] **11,** 430; **12,** 523.

Maps.[4]

O–326 OCMULGEE[5] (Okmulgee, Ockmulhee) RIVER, GA.

APPROPRIATIONS.

1876,	$15,000,	**77,** 91.
1878,	15,000,	**78,** 105.
1879,	7,000,	**79,** 142.
1880,	7,000,	**80,** 1703.
1881,	5,000,	**81,** 1876.
1882,	5,000,	**82,** 1860.
1884,	3,000,	**84,** 1657.
1886,	7,500,	**86,** 1160.
1888,	15,000,	**88,** 1174.
1890,	30,000,	**91,** 1547.
1892,	25,000,	**92,** 1274.
1894,	10,000,	**95,** 1488.
1896,	10,000,	**96,** 1269.
1899,	20,000,	**99,** 1584.
1900,	40,000,	**00,** 1947.
1901,	40,000,	**01,** 1649.
1902,	56,000,	**02,** 1193.
1905,	15,000,	**05,** 1279.
1907,	*29,000,	**07,** 1291.
1909,	*15,000,	**09,** 1343.
1910,	*40,000,	**10,** 1478.
1911,	12,000,	**11,** 1613.
1912,	20,000,	**12,** 1835.
Total,	441,500	(incl. misc., $442,302.26, **12,** 1835).

COMMERCE.

Important, **76,** 725.

Benefit of imp., **80,** 1702.

Increase of traffic, **83,** 1504.

Reduction in f. rates consequent upon imp., **89,** 1257.

C., **90,** 1396, 1479; **92,** 1273.

In 1892–93, value $1,356,915, **93,** 1574; 1898, $1,382,500, **99,** 1584; 1899, $1,675,000, **00,** 1946.

Description of, **01,** 1647.

None recently between Macon and Hawkinsville, except occasional trips of one small SS., **06,** 1203.

Company formed to operate line of SS. between Macon and Brunswick, **06,** 1203.

Rates reduced from 25 to 40%, **06,** 305.

Great increase expected, **08,** 1347.

1911, 12,251 t. In addition, 11,000,000′ of timber and lumber rafted down the R., **12,** 508.

CONTRACTS.

1887. M. A. Sweeney & Bros., snag boat, **87,** 1277.

1911. Merril-Stevens Co., constr. of two 10″ pump boats, to be named *Augusta* and *Macon,* $17,875 each, **11,** 1614.

ENGINEERS.

Chief of Engineers. R., 76, 87; **77,** 91; **78,** 105; **79,** 141; **80,** 189; **81,** 256; **82,** 250; **83,** 257; **84,** 257; **85,** 199; **86,** 198; **87,** 167; **88,** 155; **89,** 162, 164; **90,** 145, 147; **91,** 182; **92,** 178; **93,** 195; **94,** 179; **95,** 204; **96,** 182; **97,** 232; **98,** 228; **99,** 263; **00,** 301; **01,** 330; **02,** 259; **03,** 266; **04,** 273; **05,** 281; **06,** 304, 311; **07,** 317; **08,** 336; **09,** 346; **10,** 394, 407; **11,** 417; **12,** 506, 523.

In charge:

Maj. W. McFarland, 1876–77. **R., 76,** 725.

Capt. W. R. King, 1877–85. **R., 77,** 600; **78,** 767; **79,** 1272; (Maj.) **80,** 1701; **81,** 1875; **82,** 1858; **83,** 1503; **84,** 1656.

Capt. R. L. Hoxie, 1885–89. **R., 85,** 1295; **86,** 1159; **87,** 1276; **88,** 1173.

*Allotment.

[1] H. D. 304, 58th, 2d.

[2] H. D. 263, 59th, 2d.

[3] H. D. 264, 59th, 2d.

[4] H. D. 443, 62d, 2d.

[5] Sur.—**R.** (records, etc., destroyed by fire before completion of survey), 1885. (H. D. 482, 55th, 2d.)

Lt. O. M. Carter, 1889–97. **R., 89,** 1256; **90,** 1395, 1455; **91,** 1543; **92,** 1271; (Capt.) **93,** 1572; **94,** 1181; **95,** 1485; **96,** 1266; **97,** 1519.
Capt. C. E. Gillette, 1898–1902. **R., 98,** 1310; **99,** 1582; **00,** 1944; **01,** 1646; **02,** 1191.
Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1161; **04,** 1657; **05,** 1277.
Lt. Col. D. C. Kingman, 1906–. **R., 06,** 1202; **07,** 1289; (Col.) **08,** 1346; **09,** 1341; **10,** 1477; **11,** 1611; **12,** 1833.

Assistants:
B. W. Frobel. **R., 77,** 600; **78,** 767; **79,** 1273; **80,** 1701; **81,** 1876.
C. A. Locke. **R., 82,** 1859.
F. C. Armstrong. **R., 89,** 1258; **90,** 1400; **91,** 1548; **92,** 1274.
J. L. Van Orum. **R., 90,** 1462.
R. S. Burnett. **R., 93,** 1575; **94,** 1184; **95,** 1488; **96,** 1269.

OBSTRUCTIONS.

Bridges, **77,** 600.
Central Georgia Power Co. in habit of drawing down pool below level of stream, thus disturbing regular discharge of R. and seriously interfering with navigation. Sec. of War directed observations to be made, **11,** 1612.

OPERATIONS.

1877–78. Removal of 420 snags and 360 trees; chan. of 7′–8′ l. w., **78,** 105, 767.
1878–79. Removal of 1,370 snags and 44 trees, **79,** 142, 1273.
1879–80. 963 snags and 84 trees removed from bed; steam derrick boat built, **80,** 1701.
1880–81. 359 c. y. r., clay, and 540 snags removed from chan., **81,** 1876.
1881–82. 921 snags and 1,689 c. y. removed and excavated from the chan., **82,** 1859.
1882–83. 90 snags and trees removed; 3 log dams and 2 js. built, **83,** 1504.
1883–84. 216 snags and trees removed from 65 m. of chan., **84,** 1657.
1884–85. Work of cleaning chan. continued, **85,** 1296.
1885–86. 585 trees felled and removed; 70 logs and stumps cut; 611 logs and snags removed from bed, **86,** 1160.
1888–89. 886 logs and snags removed from chan. and 4,500 trees and logs cleared from banks, **89,** 1257.
1889–90. 1,956 snags and logs removed from chan., and 8,323 logs and trees cleared from banks, **90,** 1396.
1890–91. 186 snags removed from chan., and 9,409 trees cleared from banks; dam constr. and repair of Tillmans Bar, **91,** 1544.
1891–92. 2,932 snags removed from chan., and 6,733 trees cleared from banks, **92,** 1272.
1892–93. About 3,000 obstr. removed from stream and banks; 124 piles driven, 1,163 c. y. mattresses, 832 c. y. riprap st., and 2,085 poles used in wattling, in repairs to dams, and in constr. of new dams; 1,080 c. y. excavated for, and 94,332′ b. m. timber, 280 c. y. st., and 2,500 lbs. iron spikes used in constr. of crib bank protection, **93,** 1573.
1893–94. About 7,000 obstr. removed and also the wrecks of 3 SS.; 285 c. y. solid r. and 287 bowlders removed, **94,** 1182.
1894–95. About 4,000 obstr. removed, **95,** 1486, 1490.
1895–96. About 5,000 obstr. removed, 643 c. y. r. excavated, and removed, and also 1 wreck, **96,** 1267.
1896–97. About 1,400 obstr. removed and also 548 c. y. r., **97,** 1520.
1897–98. Nearly 5,000 obstr. removed and also an old wreck, **98,** 1311.
1899–00. 190 c. y. r. and over 32,000 overhanging trees, snags, and other obstr. removed from chan.; training dikes built at Oaky Bluff and Tillmans Bars and in progress at Macon Bar, **00,** 1945, 1946.
1900–01. 15,608 obstr. removed from chan. and banks; 4 dikes, aggregating 3,140′, completed; 7 aggregating 8,300′ nearly completed, and 2 aggregating 2,200′ partly built; 4,521 obstr. removed from cut-offs, **01,** 1646, 1647.
1901–02. 10 dikes, aggregating 11,950′, completed; 1,416 obstr. and quantity of earth removed from cut-offs, and 735 trees cut on banks; 3,619 c. y. r removed; 3,379 snags and stumps removed, and 22,226 trees and logs cut; house boat built, **02,** 1191.
1902–03. 1,100′ dike, 2,320′ shore protection, and 400′ spur dike built, and 2,350′ dikes rebuilt; 593 snags and stumps and 9,235 c. y. earth removed from cut-offs; 2,554 snags and stumps, 2 wrecks and 2 bridge piers removed from chan. and 7,124 trees and logs from banks; willows planted (but washed out by freshet); hoister and pile driver rebuilt, **03,** 1162.
1903–04. 30 obstr. removed from chan. and 74 from banks; 400′ spur dikes built and dike repaired; 2,685 c. y. r. removed, **04,** 1657.
1904–05. 718 obstr. removed from chan. and 24 from banks; also portion of old j., **05,** 1277.
1905–06. 2,536 obstr. removed from chan. and 2,145 from banks, **06,** 1202.
1906–07. 587 obstr. removed from chan. and 1,631 from banks; 2 sand bars imp. by harrowing, and 90 c. y. earth removed by dynamite; training wall and spur dam raised and new spur dam 245′ l. built, **07,** 1289.
1907–08. Above Hawkinsville.—134 obstr. removed from chans. and 30,302 from banks, training wall repaired, and material collected for further repairs. **Below Hawkinsville.**—123 obstr. removed from chan. and 151 from banks, and material collected for repairs to training wall; hull built for snag boat "Oconee," and latter repaired, **08,** 1346.
1908–09. Above Hawkinsville.—943 obstr., 933 c. y. st., and 499 c. y. earth removed from chan., and 515 obstr. from banks· 1,346′ shore protection, 666′ training wall and js. built, 1 training wall raised and another prolonged, by sinking old hull of snag boat, and material collected for constr., of new dike and shore protection, **09,** 1341. **Below Hawkinsville.**—453 obstr. removed from chan. and 518 from banks, training dike refilled and wall repaired, and end of training wall removed, **09,** 1342.
1909–10. Above Hawkinsville.—53 obstr. removed from chan. and 19 from banks, 1,508′ shore protection and 757′ training wall built, 4,299′ dike raised, and 2,553 c. y. st. and 448 c. y. clay removed. **Below Hawkinsville.**—328 obstr. removed from chan. and 1,582 from banks, 1,000 c. y. st. and 253 c. y. clay removed, training wall raised, 190′ dam and 275′ dike built, and wreck removed, **10,** 1477.
1910–11. 4,863 snags and other obstr. removed from chans.; 965 l. f. new training wall and 3,985 l. f. bank revet. constr.; 730 l. f. old training wall and 1,650′ of old bank revet. repaired and raised; constr. and repairs to plant, **11,** 1611.
1911–12. 217 piles driven and 1,507 c. y. brush fascines and 121 c. y. st. placed in bank revet. below Macon; 773 snags removed and 6,396 trees and saplings cut; 71 large trees girdled; floating plant repaired, **12,** 1833.

PHYSICAL CHARACTERISTICS.

Description, **72,** 531; **76,** 725, 735; **89,** 1258, 1259; **90,** 1455.
List of obstr., **76,** 725–727, 728–734; **79,** 1273.
Permanent imp. can not be made because of the new obstr. brought into the stream at every freshet, **93,** 1575.
R. obstr. by r. shoals above Hawkinsville, and sand bar below Macon, **02,** 1191.
Banks damaged by flood, **02,** 1191.

PLANS.

By B. W. Frobel, 1876, slackwater navigation by means of locks and dams; chan. way 4′ x 80′ l. w., and locks 30′ x 200′; est., $1,000,000, **76,** 735.
By Maj. McFarland, about $2,000,000. Cost should be determined by a sur., **76,** 736.

PRIVATE (STATE) WORK.

$60,000 expend. by Georgia in imp. of Ocmulgee R., **88,** 1174; **89,** 1257.

PROJECTS.

Description of prior proj. and imp., **89,** 1258.

By Capt. King, 1877, chan. 80′ w. with l. w. d. of 4′ from Macon to the mouth, by removal of sand and gravel bars, r. reefs, snags, trees, and similar obstr.; est., $56,240, **77,** 91, 600; **82,** 1276.

Est. increased, 1882, 1885, and 1886, to $112,480, **82,** 1859; **85,** 1296; **86,** 1160; **87,** 1276.

By Lt. Carter, 1890, navigable SS. chan. 3′ d. at ordinary summer l. w., Macon to R.'s mouth, to be obtained by (1) removal of r. shoals and sand bars, (2) closing incipient cut-offs and revetting caving banks, (3) removal of snags and logs from chan. and overhanging trees from the banks; est., $210,000, **90,** 1395; **91,** 1544.

1892–93, Capt. Carter est. $1,000 to $5,000 would be required an. for mainten., **93,** 1575.

Col. Kingman, 1909, did not consider advisable imp. between Macon and Hawkinsville, by locks and dams,[1] **10,** 407.

Act July 25, 1912, adopted recom. in H. D. 443, 62d, 2d, that these streams are worthy of further gradual imp. without sacrificing mainten. work, **12,** 507.

SURVEYS.

By T. C. Long, **72,** 509.

By R. C. McCalla, **72,** 531.

By W. B. Frobel, **76,** 725.

By Maj. McFarland, ex. Macon to Covington, 1876, **76,** 87, 725.

Au. act Aug. 11, 1888; made, 1890, by Lt. Carter, **90,** 1458.

Of 13 shoals, **04,** 1657.

Below Macon, **06,** 1203.

Ex. from br. at Fifth St., Macon, to Juliette, Monroe Co., Ga., au. act Mar. 3, 1905; made, 1905, by Lt. Col. Quinn (**R.** unfav.),[2] **06,** 311.

Of Okay Bluff Shoals and below Macon, **09,** 1342.

Ex., with view to imp. between Macon and Hawkinsville, by locks and dams, au. act Mar. 3, 1909; made, 1909, by Col. Kingman,[1] **10,** 407.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Col. Kingman, 1909 and 1911; est. for Oconee, Ocmulgee, and Altamaha Rs., Ga., for mainten. and gradual imp., $40,000 an.,[3] **12,** 523.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 508.

Maps.[3] **93,** 1572.

Location of works (3 sheets), **02,** 1192.

O–326(b) GEORGIA CANAL—ROME TO MACON, GA.[4]

COMMERCE.

Requirements, **72,** 535.

ENGINEERS.

Chief of Engineers. **R., 71,** 64; **72,** 60.

In charge. Maj. Walter McFarland. **R., 72,** 510, 512, 516, 518.

Assistant. R. C. McCalla. **R., 72,** 526.

PHYSICAL CHARACTERISTICS.

General description, **72,** 526.

PLANS.

By R. C. McCalla, 1872, canal 70′ x 56′ x 5′, 211.2 m. l., $20,435,684, **72,** 516, 526–535.

SURVEYS.

Under direction of Maj. McFarland, by R. C. McCalla. **R., 72,** 510, 512, 516, 518, 526.

O–355 YELLOW RIVER, GA.

ENGINEERS.

Chief of Engineers. **R., 91,** 184.

In charge. Capt. O. M. Carter, 1891. **R., 91,** 1606.

Assistant. Lt. T. H. Rees. **R., 91,** 1608.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1606.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Carter (**R.** unfav.—cost too great), **91,** 1606.

Maps. **91,** 1610.

O–428 FREDERICA RIVER, GA.

ENGINEERS.

Chief of Engineers. **R., 04,** 280, 1674; **12,** 524.

Boards. BERH. **R., 04,** 1676.

In charge:

Lt. Col. J. B. Quinn, 1904. **R., 04,** 1675.

Col. Dan C. Kingman, **12,** 484.

SURVEYS.

Ex. au. act June 13, 1902; made, 1903, by Lt. Col. Quinn (**R.** unfav.),[5] **04,** 1674.

Pre. ex. and sur. au. act Feb. 27, 1911, at or near Fort Frederica, Ga. (**R.** to come), **12,** 524.

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[1] H. D. 358, 61st, 2d.
[2] H. D. 64, 59th, 1st.
[3] H. D. 443, 62d, 2d.
[4] Part of proposed line of water communication from the Mississippi R. to the Atlantic.
[5] H. D. 220, 58th, 2d.

O–437(a) BRUNSWICK (St. Simons Sound) OUTER BAR, GA.[1]

APPROPRIATIONS.

1894,	[2] $30,000, **95,** 205.
1896,	[2] 100,000, **96,** 1276.
1899,	5,000, **99,** 1587.
	[2] 90,000, **99,** 1587.
1902,	40,000, **02,** 1194.
	[2] 45,000, **02,** 1194.
Total,	310,000

ENGINEERS.

Chief of Engineers. **R., 92,** 182; **93,** 196; **94,** 180; **95,** 205; **96,** 183; **00,** 306; **01,** 334. 1663, 1665.

Boards. Convened, Wilmington, N. C., to ascertain and certify as to the d. and w. of chan. obtained across the outer bar at Brunswick H., Ga., by C. P. Goodyear, by the explosion of dynamite and auxiliary means for smoothing the bottom of the bar chan. **R., 95,** 1501, 1503; **96,** 1278. (W. W. Duffield, Superintendent Coast and Geodetic Survey, chairman; Maj. W. S. Stanton, Capt. F. V. Abbot.)

In charge:
Capt. O. M. Carter, 1892–96. **R., 92,** 1327; **93,** 1584; **94,** 1193; **95,** 1501; **96,** 1278.
Capt. C. E. Gillette. **R., 01,** 1664, 1666.

Assistants:
Lt. Thos. H. Rees. **R., 92,** 1331.
J. H. Bacon. **R., 01,** 1719.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1502; **96,** 1279.
History of bar, material, etc.; effect of dynamite, **01,** 1669.

PROJECTS.

In 1892 Congress provided that C. P. Goodyear should be paid various sums if he should procure, in given periods, a practicable chan. over the outer bar at Brunswick, Ga., of various named d., by means of dynamite and auxiliary means for smoothing the bottom of the ba rchan., **93,** 1585; **96,** 1278.

In 1900, Capt. Gillette presents 5 methods in detail for deepening chan. on outer bar, incl. use of dynamite, js., curved or reaction breakr. Dr. preferred; est., $40,820.40 to $64,650. Recom. $150,000 for US. dr. and $25,860 for operation, to d. chan. and to maintain it, **01,** 1663. Div. Engr. approved dr. method, but est. $200,000 for U. S. dr., incl. operation for 2 yrs., **01,** 1666.

C. P. Goodyear, opinion on d. outer bar by explosions of dynamite, **01,** 1704–1713.

E. L. Corthell, C. E., opinion on d. ocean bars, **01,** 1714, 1716.

J. A. Bryan, contractor, opinion on methods used in d. Brunswick Bar, **01,** 1716, 1718.

SURVEYS.

Ex. made 1892 and 1893 by Capt. Carter, **93,** 1587; **94,** 1197; by Board of Officers in 1894, 1895, **95,** 1501, 1504; **96,** 1282; all showing that the required w. and d. had not been obtained, as provided by the acts of 1892 and 1894.

Act Mar. 3, 1899, au. C. P. Goodyear receiving stipulated compensation for making chan. 24′ x 200′ and 25′ x 100′, and au. sur. of chan., calling for plan, and est. for 26′ x 200′ m. h. t. chan. **R.** (see Projects), 1900, by Capt. Gillette,[3] **01,** 1663.

O–439(a) CLUB AND PLANTATION CREEKS, GA.

APPROPRIATIONS.

1907,	$20,000, **07,** 1292.
1910,	20,700, **10,** 1479.
Total,	40,700, **12,** 1836.

COMMERCE.

Waterway largely used; tonnage not ascertained, **12,** 510.

CONTRACTS.

1910. Savannah Engineering & Construction Co., dr. (220,000 c. y.), 15.9¢ c. y., **11,** 1615.

ENGINEERS.

Chief of Engineers. **R., 04,** 279, 1669; **07,** 319; **08,** 338; **09,** 349; **10,** 379; **11,** 420; **12,** 509.

Boards. BERH. **R., 04,** 1670, 1671.

In charge:
Lt. Col. J. B. Quinn, 1904. **R., 04,** 1670, 1673.
Lt. Col. D. C. Kingman, 1907–. **R., 07,** 1291; (Col.) **08,** 1348; **09,** 1344; **10,** 1479; **11,** 1614; **12,** 1835.

Assistant. J. H. Bacon. **R., 04,** 1672.

LEGAL PROCEEDINGS.

Quit-claim deed secured for part of land required, and permission to dr. through balance; referred to Dept. of Justice for opinion as to sufficiency, **08,** 338; held to be insufficient; negotiations with owners continued, **09,** 349; concluded, **10,** 1479.

OPERATIONS.

1907–10. Nothing done, pending acquisition of right of way necessary for part of imp., **07,** 1291; **08,** 338; **09,** 349; **10,** 397.

1910–11. 26,042 c. y. dr. from canal connecting Club and Plantation Creeks, and 118,867 c. y. from cut-off between Plantation and Lost Creeks; portion of Plantation Creek to be abandoned is being blocked by dam to prevent division of tidal flow, **11,** 1614.

1911–12. 64,244 c. y. dr.; dam constr. across old chan. of Plantation Creek; imp. completed, **12,** 510, 1836.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 1672, 1673.
Navigable chan. provided; details of d., etc.; waterway a connecting link between portion of Inside Water Route and Brunswick H., Ga., 4 m. l., **12,** 1835.

PROJECT.

By Lt. Col. Quinn, 1903, au. act Mar. 2, 1907, dr. canal 7′ x 50′ between creeks, thus connecting Altamaha and its tributaries with Brunswick H.; also straightening Plantation Creek and dr. in both where necessary to secure 7′; est., $40,700,[4] **04,** 1673; **07,** 319.

SURVEY.

Au. act June 13, 1902; made, 1903, by Lt. Col. Quinn,[4] **04,** 279, 1669.
Complete sur. of localities to be imp. made before dr., **11,** 1614.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 510.

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[1] Act June 13, 1902, combines the imp. of Brunswick Bar with that of Brunswick H., Ga.
[2] Paid to C. P. Goodyear between 1894 and 1902, for work on this bar. (See H. D. 421, 57th, 2d.)
[3] H. D. 179 and 355, 56th, 2d.
[4] H. D. 159, 58th, 2d.

O–443 BRUNSWICK HARBOR, GA.

APPROPRIATIONS.

1836,	$10,000,	**79,** 765.
1879,	20,000,	**79,** 98.
1880,	10,000,	**80,** 963.
1881,	5,000,	**81,** 1115.
1882,	25,000,	**82,** 1182.
1884,	10,000,	**84,** 1120.
1886,	22,500,	**86,** 1116.
1888,	35,000,	**88,** 1047.
1890,	35,000,	**90,** 1407.
1892,	27,500,	**92,** 1282.
1894,	10,000,	**95,** 1493.
1896,	[1] 15,000,	**96,** 1276.
1899,	10,000,	**99,** 1587.
1902,	125,000,	**02,** 1194.
1905,	40,000,	**05,** 1282.
1907,	146,650,	**07,** 1294.
1908,	303,000,	**08,** 1351.
1909,	47,000,	**09,** 1347.
1910,	50,000,	**10,** 1482.
1911,	60,000,	**11,** 1617.
1912,	33,250,	**12,** 1838.
Total,	[2] 1,039,900,	**12,** 1838.

COMMERCE.

C. facilities of Brunswick, Ga., **76,** 488.

Importance of imp., **81,** 1115, 1118; **83,** 926; **86,** 1115; **87,** 1186.

Increase in business, 1880 to 1890, **90,** 1406.

Description of, **96,** 1276; **97,** 1523; **98,** 1314; **11,** 1616, 1617, 1618.

1892, value $13,652,703, **93,** 1581; 1893, $8,978,485, **94,** 1190.

C. important, and increasing, **00,** 1962.

Rapidly increasing, **01,** 1649.

Imp. has caused a reduction on ocean-going rates on lumber of 25%, and on naval stores of 30%, **06,** 307; **12,** 513.

The regular lines of SS. estab. between Brunswick and New York and Boston comprised 14 SS. in 1906, 116 round trips being made, carrying 207,225 t., **07,** 1292; **10,** 1481.

1911, 704,252 t., **12,** 1838.

Imp. permits SS. entering and leaving regardless of tides, **12,** 513.

"The chief articles of export are cotton, lumber, crossties, and naval stores, of which the shipments for the calendar year 1911 were as follows: Of cotton, 312,970 bales; of lumber and crossties, 148,445,000' b. m.; and of naval stores, 54,385 barrels of turpentine and 130,512 barrels of rosin.

"The Clyde Steamship Co. operated a line of steamers between New York and Brunswick and other points during the calendar year 1911, carrying 213,638 tons of freight, valued at $19,300,000. In addition, there were 2,471 passengers carried by this line. Seventeen steamers were operated, making a total of 103 round trips and 13 single trips.

"On the inland waters there are a number of small steamers plying between Brunswick and adjacent ports, besides numerous schooners, small sailboats, tugs, and gasoline launches towing barges. During the calendar year 1911 this portion of the commerce amounted to 44,940 short tons, valued at $1,650,593.

"The total amount of freight received and shipped at the port of Brunswick during the calendar year 1911 was 704,252 short tons, valued at $44,506,731.

"Before improvement in 1880 the annual commerce of Brunswick H. amounted to about 100,000 short tons, valued at $1,700,000.

"The effect of the improvement has been to cause a reduction of ocean-going freight rates on lumber of 25 per cent and on naval stores of 30 per cent. It has also permitted the regular line coastwise freight steamers to enter and leave the port regardless of the tides, thereby avoiding much loss of time." **12,** 513. 1838.

CONTRACTS.

1880. J. Brady, j. J. E. Walter, dr., 13⅞¢ c. y., **80,** 963.

1881. J. E. Walter, dr., 24½¢ and 33½¢ c. y., **81,** 1116.

1882. J. E. Walter, dr., 27¢ c. y. J. C. Provost, ., **83,** 922, 923.

1884. J. S. Howell, j., **85,** 1225.

1888. P. S. Ross, dr., 21¢ c. y., **89,** 1267.

1889. C. C. Ely, training wall, $13,215, **89,** 1267.

1891. J. F. Gaynor, training wall, $21,270, **91,** 1554. P. S. Ross, dr., 24½¢ c. y., **91,** 1554.

1893. P. S. Ross, dr., 25¢ c. y. ($6,000), **93,** 1582. Atlantic Contracting Co., fascines, $1.67 c. y.; riprap st., $3.69 c. y. ($18,000), **93,** 1583.

1896. R. R. Moore, dr., 14¢ c. y. ($8,400), **97,** 1524.

1899. P. S. Ross (Inc.), dr., 13 7/10¢ c. y. ($8,905), **00,** 1950.

1902. Roderick G. Ross, repairs to training wall, st., $3.20 c. y.; Morris & Cumings Dredging Co., dr., 20¢ c. y., **03,** 1165.

1906. R. G. Ross, repairing and raising training wall; st., $3.44 c. y., **06,** 1206.

1907. P. S. Ross (Inc.), dr., 14.8¢ c. y., p. m.; Coastwise Dredging Co., dr., 16½¢ and 23¢ c. y., p. m., **08,** 1351.

1910. P. S. Ross (Inc.), dr. refractory material (23,100 c. y.), $2.80 c. y., **10,** 1482. P. S. Ross (Inc.), dr. about 60,000 c. y., at 16⅜¢ c. y., **11,** 1618.

1911. G. W. Parkhill, raising training wall; 3,500 t. st., $2.57 t. P. S. Ross (Inc.), dr. 7,500 c. y. refractory material, $3.32 c. y., **12,** 1839.

DEFENSE.

Importance of H. in maritime warfare, **76,** 488.

ENGINEERS.

Chief of Engineers. **R.,** **76,** 71; **79,** 98; **80,** 129; **81,** 175; **82,** 170; **83,** 180; **84,** 188; **85,** 188; **86,** 187; **87,** 151; **88,** 142; **89,** 162, 367; **90,** 146; **91,** 182, 185; **92,** 179; **93,** 196; **94,** 180; **95,** 204; **96,** 183; **97,** 233; **98,** 229; **99,** 264, 267; **00,** 302; **01,** 331; **02,** 261; **03,** 267; **04,** 274; **05,** 283; **06,** 305, 312; **07,** 319; **08,** 339; **09,** 350; **10,** 398; **11,** 421; **12,** 510.

Boards:

Commission appointed, 1836, by U. S. Senate "to sur. and ex. ports s. of the Chesapeake, with view to their comparative facilities and advantages for a navy yard," reported that out of 6 Hs. ex. Brunswick H. was to be preferred for a navy yard on account of its "d. of water, easy access, and capability of defense." **R.** (extract), **76,** 488. (Commodores Wolsey, Claxton, and Shubrick, commissioners.)

Convened, Savannah, Ga., Apr. 1, 1889, by S. O. No. 30, to estab. H. lines in Brunswick H. **R.,** **89,** 1293. (Capt. Bixby and Lt. Carter.)

In charge:

Lt. Col. Q. A. Gillmore, 1876–92, **76,** 71. **R.,** **76,** 486; **79,** 765; (Col.) **80,** 959; **81,** 1112; **82,** 1178; **83,** 919; **84,** 1118; **85,** 1224; **86,** 1112; **87,** 1184.

Lt. O. M. Carter, 1886–97. **R.,** **88,** 1044; **89,** 1263, 1292; **90,** 1404; **91,** 1550; **92,** 1278; (Capt.) **93,** 1578; **94,** 1187; **95,** 1490; **96,** 1273; **97,** 1521.

Capt. C. E. Gillette, 1898–1902. **R.,** **98,** 1313; **99,** 1585; **00,** 1948, 1962, 1964; **01,** 1649; **02,** 1193.

Lt. Col. J. B. Quinn, 1903–05. **R.,** **03,** 1164; **04,** 1659; **05,** 1279.

Lt. Col. Dan C. Kingman, 1906–. **R.,** **06,** 1204; **07,** 1292; (Col.) **08,** 1348; **09,** 1344; **10,** 1480; **11,** 1615; **12,** 1836.

[1] Of which $7,000 may be used on Academy Creek. [2] Includes $5,000 for Academy Creek.

Assistants:
S. L. Tremont. **R., 80,** 964; **81,** 1116.
Lt. T. N. Bailey. **R., 83,** 923.
Capt. J. C. Post. **R., 83,** 924.
W. R. Curtis. **R., 85,** 1227.
Lt. O. M. Carter. **R., 86,** 1116; **87,** 1188.
M. P. Paret. **R., 89,** 1267.
E. A. Gieseler. **R., 95,** 1495.

OPERATIONS.

1879-80. Jetty commenced; 1,848 c. y. dr. from shoal, **80,** 961.
1880-81. 830 l. f. of j. built, 34,160 c. y. dr., **81,** 1113.
1881-82. 1,319 l. f. j. built, 16,016 c. y. dr., **82,** 1179.
1882-83. 2,405 l. f. j. built, 28,484 c. y. dr., **83,** 920, 923.
1884-85. Strengthening and raising upper end of j. by the use of 6,752 s. y. of matresses and 990 c. y. of st., **85,** 1226.
1886-87. 40,000 c. y. dr. from East R. chan., 9,674 s. y. matresses and 1,448 c. y. st. placed in j., **87,** 1186, 1189.
1888-89. 50,796 c. y. dr.; 2,319 c. y. of fascines and 369 c. y. of st. placed in training wall, **89,** 1265.
1889-90. 29,096 c. y. dr.; 3,714 c. y. brush fascines and 619 c. y. st. placed in training wall, **90,** 1406.
1890-91. 1,220 l. f. of j. built, **91,** 1552.
1891-92. 49,324 c. y. dr., **92,** 1280.
1892-93. 29,933 c. y. dr.; 3,868 c. y. fascines and 412 c. y. riprap st. used in j. work, **93,** 1580.
1893-94. 3,332 c. y. fascines and 780 c. y. riprap st. used in j. work, **94,** 1189.
1894-95. 36,079 c. y. dr.; 327 c. y. st. used to fill low places in the j., **95,** 1492.
1896-97. 59,683 c. y. dr., **97,** 1523.
1897-98. 11,358 c. y. dr. and a wreck removed, **98,** 1314.
1900-01. 63,644 c. y. dr., **01,** 1649.
1901-02. 4 piling driven to mark training wall, **02,** 1193.
1902-03. Training wall built up to uniform h. of 3½′ below h. w., 2,513 c. y. st. being used; 23,783 c. y. removed from Academy Creek, completing work; 90,000 c. y. removed from inner H., **03,** 1164.
1903-04. 243,289 c. y. removed from inner H., and 141,472 c. y. from outer bar by U. S. dr. *Cumberland,* **04,** 1660.
1904-05. 126,901 c. y. removed from inner H., completing contract; 393,482 c. y. removed by dr. *Cumberland,* **05,** 1280.
1905-06. 20,000 c. y. removed from shoals near mouth of Academy Creek; training wall in East R. raised to 4′ above m. l. w., 1,040 c. y. st. being placed; dr. *Cumberland* removed 19,345 c. y. from outer bar, completing chan. 19.3′ d. with a min. w. of 225′ and an average w. of 325′; proj. completed except for mainten., **06,** 1204.
1906-07. Unserviceable boathouse and storehouse torn down and material purchased for the building of a more suitable one, **07,** 1292.
1907-08. 157,886 c. y. removed from Academy Creek, 26,505 c. y. from Turtle R., 10,153 c. y. from inner H., and 456,856 c. y. from outer bar, **08,** 1348.
1908-09. 303,941 c. y. removed from East R. and 45,219 c. y. from Turtle R., completing contract; 114,268 c. y. removed from inner H. and 713,211 c. y. from outer bar, **09,** 1344.
1909-10. 60,119 c. y. removed from shoal opposite Brunswick Pt. and 210,753 c. y. from outer bar, completing work at Brunswick Bar, Brunswick Pt. and Academy Creek, **10,** 1480.
1910-11. 13,727 c. y. removed, 8,800 c. y. of which was from upper shoal in Turtle R., 1,418.6 c. y. from lower shoal in Turtle R., and 3,509 c. y. from East R., securing proj. d. and w. in East R. and on upper shoal in Turtle R., **11,** 1615. 38,379 c. y. removed from Academy Creek and 52,925 c. y. from East R., **11,** 1616.
1911-12. 8,158.5 c. y. removed from shoal in lower Turtle R.; training wall in East R. raised, and 391,714 c. y. removed by U. S. from Brunswick Bar, **12,** 1837.

PHYSICAL CHARACTERISTICS.

Comparison with other Hs., **76,** 487.
Description of, **76,** 487; **95,** 1494; **00,** 1964, 1965; **11,** 423.
Tidal observations, **76,** 487; **95,** 1495–1498.
Gauging, **95,** 1496, 1497.
H. 111 m. by water s. of Savannah, and 46 m. n. of Fernandina, Fla.; 17′ chan., 1879, across bar; few years later, 13′, **12,** 510. (See Projects, 1907.)
Shoaling proclivities; special works needful, **12,** 512.

PRIVATE WORK.

79,600 c. y. removed by private parties from vicinity of their wharves, **09,** 1345.

PROJECTS.

By Lt. Col. Gillmore, removal of shoal; (1) constr. of gabion js., 1,600′ single tier, 1,500′ double tier, 300′ triple tier, 1,800′ spur j., single tier; est., $57,000; (2) dr. chan. 15′x100′ m. l. w.; est., $52,500, **76,** 489.
Proj. for imp. of Brunswick H., as proposed by Col. Gillmore, 1880, and modified by him, 1886, had as its object the estab. and mainten. of a 15′ l.-w. chan. across the shoal in East R. The main features were (1) training wall projecting from the most e. point of Buzzards Isld. to the opposite shore of Blythe Isld.; (2) low dam across Turtle R.; (3) short spur dams in the lower part of East R.; (4) dr. in vicinity of Truth R. Dam, and on the shoal in the lower part of East R. Orig. est., $73,187; as modified, $190,000, **80,** 962; **86,** 1113, 1116; **87,** 1184; **90,** 1404; **91,** 1551; **92,** 1279.
Capt. Gillette est., 1899, $125,700 to raise existing training wall and dr. through shoal in East R. to 21′ m. l. w., **00,** 1965.
Proj. in force to June 13, 1902, was au. by Congress, 1894, and it provided for maintaining nav. chan. of 15′ m. l. w. by keeping existing works in repair, and by dr.
Act June 3, 1896, au. imp. Academy Creek.
Cost of mainten. est. $15,000 an., **12,** 511.
Act June 13, 1902, au. chan. 21′ m. l. w. in Brunswick inner H.; est., $120,000; and chan. across outer bar 19.3′ d., m. l. w. (26′ m. h. w.); est., $40,000; also dr. Academy Creek, at not to exceed $5,000, **02,** 1193; **03,** 268.
Act Mar. 3, 1905, au. expend. of $5,000 of amount app. therein for maintaining Academy Creek.
Act Mar. 2, 1907, au. creating and maintaining throughout the inner H. (embracing Turtle R. from Southern Ry. docks to its junction with Brunswick R., Academy Creek from Aikens Wharf to its junction with East R.) and the outer H. (embracing the outer bar, the navigable chan. throughout the entrance to St. Simons Sound and up Brunswick R. to Brunswick Pt.) chans. of 30′ m. h. w., varying from 150′ in Academy Creek to 400′ across the outer bar; to be obtained by dr. and dike constr.; est., $496,650, and $33,250 an. for mainten.,[1] **07,** 320, 321.

SURVEYS.

By U. S. Commission, 1836. (See Board of Engineers.)
Ex. by Lt. Col. Gillmore, 1875–76. **R., 76,** 486.
Made, 1890, by Lt. Carter, **90,** 1407.
Sur. by Capt. Carter, 1893, **95,** 1494; ex., 1897, **97,** 1523.
Ex. and sur. of Brunswick, Ga., inner H., with view of determining what imp. would be desirable in the interest of C., and cost thereof, au. act Mar. 3, 1899; made, 1899, by Capt. Gillette (**R.** fav.; see Porjects), **00,** 1962, 1964.
Pre. ex. and sur., inner and outer Hs., incl. sur., with view to securing d. on the outer bar equal to d. in inner H., and maintaining such d.; made, 1905, and plan presented for imp.; est., $496,650, and $33,250 an. mainten.[1] (see Projects, 1907), **06,** 312.

[1] H. D. 407, 59th, 1st.

In connection with estab. of H. lines, **06,** 797.
Of chans. in Academy Creek, East R., Turtle R., opposite Brunswick Pt., and outer bar, etc., **08,** 1349.
Investigation relative to control and use of wharfage privileges, au. act Mar. 2, 1907; made and **R.** submitted[1] (with map), **08,** 341.

Observation stations located and new base on St. Simons Isld. estab., **11,** 1616.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 514.
Maps.[2] **80,** 962; **81,** 1116; **83,** 922; **85,** 1228; **86,** 1116; **87,** 1196; **88,** 1046; **89,** 1266; **92,** Atlas, 58; **93,** 1582; **95,** 1500; **99,** 1586; **09,** 1346.

O–456 JEKYL CREEK, GA.

APPROPRIATIONS.

1888,	$5,000,	**89,** 1272.
1890,	7,500,	**90,** 1422.
1892,	7,500,	**92,** 1286.
1894,	4,000,	**95,** 1507.
Total,	24,000	

COMMERCE.
Description of, **93,** 1591.
In 1893 an. traffic est. worth $1,000,000±, **93,** 1591; in 1894, $900,000, **95,** 1506.

CONTRACTS.
1888. P. S. Ross, dr., 20¢ c. y., **89,** 1272.
1891. J. F. Gaynor, training-wall constr., $21,270. P. S. Ross, dr., 24¢ c. y., **91,** 1559.
1893. Atlantic Contracting Co., j. constr.; mattresses, 99¢ s. y.; riprap st., $3.59 c. y. ($19,680), **93,** 1593.

ENGINEERS.
Chief of Engineers. **R., 81,** 1162; **87,** 154; **88,** 142, 143; **89,** 163; **90,** 146; **91,** 183; **92,** 179; **93,** 197; **94,** 181; **95,** 205; **96,** 184.

In charge:
Lt. Col. Q. A. Gillmore, 1880–89. **R., 81,** 1162; (Col.) **88,** 1073, 1075.
Capt. O. M. Carter, 1889–96. **R., 89,** 1270; **90,** 1420; **91,** 1556; **92,** 1283; **93,** 1590; **94,** 1197; **95,** 1504; **96,** 1283.

Assistant. Lt. O. M. Carter. **R., 88,** 1076.

OPERATIONS.
1888–89. 20,486 c. y. dr., **89,** 1271.
1890–91. Training-wall constr. begun, **91,** 1557.
1891–92. 13,000 c. y. dr., **92,** 1284.
1892–93. 17,170 s. y. matresses and 1,252 c. y. riprap st. placed, **93,** 1591.
1894–95. 29,844 c. y. dr., 10,616 s. y. mattresses and 1,873 c. y. riprap st. placed, **95,** 1506.

PHYSICAL CHARACTERISTICS.
Description of, **81,** 1162; **88,** 1075; **93,** 1590.

PLANS.
By Lt. Col. Gillmore, 1880, imp. of the creek from its mouth to the d. w. of Brunswick R. by training-wall and closure-dam constr. and dr.; est., $25,323, **81,** 1164.

PROJECTS.
By Col. Gillmore, 1888, estab. and mainten. of a 7′ l.-w. chan. through the shoals in the creek by the constr. of training wall at its mouth, the erection of a dam to close Mud R., and dr.; the dr. chans. to have a bottom w. of 50′; est., $38,590, **90,** 1421.

SURVEYS.
Ex. au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **81,** 1162.
Ex. au. act Aug. 5, 1886, **87,** 154.
Sur. au. act Aug. 5, 1886; made, 1887, by Col. Gillmore, **88,** 1073, 1075.
Ex., by Capt. Carter, 1894, **94,** 1199.
Maps. **88,** 1076; **89,** 1272; **92,** Atlas, 59; **93,** 1592.

O–462 SATILLA RIVER, GA.

APPROPRIATIONS.
1912, $10,000, **12,** 1839.

ENGINEERS.
Chief of Engineers. **R., 10,** 407; **11,** 430; **12,** 514, 524.
In charge. Col. D. C. Kingman, 1910–. **R., 12,** 1839.

PLAN.
To gain 6′ at l.-w. stage, **11,** 430.

PROJECTS.
Act June 25, 1912, au. removal of snags and similar obstr. between mouth and Burnt Fort, to make R. safe for boats of 6′ draft at l. w.; est., $10,000,[3] **12,** 515.

SURVEYS.
Pre. ex. and sur. of "Big" Satilla R. au. act Mar. 3, 1909, mouth to Burnt Fort, Ga.; **Rs.,** Col. Kingman, 1909 and 1910; est., $6,000, and in order to provide for a few years' mainten., $10,000,[3] **11,** 430.
Pre. ex. and sur. au. act Feb. 27, 1911, above Burnt Fort, Ga. (**R.** to come), **12,** 524.

O–501(a) CUMBERLAND SOUND TO ST. SIMONS SOUND, GA. (Inside passage.)

ENGINEERS.
Chief of Engineers. **R., 76,** 71.
In charge. Lt. Col. Q. A. Gillmore, 1876; **76,** 71. **R., 76,** 484.

PHYSICAL CHARACTERISTICS.
General description of water courses between Cumberland and St. Simons Sounds, **76,** 484.

PLANS.
By Lt. Col. Gillmore, dr. chan. 100′ w. on bottom and 6′ d. at m. l. w.; est., $10,000, and $1,500 an. for dr., **76,** 485.

SURVEY.
By Lt. Col. Gillmore, 1875–76. **R., 76,** 484.

[1] H. D. 326, 60th, 1st. [2] H. D. 407, 59th, 1st. [3] H. D. 41, 62d, 1st.

O–501(b–c) CUMBERLAND SOUND AND FERNANDINA, GA. AND FLA.

Part.	Title.	Period.	Appropriations.
b	Cumberland Sound	1879–1909	$3,407,500
c	Fernandina H	1905–1912	200,000
	Total		3,607,500

NOTE.—These 2 works were consolidated by act June 25, 1910.

Part (b), O–501 Cumberland Sound, Fla. and Ga.

APPROPRIATIONS.[1]

1880,	$30,000,	**80,** 966.
1881,	100,000,	**81,** 1123.
1882,	50,000,	**82,** 1187.
1884,	75,000,	**84,** 1123.
1886,	112,500,	**86,** 1121.
1888,	112,500,	**88,** 1053.
1890,	112,500,	**90,** 1426.
1892,	170,000,	**92,** 1290.
1894,	170,000,	**95,** 1512.
1896,	5,000,	**96,** 1289.
1897,	350,000,	**97,** 1529.
1897,	50,000,	**98,** 1326.
1898,	450,000,	**98,** 1326.
1899,	400,000,	**99,** 1595.
1901,	200,000,	**01,** 1658.
1902,	400,000,	**02,** 1199.
1903,	400,000,	**04,** 1667.
1904,	55,000,	**04,** 1667.
1905,	70,000,	**05,** 1289.
1907,	75,000,	**07,** 1300.
1909,	*20,000,	**09,** 1353.

Total, 3,407,500 (incl. sales, and less $6,987.19 carried to funds for imp. H. at Fernandina, Fla., $3,400,527.21, **12,** 1845).

COMMERCE. (See Fernandina H.)

Cumberland Sound as a H. of refuge, **76,** 482; **79,** 792.

C. superiority of location doubtful, **76,** 483.

Benefit to be conferred by imp., **81,** 1122; **87,** 1194.

Amount of, dependent upon water transportation through Cumberland Sound, **90,** 1424; **91,** 1561.

Description of, **93,** 1603; **96,** 1291; **00,** 1957, 1958.

In 1892, value $8,982,393, **93,** 1596; 1896, $9,000,000, **97,** 1529; 1899, $3,861,992, **00,** 305.

All the C. of St. Marys, Ga., and 90% of C. of Fernandina, Fla., dependent upon the sound for transportation, **96,** 1288.

Imp. has caused reduction in ft. rates of from 25 to 40%, **07,** 326.

"The total commerce of the harbor of Fernandina during the calendar year 1911 amounted to 511,133 short tons, with a value of $10,113,836. The chief articles of export are lumber, phosphate rock, and naval stores, of which the shipments for the year 1911 were as follows: Lumber, 82,191,000 feet, board measure; phosphate rock, 221,650 tons; rosin, 406,540 barrels; and turpentine, 75,125 barrels. The details of this commerce are given in the tables appended hereto.

"As Cumberland Sound merely constitutes the ocean entrance to Fernandina Harbor, the commerce is given under that head.

"The effect of the improvement has been to cause a reduction in freight rates of from 25 to 40 per cent." **12,** 521, 1844.

CONTRACTS.

1880. Lara, Ross & Co., j. constr., **81,** 1121.

1881. A. M. Newton, j. constr., **82,** 1187.

1882. Lara & Ross, j. constr., **83,** 935.

1884. Lara & Ross, j. constr., 59¢ s. y. for mattress and $3.09 c. y. for st., **85,** 1232.

1888. Anson M. Bangs, j. constr.; st., $3.27, and shells, $1.27 c. y., **89,** 1276.

1891. J. F. Gaynor, brush mattress, 97¢, and log and brush mattress, 99¢ s. y., and st., $3.49 c. y., **91,** 1563.

1892. E. H. Gaynor, j. constr.; mattresses, $1.05 s. y.; riprap st., $3.59 c. y. ($184,520), **93,** 1597.

1896. Atlantic Contracting Co., j. constr.; mattresses, $1.10 s. y.; 1st-class st., $5.25 t.; 3d and 4th class st., $3.90 and $3.50 c. y. ($2,141,250); **97,** 1530. Annulled 1899, **00,** 1957.

1900. Christie, Lowe & Heyworth, j. constr.; st., $1.90 to $2.15 t.; mattresses, 70¢ s. y. ($1,100,750), **00,** 1959. C. P. Goodyear, dr., 16¢ c. y., **01,** 1657, 1658.

1901. Christie, Lowe & Heyworth, supple., j., **01,** 1656, 1657.

1904. Merrill-Stevens Co., piling in place, $4 pile; Roderick G. Ross, st., $3.87 c. y., both for closing breach in Cumberland Isld., **04,** 1665, 1667.

1905. Roderick G. Ross, 23,465 c. y. st., $2.77 c. y., **05,** 1287, 1289.

1908. Roderick G. Ross, 30,000 t. st. for s. j., $2.47 t., **08,** 1356, 1357.

1909. Roderick G. Ross, st. in place in js., $2.74 t., **10,** 1486, 1489.

1912. G. W. Parkhill, raising low places in js. at entrance to Cumberland Sound, at $3.43 t. of st. in place, **12,** 1843.

DEFENSE.

Fitness for a military or naval depot, **76,** 481, 482.

ENGINEERS.

Chief of Engineers. R., 76, 71; **79,** 99, 100; **80,** 130, 136; **81,** 176; **82,** 172; **83,** 182; **84,** 189; **85,** 189; **86,** 189; **87,** 152; **88,** 142; **89,** 163; **90,** 146; **91,** 184; **92,** 180; **93,** 197; **94,** 181; **95,** 206; **96,** 184; **97,** 235; **98,** 232; **99,** 267; **00,** 304; **01,** 333; **02,** 263; **03,** 270; **04,** 277; **05,** 286; **06,** 309; **07,** 324; **08,** 343; **09,** 355; **10,** 405; **11,** 428; **12,** 519.

Boards:

Convened at Washington, Nov. 10, 1888, by S. O. No. 50, to report upon proj. for imp. of Cumberland Sound. **R., 89,** 1281. (Lt. Cols. Gillespie and King and Maj. Post.)

Convened, Savannah, Ga., Sept. 25, 1895, by S. O. No. 41, to consider and report upon the subject of the imp. of the sound. **R., 96,** 1289. (Col. P. C. Hains, Maj. T. H. Handbury, Capt. W. M. Black, Capt. F. V. Abbot, Capt. O. M. Carter, Addl. Lt. H. Burgess.)

Constituted June 22, 1900, for further consideration of the existing proj., **00,** 1956.

*Allotment.

[1] Appros. consolidated with those of Fernandina H., 1910, **12,** 518.

In charge:

Lt. Col. Q. A. Gillmore, 1876–87; **76,** 71; **79,** 95. **R., 76,** 446; **79,** 792; **80,** 965, 1036; **81,** 1120; **82,** 1183; **83,** 931; **84,** 1121; **85,** 1229; **86,** 1118; **87,** 1191.

Lt. O. M. Carter, 1888–97. **R., 88,** 1050; **89,** 1273, 1280; **90,** 1422; **91,** 1559, 1565; (Capt.) **92,** 1286; **93,** 1593, 1599; **94,** 1200; **95,** 1508; **96,** 1285; **97,** 1526, 1533.

Lt. Col. W. H. H. Benyaurd, 1897–98. **R., 98,** 1323.

Capt. C. H. McKinstry, 1899. **R., 99,** 1593.

Capt. C. E. Gillette, 1899–1902. **R., 00,** 1956; **01,** 1655; **02,** 1197.

Lt. Col. J. B. Quinn, 1903–05. **R., 03,** 1168; **04,** 1664; **05,** 1286.

Lt. Col. Dan C. Kingman, 1906–. **R., 06,** 1210; **07,** 1298; (Col.) **08,** 1355; **09,** 1351; **10,** 1486; **11,** 1621; **12,** 1842.

Assistants:

G. Daubeney. **R., 80,** 1037.
Lt. W. L. Fisk. **R., 81,** 1124.
Capt. J. C. Post. **R., 82,** 1188; **83,** 938.
Lt. W. T. Rossell. **R., 83,** 935; **84,** 1123.
W. R. Curtis. **R., 85,** 1232; **88,** 1054.
Lt. O. M. Carter. **R., 86,** 1122; **87,** 1196.
M. P. Paret. **R., 89,** 1276; **90,** 1426; **91,** 1575.

ESTIMATES. (See Plans.)

By Lt. Col. Gillmore, 1876, as follows: Full-height js. across bar, mixed system, $4,908,703; riprap system, $6,821,100; full-height js. to crest of bar, mixed system, $2,589,600; riprap system, $4,463,940; stump js., mixed system, $1,969,262; riprap system, $3,086,620; drowned js. full length, mixed system, $1,817,311; riprap system, $2,423,460; drowned n. j. and full-height s. j., mixed system, $3,759,161; riprap system, $4,513,860, **76,** 477–481.

By Lt. Col. Gillmore, 1879, low js., $2,071,023, **79,** 793.

OPERATIONS.

1880–81. 276 l. f. of apron foundation laid and covered with riprap st., **81,** 1121.

1881–82. Apron foundation of n. j. extended 2,010′, bottom course extended 7,196′, 10,824 c. y. st. deposited on work, apron foundation of s. j. extended, 1,316′, 2,443 c. y. riprap st. deposited, **82,** 1184, 1185.

1882–83. Second course mattress n. j. extended 73′, foundation mats for spurs placed and covered with riprap st., 4,475 c. y. st. used, foundation course of s. j. extended 2,851′, 7,350 c. y. riprap placed, **83,** 933.

1884–85. Bottom coufse of Smith Jetty advanced 3,507′, 13,487 c. y. riprap used, **85,** 1230.

1886–87. 33,303 s. y. of mattress foundation and 10,336 c. y. of st. placed in js., **87,** 1193.

1887–88. 37,725 s. y. mattresses and 11,821 c. y. st. placed in j., **88,** 1052.

1888–89. 10,513 c. y. st. and 1,253 c. y. shell placed in j., **89,** 1277.

1889–90. 18,060 c. y. st. and 818 c. y. shell placed in j., **90,** 1426.

1890–91. 2,770 s. y. of brush mattress and 382 c. y. of st. used in extending the foundation course of n. j. 267′, **91,** 1561.

1891–92. 58,759 s. y. brush mattress and 11,429 c. y. st. used in extension of foundation course of n. j. 6,177′, **92,** 1288.

1892–93. 107,734 s. y. mattresses and 13,683 c. y. riprap st. placed on n. j., **93,** 1595.

1894–95. 213,334 s. y. matttresses loaded down with 18,748 c. y. riprap st. on n. j. Portion of s. j. 300′ l. removed where the sailing line crossed it, **95,** 1511.

1896–97. 92,345 s. y. mattresses and 4,794 c. y. 3-class st. and 842 c. y. riprap st. placed on n. j.; 253,942 s. y. mattresses, 4,036 c. y. 3-class st., 8,018 c. y. 4th-class st., and 607 c. y. riprap st. for repairs placed on s. j., **97,** 1528.

1897–98. 111,868 s. y. mattresses, 375 c. y. 3d-class st., and 7,616 c. y. 4th-class st. placed on n. j.; 1,361 c. y. 4th-class st. placed on mattresses previously sunk, and some repairs made on s. j., **98,** 1324. 87,311 c. y. dr., 129 c. y. r. removed, and a few logs and other obstr. removed, **98,** 1325.

1898–99. 19,316 c. y. dr., 1,237 c. y. r. and 366 logs removed from chan., **99,** 1594.

1900–01. Effective longitudinal j. section constr., 62,087 s. f., **01,** 1657.

1901–02. 139,277.35 t. large st. and 123,386.24 t. small st. placed, making a total of 192,430.97 t. large and 192,955.67 t. small st. placed, **02,** 1197. U. S. dr. removed 114,083 c. y. from chan.; contract for dr. completed by removal of 47,292.39 c. y.; 128,800 s. f. effective longitudinal j. section constr.; d. on the bar, 20′ m. l. w., 19′ inside, **02,** 1197, 1198. Dr. for this work 59.6% completed; amount involved, $144,750, **02,** 264.

1902–03. 131,852.92 t. first class, 30,263.65 t. second class, and 15,131.83 t. third class st. placed in n. j.; 50,485.93 t. first class, 36,960.48 t. second class, and 18,480.24 t. third class st. placed in s. j., **03,** 1168. Dr. *Cumberland,* completed during the year, removed 379,571 c. y., resulting in chan. 100′ x 24′, **03,** 1168. Condition of js. June 30, 1903, **03,** 1169.

1903–04. U. S. dr. *Cumberland* removed 166,479 c. y. (8.1¢ c. y.); 1,499.91 t. first-class st. placed in n. j., and 9,121.09 t. placed in s. j.; contract completed; total amount of st. placed in 2 js., 376,987.02 t. first class, 201,329.17 t. second class, and 100,664.57 t. third class, **04,** 1664. 1,197.9 t. st., 1,500 sand bags, and 300 c. y. brush placed in n. j. by hired labor, and work done in closing breach on Cumberland Isld., **04,** 1665. Condition of works of imp., 1904, **04,** 1665, 1666.

1904–05. U. S. dr. *Cumberland* removed 59,412 c. y., at 7.7¢ c. y.; work on dike for closing breach on Cumberland Isld. carried on, **05,** 1286, 1287. Proj. completed as far as d. is concerned, **05,** 1287.

1905–06. 153,941 c. y. dr. from the j. chan. by the U. S. dr. *Cumberland,* at 7.9¢ c. y.; 21,679.49 t. st. placed in s. j. to raise and repair it, and 814.55 t. placed on mound at end of n. j.; 139 t. st. placed in gap, inner end of n. j.; Cumberland Isld. dike protected by placing sheet piling, brush, and st., and course of Beach Creek changed by dr. 5,200 c. y. to form a canal protected by sheet piling, **06,** 1211. Condition of js., dike, ship chan., and Fernandina H., **06,** 1212. Floating plant repaired, **06,** 1213.

1906–07. Canal to change course of Beach Creek completed by dr. 1,300 c. y.; dike at Cumberland Isld. raised by placing brush and st., and a small spur dam of brush and st. built across slough near old breach, **07,** 1298, 1299.

1907–08. 186,981 c. y. removed by U. S. dr. *Cumberland* in d. and straightening chan. along n. j., at field cost of 3.8¢ c. y., **08,** 1355. Chan. d., **08,** 344.

1908–09. 29,697.56 t. st. placed in s. j.; outer end aproned, **09,** 1351.

1909–10. 8,298.6 t. st. used in filling low places in n. j. and a gap at inner end of s. j., **10,** 406, 1486.

1910–11. 121,214 c. y. excavated by U. S. dr. *Galveston,* removing shoals on and adjacent to center line of ship chan., **11,** 1621, 1622.

1911–12. 47,260 c. y. dr. by U. S. dr. *Galveston* in removing shoals, practically completing work; low places in n. and s. js. raised by contractor and hired labor, **12,** 1843.

PHYSICAL CHARACTERISTICS.

Description of. **76,** 446, 447, 482; **79,** 792; **93,** 1600, 1604; **96,** 1287, 1290; **97,** 1529, 1534; **99,** 1595; **01,** 333, 1655; **03,** 1168; **07,** 1299; **08,** 1356; **10,** 1487.

Locations of chans. since 1843, **76,** 447, 448, 449.

Tidal observations, **76,** 450, 453, 457, 482; **91,** 1576.

Amount of rainfall, **76,** 457, 458.

Depths at entrance to Cumberland Sound, **76,** 462, 463, 465, 466, 469.

Direction and velocity of currents, **91,** 1581, 1582.

Ebb and flood volumes, **91,** 1591.

Borings, **91,** 1596.

Details of chan. d., **12,** 1843.

Cumberland Sound is merely ocean entrance of Fernandina H.

Middle ground between js., 1912, moving seaward at usual rate of about 400′ an.; 30′ curve beyond bar did not move seaward 1912. Depths, 1912, 23′–24′, **12,** 520.

PLANS. (See Estimates and Projects.)

By Lt. Col. Gillmore, 1876. Discussion of j plans: Full-height js. extending across the par, **76,** 459–462; full-height js. reaching the crest of the bar, **76,** 462–467; stump js., **76,** 467–471; full-length drowned js., **76,** 471–475; full-length drowned n. j. and full-height s. j., **76,** 475. Duration of the imp. chan., **76,** 475. Lt. Col. Gillmore preferred low js. to high, **76,** 477; recom. neither of these plans for execution, but simply a chan. 13′ m. l. w. across the bar, **76,** 483.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Gillmore, 1879. 2 low js. of riprap st. resting upon a foundation mattress of logs and brush, starting from the shores on opposite sides of the extrance and extending seaward across the bar, with outer ends parallel to each other and from 3,000 to 3,500′ apart, designed to give a l.-w. chan. 20′–21′; est., $2,071,023, **79,** 793; **80,** 965; **86,** 189; **87,** 1191; **91,** 1566, 1573; **92,** 1286.

In 1891 BE. fixed the w. between the outer ends of the js. at 3,900′, and made the elevation of the s. j. to h. w. throughout its entire length provisional upon failure to secure sufficient d. with lower js., **91,** 1601.

By Capt. Carter, 1895, approved by BE., 1895. For 2 js. of riprap st., with mattress hearting wherever admissible, resting upon a foundation mattress of brush or of logs and brush, starting from the shores on opposite sides of the entrance and extending seaward upon lines so directed that the ends resting in 30′ d. at m. l. w. would be parallel to each other and about 3,900′ apart, to estab. a m. l. w. chan. across the bar of not less than 19′ d. After incl. the above the est. would be increased to $2,350,000, **96,** 1289.

After receiving a report from Capt. Carter, 1897, recom. commencement under the proj. of dr., sluicing, and the raising of the n. and s. js. under the existing contracts, Congress app. the amount recom. for this purpose, $50,000, **97,** 1533; **98,** 1324.

SURVEYS. (See Plans.)

Of entrance to sound, au., **79,** 100.

Au. act June 14, 1880; made, 1880, by Lt. Col. Gillmore, **80,** 1036; **86,** 1120; **87,** 1188.

R. on entrance to Cumberland Sound—Sen. Doc. 19, 57th Cong., 2d; **88,** 1052; **89,** 1276; **92,** 1288; **93,** 1596; **02,** 1198.

Lower end of sound and Amelia R., **91,** 1560.

Ex. made, 1894–95, by Capt. Carter, **94,** 1202; **95,** 1511.

Sur. made of the entrance, 1897, by Capt. Carter, **97,** 1528; 1897, by Capt. Gillette, **98,** 1324; and by Lt. Col. Benyaurd, 1898, **98,** 1325.

Sur. made, 1899, by Capt. McKinstry, **99,** 1594.

Sur. made, 1900, by Capt. Gillette, **00,** 1957.

Complete sur. of entrance, and pre. ex. of Fernandina H., au. act Mar. 3, 1905; made by Lt. Col. Quinn, **05,** 1287.

Complete sur. of entrance and ex. of chan. between js. made; on n. side 24′ m. l. w., on s. side 20′ m. l. w., **07,** 1299.

Ex. of bar near s. j., Nov., 1907, and complete sur. of entrance May, 1908, **08,** 1355. Sur. of 1908 compared with that of 1857, **08,** 1356.

Of entrance, **09,** 1351.

Of entrance, completed and results platted, **10,** 1486.

Of n. j. to determine low places, **11,** 1622.

Special topographic and hydrographic sur. made, **12,** 1843.

Detailed sur., incl. location of h. and l. w. lines on Amelia Isld. and Cumberland Isld., **12,** 1844.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 521.

Maps. Two plates with sketches of proposed js.; profiles and sketches of current directions, etc., **76,** 483; **83,** 934; **85,** 1232; **86,** 1120; **87,** 1188; **88,** 1052; **89,** 1276; **91,** 1561; **92,** Atlas, 60; **93,** 1596; **98,** 1326; **99,** 1596; **02,** 1198; **06,** 1214; **08,** 1356; **09,** 1352.

Part (c), O–501 Fernandina Harbor, Fla.

APPROPRIATIONS.

1907,	$115,000,	**07,** 1301.
1910,	45,000,	**10,** 1488.
1911,	25,000,	**11,** 1623.
1912,	15,000,	**12,** 1844.
Total,	200,000	(incl. $6,987.19 carried from imp. Cumberland Sound, Ga., $206,987.19, **12,** 1844).

COMMERCE.

Description of, **07,** 1301.

"Before the improvement of Cumberland Sound, in 1879, which constitutes the ocean entrance to Fernandina Harbor, the annual in and out bound tonnage at Fernandina was about 300,000 short tons, and the value of imports and exports estimated at about $2,500,000. The commerce of the port during the calendar year 1911 amounted to 511,133 short tons, with a value of $10,113,836. The chief articles of export are lumber, phosphate rock, and naval stores.

"The effect of the improvement of Cumberland Sound has been to cause a reduction in freight rates of from 25 to 40 per cent. It has not been practicable as yet to determine what further effect, if any, the improvement of Fernandina Harbor has had upon these rates." **12,** 1844.

CONTRACTS.

1907. North American Dredging Co., dr., 17¾¢ c. y., **08,** 1359.

ENGINEERS.

Chief of Engineers. R., 06, 312; **07,** 326; **08,** 345; **09,** 357; **10,** 404; **11,** 427; **12,** 518.

In charge:

Lt. Col. D. C. Kingman, 1907–. **R., 07,** 1301; (Col.) **08,** 1358; **09,** 1353; **10,** 1486; **11,** 1621; **12,** 1842.

OPERATIONS.

1907–08. 484,761 c. y. dr., **08,** 1358.

1908–09. 46,341 c. y. dr., completing proj.; engineering building repaired, **09,** 1353.

1911–12. Ex. of chan. to ascertain condition, **12,** 1842.

PHYSICAL CHARACTERISTICS.

Description of, **07,** 326.

Lower end of Amelia R. forms deep basin opp. Fernandina; this part of R. known as F. H. L. end connects with Cumberland Sound, and is 3½ m. from bar. H. about 1,300′ x 2 m. Sit. 58 m. n. of Jacksonville, and 128 m. s. of Savannah, **12,** 518.

PROJECTS.

By Lt. Col. Quinn, 1905, dr. chan., w. varying 400′–600′ and d. from 20′–24′ in front of, and to short distance above city; est., $115,000, with $15,000 for mainten. every 2 or 3 yrs.,[1] **06,** 312; **07,** 326; **12,** 518.

Col. Kingman recom., 1909, further work be combined with Cumberland Sound, **09,** 1353.

SURVEYS. (See Operations, 1911–12.)

Au. act Mar. 3, 1905; made, 1905, by Lt. Col. Quinn,[1] **06,** 312.

Maps. **08,** 1358.

[1] H. D. 388, 59th, 1st.

O–510 ST. MARYS RIVER, GA. AND FLA.

APPROPRIATIONS.

1912, $19,450, **12,** 523.

ENGINEERS.

Chief of Engineers. R., 10, 407; **11,** 430; **12,** 522, 523.

In charge. Col. D. C. Kingman, 1910–. **R., 12,** 1846.

PROJECT.

Act July 25, 1912, adopted proj. for chan. 17′ d m. l. w. and 200′ w. from mouth to Crandall, a distance of 12 m.; est., $14,450; and clearing chan. of snags and obstr. as may be practicable with sum of $5,000, making a total of $19,450,[1] **12,** 522.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, **10,** 407; **11** 430. **R.** by Col. Kingman, May 22, 1909, and Oct. 28, 1910; est., $19,450,[1] **12,** 523.

O–510(b) ATLANTIC OCEAN, CONNECTING WITH, VIA WATERWAY ACROSS FLORIDA.

COMMERCE.

Discussion of barge transportation, **77,** 383.

C. advantages of barge routes compared with other routes, **77,** 394–403.

Statements of freight tariffs, **77,** 399, 400, 402.

Dangers of the Florida Pass, **77,** 403.

Dimensions of wheat barges, **76,** 512; **77,** 383.

ENGINEERS.

Chief of Engineers. R., 76, 74, 512; **77,** 69; **78,** 78; **79,** 99.

Boards. The board of internal imps., 1826, reporting upon the results of surs. for canal bet. Atlantic Ocean and Gulf of Mexico, and for canal to connect Mobile and Pensacola Bays, reported ship canal across peninsula (connecting Atlantic with Gulf of Mexico) not practicable; route. bet. heads of Santa Fe R. and Black Creek presented best passage across summit of divide; but since the Suwanee R. was much obstr. at mouth, and had no H. at entrance, expedient to continue line of canal from Santa Fe R. to St. Mark, the whole route being 168 m. long, with an ascent and descent together of 224′. In view of inland coastwise navigation from Chesapeake Bay, necessary to open sloop canal from St. Marks to St. Johns. Respecting inland coastwise navigation, St. Marks to Mississippi, it should be rendered secure, safe, and commodious, by: (1) Canal along Crooked Creek, Ocklockony R. to convenient point in St. Georges Sound; (2) cleaning and d. of Santa Rosa Sound at meeting of tides; (3) canal, Bay of Pensacola to Mobile Bay, through the Great Lagoon and R. Bon Secour; (4) d. of Pass au Heron, bet. point of Dauphin Isld. and mainland; canal from Lake Pontchartrain to Mississippi at or near New Orleans, by Bayou Manchac, already proj., **76,** 514. (Gen. Bernard, member of the board; Capt. Poussin, assistant to board.)

In charge:

Col. J. J. Abert, 1852; **76,** 523, 525.

Capt. C. W. Howell, 1873. **R., 76,** 512.

Capt. A. N. Damrell, 1873. **R., 76,** 513.

Lt. Col. Q. A. Gillmore, 1877–79. **R., 77,** 382.

Assistant. Lt. M. L. Smith, **76,** 511. **R., 76,** 523.

ESTIMATES. (See Plans.)

For route bet. Mobile and Apalachicola, 1833, $7,000,000, **76,** 509.

By Lt. Smith, 1853, canal across Peninsula of Florida, $3,700,000, **76,** 511, 539, 540, 541.

By Capt. Howell, 1873, completing the 7′ canal bet. the Mississippi and Mobile Bay, $250,000, **76,** 512.

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By board of internal imps., 1826, canal connecting St. Marys and St. Marks Hs., thence by inland water communication to the Mississippi, **76,** 514, 516, 517, 518, 522. (See Board of Engineers.) Practicability of route dependent on permeability of soil, **76,** 520. Comparison of St. Johns and St. Marys routes, **76,** 521. Board recom. St. Johns route, **76,** 521. Ship canal to connect the Atlantic with the Gulf of Mexico through the peninsula not practicable, **76,** 522. For a coast navigation from St. Marks to the Mississippi, **76,** 522.

By Lt. Smith, 1852, canal across the peninsula of Florida, **76,** 511. Discussion of routes, **76,** 523, 524, 537, 541, 542, 543. Route recom. from St. Johns to Tampa Bay, **76,** 538; 31 locks required, 110′ w. and 16′ d., with 8′ lift, **76,** 540, 541. Lt. Smith suggested St. Marys H. as most natural e. terminus. **76,** 543.

By Capt. Howell, 1873, canal 7′ d., Mississippi R. to Mobile Bay, **76,** 512, 513.

By Capt. Damrell, 1873, canal 100′ x 9′, Mississippi to Apalachicola, $7,000,000, **76,** 513, 514.

By Brig. Gen. Humphreys, 1876, discussion of plans for a canal, Mississippi to the Atlantic, via peninsula of Florida, **76,** 508–511.

By Lt. Col. Gillmore, discussion of plans for a canal, Mississippi, across Florida, to Atlantic, **77,** 383, 387, 388, 393, 394. Canal with 9′ d. and 80′ w. at bottom, **77,** 383, 388. Reclaiming land of Okefenokee Swamp, **77,** 392, 393. Feasibility of ship canal more problematic than barge canal, **77,** 393. Discussion of plan for a ship canal, **77,** 394.

Lt. Col. Gillmore recom. detailed sur. to determine feasibility of proj., **77,** 404.

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In 1826, canal bet. Atlantic and Gulf of Mexico across Florida; one from St. Marys R. to Apalachicola R. or Bay; also one from St. Johns R. to Vassasousa Bay, **76,** 509.

In 1833, ex. of water communication, Mobile to Pensacola Bay, **76,** 508.

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[1] H. D. 697, 62d, 2d.

O–510(c) ST. MARYS RIVER TO GULF OF MEXICO, FLA. (Canal.)

COMMERCE.

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ENGINEERS.

Chief of Engineers. **R.,** **80,** 132.
In charge. Lt. Col. Q. A. Gillmore. **R.,** **80,** 973.
Assistant. S. L. Tremont. **R.,** **80,** 994.

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SURVEY.

Au. act June 18, 1878, **80,** 132; made by Col. Gillmore, 1878 (see Plans), **80,** 973.
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O–511(a) ST. MARYS, GA., AND ST. JOHNS, FLA. (Inland passage between.)[1]

APPROPRIATIONS.

1828,	$13,500, act May 23.
1830,	1,500, act Apr. 23.
1833,	9,000, act Mar. 2.
1835,	15,000, act Mar. 3.
1836,	5,000, act July 2.
1837,	5,000, act Mar. 3.
1838,	29,000, act July 7.
Total,	78,000

ENGINEERS.

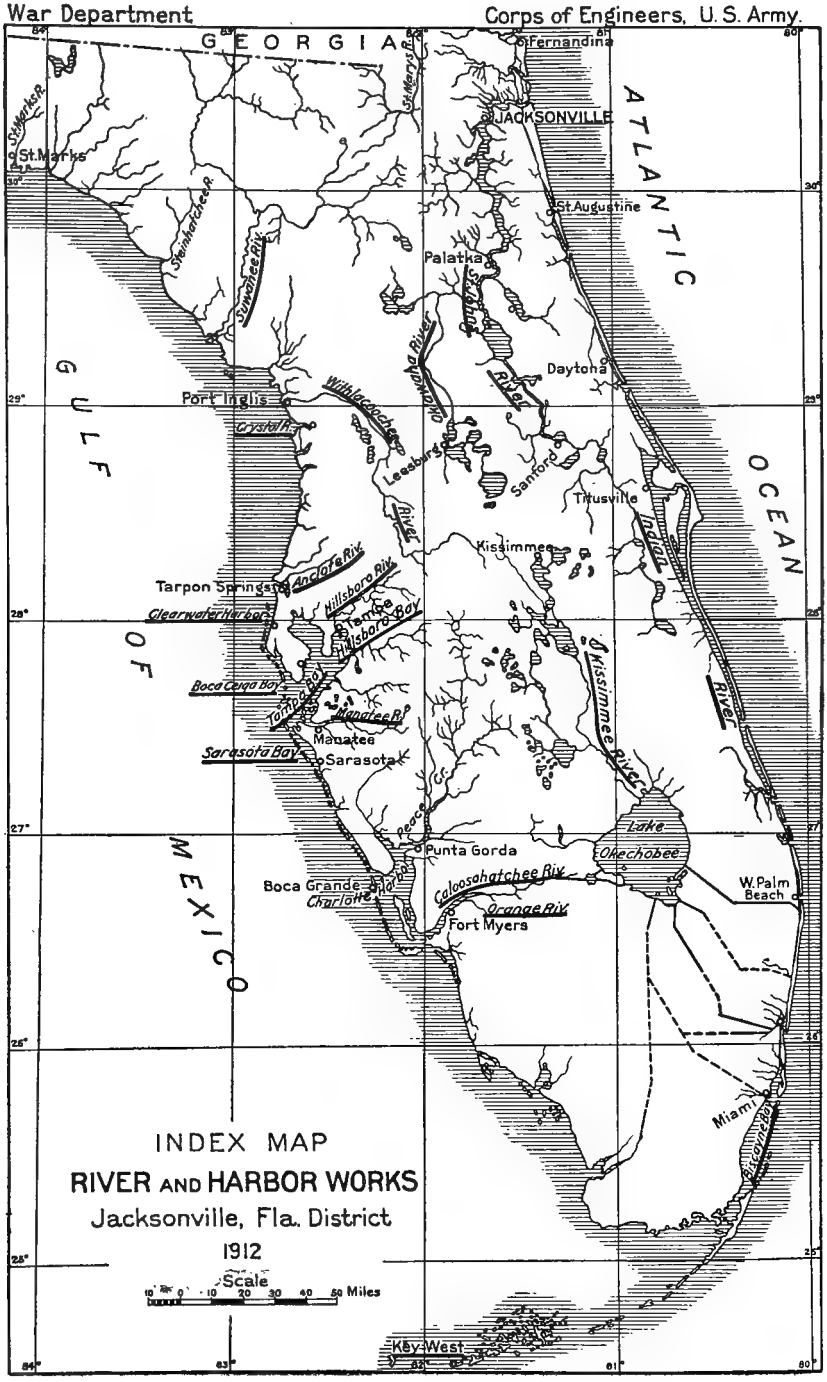
Chief of Engineers. **R.,** **66,** 7.

[1] Ex.—**R.** (fav.) June 10, 1835. Sur.—**R.** Oct. 1836. H. D. 482, 55th, 2d.

RIVER AND HARBOR WORKS.

GULF OF MEXICO.

P.—JACKSONVILLE, FLA., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
GEORGIA
Fernandina
JACKSONVILLE
St. Marks
St. Augustine
ATLANTIC
OCEAN
Palatka
Daytona
Port Inglis
Crystal R.
Withlacoochee River
Ocklawaha River
Leesburg
Sanford
Titusville
Indian River
Kissimmee
Tarpon Springs
Anclote Riv.
Hillsboro Riv.
Clearwater Harbor
Terra Ceia Bay
Hillsboro Bay
Boca Ciega Bay
Tampa Bay
Manatee R.
Manatee
Sarasota Bay
Sarasota
Kissimmee River
Lake Okechobee
Peace Cr.
Punta Gorda
Boca Grande
Charlotte Harbor
Caloosahatchee Riv.
Orange Riv.
Fort Myers
W. Palm Beach
GULF OF MEXICO
Miami
Key West
INDEX MAP
RIVER AND HARBOR WORKS
Jacksonville, Fla. District
1912
Scale
10 0 10 20 30 40 50 Miles

P.—JACKSONVILLE, FLA., DISTRICT.

In charge of U. S. Engineer Office,
Jacksonville, Fla.

P 1 Florida Waters
P 2 Waterway from St. Johns R. to Cumberland Sound (10)
P 3 Amelia R., Fla. (*)
P 4 Kingsleys Cut, Fla. (3)
P 5 Nassau Sound, Fla. (*)
P 6 Nassau R., Fla. (*)
P 7 Lofton Cr., Fla. (6)
P 8 Ft. George Inlet, Fla. (*)
P 9 Ft. George R., Fla. (8)
P 10 St. Johns R., Fla. (*)
P 11 Sisters Cr., Fla. (10)
P 12 Hannah Mills Cr., Fla. (10)
P 13 Clapboard Cr., Fla. (10)
P 14 Browns Cr., Fla. (10)
P 15 St. Charles Cr., Fla. (10)
P 16 Dunns Cr., Fla. (10)
P 17 Cedar Cr., Fla. (10)
P 18 Drummonds Cr., Fla. (10)
P 19 Trout Cr., Fla. (10)
P 20 Moncrief Cr., Fla. (19)
P 21 Six Mile Cr., Fla. (10)
P 22 Deer Cr., Fla. (10)
P 23 Hogans Cr., Fla. (10)
P 24 McCoys Cr., Fla. (10)
P 25 Fishweir Cr., Fla. (10)
P 26 McGirts Cr., Fla. (10)
P 27 Cedar Cr., Fla. (26)
P 28 Butcherpen Cr., Fla. (26)
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P 63 Lake Harney, Fla. (10)
P 64 Econlockhatchee R., Fla. (10)
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P 66 Lake Winder, Fla. (10)
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P 119 Elbow Cr., Fla. (112)
P 120 Crane Cr., Fla. (112)
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P 226 Big Carlos Pass, Fla. (**)
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[1] Closed by F. E. C. R. R. embankment.
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[2] Closed by natural influences.

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P 274 Roberts B., Fla. (273)
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P 280 N. Cr., Fla. (278)
P 281 Phillippe Cr., Fla. (278)
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P 285 Passage Key Inlet, Fla. (**)
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P 287 N. Chan., Tampa B., Fla. (**)
P 288 Tampa B., Fla. (**)
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P 292 Snells Bayou, Fla. (290)
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** Gulf of Mexico.

[1] Closed by natural influences.

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P 363 Pocason Cr., Fla. (**)
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P-1(a) ATLANTIC OCEAN TO THE GULF OF MEXICO. (Canal between).[1]

APPROPRIATIONS.[2]

1826,	$20,000
1830,	10,400
1852,	20,000
Total,	50,400

NOTE.—Canal via St. Marys R., Fla., to St. Andrews B., Fla. (See DISTRICT O, p. 563.)

P-1(b-e) FLORIDA, LOUISIANA, AND TEXAS WATERWAYS. (Hyacinth removal).

Part.	Title.	Period.	Appropriations.
b	Florida waters	1897–1912	$146,000
c	Louisiana waters	1897–1902	36,000
d	Louisiana and Texas waters	1902–1912	149,480
e	Texas waters	1907–1909	500
	Total		331,580

Part (b), P-1 Florida Waters. (Removing water hyacinths.)

APPROPRIATION.

1897,	$5,000[2]
1899,	36,000, **99,** 1612.
1902,	*25,000, **03,** 1186.
1904,	*25,000, **04,** 1713.
1905,	25,000, **05,** 1319.
1907,	15,000, **07,** 1333.
1910,	5,000, **10,** 1530.
1911,	10,000, **11,** 1668.
Total,	146,000 (incl. sales, $146,416.80[3], **12,** 1884).

COMMERCE.

Great financial loss and inconvenience is suffered by the growth of this plant, **01,** 342.

U.S. work has relieved congestion of traffic caused by accumulation of the plant, **04,** 1713.

CONTRACTS.

1906. W. M. Boyd, hull for SS. *Le Reve*, **07,** 1334.

ENGINEERS.

Chief of Engineers. R., 97, 25; **98,** 35; **99,** 40, 276; **00,** 315; **01,** 341; **02,** 272; **03,** 279; **04,** 299; **05,** 308; **06,** 330; **07,** 346; **08,** 367; **09,** 383; **10,** 433; **11,** 461; **12,** 566.

Boards. Convened, St. Augustine, Fla., Sept. 5, 1897, by S. O. No. 18, dated June 19, 1897, to investigate the water hyacinth question in Florida and Louisiana; **R., 99,** 1615. (Lt. Col. W. H. H. Benyaurd and Maj. J. B. Quinn.)

In charge:

Capt. C. H. McKinstry, 1899–1900. **R., 99,** 1612; **00,** 1985.

Capt. T. H. Rees, 1900–01. **R., 00,** 1985; **01,** 1746.

Lt. E. M. Rhett, 1901. **02,** 265.

Capt. H. Deakyne, 1901–02. **R., 02,** 1215.

Capt. F. R. Shunk, 1903–08. **R., 03,** 1184, 2433; **04,** 1712; (Maj.) **05,** 1318; **06,** 1234; **07,** 1333.

Col. J. B. Quinn, **06,** 312.

Lt. Col. D. C. Kingman, **07,** 328.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1393.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1383; **10,** 1529; **11,** 1668.

Capt. J. R. Slattery, 1912–. **R., 12,** 1884.

Assistants:

J. W. Sackett, **99,** 1621.

Lt. E. M. Markham, **01,** 335.

Lt. E. M. Rhett, **01,** 335; **02,** 265.

OBSTRUCTIONS.

Lower br. trusses prevent a free flow of the masses of hyacinths, **99,** 1619.

OPERATIONS.

Experiments made, 1898, to discover the action of various chemicals on the life of the plant, **99,** 1620.

1900-01. Experiments made with chemical process of destroying plants, **01,** 1746–47. Test of mechanical device, **01,** 1747–48.

1902-03. SS. *Le Reve* purchased and fitted up with spraying apparatus; 2,910,000 s. y. of

* Allotment.
** Gulf of Mexico.
[1] Reports of sur. rendered Feb. 19, 1829; Mar. 6, 1832; May 1, 1855. **R.** (fav.) of ex. made Apr. 3, 1876. Sur. made 1880; **R.** Apr. 6; est. $50,000 would be required. (H. R. D. 482, 55th, 2d.)
[2] H. D. 421, 57th, 2d.
[3] Including $5,000, 1897.

hyacinth growth destroyed in St. Johns R. and tributaries, **03,** 1185. Experiment made to determine injurious effect on cattle from eating the sprayed plants, **03,** 1185–86.

1903-04. 11,283,982 s. y. of hyacinths destroyed in St. Johns R. and tributaries, **04,** 1712.

1904-05. 6,977,000 s. y. of hyacinths destroyed in St. Johns R. and tributaries, **05,** 1318.

1905-06. Experiments made in attempt to find chemical process for destroying plants which would not be injurious to cattle; unsuccessful, mechanical process adopted; 8 m. of Withlacoochee R. and 10 m. of Kissimmee R. cleared by breaking up packs and allowing them to float away. Many inlets and sloughs closed with log booms, **06,** 1234.

1906-07. 3 m. of Withlacoochee R. and 5 m. of Kissimmee R. cleared of obstr. by mechanical means, **07,** 1333.

1907-08. About 433,660 s. y. of plants cleared from tributaries of St. Johns R., **08,** 1393.

1908-09. Hyacinths cleared from various streams; amount not stated, **09,** 1383.

1909-10. Portions of various streams cleared. A gasoline-driven hyacinth elevator was constr. and operated, removing 156 acres of plants in St. Johns R. and tributaries, **10,** 1529.

1910-11. 410 acres of plants removed from St. Johns R. and Black Creek by hyacinth elevator, **11,** 1668.

1911-12. Repairs to elevator, **12,** 1884.

PHYSICAL CHARACTERISTICS.

Description of plant and its effects, **99,** 1616.

R. on experiments made to find suitable chemical for spraying plants. Effect of this chemical on animal life, **03,** 2433.

R. of Maj. Shunk on experiments for destroying water hyacinths by chemical means which would not be injurious to cattle, **06,** 1235.

PROJECTS.

BE., 1897, est., 1898, $36,000 to remove the water hyacinth from the navigable waters of Florida and Louisiana; add'l an. app. would be needed to keep the waters free from this plant, **99,** 1621.

By BE., 1897, for removing plant; cost, boats, $25,000; log booms, $1,000; and operating expenses, $10,000, **99,** 1621; **00,** 1985.

Proj. modified by act June 13, 1902, to permit use of funds therein and theretofore app. for exterminating or removing the plants by chemical or any other methods, **02,** 273.

Est. by Capt. Shunk that not less than $150,000 per year would be needed for operating expenses, **03,** 1185.

Act Mar. 3, 1905, app. $25,000, provides that no chemical process injurious to cattle which may feed upon the water hyacinth should be used. Recom. that Dept. of Agriculture undertake experiments to determine effect on cattle of solution in use (arsenic and soda), **05,** 1318.

Experiments, 1906: No suitable chemical process for destroying plants without injury to cattle having been found, plan recom. to close inlets, sloughs, etc., with booms, and to break up the packs of plants with a suitable boat and propel them with the current in order to insure their floating away, or be able to place them ashore, **06,** 1239; **12,** 566.

SURVEYS.

Investigation of the hyacinth question in the States of Fla. and La. au. act June 4, 1897 (see Board of Engineers; Projects), **99,** 1615.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 566.

Part (c), P-1 Louisiana Waters. (Removing water hyacinths from.)

APPROPRIATION.

1899, $36,000, **99,** 1855.

CONTRACTS.

1899. E. E. Wood, stern-wheel SS., $8,000; Johnson Iron Works (Limited), furnishing and installing machinery on boat, $4,750; F. B. Williams, log boom at mouth of Bayou Teche, $950, **00,** 2271.

ENGINEERS.

Chief of Engineers. R., 97, 25; **98,** 35; **99,** 332; **00,** 377; **01,** 395; **02,** 327.

In charge:
Maj. J. B. Quinn, 1899. **R., 99,** 1855.
Maj. H. M. Adams, 1900. **R., 00,** 2270.
Lt. E. M. Adams, 1901. **R., 01,** 1906.
Lt. Col. H. M. Adams, 1902. **R., 02,** 1347.

Assistants:
Lt. E. M. Adams, 1901–02. **02,** 310.
Lt. P. S. Bond, 1902. **02,** 310.

OPERATIONS.

1900-01. 188,000 sq. yds. plants removed from Bayou Plaquemine by crushing apparatus, **01,** 1906.

PROJECTS.

By BE., 1897, expending $25,000 for boat and machinery suitable for raising the plants and crushing them; $1,000 for log booms across the mouths of small streams to prevent the drift of the hyacinths into the larger Rs. and bayous, and $10,000 for conducting operations, **00,** 2270.

Subproj., 1899, provided boom at the mouth of Bayou Teche, La. (one of the principal navigable streams affected by the hyacinths), with a gate arranged to allow the hyacinths to float out with outgoing tides and to prevent their return, **00,** 2270.

Act June 13, 1902, au. extension of operations for removal of water hyacinths to include navigable waters in State of Texas; also au. use of chemicals, **02,** 327, 3172.

Part (d), P-1 Louisiana and Texas Waters. (Removing the water hyacinth from.)

APPROPRIATIONS.

1902,	*$18,000	**03,** 1314.
	*1,480	
1903,	*500,	**04,** 361, 1914.
1904,	*15,000,	**04,** 361, 1914.
1905,	40,000,	**05,** 1478.
1907,	9,500,	**07,** 1451.
1909,	*5,000	**09,** 1485.
	*20,000	
1910,	20,000,	**10,** 1626.
1911,	20,000,	**11,** 1769.
Total,	[1]149,480	(incl. misc., $1,119.04, $150,599.04,[2] **12,** 1987).

* Allotment.
[1] $500 allotted to Buffalo Bayou, Tex. **09,** 468.
[2] $36,000 in 1899 not included. See Part (c), P-1.

CONTRACTS.

1903. J. G. Fuller, repairs to log boom at mouth of Bayou Teche, $447.50, **03,** 1314.

ENGINEERS.

Chief of Engineers. **R., 03,** 343; **04,** 360; **05,** 380; **06,** 409; **07,** 427; **08,** 447; **09,** 466; **10,** 523; **11,** 560; **12,** 680.

In charge:

Lt. Col. H. M. Adams, 1902, **R., 03,** 335.
Capt. C. S. Bromwell, 1902–04. **R., 03,** 1312.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1913.
Capt. J. F. McIndoe, 1904–08. **R., 05,** 1476; **06,** 1324; **07,** 1450; (Maj.) **08,** 1504.
Col. E. H. Ruffner, 1907–09. **08,** 431; **09,** 439.
Lt. Col. L. H. Beach, 1909–11. **R., 09,** 1484; **10,** 1625.
Maj. H. Burgess, 1911. **R., 11,** 1768.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1986.

Assistants:

1st Lt. W. Willing, **08,** 431; **09,** 439.
1st Lt. R. R. Ralston, **09,** 439; (Capt.) **10,** 489.
1st Lt. R. P. Howell, jr., **11,** 526; (Capt.) **12,** 645.

OPERATIONS.

1902–03. SS. *Ramos* filled with spraying machinery destroyed 3,690,662 sq. yds. of plants in Bayou Plaquemine, Grand R., Bayou Natchez, Grosse Tete B., Grosse Tete Bayou, and Chocolate Bayou, using the Harvesta chemical compound, **03,** 1313. Repairs made to log boom at mouth of Bayou Teche, **03,** 1314.

1903–04. 1,818,362 sq. yds. of hyacinths sprayed; repairs made to SS. *Ramos*, **04,** 1913.

1904–05. SS. *Ramos* operated in Bayou Plaquemine and other waters and effectively cleared them of hyacinths, 192,442 gal. of chemicals being used, each gal. est. to destroy 12 sq. yds. of plants; use of Harvesta chemical discontinued and more economical mixture substituted during latter part of year; booms constructed at various points and watchmen maintained; extensive repairs and imp. to SS. *Ramos;* work of equipping a second boat commenced, **05,** 1477.

1905–06. Spraying continued in Plaquemine-Morgan City water route until Oct., 227,292 gals. chemicals being used; SS. *Ramos* fitted with apparatus for burning oil fuel, and minor repairs made; second boat (*Hyacinth*) built and equipped by hired labor at a cost of $8,900, for use in streams of sw. Louisiana and Texas; booms operated during part of year, **06,** 1325.

1906–07. SS. *Ramos* and *Hyacinth* operated in Plaquemine-Morgan City water route, and other localities in Louisiana and Texas, 212,118 gals. of chemical compound being used; booms operated during portion of year; repairs made to SS. *Ramos*, **07,** 1450–51.

1907–08. SS. *Ramos* and *Hyacinth* operated in various waters, effectively clearing them, 631,858 gals. compound being used, each gal. est. to destroy 10 sq. yds.; minor repairs to SS. *Hyacinth;* booms operated part of year at Bayou des Allemands and Bayou Plaquemine, **08,** 1504–05.

1908–09. SS. *Hyacinth* operated in various waters, and 2,979,090 sq. yds. of hyacinths removed by spraying and use of boats and booms, 143,079 gals. chemical compound used; repairs and alterations to SS. *Hyacinth;* booms operated during a portion of year, **09,** 1484–85.

1909–10. SS. *Hyacinth* operated in various waters spraying plants and placing additional booms, 148,149 gals. compound used; additional improvised outfit furnished by local interests used in Spanish Lake; system of patrols estab. on lower Vermilion; repairs and imp. to SS. *Hyacinth;* watchmen employed at certain booms, **10,** 1625–26.

1910–11. SS. *Hyacinth* operated in various waters spraying plants and placing booms; 189,770 gals. compound used, destroying 1,897,700 sq. yds. plants; operation of improvised equipment in Spanish Lake continued, similar equipment used in Bayou Vermilion, **11,** 1768.

1911–12. 1,550,000 sq. yds. plants destroyed, using 155,264 gals. solution, **12,** 1986.

PHYSICAL CHARACTERISTICS.

Action of chemical compound found to be ineffective during cold weather, **03,** 1313.

H. w. in spring of 1903 cleared nearly all of the hyacinth-infested streams of most of the plants, **03,** 1313.

Bayous Plaquemine and Grosse Tete, where there is absence of R. current, are breeding places for hyacinths which later on obstr. lower streams, **03,** 1313.

Unusual h. w. during 1905 in streams of sw. Louisiana and Texas made it unnecessary to destroy hyacinths which had been troublesome in 1904, **06,** 1325.

Mississippi R. flood in 1912 carried most of hyacinths into Gulf of Mexico, **12,** 1987.

PROJECTS.

Act June 13, 1902, au. extermination of plants by chemical or other means, **03,** 1312–13.

Proj. approved Aug. 1, 1902, au. use of available funds for destruction of plants in Bayou Plaquemine, Grand R., Flat Lake, and Bayou Natchez, La., modified Sept. 26, to permit of necessary repairs to log boom at mouth of Bayou Teche and its operation for 2 years, **03,** 1312–13.

Proj. approved Aug. 19, 1902, au. equipping SS. *Ramos* with spraying apparatus for destruction of plants by chemical means, **03,** 1312–13.

Proj. of 1905 au. continuance of spraying operations in Plaquemine-Morgan City water route, and outfitting a second boat for operations in Calcasieu R., La.; Sabine and Neches Rs., Tex., **05,** 1477.

Plants can not be eradicated within reasonable cost without cooperation of local au.; even then a long and difficult process, **12,** 681.

Part (e), P-1 Texas Waters. (Removing the water hyacinth from.)

APPROPRIATIONS.

1907, *$500, **08,** 1521.

ENGINEERS.

Chief of Engineers. **R., 08,** 457; **09,** 477.
In charge. Capt. J. C. Oakes, 1907–09. **R., 08,** 1521; **09,** 1500.

OPERATIONS.

1907–08. Supervision of work done by city of Galveston in clearing Buffalo Bayou of hyacinths, **08,** 1521.

PRIVATE WORK.

Buffalo Bayou, Tex., cleared of hyacinths by men with boats employed by city of Houston, Tex., working under supervision of U. S. Engr. Dept., **08,** 1521.

City of Houston removed numerous scattered bunches of hyacinths from vicinity of Houston, **09,** 1500.

* Allotment.

P-1(f) FLORIDA RIVER AND HARBOR IMPROVEMENTS

APPROPRIATIONS.

1899, $35,000, **99,** 1613.
1902, 35,000, **02,** 1216.

Total, 70,000, **05,** 1320.

CONTRACTS.

1903. Merrill-Stevens Eng. Co., combined dr. and snag boat, $61,404.50, **04,** 1714.

ENGINEERS.

Chief of Engineers. R., 99, 277; **00,** 315; **01** 342; **02,** 273; **03,** 280; **04,** 300; **05,** 309.

In charge:
Capt. C. H. McKinstry, 1899. **R., 99,** 1613.
Capt. T. H. Rees, 1900–01. **R., 00,** 1985; **01,** 1749.
Capt. Herbert Deakyne, 1902. **R., 02,** 1215.
Lt. E. M. Rhett, 1902, **02,** 265, 274.
Capt. F. R. Shunk, 1903–05. **R., 03,** 1186; **04,** 1713; (Maj.) **05,** 1319.

OPERATIONS.

1903-04. Work on boat begun, hull launched, A frame and gallows frame in position, machinery installed, **04,** 1713.
1904-05. Constr. of dr. finished Mar., 1905, placed in operation, satisfactory, **05,** 1319.

PROJECTS.

Purchase or constr. of a suitable dr., with snagging outfit, to be used in Florida waters, au. act Mar. 3, 1899; est., $50,000 to $55,000, **99,** 1613; **00,** 1985, 1986.
Details, boat, **99,** 1615.
Capt. Rees recom. additional app. $35,000 to constr. a satisfactory dr., **01,** 1750.

P-2 ST. JOHNS RIVER AND FERNANDINA, FLA. (Inside passage between.)

APPROPRIATION.

1880, $7,000, **80,** 968.

CONTRACTS.

1879. J. S. Lawrence, dr., 15¢ c. y., **80,** 967.
1881. J. A. Cloud, dr., 26¢ c. y., **81,** 1126.

ENGINEERS.

Chief of Engineers. R., 80, 131; **81,** 177; **82,** 175; **83,** 185; **84,** 190; **85,** 191; **86,** 190; **87,** 153.

In charge. Col. Q. A. Gillmore, 1869–87. **R., 80,** 966; **81,** 1125; **82,** 1203; **83,** 954; **84,** 1125; **85,** 1234; **86,** 1124; **87,** 1199.

Assistants:
S. L. Fremont. **R., 80,** 968.
Lt. W. L. Fisk. **R., 81,** 1127.

OPERATIONS.

1879-80. 38,763 c. y. dr., **80,** 967.
1880-81. 8,684 c. y. dr., **81,** 1126.
1881-87. Operations discontinued, because there seemed no urgent need for its continuance and no prospect of permanency, **86,** 190; **87,** 1199.

PROJECTS.

By Col. Gillmore, 1875, for imp. of inside passage from St. Johns R. to Fernandina by a chan. 80′ w. and 11′ d. h. w.; est., $160,000, **75,** ii, 59; **79,** 98.

P-3 AMELIA RIVER, FLA.

ENGINEERS.

Chief of Engineers. R., 85, 191.
In charge. Capt. W. T. Rossell. **R., 85,** 1285.

SURVEYS.

Reference to previous exs., **85,** 1284.
Ex. au. act July 5, 1884; made by Capt. Rossell, 1884 (**R.** unfav.), **85,** 1285.

P-10 ST. JOHNS RIVER, FLA.[1]

Part.	Title.	Period.	Appropriations.
a	General imp., incl. inside passage to Fernandina, Nassau R. sur., etc.	1852–1912	$5,447,089.02
b	Opposite Jacksonville	1905–1912	486,500.00
c	Jacksonville to Palatka (incl. Orange Mills Flats)	1899–1912	179,040.00
d	Palatka to Lake Harney (incl. L. George and Monroe)	1907–1912	87,400.00
e	Lake George to Lake Monroe	1882–1884	.....
f	Volusia Bar (bet. Lakes George and Monroe)	1880–1909	50,840.00
g	Upper River (above or south of L. Monroe)	1884–1896	5,000.00
	Total	.....	6,255,869.02

[1] Sur. of Fort George Inlet—**R.** May 24, 1853. (H. D. 482, 55th, 2d.)

Part (a), 10 St. Johns River, Fla. (General improvement, including inside passage to Fernandina, and Nassau River survey.)

APPROPRIATIONS.

1852,	$10,000.00, act Aug. 30.
1870,	15,000.00, **70,** 63.
1871,	15,000.00, **71,** 70.
1872,	10,000.00, **72,** 66.
1873,	10,000.00, **73,** 70.
1874,	10,000.00, **74,** 78.
1878,	10,000.00, **78,** 581.
1879,	7,000.00, **79,** 98.
1880,	125,000.00, **80,** 971.
1881,	100,000.00, **81,** 1132.
1882,	150,000.00, **82,** 1195.
1884,	150,000.00, **84,** 1132.
1886,	150,000.00, **86,** 1130.
1888,	175,000.00, **88,** 1087.
1890,	170,000.00, **90,** 1557.
1892,	112,500.00, **92,** 1357.
1893,	284,500.00, **93,** 1618.
1896,	200,000.00, **96,** 1308.
1899,	200,000.00, **99,** 1599.
1901,	*10,000.00, **02,** 1202, 1204.
1902,	350,000.00, **02,** 1204.
1903,	350,000.00, **03,** 1176.
1904,	395,000.00, **04,** 1689.
1905,	205,000.00 / 100,000.00 } **05,** 1294.
1906,	309,750.00, **06,** 1217.
1907,	100,000.00, **07,** 1307.
	*12,339.02, **07,** 1307 (acts 1902 and 1905).
	*10,000.00, **08,** 1364.
1908,	*4,000.00 / *6,000.00 } **09,** 1357 (act 1905).
1909,	300,000.00, **09,** 1357.
1910,	*16,000.00, **10,** 1495.
	300,000.00, **10,** 1495.
1911,	425,000.00, **11,** 1631.
1912,	300,000.00 / 350,000.00 } **12,** 1850.
Total,	5,447,089.02

COMMERCE.

Important, **69,** 271, 272; **73,** 70; **78,** 581.

Benefit from imp., **81,** 1130, 1131.

C. interests, **69,** 271; **75,** ii, 59; **77,** 380, 381; **79,** 767; **88,** 1087, 1088.

Existing and prospective C. development, **90,** 1556.

Detailed description of, **95,** 1598.

Increased 75%, 1895 to 1902, **02,** 266.

Est. that imp. has maintained rates to n. points 100% less than otherwise would have been, **05,** 290.

Were it not for imp. rates from Florida to n. points would be 50% greater than they are, **07,** 329.

Decrease in lumber shipments, but great increase in cotton, tobacco, and other merchandise; also great increase in foreign trade, **09,** 360.

Diagram showing C. and app., **12,** 1851.

1911, 1,790,498 t., **12,** 1851.

"The commerce for the fiscal year 1911 amounted to 1,790,498 short tons, valued at $56,865,789, consisting of coal, cement, fertilizers, fertilizer materials, fruits lumber, merchandise, phosphate, oils, steel rails, vegetables, etc. The increase in tonnage over the preceding year amounted to only 1.5 per cent. One steamer line was established during the year, an intracoastal line to Fort Pierce, and one line was abandoned, the Roome Line to Miami.

"The post-office receipts during 1911 were $476,299.27 and the bank clearings $146,740,819.23.

"Were it not for the improvement, freight rates from Florida to northern points would be 50 per cent greater than they are.

"The work on previous projects has resulted in establishing favorable rates for this port, which permit it to reach far into the Middle West. In its incomplete state the present project can not be said to have had any effect on freight rates nor on the establishment of new business, though in anticipation of deeper water the farseeing men in the city are striving to have adequate terminals to handle the large business which is expected with the completion of the project." **12,** 527.

CONTRACTS.

1870. C. H. Campbell, dr., $1,200 month, **70,** 63; **72,** 665; annulled, **71,** 70.

1875. American Dredging Co., dr., 24¢ c. y., **76,** 445.

1880. Lara Ross & Co., j. constr., **81,** 1132.

1881. J. H. Durkee, j. constr., **81,** 1133.

1882. A. A. Howlett, j. constr., **83,** 946.

1885. A. A. Howlett, j. constr., **85,** 1250.

1886. J. A. Bryan, dike constr., $7.22 l. f., **87,** 1210. R. Moore, mattress and st., 45¢, $2.45 s. y. and t., **87,** 1215.

1889. R. G. Ross, st., $2.14 to $2.35 t.; oyster shell, $1.25 c. y; and brush mattress, 74¢ s. y., **89,** 1305.

1890. M. Conant, j. constr., $126,420, **91,** 1617.

1891. J. Satterlee, st., $4.17 t., **91,** 1618.

1892. J. H. Hathaway & Co., mattresses, 75¢ s. y.; st., $2.09, $2.49, and $4.30 t. ($402,650), **93,** 1618.

1896. R. G. Ross, st., $2.24 and $2.64 t., **97,** 1549.

1899. R. G. Ross, st., $2 and $2.33 t. ($207,760), **00,** 1971.

1903. Coastwise Dredging Co., dr., 21.5¢ c. y. (contract annulled, **04,** 1686); R. G. Ross, j. constr., st., $2.22 and $2.13 t., **03,** 1177. R. G. Ross, training wall constr., unit prices; F. C. Blackmer and David Warrington, constr. of hull for dr., $12,305, **04,** 1689.

1904. North American Dredging Co., dr., 8.23¢ c. y., **05,** 1294.

1906. North American Dredging Co., dr., 9.9¢ c. y., **06,** 1217. R. G. Ross, removing r., $4.33 c. y.; other material, 22¾¢ c. y., **08,** 1364.

1907. R. G. Ross, work on n. j., **07,** 1308.

1909. Blackstaff Engineering Co., j. work, st., $2.14 t., **10,** 1495. R. G. Ross, dr.; sand and mud, 14¢; coquina, 40¢ c. y. R. G. Ross, hire of dr. plant, $415 day, **10,** 1496.

1910. R. G. Ross, for 24,100 sq. yds. mattress, 53,600 c. y. oyster shells, 19,050 t. first-class st., and 14,500 c. y. 2d-class st. (prices given); also for hire of dr. plant for about 12 mo., $470 day, **11,** 1632.

1911. Bowers Southern Dredging Co., dr. 5,486,200 c. y., 10.4¢ c. y., **11,** 1632. P. Sanford Ross (Inc.), dr. 65,000 c. y., 74¢ c. y., and furn. 6,200 t. st. for capping, $2.95 t., **12,** 1850.

ENGINEERS.

Chief of Engineers. R., 69, 47, 270; **70,** 63; **71,** 70; **72,** 65; **73,** 70; **74,** 78; **75,** 83; **76,** 70; **77,** 68; **78,** 78; **79,** 98; **80,** 131; **81,** 178; **82,** 173; **83,** 183; **84,** 190; **85,** 191; **86,** 190; **87,** 154; **88,** 143; **89,** 165; **90,** 147; **91,** 185, 195, 1666; **92,** 182; **93,** 199; **94,** 182; **95,** 208, 222; **96,** 186; **97,** 238; **98,** 234; **99,** 269; **00,** 307; **01,** 335; **02,** 265; **03,** 271; **04,** 280; **05,** 288; **06,** 312; **07,** 328; **08,** 347; **09,** 359; **10,** 407; **11,** 430; **12,** 524, 570, 571.

Boards. Convened, S. O. No. 44, dated Oct. 14, 1895, at St. Augustine, Fla., Dec. 19, 1895, to consider imp. of St. Johns R., Fla. **R., 96,** 1309. (Col. P. C. Hains, Maj. T. H. Handbury, Capt. W. M. Black, Capt. F. V. Abbot, Capt. O. M. Carter, and addl. 2d Lt. H. Burgess.)

In charge:

Lt. H. G. Wright. **R.,** May 24, 1853, **78,** 581.

Maj. Q. A. Gillmore, 1869–85. **R., 69,** 266, 271; **72,** 662, 672, 674; **73,** 749; **74,** ii, 8–11; **75,** ii, 37, 48,

* Allotment.

60; **76,** 445; **77,** 378; **78,** 580; **79,** 765–767, 795; (Col.) **80,** 970; **81,** 1127; **82,** 1189; **83,** 940; **84,** 1126.

Capt. W. T. Rossell, 1885–86. **R., 85,** 1243.

Capt. W. M. Black, 1886–92. **R., 86,** 1125; **87,** 1207; **88,** 1079; **89,** 1298; **90,** 1549; **91,** 1612, 1667.

Maj. J. C. Mallery, 1892. **R., 92,** 1349.

Lt. A. M. D'armit, 1893. **R., 93,** 1613.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1211; **95,** 1529, 1560, 1586.

Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1305; **97,** 1547; **98,** 1327, 1343.

Capt. C. H. McKinstry, 1899. **R., 99,** 1597.

Capt. T. H. Rees, 1900–01. **R., 00,** 1967; **01,** 1733.

Capt. H. Deakyne, 1902. **R., 02,** 1201.

Capt. F. R. Shunk, 1903–07. **R., 03,** 1173; **04,** 1685; (Maj.) **05,** 1291; **06,** 1215; **07,** 1305.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1361.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1355; **10,** 1491; **11,** 1627.

Capt. J. R. Slattery, 1912–. **R., 12,** 1847.

Assistants:

Capt. J. C. Post, **77,** 66. **R., 77,** 66, 378; **82,** 1195; (special **R.**) **83,** 949.

G. Daubeney. **R., 79,** 785, 796.

Lt. W. L. Fisk. **R., 81,** 1133.

Lt. W. T. Rossell. **R., 83,** 946; **84,** 1132.

J. H. Bacon. **R., 89,** 1306; **90,** 1558; **91,** 1618; **93,** 1619; **94,** 1215; **98,** 1345.

E. A. Gieseler. **R., 92,** 1357; **93,** 1623.

Lt. D'armit. **R., 95,** 1595.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Gillmore, 1875: (1) inside passage, St. Johns R. to Fernandina; chan. 13′ x 125′ h. w., $370,000; (2) if 11′ x 125′, $265,000; (3) if 13′ x 80′, $225,000; (4) if 11′ x 80′, $160,000. No. 4 recom. by Lt. Col. Gillmore, **75,** ii, 59.

By Lt. Col. Gillmore, 1879: (1) js. at mouth of R., $1,306,409; (2) dr. in connection with js., $120,000; (3) n. j., if completed in 3 years, $800,000, **79,** 784, 785.

OPERATIONS.

1870–71. Dr. of chan. 10′ x 80′, **71,** 70.

1871–72. Removal of 40,764 c. y.; chan. 10′ x 150′ x 2,400′ y., **72,** 66, 671.

1872–73. Removal of 23,868 c. y. by dr., **73,** 70, 750.

1873–74. Removal of 14,649 c. y. by dr., **74,** 74, ii, 9, 12.

1875–76. Removal of 28,973 c. y. from inside passage, **76,** 70, 446.

1876–77–78–79. Operations practically suspended; ex. of chan., 1876, **77,** 69, 378; and occasional dr. on the bar by the *H. Burden* in 1878–79, **78,** 78, 580; **79,** 98, 766. Description of operations by the dr. SS. *H. Burden,* **72,** 666–669; **73,** 750; **74,** ii, 11; **75,** ii, 37.

1880–81. Work commenced by partial constr. of 2,786′ of s. j., **81,** 1128.

1881–82. Apron foundation of s. j. extended 2,027′ and portions of 2d, 3d, 4th, and 5th courses laid; 8 spur js. built from s. j., averaging 90′ in l.; 1,115′ of n. j. foundation course laid, **82,** 1191, 1192.

1882–83. Orig. foundation course of s. j. enlarged by 2,113 l. f. of mattress revet.; j. raised by add'l st. and mattress courses, aggregating 2,119′; 13,100 c. y. riprap deposited on j., **83,** 942, 944.

1883–84. 1,950 l. f. of apron mattress laid on n. side of s. j. and s. side revet. extended 400′, **84,** 1128.

1884–85. 16,312 c. y. of st. and 52,037 s. y. of mattress placed in s. j.; 3,699 c. y. of st. and 16,712 s. y. of mattress placed in n. j., **85,** 1247.

1885–86. 1,339 l. f. of mattress work placed in line of j. and ballasted with 3,911 c. y. of st., **86,** 1127.

1886–87. 11,265 t. of st. and 16,470 s. y. of brush mattress used in dike and j. constr., **87,** 1209–1212.

1887–88. 7,204 c. y. st. and shell used in the s. j.; 12,000 s. y. of mattress, 21,951 c. y. st., and 2,309 c. y. shell placed in the n. j.; also 286 c. y. concrete, **88,** 1081.

1888–89. 19,361 t. of st., 1,522 c. y. oyster shells, and 20,000 s. y. of brush mattress placed in the n. j., **89,** 1299.

1889–90. 13,000 s. y. brush mattress, 21,151 t. st., and 3,482 c. y. oyster shells placed in n. and s. js., **90,** 1551.

1890–91. 4,240 c. y. dr., 3,731 c. y. st. placed in s. j., and 14,783 s. y. of brush mattress and 7,857 c. y. st. placed in n. j., **91,** 1613.

1891–92. 14,586 s. y. mattress, 13,344 c. y. of st., and 849 c. y. shell placed in s. j., and 10,773 s. y. of mattress, 10,663 c. y. st., and 494 c. y. shell placed in n. j.; also 227 c. y. concrete coping laid, **92,** 1351. In 1892 the s. j. had been completed to 8,293′, and the n. j. to 10,991′, **92,** 1352.

1892–93. 22,894 s. y. matresses, and 12,182 c. y. st. placed, **93,** 1616.

1893–94. 69,119 t. st., and 15,673 s. y. mattresses placed in the js., **94,** 1213.

1894–95. 61,223 t. st. placed in the js., **95,** 1531.

1896–97. 22,130 t. st. placed in s. j., **97,** 1548.

1897–98. 30,700 t. st. placed in js., **98,** 1327.

1899–00. 17,311 t. st. placed in n. j., and 94,220 c. y. dr., **00,** 1968.

1900–01. 56,756 t. st. placed in n. j., **01,** 1734. 16,425 c. y. dr. from mouth and 148,146 c. y. above mouth, **01,** 1735.

1901–02. 84,428 t. st. placed in n. j. and 83,719 c. y. dr., **02,** 1202.

1902–03. 231,478 c. y. dr. and 2,791 t. st. placed in n. j., **03,** 1174.

1903–04. 245,287 c. y. dr.; 145,027 t. st. placed in js.; 37,165 s. y. mattress, 32,034 c. y. st. and 293 c. y. shells placed in training walls, and 2,741 c. y. material removed from old work and placed in new, **04,** 1686, 1687.

1904–05. 153 s. y. mattress, 33,248 c. y. st., and 28,612 c. y. shells placed in training walls and walls completed; 1,539,763 c. y. dr.; new machinery placed in dr. *Jacksonville* and new dr. *St. Johns* received, **05,** 1292, 1293.

1905–06. 1,658,694 c. y. dr., and 2,037 c. y. coquina reef, 4,476 c. y. r., 117,155 c. y. sand and clay and 1,100 c. y. r. and clay removed, **06,** 1215, 1216.

1906–07. 1,888,975 c. y. dr., 7,420 c. y. r. and 69,688 c. y. other material removed, and 2,410 c. y. st. placed in n. j., **07,** 1305, 1306.

1907–08. 8,137 c. y. r. and 6,935 c. y. other material removed, **08,** 1361; 337,213 c. y. dr., **08,** 1362.

1908–09. 153,067 c. y. dr., **09,** 1355. Bowlders removed from Trout Creek, **09,** 1356.

1909–10. 16,898 c. y. st. placed in js.; 694,943 c. y. dr.; 4,788 s. y. mattress and 3,981 t. st. placed in revet.; 15,101 c. y. mattress, 19,911 c. y. shells, 6,620 c. y. r. placed in Mile Pt. training wall; 24,156 c. y., mostly r., removed from Trout Creek, and 3,215 c. y. from opposite Jacksonville placed in training wall; 8,300 l. f. mattress foundation for training wall laid and ballasted, 2,600 l. f. wall completed to m. l. w., and 1,000 l. f. more built up 5′ above bottom; 133,475 c. y. dr. by US. dr., **10,** 1491, 1492, 1493.

1910–11. 878,115 c. y. dr. under contracts, and 821,321 c. y. by U. S. dr. *St. John;* 25,000 c. y., mostly r., dr.; 24,200 s. y. mattress, 41,021 t. st., and 45,981 c. y. shells placed in training walls; 886 s. y. mattress and 1,928 t. st. placed in js.; training walls and dams nearly completed under contracts. Portions of chan. completed to proj. w. and d., other portions to full d. for about one-half the proj. w., **11,** 432, 1628–30.

1911–12. 28,956 c. y. dr. from Mayport cut under contract with R. G. Ross. 827,147 c. y. removed, under contract, to 30′, and 86,156 c. y. between 30′ and 32′; submerged wreck of a lighter found in Browns Creek cut and removed by contractor for dr.; 68,267 c. y. oyster shells dr. and placed in protection wall, and 2,997 t. st. placed in capping, **12,** 1848. 7,328 c. y. r. and soft material removed and 2,860 c. y. of this material was placed in protecting wall from Isle of Content toward New Berlin; U. S. dr. *St. John* removed 926,746 c. y. from 4 cuts; U. S. dr. *Key West* removed 208,401 c. y. from 2 cuts, **12,** 1849. 5,545′ core wall built and capped with heavy st. for 3,000′, **12,** 526.

PHYSICAL CHARACTERISTICS.

Described, **69,** 266, 269; **72,** 662, 673; **75,** ii, 48–51, 55, 58; **78,** 581, 582, 585; **94,** 1213; **95,** 1532, 1561, 1588, 1593; **96,** 1311; **97,** 1548; **98,** 1328, 1344; **99,** 1597.
List of obstructions, **75,** ii, 51.
Inside passage, **77,** 378; **78,** 78.
Current observations, soundings, discharge of stream, etc., **79,** 768–781, 785–792.
Tables of velocities, **79,** 775, 778, 779, 788.
Tables of discharges, **79,** 776–779, 788, 790.
Description of upper St. Johns, **79,** 796.
Tidal observations, **88,** 1085; **89,** 1301; **90,** 1561; **93,** 1623; **95,** 1592.
Density of water and sediment, **89,** 1302.
Velocity of current, **89,** 1306; **90,** 1558.
Low-water cross-sectional areas and mean d. at the mouth of the St. Johns R. from 1883 to 1892, **92,** 1358; **93,** 1644.
Tidal data, **92,** 1360, 1362.
Surface areas of St. Johns R., **92,** 1361.
Rainfall observations, **79,** 780; **93,** 1628, 1641–2.
St. Johns, the principal R. in Florida, **95,** 1561.
Changes in chan. and bar, **01,** 1734, 1735.
Shoaling beyond end of js., **09,** 1356.
Increased size and speed of SS. causing banks to wash down; chan. over outer bar increasing in cross section, especially in d., **09,** 360.
Storm of Oct. 17, 1910, damaged White Shells spoil bank, **11,** 1630.
Chan. increasing in d. and w. under natural influences, **11,** 432.
Sand movement, **11,** 432.
Max. draft, 22.5′, **11,** 432.
Mean rise in tide, 4′, **11,** 432.
Length of imp. section, 27.5 m., **11,** 432.
Obstr. oyster bank in front of Pilot Town in Mayport anchorage basin, removed, **12,** 1849.

PLANS. (See Estimates and Projects.)

By Lt. Wright, 1853, break'r on North Shoal, **78,** 584.
For imp., 1854, by means of piers at the mouth; est., $496,000.
Not recom., the expense being too great and not commensurate with the benefit derived, **69,** 267, 268; **72,** 664.
By Dr. A. S. Baldwin, a citizen of Jacksonville, for closing the mouth of Fort George Inlet; not approv., **69,** 268; **72,** 664; **78,** 584.
By Maj. Gillmore, 1872, imp. by ship chan., Fernandina to St. Johns R., 29.5 m.; est., $758,516; **72,** 665, 675.
By Maj. Gillmore, 1872, ship chan., Nassau Sound to St. Johns R., 9.75 m.; est., $602,624, **72** 655. These last plans not recom. by Lt. Col. Gillmore, **72,** 676.

PRIVATE (COUNTY) WORK.

See Proj. of 1892 below.
Under a proj. prepared by Maj. Mallery to procure by dr. a navigable ship chan. 18′ l. w. from Jacksonville, Fla., to the bar of the St. Johns R., Duval County, Fla., provided $300,000, by means of which 19,265 l. f. training dike built, and 736,291 c. y., p. m., dr., **94,** 1216.

PROJECTS. (See Estimates and Plans.)

By Maj. Gillmore, 1869, chan. 10′ x 80′ m. l. w. at the mouth, by repeated dr. and raking; est., $10,000 an., **69,** 47, 269; **70,** 63.
By Maj. Gillmore, 1871, d. chan. by dr. with a steamer with a centrifugal pump, **71,** 70; **72,** 66, 666.
By Lt. Col. Gillmore, 1874, dr. inside passage between Nassau Inlet and St. Johns R., **74,** ii, 11; **75,** 84.
By Lt. Col. Gillmore, 1875, imp. of the inside passage, St. Johns R. to Fernandina by chan. 11′ x 80′ h. w.; est., $160,000, **75,** ii, 59; **79,** 98.
By G. Daubeney, 1878, d. Volusia Bar by means of 2 js. to extend to 5.5′ to 6′ of water, with outer ends 200′ to 250′ apart, their crests at the level of l. w.; est., $12,520; for straightening R. above Volusia Bar by cut-offs, 1,160 y. aggregate l.; est., $29 000, **79,** 797, 798. Lt. Col. Gillmore recom. that j. on w. side be tried first before incurring the expense of 2, and amended est. for js. and cut-offs to $15,000 and $35,000, **79,** 795, 796.
By Lt. Col. Gillmore, 1879, js. at the mouth of St. Johns R.; n. j. to be 9,400′ l., with its inner end on Fort George Isld.; s. j. to be 6,800′ l., with inner end on the mainland below Generals Mound; w. between js., 1,600′; both js. to be submerged from shore to a point 2,000′ from the sea ends, the rest at the level of half tide; js. to extend to the 16′ curve, and to produce a midchan. d. of from 15′–16′ m. l. w.; est., $1,306,409, **79,** 784, 785. Increased in 1888 to $1,426,409, **89,** 1298.
In 1891 an increased l. of j. being required to meet the growth of the bar seaward, est. increased to $1,622,000, **91,** 1616.
In 1892 proposed to d. ship chan. in the defective reach, Dames Pt. to Beacon No. 1, by dr., and protection by dikes and shore protection; est., $324,000. This work is "now" being carried out by means of an app. of $300,000 made by Duval County. Est. cost of entire imp. increased to $1,741,000, **92,** 1350.
By Maj. Handbury, 1895, chan. 24′ x 300′ over all shoals, by dr. and training dikes; est., $600,000; and by the extension of the n. and s. js.; est., $1,509,750, **96,** 1307.
In 1895 the BE. est. $500,000 to raise the s. j. so that a practicable 15′ d. could be secured, **96,** 1311.
Lt. Col. Benyaurd, 1898, est. $120,000 to constr. chan. 200′ x 13′ m. l. w. between Jacksonville and Palatka, **98,** 1345.
Act June 13, 1902, au. $150,000 for dr., **02,** 1202.
Enlarged to provide for 25′ x 400′ at Dames Pt., **04,** 1686.
Lt. Col. Beach, 1908, increased est. for completing work $67,000; also est. $300,000 to restore both js. and maintain dr. chan., **08,** 1362, 1363.
By Capt. Spalding, 1909, au. act June 25, 1910, chan. 30′ x 300′ from Jacksonville to the ocean, following generally the line of the 24′ chan., increasing to as much as 600′ at bends and through js.; est., $2,852,000, which includes w. chan. opposite Mayport to 800′ in excess of chan. w. to d. of 27′ to provide anchorage basin for vessels awaiting favorable weather,[1] **10,** 409, 435; **11,** 431.

SURVEYS.

By U. S. Coast Sur., 1853, of entrance to St. Johns R., **78,** 581.
By Maj. Gillmore, 1871, **69,** 47, 266; **72,** 672.
By G. Daubeney, 1875, **75,** ii, 48.
By Capt. Post, 1877, ex. of chan., **77,** 378.
By Lt. Col. Gillmore, 1878, **79,** 99, 769, 795.
By G. Daubeney, 1879, borings, current observations, and soundings, **79,** 98, 769–781, 785–792.
By G. Daubeney, 1879, of upper St. Johns R., **79,** 796.
Of the bar between the ends of the js., 1888, **88,** 1084.
Of the R. from Great Marsh Isld. to Trout Creek, **90,** 1558.
Ex., Jacksonville to Sanford, au. act Sept. 19, 1890; made, 1891, by Capt. Black, **91,** 1667.
Sur. made, 1893 and 1894, by Lt. D'Armit, **93,** 1616; **94,** 1215.
Sur., Jacksonville to the ocean, au. act Aug. 17, 1894; made by Maj. Handbury, 1895 (**R.** fav.; see Projects), **95,** 1595.
Ex. Orange Mills near Palatka, for imp. of the chan., and to Sanford and above, au. act Aug. 17, 1894; made by Maj. Handbury, 1895 (**R.,** unfav.), **95,** 1560.
Sur. of the entrance to the R.; made, 1897–98, by Lt. Col. Benyaurd, **97,** 1548; **98,** 1328.
Sur. of the R. at Orange Mills with reference to navigation for ocean-going craft au. under concurrent resol. of Congress, 1898; made by Lt. Col. Benyaurd, 1898 (**R.** fav.; see Projects), **98,** 1343.
Sur., 1899, by Capt. McKinstry, **99,** 1597.
Sur., 1900, by Capt. Rees, **00,** 1968.
From entrance to Dames Pt., **01,** 1734.
Various minor, **02,** 1202.

[1] H. D. 611, 61st, 2d.

Of entrance, **03,** 1175; **04,** 1687; **05,** 1293; **08,** 1362; **09,** 1356; **10,** 1493.
Of Trout Creek, **09,** 1356.
From Jacksonville to ocean, au. act Mar. 3, 1909; made, 1909, by Capt. Spalding,[1] **10,** 435.
Ref. to ex. and surs., H. docs., **Rs.** of Chief of Engrs., etc., **11,** 433, 1630.
Pre. ex. and sur. au. act June 25, 1910, of R., Jacksonville to Palatka, with view to securing increased d. **R.** by Capt. Spalding, May 29, 1911[2] (unfav.), **12,** 570.
Pre. ex. and sur. au. act Feb. 27, 1911, of R., from d. w. at or below Commodores Pt. to d. w. above Sixmile Creek, westward of the middle ground between Arlington Cut and the w. shore of the R., etc. **R.** by Capt. Spalding, July 15, 1911[3] (unfav.), **12,** 571.
Pre. ex., with plan and est. of cost of imp. of chan., au. act Feb. 27, 1911, between St. Johns R. and Cumberland Sound, by way of the Sisters, out of St. Johns R., with view to straightening and d. chan. **R.** by Capt. Spalding, July 12, 1911, on pre. ex., and Capt. Slattery, Nov. 7, 1911, on sur.; est., $101,000, and $1,000 an. mainten.,[4] **12,** 571.
Pre. ex. and sur. au. act Feb. 27, 1911, of chan. from St. Johns R. through Lake Dexter, thence to Lake Woodruff, thence to St. Johns R. below Hawkinsville (**R.** to come), **12,** 571.

Maps.[1]
Sketch of the dr. SS. *Henry Burden,* **75,** ii, 41.
Comparative chart of surs. of the bar, 1853, 1868, and 1878, showing the sites of proposed js. Map of the bar in San Juan R., 1791, **79,** 784. Charts showing the discharge of St. Johns R., sheets A to K, **79,** 790.
Of Volusia Bar, followed by chart showing certain bends on the St. Johns R. between Lakes George and Monroe, **79,** 796.
81, 1132; **83,** 946; **84,** 1132; **85,** 1250; **86,** 1128; **87,** 1214; **88,** 1086; **89,** 1304; **90,** 1560; **91,** 1618; **92,** Atlas, 61, 62, 63, 64; **93,** 1618; **94,** 1214; **95,** 1534; **96,** 1310; **97,** 1548; **98,** 1328; **99,** 1598; **01,** 1736; **02,** 1202; **04,** 1686; **05,** 1292; **06,** 1218; **07,** 1308; **08,** 1364; **09,** 1356; **10,** 1493; **12,** 1848.

Part (b), P-10 St. Johns River, Fla., Opposite Jacksonville.

APPROPRIATIONS.

1907,	$371,500,	**07,** 1309.
1910,	115,000,	**10,** 1497.
Total,	486,500	

COMMERCE.
See St. Johns R., Fla.

CONTRACTS.
1907. P. S. Ross, removing r., sand, and clay, $3.03 c. y., **08,** 1366.
1911. P. S. Ross (Inc.), dr. 44,000 c. y. r., $2.64 c. y., material to be placed in training walls in lower R., **11,** 1634.

ENGINEERS.
Chief of Engineers. R., 06, 332; **07,** 329; **08,** 348; **09,** 362; **10,** 411; **11,** 434; **12,** 528.

In charge:
Maj. F. R. Shunk, 1907. **R., 07,** 1309.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1365.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1358; **10,** 1497; **11,** 1633.
Capt. J. R. Slattery, 1912–. **R., 12,** 1852.

OPERATIONS.
1907–08. 43,208 c. y. r., sand, and clay removed, **08,** 1365.
1908–09. 62,629 c. y. removed, **09,** 1358.
1909–10. 46,173 c. y. r. removed, **10,** 1497.
1910–11. 25,013 c. y. r. removed and placed in White Shells and Shipyard training walls, **11,** 1633.
1911–12. 12,840 c. y. r. removed and placed in training walls, completing contract June 22, 1912, **12,** 1852.

PROJECT.
By Maj. Shunk, 1905, 24′ from existing chan. to pierhead lines on left bank between Florida East Coast Ry. br. and mouth of Hogans Creek; est., $371,500, with $1,000 an. mainten,[5] **06,** 332; **07,** 329. Est. raised, 1908, to $586,500, **08,** 349.

SURVEY.
Ex. opposite Jacksonville, au. act Mar. 3, 1905; made, 1905, by Maj. Shunk,[5] **06,** 332.

Part (c), P-10 St. Johns River, Fla., at Orange Mills Flats. (Jacksonville to Palatka.)

APPROPRIATIONS.

1899,	$40,000,	**99,** 1601.
1902,	30,000,	**02,** 1206.
1905,	25,000,	**05,** 1295.
1905,	*3,000,	**09,** 1359, 1909.
1907,	25,000,	**07,** 1310.
1909,	*8,640,	**10,** 1498, 1910.
1910,	32,400,	**10,** 1498.
1912,	15,000,	**12,** 1853.
Total,	179,040	

COMMERCE.
Materially increased, **02,** 267.
13′ chan. permits light-draft vessels to load at Palatka with lumber; diminution of d. would probably cause rates to rise; navigation difficulties on account of insufficient w. at angles and lack of chan. marks, **09,** 363.
1911, 198,293 t., **12,** 1853.
"The existence of the St. Johns waterway has probably had an important effect in keeping down freight rates, but the increase of the channel to 13 feet has not, as far as known, caused any changes in rates.
"This channel, however, permits light-draft schooners to load at Palatka with cypress lumber from the large mills at that place, and a diminution in depth in the channel, requiring lightering of this material to Jacksonville, would, it is thought, raise the freight rates.
"The commerce for the year amounted to 198,293 short tons, valued at $7,636,633, consisting principally of crate material, fertilizers, fruit, grain,

* Allotment.
[1] H. D. 611, 61st, 2d.
[2] H. D. 281, 62d, 2d.
[3] H. D. 493, 62d, 2d.
[4] H. D. 898, 62d, 2d.
[5] H. D. 663, 59th, 1st.

groceries, logs, lumber, merchandise, naval stores, and vegetables. The commerce increased 19.3 per cent during the year." **12,** 530.

CONTRACTS.

1899. P. S. Ross, dr., 9.7¢ c. y. ($32,010), **00,** 1973.
1902. P. S. Ross, dr., 12¢ c. y., **03,** 1178.
1906. P. S. Ross, dr., 10.4¢ c. y., **06,** 1219.
1907. P. S. Ross, dr., 12¢ c. y., **08,** 1367.

ENGINEERS.

Chief of Engineers. R., 99, 271; **00,** 309; **01,** 336; **02,** 266; **03,** 273; **04,** 282; **05,** 290; **06,** 314; **07,** 329; **08,** 349; **09,** 363; **10,** 412; **11,** 435; **12,** 529.

In charge:
Capt. C. H. McKinstry, 1899–1900. **R., 99,** 1600; **00,** 1974.
Capt. T. H. Rees, 1900–01. **R., 00,** 1972; **01,** 1737.
Capt. H. Deakyne, 1902. **R., 02,** 1205.
Lt. E. M. Rhett, **02,** 265.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1178; **04,** 1690; (Maj.) **05,** 1295; **06,** 1218; **07,** 1309.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1366.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1359; **10,** 1498; **11,** 1634.
Capt. J. R. Slattery, 1912–. **R., 12,** 1852.

Assistant. J. H. Bacon. **R., 00,** 1976.

OPERATIONS.

1899-00. 160,426 c. y. dr., **00,** 1972.
1900-01. 160,426 c. y. dr., **01,** 1738.
1902-03. 113,232 c. y. dr., **03,** 1178.
1903-04. 113,553 c. y. dr., **04,** 1690.
1905-06. 204,395 c. y. dr., **06,** 1218.
1907-08. 193,951 c. y. dr., **08,** 1366.
1909-10. 92,070 c. y. dr., **10,** 1498.
1910-11. Cut through Racy Pt. Shoal and cut through Orange Mills Flats completed Jan. 12, 1911; total of 530,937 c. y. dr. by U. S. dr. *Florida,* **11,** 1634.
1911-12. Dr. *Florida* began work at Tocoi Cut; removed 64,899 c. y., making a cut along e. side of chan. 15′ x 60′ x 9,590′ m. l. w., **12,** 1852.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 1976, 1977.

PROJECTS.

By Lt. Col. Benyaurd, chan. 13′ x 200′ through shoals between Jacksonville and Palatka, Fla.; est., $120,000, **99,** 1601.
Est. raised, 1906, to $185,000, **06,** 314.

SURVEYS.

Sur. Orange Mill Flats au. by Chief of Engineers, Mar. 30, 1899; made, 1899, by Capt. McKinstry (see Projects), (Maps), **00,** 1975.
From Tocoi Pt. to Cow Creek, **01,** 1738.
Of portions requiring imp., **01,** 1738.
See St. Johns R., Palatka to Lake Harney, **10,** 412.
Ex. of cut through Tocoi Shoal, **11,** 1634.
Cong. docs., etc., relating to ex., surs., plans, etc., **11,** 436.
Reex. and sur. au. act June 25, 1910, of this section of R., with view to securing increased d. **R.** by Capt. Spalding, May 29, 1911[1] (unfav.), **10,** 412; **12,** 570.
Maps. **00,** 1976.

Part (d), P-10 St. Johns River, Fla.; Palatka to Lake Harney.

APPROPRIATIONS.

1910,	$32,400,	**10,** 1500.
1911,	30,000,	**11,** 1637.
1912,	25,000,	**12,** 1855.
Total,	87,400	

COMMERCE.

In 1911, 203,353 t., **12,** 1856.
"The commerce for the year 1911 amounted to 203,353 short tons, an increase of 77.8 per cent over the tonnage for 1910, valued at $4,548,657, and consisted principally of crate material, fertilizers, fruit, grain, groceries, logs, naval stores, and merchandise. About 75 per cent of the commerce consists of logs. Of the commerce of the river 99,166 tons comes from the Oklawaha River and passes down the St. Johns, only from the mouth of the Oklawaha to Palatka, a distance of 25 miles.
"Towns along the river enjoy materially lower freight rates than points not located on the river, but equal distances from Jacksonville. The differences frequently amount to 50 per cent." **12,** 532.

ENGINEERS.

Chief of Engineers. R., 09, 385; **10,** 413; **11,** 436; **12,** 531.

In charge:
Capt. G. R. Spalding, 1910–11. **R., 10,** 1499; **11,** 1635.
Capt. J. R. Slattery, 1912–. **R., 12,** 1854.

OPERATIONS.

1909-10. 9,710 c. y. dr. and 143 piles driven in guiding dikes at Volusia Bar, **10,** 1500.
1910-11. 25,907 c. y. dr. and 21 old submerged piles removed by US. dr. *Florida.* 56,092 c. y. dr. from cut-off at Dutchmans Pt., 1,333 c. y. removed from Florida Bend, and 18,862 c. y. from cut-off at Revolving Bend, **11,** 1636.
1911-12. 36,054 c. y. dr. from cut-off at Florida Bend, completing work and making chan. 10′ x 110′ x 960′. 38,567 c. y. dr. from Coxetters Bend, completing work and making chan. 10′ x 110′ x 990′. Chan. at Fort Florida completed, a total of 28,224 c. y. being removed, forming chan. 10′ x 110′ x 1,800′. Shoal at Lake Monroe, upper bar, dr. removing 22,916 c. y., forming chan. 6′ x 110′ x 1,900′. 10,109 c. y. removed from Geneva Ferry Lower Shoal, forming chan. 6′ x 110′ x 970′. 13,183 c. y. removed from Geneva Ferry Upper Shoal, completing work and forming chan. 6′ x 110′ x 1,300′. 11,852 c. y. dr. from Geigers Shoal, completing work and forming chan. 6′ x 110′ x 1,300′. 7,700 c. y. dr. from Lemon Bluff Shoal, completing work and forming chan. 6′ x 110′ x 1,100′. 27,699 c. y. dr. from Lake Harney Lower Bar, completing work and forming chan. 5.2′ x 110′ x 2,700′. Total of 197,125 c. y. removed on above work by U. S. dr. *Florida,* **12,** 1854.

PRIVATE WORK.

Incident to constr. of br. at Geneva Ferry; Orange County dr. between upper and lower shoals, 13,183 c. y., forming chan. 6′ x 110′ x 1,300′, **12,** 1854.

PROJECT.

By Capt. Spalding, 1908, chan. 8′ x 100′, Palatka to Sanford, and 5′ Sanford to Lake Harney; total est., $129,600, and $6,000 an. mainten.,[2] **09,** 385; au. act June 25, 1910, **10,** 413.

SURVEY.

Ex., Jacksonville to Sanford, and from Sanford to Lake Harney. and surs. from Palatka to Sanford and Sanford to Lake Harney, au. act Mar. 2, 1907; made, 1907–08, by DO.,[2] **09,** 385.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 531.
Map.[2]

[1] H. D. 281, 62d, 2d.

[2] H. D. 1111, 60th, 2d.

Part (e), P-10 St. Johns River, Fla., Lake George to Lake Monroe.

ENGINEERS.

Chief of Engineers. **R., 84,** 194.

In charge:
Capt. J. C. Post. **R., 84,** 1138.
Col. Q. A. Gillmore. **R., 84,** 1140.

Assistant. Lt. W. T. Rossell. **R., 84,** 1139.

PLANS.

By Col. Gillmore, 1883, l.-w. chan d. of 6′ at bends by formation of straight cut-offs; est., $43,000, **84,** 1142.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Col. Gillmore (see Plans), **84,** 1138, 1140.

Part (f), P-10 St. Johns River, Fla., at Volusia Bar.

APPROPRIATIONS.

1880,	$5,000,	**80,** 972.
1881,	5,500,	**81,** 1137.
1882,	5,000,	**82,** 1200.
1884,	2,000,	**84,** 1136.
1886,	7,500,	**86,** 1137.
1888,	500,	**88,** 1090.
1890,	500,	**90,** 1565.
1892,	1,000,	**92,** 1370.
1894,	1,000,	**95,** 1537.
1896,	1,000,	**96,** 1313.
1899,	2,000,	**99,** 1602.
1902,	2,000,	**02,** 1207.
1904,	2,000,	**04,** 1692.
1905	2,000,	**05,** 1297.
	*5,000,	**07,** 1311.
1907,	2,000,	**07,** 1311.
1908,	*1,840,	**09,** 1361 (act 1907).
1909,	5,000,	**09,** 1361.
Total,	50,840	

COMMERCE.

Not large, but exercises controlling influence on RR. rates, **02,** 268.
1908, 66,690 t., **09,** 365.

CONTRACTS.

1880. Anderson & Blaisdell, mattress and riprap constr., $2.95 l. f., **81,** 1137.
1881. L. A. Cunningham, j. constr., brush mattress, $1 s. y., and riprap, $6 c. y., **82,** 1201.
1882. G. A. De Cottes, j. constr., mattresses, 95¢ s. y.; riprap st., $5.95 c. y., **83,** 953.
1884. Hopkins & Le Baron, j. reconstr., **85,** 2257.
1886. I. A. Bryan, j. constr., **87,** 1218.
1892. Marzyck & Browne, dr., 36¢ c. y.; repaiting fender piling, $225 ($900), **93,** 1650.
1896. Florida Dredging Co., dr., 43¢ c. y. ($3,440), **97,** 1551.

ENGINEERS.

Chief of Engineers. **R., 80,** 131; **81,** 178; **82,** 174; **83,** 184; **84,** 192; **85,** 193; **86,** 192; **87,** 155; **88,** 145; **89,** 166; **90,** 149; **91,** 187; **92,** 184; **93,** 201; **94,** 186; **95,** 211; **96,** 188; **97,** 240; **98,** 235; **99,** 271; **00,** 310; **01,** 337; **02,** 267; **03,** 274; **04,** 283; **05,** 291; **06,** 315; **07,** 330; **08,** 350; **09,** 364.

In charge:
Col. Q. A. Gillmore, 1880–85. **R., 80,** 971; **81,** 1135; **82,** 1198; **83,** 951; **84,** 1134.
Capt. W. T. Rossell, 1885–86. **R., 85,** 1254.
Capt. W. M. Black, 1886–92. **R., 86,** 1135; **87,** 1216; **88,** 1088; **89,** 1308; **90,** 1564; **91,** 1627.
Maj. J. C. Mallery, 1892. **R., 92,** 1369.
Lt. D'Armit, 1893. **R., 93,** 1648.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1220; **95,** 1536.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1313; **97,** 1550; **98,** 1330.
Capt. C. H. McKinstry, 1899. **R., 99,** 1602.
Capt. T. H. Rees, 1900–01. **R., 00,** 1978; **01,** 1739.
Capt. H. Deakyne, 1902. **R., 02,** 1206.
Lt. E. M. Rhett. **02,** 265.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1179; **04,** 1692; (Maj.) **05,** 1296; **06,** 1219; **07,** 1310.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1367.
Capt. G. R. Spalding, 1909. **R., 09,** 1360.

Assistants:
Lt. W. L. Fisk. **R., 81,** 1137.
Capt. J. C. Post. **R., 82,** 1201.
Capt. W. T. Rossell. **R., 83,** 953.
A. W. Barber. **R., 85,** 1250.

OPERATIONS.

1880-81. 1.950 l. f. of brush and st. j. built, **81,** 1136.
1881-82. 1,836 l. f. of mattress; bottom course, laid on line of e. j., w. j. extended 256′; 100 piles driven, **82,** 1200.
1882-83. E. j. extended to the bar by addition of 1,623 l. f. of work; 43 guide piles driven, **83,** 952.
1884-85. Broken piling removed, guide piling driven, and 75 c. y. riprap st. placed in e. j., **85,** 1256.
1886-87. Js. raised to l. w. by brush fascines and st., and repairs to guide piling, **87,** 1217.
1888-89. Repairs to pile-fender system, **89,** 1309.
1889-90. 100 c. y. st. placed in w. j., **90,** 1565.
1890-91. 175 t. of r. used in repair of j., **91,** 1628.
1891-92. Repair of j. completed, **92,** 1369.
1892-93. Fender piles repaired, **93,** 1649.
1893-94. 257 c. y. dr., **94,** 1221.
1896-97. 4,242 c. y. dr., **97,** 1550.
1898-00. Two rows of fender piles repaired, **00,** 1978.
1900-01. Fender piles repaired, **01,** 1739.
1904-05. 16,961 c. y. dr. and 38 obstr. removed, **05,** 1296.
1906-07. 23,854 c. y. dr. and 8 obstr. removed, **07,** 1310.
1907-08. 20,354 c. y. dr., **08,** 1367.

PROJECTS.

By Col. Gillmore, narrowing the existing chan. by 2 converging brush and st. js., starting from the shore and extending to the 6′ curve in the lake, and with such w. between the ends as would maintain d. of 6′ l. w., chan. to be further defined and guarded by rows of fender piles and d. by dr. if necessary; est., $15,000, **80,** 972. Revised, $25,000, **86,** 1135; **87,** 1217.
In 1893–94 Maj. Handbury est. $1,000 required an. for mainten., **94,** 1221.
In 1895–96, Lt. Col. Benyaurd, dr. the shoal at the outer ends of the js., **96,** 1313.
Lt. Col. Benyaurd, 1895–96, est. $2,000 would be required an. for mainten., **96,** 1313.
For further reports, see "St. Johns River, Fla., Palatka to Lake Harney."

SURVEY.

Sur., 1894, showing 6′ d., by Maj. Handbury, **94,** 1221.
Maps. **81,** 1136; **83,** 952.

* Allotment.

Part (g), P-10 St. Johns River (Upper), Fla.

APPROPRIATION.

1884, $5,000, **84,** 1138.
Balance unused, $304.29, returned to Treas., **96,** 1312.

CONTRACT.

1892. Marzyck & Browne, dr., 36¢ c. y., p. m. ($4,100), **93,** 1650.

ENGINEERS.

Chief of Engineers. **R., 84,** 193; **85,** 193; **86,** 191; **87,** 156; **88,** 143; **91,** 195, 1666; **93,** 200; **94,** 185; **95,** 210; **96,** 188.

In charge:
Lt. Col. Q. A. Gillmore, 1884–85. **R., 84,** 1137.
Capt. W. T. Rossell, 1885–86. **R., 85,** 1253.
Capt. W. M. Black, 1886–91. **R., 86,** 1133; **87,** 1219; **88,** 1090; **91,** 1667.
Lt. D'Armit, 1893. **R., 93,** 1646.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1218; **95,** 1534.
Lt. Col. W. H. H. Benyaurd, 1896. **R., 96,** 1312.

OPERATIONS.

1892–93. 2,006 c. y., p. m., dr., **93,** 1647.
1893–94. 9,397 c. y., p. m., dr., **94,** 1219.

PLANS.

In 1891 Capt. Black did not consider upper R. worthy of imp., **91,** 1669.

PROJECTS.

By Lt. Col. Gillmore, 1884, imp. upper St. Johns R. to get chan. 6′ x 100′ by excavating curved cut-offs with dr., and with closure dams; est., $38,800, **84,** 1137; **87,** 1220.

Orig. proj. modified, 1892, so that funds available could be expend. in removing the worst points at the bends mentioned in the orig. proj. instead of openirg the cut through the bend at Old Town, **93,** 1647.

SURVEYS.

Maps. **95,** 1534.

P-10(h) ST. JOHNS RIVER TO JUPITER INLET, FLA. (Canal.)

ENGINEERS.

Chief of Engineers. **R., 85,** 199.
In charge. Capt. W. T. Rossell. **R., 85,** 1291.
Assistant. A. W. Barber. **R., 85,** 1293.

PLANS.

Capt. Rossell, in 1884, considered the route worthy of imp. and recom. surs., **85,** 1292.

SURVEY.

Au. act July 5, 1884, **85,** 199; ex. made by Capt. Rossell in 1884, **85,** 1291.

P-33 OKLAWAHA (Ocklawaha) RIVER, FLA.

APPROPRIATIONS.

1835,	$10,000, act Feb. 24.
1890,	10,000, **91,** 1621.
1892,	1,000, **92,** 1367.
1894,	3,000, **95,** 1538.
1896,	3,000, **96,** 1315.
1899,	3,000, **99,** 1604.
1902,	2,000, **02,** 1208.
1905,	2,000, **05,** 1299.
1907,	15,000, **07,** 1312.
1909,	4,000, **09,** 1362.
1910,	20,710, **10,** 1502.
1912,	15,000, **12,** 1856.
Total,	88,710

COMMERCE.

"Present" and prospective C. of R., **91,** 1626; **92,** 1368.

From Silver Spring Run to its mouth celebrated for its scenery, which attracts thousands of tourists every winter. If obstr. were cleared large quantity of produce would be shipped by water which goes at dear rates by rail, **95,** 1538.

Average of 17,000,000′ of timber rafted yearly in 4 years, **99,** 1606.

Logging business preceding 1899, the principal industry, but conducted in such a way as to interfere with and obstr. other navigation, **99,** 1604.

Small, mostly excursion SS. during winter months, **05,** 292.

One SS. runs regularly the entire year, and forms only means of communication for adjacent country, **08,** 352.

Revival of interest in R. among business men; completion of proj. would probably have considerable effect on rates, **09,** 366.

2 SS. ply R. regularly, carrying freight, **10,** 415.
1911, 102,206 t., **12,** 1857.

CONTRACTS.

1907. Roland Woodward, hire of dr. plant, $40 per day, **08,** 1370.
1910. Merrill-Stevens Co., hire of dr., $60 per day, **10,** 1501.

ENGINEERS.

Chief of Engineers. **R., 89,** 1360; **91,** 186; **92,** 183; **93,** 202; **94,** 187; **95,** 211; **96,** 189; **97,** 241; **98,** 236; **99,** 272; **00,** 310; **01,** 338; **02,** 268; **03,** 275; **04,** 284; **05,** 292; **06,** 315, 332; **07,** 331; **08,** 351; **09,** 365; **10,** 414; **11,** 438; **12,** 533, 571.

Boards. Special bd. appointed Apr. 15, 1911, to consider and make recom. concerning imp. and preservation of navigability of stream, met at Jacksonville, Fla., and recom. cut-off, 4 m. l. (made by private enterprise), for reclaiming land between Moss Bluff and a point about 10 m. above Silver Springs Run, be legalized, and that available funds be expend. in constr. of a lock in cooperation with the work. Further recom. that

should available funds be sufficient, bar in the R. above Sharps Ferry and below canal be removed, the bends in R. above dam be eased, and such minor obstr. as exist in R. upward to Lake Griffin be removed to extent which should not endanger lake levels at source of stream, **11,** 1638.

In charge:
Capt. W. M. Black, 1888–92. **R., 89,** 1360; **91,** 1620.
Maj. J. C. Mallery, 1892. **R., 92,** 1366.
Lt. A. M. D'Armit, 1893. **R., 93,** 1651.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1221; **95,** 1537.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1314; **97,** 1552; **98,** 1331.
Capt. C. H. McKinstry, 1899. **R., 99,** 1603.
Capt. T. H. Rees, 1900–01. **R., 00,** 1980; **01,** 1740.
Capt. H. Deakyne, 1902. **R., 02,** 1207.
Lt. E. M. Rhett, **02,** 265.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1180; **04,** 1693; (Maj.) **05,** 1298; **06,** 1220; **07,** 1312.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1369.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1362; **10,** 1501; **11,** 1638.
Capt. J. R. Slattery, 1912–. **R., 12,** 1856.

Assistants:
Lt. D. D. Gaillard. **R., 89,** 1361.
J. H. Bacon. **R., 91,** 1621.
O. N. Bie. **R., 99,** 1605.

OPERATIONS.

1891–92. 3,880 snags removed from the chan., and 705 trees cleared from the banks, **92,** 1367.

1892–93. About 900 snags and other obstr. removed from the R. and banks, **93,** 1651.

1895–96. About 600 obstr. removed, **96,** 1315.

1898–99. 1,365 snags, 400 c. y. sand and mud, 54 c. y. r., and 2 wrecks were removed from chan., **99,** 1604.

1899–00. Dr. *Suwanee* overhauled and repaired, **00,** 1980.

1904–05. 321 obstr. removed and 710 c. y. dr., **05,** 1298.

1907–08. 343 c. y. r., 2,840 c. y. marl, 8,033 c. y. mud and sand, 1,252 snags, 175 trees, 984 sunken logs, 21 floating islds., and 14,670 s. y. water hyacinths removed, **08,** 1369.

1909–10. 11,795 c. y. dr., 771 snags and logs, and 758 trees removed, **10,** 1502.

1910–11. Preparation of plans and specifications for lock in progress, **11,** 1638.

1911–12. Dam across old R. at upper end of cut-off constr. Site of dam cleared of snags, logs, and other obstr. 213 palmetto piles cut and driven in line of dam in 2 rows and cut off; space between the rows filled with brush and débris from sawmill near by, **12,** 1856.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1360; **94,** 1222; **99,** 1605; **01,** 338.
Table of distances, **91,** 1623.
Considerable scenic value, **10,** 415.

PLANS.

By Capt. Black, 1889, 3′ chan., mouth to Lake Griffin, by removal of snags, logs, and overhanging trees, and cutting off bends; est., $50,000, **89,** 1361.

PROJECTS.

By Capt. Black, 1891, clearing chan. between Lake Griffin and the mouth by removal of snags, overhanging trees, and floating drift; est., $7,500, **91,** 1620.

In 1892 Maj. Mallery recom. extension of imp. to Leesburg at the upper end of Lake Griffin; est., $15,000, with an an. outlay for mainten. of entire imp. of $1,000, **92,** 1367.

By Lt. D'Armit, 1892, removal of snags by hired labor as far as available funds would permit, **93,** 1651; and continuance of imp. to Lake Griffin, making total cost of the whole proj. $26,000, **93,** 1652.

By Maj. Shunk, 1906, plan for imp., mouth to Silver Springs Run, about 62 ms., by removing obstrs. and dg. chan. to 6′; est., $15,000, and $600 an. mainten.,[1] **06,** 332; au. act Mar. 2, 1907, as modification of orig. proj., **07,** 331.

Enlarged by act 1910 to provide for mainten. of lake levels at head of stream, especially Lake Griffin, **10,** 415.

June 15, 1911, Chief of Engineers au. prep. of plans and specifications for lock, and proceeding with work recom. by board, under restrictions necessary to properly guard interests of U. S. (see Boards), **11,** 1638.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black, **89,** 1360.
Sur. made 1891, by Capt. Black, **91,** 1621.
Au. act Mar. 3, 1905; made, 1905–06, by Maj. Shunk,[1] **06,** 332.
Pre. ex. and sur. au. act Feb. 27, 1911, of Oklawaha R. to Dora Lake, Fla. (**R.** to come), **12,** 571.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 533.
Maps. **91,** 1626.

P-60 WEIKWA (Weikva) RIVER, FLA.

COMMERCE.

Future, probably important, **85,** 1281.

ENGINEERS.

Chief of Engineers. **R., 85,** 199; **08,** 369; **12,** 572.

In charge:
Capt. W. T. Rossell. **R., 85,** 1281.
Maj. F. R. Shunk, **08,** 347.
Capt. G. R. Spalding, **12,** 524.

Assistant. H. C. Miller. **R., 85,** 1282.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 1282.

SURVEYS.

Ex. au. act July 5, 1884; made, 1884, by Capt. Rossell (**R.** fav.), **85,** 1281.
Pre. ex. au. act Mar. 2, 1907. **R.** by Maj. Shunk, 1907[2] (unfav.), **08,** 369.
Pre. ex. and sur. au. act Feb. 27, 1911, **12,** 572.

[1] H. D. 782, 59th, 1st.
[2] H. D. 532, 60th, 1st.

P-84 ST. AUGUSTINE HARBOR, FLA.[1]

APPROPRIATIONS.

Sea walls:

1829,	$300.00 (sur.), act Mar. 2.
1834,	2.84, act June 27.
1852,	3,000.00, act Aug. 30.
Total,	3,302.84

Harbor:

1841,	$15,000.00, act Mar. 3.
1841,	5,000.00, act Sept. 9.
1845,	5,266.96, act Mar. 3.
1849,	5,000.00, act Mar. 3.
1888,	35,000.00, **89,** 1311.
1890,	20,000.00, **90,** 1570.
1892,	10,000.00, **92,** 1373.
1894,	6,000.00, **95,** 1540.
Total,	101,266.96

COMMERCE.

C. requirements of St. Augustine, **88,** 1126, 1142.

Practically none, imp. not designed to effect character or amount of C., **01,** 339.

CONTRACT.

1893. I. H. Hathaway & Co., st., $2.74 s. t. ($4,110), **93,** 1655.

ENGINEERS.

Chief of Engineers. R., 66, 7; **85,** 199; **87,** 162; **88,** 145, 151; **89,** 167, 1312; **90,** 149, 426; **91,** 188, 195, 1671; **92,** 185; **93,** 203; **94,** 187; **95,** 212; **96,** 190; **97,** 242; **98,** 237; **99,** 273; **00,** 311; **01,** 338; **02,** 269; **03,** 275; **04,** 284; **10,** 435; **11,** 464; **12,** 569.

Boards:

Convened, St. Augustine, Jan. 31, 1889, by S. O. No. 60, to ex. and **R.** upon Capt. Black's proj. for imp. **R., 89,** 1313. (Col. Abbot, Lt. Col. Hains, and Capt. Bixby.)

Convened, St. Augustine, Fla., Jan. 26, 1891, by S. O. No. 3, to **R.** upon the estab. of H. lines. **R., 91,** 1687. (Capt. Black and Lts. Carter and Gaillard.)

In charge:

Capt. W. T. Rossell. **R., 85,** 1282.

Capt. W. M. Black, 1886–92. **R., 88,** 1123; **89,** 1309; **90,** 1566, 1577; **91,** 1630, 1671, 1685.

Maj. J. C. Mallery, 1892. **R., 92,** 1371.

Lt. A. M. D'Armit, 1893. **R., 93,** 1653.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1223; **95,** 1539.

Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1316; **97,** 1553; **98,** 1332.

Capt. C. H. McKinstry, 1899. **R., 99,** 1607.

Capt. T. H. Rees, 1900. **R., 00,** 1981; **01,** 1741.

Capt. H. Deakyne, 1902. **R., 02,** 1208.

Lt. E. M. Rhett, **02,** 265.

Capt. F. R. Shunk, 1903–. **R., 03,** 1181; **04,** 1694.

Capt. G. R. Spalding, **10,** 407; **11,** 430; **12,** 524.

Assistants:

A. W. Barber. **R., 85,** 1283.

Lt. D. D. Gaillard. **R., 88,** 1145; **90,** 1571; **91,** 1635.

OPERATIONS.

1889-90. 3 groins and 290 l. f. of sand catch built by hired labor, **90,** 1567.

1890-91. Groin No. 2 extended seaward, and groins 4 and 5, aggregating 988 l. f. of new work, built, **91,** 1631.

1891-92. 327 l. f. of sheet pile wing dam built to protect the beach from erosion in the vicinity of groin No. 4, **92,** 1372.

1892-93. 7,245 l. f. fascines and 1,655 s. t. st. placed in groins Nos. 6 and 7, **93,** 1655.

1893-94. Groins Nos. 6 and 7 completed, **94,** 1225.

1901-02. Timber dam, 440′ l., and 4 wings, 100′ each, built for sand catches, **02,** 1209.

1902-03. 4,893 c. y. sand impounded in l. of 330′ by sand catches; encroachment of sea stopped; work regarded as finished, **03,** 1181.

PHYSICAL CHARACTERISTICS.

Description of, St. Augustine H. and vicinity, **88,** 1123, 1129.

Tides and tidal flow, **88,** 1131, 1149.

Soundings, borings, chan. gauging, measurement of current velocities, and of direction and velocity of winds, **88,** 1145, 1153.

Observations on wave action at St. Augustine H., **91,** 1635.

Break in shore line by wave action, near groin No. 4, **02,** 1209.

PLANS. (See Projects.)

In 1884 Capt. Rossell considered that the H. was ample for the existing requirements of C., **85,** 1282.

After ex., 1891, Capt. Black did not consider the H. worthy of imp. to the extent of joining a deep-sea chan. through the outer and inner H. bars, **91,** 1672.

PROJECTS. (See Plans.)

By Capt. Black, 1887, chan. through the bar at the entrance to St. Augustine H., giving d. of 16′ with 2 converging brush and riprap js., one extending from North Beach and the other from St. Anastasia Isld.; est., $1,467,888, **88,** 1142.

Approved by BE., 1889, with the recom. that $35,000 be applied to the constr. of st. protection on Anastasia Isld. and North Pt. (Col. Abbot, Lt. Col. Hains, and Capt. Bixby), **89,** 1316.

Revised est. of cost submitted, 1893, by Lt. D'Armit, making the total est. cost of the imp. $95,000, **93,** 1654.

By Capt. Deakyne, 1902, timber dam to prevent further erosion near groin No. 4; est., $6,000, **02,** 1209.

SURVEYS.

Ex. au. act July 5, 1884; made by Capt. Rossell, **85,** 1282 (see Plans); **87,** 162.

Ex. au. act Aug. 5, 1886, **87,** 162; sur. made, 1887, by Capt. Black, **88,** 1128.

Ex. for deep-sea chan. through outer and inner H. bars au. act Sept. 19, 1890; made, 1891, by Capt. Black (see Plans), **91,** 1671.

Resur. made, 1892, on which to base a proj. for expend. of app. of 1892, made by Lt. D'Armit, **93,** 1654.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to constr. necessary sea walls, and also providing chan. 16′ x 300′, city of St. Augustine to ocean, **10,** 435; **11,** 464. **R.** by Capt. Spalding, Apr. 1, 1909, and June 8, 1911[2] (unfav.), **12,** 569.

Maps.[2] **88,** 1142; **89,** 1316; **91,** 1634; **93,** 1654.

P-95 MOSQUITO INLET, FLA. (Channel to New Smyrna.)

ENGINEERS.

Chief of Engineers. R., 10, 434.

In charge. Capt. G. R. Spalding, **10,** 407.

SURVEY.

Ex. to New Smyrna au. act Mar. 3, 1909. **R.,** Capt. Spalding (unfav.),[3] **10,** 434.

[1] Sur.—**R.,** Apr. 5, 1830; est., $35,600 and $772,090. (H. D. 482, 55th, 2d.) [2] H. D. 580, 62d, 2d.
[3] H. D. 362, 61st, 2d.

P-107(a) CAPE CANAVERAL, FLA.

COMMERCE.

No d.-w. H. on the s. coast s. of Port Royal, N. C.; H. at Cape Canaveral would be of great advantage to the phosphate interests of the locality, to the Navy, and to the merchant marine, **93,** 1681; **95,** 1609.

ENGINEERS.

Chief of Engineers. **R., 93,** 211; **95,** 222.

In charge:
Lt. A. M. D'Armit, 1893. **R., 93,** 1681.
Maj. T. H. Handbury, 1895. **R., 95,** 1604.

PHYSICAL CHARACTERISTICS.

Detailed description of (see Commerce), **93,** 1682; **95,** 1605.
Currents and tides, **95,** 1605, 1606.

PROJECTS.

Maj. Handbury, 1895, est. $7,460,970 to constr. a break'r 2½ m. l., and $4,091,010 for works to protect a small area to accommodate 25 first-class vessels and 500 small coasting vessels, **95,** 1604.

SURVEYS.

Ex. for H. at Cape Canaveral au. act July 13, 1892; made by Maj. Mallery, 1892 (**R.** fav.), **93,** 1681.
Sur. of the same locality au act Aug. 17, 1894; made, 1895, by Maj. Handbury (see Projects), **95,** 1604.

P-112 INDIAN RIVER, FLA., AND CONNECTING WATERWAYS.[1]

APPROPRIATIONS.

1844,	$1,500, act June 15.
1852,	5,000, act Aug. 30.
1892,	15,000, **93,** 1657.
1894–95,	[2] 20,000, **95,** 1545.
1896,	[2] 7,500, **96,** 1320.
1896,	500, **96,** 1319.
1899,	[2] 5,000, **99,** 1609.
1900,	*1,000, **01,** 1744.
1902,	2,000, **02,** 1211.
1905,	20,000, **05,** 1300.
1907,	9,000, **07,** 1313.
1908	*5,000 } *5,000 } **08,** 1371, act 1907.
1909,	4,000, **09,** 1364.
1909,	*2,000, **09,** 1364, act 1905.
1910,	13,000, **10,** 1504.
Total,	115,500

COMMERCE.

Present and prospective C. of the locality, **82,** 1242; **85,** 1291; **91,** 1674.
Jupiter Inlet of no particular value from a C. point of view, **97,** 1568.
Decreased by extension of RR.; boat line no longer operating, **02,** 270.
R. chiefly used by small local SS., launches, and sailing vessels, **05,** 293.
No effect on rates, as there is no connection with d.-w. port; R. much used for transportation of fruit and vegetables to nearest RR. stations, effecting considerable saving to producers; is also important link in waterway along e. coast, and much used by vessels trading between Lake Worth and Jacksonville, **09,** 367; **12,** 536.
In 1911, 11,600± t., mostly fruit, vegetables, and lumber, **12,** 1859.

CONTRACTS.

Hillsboro Dredging Co., dr. about 82,000 c. y., 18¢ c. y. (Great Pocket and Pecks Lake, Fla.), **11,** 1639, 41.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **82,** 176; **84,** 194; **85,** 199; **87,** 162; **91,** 195, 1673; **93,** 203; **94,** 188; **95,** 213; **96,** 190; **97,** 242; **98,** 238; **99,** 273; **00,** 312; **01,** 339; **02,** 269; **03,** 276; **04,** 285; **05,** 293; **06,** 316, 332; **07,** 332; **08,** 352; **09,** 366, 386; **10,** 415; **11,** 440; **12,** 535.

In charge:
Col. Q. A. Gillmore. **R., 82,** 1229; **84,** 1144.
Capt. J. C. Post. **R., 84,** 1143.
Capt. W. Rossell. **R., 85,** 1287, 1288.
Capt. W. M. Black, 1887–91. **R., 87,** 1261; **91,** 1673.
Lt. A. M. D'Armit, 1893. **R., 93,** 1656.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1225; **95,** 1541.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1318; **97,** 1554, 1568; **98,** 1333.
Capt. C. H. McKinstry, 1899. **R., 99,** 1608.
Capt. T. H. Rees, 1900–01. **R., 00,** 1982; **01,** 1742.
Capt. H. Deakyne, 1902. **R., 02,** 1210.
Lt. E. M. Rhett, **02,** 265.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1181; **04,** 1694; (Maj.) **05,** 1299; **06,** 1220; **07,** 1312.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1370.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1363; **10,** 1503; **11,** 1639.
Capt. J. R. Slattery, 1912–. **R., 12,** 1857.

Assistants:
J. F. Le Baron. **R., 82,** 1233.
A. W. Barber. **R., 85,** 1293.
Lt. D'Armit. **R., 94,** 1228.
J. W. Sackett. **R., 94,** 1229.

LEGAL PROCEEDINGS.

Comp. of the Treas. in 1896–97 decided that the app. of 1896 could not be used for training wall at Negro Cut, **97,** 1554.

OPERATIONS.[3]

1894–95. 56,665 c. y. dr., **95,** 1542.
1895–96. 70,486 c. y. dr., **96,** 1319.
1896–97. 23,097 c. y. dr., **97,** 1554.
1900–01. 1,987 c. y. dr. from Negro Cut; assisted people of locality in opening Jupiter Inlet, **01,** 1743.
1901–02. 37,104 c. y. dr. and 2 training walls built, 560′ and 880′ l., in Negro Cut, **02,** 1210.
1905–06. 78,594 c. y. dr. between Goat Isld. and Jupiter Inlet, **06,** 1220.
1907–08. 145,592 c. y. dr. between Goat Isld. and Jupiter Inlet, **08,** 1370.
1908–09. Chan. marked between Goat Isld. and Jupiter Inlet, and preparations made to open Jupiter Inlet, **09,** 1363.
1909–10. 5,050 c. y. excavated from trench, and embankment of sand bags and dam built in

* Allotment.
[1] Indian R., Fla., to Mosquito Lagoon: Sur.—**R.,** July 20, 1845; est., $6,500; Jan. 6, 1856, est., $5,000. (H. D. 482, 55th, 2d.)
[2] Negro Cut.
[3] History of previous operations toward the constr. of a canal connecting Indian R. with Mosquito Lagoon, **82,** 1229, 1233; **84,** 1148.

unsuccessful attempt to open Jupiter Inlet, **10,** 1503.

1911-12. 64,563 c. y. dr. from cut-off from Great Pocket to Pecks L., **12,** 1857. 1,088 c. y. removed from shoal near Long Pt., **12,** 1858.

PHYSICAL CHARACTERISTICS.

Description, **82,** 1234; **84,** 1146; **85,** 1288; **91,** 1674.

Description of, vicinity of Negro Cut, **94,** 1229; **95,** 1544, 1545; vicinity of Jupiter Inlet, **96,** 1319; **97,** 1568.

Borings, **94,** 1229.

Jupiter Inlet closed, **01,** 1743; **09,** 1363; **10,** 1503.

St. Lucie Inlet more than ½ m. w., **11,** 1640.

Shoaling, **12,** 1857.

I. R. is a shallow sheet of water on e. coast of Fla., between mainland and the Keys, extending from a slight distance n. of Titusville to Jupiter Inlet, 140± m. Avr. w., 1½ m. Not a R., but a tidal sound. Forms part of intracostal canals along e. coast of Fla. D. before imp., 2½', **12,** 535. St. Lucie Inlet artificial opening made into ocean 1892; cause filling of chan. in sound. Goat Creek, 77 m. from Jupiter Inlet, **12,** 536.

PLANS. (See Projects.)

By Col. Gillmore, 1881, enlargement of the section of the existing canal from Mosquito Lagoon to Indian R. to 60' x 4½'; est., $66,000, **82,** 1231, 1232, 1238, 1241; **84,** 1143.

Modified in 1884 and est. increased to $68,800, **84,** 1146; **85,** 1292.

By Capt. Rossell, 1884, imp. of the entrance to Mosquito Inlet, by js.; est., $500,000 to $750,000, **85,** 1290.

In 1887 Capt. Black did not consider the imp. of chan. from Haulover on Indian R. to Gilberts Bar worthy of imp., **87,** 1261.

In 1891 Capt. Black reported locality worthy of imp. on condition that the Florida Coast Line Canal & Transportation Co. surrender to the U. S. all rights held under State charter, **91,** 1675.

PRIVATE (CORPORATE) WORK.

The Florida Coast Line Canal & Transportation Co. up to 1892–93 had dr. 23 cuts across shoals in the R., making a continuous navigable chan. 5' x 50' l. w., **93,** 1656.

Description of the work done by the co., **96,** 1322.

Citizens of locality in conjunction with U. S. opened Jupiter Inlet, **01,** 1743; citizens of locality opened inlet without assistance of U. S., **09,** 1363.

84,220 c. y. dr. by Florida Coast Line Canal & Transportation Co. from passage between Jupiter Inlet and Biscayne B., **02,** 1211.

PROJECTS. (See Plans.)

By Capt. Black, 1891, continuous chan. 5' x 75' l. w., except in the bends where various w. might be required, by w. the cuts of the canal co. and making new cuts wherever needed; and for the removal of mangroves in the narrows; est., $44,000, no money to be expend. until the canal co. should surrender its charter rights along the route of the R., **93,** 1656, 1657. A proj. was submitted in 1894 for the expend. of the app. of 1894 for the above work, the work to be done by the U. S. plant; proj. submitted by Maj. Handbury, **95,** 1544.

In 1893 Maj. Handbury est. that it would cost $32,795 to make a chan. 6' x 100' through Negro Cut, and for training wall for its protection; and submitted a proj. for the work, the U. S. plant to do the dr., **94,** 1228; **95,** 1545.

By Lt. Col. Benyaurd, 1896, opening at Jupiter Inlet 2' x 40' l. w.; est., $500, **97,** 1554.

Capt. Spalding recom., 1910, that further effort to keep Jupiter Inlet open be abandoned, **10,** 1503.

Funds being barely sufficient to make the required w. of chan., Chief of Engineers, July 6, 1911, au. increase of $20,000 in orig. est. for completion, **11,** 1640.

Owing to w. of St. Lucie Inlet, the chan. filled with sand and became impossible to maintain; to obviate these conditions a chan. between Great Pocket and Pecks Lake was dug, **12,** 536.

SURVEYS.

Between Indian R. and Mosquito Lagoon, au. act July 14, 1880; made by Col. Gillmore, **82,** 1229.

Sur. of same locality au. act Aug. 2, 1882; made by Col. Gillmore, **84,** 1143, 1144.

For line of inland communication from St. Johns R. to Jupiter Inlet via Mosquito Lagoon, au. act July 5, 1884; made by Capt. Rossell, **85,** 1291.

Of Mosquito Inlet au. act July 5, 1884; made by Capt. Rossell, **85,** 1288.

Ex. of chan. from Haulover on Indian R. to Gilberts Bar au. act Aug. 5, 1886; made by Capt. Black, **87,** 1261.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Black, **91,** 1673.

Ex. by Maj. Handbury; made, 1893, au. by Senate resol. of 1893, to deter. cost of dr. chan. through Negro Cut, **94,** 1227; and again in 1897, by Lt. Col. Benyaurd (see Proj.), **97,** 1568.

Ex. Jupiter Inlet made, 1896, by Lt. Col. Benyaurd, **96,** 1319.

Ex. Jupiter Inlet au. act June 3, 1896; made, 1897, by Lt. Col. Benyaurd (**R.** unfav.), **97,** 1569.

Of Negro Cut, **01,** 1743.

Of Sebastian Inlet au. act Mar. 3, 1905; made, 1905, by Maj. Shunk (**R.** unfav.),[1] **06,** 332.

Ex. Fort Pierce to Sewalls Pt. au. act Mar. 3, 1909; made, 1909, by Capt. Spalding (**R.** unfav.),[2] **09,** 386.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 535.

P-125(a) ST. LUCIE INLET AND RIVER, FLA.

COMMERCE.

Description of, **95,** 1566; **98,** 1350.

ENGINEERS.

Chief of Engineers. **R., 95,** 221; **98,** 246; **09,** 386; **12,** 570, 571.

In charge:

Maj. T. H. Handbury, 1895. **R., 95,** 1564.

Lt. Col. W. H. H. Benyaurd, 1898. **R., 98,** 1348.

Capt. G. R. Spalding, **R., 09,** 359; **12,** 524.

Assistant. J. H. Bacon. **R., 98,** 1352.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1565; **98,** 1349.

The inlet is an artificial opening through a strip of sand separating Indian R. on the e. coast of Florida from the Atlantic Ocean. The R. is a tributary of Indian R., having a navigable d. of from 11' to 18'. **95,** 1564–1565.

Tide and current observations, **98,** 1356.

PROJECTS.

In 1898 Lt. Col. Benyaurd est. that it would cost $347,000 for a break'r at the bar at the inlet as far as the 18' contour and $729,000 as far as the 24' contour; that it would cost $24,600 to secure, by dr., a w. of 200' and 8' d., $230,600 to secure 10' d., and $484,000 to secure 12' d., **98,** 1348, 1349.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Handbury (**R.** fav.), **95,** 1564.

[1] H. D. 858, 59th, 1st.

[2] H. D. 75, 61st, 1st.

Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1898 (**R.** fav.; see Projects), **98,** 1349.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Maj. Shunk, July 19, 1907, and by Capt. Spalding, Oct. 1, 1908, with plan for imp., providing local interests contribute share of cost; est., **$1,400,000**[1] **09,** 386.

R. by BERH., Mar. 7, 1910, requested by Sen. Comm. Cost for chan. 12′ x 150′, $285,000. As a sur. for an inland waterway has been au. at this locality, BERH. considers it inadvisable to recom. imp.[2]

Pre. ex. of Gilberts Bar au. act June 25, 1910. **R.** by Capt. Spalding, Sept. 22, 1910[1 3] (imp. by U. S. recom., **12,** 570.

Pre. ex. of inlet au. act Feb. 27, 1911, with view to obtaining d. of from 12′ to 14′. **R.** by Capt. Spalding, Aug. 29, 1911[4] (unfav., but immediate expend. of about $300,000 for excavating cut of 18′ center d. across obstr. r. and ocean bar is advisable as preliminary step to securing later the full proj. chan. of 18′ d. over 200′ w. from ocean to Sewalls Pt.), **12,** 571.

P-136 JUPITER INLET, FLA.

ENGINEERS.

Chief of Engineers. **R., 12,** 570.
In charge. Capt. G. R. Spalding, **12,** 524.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** Capt. Spalding, Sept. 20, 1910 (unfav.),[5] **12,** 570.

P-146 PALM BEACH, FLA.

COMMERCE.

Description of, **97,** 1588.

ENGINEERS.

Chief of Engineers. **R., 97,** 252.
In charge. Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1585.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1586.

PROJECTS.

In 1897 Lt. Col. Benyaurd est. $600,000 to constr. break'r on the reef extending some 200′ or 300′ n. of the ocean pier, and s. some 1,000′ to 1,500′, a cut through the reef near and beyond the s. end of the break'r, and to dr. a basin inside, **97,** 1585.

SURVEY.

Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1897, **97,** 1585.

P-152 NEW RIVER, FLA.

ENGINEERS.

Chief of Engineers. **R., 09,** 386.
In charge. Capt. G. R. Spalding. **R., 09,** 359.

SURVEY.

Ex. to 20′ at cut-off near mouth, with js. to protect same, au. act Mar. 3, 1909. **R.,** Capt. Spalding[6] (unfav.), **09,** 386.

P-159 BISCAYNE BAY (Miami), FLA.

APPROPRIATIONS.

1896,	[7] $1,500,	act Feb. 26.
1902,	50,000,	**02,** 1213.
1903,	250,000,	**03,** 1183.
1905,	[8] 10,000,	**06,** 1221.
1907,	100,000,	**07,** 1314.
1908,	119,000,	**08,** 1372.
1909,	27,000,	**09,** 1365.
1910,	5,000,	**10,** 1506 (mainten.).
1912,	100,000,	**12,** 1860.
Total,	[9] 662,500	($661,001.50—omitting item 1896, and adding sales—**12,** 1860).

COMMERCE.

Description of, **95,** 1569; **00,** 1990, 1994; **11,** 442.

In 1895 the apparent value of the C. warranted a sur., **95,** 1570. In 1897 the C. statistics were not sufficiently definite to determine what benefit would be derived by an imp. of the B. by U. S., **97,** 1592.

Value, 1905, $514,710, **05,** 295; about $1,000,000 in 1910. **11,** 442,

Schooner line estab. between Miami and New York, etc., **06,** 318.

Steamers operating between Jacksonville and Havana make Miami a port of call, **09,** 368.

Imp. resulted in a reduction of rates of 50% by a large share of C. going by way of Cape Florida, **10,** 442, 1507.

Traffic, 1911, 220,000 t., **12,** 1861.

CONTRACTS.

1903. P. S. Ross (Inc.), dr., sand at 24¢ and r. at $1.78 c. y.; and break'r constr., hard r. at $5.50 t., and coral r. at $2.50 c. y., **04,** 1696.

1906. R. G. Ross, placing riprap in threatened breach of break'r, $2.90 c. y., **06,** 1222.

1907. P. S. Ross (Inc.), (supple.), suspension of work until more fav. conditions, on account of dr. cut filling in almost as fast as material was dr., **07,** 1313.

1907. R. G. Ross, building s. and extending n. j., hearting at $2.20 c. y. and capping at $5 t., **08,** 1372, 1373.

1910. R. G. Ross, limest. for revet. purposes, $3.40 c. y., **10,** 1505.

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[1] H. D. 1312, 60th, 2d.
[2] Sen. D. 423, 61st, 2d.
[3] H. D. 471, 62d, 2d.
[4] H. D. 675, 62d, 2d.
[5] H. D. 257, 62d, 2d.
[6] H. D. 70, 61st, 1st.
[7] Sur. of Biscayne B. and Palm Beach.
[8] Allotment: Emer. R.-H. App., Mar. 3, 1905, for shore protection.
[9] Including $1,500 app. by act Feb. 26, 1896, for sur. of Biscayne B. and Palm Beach.

1910. Southern Dredging Co., dr. and r. removal, 25¢ c. y. for sand and $2.44 c. y. for r., **11,** 1642.

1911. Roderick G. Ross, st., $2.93 c. y., **11,** 1643.

ENGINEERS.

Chief of Engineers. **R., 95,** 221; **97,** 252; **00,** 316; **02,** 271; **03,** 277; **04,** 286; **05,** 294; **06,** 317; **07,** 332; **08,** 353; **09,** 368; **10,** 416; **11,** 441; **12,** 536, 570.

Boards. Convened, St. Augustine, Fla., Mar 29, 1899, by S. O. No. 14, Mar. 16, 1899, to ex. and report upon the respective routes from Miami to the sea, by Norris Cut, Bear Cut, and Cape Florida Entrance, resp., with reference to the most feasible route and the cost of providing a chan. 18′ d. and of suitable w., with a view to ascertain the desirability of imp. the same. **R., 00,** 1987.

(Maj. W. T. Rossell, Capts. C. E. Gillette (replacing Lt. Col. W. H. H. Benyaurd, deceased), and C. H. McKinstry.)

In charge:
Maj. T. H. Handbury, 1895. **R., 95,** 1567.
Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1588.
Capt. C. H. McKinstry, 1899. **R., 00,** 1986.
Capt. H. Deakyne, 1902. **R., 02,** 1212.
Lt. E. M. Rhett, **02,** 265.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1182; **04,** 1695; (Maj.) **05,** 1300; **06,** 1221; **07,** 1313.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1371.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1364; **10,** 1505; **11,** 1642.
Capt. J. R. Slattery, 1912–. **R., 12,** 1859.

Assistants:
J. W. Sackett. **R., 97,** 1592.
O. N. Bie. **R., 97,** 1594.
J. H. Bacon. **R., 00,** 2000, 2002.

LEGAL PROCEEDINGS.

42.6 acres acquired by U. S. through condemnation proceedings in U. S. Circuit Court; consideration, $12,780, **05,** 1300.

OPERATIONS.

1903-04. 8,609.7 c. y. coral r. placed as heart for proposed break'r 1,080′ l. with an average crest w. of 20′ at height of m. l. w., **04,** 1695.

1904-05. 9,784.1 c. y. coral r. and 4,760.53 t. granite r. placed; and 95,699.8 c. y. soft material and 10,092.4 c. y. r. removed, forming chan. 1,745′ l., 6′–14′ d., and 120′–200′ w., **05,** 1300.

1905-06. 2,513.6 c. y. sand, and 32,120.5 c. y. r. removed, and 3,010.3 c. y. coral r. used in closing breach in break'r, **06,** 1221.

1906-07. Work under contract with P. S. Ross suspended Aug. 31, 1906, until conditions more fav.; 92.4 c. y. sand and 2,298.8 c. y. r. removed, **07,** 1313.

1907-08. 20,726.3 c. y. hearting placed in s. j. and 13,718.5 c. y. in n. j., **08,** 1372.

1908-09. 1,556.3 t. hearting and 7,323.28 t. granite capping placed in s. j. and 404.9 c. y. hearting and 3,220.8 t. granite capping in n. j.; 1,298.1 c. y. limest. used to revet s. shore inside of j. and 2,403.3 c. y. placed along inner portion of n. j., **09,** 1364.

1909-10. 42,170.74 c. y. r. and 9,870.39 c. y. soft material removed, completing chan. 18′–19′ x 85′ from shoreward to within a distance of 700′ of the 20′ contour at sea; 372.13 c. y. limest. placed in n. j. to prevent sand movement, and 129.59 c. y. stored for emergency use, **10,** 1505.

1910-11. 12,982.2 c. y. soft material and 10,062.32 c. y. r. removed under contract of 1903, and contract completed; 10,148.3 c. y. sand and 22,059.24 c. y. r. removed under contract of 1910; 136 c. y. st. placed in revet. along shore inside n. j., **11,** 1642.

1911-12. 2,992.3 c. y. r. and 6,924 c. y. sand removed; 749.1 c. y. st. placed in revet., **12,** 1859, 1860.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1567; **97,** 1589, 1590, 1591; **00,** 2002; **11,** 441, 442.

B. located on the e. coast of Florida and near its s. extremity, **95,** 1567.

Naturally scarcely practicable for boats drawing 3′, **03,** 277.

Sides of dr. cut being rapidly eroded by wave action, which is forming a 3′ shoal at entrance, **05,** 295.

Chan. filled, 1906–7, as rapidly as dr., **07,** 1313; **11,** 442.

PRIVATE WORK.

The Florida East Coast Ry. Co. to some extent imp. chan. of a tributary of the B., and out into the B. for about 2 m., **97,** 1589.

By Florida East Coast Ry. Co., dr. pre. chan. 10.6′–13.4′ x 60′ for 11,276′; upon completion of work to be performed by ry. co., work will be commenced by U. S., **03,** 278; completed chan 10′ x 60′ across B., **04,** 287; dr. 224,603 c. y., completing chan. from wharves at Miami across B. 10′–16′ x 90′, connecting with work done by U. S., **05,** 1300; removed 191,993 c. y. soft material; work to be done by corporate interests about 25% completed, **06,** 1221.

F. E. C. R. Co. notified to complete their work, **10,** 1505.

PROJECTS.

In 1897 Lt. Col. Benyaurd est. $239,000 to $845,000 to make an imp. according to plans submitted, **97,** 1588.

BE. est., 1900, $1,493,743 for an 18′ chan., bottom w. 150′, 200′, and 300′, and having a basin 400′ x 1,200′, via Norris Cut, **00,** 1987.

By BERH., au. act June 13, 1902, chan. 18′, wharves at Miami to the sea, by way of a line entering the sea about 4,000′ above Norris Cut; and a basin of same d. 500′ x 1,600′ adjacent to wharves at Miami; $50,000 app., and continuing contracts to extent of $250,000 au., provided Florida East Coast Ry. Co. perform certain work at its own expense, **02,** 271, 1212.

N. break'r, 1905, should be extended, and the southern break'r needed, **05,** 295.

Act Mar. 2, 1907, modified proj. of 1902, by prescribing a bottom chan. w. of 100′ instead of 85′, and au. a j. on s. side of entrance, **07,** 333.

Draft of 6′ between js., 1909, and proj. of U. S. 90% done, **10,** 417.

Act July 25, 1912, modified proj. to provide chan. through cut between B. and ocean 20′ x 300′; for refuge basin to 18′ d.; extending js., and constr. of dr. plant; est., $400,000,[1] no work to be done by U. S. unless Florida East Coast Ry. completes its contract, and suitable terminal facilities be provided by city of Miami, **09,** 1364; **12,** 537.

No practicable chan. at 1911–12, thro. cut, **12,** 538.

SURVEYS.

Ex. of the entrance au. act Aug. 17, 1894; made by Maj. Handbury, 1895 (**R.** fav.), **95,** 1567.

Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1897 (see Projects), **97,** 1589.

Ex. and sur. with view to chan. 18′ d. from Miami to the sea, by way of Norris Cut, Bears Cut, or Cape Florida Entrance, au. act Mar. 3, 1899; made, 1900, by BE. (**R.** unfav.; see Projects), **00,** 1987.

Au. act June 25, 1910, with view to chan. 20′ x 300′ through entrance, and of same d. and 150′ w. thence to mouth of the Miami R.; made by Capts. Spalding and Slattery, and plan submitted; est., $400,000,[1] **10,** 1506; **12,** 570.

Sur. made having in view amplification of proj., **11,** 1642.

Cong. docs., etc., relating to exs., surs., plans, etc., **06,** 1221; **07,** 333; **11,** 443; **12,** 538.

Maps.[1] **03,** 1182; **05,** 1300.

[1] H. D. 554, 62d, 2d.

P-200 KEY WEST HARBOR, FLA. (Including entrance thereto.)

APPROPRIATIONS.

1882,	$25,000,	**83,** 972.
1886,	2,500,	**86,** 1145.
1888,	25,000,	**88,** 1093.
1890,	40,000,	**90,** 1580.
1892,	75,000,	**92,** 1376.
1894,	80,000;	**95,** 1548.
1896,	80,000,	**96,** 1326.
1899,	25,000,	**99,** 1611.
1900,	*5,000,	**01,** 1745.
1901,	*5,000,	**02,** 1214.
1902,	100,000,	**02,** 1215.
1905,	50,000,	**05,** 1303.
1907,	200,000,	**07,** 1316.
1911,	25,000,	**11,** 1645.
1912,	63,000,	**12,** 1862.

Total, 800,500 (incl. misc., $800,553.47, **12,** 1862).

COMMERCE.

Benefit to C. of imp., **68,** 518.

Advantages to follow d. of Northwest Bar, **89,** 1336.

Not large and not increasing, but H. important as naval base, **04,** 1740.

Existence of nw. chan. has important effect on rates between Key West and Tampa, **06,** 319.

1911, 765,000 t., **12,** 1863.

Effect of imp. on rates; has lowered water rates; C. increased 74.3% during 1911; total trade by water, **12,** 541, 1863.

Through SS. competition Key West has better rates than points farther n. in Fla., which condition is not due to U. S. works, **12,** 541.

CONTRACTS.

1883. S. N. Kimball, dr., $1.30 c. y., **83,** 972.

1890-91. R. G. Ross, st., $1.90 c. y., **91,** 1641.

1892. R. G. Ross, st., $2.58 c. y.; quarry chips, $2.40 c. y. ($65,000), **93,** 1660.

1894. R. G. Ross, st., $3.80 s. t. ($38,000), **95,** 1548.

1897. R. G. Ross, st., $1.57 t., **97,** 1557.

1899. R. G. Ross, st., $2.17 t. ($32,550), **99,** 1611.

1908. R. G. Ross, j. work, granite, $3.57 t., **09,** 1367.

ENGINEERS.

Chief of Engineers. **R., 68,** 56; **81,** 189; **82,** 185; **83,** 187; **84,** 195; **85,** 195; **86,** 194; **87,** 156; **88,** 146; **89,** 168, 1328; **90,** 150, 582; **91,** 188; **92,** 186; **93,** 204; **94,** 189; **95,** 215; **96,** 192; **97,** 244; **98,** 248; **99,** 275; **00,** 314; **01,** 340; **02,** 272; **03,** 278; **04,** 288, 301, 1738; **05,** 296; **06,** 318; **07,** 334; **08,** 354, 369; **09,** 369; **10,** 418; **11,** 443; **12,** 539, 570.

Boards:

Convened, St. Augustine, Jan. 31, 1889, to ex. and **R.** upon Capt. Black's plan for imp. of Key West H. **R., 89,** 1329; **90,** 1581, 1583. (Col. Abbot, Lt. Col. Hains, and Capt. Bixby.)

BERH. **R., 04,** 1741, 1743.

In charge:

Col. J. H. Simpson. **R., 68,** 517, 520.

Maj. A. N. Damrell, 1881–85. **R., 82,** 1314; **83,** 972; **84,** 1166.

Capt. W. T. Rossell, 1885–86. **R., 85,** 1267.

Capt. W. M. Black, 1886–92. **R., 86,** 1144; **87,** 1221; **88,** 1092; **89,** 1324, 1333; **90,** 1578; **91,** 1640.

Maj. J. C. Mallery, 1892. **R., 92,** 1374.

Lt. A. M. D'Armit, 1893. **R., 93,** 1657.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1230; **95,** 1546.

Lt. Col. W. H. H. Benyaurd, 1896–97. **R., 96,** 1325; **97,** 1555.

Lt. C. H. McKinstry, 1898–99. **R., 98,** 1371; (Capt.) **99,** 1610.

Capt. T. H. Rees, 1900–01. **R., 00,** 1983; **01,** 1744.

Capt. H. Deakyne, 1902. **R., 02,** 1213.

Lt. E. M. Rhett, **02,** 265.

Capt. F. R. Shunk, 1903–07. **R., 03,** 1183; **04,** 1697, 1739, 1744; (Maj.) **05,** 1302; **06,** 1223; **07,** 1315.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1373.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1366; **10,** 1507; **11,** 1644.

Capt. J. R. Slattery, 1912–. **12,** 1861.

Assistants:

Lt. W. R. Livermore. **R., 68,** 520.

T. L. Harrison. **R., 82,** 1315.

J. W. Sackett. **R., 87,** 1226; **89,** 1326, 1333; **90,** 1594.

ESTIMATES. (See Plans and Projects.)

By Col. J. H. Simpson, dr. and operating same 4 years, $165,941, **68,** 56, 520. For 2 dr. and operating same 4 years, $217,272, **68,** 56, 520.

OPERATIONS.

1883-84. 15,692 c. y. dr. from the cut through the bar in formation of a cut 15′ x 60′, **84,** 1167; **87,** 1221.

1886-87. Sur. of entrance to H., **87,** 1221.

1890-91. 1,160 c. y. st. deposited in j., **91,** 1641.

1891-92. 26,822 c. y. st. deposited in j., **92,** 1375.

1892-93. 2,969 c. y. st. deposited in j., **93,** 1659.

1893-94. 20,864 c. y. st. deposited in j. and Pinnacle Rocks removed from the main ship chan., **94,** 1231.

1894-95. 16,336 t. st. deposited in js., **95,** 1547.

1895-96. 1,000 t. st. deposited, **96,** 1326.

1897-98. 14,980 t. st. deposited in w. j., **98,** 1372.

1898-99. 28,416 t. st. deposited, **99,** 1610.

1899-00. 10,503 t. st. deposited, **00,** 1983.

1900-01. Work prevented by bad weather **01,** 1744.

1901-02. 97,683 c. y. dr., **02,** 1214.

1902-03. Old wharf removed, **03,** 1183.

1904-05. 210,509 c. y. dr., **05,** 1302.

1905-06. 290,882 c. y. dr., **06,** 1223.

1906-07. 48,004 c. y. dr., **07,** 1315.

1908-09. 37,162 t. granite capping placed in e. j., **09,** 1366. 4 coral reefs removed from chan., **09,** 1367.

1909-10. 159,389 c. y. dr., **10,** 1507.

1910-11. 161,140 c. y. dr. by U. S. dr. *Key West;* temp. range marks estab., **11,** 1644.

1911-12. 240,441 c. y. dr. to outer shoal across bar, **12,** 1861.

PHYSICAL CHARACTERISTICS.

Description of, **68,** 518, 521; **87,** 1222.

Tidal volumes and velocities, **87,** 1223, 1229.

Description of Florida Keys, **88,** 1092; **89,** 1324.

Current observations, **89,** 1333; **90,** 1594.

Hurricane of Oct. 15, 1910, destroyed all chan. marks; outer portion of chan. shifted to the w.; available d., 16½′, **11,** 1644.

Least d., 17′ for least w. of 200′, **12,** 1861.

H. consists of pocket in reef protected on e. side by island of Key West and the submerged reef, and on n. and w. sides by the submerged reef. Approx. dimensions, 2 m. x ¼ m. 5 entrances. All chan. obstr. by coral heads. Large anchorage area nearby. Key West 516 m. from Jacksonville, 644 m. from New Orleans, and 246 m. from Tampa. See Oper. and Proj. items for idea of phy. data of proj. portion, **12,** 539.

PLANS. (See Estimates and Projects.)

By Col. J. H. Simpson, chan. 18′ x 300′ x 9.000′, **68,** 56, 519.

By Capt. Black, 1887, dike or break'r along the w. side of the bar; est., $590,000, **87,** 1224, 1226.

* Allotment.

PROJECTS. (See Estimates and Plans.)

By Capt. Damrell, 1882, cut 17′ x 300′ m. l. w., nw. chan.; est., $140,000, **82,** 1314. Chan. 15′ x 60′ formed in 1883–84, **84,** 1167; **87,** 1221.

By Capt. Black, 1887, formation and mainten. of chan. across the bar 17′ m. l. w., with a dike along its w. side, r. removal and dr.; est., $608,000, **88,** 1093.

By BE., 1890, st. j. along the submerged reef on the ne. side of the Northwest Passage near its n. end, the j. to be raised approx. to the level of m. l. w.; a w. j. to be constr. if found necessary; est., $500,000, **90,** 1587; **92,** 1375.

By Lt. Col. Benyaurd, 1897, location of a w. j., as provided in the orig. proj. of 1890, **97,** 1556.

By Capt. Shunk, 1904, proposed chan. 30′ x 400′ through entrance and 2,500′ x 1 m. in H.; est., $10,317,000; also est. on plans by Navy Dept., varying from $7,151,500 to $11,367,000,[1] **04,** 1739, 1744, 1746.

Modified by act of Mar. 2, 1907, by au. continuance of work on existing js. or the building of training walls, at discretion of Sec. of War; no est., **07,** 334.

By Lt. Col. Beach, 1908, expend. of $125,000 of 1907 app. in raising e. j., balance to be reserved for dr., **08,** 1374.

Act May 28, 1908, au. expend. of $5,000 in removing coral reefs from ship chan., **08,** 1374.

Lt. Col. Beach, 1908, did not consider H. worthy of imp. beyond that contemplated by existing proj.,[2] **08,** 369.

Capt. Spalding, 1909, of opinion that results of work warranted adoption of more comprehensive plan of imp., that of providing chan. which could be utilized by Gulf C., **09,** 1367.

Act July 25, 1912, au. d. and w. of main ship chan. at entrance and at Triangle Shoals, to give chan. 30′ x 300′, and au. removing shoals in anchorage;[3] est., $48,000, **12,** 540.

Jetties, in 1912, 60% done, **12,** 540.

SURVEYS.

By J. Rodgers, 1851, **68,** 521.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. Damrell, **82,** 1314.

Sur. au. act Aug. 5, 1886; made by Capt. Black, **87,** 1221.

Sur. of the bar made by Lt. D'Armit, 1895, **95,** 1547.

Sur. by Lt. Col. Benyaurd, 1896, **97,** 1556.

Sur. made, 1900, by Capt. McKinstry (maps), **00,** 1983.

Au. act June 13, 1902; made, 1902–04, by Capt. Shunk,[1] **04,** 1738.

Between bar and H., **07,** 1315.

Ex. au. act Mar. 2, 1907; made, 1908, by Lt. Col. Beach,[2] **08,** 369.

Pre. ex., with plan and est. of cost of imp. of Key West H., Fla., and chan. leading thereto, au. act June 25, 1910. **R.,** Capt. Spalding, 1910, and Capt. Slattery, 1912; est., $48,000[1] (see Projects), **12,** 570.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 540.

Maps:[3]

Of Northwest Chan. Bar, **87,** 1234.

92, Atlas, 66, 67; **93,** 1658; **95,** 1548; **96,** 1326; **99,** 1610; **00,** 1984.

P-227 (a). ESTERO RIVER, AND BAY, FLA.

COMMERCE.

Small; principally fruit and vegetables; 670 t., 1902, **04,** 1721.

ENGINEERS.

Chief of Engineers. **R., 04,** 301, 1719; **09,** 385.

Boards. BERH. **R.** (concurs on inadvisability of imp.), **04,** 1720.

In charge:
Capt. H. Deakyne, 1902. **R., 04,** 1719.
Lt. E. M. Rhett, **62,** 274.
Capt. Geo. R. Spalding, **09,** 359.

Assistant. W. H. Caldwell. **R., 04,** 1721.

PHYSICAL CHARACTERISTICS.

Chan. d. from 3′ to 15′; varying w., 45′ to 100′.

Description of; stream is in Lee Co., **04,** 1721.

SURVEYS.

Ex. au. act June 13, 1902; made, 1902, by Capt. Deakyne (**R.** unfav.),[4] **04,** 1719.

Ex. and sur. au. act Mar. 2, 1907; made, resp., 1907–08, by Maj. Shunk and Capt. Spalding (**R.** unfav.),[5] **09,** 385.

Maps.[5]

P-231 PUNTARASA HARBOR, FLA.

COMMERCE.

C. interests, **88,** 1156.

ENGINEERS.

Chief of engineers. **R., 88,** 151.

In charge. Capt. W. M. Black, 1886. **R., 88,** 1157.

Assistant. J. W. Sackett. **R., 88,** 1156.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1155.

PROJECTS.

By Capt. Black, 1887, excavating chan. 11′ x 200′ through the bar at the H. entrance, involving the removal of 70,000 c. y.; est., $40,643, **88,** 1156.

SURVEY.

Sur. au. act Aug. 5, 1886; made, 1887, by Capt. Black (see Projects), **88,** 1155.

[1] H. D. 567, 58th, 2d.
[2] H. D. 970, 60th, 1st.
[3] H. D. 706, 62d, 2d.
[4] H. D. 175, 58th, 2d.
[5] H. D. 1189, 60th, 2d.

P-232 CALOOSAHATCHEE RIVER, FLA.

APPROPRIATIONS.

1882,	$5,000,	**83,** 1004.
1884,	5,000,	**84,** 1196.
1886,	4,000,	**86,** 1153.
1888,	10,000,	**88,** 1095.
1890,	3,600,	**90,** 1599.
1892,	1,000,	**92,** 1378.
1894,	2,000,	**95,** 1550.
1896,	1,000,	**96,** 1328.
1899,	2,000,	**99,** 1626.
1902,	1,500,	**03,** 1195.
1905,	2,000,	**05,** 1306.
1906,	*2,000,	**06,** 1226.
1907,	*2,000,	**07,** 1320.
1907,	3,000,	**08,** 1379.
1909,	*400,	**09,** 1371.
1910,	50,000,	**10,** 1514.
1910,	6,000,	**11,** 1650.
1911,	69,000,	**11,** 1650.
1912,	5,000,	**12,** 1867.

Total, 174,500 (incl. sales, etc., $174,501.05, **12,** 1867).

COMMERCE.

Benefit of imp. to C., **79,** 864, 866, 867, 869.

Orange R. the only outlet for the large quantities of oranges grown in its vicinity, **97,** 1571.

In 1899–1900 shipments of oranges and grape fruit, $31,625, **00,** 2036.

Description of, **00,** 2034, 2036.

Decreased 22% during 1906, **06,** 1226.

132% increase in 1906, and 50% increase over average for past 6 years, **07,** 1320.

Decreased 80% during 1907, **08,** 1379.

Increasing rapidly; amount, 1911, 89,009 t.; towns on R. absolutely dependent upon R. for transportation, **12,** 547.

CONTRACTS.

1882. S. N. Kimball, dr., 62½¢ c. y., **83,** 1004.

1884. S. N. Kimball, dr., 69 9/10¢ c. y., **85,** 1274.

1910. Bowers Southern Dredging Co., dr. 155,000 c. y., secs. A and B, 18¢ c. y., and 200,000 c. y. from secs. D, E, and F, 11¢ c. y., **11,** 1650.

1911. Bowers Southern Dredging Co., dr. secs. A and B, 36,900 c. y., 18¢ c. y.; secs. G to S, 244,500 c. y., 10¢ c. y., and secs. T to V, 155,000 c. y., 10¢ c. y., **11,** 1650.

1912. Arrangements with Hillsboro Dredging Co., Mar. 1, 1912, for r. removal, **12,** 546.

ENGINEERS.

Chief of Engineers. R., 78, 81; **79,** 106; **83,** 193; **84,** 201; **85,** 197; **86,** 196; **87,** 157; **88,** 146; **89,** 169; **90,** 151; **91,** 189; **92,** 187; **93,** 205; **94,** 190; **95,** 216; **96,** 193; **97,** 245, 251; **98,** 239; **99,** 278, 288; **00,** 316, 326; **01,** 343, 350; **02,** 274, 282; **03,** 283; **04,** 291; **05,** 299; **06,** 321, 332; **07,** 337; **08,** 357, 369; **09,** 372; **10,** 421; **11,** 446; **12,** 545, 572.

In charge:

Capt. A. N. Damrell, 1878–84. **78,** 81; **79,** 105. **R., 79,** 863; (Maj.) **83,** 1003; **84,** 1195.

Capt. W. T. Rossell, 1884–86. **R., 85,** 1273.

Lt. W. M. Black, 1886–92. **R., 86,** 1152; **87,** 1235; (Capt.) **88,** 1093; **89,** 1337; **90,** 1596; **91,** 1643.

Maj. J. C. Mallery, 1892. **R., 92,** 1377.

Lt. A. M. D'Armit, 1893. **R., 93,** 1660.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1233; **95,** 1549.

Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1327; **97,** 1557, 1569; **98,** 1334.

Capt. H. Jervey, 1899. **R., 99,** 1625; **00,** 2032, 2035.

Capt. T. H. Rees, 1900–01. **R., 00,** 2015; **01,** 335, 1751.

Capt. H. Jervey, 1902. **R., 02,** 1229.

Capt. Herbert Deakyne, 1902. **R., 02,** 1218, 1239.

Lt. E. M. Rhett, **02,** 274.

Capt. F. R. Shunk. 1903–07. **R., 03,** 1195; **04,** 1701; (Maj.) **05,** 1306; **06,** 332, 1226; **07,** 1319.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1379.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1370; **10,** 1513; **11,** 1649.

Capt. J. R. Slattery, 1912–. **R., 12,** 1866.

Assistants:

J. L. Meigs. **R., 79,** 864.

J. W. Sackett. **R., 88,** 1095.

Lt. J. J. Meyler. **R., 97,** 1571.

O. Bie. **R., 94,** 1235.

W. H. Caldwell. **R., 00,** 2037.

A. Thompson. **R., 00,** 2038.

W. H. Caldwell. **R., 02,** 1231, 1242.

OPERATIONS.

1883-84. 6,905 c. y. dr. from bar at mouth, **84,** 1195.

1885-86. 5,000 c. y. dr. from chan. near Fish Bayou, completing proj., **86,** 1153.

1886-87. Removal of snags and similar obstr. in progress, **87,** 1236.

1889-90. 1,391 snags and 200 c. y. sand removed from the chan., and 584 overhanging trees from the banks; 1,300 piles sunk, 1,157 l. f. of walling and 242 c. y. brush protection placed, **90,** 1598.

1890-91. 9,044 c. y. sand and 330 snags cleared from the chan., and 1,800 trees cut from the banks; 18 c. y. r. blasted and 615 l. f. of training wall built, **91,** 1645.

1893-94. About 70 obstr. removed from banks and stream, **94,** 1235.

1894-95. Over 500 obstr. removed, **95,** 1550.

1897-98. About 400 obstr. removed, **98,** 1334.

1900-01. About 950 obstr. removed, **01,** 1752.

1902-03. 213 snags and 151 overhanging trees removed, **03,** 1195.

1903-04. 15,097 c. y. of material and a sunken lighter removed from the chan.; proj. completed Sept. 23, 1903, **04,** 1701.

1905-06. 1,540 snags removed and 2,015 overhanging trees trimmed, **06,** 1226.

1906-07. 746 snags, 9 c. y. obstr. rs. removed, and 21 overhanging trees trimmed, **07,** 1319.

1907-08-09. 96 snags and 3 c. y. r. removed, and 161 trees trimmed, **08,** 1379; **09,** 1370.

1909-10. 193 snags, 151 overhanging trees, 2,585 c. y. limest. and marl, and 1,778 c. y. sand removed, **10,** 1513.

1910-11. 527,342 c. y. dr.; U. S. dr. and snag boat *Kissimee* repaired; removed 1,345 snags, 1,977 overhanging trees, and 1,192 logs, **11,** 1649.

1911-12. 744 c. y. ledge r. removed; 318,266 c. y. dr.; proj. 95% completed, **12,** 547, 1866.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 864, 865, 866, 869; **88,** 1093; **91,** 1643.

Table of measurements and observations, **79,** 868.

Tide levels, **79,** 870.

Description of, Orange R., **97,** 1570; **00,** 2033.

Storm of Oct. 17, 1910, caused accumulation of numerous snags and trees in R. about Fort Myers, **11,** 1649.

Drafts, tides, etc., **12,** 547.

C. R. rises in Lake Okechobee; flows w., empties into Gulf of Mexico at Puntarasa, Fla.; distance, lake to gulf, 81 m.; Puntarasa to Ft. Myers, 21½ m., **12,** 545.

PLANS. (See Projects.)

By J. L. Meigs, 1879, w., d., and straightening chan., mouth to Fort Thompson, and cutting 6 m. of canals to reclaim lands subject to overflow; est., $148,978, **79,** 866.

For dr. and removing snags for chan. 7′ x 100′ mouth to Fort Myers; est., $19,094, **79,** 864, 869.

PROJECTS. (See Plans.)

By Capt. Damrell, 1879, chan. 7′ x 100′, by dr. and removal of snags, R. mouth to Fort Myers, 14 m.; est., $20,000, **79,** 864, 869; **83,** 1003; **85,** 1273. Completed, 1886; cost, $14,000, **87,** 1236.

By Capt. Black, 1887, imp. Forts Myers and Thompson, for vessels drawing 4′, by clearing the

R. of obstr., and straightening and d. chan. at Beautiful Isld.; est., $13,647, **87,** 1236; **89,** 1338.

Proj. for imp. completed in 1892. An. expend. required for mainten., $1,000, **92,** 1378.

Lt. Col. Benyaurd est., 1896, that an an. app. of $1,000, or a biennial one of $2,000, would be required for mainten., **96,** 1328.

Capt. Jervey est., 1900, $2,500 for chan. in Orange R. 4′ x 50′ to the head of navigation, with $500 an. for mainten., **00,** 2036.

Act June 13, 1902, au. imp. of Orange R., 4′ x 50′ m. l. w.; chan. between Punta Gorda, in Charlotte H., and Myers on the Caloosahatchee, 7′ x 100′ m. l. w.; also, as much as may be necessary may be expend., Puntarasa to Ft. Thompson; est. for Orange R., $2,500, and $500 an. mainten.; Punta Gorda to Myers, $6,000, **02,** 274, 1218.

Au., 1905; mainten. by snag removal in upper R., Alva to Ft. Thompson; to be done by hired labor, using a U. S. dr., **05,** 1306.

Au. Apr. 26, 1907; snag removal and tree trimming, work to be done by chartered boat, **07,** 1319.

Au., 1910; chan., Puntarasa to Ft. Myers, 200′ x 12′ over bar at entrance; and 10′ x 100′ thence to Ft. Myers, with turning basin at that point; est., $119,000, and $2,000 an. mainten.,[1] **10,** 421.

SURVEYS.

Ex. au., **78,** 81; completed by J. L. Meigs, **79,** 106, 864.

Sur. made, **87,** 1236.

Au. act Aug. 5, 1886; made, 1888, by Capt. Black, **88,** 1095.

Ex., Orange R., Fla., to its confluence with the Caloosahatchee, thence to the Gulf of Mexico, au. act June 3, 1896; made by Lt. Col. Benyaurd, 1896 (**R.** fav.), **97,** 1571.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Jervey (**R.** fav.; see Projects), **00,** 2033, 2035.

Pre. ex. and sur. au. act Mar. 3, 1899, of Kissimmee R., Fla., and lakes and canal flowing into Lake Okechobee, down Caloosahatchee R. to Gulf of Mexico; **Rs.,** Capt. Jervey, 1899, and Capt. Deakyne, 1901; est., $24,220.90 to imp. these waterways (see Kissimmee R.), **02,** 282, 1225.

Pre. ex. au. act Mar. 3, 1905; **R.** by DO., 1905 (unfav., except mainten.—periodical snagging and dr.),[2] **06,** 332.

Pre. ex. au. act Mar. 2, 1907, Lake Okechobee to the Gulf, incl. Orange R.; **R.** by DO., 1907 (unfav.),[3] **08,** 369.

Pre. ex. and sur. au. acts June 25, 1910, and Feb. 27, 1911, Kissimmee and Caloosahatchee Rs., and Lake Okechobee and tributaries, Fla., for imp. to harmonize with scheme of Florida for drainage of Everglades, **12,** 571, 572.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 546.

Maps. **89,** 1338; **90,** 1598.

P-233 ORANGE RIVER, FLA.

APPROPRIATIONS.

1902,	$2,000,	**03,** 1195.
1905,	*1,000,	**05,** 298.
1907,	*1,000,	**07,** 336.
1909,	*600,	**09,** 1369.
1910,	1,500,	**10,** 1511.
Total,	6,100	

COMMERCE.

Increased 202% during f. y. 1907, **07,** 1318.

Decreased 36% during calendar year 1907, **08,** 1377.

In 1911, 5,390 t., **12,** 1865.

ENGINEERS.

Chief of Engineers. **R., 03,** 282; **04,** 290; **05,** 298; **06,** 320; **07,** 336; **08,** 357; **09,** 371; **10,** 420; **11,** 445; **12,** 543.

In charge:

Capt. F. R. Shunk, 1903–07. **R., 03,** 1195; **04,** 1700; (Maj.) **05,** 1305; **06,** 1224; **07,** 1318.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1377.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1369; **10,** 1511; **11,** 1648.

Capt. J. R. Slattery, 1912–. **R., 12,** 1865.

OPERATIONS.

1902–03. Dr. and snag boat *Suwanee* removed 2,626.1 c. y. of material, 215 snags, and 170 overhanging trees trimmed, completing the proj. on June 8, 1903, **03,** 1195.

1905–06. 835 snags and 935 overhanging trees removed, **06,** 1225.

1907–08. 67 snags and 6 c. y. r. removed, and 223 overhanging trees trimmed, **08,** 1377.

PROJECTS.

Adopted June 13, 1902, au. chan. 4′ x 50′ m. l. w., from mouth to head of navigation; est., $2,500, and $500 an. mainten., **03,** 282.

Of Apr. 29, 1905, for mainten. of chan. by dr. and obstr. removal, **05,** 1305.

Approved Apr. 26, 1907, for removal of snags and obstr., **07,** 1318.

SURVEYS.

Pre. ex. au. act Mar. 2, 1907, of Caloosahatchee R. from Lake Okechobee to the Gulf, incl. Orange R. **R.** by Maj. Shunk, July 20, 1907[3] (locality not considered worthy of imp.), **08,** 369.

P-236 LAKE OKECHOBEE, FLA.

ENGINEERS.

Chief of Engineers. **R., 12,** 572.

In charge. Capt. J. R. Slattery, **12,** 524.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, of Kissimmee and Caloosahatchee Rs. and Lake Okechobee and tributaries, Fla., for plan of imp. of said waters which would harmonize as nearly as practicable with general scheme of State of Florida for drainage of Everglades (**R.** to come), **12,** 572.

* Allotment. [1] H. D. 8, 61st, 2d. [2] H. D. 180, 59th, 1st. [3] H. D. 347, 60th, 1st.

P-237 KISSIMMEE RIVER, FLA.

APPROPRIATIONS.

1902, $8,000, **02,** 1217.
1905, 7,000, **05,** 1304.
1907, 12,221, **07,** 1317.
1909, *600, **09,** 1369, act 1905.
1910, 5,000, **10,** 1510.

Total, 32,821 (incl. misc., $32,852, **12,** 1864).

COMMERCE.

Description of, **02,** 1227, 1228, 1236, 1239.
Rates lowered; freight hauled by wagons when SS. are not running, there being no RR., **05,** 297.
Failure to maintain imp. would be no less than calamity to people in lower Kissimmee Valley, **09,** 370.
Rates lowered 75%, **10,** 419.
1911, 46,000 t., an increase of 49% over preceding year, **12,** 542, 1864.
R. is only means of communication between 3,000 sq. m. of territory along R. and Kissimmee, **12,** 542.

ENGINEERS.

Chief of Engineers. **R., 02,** 274, 282, 1225; **03,** 281; **04,** 289; **05,** 297; **06,** 319; **07,** 335; **08,** 355; **09,** 370; **10,** 419, 435; **11,** 444, 464; **12,** 541, 572.

In charge:
Capt. H. Jervey. **R., 02,** 1226.
Capt. H. Deakyne, 1902. **R., 02,** 1217, 1239.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1193; **04,** 1698; (Maj.) **05,** 1303; **06,** 1224; **07,** 1316.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1375.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1368; **10,** 1510; **11,** 1646.
Capt. J. R. Slattery, 1912–. **R., 12,** 1863.

Assistant. W. H. Caldwell. **R., 02,** 1231, 1242.

OPERATIONS.

1902–03. Plant secured, 2,960′ bulkhead built, and 4,094 c. y. dr., **03,** 1193.
1903–04. 21,521 c. y. dr. and 600′ bulkhead built, **04,** 1698.
1904–05. 3,796 c. y. dr., 129 c. y. r. removed, and 900′ bulkhead built, **05,** 1304.
1905–06. 16,342 c. y. dr., 1,644 c. y. bonnet roots and 20 c. y. r. removed, and 468′ bulkhead built, **06,** 1224.
1906–07. 600′ bulkhead built, **07,** 1317.
1907–08. Bulkheads repaired and 312′ built; 237 c. y. r. blasted and removed, 18,500 c. y. dr., 690 snags removed and 3,715 trees trimmed, **08,** 1375. 84 snags removed, 104 trees trimmed, and 1,608 c. y. dr. from Istokpoga Creek, **08,** 1376.
1908–09. 2,182 overhanging trees and 100 snags removed and 2 dams built; 1,086 overhanging trees, 285 snags and 100 c. y. sand removed from Istokpoga Creek, **09,** 1368.
1909–10. 2,800 c. y. dr., **10,** 1510.
1910–11. 751 piles driven by water jet to form dam across outlet to a subsidiary chan. from Lake Kissimmee Canal, and chan. was cleared of aquatic growth, **11,** 1646.
1911–12. Repairs made to timber training walls damaged by storms, **12,** 1863.

PHYSICAL CHARACTERISTICS.

Description of chan. and adjacent country, from source in Lake Tohopekaliga to outlet in Gulf of Mexico, **02,** 1230, 1231, 1242.
Damages to training walls by hurricane of 1910, **12,** 1863.
Rises in L. Tohopekaliga, central of Fla.; flows s. through L. Cypress, Hatcheneha, and Kissimmee, and empties into L. Okechobee. L., source to mouth, 137 m. (See Oper. and Proj. for general character of proj. section.) Distance between Kissimmee and Ft. Bassinger, proj. portion, 99½ m. R., together with L. Okechobee and Caloosahatchee R., affords a navigable waterway, from Gulf of Mexico to Kissimmee 309 m., **12,** 541, 542.

PROJECT.

By Capt. Deakyne, 1901, au. act June 13, 1902, for chan. 3′ x 30′–60′ from Kissimmee to Ft. Bassinger, by dr. and constr. of bulkheads; est., $22,319.90; and chan. 3′ x 25′ in Istokpoga (Southport) Creek by dr. and removal of obstr.; est., $1,901, **02,** 1240; **04,** 289.

SURVEYS.

Ex., incl. connecting lakes and canals flowing into L. Okechobee, thence down Caloosahatchee R. into Gulf of Mexico, and sur. from Kissimmee to L. Okechobee and of Istokpoga Creek, au. act Mar. 3, 1899; made, resp., in 1899, by Capt. Jervey, and in 1901, by Capt. Deakyne,[1] **02,** 1225.
From Kissimmee to L. Okechobee, au. act Mar. 3, 1909, **10,** 435 (**R.** to come), **12,** 542.
Pre. ex. and sur. of Kissimmee and Caloosahatchee Rs., L. Okechobee and tributaries, au. act Feb. 27, 1911, plan of imp. which would harmonize with general scheme of State of Florida for drainage of Everglades, **12,** 572.
Maps.[1] **02,** 1225.

P-254 PINE ISLAND SOUND, FLA.

ENGINEERS.

Chief of Engineers. **R., 09,** 386.
In charge. Capt. G. R. Spalding, **09,** 359.

SURVEYS.

Ex. from Wulfert bulkhead to Blind Pass, thence along western side of sound to Captiva bulkhead, au. act Mar. 3, 1909. **R.** by Capt. Spalding[2] (unfav.), **09,** 386.

* Allotment. [1] H. D. 176, 57th, 1st. [2] H. D. 77, 61st, 1st.

P-258 (a) CHARLOTTE HARBOR AND PEACE CREEK (River), FLA.

APPROPRIATIONS.

1890,	$35,000,	**91,** 1648.
1894,	20,000,	**95,** 1552.
1896,	20,000,	**96,** 1330.
1899,	25,000,	**99,** 1627.
1903,	6,000,	**03,** 1195.
1912,	20,000,	**12,** 1866.
Total,	126,000,	**12,** 1866.

COMMERCE.

Requirements of, **80,** 1100; **85,** 1286.
C., **91,** 1682; **00,** 2050.
Decreased 15%, **07,** 1319.
Tonnage, 1900-01, 85,000 t., **01,** 344; 1911, 519,000 t., **12,** 1866.

CONTRACTS.

1891. Alabama Dredging & Jetty Co., dr., 25¢ c. y., **91,** 1647.
1894. J. A. Bryan, dr., 24¢ c. y. ($16,800), **95,** 1553.
1897. J. A. Bryan, dr., 29¢ c. y., **97,** 1559.
1899. Stewart Contracting Co., and National Dredging Co., 19¢ c. y. ($23,750), **99,** 1628; **00,** 2017.

ENGINEERS.

Chief of Engineers. **R., 80,** 140; **85,** 199; **87,** 162; **91,** 190, 196; **92,** 187; **93,** 206; **94,** 191; **95,** 216; **96,** 194; **97,** 246; **98,** 240; **99,** 279, 288; **00,** 317, 327; **01,** 343; **02,** 274; **03,** 282; **04,** 291; **05,** 298; **06,** 321; **07,** 337; **08,** 357; **09,** 372; **10,** 421; **12,** 544.

In charge:
Capt. A. N. Damrell. **R., 80,** 1100.
Capt. W. T. Rossell. **R., 85,** 1286.
Lt. W. M. Black, 1887–92. **R., 87,** 1258; (Capt.) **91,** 1646, 1681, 1683, 1684.
Maj. J. C. Mallery, 1892. **R., 92,** 1379.
Lt. A. M. D'Armit, 1893. **R., 93,** 1663.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1236; **95,** 1551.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1329; **97,** 1559; **98,** 1335.
Capt. H. Jervey, 1899. **R., 99,** 1626; **00,** 2048, 2053.
Capt. T. H. Rees, 1900–02. **R., 00,** 2017; **01,** 1752; **02,** 274, 1218.
Capt. H. Deakyne, **02,** 274.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1195; **04,** 1700; (Maj.) **05,** 1305; **06,** 1225; **07,** 1319.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1378.
Capt. G. R. Spalding, 1909–10. **R., 09,** 1370; **10,** 1512.
Capt. J. R. Slattery, 1912–. **R., 12,** 1866.

Assistants:
J. L. Meigs. **R., 80,** 1101.
J. H. Bacon. **R., 91,** 1648.
Lt. J. J. Meyler. **R., 97,** 1573.
Lt. F. C. Boggs. **R., 00,** 2052.

OPERATIONS.

1890-91. Excavation of chan., **91,** 1647.
1892-93. 141,293 c. y. dr., **93,** 1664.
1894-95. 20,553 c. y. dr., **95,** 1552.
1895-96. 49,167 c. y. dr., **96,** 1329.
1896-97. 15,173 c. y. dr., **97,** 1559.
1897-98. 43,427 c. y. dr., **98,** 1335.
1899-00. 125,182 c. y. dr., **00,** 2017.
1902-03. 4,784 c. y. removed from shoal, resulting in chan. 8′ x 50′ x 1,500′ m. l. w., **03,** 1195.
1903-04. 16,012 c. y. removed; proj. completed Oct. 10, 1903, **04,** 1700.
1909-10. Imp. unworthy of continuance, **10,** 1512.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1646; **00,** 2053; **12,** 544.
70 m. south of Tampa B.

PLANS. (See Project.)

In 1880 Capt. Damrell reported Charlotte H. did not require imp.; that to improve Peace Creek from its mouth to Fort Meade would cost $17,000, **80,** 1100.

In 1884 Capt. Rossell reported there was no "present" need for the imp. of Charlotte H., **85,** 1286.

In 1887 Lt. Black did not consider the H. worthy of imp., **87,** 1258.

PRIVATE WORK.

Local interests contributed $20,000 toward imp. **12,** 1866.

PROJECTS. (See Plans.)

By Capt. Black, 1891, 12′ chan., from 50′–60′ w., across all the shoals between Boca Grande and Punta Gorda; est., $35,000, **91,** 1684.

By Maj. Handbury, 1895, expend. of the app. of 1894, dr. on the shoals near Cape Haze, thence outward toward Boca Grande Pass, **95,** 1552.

By Lt. Col. Benyaurd, 1896, expend. of the app. of 1896, in imp. chan. over Cape Haze Shoal, and w. the chan. leading to the wharves previously dr., **96,** 1330.

Capt. Jervey est., 1899, $140,000 for a 24′ chan. 300′ w. across the bar at the entrance of the H., with $1,000 an. mainten., **00,** 2054.

App. proj., act 1901, seemingly to gain 12′ x 200′ from wharves at Punta Gorda to Boca Grande; est., $127,500; reduced, 1896, to $100,000, **01,** 343.

Act June 13, 1902, au. chan. 7′ x 100′ m. l. w., Punta Gorda (in Charlotte H.) to Myers on the Caloosahatchee; est., $6,000, **02,** 274, 1218.

Maj. Shunk recom., 1905, no allotment, as work showed no sign of deterioration, **05,** 1305.

Act July 25, 1912, au. 24′ x 300′, Gulf of Mexico to Boca Grande; est., $40,000, and $4,000 an. mainten., **12,** 544.

SURVEYS. (See Plans.)

Au. act Mar. 3, 1879, **80,** 140; made by Capt. Damrell, **80,** 1100; by act July 5, 1884, by Capt. Rossell, **85,** 1286; by act Aug. 5, 1886, by Lt. Black, **87,** 1258.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Black, **91,** 1684.

Sur. of the shoal n. of Cape Haze to determine the best location on which to develop a 12′ chan. made by Maj. Handbury, 1894, **94,** 1236.

Ex., plan, and est. for imp. of Boca Grande and Charlotte H. with view to 24′ over the bar at the entrance of the H. and 18′ thence up to Punta Gorda au. act Mar. 3, 1899; made, 1899, by Capt. Jervey (**R.** fav.; see Projects), **00,** 2049, 2053.

Pre. ex. au. act June 13, 1902, for Charlotte H., for extending 12′ chan. to RR. wharf at Punta Gorda and along dock line; **R.** by Capt. Deakyne, Sept 18, 1902 (unfav.),[1] **04,** 301, 1714.

Com. on R. and H., H. of R., asked, 1907, consideration by BE. (R. and H.) of Charlotte H., etc. Brd. reported, 1907, against further imp.[2]

Pre. ex. and sur. au. act June 25, 1910, for chan. of increased d.; **Rs.** by Capt. Spalding, 1911, and Capt. Slattery, 1911, 1912; est., $40,000, and $4,000 an. mainten.; local interests to bear ½ cost ($20,000),[3] **12,** 570.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 545.

Maps.[3] **91,** 1650, 1685.

[1] H. D. 181, 58th, 2d. [2] H. D. 1, 60th, 1st. [3] H. D. 699, 62d, 2d.

P-258 (b) CHARLOTTE HARBOR, FLA. (Waterway from, to St. Johns River.)

ENGINEERS.

Chief of Engineers. **Rs., 80,** 132; **81,** 179; **82,** 175.

In charge. Lt. Col. Q. A. Gillmore, 1880–82. **R., 82,** 1204.

Assistant. W. G. Williamson. **R., 82,** 1219.

PLAN.

By Col. Gillmore, 1882, SS. route, with locks, from the St. Johns R. to Peace Creek or Charlotte H., via Tohopokeliga Lake; canal 40′ w. at bottom and 5′ d.; locks 25′ w. and 125′ l.; with the necessary imp. of the natural chans. of St. Johns R. and Peace Creek; est., $5,662,812, **82,** 1204, 1213, 1216.

SURVEY.

Au. act June 14, 1880, **80,** 132; made by Lt. Col. Gillmore, 1882, **82,** 1204

P-258 (c) CHARLOTTE HARBOR, FLA. (Inside passage to, from Puntarasa.)

COMMERCE.

Increasing in 1896; $154,500 an., **97,** 1573.
Description of, **00,** 2042.

ENGINEERS.

Chief of Engineers. **Rs., 97,** 252; **99,** 288; **00,** 327.

In charge:
Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1572.
Capt. H. Jervey, 1900. **R., 00,** 2041, 2043.

Assistants:
Lt. J. J. Meyler. **R., 97,** 1573.
W. H. Caldwell. **R., 00,** 2046.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1573; **00,** 2041.

The passage known as Pine Isld. Harbor is part of the direct water route from the Caloosahatchee R. to Charlotte H., or by way of Boca Grande Pass to more n. Gulf points, **97,** 1572.

PROJECTS.

Capt. Jervey est., 1899, $6,000 for an 8′ chan., bottom w. 100′, through obstructive shoals ne. of Patricio Isld. and ne. of Blind Pass, **00,** 2045.

SURVEYS.

Ex. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1896 (**R.** fav.), **97,** 1572.

Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Capt. Jervey (**R.** fav.; see Projects), **00,** 2041, 2043.

P-260 PEACE (Pease) RIVER (Creek), FLA.

APPROPRIATIONS.

1881,	$7,000,	**81,** 1198.
1882,	4,000,	**82,** 1277.
1886,	[1] 2,000,	**87,** 1239.
Total,	13,000	

COMMERCE.

Irregular and desultory, **85,** 1269.

ENGINEERS.

Chief of Engineers. **Rs., 80,** 140; **81,** 185; **82,** 181; **83,** 193; **84,** 201; **85,** 196; **86,** 195; **87,** 158; **88,** 147; **89,** 169; **90,** 152; **91,** 190.

In charge:
Maj. A. N. Damrell, 1879–85. **Rs., 80,** 1100; **81,** 1198; **82,** 1276; **83,** 1004; **84,** 1196.
Capt. W. T. Rossell, 1885–86. **R., 85,** 1268.
Lt. W. M. Black, 1886–90. **Rs., 86,** 1146; **87,** 1237; (Capt.) **88,** 1102; **89,** 1339; **90,** 1600.

Assistants:
J. L. Meigs. **R., 80,** 1101.
Lt. D. D. Gaillard. **R., 88,** 1104.

OPERATIONS.

1882–83. 36 m. of R. cleaned of trees, snags, logs, and similar obstr., **83,** 1005.

1883–84. 1,617 logs and snags removed from the chan.; 306 trees felled and 804 c. y. r. removed, **84,** 1197.

PHYSICAL CHARACTERISTICS.

Description, **86,** 1146; **88,** 1102; **89,** 1339.

PROJECTS.

By Maj. Damrell, 1880, imp. of Peace Creek from its mouth to Fort Meade, by removal of snags, sunken logs, overhanging trees, and loose r., securing a h. w. navigable chan. during 9 months in the year; est., $17,000, **80,** 1100, 1101.

By Capt. Black, 1888, imp. of Peace R. between the Florida Southern RR. wharf and d. w. of the H. by r. excavation, removal of snags, and clearing the banks of overhanging trees, giving a 2′ navigable chan. of 30′ w. during about half the year; est., $25,000, **88,** 1102, 1103.

SURVEY.

Ex. au. act Mar. 3, 1879; made, 1880, by Maj. Damrell, **80,** 1100.

[1] Allotted from Manatee R., **87,** 1238.

P-264 (a) GASPARILLA SOUND AND LEMON BAY, FLA., INCLUDING CUT-OFF.

COMMERCE.

Chiefly fishing, small and local, **04,** 1723, 1725.

ENGINEERS.

Chief of Engineers. **Rs., 04,** 301, 1722; **12,** 572.

Boards: BERH. do not consider imp. advisable. **R., 04,** 1724.

In charge:
Capt. H. Deakyne, 1902. **R., 04,** 1722.
Capt. G. R. Spalding, **12,** 524.

Assistant. W. H. Caldwell. **R., 04,** 1725.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 1723, 1725.

SURVEY.

Ex. au. act June 13, 1902; made, 1903, by Capt. Deakyne (sur. recom.),[1] **04,** 1722.

Pre. ex. and sur. au. act Feb. 27, 1911, Lemon B. to Gasparilla Sound, Fla. **R.** to come, **12,** 572.

P-288 TAMPA BAY AND HILLSBORO BAY AND RIVER, FLA.

Part.	Title.	Period.	Appropriations.
a	Tampa B., Fla	1871–1912	$787,012.76
b	Hillsboro B. and R., Fla	1896–1899	125,000.00
c	Hillsboro B., Fla	1902–1912	1,664,944.00
d	Hillsboro R., Fla	1910–1912	25,000.00
	Total		2,601,956.76

Part (a), P-288 Tampa Bay, Fla.

APPROPRIATIONS.

1880,	$10,000.00,	**80,** 1078.
1881,	10,000.00,	**81,** 1192.
1882,	20,000.00,	**82,** 1268.
1884,	20,000.00,	**84,** 1178.
1886,	10,000.00,	**86,** 1139.
1888,	25,000.00,	**88,** 1114.
1890,	25,000.00,	**90,** 1605.
1892,	10,000.00,	**92,** 1388.
1899,	75,000.00,	**99,** 1634.
1900,	135,000.00,	**00,** 2024.
1901,	127,000.00,	**01,** 1758.
1902,	86,675.00,	**02,** 1221.
1903,	186,337.76,	**03,** 1200.
1909,	20,000.00,	**09,** 1375.
1910,	9,000.00,	**10,** 1520.
1911,	9,000.00,	**11,** 1655.
1912,	9,000.00,	**12,** 1872.

Total, 787,012.76 (incl. misc., $787,024.46, **12,** 1872).

COMMERCE.

Description, **72,** 64,587,647.

Up to 1894 phosphate shipments rapidly increasing; H. considered favorably located to allow of competition for the West India trade and Central American trade, **95,** 1571; **97,** 1597.

1898 warranted 24′, but not 30′ m. l. w., **99,** 1643.

Rates lowered 20% on phosphate shipments since beginning of imp., **05,** 302.

1911, 2,864,997 t., **12,** 552.

"The commerce for the year 1911 amounted to 2,864,997 tons, valued at $49,343,589, consisting principally of cigars, coal, crude oil, fertilizers, fish, fuller's earth, lumber, naval stores, phosphate, tobacco leaf, fruit, and merchandise. Tampa Bay must be traversed by the water-borne commerce bound to and from Tampa, Port Tampa, St. Petersburg, points on Boca Ceiga Bay, Clearwater Harbor, Manatee River, and Sarasota Bay. Its commerce in reality is the combined commerce of all these points. Tampa is the general collecting and distributing center. (See also Hillsboro Bay.)

"The improvement in connection with improved tributary waterways has lowered the freight rates for many points as much as 25 per cent. As tributary waterways are further improved, these benefits will be further extended." **12,** 552.

CONTRACTS.

1881. J. E. Slaughter, dr., 50¢ c. y., **81,** 1191.

1885. J. E. Slaughter, dr., 34.7¢; r. excavation, $5.90 c. y., **85,** 1264.

1887. J. R. Moore, r. excavation, $5.90 c. y.; dr., 44¢ c. y., **87,** 1244.

1888. D. G. Ambler, dr., 29¢ c. y., **89,** 1344.

1891. Alabama Dredging & Jetty Co., dr., 25¢ c. y., **91,** 1657.

1892. J. A. Bryan, dr.; sand, 33¢ c. y.; r., $4.77 c. y., **93,** 1673.

1899. Alabama Dredging & Jetty Co., dr. on bar, 15¢, and in B., 11.99¢ c. y. ($511,130), **99,** 1635.

1907. Bowers Southern Dredging Co., dr., 26¢ c. y., **08,** 1385.

ENGINEERS.

Chief of Engineers. **R., 71,** 69; **72,** 64; **78,** 81; **79,** 106; **80,** 136; **81,** 183; **82,** 179; **83,** 189; **84,** 198; **85,** 194; **86,** 192; **87,** 159, 162; **88,** 148; **89,** 171; **90,** 153; **91,** 192; **92,** 189; **93,** 208; **94,** 193; **95,** 221; **97,** 253; **98,** 248; **99,** 282, 287; **00,** 321; **01,** 345; **02,** 275; **03,** 284; **04,** 293; **05,** 301; **06,** 323; **07,** 340; **08** 361; **09,** 376; **10,** 425; **11,** 451; **12,** 551.

In charge:
Col. J. H. Simpson, 1872. **R., 72,** 587, 647.
Capt. A. N. Damrell, 1878–85. **R., 79,** 870; (Maj.) **80,** 1077; **81,** 1191; **82,** 1268; **83,** 983; **84,** 1178.
Capt. W. T. Rossell, 1885–86. **R., 85,** 1262.
Lt. W. M. Black, 1886–92. **R., 86,** 1137; **87,** 1243, 1257; (Capt.) **88,** 1112; **89,** 1342; **90,** 1604; **91,** 1655.
Maj. J. C. Mallery, 1892. **R., 92,** 1386.
Lt. A. M. D'Armit, 1893. **R., 93,** 1670.

[1] H. D. 191, 58th, 2d.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1241; **95,** 1570.
Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1596
Capt. H. Jervey, 1899. **R., 99,** 1632, 1640.
Capt. T. H. Rees, 1900–01. **R., 00,** 2022; **01,** 1756.
Capt. H. Deakyne, 1902. **R., 02,** 1219.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1198; **04,** 1704; (Maj.) **05,** 1309; **06,** 1228; **07,** 1324.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1383.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1374; **10** 1519; **11,** 1655.
Capt. J. R. Slattery, 1912. **R., 12,** 1871.

Assistants:
Capt. A. N. Damrell. **R., 72,** 647.
G. Jaenicke. **R., 72,** 648.
D. M. Currie, **72,** 587, 648.
J. L. Meigs. **R., 79,** 871.
J. W. Sackett. **R., 87,** 1246; **95,** 1572; **97,** 1598
O. N. Bie. **R., 97,** 1600.

OPERATIONS.

1880–81. 18,530 c. y. dr., **81,** 1191.
1881–82. 30,709 c. y. dr., **81,** 1191; **82,** 1268.
1882–83. 16,691 c. y. dr. and 2,470 c. y. r. blasted from chan., **83,** 983.
1884–85. 3,632 c. y. mud and 914 c. y. r. removed, **85,** 1263.
1885–86. 28,093 c. y. mud and 1,200 c. y. st. removed from chan., **86,** 1138.
1886–87. Rock removal and dr. continued, **87,** 1245.
1887–88. 473 c. y. r. removed, and 7,250 c. y. dr. from chan., **88,** 1113.
1889–90. 14,688 c. y. dr., **90,** 1605.
1890–91. 48,771 c. y. dr., **91,** 1656.
1891–92. 52,664 c. y. dr., **92,** 1388.
1892–93. 932 c. y. r. excavated and 30,237 c. y. sand dr., **93,** 1672.
1899–00. 295,716 c. y. dr., **00,** 2023.
1900–01. 268,571 c. y. dr., **01,** 1756.
1901–02. 778,229 c. y. dr., **02,** 1220.
1902–03. 684,938 c. y. dr., **03,** 1198.
1903–04. 8,460 c. y. dr., **04,** 1704.
1906–07. 97,487 c. y. dr., **07,** 1324.
1907–08. 542,090 c. y. dr., **08,** 1383, 1384.
1908–09. 382,723 c. y. dr., **09,** 1374.
1909–10. 165,149 c. y. dr., **10,** 1519.
1910–11. Wharf and coal bin at Egmont repaired, **11,** 1655.
1911–12. Proj. completed, launch *De Soto* purchased, and dr. *Key West* repaired, **12,** 552, 1871–72.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 648, 651; **79,** 871; **88,** 1112; **89,** 1342; **95,** 1572; **99,** 1632; **01,** 345.
Tidal observations, **97,** 1599.
Shoaling, **12,** 552.

PLANS.

By G. Jaenicke, 1871: (1) straight chan. 12′ x 200′, $502,121.90; (2) d. sailing chan. 12′ x 200′, $549,621.80; (3) d. sailing chan. 12′ x 100′, **72,** 64, 587, 647, 650.
By Col. Simpson, 1872, RR. instead of chan. from Tampa B. to Passage Pt., to be built by private parties, $180,000, **72,** 64, 587, 647.
By J. L. Meigs, 1879: (1) d. chan. to 9′, $97,000; (2) new, straight 9′ chan., $121,899, **79,** 871.

PROJECTS.

By Lt. Col. Damrell, 1879, mp. of Tampa B. by d. present chan. from Ballast Pt. to Tampa, 5¾ m., by dr. and r. removal to 9′, with 200′ w. in R. and 150′ in B.; est., $97,000, **79,** 871; **80,** 1077. Increased in 1886 and 1887 to $133,000, **86,** 1189; **87,** 1245.
Proj. modified, 1888, by Capt. Black, to provide for formation and mainten. of chan. 8′ d. in Hillsboro B. and Hillsboro R. to city of Tampa, and chan. 200′ x 20′ m. l. w. from the outer bar to Port Tampa; est., $60,000, **90,** 1605; **92,** 1387.
Lt. Col. Benyaurd, 1897, est. $336,000 to obtain by dr. under a continuous contract chan. 500′ w. on the bar and 300′ w. in the B., with 24′ d. m. l. w., **97,** 1598.
Plan and est. submitted, 1898, by Lt. Col. Benyaurd for a 30′ chan., Gulf to Port Tampa; est., $3,335,000, **99,** 1642.
By Capt. Jervey, 1899, 27′ chan.; est., $750,000, **99,** 1633; **00,** 2022.
Modified, act 1905, to provide for chan. 26′ d. and of sufficient w., Port Tampa to Gulf of Mexico; also provided that no further expend. be made until Atlantic Land & Imp. Co. agree to submit schedule of wharfage charges to Sec. of War for approval, **05,** 301. Schedule of charges approv., Oct., 1906, **07,** 1324.

SURVEYS.

By G. Jaenicke and D. M. Currie, 1871, under direction of Col. Simpson and Capt. Damrell. **R., 72,** 587, 647, 648.
By J. L. Meigs, 1879, under direction of Capt. Damrell. **R., 79,** 870, 871.
Ex. and resur. of Tampa B., incl. Hillsboro R., up to city of Tampa, au. act Aug. 5, 1886; made 1887, by Capt. Black, **87,** 1257.
Ex., Tampa to mouth of the B., au. act Aug. 17, 1894; made by Maj. Handbury, 1894 (**R.** fav.), **95,** 1572.
Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1897 (**R.** fav.; see Projects), **97,** 1597.
Joint resol. of Congress, June 4, 1898, called for plan and est. for imp., Port Tampa to mouth of B.; made, 1898, by Lt. Col. Benyaurd (see Projects), **99,** 1641.
Of all sections, made July and August, 1910, **11,** 1655.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 552.

Maps. **86,** 1138; **87,** 1247; **88,** 1112.

Part (b), P-288 Hillsboro Bay and River, Fla.

APPROPRIATION.

1899, $125,000, **99,** 1637.

COMMERCE.

Description of; rapidly growing, **97,** 1575, 1576.

CONTRACTS.

1899. I. T. Brown, dr., 19¾¢ c. y.; r. removal, $4.90 c. y. ($79,604.82), **00,** 2027.

ENGINEERS.

Chief of Engineers. **R., 97,** 252; **98,** 246; **99,** 284; **00,** 323.

In charge:
Lt. Col. W. H. H. Benyaurd, 1897–98. **R., 97.** 1574; **98,** 1357.
Capt. H. Jervey, 1899. **R., 99,** 1635.
Capt. T. H. Rees, 1900. **R., 00,** 2025.

Assistant. J. W. Sackett. **R., 97,** 1576.

OPERATIONS.

1899–00. 201,038 c. y. dr., **00,** 2026.

PHYSICAL CHARACTERISTICS.

Detailed description of, **97,** 1576; **99,** 1636.
Current observations, **97,** 1575.

PROJECTS.

Au. of joint resolu. of Congress, 1898, Lt. Col. Benyaurd est. $300,000 to dr. chan. 200′ w. in the R. and 150′ w. in the B., with 12′ d., and that $1,000 would be required for an. mainten., **98,** 1358; adopted plan, **99,** 1636.

SURVEYS.

Ex. of the B., from its confluence with Tampa B. through Hillsboro B. and R. to the city of Tampa, au. act June 3, 1896; made by Lt. Col. Benyaurd, 1897, **97,** 1574 (**R.** fav.; see Projects).

Sur. made, 1899, by Capt. Jervey, **99,** 1636.

Part (c), P–288 Hillsboro Bay, Fla.

APPROPRIATIONS.

1902,	$150,000, **02,** 1222.
1905,	100,000, **05,** 1311.
1906,	348,350, **06,** 1230.
1908,	*1,000, **09,** 1377.
1909	10,000, **09,** 1377.
1909	*5,594, **10,** 1522.
1910,	300,000, **10,** 1522.
1911,	3[illegible]0,000, **11,** 1658.
1912,	450,000, **12,** 1875.

Total, 1,664,944 (incl. misc., and $125,000 carried under P–80(a), $1.790, 1913 **12,** 1875).

COMMERCE.

Description of present, and prospective, **04,** 1728, 1733, 1737.

Growth of city of Tampa since beginning of imp., **04,** 1728.

Rates by water lowered 25% since imp. was undertaken, **05,** 303; lowered 10%, 1908, **09,** 378; 30 to 40%, **12,** 557.

Diagram showing tonnage values and app., **12,** 1875.

Tonnage in 1911, 1,637,676 t., **12,** 557.

"The commerce for the year 1911 amounted to 1,637,676 short tons, valued at $29,904,179, an increase of 49.7 per cent over 1910. The commerce consists principally of cigars, coal, crude oil, fertilizers, fish, lumber, naval stores, oranges, phosphates, tobacco leaf, vegetables, and general merchandise. Three lines of steamers give regular service to New Orleans, Habana, Key West, and New York. Two of these lines each added a steamer to the Tampa run during the year. Local commerce between Tampa and other points on Tampa Bay, Sarasota Bay, Manatee River, and Boca Ceiga Bay is carried on by four lines of steamers. In addition to this there are many small gasoline boats making more or less regular runs.

"Freight rates have been reduced from 30 to 40 per cent." **12,** 557.

CONTRACTS.

1902. E. W. Preston, dr., 18⅞ ¢ c. y.; removing r., $4.89 c. y., **03,** 1201.

1905. G. W. Catt, dr., 14¢ c. y.; r. removal $4.90 c. y., **06,** 1230.

1907. Estate of G. W. Catt, supple. agreement providing for omission of r. removal work, and for depositing material at a min. distance of 1,200′ from R. bank, 12¢ c. y., **08,** 1386.

1908. Southern Dredging Co., dr., 13¢ c. y.; Bowers Southern Dredging Co., lease of dr. plant, $300 per day, **09,** 1377.

1909. Hillsboro Dredging Co., dr., 16 and 21¢ c. y., **10,** 1521.

1910. Hillsboro Dredging Co., dr., 16 and 21¢ c. y., **10,** 1521. R. Moore, dr. (1,200,000 c. y.), 8½¢ c. y.; North American Dredging Co., dr. (1,500,000 c. y.), 7.98¢ c. y.; Hillsboro Dredging Co., dr. r., $6 c. y.; other than r., 17¾¢ c. y., **11,** 1658–59.

1911. J. C. Titzell, dr. (4,400,000 c. y.), 7.45¢ c. y., **12,** 1875.

ENGINEERS.

Chief of Engineers. **R., 01,** 347; **02,** 277; **03** 285; **04,** 294, 301, 1726; **05,** 302; **06,** 324; **07,** 341; **08,** 362; **09,** 377, 385; **10,** 426, 435; **11,** 452; **12,** 554.

Boards. BERH. **R., 04,** 1730, 1731.

In charge:

Capt. T. H. Rees, 1901. **R., 01,** 1758.

Capt. H. Deakyne, 1902. **R., 02,** 1222; **04,** 1728.

Lt. E. M. Rhett, **02,** 274.

Capt. F. R. Shunk, 1903–07. **R., 03,** 1200; **04,** 1705, 1735; (Maj.) **05,** 1310; **06,** 1229; **07,** 1326.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1385.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1376; **10,** 1521; **11,** 1656.

Capt. J. R. Slattery, 1912–. **R., 12,** 1874.

Assistant. W. H. Caldwell. **R., 04,** 1733.

LEGISLATION.

Act Feb. 27, 1911, requires that municipality of Tampa obtain control of 700′ on each side of proposed Ybor chan.; complied with by city, **11,** 453, 454.

OPERATIONS.

1900-01. 212,525 c. y. dr. and 2,989 c. y. r. removed, **01,** 1759.

1902-03. 222,183 c. y. dr. and 13,776 c. y. r. removed, **03,** 1201.

1903-04. 82,511 c. y. dr. and 1,020 c. y. r. removed; 2 sunken pontons and dr. ladder removed from chan., **04,** 1706.

1904-05. 114,775 c. y. dr., **05,** 1310.

1905-06. 876,462 c. y. dr. and 30 c. y. r. removed, **06,** 1229.

1906-07. 1,184,862 c. y. dr., **07,** 1326.

1907-08. 383,230 c. y. dr. and 156,046 c. y. removed under supple. agreement, **08,** 1386.

1908-09. 210,739 c. y. dr.; dolphin built, **09,** 1376.

1909-10. 58,946 c. y. dr., **10,** 1521.

1910-11. 1,904,595 c. y. dr. by contract and 296,361 c. y. by U. S., practically completing secs. A and B to required d., **11,** 1657.

1911-12. 1,416, 326 c. y. dr. under contracts; result of work, **12,** 1874.

PHYSICAL CHARACTERISTICS.

Quantity of r. found to be less than orig. est., **03,** 1201.

Description of, **04,** 1733.

B. an arm of Tampa B., about 9 m. x 4½ m. Tampa is at its head and is 259 m. from Key West and 550 m. from New Orleans, **12,** 554.

PROJECTS.

By Capt. Shunk, 1903, est. for chans., viz: 15′, $265,516; 18′, $569,259; 20′, $837,335; 24′, $1,464,042 (all plus 10% for engineering expenses); 20′ recom., **04,** 1736. BERH. recom. 18′ and abandonment of further imp. at Port Tampa, when d. of 24′ should be secured there, **04,** 1732 Act 1905 au. part of plan, for chan. 20′ x 150′, lower B. to mouth of Hillsboro R., with turning basin 450′ x 1,050′ at inner end of chan.; est., $448,350,[1] **05,** 303, 1310.

By Capt. Spalding, 1909 (modification au. act June 25, 1910), chan. 24′ d., 200′ w., from Tampa B. to turning basin, thence e. 300′ w. to mouth, and up estuary through present Tampa Northern Chan. to main chan., by dr. and r. removal; est., $1,750,000, and $20,000 an. for 5 years, and $10,000 an. thereafter for mainten.,[2] **10,** 427, 435.

* Allotment. [1] H. D. 306, 58th, 2d. [2] H. D. 634, 61st, 2d.

Modified Feb. 16, 1912, to provide straight chan. in Ybor Estuary, in lieu of chan. shown on map in H. Doc. No. 634, 61st Cong., 2d sess., **12,** 555.

SURVEYS.

Ex. and sur. au. act June 13, 1902; made, resp., in 1902 by Capt. Deakyne; and in 1903 by Capt. Shunk,[1] **04,** 1726.

Ex. and sur., from turning basin to head of estuary in direction of Ybor City, au. act Mar. 2, 1907; made, resp., in 1907 and 1908, by Maj. Shunk and Lt. Col. Beach,[2] **09,** 385.

From 24′ contour in B., through existing 20, chan. to head of estuary, in direction of Ybor City′ thence from mouth of said estuary through B., etc., au. act Mar. 3, 1909; made, 1909, by Capt. Spalding,[3] **10,** 435.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 556.

Map.[2 3] **12,** 1874.

Part (d), P-288 Hillsboro River, Fla.

APPROPRIATIONS.

1910, $25,000, **10,** 1523.

CONTRACTS.

1911. Southern Dredging Co., lease of clamshell dr., $350 day, **11,** 1660.

ENGINEERS.

Chief of Engineers. R., 10, 428; **11,** 455; **12,** 557.

In charge:

Capt. G. R. Spalding, 1910–11. **R., 10,** 1523; **11,** 1660.

Capt. J. R. Slattery, 1912–. **R., 12,** 1876.

OPERATIONS.

1910–11. 9,489 c. y. dr., **11,** 1660.

1911–12. 24,333 c. y. dr., **12,** 1876.

PROJECT.

This imp. formed part of the 12′ proj. for Hillsboro B., au. Mar. 3, 1899 (see **R.** for 1911, p 452, Hillsboro B.), **10,** 428; **11,** 455.

Proj. completed except where superseded by that for imp. of Hillsboro B., **10,** 428.

P-288(e) TAMPA BAY AND OLD TAMPA BAY, FLA. (Channel between.)

ENGINEERS.

Chief of Engineers. R., 89, 175.

In charge. Capt. W. M. Black, 1888. **R., 89,** 1368.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1368.

PLANS.

By Capt. Black, 1889, imp. of the waterway connecting Tampa and Old Tampa Bs. by excavation of a chan. 200′ x 20′ m. l. w. across the bars, **89,** 1369.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black (see Plans), **89.** 1369.

P-290 SARASOTA BAY, FLA.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1652.
1892,	2,500,	**92,** 1383.
1894,	2,500,	**95,** 1554.
1896,	2,500,	**96,** 1332.
1899,	5,000,	**99,** 1629.
1902,	5,000,	**02,** 1219.
1905	*5,000,	**06,** 1227.
	5,000,	**05,** 1308.
1907,	22,500,	**07,** 1322.
1908,	*3,000,	**09,** 1372.
1909	5,000,	**09,** 1372.
	4,000,	**10,** 1516.
1910,	30,000,	**10,** 1516.
1912,	13,000,	**12,** 1869.
Total,	110,000	(incl. misc., $112,042.75, **12,** 1869).

COMMERCE.

Evident, 1898, that when imp. should be completed it would be commensurate with the value of the C. as far as the town of Sarasota; but thence to Caseys Pass the value of the C. problematical, **98,** 1337.

Description of, **00,** 2056.

Region between Sarasota and Caseys Pass well adapted to fruit and vegetables, and would be settled as soon as water transportation secured, **01,** 1754.

Rates lowered from 25 to 50% since beginning of imp., **05,** 301.

Believed to be increasing, **10,** 423.

1911, 35,811 t., **12,** 549.

CONTRACTS.

1911. Hillsboro Dredging Co., dr. 177,550 c. y., 12½¢ c. y., **11,** 1652. Hillsboro Dredging Co., dr. 155,000 c. y. from secs. A and B, 18¢ c. y., and 200,000 c. y. from secs. D, E, and F, 11¢ c. y., **12,** 1869.

ENGINEERS.

Chief of Engineers. R., 89, 175; **90,** 156; **91,** 191; **92,** 188; **93,** 207; **94,** 191; **95,** 217; **96,** 195; **97,** 247; **98,** 241; **99,** 280; **00,** 318, 327; **01,** 344; **02,** 275; **03,** 284; **04,** 292; **05,** 300; **06,** 322; **07,** 338; **08,** 358; **09,** 373; **10,** 422, 435; **11,** 448; **12,** 548.

In charge:

Capt. W. M. Black, 1888–92. **R., 90,** 1615; **91,** 1651.

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* Allotment. [1] H. D. 306, 58th, 2d. [2] H. D. 1121, 60th, 2d. [3] H. D. 634, 61st, 2d.

Maj. J. C. Mallery, 1892. **R., 92,** 1382.
Lt. D'Armit, 1893. **R., 93,** 1665.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1237; **95,** 1553.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1331; **97,** 1560; **98,** 1337.
Capt. H. Jervey, 1899–1900. **R., 99,** 1629; **00,** 2054, 2060.
Capt. T. H. Rees, 1900–01. **R., 00,** 2018; **01,** 1753.
Capt. H. Deakyne, 1902. **R., 02,** 1218.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1197; **04,** 1702; (Maj.) **05,** 1307; **06,** 1227; **07,** 1321.
Lt. Col. L. H. Beach, 1908. **R., 08.** 1380.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1371; **10,** 1516; **11,** 1651.
Capt. J. R. Slattery, 1912–. **R., 12,** 1868.

Assistants:
D. B. Dunn. **R., 90,** 1616.
J. H. Bacon. **R., 90,** 1618.
W. H. Caldwell. **R., 00,** 2058, 2062.

OPERATIONS.

1891-92. 4,363 c. y. dr., **92,** 1383.
1892-93. 6,457 c. y. dr., **93,** 1666.
1894-95. 13,614 c. y. dr., **95,** 1554.
1897-98. 10,972 c. y. dr., **98,** 1337.
1900-01. 35,764 c. y. dr., **01,** 1754.
1902-03. 33,952 c. y. dr., **03,** 1197.
1905-06. 21,568 c. y. dr., 167 c. y. r. removed, and 840 l. f. bulkhead built, **06,** 1227.
1906-07. 24,977 c. y. dr. and 163 c. y. r. removed, **07,** 1321.
1907-08. 61,131 c. y. dr. and 449 c. y. r. removed, **08,** 1380.
1908-09. 12,812 c. y. dr. and 74 c. y. r. removed, **09,** 1371.
1909-10. 44,698 c. y. dr., **10,** 1516.
1910-11. 114,560 c. y. dr., **11,** 1651.
1911-12. 39,005 c. y. dr., by which a chan. 50′ w., and not less than 3′ d., m. l. w., obtained from Sarasota s. through Little Sarasota B. for 11 m., **12,** 1868.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1617; **91,** 1651; **00,** 2055.
Chans. in vicinity of Gulf of Mexico difficult to maintain on account of strong tidal currents and shifting nature of bottom, **11,** 1651.

PLANS. (See Projects.)

By Capt. Black, 1889, excavating chan. 5′ x 100′ through Sarasota B. from Tampa B. to Sarasota, and 3′ x 75′ from Sarasota to Caseys Pass; est., $37,500, **90,** 1618.

PROJECTS. (See Plans.)

By Capt. Black, 1891, chan. 5′ x 100′, Tampa B. to Sarasota; est., $10,000, **91,** 1651.
In 1893, after close ex. of the shoal near Long Bar, a revised est. submitted by Lt. D'Armit making total est. $17,500, **93,** 1667.
Lt. Col. Benyaurd, 1896, proposed to expend app. of 1896, intended for imp. of the B. from Tampa B. to Caseys Pass, in work above Sarasota in furtherance of the proj., **96,** 1332; proj. modified to provide for imp. of the B. from Tampa B. to Caseys Pass, increasing total est. to $55,000, **98,** 1337.
Capt. Jervey est., 1899, $27,000 or $41,000 for the betterment of the chan. connecting Sarasota B. with Lemon B., with $1,000 an. mainten., **00,** 2061, 2062.
Act 1907 au. extending imp. Tampa B. to Venice; est. increased $15,000, **07,** 338.
Capt. Spalding, 1910, did not consider stretch between Venice and Gasparilla Sound worthy of imp.; est., $25,000 to complete existing proj. to Venice,[1] **10,** 423, 435.
Owing to difficulty to maintain chan. in vicinity of Gulf of Mexico, change in route made, increasing dr. required. Chief of Engineers au. increase of $25,000 in the est. cost of completing work, **11,** 1651.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Capt. Black, **90,** 1617.
Ex. and sur. of inside passage through Sarasota B. to Lemon B., Fla., au. act Mar. 3, 1899. Ex. made, 1899, by Capt. Jervey; no existing inside passage connecting the 2 Bs.; to build an artificial passage would not be justifiable. Sec. of War approv., Oct. 19, 1899, recom. of Chief of Engineers that the district office be au. to make a sur. and report upon such portion of the route covered by his pre. report as connected the navigable waters of Sarasota and Lemon Bs. (**R.** unfav.; see Projects), **00,** 2055, 2060.
From Tampa B. to Venice, thence through Caseys Pass to Lemon B., thence to Gasparilla Sound, au. act Mar. 3, 1909; made, 1909–10, by Capt. Spalding,[1] **10,** 435.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 548.

P-296 MANATEE RIVER, FLA.

APPROPRIATIONS.

1882,	$12,000.00,	**83,** 1028.
1886,	[2] 11,000.00,	**86,** 1151; **87,** 1241.
1888,	5,000.00,	**88,** 1109.
1890,	6,000.00,	**90,** 1603.
1892,	6,000.00,	**92,** 1386.
1894	3,000.00,	**95,** 1556.
	56.37 (claim), act Aug. 23.	
1896,	[3] 4,000.00,	**96,** 1333.
1899,	10,000.00,	**99,** 1631.
1902,	*2,342,00,	**03,** 1202.
1905,	10,000.00,	**05,** 1317.
1907,	70,710.00,	**07,** 1323.
1909,	10,000.00,	**09,** 1373.
1912,	5,000.00,	**12,** 1870.
Total,	155,108.37	(incl. misc., less claim of $56.37, $155,060.80, **12,** 1870).

COMMERCE.

Description of, **97,** 1562.
C. of the R. and Terraceia B. of sufficient importance, 1896, to warrant an imp. of the cut-off, **97,** 1562.
In 1898 locality the largest shipping point for fruits and vegetables on the w. coast of Florida, **98,** 1339.
Adjacent country developing rapidly, and C. growing, **03,** 287.
Description of; large and increasing, **04,** 1753–54.
1911, 63,000 t., an increase of 75.5% over previous year, all due to imp.; imp. also controlling factor over rates, **12,** 551.

CONTRACTS.

1883. J. Maguire, dr., 49 9/10¢ c. y., **83,** 1029.
1886. R. Moore, dr., 50¢ c. y., **87,** 1241.
1888. D. G. Ambler, dr., 29¢ c. y., **89,** 1341.

* Allotment.
[1] H. D. 849, 61st, 2d.
[2] Part of $13,000, $2,000 of which was for Pease R., **87,** 1241.
[3] $3,000 for imp. of the cut-off.

ENGINEERS.

Chief of Engineers. R., 82, 186; **83,** 197; **84,** 205; **85,** 197; **86,** 195; **87,** 159; **88,** 147; **89,** 170; **90,** 152; **91,** 191; **92,** 188; **93,** 267; **94,** 192; **95** 218; **96,** 195; **97,** 248; **98,** 242; **99,** 281; **00,** 319, **01,** 345; **02,** 279; **03,** 287; **04,** 296, 301, 1749; **05,** 307; **06,** 328; **07,** 339; **08,** 360; **09,** 375; **10,** 424; 435; **11,** 450, 464; **12,** 549, 569.

Boards. B.E.R.H. **R., 04,** 1751, 1755.

In charge:
Maj. A. N. Damrell, 1881–85. **R., 82,** 1319; **83,** 1028; **84,** 1215.
Capt. W. T. Rossell, 1885–86. **R., 85,** 1272.
Capt. W. M. Black, 1886–92. **R., 86,** 1150; **87,** 1239; **88,** 1107; **89,** 1340; **90,** 1602; **91,** 1653.
Maj. J. C. Mallery, 1892. **R., 92,** 1384.
Lt. A. M. D'Armit, 1893. **R., 93,** 1668.
Maj. T. H. Handbury, 1894–95. **R., 94,** 1238; **95,** 1555.
Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1332; **97,** 1562; **98,** 1338.
Capt. H. Jervey, 1899. **R., 99,** 1630.
Capt. T. H. Rees, 1900–01. **R., 00,** 2020; **01,** 1755.
Capt. Herbert Deakyne, 1902. **R., 02,** 1223; **04,** 1749, 1754.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1203; **04,** 1708; (Maj.) **05,** 1317; **06,** 1233; **07,** 1322.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1382.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1373; **10,** 1517; **11,** 1653.
Capt. J. R. Slattery, 1912–. **R., 12,** 1870.

Assistants:
P. Robinson. **R., 82,** 1320.
J. H. Bacon. **R., 88,** 1109.
W. H. Caldwell. **R., 04,** 1752.

OPERATIONS.

1882–83. 2,405 c. y. dr. from chan. in Tampa B., **83,** 1028.
1883–84. 21,269 c. y. dr. from cut between Tampa B. and Shaws Pt., **84,** 1216.
1887–88. 15,302 c. y. dr. from cut, **88,** 1108.
1889–90. 14,977 c. y. dr., **90,** 1603.
1892–93. 1,389 c. y. dr., **93,** 1669.
1893–94. 22,300 c. y. dr., **94,** 1240.
1897–98. 20,074 c. y. dr., and a temporary training wall 1,475′ l. built; 3 chan. marks built, **98,** 1338.
1899–00. 53,231 c. y. dr., **00,** 2021.
1902–03. 17,144 c. y. dr. from Terraceia Cut-off, **03,** 1203.
1905–06. 47,849 c. y. dr., 160 snags removed, and 48 trees trimmed, **06,** 1234.
1907–08. 122 snags removed, 129 trees trimmed, and 7,664 c. y. dr., **08,** 1382.
1908–09. 204,320 c. y. dr., **09,** 1373.
1909–10. 235,087 c. y. dr. and 21 chan. marks estab., **10,** 1517.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1108; **04,** 1752.
Rises in w. part of the central portion of Fla., and empties into s. part of Tampa B.; 50 m. l.; for 13 m. above mouth the R. is a tidal estuary ½–1 m. w.; proj. section, 22 m., **12,** 549.

PROJECTS.

By Maj. Damrell, 1882, chan. 13′ x 100′ m. l. w., Tampa B. to Shaws and McNeills Pts., 4 m.; est., $70,000, **82,** 1319; **83,** 1028; **86,** 1151.
This proj. subsequently modified, increasing the est. to $73,000, to provide for opening up the entire lower R. to light-draft boats, by chan. 8′ x 100′ m. l. w., Tampa B. to Manatee, **90,** 1602; **91,** 1653.
Lt. D'Armit, 1892, dr. with U. S. dr. a cut 12′ x 100′ m. l. w. through the bulkhead at Snead Pt., **93,** 1669.
In 1897 Lt. Col. Benyaurd est. $20,000 to form a chan. 6′ x 100′ m. l. w., connecting the 6′ contours. of Manatee R. and Terraceia B., **97,** 1562; a proj. on this basis approv. in 1897, **98,** 1338.
Proj., 1912, embraced foregoing and that by Capt. Deakyne, 1902, for a chan. 9′ x 100′ from McNeills Pt. to Rocky Bluff, and 4′ x 75′, Rocky Bluff to Rye; total est., $130,520,[1] **04,** 1754; au. act Mar. 3, 1905, **05,** 307, **12,** 550.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. Damrell, **82,** 1319.
Made, 1888, by Capt. Black, **88,** 1108, 1109.
Sur. au. to find character and extent of the imp. required at the cut-off for which Congress app. $3,000 in 1896. Sur. made by Lt. Col. Benyaurd, 1897 (**R.** fav.; see Projects), **97,** 1562.
From mouth to Ellenton, thence to Rye, au. act June 13, 1902; made, 1902, by Capt. Deakyne,[1] **04,** 1749.
Pre. ex. and sur. au. act Mar. 3, 1909, for 13′, mouth to Palmetto and Bradentown; and thence such d. to Ellenton and Rye as commerce might need. **R.,** Capt. Spalding, 1909 and 1910[2] (supple. imp. unnecessary), **10,** 435; **11,** 464; **12,** 569.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 550.
Maps.[2] **88,** 1108; **97,** 1562.

P-304 ALAFIA RIVER, FLA.

ENGINEERS.

Chief of Engineers. R., 89, 174.
In charge. Capt. W. M. Black. **R., 89,** 1357.
Assistant. D. B. Dunn. **R., 89,** 1358.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1357.

PLANS.

By Capt. Black, 1889, for imp. by carrying the chan. d. at the mouth, 15′ at l. w., over the shoals as far as Peru, by dr., assisted by light wing dams; est., $10,000, **89,** 1358.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black, **89,** 1357.

P-314 ST. PETERSBURG, FLA. (Harbor at.)

APPROPRIATIONS.

1912, $32,000, **12,** 1873.

COMMERCE.

In 1911, 771,850 t., **12,** 554.

ENGINEERS.

Chief of Engineers. R., 06, 332; **12,** 553, 571.

In charge:
Maj. F. R. Shunk, **06,** 312.
Capt. J. R. Slattery, 1912–. **R., 12,** 1873.

[1] H. D. 117, 58th, 2d

[2] H. D. 271, 62d, 2d.

PRIVATE WORK.

In 1911 local interests excavated chan. 120′ x 13′, and a basin 14′, x 450′ x 1,360′ **12,** 553.

PROJECTS.

Act July 25, 1912, au. proj. for w. and d. chan. entering Bayboro H. to 10′ x 200′ at outer end, and 300′ w. at inner end, and protecting chan. by j. along s. side; est., $32,000, and $1,500 an. mainten.; provided local interests would do all necessary work inshore, incl. w. basin 175′ and mainten. to d. of 10′; and that the frontage on basin acquired by the city would be moved 300′ n., and land along Salt Creek be reserved for future enlargements,[1] **12,** 553.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905. **R.** by Maj. Shunk,[2] (unfav.), **06,** 332.

R. by BERH., Sept. 9, 1907, requested by R. & H. Comm. C. not sufficient to justify exp.[3]

Pre. ex. and sur. au. act Feb. 27, 1911. **R.** by Capt. Spalding on ex., June 5, and Capt. Slattery on sur., Nov. 21, 1911; est., $32,000, subject to co-operation by local interests,[1] **12,** 571.

Map.[1]

P-323 (a) CLEARWATER HARBOR AND BOCA CEIGA BAY, FLA.

APPROPRIATIONS.

1910,	$29,500,	**10,** 429.
1911,	29,500,	**11,** 1661.
1912,	20,000,	**12,** 1877.
Total,	79,000,	**12,** 1877.

COMMERCE.

Description, **85,** 1325, 1328.
None, **97,** 1579.
About 3% of total trade uses waterway, **10,** 429.
Tonnage, 1911, 5,000+ t., **12,** 1878.

CONTRACTS.

1910. Hillsboro Dredging Co., dr., 13¾¢ c. y., **11,** 1660.

1911. Hillsboro Dredging Co., dr. about 131,000 c. y., at 15½¢ c. y., **12,** 1878.

ENGINEERS.

Chief of Engineers. R., 85, 207; **87,** 162; **97** 252; **09,** 385; **10,** 428; **11,** 455; **12,** 559.

In charge:
Capt. R. L. Hoxie. **R., 85,** 1323, 1324.
Capt. W. M. Black. **R., 87,** 1259.
Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1578.
Capt. G. R. Spalding, 1910–11. **R., 10,** 1523; **11,** 1660.
Capt. J. R. Slattery, 1912–. **R., 12,** 1877.

Assistants:
H. Haines. **R., 85,** 1324.
J. L. Meigs. **R., 85,** 1326.
J. W. Sackett. **R., 97,** 1579.

OPERATIONS.

1910–11. 103,880.5 c. y. removed under contract, and 33,339 c. y. by hired plant, at 16.8¢ c. y., resulting in chans. 5′ x 50′ x 100′, **11,** 1660.

1911–12. 244,548 c. y. dr.; proj. 85% completed, **12,** 1877.

PHYSICAL CHARACTERISTICS.

Description of; H. a shallow sound on the w. coast of Florida, about 20 m. n. of entrance to Tampa B., **85,** 1326; **97,** 1579. Boca Ceiga B. lies to s. of Clearwater H., **12,** 559.

Description of, **10,** 428.

PLANS.

By Capt. Hoxie, 1885, dr. chan. 5½′ d. at l. w. through Sand Key Bar and Dunedin and Clearwater Chans.; est., $11,553, **85,** 1325, 1328.

PROJECTS.

Act June 25, 1910, au. chan. 5′ x 50′ w., Clearwater H. to Boca Ceiga B.; thence 7′ x 100′ to Tampa B.; est., $59,000, and $3,000 an. mainten.,[4] **10,** 428. Est. increased to $79,000 in 1912, as amount required to complete proj., **12,** 559.

SURVEYS.

Ex. au. acts July 5, 1884, and Aug. 5, 1886; made by Capt. Hoxie, 1885, **85,** 1323, and Capt. Black, 1887 (**R.** unfav.), **87,** 1259.

Ex. au. act June 3, 1896; made by Lt. Col. Benyaurd (**R.** unfav.), **97,** 1579.

Ex. and sur. au. act Mar. 2, 1907; made, 1907–08; est., $59,000,[4] **09,** 385.

Act Feb. 27, 1911, au. ex. and sur., mouth of Anclote R. to beginning of chan. from Clearwater H., through Boca Ceiga B., thence to Tampa B., **12,** 572.

Cong. docs., etc., relating to exs., surs., plans etc., **12,** 559.

Map.[4]

P-323 (b) CEDAR KEYS TO CLEARWATER HARBOR, FLA.

COMMERCE.

Small, **84,** 1220.

ENGINEERS.

Chief of Engineers. R., 84, 206.

In charge. Capt. A. N. Damrell. **R., 84,** 1220.

Assistant. Lt. J. L. Lusk. **R., 84,** 1220.

PHYSICAL CHARACTERISTICS.

Route described, **84,** 1220.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Capt. Damrell (**R.** unfav.), **84,** 1220.

[1] H. D. 512, 62d, 2d.
[2] H. D. 148, 59th, 1st.
[3] R. and H. Comm. Doc. 24, 61st, 2d.
[4] H. D. 1190, 60th, 2d.

P-328(a) ANCLOTE BAY, HARBOR, AND RIVER, FLA.

APPROPRIATIONS.

1899, $5,000, **99,** 1638.
1903, *10,000, **03,** 1202.
1905, 5,000, **05,** 1313.
1907, *17,000, **07,** 1328.
1909, *5,000, **09,** 1380.
1910, 14,500, **10,** 1526.

Total, 56,500 ($56,725, incl. sales, **12,** 1880).

COMMERCE.

Description of, **95,** 1575; **98,** 1361.

Anclote Anchorage, at mouth of R., great rendezvous for small vessels in sponge business in nearby waters, **95,** 1574.

Increased 274% during 1906; rates lowered 20%, **06,** 1231; **12,** 1881; tonnage, 1912, 14,000 t., **12,** 1881

CONTRACTS.

1910. Hillsboro Dredging Co., dr., 13.75¢ c. y.; hire of dr. plant, $175.50 per day of 10 hrs., **11,** 1664.

ENGINEERS.

Chief of Engineers. R., 85, 199; **95,** 222; **98,** 247; **99,** 285; **00,** 324; **01,** 348; **02,** 279; **03,** 287; **04,** 297; **05,** 305; **06,** 326; **07,** 343; **08,** 364; **09,** 379; **10,** 430; **11,** 457; **12,** 562.

In charge:
Capt. W. T. Rossell, 1885. **R., 85,** 1280.
Maj. T. H. Handbury, 1895. **R., 95,** 1573.
Lt. Col. W. H. H. Benyaurd, 1898. **R., 98,** 1361.
Capt. H. Jervey, 1899. **R., 99,** 1638.
Capt. T. H. Rees, 1900–01. **R., 00,** 2028; **01,** 1760.
Lt. E. M. Rhett, 1902. **02,** 274.
Capt. H. Deakyne, 1902. **R., 02,** 1223.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1203; **04,** 1709; (Maj.) 05, 1312; **06,** 1231; **07,** 1330.
Col. J. B. Quinn, 1905. **06,** 312.
Lt. Col. L. H. Beach, 1907–08. **R., 08,** 1389.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1380; **10,** 1525; **11,** 1663.
Capt. J. R. Slattery, 1912–. **R., 12,** 1880.

Assistants:
A. W. Barber. **R., 85,** 1280.
J. W. Sackett. **R., 95,** 1575.
O. N. Bie. **R., 98,** 1362.
Lt. E. M. Rhett, **02,** 274.

OPERATIONS.

1899-00. 11,987 c. y. drd., **00,** 2028.
1900-01. 11,376 c. y. drd., **01,** 1760.
1903-04. 43,698 c. y. soft material and 203 c. y. r. removed, **04,** 1709.
1904-05. 8,221 c. y. drd., **05,** 1313.
1905-06. 43,025 c. y. drd., **06,** 1231.
1907-08. Repairs, dre. *Florida,* **08,** 1389.
1908-09. 101,751 c. y. drd., **09,** 1380.
1909-10. 24,192 c. y. drd., **10,** 1525.
1910-11. 83,168 c. y. drd., **11,** 1663.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1574; **98,** 1361.

R. flows into the Gulf of Mexico on w. coast of Florida; about 20 m. l., **95,** 1574.

PROJECTS.

By Lt. Col. Benyaurd, 1897, 6′ chan., m. l. w., 100′ w., Anclote Anchorage to Sponge H.; thence 4′ chan., m. l. w., to county br. at Tarpon Springs; est., $51,500, **98,** 1362; **99,** 286.

Modified May 31, 1904, to provide for dr. between Sponge H. and county br. at Tarpon Springs, **04,** 1709.

Approved, 1905, for chan. 4′ x 50′ from existing chan. to Tarpon Springs; and extension of existing chan. between Anclote Anchorage and Sponge H. to such w. as funds would permit, **05,** 1313.

SURVEYS.

Ex. au. act July 5, 1884; made by Capt. Rossell; **R.,** 1884, unfav., **85,** 1280.

Ex. au. act Aug. 17, 1894; made by Maj. Handbury; **R.** fav., **95,** 1575.

Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd; **R.,** 1897, fav., **98,** 1361. (See Projects.)

Cong. docs., etc., relating to exs., surs., etc., **12,** 562.

P-329 PITHLOCHASCOOTIE RIVER, FLA.

ENGINEERS.

Chief of Engineers. R., 12, 571.
In charge. Capt. J. R. Slattery, **12,** 524.

SURVEY.

Pre. ex. au. act Feb. 27, 1911. **R.** by Capt. Slattery, Aug. 11, 1911[1] (unfav.), **12,** 571.

P-330 HUDSON BAY, PASCO COUNTY, FLA.

COMMERCE.

Description of, **00,** 2074.

C., 1897–99, incl., est. at $36,985, $78,781, and $131,525, resp., **00,** 2067.

ENGINEERS.

Chief of Engineers. R., 99, 288; **00,** 327.

In charge. Capt. H. Jervey, 1900. **R., 00,** 2066, 2069.

Assistants:
W. H. Caldwell. **R., 00,** 2068, 2071.
P. B. Bird, jr. **R., 00,** 2073.

PHYSICAL CHARACTERISTICS.

Description of. Town of Hudson on shoal w. coast of Florida, about 60 m. from Tampa B. entrance, and 15 m. n. of Anclote Keys. The indentation of the coast (bay) is hardly noticeable, **00,** 2066.

PROJECTS.

Capt. Jervey est., 1899, not less than $200,000 for a navigable chan. 6′ x 60′ m. l. w., **00,** 2070.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; made, 1899, by Capt. Jervey (**R.** unfav.; see Projects), **00,** 2066, 2069.

* Allotment.

[1] H. D. 429, 62d, 2d.

P-338 HOMOSASSA BAY, FLA.

ENGINEERS.

Chief of Engineers. **R., 85,** 214.

In charge. Maj. A. N. Damrell. **R., 85,** 1373.

PROJECTS.

In 1884 imp. would cost from $100,000 to $180,000, **85,** 1373.

SURVEY.

Ex. au. act July 5, 1884; made by Maj. Damrell (**R.** unfav.), **85,** 1373.

P-339 HOMOSASSA RIVER, FLA.

COMMERCE.

Description of, **89,** 1353.

ENGINEERS.

Chief of Engineers. **R., 89,** 174.

In charge. Capt. W. M. Black, 1888. **R., 89,** 1353.

Assistant. Lt. D. D. Gaillard. **R., 89,** 1354.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1354.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black (**R.** unfav.), **89,** 1353.

P-341 CRYSTAL RIVER, FLA.

APPROPRIATIONS.

1902,	*$10,000,	**03,** 1202.
1905,	*15,000,	**05,** 1315.
1909,	*3,000,	**09,** 1379.
1910,	2,000,	**10,** 1524.
1912,	2,000,	**12,** 1879.
Total,	32,000	(incl. receipts from sales, dr. rents, etc., $32,431.72, **12,** 1879).

COMMERCE.

In 1894 most of the freight carried by the RRs., **95,** 1577.

In 1897 C. had increased and there was a probability that it would still increase if a chan. were made through the bar at the entrance to the R., **97,** 1581.

Est. imports and exports for 1900, with d. w. to Gulf, $2,257,550, **00,** 2080.

Rates lowered 10%, **06,** 326; U. S. imp. had no effect on freight rate, **12,** 1880.

Tonnage, 1911, 5,192 t., **12,** 561.

CONTRACTS.

1911. Hillsboro Dredging Co., hire of dr. plant, $175 per day of 12 hrs., **11,** 1661.

ENGINEERS.

Chief of Engineers. **R., 81,** 189; **82,** 185; **89,** 1355; **95,** 222; **97,** 252; **99,** 288; **00,** 327; **02,** 278; **03,** 286; **04,** 295; **05,** 304; **06,** 325; **07,** 342; **08,** 363, 369; **09,** 379; **10,** 429; **11,** 456; **12,** 560.

In charge:

Capt. A. N. Damrell. **R., 82,** 1316.
Capt. W. M. Black, 1888. **R., 89,** 1355.
Maj. T. H. Handbury, 1895. **R., 95,** 1576.
Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1580.
Capt. H. Jervey, 1900. **R., 00,** 2074.
Capt. T. H. Rees, 1900. **R., 00,** 2078.
Capt. Herbert Deakyne, 1902. **R., 02,** 1223.
Lt. E. M. Rhett, **02,** 274.
Capt. F. R. Shunk, 1903–07. **R., 03,** 1202; **04,** 1707; (Maj.) **05,** 1312; **06,** 1231; **07,** 1329.
Lt. Col. L. H. Beach, 1908. **R., 08,** 1388.
Capt. G. R. Spalding, 1909–11. **R., 09,** 1379; **10,** 1524; **11,** 1661.
Capt. J. R. Slattery, 1912–. **R., 12,** 1879.

Assistants:

P. Robinson. **R., 82,** 1317.
Lt. D. D. Gaillard. **R., 89,** 1356.
Lt. J. J. Meyler. **R., 97,** 1581.
J. W. Sackett. **R., 95,** 1577.
W. H. Caldwell. **R., 00,** 2077, 2080.
P. B. Bird, jr. **R., 00,** 2082.

OPERATIONS.

1903–04. 41,659 c. y. soft material and 244 c. y. r. dr., **04,** 1708.

1906–07. 47,254 c. y. dr. and 3,435 c. y. r. removed, **07,** 1329.

1909–10. 22,288 c. y. dr., **10,** 1524.

1910–11. 2,012.5 c. y. dr., **11,** 1661–2.

1911–12. 465 c. y. dr., **12,** 1879.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1355; **95,** 1576; **00,** 2075; **02,** 278.

A broad, clear stream on the w. coast of Florida, about 25 m. to the se. of Cedar Keys, having an ample d. of water except near the village of Crystal R., **95,** 1576.

Max. dr., June 30, 1912, 6′ m. l. w., **12,** 561.

PLANS. (See Projects.)

For dr. and blasting chan. 6′ d. through shoals at the mouth; est., $115,000, **82,** 1317.

In 1889 Capt. Black reported available chan. d. sufficient for existing C. requirements, **89,** 1355.

PROJECTS. (See Plans.)

Capt. Rees submitted, 1900, plans for 3 routes, with est. of cost, viz, $84,647.46, $77,929.47 and $54,190.75, giving preference to the first route, via a straight line from d. w. of the Gulf to the river's mouth, **00,** 2079.

Act June 13, 1902, au. chan. 6′ x 60′, Gulf of Mexico to town of Crystal R.; est., $84,647.46,[1] **02,** 278.

SURVEYS.

Ex. au. act Mar. 3, 1881; made by Capt. Damrell, **82,** 1316.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black, **89,** 1355.

Ex. au. act Aug. 17, 1894; made by Maj. Handbury, 1894 (**R.** unfav.), **95,** 1577.

Ex. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1896 (**R.** fav.), **97,** 1581.

Ex. and sur. of Crystal R., Fla., town of Crystal R. to entrance in the Gulf of Mexico, au. act Mar. 3, 1899; ex., 1899, by Capt. Jervey (**R.** fav.); sur., 1900, by Capt. Jervey; **R.** by Capt. Rees (fav.; see Projects), **00,** 2075, 2078.

Ex. au. act Mar. 2, 1907; made, 1907, by Maj. Shunk (**R.** unfav.),[2] **08,** 369.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 561.

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* Allotment. [1] H. D. 386, 56th, 1st. [2] H. D. 395, 60th, 1st.

P-342 WITHLACOOCHEE RIVER, FLA.

APPROPRIATIONS.

1881,	$7,500, **81,** 1198.
1884,	3,000, **84,** 1195.
1886,	3,000, **86,** 1156.
1888,	5,000, **88,** 1116.
1890,	5,400, **90,** 1608.
1894	800, **95,** 1557.
1902	15,000, **02,** 1225.
	*5,000, **03,** 1202.
1905,	*15,000, **05,** 1315.
1907,	65,400, **07,** 1332.
1908,	100,000, **08,** 1392.
1909,	50,000, **09,** 1382.
1910,	6,000, **10,** 1528.
1912,	38,000, **12,** 1883.
Total,	319,100

COMMERCE.

Does not justify the proposed imp., **75,** ii, 46.

Statement of C. to be effected by imp., **85,** 1279, **87,** 1249.

Description of, **95,** 1582.

Great interest and capital attracted by the phosphate products found in the vicinity; large quantities of fruits raised, **95,** 1579.

Maj. Handbury, in 1894, believed that in view of the interests involved the place was worthy of imp. by U.S., **95,** 1581.

Not greatly benefited by imp., because season of navigation does not correspond with horticultural season; great cost of transporting phosphate by RR., the only means available, **01,** 348.

Great increase, **03,** 289.

Vessels plying regularly from anchorage basin off R. entrance to European ports with cargoes of phosphate, **04,** 298.

Rates reduced 30%, **05,** 306; **11,** 460.

New line of SS. estab., **06,** 1233.

1911, 140,285 t.; increase of 12.6% over that of 1910, **12,** 565.

CONTRACTS.

1887. C. S. Baker, removal of obstr., **87,** 1250.

1904. A. G. Bigelow, dr., 16¢ c. y.; removing r., $2.50 c. y., **05,** 1315.

1905. A. G. Bigelow, dr., 16¢ c. y.; removing r., $3.50 c. y., **06,** 1232.

1908. Southern Dredging Co., dr., 19½¢ c. y.; removing r., $3 c. y., **08,** 1392.

1911. Hillsboro Dredging Co., hire of dr. plant, $175 per day of 12 hours, **11,** 1666.

ENGINEERS.

Chief of Engineers. **R., 75,** 84; **79,** 106; **80,** 140; **81,** 185; **82,** 181; **83,** 193; **84,** 201; **85,** 198, **86,** 197; **87,** 160; **88,** 149; **89,** 172; **90,** 154; **91,** 193; **92,** 190; **93,** 209; **94,** 193; **95,** 219, 222; **96,** 196; **97,** 249; **98,** 243, 247; **99,** 286; **00,** 324; **01,** 348; **02,** 280; **03,** 288; **04,** 298; **05,** 306; **06,** 327, 332; **07,** 345; **08,** 366; **09,** 382; **10,** 431; **11,** 459; **12,** 564.

In charge:

Lt. Col. Q. A. Gillmore, 1875. **R., 75,** ii, 45.

Capt. A. N. Damrell, 1879–85. **R., 79,** 106; (Maj.) **80,** 1110; **81,** 1197; **82,** 1275; **83,** 1001; **84,** 1194.

Capt. W. T. Rossell, 1885. **R., 85,** 1277.

Lt. W. M. Black, 1886–92. **R., 86,** 1155; **87,** 1248; (Capt.) **88,** 1114; **89,** 1345, 2797; **90,** 1606; **91,** 1659, 2797.

Maj. J. C. Mallery, 1892. **R., 92,** 1389.

Lt. A. M. D'Armit, 1893. **R., 93,** 1674.

Maj. T. H. Handbury, 1894–95. **R., 94,** 1242; **95,** 1556, 1579.

Lt. Col. W. H. H. Benyaurd, 1896–98. **R., 96,** 1334; **97,** 1564; **98,** 1340, 1363.

Capt. H. Jervey, 1899. **R., 99,** 1638.

Capt. T. H. Rees, 1900–01. **R., 00,** 2029; **01,** 1761.

Capt. Herbert Deakyne, 1902. **R., 02,** 1224.

Lt. E. M. Rhett, **02,** 274.

Capt. F. R. Shunk, 1903–07. **R., 03,** 1203; **04,** 1710; (Maj.) **05,** 1314; **06,** 1232; **07,** 1331.

Lt. Col. L. H. Beach, 1908. **R., 08,** 1391.

Capt. G. R. Spalding, 1909–11. **R., 09,** 1382; **10,** 1527; **11,** 1666.

Capt. J. R. Slattery, 1912–. **R., 12,** 1882.

Assistants:

E. Sherman Gould. **R., 75,** ii, 45.

J. L. Meigs. **R., 80,** 1111.

J. W. Sackett. **R., 95,** 1581.

O. N. Bie. **R., 98,** 1366.

OBSTRUCTIONS.

Br. obstr. R. at Dunellon, **89,** 2797.

OPERATIONS.

1881-82. 648 snags, 99 trees, and 200 c. y. r. removed from 4 m., **82,** 1275.

1882-83. Removal of snags, logs, and similar obstr. continued, **83,** 1002.

1884-85. 497 c. y. r. and 35 logs removed, and 23 y. riprap dam built, **85,** 1277.

1886-87. Removal of obstr. between Pembertons and Hays Ferries, **87,** 1248.

1889-90. 47 snags and trees removed from bed, and 203 c. y. r. blasted; 891 trees cut and trimmed on the banks, **90,** 1607.

1890-91. Removal of obstr., **91,** 1659.

1891-92. 79 snags and 10 overhanging trees removed; 465 c. y. r. blasted; 296 c. y. r. removed and 128 l. f. of dam built, **92,** 1390.

1892-93. 460 snags and other obstr. removed, **93,** 1675.

1904-05. 8,279 c. y. dr. and 4,074 c. y. r. removed, **05,** 1314.

1905-06. 2,560 c. y. dr. and 3,610 c. y. r. removed, **06,** 1232.

1907-08. 32,837 c. y. dr., **08,** 1391.

1908-09. 8,729 c. y. dr. and 15,912 c. y. r. removed, **09,** 1382.

1909-10. 72,989 c. y. dr. and 32,611 c. y. r. removed, **10,** 1527.

1910-11. 6,385.07 c. y. r. and 20,556.62 c. y. soft material removed, completing chan. to within three-fifths m. of Port Inglis, **11,** 1666.

1911-12. 25,752 c. y. removed by leased plant, **12,** 1882.

PHYSICAL CHARACTERISTICS.

Measurements of discharge, **80,** 1112.

Description of the R., **75,** ii, 45, 46; **89,** 1345; **95,** 1579–1585; **98,** 1365.

R. has its source in the swamp lands of Polk County, Fla., and empties into the Gulf of Mexico about 20 m. to the se. of Cedar Key, **95,** 1579.

Large deposits of phosphate discovered along banks of R., **01,** 348.

Navigation made much easier by élimination of some short turns, and by increased d. and w. in completed portions, **12,** 565.

PLAN. (See Projects.)

By E. S. Gould, removal of rs. and shoals; est., $9,900, **75,** ii, 46.

PRIVATE WORK.

The Dunnellon Phosphate Co., plans approv. by Sec. of War, Apr. 21, 1894, engaged, 1900, in d. the chan. so that the product of the mines might be lightered to vessels in the outer anchorage, **00,** 2030.

161,770 c. y. r. and 328,064 c. y. sand removed by Dunnellon Phosphate Co., **02,** 1224.

Work done on chan. by Port Inglis Terminal Co., **05,** 306.

PROJECTS. (See Plan.)

By Maj. Damrell, 1880, imp. from mouth to Hays Ferry, 100 m., by removal of snags, overhanging trees, and loose rs., and cutting through shoals and a bar at the mouth; est., $23,874, **80,** 1111.

1888, proj. modified to permit the extension of the imp. chan. to Pemberton Ferry, 6 m. from Hays Ferry, **92,** 1390.

In 1897 Lt. Col. Benyaurd est. $120,000 to secure at the mouth chan. 6′ x 100′ m. l. w., **98,** 1364.

Act 1902 app. $15,000 for d. to 8′ the chan. from mouth to loading pool in Gulf, **02,** 278.

By Maj. Shunk, 1906, chan. 10′, x 100′ Port Inglis to anchorage in Gulf of Mexico; est., $215,400, and $5,000 an. mainten.,[1] **07,** 345.

SURVEYS.

By E. S. Gould, 1874, an ex. **R., 75,** ii, 45.

In progress, under direction of Capt. A. N. Damrell, 1879, **79,** 106.

Au. act Mar. 3, 1879; made, 1880, by Capt. Damrell, **80,** 1110.

Ex. from mouth to head of navigation au. act Aug. 17, 1894; made, 1894, by Maj. Handbury (**R.** fav.), **95,** 1579.

Sur. au. act June 3, 1896; made by Lt. Col. Benyaurd, 1897 (**R.** fav.; see Projects), **98,** 1364.

Of chan., mouth to Gulf, **02,** 1224.

By Capt. Shunk, **03,** 1203.

From Port Inglis to anchorage in Gulf, au. act Mar. 3, 1905; made, 1905–06, by Maj. Shunk,[1] **07,** 347.

Ex., Port Inglis to Panasoffkee, au. act June 25, 1910. **R.** by Capt. Spalding, Feb. 16, 1911[2] (unfav.), **12,** 570.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 565.

Maps.[1]

P-349 CEDAR KEYS HARBOR, FLA.

APPROPRIATIONS.

1872,	$7,500,	**73,** 67; **74,** 75.
1875,	15,000,	**75,** 80.
1876,	10,000,	**76,** 72.
1878,	20,000,	**78,** 79.
1879,	15,000,	**79,** 101.
1880,	15,000,	**80,** 1070.
1884,	5,000,	**84,** 197.
1886,	7,000,	**86,** 1149.
1888,	7,500,	**88,** 1118.
1890,	2,500,	**90,** 1610.
Total,	104,500	

COMMERCE.

Limited, **73,** 722, 725.

Decline in, **90,** 1610.

In 1894, C. declining, primary object for the imp. did not exist, **94,** 1245.

In 1896 the C. not sufficient to warrant imp. of H., **97,** 1584.

CONTRACTS.

1874. J. E. Slaughter, dr., 99¢ c. y., **75,** ii, 7.

1875. J. E. Slaughter, dr., 59½ and 92¢ c. y., **76,** 492; **77,** 412.

1877. J. E. Slaughter, dr., 59½ and 92¢ c. y., **78,** 589.

1880. J. E. Slaughter, dr., 69¢ c. y., **80,** 1070; completed, **81,** 1180. J. E. Slaughter, removing wreck of SS. *Lewisburg*, at $1,999, **80,** 1070; completed, **81,** 1180.

1881. J. E. Slaughter, dr., 67¢ c. y.; completed, **81,** 1181.

1884. S. N. Kimball, dr. and r. excavation, $1 and $6.50, resp., c. y., **85,** 1271.

1887. R. Moore, dr., 45¢ c. y., **87,** 1252.

1889. D. G. Ambler, dr., 29¢ c. y., **89,** 1348.

ENGINEERS.

Chief of Engineers. **R., 72,** 64; **73,** 67; **74,** 75; **75,** 80; **76,** 71; **77,** 70; **78,** 79; **79,** 101; **80,** 133 **81,** 181; **84,** 206; **85,** 196; **86,** 195; **87,** 161; **88,** 149; **89,** 172; **90,** 155; **91,** 193; **92,** 191; **93,** 209; **94,** 194; **97,** 252; **06,** 332.

In charge:

Col. J. H. Simpson, 1872. **72,** 64; **73,** 66.

Lt. Col. W. F. Raynolds, 1873. **73,** 66.

Capt. A. W. Damrell, 1873–85. **73,** 66. **R., 73,** 721; **74,** 895; **75,** ii, 7; **76,** 492; **77,** 412; **78,** 589; **79,** 812; **80,** 1069; **81,** 1180; **84,** 1218, 1220, 1223.

Capt. W. T. Rossell, 1885–86. **R., 85,** 1270.

Lt. W. M. Black, 1886–92. **R., 86,** 1148; **87,** 1251; (Capt.) **88,** 1116; **89,** 1347; **90,** 1609; **91,** 1661.

Maj. J. C. Mallery, 1892. **R., 92,** 1392.

Lt. A. M. D'Armit, 1893. **R., 93,** 1676.

Maj. T. H. Handbury, 1894. **R., 94,** 1244.

Lt. Col. W. H. H. Benyaurd, 1897. **R., 97,** 1583.

Maj. F. R. Shunk, 1906. **06,** 312.

Assistants:

G. Jaenicke. **R., 73,** 723.

C. F. Geisinger, **73,** 721.

Lt. J. L. Lusk. **R., 84,** 1219, 1220.

H. Harding. **R., 84,** 1226.

Lt. J. J. Meyler. **R., 97,** 1584.

OPERATIONS.

1872–73. Sur. made, **73,** 67.

1874–75. 6,694 c. y. dr. (chan. cut 12′ x 60′ x 1,350′), **75,** 80, ii, 7.

1875–76. 24,045 c. y. dr. (chan. completed through outer bar), **76,** 72, 493.

1877–78. 14,221 c. y. dr. (chan. 11.5′ x 80′ between Depot Key and Way Key), **78,** 79, 589.

1878–79. 24,748 c. y. dr. (chan. 11.5′ x 200′ through Middle Ground), **79,** 101, 813.

1879–80. Wreck of SS. *Lewisburg* removed and 14,273 c. y. dr. on outer bar, **80,** 1069.

1880–81. 33,968 c. y. dr., **81,** 1180, 1181.

1885–86. 370 c. y. sand and 6,153 c. y. st. removed, **86,** 1149.

1887–88. 12,945 c. y. dr., **88,** 1117.

1889–90. 9,180 c. y. dr. **90,** 1610.

1890–91. 19,055 c. y. dr., **91,** 1662.

1891–92. 3,962 c. y. dr., **92,** 1392.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 721, 722, 724, 725; **78,** 589; **89,** 1347.

Soundings and tide observations, **73,** 724.

PLANS. (See Projects.)

By G. Jaenicke, 1873: 1st, dr. chan. 12′ x 150′ from the 12′ curve outside to the same inside; est., $17,923, **73,** 722, 726. 2d, chan. same w. and d. as foregoing across the bend of the R. below and to the w. of Harbor Key; est., $115,578, **73,** 722, 726.

PROJECTS. (See Plans.)

By Capt. Damrell, 1873, dr. chan. 10′ x 100′ across the bend at the proposed line; est., $37,510, **73,** 721, 722; **75,** 80, ii, 7; modified to chan. 200′ w. and imp. chan. inside of Sea Horse Key and at the bend between Depot Key and Harbor Key, **75,** ii, 7; **76,** 72, 493. For chan. through Middle Ground 10′ x 80′ x 200′, **78,** 589; **79,** 813; **87,** 1251. For removal of the wreck of the SS. *Gettysburg*, **79,** 101, 813.

By Capt. Damrell, 1884, w. the chan. formed in 1872–81 through the Middle Ground to 10½′ x 200′, by dr. and r. removal; est., $25,000, **85,** 196, 1270; revised in 1887 to $66,000, on account of increased quantity of r. to be removed, **87,** 1252.

In 1891 Capt. Black reported further imp. undesirable; decreasing C. importance of the locality, **91,** 1662; **92,** 1392.

[1] H. D. 483, 59th, 2d.

[2] H. D. 395, 62d, 2d.

SURVEYS.

Au., **72,** 64; completed by G. Jaenicke, **73,** 67, 721, 723.

Ex. for H. at Cedar Keys and also for chan. inside the shoals along the coast of Florida, Cedar Keys to Clearwater H. and Tampa, au. act Aug. 2, 1882; made by Capt. Damrell (**R.** unfav.), **84,** 1218, 1220.

Of H. at Cedar Keys au. act Aug. 2, 1882; made, 1884, by Capt. Damrell, **84,** 1224.

Ex. au. act June 3, 1896; made by Lt. Col. Benyaurd (**R.** unfav.), **97,** 1583.

Ex. au. act Mar. 3, 1905; made, 1905, by Maj. Shunk (**R.** unfav.),[1] **06,** 332.

Maps. **86,** 1149; **88,** 1118.

P-355 SUWANEE RIVER, FLA.[2]

APPROPRIATIONS.

1839,	$15,000,	act Mar. 3.
1880,	5,000,	**80,** 1078.
1881,	3,000,	**81,** 1193.
1882,	5,000,	**82,** 1270.
1884,	5,000,	**84,** 1180.
1886,	5,000,	**86,** 1144.
1888,	15,000,	**88,** 1121.
1890,	3,000,	**90,** 1613.
1892,	3,000,	**92,** 1396.
1894,	3,000,	**95,** 1559.
1896,	3,000,	**96,** 1337.
1899,	5,000,	**99,** 1640.
1902,	*7,658,	**03,** 1202.
1905,	*5,000,	**05,** 1315.
1907,	*8,000,	**07,** 1331.
Total,	90,658	(incl. miscl., and less app. of 1839, $75,736.90, **12,** 1881).

COMMERCE.

Important, **79,** 857, 863.

Imp. of the R. essential to the development of C., **88,** 1121.

In 1892–93 several phosphate mines opened contiguous to the stream, the products to be shipped by water, **93,** 1680.

Only one SS. operates regularly, **06,** 327.

Very small, only 3 SS. operating occasionally; well served by existing chan., **10,** 431.

1911, 40,968 t., **12,** 564.

CONTRACTS.

1881. J. E. Slaughter, dr., 50¢ c. y., **81,** 1194.
1882. S. N. Kimball, dr., 50¢ c. y., **83,** 987.
1884. S. N. Kimball, dr., 47¢ c. y., **85,** 1266.
1910. Hillsboro Dredging Co., hire of plant, $210 per day of 24 hours, **11,** 1665.

ENGINEERS.

Chief of Engineers. **R.,** **78,** 81; **79,** 106; **80,** 136; **81,** 184; **82,** 180; **83,** 190; **84,** 198; **85,** 195; **86,** 194; **87,** 161; **88,** 150; **89,** 173; **90,** 155; **91,** 194; **92,** 191; **93,** 210; **94,** 195; **95,** 220; **96,** 197, **97,** 249; **98,** 234; **99,** 286; **00,** 325; **01,** 349; **02,** 280; **03,** 288; **04,** 297; **05,** 305; **06,** 327; **07,** 343; **08,** 365; **09,** 380; **10,** 430; **11,** 458; **12,** 563.

In charge:

Capt. A. N. Damrell, 1879–85. **R.,** **79,** 857; (Maj.) **80,** 1078; **81,** 1193; **82,** 1269; **83,** 986; **84,** 1179.

Capt. W. T. Rossell, 1885–86. **R.,** **85,** 1265.

Capt. W. M. Black, 1886–92. **R.,** **86,** 1143; **87,** 1253; **88,** 1118; **89,** 1349; **90,** 1611; **91,** 1663.

Maj. J. C. Mallery, 1892. **R.,** **92,** 1393.

Lt. A. M. D'Armit, 1893. **R.,** **93,** 1677.

Maj. T. H. Handbury, 1894–95. **R.,** **94,** 1246; **95,** 1558.

Lt. Col. W. H. H. Benyaurd, 1896–98. **R.,** **96,** 1335; **97,** 1564; **98,** 1341.

Capt. H. Jervey, 1899. **R.,** **99,** 1639.

Capt. T. H. Rees, 1900–01. **R.,** **00,** 2030; **01,** 1762.

Capt. Herbert Deakyne, 1902. **R.,** **02,** 1223.

Lt. E. M. Rhett, **02,** 274.

Capt. F. R. Shunk, 1903–07. **R.,** **03,** 1203; **04,** 1767; (Maj.) **05,** 1312; **06,** 1232; **07,** 1330.

Lt. Col. L. H. Beach, 1908. **R.,** **08,** 1390.

Capt. G. R. Spalding, 1909–11. **R.,** **09,** 1381; **10,** 1527; **11,** 1665.

Capt. J. R. Slattery, 1912–. **R.,** **12,** 1881.

Assistant. J. L. Meigs. **R.,** **79,** 857.

OBSTRUCTIONS.

Obstr. of the R. by sawmill refuse, **88,** 1121.

OPERATIONS.

1881-82. 17,026 c. y. dr., **82,** 1269.
1883-84. 8,205 c. y. dr., **84,** 1179.
1884-85. 4,418 c. y. dr., **85,** 1266.
1885-86. 4,582 c. y. dr., **86,** 1143.
1886-87. 56 snags and logs, 370 c. y. r. removed from chan., and 77 trees cut, **87,** 1254, 1255.
1887-88. 1,515 c. y. r. blasted and removed from chan., 17 trees cut and 42 logs removed, **88,** 1119, 1120.
1888-89. 283 c. y. dr., 265 c. y. r. blasted, and 74 c. y. removed from chan.; 76 trees cut and trimmed on the banks, **89,** 1351.
1889-90. 135 trees and 1,900 c. y. brush cut from the banks; 19 snags and logs, 611 c. y. r., and 150 c. y. sand removed from chan., and 331 c. y. r. blasted, **90,** 1613.
1890-91. Logs, snags, and 526 c. y. r. removed; repairs to snag boat, **91,** 1665.
1891-92. 261 c. y. r. blasted and 561 c. y. removed; 607 c. y. dr., **92,** 1395.
1893-94. 2,873 c. y. dr. and some snags removed, **94,** 1247.
1895-96. 5,846 c. y. dr. and 15 beacons estab.; 200 c. y. r. used in the constr. of 2 dams; 140 c. y. r. and sand excavated and removed, and about 15 obstr. removed, **96,** 1336.
1897-98. 2,043 c. y. sand and r. excavated and dr., and about 18 obstr. removed, **98,** 1342.
1900-01. 10,499 c. y. dr., **01,** 1762.
1906-07. 57,888 c. y. dr., **07,** 1330.
1910-11. 8,571 c. y. removed, w. chan. at Derrick Gap 35′. Clusters of piles placed to indicate dr. chan. Proj. about 95% completed, **11,** 459, 1665.

PHYSICAL CHARACTERISTICS.

Discharge of R., **79,** 863.

Description of, **79,** 857, 858, 862, 863; **90,** 1611; **01,** 349.

PLAN. (See Projects.)

By Maj. Damrell, 1879, 5′ chan. mouth to Rolands Bluff, thence 4′ chan. to Ellaville; est., $55,158, **79,** 857, 862, 863.

PROJECTS. (See Plans.)

By Maj. Damrell, 1879, imp. of the Suwanee R. from its mouth to Rolands Bluff, 74 m., by a 5′ chan. 150′ w.; thence to Ellaville, 50 m., chan. 4′ x 60′, to be estab. by snag and r. removal, dam constr., and dr.; est., $55,158, **79,** 857, 862, 863; **86,** 1143; **92,** 1394.

By Capt. Jervey, 1899, removal of shoals formed in the dr. chan. at the mouth of the R. and at Derricks Gap; for reestab. chan. marks, and for work upon r. shoals above Branford, **99,** 1639.

SURVEYS.

Ex. by J. L. Meigs, 1878–79, **78,** 81; **79,** 106, 857.

Au. act June 18, 1878, **78;** made by Capt. Damrell, 1878, **79,** 857.

Ex., **06,** 1232.

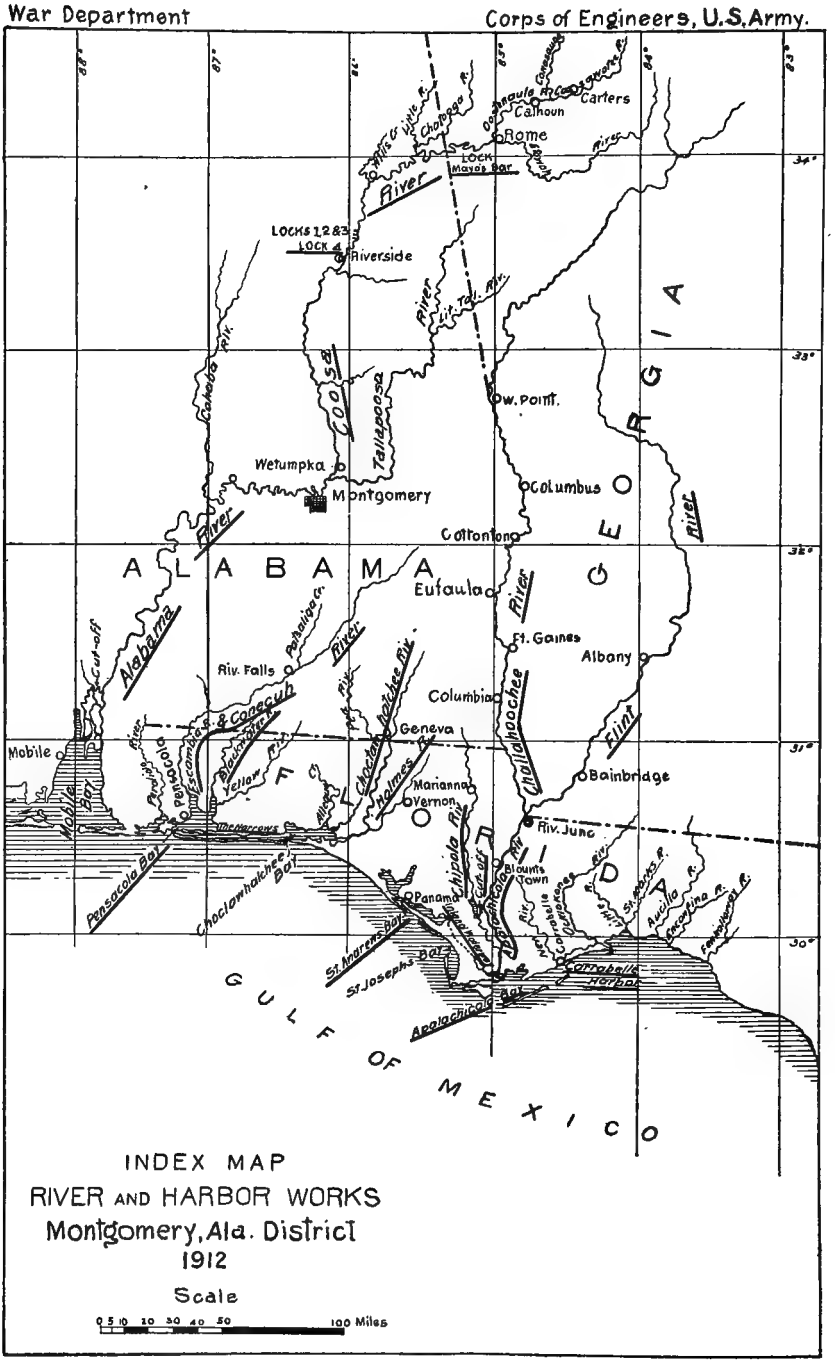
At Derrick Isld. Gap, and East Pass, **06,** 1232.

Ex. au. act Mar. 3, 1909; made, 1909, by Capt. Spalding (**R.** unfav.),[3] **10,** 434.

* Allotment.
[1] H. D. 155, 59th, 1st.
[2] Sur.—**R.** May 15, 1841; est. $40,000. (H. D. 482, 55th, 2d.)
[3] H. D. 427, 61st, 2d.

RIVER AND HARBOR WORKS—GULF OF MEXICO.

Q.—MONTGOMERY, ALA., DISTRICT.


War Department
Corps of Engineers, U.S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Montgomery, Ala. District
1912
Scale
0 5 10 20 30 40 50 100 Miles
ALABAMA
GEORGIA
FLORIDA
GULF OF MEXICO
Carters
Calhoun
Rome
Lock Mayo's Bar
Riverside
Wetumpka
Montgomery
W. Point
Columbus
Cottonton
Eufaula
Ft. Gaines
Albany
Riv. Falls
Columbia
Geneva
Bainbridge
Marianna
Vernon
Riv. Junc
Blounts Town
Panama
Mobile
Pensacola
Mobile Bay
Pensacola Bay
Choctawhatchee Bay
St. Andrews Bay
St. Josephs Bay
Apalachicola Bay
Carrabelle Harbor
Cohaba Riv.
Coosa
Tallapoosa
Alabama River
Chattahoochee River
Flint River
Chipola Riv.
Apalachicola Riv.
Escambia R.
Yellow Riv.
Blackwater R.
Choctawhatchee Riv.
Holmes R.
Chattahoochee Riv.
Cut-off
Lit. Tal. Riv.
Chatooga R.
Oostanaula R.
Coosawatee R.
Conasauga R.
Hills Cr.
Little R.
Cut-off
Aucilla R.
Ancantina R.
Fenholloway R.
St. Marks R.
Carrabelle R.
Ocmulgee R.
Little R.
Neal Riv.
Pea Riv.
Pataliga Cr.
Alleg
The Narrows
Cohoba Riv.
88°
87°
86°
85°
84°
83°
34°
33°
32°
31°
30°

Q.—MONTGOMERY, ALA., DISTRICT.

In charge of U. S. Engineer Office,
Bell Bldg., Montgomery, Ala.

Q 1 Gulf of Mexico.
Q 2 Spring Warrior (Warrior) Cr., Fla. (1)
Q 3 Fenholloway R., Fla. (1)
Q 4 Enconfina R., Fla. and Ga. (1)
Q 5 Aucilla R., Fla. (1)
Q 6 Wacissa R., Fla. (5)
Q 7 Apalachee B., Fla. (1)
Q 8 East R., Fla. (7)
Q 9 St. Marks R., Fla. (7)
Q 10 Little St. Marks R., Fla. (9)
Q 11 Waukulla R., Fla. (9)
Q 12 Ochlockonee B., Fla. (1)
Q 13 Ochlockonee R., Fla. and Ga. (12)
Q 14 Crooked R., Fla. (12)
Q 15 St. Georges Sound, Fla. (1)
Q 16 Dog Island H., Fla. (15)
Q 17 Carrabelle H., Fla. (15)
Q 18 Carrabella R., Fla. (15)
Q 19 New R., Fla. (18)
Q 20 Apalachicola B., Fla. (1)
Q 21 Apalachicola R., Fla. (20)
Q 22 Flint R., Ga. (21)
Q 23 Chattahoochee R., Ala. and Ga. (21)
Q 24 Chipola R. (lower and upper), Fla. (21)
Q 25 Gulf of Mexico (north shore)—waterway (26) (30) (37) (46)
Q 26 Apalachicola R. to St. Andrews B., Fla.—waterway (25) (21) (29)
Q 27 Indian Pass, Fla. (20) (1)
Q 28 St. Josephs B., Fla. (1)
Q 29 St. Andrews B., Fla. (1)
Q 30 St. Andrews B., to Choctawhatchee R. and B., Fla. (25) (31) 32)
Q 31 Choctawhatchee B., Fla. (1)
Q 32 Choctawhatchee R., Fla. and Ala. (31)
Q 33 Holmes R., Fla. (32)
Q 34 Pea R., Ala. (32)
Q 35 Black Cr., Fla. (31)
Q 36 Alaqua (Allequa) Cr., Fla. (31)
Q 37 Narrows (The), Fla. (31) (38) (25)
Q 38 Pensacola H., Fla. (Pensacola B.) (1)
Q 39 East B., Fla. (Pensacola B.)
Q 40 Yellow R., Fla. (39)
Q 41 Blackwater R., Fla. and Ala. (39)
Q 42 Escambia B., Fla. (Pensacola B.)
Q 43 Escambia and Conecuh Rs., Fla. and Ala. (42)
Q 44 Patsaliga R., Ala. (Conecuh R.)
Q 45 Bayou Grand, Fla. (Pensacola B.)
Q 46 Pensacola B., Fla., to Bon Secour B., Ala.—canal (25) (47)
Q 47 Perdido B., Fla. and Ala. (1)
Q 48 Perdido R., Ala. and Fla. (47)
Q 49 Alabama R., Ala. (Mobile R.—District R.)
Q 50 Tallapoosa R., Ala. and Ga. (49)
Q 51 Little Tallapoosa R., Ala. and Ga. (50)
Q 52 Coosa R., Ala. and Ga. (49)
Q 53 Etowah R., Ga. (52)
Q 54 Oostenaula R., Ga. (52)
Q 55 Coosawattee R., Ga. (54)
Q 56 Connesauga R., Ga. (54)
Q 57 Chattooga R., Ala. and Ga. (52)
Q 58 Little R., Ala. (57)
Q 59 Wills Cr., Ala. (52)
Q 60 Cahaba R., Ala. (49)

Q-3 FENHALLOWAY RIVER, FLA.

ENGINEERS.

Chief of Engineers. **R., 80,** 141; **81,** 189; **82,** 185.

In charge. Capt. A. N. Damrell. **R., 82,** 1301.

Assistant. P. Robinson. **R., 82,** 1301.

PLANS.

By Capt. Damrell, 1881, removing such snags and trees as might interfere with rafting logs, mouth to head of Dead R., 12 m.; est., $500 **82,** 1302.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Capt. Damrell, **82,** 1301.

Q-5 AUCILLA AND WACISSA RIVERS, FLA.

COMMERCE.

None, **80,** 1302.

ENGINEERS.

Chief of Engineers. **R., 80,** 141; **81,** 189; **82,** 185; **85,** 214; **86,** 212.

In charge. Capt. A. N. Damrell, 1880–86. **R., 82,** 1302; Maj. **86,** 1220.

Assistants:
P. Robinson. **R., 82,** 1302.
R. Rauchenstein. **R., 86,** 1221.

PLANS.

By Maj. Damrell, 1881, imp. Aucilla R. by removing 12 natural brs.; est., $5,000, **82,** 1303.

In 1881 Capt. Damrell reported removal of obstr. logs could be accomplished for $500 if done in connection with the imp. of the Aucilla R., **82,** 1303.

By Maj. Damrell, 1884, imp. Wacissa R., giving min. w. of 30′ and 2½′ d. l. w. by removing snags, trees, and brush, excavating rs. and earth at the shoals, and dam constr.; est., $17,000, **86,** 1220, 1221.

SURVEY.

Au. act June 14, 1880; made, 1881, by Capt. Damrell, **82,** 1302.

Q-9 ST. MARKS RIVER, FLA.[1]

APPROPRIATIONS.

1828,	$500 (sur.), act May 23.
1829,	6,500, act Mar. 2.
1830,	10,000, act Apr. 30.
1831,	7,430, act Mar. 2.
1832,	4,500, act July 3.
1833,	1,500, act Mar. 2.
1834,	4,600, act June 28.
1844,	2,500, act June 15.
Total,	37,530

COMMERCE.

C. advantages of vicinity, **72,** 637.
Rates of transportation, **72,** 638.
C. does not warrant further imp., **72,** 639.

ENGINEERS.

Chief of Engineers. R., 71, 69; **72,** 63; **84,** 206; **89,** 175; **12,** 606.

In charge:
Col. J. H. Simpson, 1872. **R., 72,** 586, 636.
Capt. A. N. Damrell. **R., 84,** 1222.
Capt. W. M. Black, 1888. **R., 89,** 1364.
Lt. Col. G. D. Fitch, **12,** 572.

Assistants:
R. H. Curtis, **72,** 586.
Jos. Burney, **72,** 586. **R., 72,** 637.
Lt. J. L. Lusk. **R., 84,** 1222.
D. B. Dunn. **R., 89,** 1365.

PHYSICAL CHARACTERISTICS.

General, **72,** 638, 639; **89,** 1364.
Condition of the chan., **72,** 586, 636, 639.

PLANS.

By Jos. Burney, for chan. through the oyster beds to a w. of 200′ and d. of 9′ at low tide; est., $40,866.10, **72,** 63, 639.

By Capt. Black, 1889, for straightening and d. chan. and removing r. obstr.; est., $39,000, **89,** 1364.

SURVEYS.

By Jos. Burney, 1872. **R., 72,** 637.

Ex. au. act Aug. 2, 1882; made by Capt. Damrell (**R.** unfav.), **84,** 1222.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Black, **89,** 1364.

Pre. ex. and sur. au. act Feb. 27, 1911, from town of St. Marks to the Gulf of Mexico, **12,** 606.

Q-11 WAUKULLA RIVER, FLA.

ENGINEERS.

Chief of Engineers. R., 87, 162; **08,** 392.

In charge:
Lt. W. M. Black. **R., 87,** 1260.
Maj. J. B. Cavanaugh, **08,** 369.

PHYSICAL CHARACTERISTICS.

In 1887 chan. sufficient, **87,** 161.

SURVEY.

Ex. au. act Aug. 5, 1886; made by Lt. Black, **87,** 1260.

Pre. ex. from town of St. Marks to Gulf of Mexico, and of St. Marks R., au. act Mar. 2, 1907. **R.** by Capt. Cavanaugh[2] (unfav.), **08,** 392.

Q-13 OCKLOCKONEE (Ochlockonee) RIVER, GA. AND FLA.

APPROPRIATION.

1833, $5,000, act Mar. 2.

COMMERCE.

Unimportant, **75,** ii, 48.
Very little C. and little prospect of any, **00,** 2147.

ENGINEERS.

Chief of Engineers. R., 75, 84; **80,** 141; **81,** 189; **82,** 185; **99,** 302; **00,** 343.

In charge:
Lt. Col. Q. A. Gillmore, 1875. **R., 75,** ii, 46.
Capt. A. N. Damrell. **R., 82,** 1307.
Capt. C. A. F. Flagler, 1900–. **R., 00,** 2146, 2152.

Assistants:
E. S. Gould. **R., 75,** ii, 47.
P. Robinson. **R., 82,** 1307.
Lt. L. H. Rand. **R., 00,** 2148.

PHYSICAL CHARACTERISTICS.

General, **75,** ii, 47.
Obstr.: Rocks and snags, **75,** ii, 48.
Timber productions of adjacent country, **75,** ii, 48.
Description of R. and its obstr., **82,** 1307; **00,** 2147.

PLANS.

By Capt. Damrell, 1881, imp. mouth to Old R. Lake by removal of snags, logs, and similar obstr., $1,000. Imp. above Old R. Lake, $5,000. Imp. not recom., **82,** 1307.

PROJECTS.

Capt. Flagler est., 1899, $2,650 for snagging operations from Stoutamire rosin landing to the Carrabelle R. by way of Crooked R., **00,** 2152.

[1] Sur.—**R.** Sept. 11, 1828; est. $10,000. Ex.—**R.** (fav.) Jan. 28, 1845. (H. D. 482, 55th, 2d.)
[2] H. D. 851, 60th, 1st.

SURVEYS.

By E. Sherman Gould, an ex., 1875. **R., 75,** ii, 47.

Au. act June 14, 1880; made, 1881, by Capt. Damrell (**R.** unfav.: see Plans), **82,** 1307.

Ex. and sur. au. act Mar. 3, 1899; ex. only made, 1899, by Capt. Flagler (**R.** unfav.), **00,** 2147.

Plan and est. au. July 29, 1899, by the Sec. of War; made, 1899, by Capt. Flagler (see Projects) **00,** 2152.

Q-14 CROOKED RIVER, FLA.

ENGINEERS.

Chief of Engineers. R., 81, 189; **82,** 180, 186.
In charge. Capt. A. N. Damrell. **R., 82,** 1314.

PLANS.

By Capt. Damrell, 1882, dr. chan. over the bar and a short distance above to 13′; est., $72,000, **82,** 1314.

SURVEY.

Ex. au. act Mar. 3, 1881; made by Capt. Damrell, **82,** 1314.

Q-15 ST. GEORGES SOUND, FLA.

ENGINEERS.

Chief of Engineers. R., 06, 355.

In charge. Capt. J. B. Cavanaugh, **06,** 333.

SURVEYS.

Pre. ex., with plan and est. of cost of imp., of St. Georges Sound, Fla., incl. Apalachicola and Carrabelle Hs., with view to such extensions of chan. d. or modification of proj. as would meet requirements of C. **R.** by Capt. Cavanaugh, Oct. 19, 1905. Modification of existing proj. for Carrabelle H., by omitting closing of gap in Dog Isld., recom., and an amended plan for Apalachicola H. submitted; est., $85,000, with $17,500 an. mainten.,[1] **06,** 355.

Q-16 DOG ISLAND HARBOR, FLA.

ENGINEERS.

Chief of Engineers. R., 81, 189; **82,** 186.

In charge. Capt. A. N. Damrell. **R., 82,** 1314.

PHYSICAL CHARACTERISTICS.

Existing natural H. needed no imp., **82,** 1314.

SURVEY.

Au. act Mar. 3, 1881; made by Capt. Damrell, **82,** 1314.

Q-17 CARRABELLE BAR AND HARBOR (including East Pass), FLA.

APPROPRIATIONS.

1896,	$10,000.00,	**97,** 1604.
1899,	10,000.00,	**99,** 1648.
1900,	*1,704.08,	**01,** 1766.
1902,	20,000.00,	**02,** 1254.
1904	*7,500.00,	**04,** 1763.
	*5,000.00,	**05,** 1323.
1905,	15,000.00,	**05,** 1323.
1907,	60,000.00,	**07,** 1336.
1909	*10,000.00	**09,** 1386.
	*15,000.00	
1910	*15,000.00,	**10,** 1532.
	25,000.00,	**10,** 1532.
Total,	194,204.08,	**12,** 1886.

COMMERCE.

Description of, **95,** 1680–1682; **00,** 2156.

In 1895, $600,000 per year, **95,** 1680.

Value, 1898–99, $382,000; prospective C., $1,030,000, if H. and pass were imp., **00,** 2153.

1911, $772,588, **12,** 573.

A substantial reduction in ocean rates is expected due to work of imp., **12,** 574.

CONTRACTS.

1897. R. Moore Dredging Co., dr., 30¢ c. y., **97,** 1604.

1899. National Dredging Co., dr., 27¢ c. y. ($8,640), **00,** 2089.

1903. R. Moore, dr., 30¢ c. y., **04,** 1762.

1904. Charles W. Eaton, dr., 24¢ c. y., **05,** 1322.

1905. Home Dredging Co., dr., 25¢ c. y., **06,** 1242.

1907. J. F. Taylor, dr., 17½¢ c. y., **08,** 1396.

1912. Home Dredging Co., dr., 17½¢ c. y., **12,** 1886.

ENGINEERS.

Chief of Engineers. R., 95, 235; **96,** 198; **97,** 253; **98,** 249; **99,** 288, 302; **00,** 328, 343; **01,** 350, 364, 1800; **02,** 282; **03,** 290; **04,** 302; **05,** 310; **06,** 333, 355; **07,** 348; **08,** 370; **09,** 386; **10,** 435; **11,** 464; **12,** 572, 606.

In charge:

Maj. F. A. Mahan, 1895–98. **R., 95,** 1680; **97,** 1603; **98,** 1375.

Capt. C. A. F. Flagler, 1899–1901. **R., 99,** 1647; **00,** 2088, 2152, 2157; **01,** 1800.

Capt. W. V. Judson, 1901. **R., 01,** 1766, 1803.

Lt. R. R. Raymond, 1902. **R., 02,** 1253.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1207; **04,** 1762; **05,** 1322; **06,** 1241; **07,** 1335.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1395; **09,** 1385; **10,** 1531.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1669; **12,** 1885.

Assistants:

Lt. C. P. Echols. **R., 95,** 1681.

Lt. L. H. Rand. **R., 00,** 2155.

* Allotment.

[1] H. D. 422, 59th, 1st.

OPERATIONS.

1897-98. 30,592 c. y. dr., **98,** 1376.
1899-00. 32,000 c. y. dr., **00,** 2089.
1902-03. Only one bid for dr. East Pass received, which was rejected because of bidder's insufficient plant, **03,** 1208.
1904-05. 60,080 c. y. removed from East Pass and contract completed; 46,681 c. y. removed from bar at mouth of R., **05,** 1322.
1905-06. 44,000 c. y. removed from bar, **06,** 1242.
1907-08. 83,026 c. y. dr., **08,** 1396.
1908-09. 186,292 c. y. dr. under contract; 201,985 c. y. removed by U. S. dr. *Caucus* from outer bar, **09,** 1385, 1386.
1911-12. 65,394 c. y. dr., **12,** 1886.
Proj. 78% complete, **12,** 573.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1681, 1682.
H. much more advantageously situated for trade than Apalachicola, on account of being nearer the anchorage grounds for seagoing vessels, **95,** 1680.
Description of, East Pass, **00,** 2153.
Max. draft through chan., 11′; through East Pass, 20½′, **11,** 465.
Shoaling due to storm action, **12,** 573.
H. about 28 sq. m.; 180 m. e. of Pensacola H. Carrabelle at mouth of C. R., which empties into St. Georges Sound. Dog Isld. anchorage is a protected portion of St. Georges Sound, and is connected with Gulf of Mexico by East Pass, **12,** 572

PROJECTS.

By Maj. Mahan, 1895, for a 10′ x 100′ chan., mouth of the Carrabelle R. to the chan. in the B., **97** 1604.
Capt. Flagler est., 1900, $24,900 to complete the work, **00,** 2089.
Capt. Flagler est., 1899, $27,450 to dr. chan., East Pass, as proposed, and to close a breach recently made through Dog Isld., **00,** 2157.
Proj. of 1896 extended by act June 13, 1902, to include imp. of East Pass by dr. chan. 20½′ x 150′ across bar at entrance to Carrabelle H., and closing opening in Dog Isld.;[1] est., $27,450, **02,** 1254; **07,** 348.
Modified by act Mar. 2, 1907, to include chan. 18′ x 100′ between certain points, with turning basin; cost undetermined, **07,** 348.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Maj. Mahan, 1895 (**R.** fav.; see Projects), **95,** 1680.
Ex. made, 1898, by Maj. Mahan, **98,** 1376.
Est. of cost of completion au. by Chief of Engineers, June 18, 1900; made, 1900, by Capt. Flagler (see Projects), **00,** 2089.
Ex. and sur., East Pass, at entrance of Carrabelle H., Fla., to obtain 22′ chan. m. l. w., au. act Mar. 3, 1899. Ex. only made, 1899, by Capt. Flagler (**R.** fav.), **00,** 2153.
Plan and est. of cost of obtaining 20½′ x 150′ chan. m. l. w. through East Pass, at the entrance of Carrabelle H., Fla., au. July 19, 1899, by Sec. of War; made, 1899, by Capt. Flagler (see Projects), **00,** 2157.
Act June 6, 1900, au. ex. and sur. of H.; **Rs.,** July 12 and Dec. 15, 1900, by Capt. Flagler and Capt. Judson; est., $47,300,[2] **01,** 364, 1800–1806.
Ex., plan, and est., St. Georges Sound, Fla., incl. Apalachicola and Carrabelle Hs., for such extensions of chan. d. or modifications as would meet the demands of C.; modification of existing proj. for Carrabelle H. embracing omitting closing of gap in Dog Isld., recom.,[3] **06,** 355.
R. by BERH. requested by R. and H. Comm. Recom. imp., but state comm. advantages of Apalachicola outweigh engineering advantages of Carrabelle.[4]
Of bar at mouth of R. to locate new 18′ chan. **07,** 1336.
From anchorage to Carrabelle, **10,** 1531.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 466; **12,** 573.
Pre. ex. au. act Feb. 27 1911, for 21′ from Gulf of Mexico to St. Georges Sound; also 21′ chan., Gulf to Carrabelle. **R.** by Lt. Col. Fitch, June 17, 1911 (unfav.),[5] **12,** 606.

Q-20 APALACHICOLA BAY, FLA.[6]

APPROPRIATIONS.

1833,	$8,700.00,	act Mar. 2.
1834,	[7] 500.00,	act June 30.
1838,	10,000.00,	act July 4, 1836, and July 7, 1838.
1839,	[8] 9,900.00,	act Mar. 3. (Treas. Doc. No. 373, 1882.)
1840,	[7] 150.29,	act May 8.
1880,	10,000.00,	**80,** 1077.
1881,	10,000.00,	**81,** 1191.
1882,	25,000.00,	**82,** 1267.
1884,	10,000.00,	**84,** 1177.
1886,	12,000.00,	**86,** 1141.
1888,	20,000.00,	**88,** 1161.
1890,	20,000.00,	**90,** 1624.
1892,	20,000.00,	**92,** 1399.
1894,	15,000.00,	**95,** 1613.
1896,	12,000.00,	**96,** 1342.
1899,	20,000.00,	**99,** 1651.
1902	40,000.00,	**02,** 1256.
	*3,000.00,	**06,** 1244.
1904	*12,500.00,	**04,** 1765.
	*5,000.00,	**05,** 1325.
1905	40,000.00,	**05,** 1325.
	*7,500.00,	**06,** 1244.
	*2,500.00,	
1907,	85,000.00,	**07,** 1338.
1909,	*20,000.00,	**09,** 1387.
1910,	22,500.00,	**10,** 1533.
1911,	5,000.00,	**11,** 1671.
Total,	446,250.29	($436,350.29, not incl. item of 1839 above, **12,** 1887).

COMMERCE.

Increase of, due to imp., **82,** 1267; **84,** 1176.
1895, the C. of the B. seemed to warrant a w. and d. chan., **95,** 1613.
Description of, **00,** 2093; **12,** 575, 576.
Increase of C. immediate effect of imp., **00,** 2093.
Opening of West Pass should reduce rates 50¢ t., **05,** 313.
Greatly increased facilities, and substantial reduction in coastwise rates, **08,** 373.
Traffic, domestic and foreign, 1912, about 230,000 t. About 40% of C. should be credited to Carrabelle, **12,** 1888.

* Allotment.
[1] H. D. 63, 56th, 1st.
[2] H. D. 227, 56th, 2d.
[3] H. D. 422, 59th, 1st.
[4] R. and H. Comm. Doc. No. 41, 61st, 2d.
[5] H. D. 622, 62d, 2d.
[6] Approaches to Apalachicola: Sur.—**R.,** Dec. 24, 1832; est., $8,772. Feb. 23, 1835 (maps; no **R.**). H. D. 482, 55th, 2d.
[7] Sur. of East Pass.
[8] For d. the straight chan. of East Pass to Apalachicola.

CONTRACTS.

1880. W. A. Alexander, dr., 46¾¢ c. y., **81,** 1190.

1881. J. Thomlinson, dr., 29½¢ c. y., **82,** 1268; **83,** 980.

1882. J. Maguire, dr., 22½¢ c. y., **83,** 980 981.

1885. S. N. Kimball, dr., 29¾¢ c. y., **85,** 1259.

1886. S. N. Kimball, dr., 34.9¢ c. y., **87,** 1265.

1889. Alabama Dredging & Jetty Co., dr., 24¾¢ c. y., **89,** 1374.

1891. Alabama Dredging & Jetty Co., dr., 25¢ c. y., **92,** 1399.

1892. R. Moore, dr., 33¢ c. y., **93,** 1692.

1895. R. Moore Dredging Co., dr., 24¢ c. y., **95,** 1614.

1897. R. Moore Dredging Co., dr., 24¢ c. y., **97,** 1607.

1899. R. Moore, dr., 24½¢ c. y. ($18,535), **00,** 2093.

1902. National Dredging Co., dr., 29¢ c. y., **03,** 1209.

1903. R. Moore, dr., 30¢ c. y., **04,** 1764.

1904. Charles W. Eaton, dr., 24 and 22¢ c. y., **05,** 1324.

1905. Home Dredging Co., dr., 24¢ c. y. ($15,000); Southern Dredging Co., dr., 23¢ c. y. ($10,000); M. P. Palmes, coal ($2,125), **06,** 1245.

1907. Home Dredging Co., dr., **08,** 1397.

1908. John H. Gardner, bulkhead, $2.88 l. f. **08,** 1398.

1911. Home Dredging Co., dr., 14.6¢ c. y., **12,** 1887.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 136; **81,** 183; **82,** 179; **83,** 189; **84,** 197; **85,** 194; **86,** 193; **87,** 163; **88,** 152; **89,** 175; **90,** 157; **91,** 196; **92,** 192; **93,** 211; **94,** 196; **95,** 223; **96,** 199; **97,** 254, 262; **98,** 250; **99,** 289; **00,** 329; **01,** 351; **02,** 283; **03,** 291; **04,** 303; **05,** 311; **06,** 334, 355; **07,** 349; **08** .371; **09,** 388; **10,** 437; **11,** 466; **12,** 574.

In charge:

Capt. A. N. Damrell, 1870–84. **R.,** **80,** 1076; **81,** 1190; **82,** 1266; **83,** 980; **84,** 1175.

Capt. W. T. Rossell, 1884–86. **R.,** **85,** 1258.

Lt. W. M. Black, 1886–87. **R.,** **86,** 1140.

Capt. R. L. Hoxie, 1887–89. **R.,** **87,** 1265; **88,** 1160.

Capt. P. M. Price, 1889–93. **R.,** **89,** 1372; **90,** 1623; **91,** 1694; **92,** 1397; **93,** 1690.

Maj. F. A. Mahan, 1894–98. **R.,** **94,** 1249; **95,** 1611; **96,** 1339; **97,** 1605, 1655; **98,** 1377.

Capt. C. A. F. Flagler, 1899–1900. **R.,** **99,** 1649; **00,** 2091.

Capt. W. V. Judson, 1901. **R.,** **01,** 1767.

Lt. R. R. Raymond, 1902. **R.,** **02,** 1255.

Capt. J. B. Cavanaugh, 1903–07. **R.,** **03,** 1209; **04,** 1764; **05,** 1323; **06,** 1243; **07,** 1337.

Capt. H. B. Ferguson, 1908–10. **R.,** **08,** 1397; **09,** 1387; **10,** 1532.

Lt. Col. G. D. Fitch, 1911–. **R.,** **11,** 1670; **12,** 1886.

Assistant. A. W. Barber. **R.,** **85,** 1260.

OPERATIONS.

1881-82. 51,943 c. y. dr., resulting in increasing the chan. d. from 2½′ to 3′, **82,** 1267.

1882-83. Dr. chan. 9½′ x 75′, **83,** 980.

1883-84. 2,290 c. y. dr., resulting in chan. from 60′ to 75′ w. and 9½′ d., **84,** 1176.

1884-85. 27,000 c. y. removed in formation of dr. chan. 9½′ x 60′, **85,** 1259.

1886-87. 4,607 c. y. dr. at Carrabelle and 18,885 c. y. at Apalachicola Bar, **87,** 1265.

1887-88. 7,688 c. y. dr. from the bar, **88,** 1161.

1889-90. 65,547 c. y. mud and sand removed from the chan., **90,** 1624.

1891-92. 54,458 c. y. dr., **92,** 1398.

1892-93. 55,126 c. y. dr., **93,** 1691.

1895-96. 54,253 c. y. dr., **96;** 1341–1346.

1896-97. 45,000 c. y. dr., **97,** 1606.

1899-00. 75,653 c. y. dr., **00,** 2093.

1902-03. 74,256 c. y. dr., **03,** 1210.

1904-05. 60,020 c. y. dr. from outer bar, 68,000 from mouth of R., **05,** 1324.

1905-06. 40,058 c. y., s. m., dr. from mouth of R.; 78,997 c. y., s. m., from Link Chan.; wharf built near e. end of St. Vincents Isld.; U. S. dr. *Charleston* removed 139,265 c. y., **06,** 1243.

1907-08. 295,365 c. y. dr.; 6,000 l. f. bulkhead built at e. side of chan., **08,** 1397.

1908-09. Bulkhead at e. side of chan. completed; 7,697 c. y. oyster shells placed along dike, **09,** 1387.

1909-10. 1,655′ bulkhead rebuilt and strengthened; 11,000 c. y. dr., **10,** 1532.

1910-11. Bulkhead repaired by renewing sheet piling and placing oyster shells in the e. and w. ends, **11,** 1670.

1911-12. 133,650 c. y. removed at mouth of R.; bulkhead repaired by hired labor, **12,** 1886.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1657; **98,** 1377; **99,** 1649; **10,** 437; **11,** 467, 1670.

Nearest Hs., at Pensacola and Tampa, 150 and 230 m. distant, resp., **01,** 1768.

Shoaling due to wave action, and strong w. cross currents; hurricane seriously damaged chan. across outer bar of West Pass, **07,** 350.

PROJECTS.

By Capt. Damrell, 1879, dr. chan. 11′ x 100′ through the bar in the B. at the mouth of the R.; est., $100,000, **79,** 823; **85,** 1258; **87,** 1265.

Auxiliary works needed to make imp. permanent, **80,** 1077; **86,** 193; **87,** 1265.

In 1890, after the app. of $107,000, est. $40,000 would be required for completion, **90,** 1624. Dr. chan. 9′ d. and not less than 100′ w. au., 1890, across Bulkhead Shoals, **12,** 574.

Maj. Mahan, 1896, est. $350,000 to imp. chan. and $20,000 to $30,000 would be required an. for mainten., **97,** 1656–1659. Au., 1899, **12,** 575.

$15,000 required to maintain chan. at R. mouth, and $15,000 for dr. chan. across the sea bar, **01,** 1767.

Importance of d.-w. H. urged by Capt. Judson; est., $500,000 to complete imp., excl. of work on sea bar (see Pensacola H.), **01,** 1768.

Amended proj. to provide for d. of 10′ instead of 18′, and w. of 100′ across bar at mouth of Apalachicola R., thence through Link Chan. and West Pass to the Gulf, to provide chan. 150′ w. instead of 100′, and 18′ d.; est., $85,000 addl. and $17,500 an. mainten.,[1] **06,** 355; **12,** 575.

SURVEYS.

Minor ex., **94,** 1251; **95,** 1613.

H. lines estab., **96,** 1341–1346.

Sur. with view to chan. 18′ x 100′ m. l. w. au. act June 3, 1896; **R.** (fav.; see Projects), by Maj. Mahan, 1896, **97,** 1655.

Of St. Georges Sound, incl. Apalachicola and Carrabelle Hs., au. act Mar. 3, 1905; made, 1905; **R.** by Capt. Cavanaugh,[1] **06,** 355.

Of bar at mouth of R., **07,** 1337.

Minor, local, **10,** 1532.

Maps. **86,** 1142; **90,** 1624; **12,** 1886.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 575.

[1] H. D. 422, 59th, 1st.

Q-21 APALACHICOLA (including Chipola River) RIVER, FLA.

Part.	Title.	Period.	Appropriations.
a	Apalachicola R., including Cut-off, Lees Slough, and lower Chipola R.	1828–1904	$86,750
b	Chipola R. (upper)	1835–1904	16,000
c	Apalachicola R., including Cut-off, Lees Slough, lower Chipola and upper Chipola Rs.	1905–1912	78,500
	Total		[1] 181,250

Part (a), Q-21 Apalachicola River (including the cut-off, Lees Slough, and lower Chipola River.)[2]

APPROPRIATIONS.

1828, $3,000, act May 23.
1830, 2,000, act Apr. 23.
1831, 8,000, act Mar. 2.
1874, 10,000, **74,** 76, 896.
1875, 10,000, **75,** 81, ii, 9.
1878, 8,000, **78,** 80, 591.
1879, 5,000, **79,** 103, 822.
1880, 2,000, **80,** 1075.
1881, 1,500, **81,** 1190.
1882, 2,000, **82,** 1265.
1884, 1,000, **84,** 1175.
1886, 1,000, **86,** 1155.
1888, 2,000, **88,** 1160.
1890, 2,000, **90,** 1622.
1892, 5,000, **92,** 1401.
1894, 5,000, **95,** 1616.
1896, 5,000, **96,** 1350.
1899, 3,000, **99,** 1654.
1900, *1,500, **01,** 1771.
1902 { 6,000, **02,** 1258.
1902 { *3,750, **04,** 1767.

Total, 86,750

COMMERCE.

Country bordering R. dependent upon R. for transportation, **96,** 1350; **03,** 293. In 1898 it was improbable that R. would be much used above Cut-off, even if cleared out, **98,** 1424.

C. a part of Chattahoochee, Flint, and Chipola system; combined value, about $16,000,000 at 1912, **12,** 577.

ENGINEERS.

Chief of Engineers. R., 70, 32, 63; **71,** 69; **72,** 63, 64; **73,** 67; **74,** 75; **75,** 81; **76,** 72; **77,** 71; **78,** 80, 81; **79,** 103; **80,** 135, 140; **81,** 182, 189; **82,** 178, 185; **83,** 189; **84,** 197; **85,** 198; **86,** 196; **87,** 162; **88,** 151; **89,** 175; **90,** 156; **91,** 197; **92,** 193; **93,** 212; **94,** 197; **95,** 224; **96,** 199; **97,** 254; **98,** 251, 259; **99,** 290; **00,** 330; **01,** 352; **02,** 284; **03,** 292; **04,** 305.

In charge:

Maj. C. B. Reese, 1870, **R., 71,** 68.
Capt. A. N. Damrell, 1870, **R., 71,** 68.
Col. J. H. Simpson, 1870–73. **R., 71,** 577; **72,** 583, 612.
Lt. Col. W. F. Raynolds, 1873, **R., 73,** 66.
Capt. A. N. Damrell, 1873–84. **R., 73,** 698; **74,** 896; **75,** ii, 9; **76,** 494; **77,** 414; **78,** 590; **79,** 821, 823; **80,** 1075; **81,** 1188; **82,** 1264–1304; **83,** 979; **84,** 1174.
Capt. W. T. Rossell, 1884–86. **R., 85,** 1275.
Lt. W. M. Black, 1886–87. **R., 86,** 1153.
Capt. R. L. Hoxie, 1887–89. **R., 87,** 1263; **88,** 1159.
Capt. P. M. Price, 1889–93. **R., 89,** 1372, 1416; **90,** 1621; **91,** 1696; **92,** 1400; **93,** 1692.
Maj. F. A. Mahan, 1894–99. **R., 94,** 1252; **95,** 1615; **96,** 1346; **97,** 1609; **98,** 1381, 1423.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1653; **00,** 2095.
Capt. W. V. Judson, 1901. **R., 01,** 1769.
Lt. R. R. Raymond, 1902. **R., 02,** 1257.
Capt. J. B. Cavanaugh, 1903–04. **R., 03,** 1212; **04,** 1766.

Assistants:

Capt. A. N. Damrell. **R., 72,** 613.
C. F. Trill. **R., 72,** 620.
Walter Griswold, **R., 73,** 700.
M. J. Mack. **R., 73,** 698.
P. J. Quattlebaum. **R., 79,** 824.
H. Haines. **R., 82,** 1305.
M. J. Mack, **R., 86,** 1154.
T. Robinson. **R., 89,** 1418; **91,** 1697.

ESTIMATES. (See Plans and Projects.)

By Col. Simpson and Capt. Damrell, 11′ chan. at R. mouth, 200′ w., $185,000, **72,** 584, 612. Various est. submitted by C. F. Trill, **72,** 612, 623.

By Capt. Damrell and Mr. Mack, R. imp., $80,333, **73,** 698, 699.

By Capt. Damrell, 11′ chan. at R. mouth, $100,000, **79,** 823.

By P. J. Quattlebaum, 11′ chan. at R. mouth, $85,000, **79,** 824.

OBSTRUCTIONS.

Brs. without draws on the Chipola prevent boats reaching Marianna, **98,** 1424.

OPERATIONS.

1838. Dr. through bar, **72,** 619.

1874–75. Removal of rafts, snags, etc., and straightening the chan. at Moccasin Slough, **75,** 81, ii, 9.

1875–76. Imp. chan. at Moccasin Slough and Styx R., **76,** 72, 494.

1876–77. Removal of rafts and stumps at Moccasin Slough, **77,** 71, 414.

1877–78. Snags, logs, etc., removed, a dam 130′ l. built, and 486 c. y. of earth removed, **78,** 80 591.

1878–79. Snags, rafts, and overhanging timber removed at various points along the R. Chipola Cut-off opened, **79,** 103, 821.

1879–80. Canal 5′ x 70′, cut between Apalachicola R. and Moccasin Slough; removal of raft from Styx R., **80,** 1076.

1880–81. Removal of 676 snags and overhanging trees and 2,233 c. y. of dr. material, **81,** 1189.

1881–82. 165 snags and overhanging trees, 2 rafts, and 3,000 c. y. of dr. material removed, **82,** 1265.

[1] $172,250, excluding Chipola R., **12,** 1889. * Allotment.
[2] Combined by act of 1905, with Apalachicola R. and other works.

1882-83. Removal of drift from Moccasin Slough, **83,** 979.

1883-84. Widening Moccasin Slough Canal by removal of 240 c. y. of clay and 3,679 snags and overhanging trees, **84,** 1175.

1885-86. Removal by hired labor of 110 snags and logs from chan. above Moccasin Slough, **86,** 1155; completion of imp. as orig. proj., **86,** 1154.

1886-87. 33 snags and 141 leaning trees removed, **87,** 1264.

1887-88. Imp. completed as proj., **88,** 1160.

1888-89. 304 logs and snags removed from the chan. and 2,328 overhanging trees and logs removed from the banks, **89,** 1372.

1889-90. 366 logs and snags removed from the chan. and 1,246 overhanging trees cut from the banks, **90,** 1622.

1890-91. 582 logs, snags, and stumps removed from the chan. and 2,142 overhanging trees cleared from the banks, **91,** 1697.

1891-92. 313 snags cleared from the chan. and 878 trees, logs, and stumps removed from the banks, **92,** 1401.

1892-93. About 15,000 obstr. removed from the banks and chans., **93,** 1694.

1894-95. About 10,000 obstr. removed, **95,** 1616.

1896-97. About 5,000 obstr. removed, and snag boat repaired, **97,** 1610.

1897-98. About 200 obstr. removed, **98,** 1382.

1899-00. 6,262 snags and overhanging trees, 633 cords brush, and 235 c. y. clay removed from the chan. and banks; 536 l. f. js. finished and 70 l. f. fascines laid, **00,** 2097.

1900-03. Overhanging trees cut from bank, and snags and logs removed, **01,** 1770; **03,** 1212.

1903-04. Overhanging trees cut from bank, and snags and logs removed; 24,453 c. y. dr., **04,** 1766.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 618, 622; **73,** 699; **79,** 824; **97,** 1609; **98,** 1381, 1382; **01,** 352.

Description of the Cut-off and the Chipola R., **89,** 1416; **93,** 1694; **94,** 1253; **98,** 1423.

From junction of Chattahoochee and Flint Rs. to Gulf of Mexico (Apalachicola B.) the R. is 137 m. l.; w., 150–300 yds.; d., about 6′ m. l. w., **12,** 576.

PLANS. (See Estimates and Projects.)

By Capt. Damrell, 1881, imp. Chipola R, Marianna to Apalachicola R., by dr. and removal of obstr.; est., $21,000, **82,** 1304.

PROJECTS. (See Estimates and Plans.)

By Col. Simpson and Capt. Damrell, dr. 11′ chan., 100′ w., through the bar at mouth of R. $100,000, **72,** 63, 584, 612, 619.

By Capt. Damrell, 1874, for chan. of navigable w. and 6′ d. by removal of snags and overhanging trees, and by utilizing Styx R. and Moccasin Slough, to avoid worst part of Apalachicola R.; est., $80,333, **73,** 698. Proj. accomplished in 1880 by expend. of $37,244, **80,** 1076. In addition to orig. proj., Chipola Cut-off opened to Whites Bluff, **82,** 1265. An. app. required for preservation of imp., $2,000, **85,** 1276; **86,** 1154.

Ex. Chipola R., mouth to Wewachitka, and the Cut-off and Lee Slough running from the Apalachicola to the Chipola R., made in 1889, resulted in recom. that chan. 5′ x 60′ be cleared through Cut-off, Lees Slough, and the Lower Chipola R.; est., $7,500, **89,** 1417; **91,** 1696; **12,** 576.

Capt. Price, 1893 est. that $2,000 would be required an. for mainten. of an unobstr. chan., **93,** 1694.

Capt. Cavanaugh suggested, 1904, that the Cut-off, Lees Slough, and lower Chipola R. be imp. instead of old chan. of R., **04,** 1767.

SURVEYS.

Under direction of Col. Simpson, by Capt. Damrell and C. F. Trill, 1871, **71,** 577. **R., 72,** 584, 612, 613, 620.

Under direction of Lt. Col. Raynolds and Capt. Damrell, by M. J. Mack, 1872–73. **R., 73,** 698.

Under direction of Capt. Damrell, by C. J. Quattlebaum, 1879. **R., 79,** 823, 824.

Au. act June 14, 1880, **80,** 141; made by Capt Damrell, **82,** 1304.

Ex. of Chipola R., mouth to Marianna, au. act Aug. 11, 1888; made, 1889, by Capt. Price, **89,** 1416. (See Projects, 3d par.)

Ex. Chipola R., Fla., Marianna to its connection with the Apalachicola R., au. act June 3, 1896; Maj. Mahan's **R.,** 1897, unfav., **98,** 1423.

Maps. **91,** 1697.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 579.

Part (b), Q-21 Chipola River (Upper), Fla.[1]

APPROPRIATIONS.[2]

1835,	$5,000, act Feb. 24.
1836,	4,000, act July 2.
1899,	5,000, **99,** 1656.
1902,	2,000, **02,** 1259.
Total,	16,000

COMMERCE.

Little benefit above Look and Tremble Shoal; great benefit below, **04,** 307.

ENGINEERS.

Chief of Engineers. R., 99, 291; **00,** 331; **01,** 353; **02,** 285; **03,** 294; **04,** 307.

In charge:

Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1655; **00,** 2099.

Capt. W. V. Judson, 1901. **R., 01,** 1771.

Lt. R. R. Raymond, 1902. **R., 02,** 1258.

Capt. J. B. Cavanaugh, 1903–04. **R., 03,** 1213; **04,** 1768.

OBSTRUCTIONS.

Three brs. near Marianna, **99,** 1655.

OPERATIONS.

1899-00. Over 10,800 snags and other obstr. removed from banks and chan., and 235 c. y. dr., **00,** 2100.

1903-04. Trees, stumps, snags, and logs removed from the Dead Lakes, **04,** 1768.

PHYSICAL CHARACTERISTICS.

Description of; many districts, **99,** 1655.

PROJECTS.

By Capt. Price, 1889, clearing out l.-w. chan. 3′ x 60′, Marianna to foot of Dead Lakes; est., $41,000, **89,** 1416. Modified, 1899, to permit work to begin at Marianna, and on that section down R. to Look-and-Tremble Shoals, **99,** 1655.

Capt. Cavanaugh recom., 1903, that further work of imp. be confined to removal of obstr. between Look-and-Tremble Shoals and foot of Dead Lakes, and dr. chan. at Sister Islds.; est., $8,500, **03,** 1214.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 579.

[1] Combined by act of 1905, with Apalachicola R. and other works.

[2] App. subsequent to 1836, up to 1899, were made with those for Apalachicola R., q. v.

Part (c), Q-21 Apalachicola River, including the Cut-off, Lees Slough, Lower Chipola and Upper Chipola Rivers, Fla.

APPROPRIATIONS.

1905,	$12,000,	**05,** 1328.
1906,	*5,000,	**07,** 1342.
1907,	25,000,	**07,** 1342.
1909,	*13,000,	**09,** 1390.
1910,	6,500,	**10,** 1536.
1911,	5,000,	**11,** 1673.
1912,	12,000,	**12,** 1889.
Total,	78,500	

COMMERCE.

Inseparably combined with that of Chattahoochee, Flint, and upper Chipola Rs.; increased from $4,000,000 to over $10,000,000 from 1899 to 1909, **10,** 440.

Details, **11,** 469, 470; **12,** 577, 579.

Letters from C. interests relative to imp.[1]

ENGINEERS.

Chief of Engineers. R., 05, 313; **06,** 336; **07,** 351; **08,** 373; **09,** 390; **10,** 439; **11,** 468, 469; **12,** 576, 578.

In charge:

Capt. J. B. Cavanaugh, 1905–07. **R., 05,** 1326; **06,** 1246; **07,** 1339.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1399; **09,** 1388; **10,** 1534.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1672; **12,** 1888, 1889.

OPERATIONS.

1904–05. Overhanging trees cut from bank, and snags and logs removed; 22,894 c. y. dr., **05,** 1326.

1905–06. Overhanging trees cut from bank, and snags and logs removed; 15,177 c. y. dr., **06,** 1246.

1906–07. Overhanging trees and stumps removed; 46,297 c. y. dr. from lower Chipola R., **07,** 1339.

1907–08. Trees, stumps, logs, and snags removed; 62,562 c. y. dr., **08,** 1399.

1908–09. Trees, stumps, and snags removed; 62,461 c. y. dr., **09,** 1389.

1909–10. 74 obstr. removed from Apalachicola R. and 4,514 from the Cut-off and lower Chipola R.; 47,497 c. y. dr., **10,** 1534.

1910–11. 3,582 snags and other obstr. removed from mouth of Dead Lake to Jones Lake, upper Chipola R., **11,** 1672. 7,800 c. y. dr. and 74 snags and other obstr. removed from Cut-off and lower Chipola, **11,** 1672.

1911–12. 244 snags and other obstr. removed from Apalachicola R., **12,** 1888. 43,415 c. y. dr., and 181 snags and other obstr. removed from Cut-off and lower Chipola R., **12,** 1888. 3,050 c. y. dr. and 845 snags and other obstr. removed from upper Chipola R., **12,** 1889.

PHYSICAL CHARACTERISTICS.

Details, **10,** 439, 440; **11,** 468, 469, 470; **12,** 577, 578, 579.

PROJECTS.

Act 1905 combined imp. of upper Chipola R., Marianna to its mouth with Apalachicola, lower Chipola R., the Cut-off, and Lees Slough, **05,** 314.

Lt. Col. Fitch recom. no further work be done save to keep the d. gained in Apalachicola, the Cut-off, Lees Slough, and lower Chipola R., **12,** 1889.

SURVEYS.

Pre. ex. Chipola R. au. act June 25, 1910. **R.** by Lt. Col. Fitch, May 18, 1911.

Imp. above Look-and-Tremble Shoal unworthy, but below that point recom. snagging and R. regulation.[1]

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 579.

Q-23 CHATTAHOOCHEE AND FLINT RIVERS, ALA., FLA., AND GA.[2]

Part.	Title.	Period.	Appropriations.
a	Chattahoochee and Flint Rs., Ala., Fla., and Ga.	1871–1879	$122,000.00
b	Chattahoochee R., Ala. and Ga.	1880–1912	972,650.00
c	Flint R., Ga.	1880–1912	313,500.00
	Total		1,408,150.00

* Allotment.

[1] H. D. 463, 62d, 2d.

[2] Sur.—R., July 4, 1853; est., $30,000 ($12,000 for Flint R.). (H. D. 482, 55th, 2d.)

Part (a), Q-23 Chattahoochee and Flint Rivers, Ala., Fla., and Ga.

APPROPRIATIONS.

1835,	[1] $2,000,	act Feb. 24.
1874,	25,000,	**74,** 76, 896; **75,** 81.
1875,	25,000,	**75,** 82.
1876,	20,000,	**76,** 73, 495.
1878,	[1] 18,000,	**78,** 170; **79,** 819.
1878,	[2] 10,000,	**78,** 170; **79,** 819.
1879,	[1] 15,000,	**79,** 102, 816.
1879,	[2] 7,000,	**79,** 818.
Total,	122,000	

COMMERCE.

Statistics, Chattahoochee and Flint, **77,** 416; **78,** 592; **79,** 816. Chattahoochee, **72,** 625; **73,** 702. Flint, **73,** 709; **79,** 821.

ENGINEERS.

Chief of Engineers. R., 71, 69; **72,** 63, 64; **73,** 67, 68; **74,** 76; **75,** 81; **76,** 73; **77,** 71; **78,** 80, 81, 105; **79,** 101, 102, 142.

In charge:
Col. J. H. Simpson, 1871. **R., 72,** 584.
Capt. A. N. Damrell, 1873–. **R., 73,** 699, 707; **74,** 896; **75,** ii, 10; **76,** 494; **77,** 415; **78,** 591, 592; **79,** 814, 817, 818.

Assistants:
C. F. Trill. **R., 72,** 623.
M. J. Mack **R., 73,** 698.
W. Griswold. **R., 73,** 700.
H. A. Pattison, **73,** 707.
H. K. Hodges. **R., 73,** 708.
H. Oladowski, **75,** ii, 10.
P. Robinson. **R., 79,** 818.

ESTIMATES. (For Chattahoochee, unless otherwise stated.)

By C. F. Trill, 1872, imp. of R. from Columbus to its mouth, at Apalachicola: 1st, $464,000; 2d, $327,000; 3d, $85,185, **72,** 63, 585, 629–635.

By Capt. Damrell, W. Griswold, and M. J. Mack, 1873, Columbus, Ga., to Chattahoochee: 1st, $63,333; 2d, $81,914; 3d, $982,945, **73,** 700, 704–707.

By Capt. Damrell, 1873, removal of snags, r., gravel, etc., and constr. of dams, $145,247.66, **74,** 897. In 1879, to complete existing proj., $105,000, and $5,000 an. mainten., **79,** 816.

By Capt. Damrell and H. K. Hodges, 1873. 3′ chan. in Flint R., Chattahoochee to Albany, $184,862, **73,** 707, 721; **74,** 897. Completion of existing proj., $105,000, and $2,000 an. mainten., **79,** 818.

By Capt. Damrell and P. Robinson, 1879, Flint R., Albany to Montezuma, $15,000 to $15,100, **79,** 819, 820.

By Capt. Damrell, 1873, Chattahoochee and Flint Rs., $330,109.66, **74,** 897.

OPERATIONS. [3]

Chattahoochee River:

1874–75. Confined chiefly to Wolfax (Woolfolks) Bar. A wreck, 500 c. y. sand, gravel, and r., a large number of snags, sunken logs, and overhanging trees removed from above and below the bar; 275′ of j. built, **75,** 81, ii, 10.

1875–76. J. extended 235′; constr. of 200′ of new j. below the bar and 380 ′ of break'r; obstr. removed, **76,** 73, 495.

1876–77. Snags, etc., removed, js. repaired; extension of break'r 560′, and several shoals imp. by blasting, **77,** 71, 415.

1877–78. Completion of 4′ chan. over Wolfax Bar by constr. of shore-protection js. and wing dams; snags and logs removed; chan. 4′ x 60′ obtained by blasting r. on shoals, **78,** 80, 591.

1878–79. Snags and trees removed, js. repaired, and 640′ of brush wing dams built at Upatoi Bar, **79,** 101, 814.

Flint River:

1875–76. Obstr. removed, **76,** 495.

1877–78. 4′ x 60′ chan. obtained between Bainbridge and Lamberts Isld. by blasting r. and the removal of sunken logs, etc., **78,** 80, 592.

1878–79. Completion of imp. at Lamberts Isld., Broad Axe, Bryants Rocks, Cross Chute, and Red Bluff, **79,** 102, 817.

PHYSICAL CHARACTERISTICS.

Of Chattahoochee, **72,** 627; **73,** 702.
Of Flint, **73,** 707, 713; **79,** 820.

PLANS. (See Estimates.)

By Capt. Damrell, W. Griswold, and M. J. Mack, 1873, between Chattahoochee, Fla., and Columbus, Ga., removal of obstr., and d. and w. chan., **73,** 700, 704–707.

PRIVATE (STATE) WORK.

Indifferent results obtained from apps. from the State prior to the war, **72,** 627.

PROJECTS. (See Estimates and Plans.)

By Capt. Damrell, 1873, 4′ chan. in Chattahoochee, by removing obstr. and straightening and w. chan., **73,** 700; **74,** 897.

By Capt. Damrell, 1873, 3′ chan. in Flint R., below Albany, by blasting, dr., wing dams, etc., **73,** 707; **74,** 897. In 1879, removal of obstr. from Albany to Montezuma, **79,** 819.

SURVEYS.

Chattahoochee River:
Early attempts at, **72,** 627.

By C. F. Trill, under direction of Col. Simpson, 1871–72, from Columbus to Eufaula. **R., 72,** 584, 623.

By W. Griswold and M. J. Mack, 1872, under direction of Col. Simpson and Capt. Damrell, Eufaula to mouth at the junction with the Flint, **73,** 699, 700.

By Capt. Wm. R. King, above Columbus, **78,** 105; **79,** 142.

Flint River:

By H. K. Hodges and H. A. Pattison, 1872–73, under direction of Col. Simpson and Capt. Damrell, from Chattahoochee, Fla., to Albany, Ga. **R., 73,** 707, 708.

By P. Robinson, 1878–79, under direction of Capt. Damrell, Albany to Montezuma. **R., 79,** 818, 820.

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[1] Chattahoochee. For continuing imp., Cedar Bluff to the Big Spring, Fla., "according to the report of the assistant quartermaster charged with the superintendence of the removal of obstructions."—Treas. Doc. 373, 1882.
[2] Flint.
[3] History of operations to 1879, **79,** 814, 817.

Part(b), Q–23 Chattahooche River, Ala. and Ga.

APPROPRIATIONS.

1880,	$20,000.00,	**80,** 1073.
1881,	20,000.00,	**81,** 1186.
1882,	25,000.00,	**82,** 1261.
1884,	35,000.00,	**84,** 1167.
1886,	20,000.00,	**86,** 1169.
1888,	20,000.00,	**88,** 1183.
1890,	20,000.00,	**90,** 1648.
1892,	[1] 25,000.00,	**92,** 1406.
1894,	[1] 30,000.00,	**95,** 1620.
1896,	[1] 25,000.00,	**96,** 1357.
1899,	[1] 50,000.00,	**99,** 1662.
1902,	100,000.00,	**02,** 1264.
1904,	*32,650.00,	**04,** 1775.
1905,	75,000.00,	**05,** 1334.
1906.	*10,000.00,	**07,** 1347.
1907,	150,000.00,	**07,** 1347.
1909,	*115,000.00,	**09,** 1394.
1910,	75,000.00,	**10,** 1540.
1911,	75,000.00,	**11,** 1678.
1912,	50,000.00,	**12,** 1895.
Total,	[2] 972,650.00	(incl. $87,000 app. between 1835 and 1879, incl., included under Part(a), and less $20,000 used between West Pt. and Franklin and $2,000 carried to surplus fund, and $280.78 carried as a transfer from one % to another of the same app., $1,037,930.78, **12,** 1895.)

COMMERCE.

Navigation benefited by imp., **90,** 1646.
Description of, **93,** 1700; **96,** 1363; **97,** 1619.
Maintenance of a good navigable chan. of great importance to large section of country extending from Columbus, Ga., to Apalachicola, Fla., **93,** 1700.
In 1897–98 apparently no C., West Pt. to Franklin, **98,** 1393.
Few RRs., R. C. therefore large, **02,** 1264.
Rates reduced, **08,** 380; **10,** 445.
In 1911, 117,115 t., **12,** 584.
C. is combined "inseparably" with that of Flint, Apalachicola, and Chipola Rs.
Columbus, Ga., at head of navigation, having magnificent water power, rapidly becoming one of greatest mfg. centers of South. This fact, and completion of d. w. H. proj. at mouth of above system of Rs., has tendency to increase C. value of U. S. imps., **12,** 1895.
Effect of U. S. imp. to give reduced rates over "all-rail" rates, **12,** 584.
"The commerce of this stream consists of cotton, cotton seed, fertilizers, grain, naval stores, provisions, hardware, and general merchandise, and is so combined with that of the Flint and Apalachicola Rivers that a separation is impossible. It is given under the report of the Flint River as 117,115 short tons in 1911, valued at $15,784,029.
"The effect of the improvement has been to give to Columbus and all other points on the river water rates, or a material reduction over rates to all-rail points, but the exact amount of reduction can not be stated." **12,** 584.

CONTRACTS.

1888. M. A. Sweeney & Bro., drilling barge, $3,400; dumping flat, $600, **89,** 1395.
1900. M. A. Sweeney Shipyard & Foundry Co., dipper dr., $13,749, **00,** 2109.
1903. M. A. Sweeney Shipyard & Foundry Co., constr. and equipping one stern-wheel towboat $20,700; 2 r. barges, $8,000; 1 suction dr., $12,900; and 2 dump scows, $7,600, **03,** 1220.
1905. Hartley Boiler Works, steel boiler, $681.50; Wm. Beach Hardware Co., 2,000 lbs. dynamite, **05,** 1334.

ENGINEERS.

Chief of Engineers. R., 80, 134, 190; **81,** 182, 189; **82,** 177, 252; **83,** 188; **84,** 196; **85,** 202; **86,** 200; **87,** 169; **88,** 156; **89,** 181; **90,** 164; **91,** 199, 211; **92,** 195; **93,** 215; **94,** 200, 201; **95,** 227; **96,** 201; **97,** 256, 257; **98,** 252, 253; **99,** 293, 294; **00,** 333, 334, 344; **01,** 355, 363, 1793; **02,** 286, 293; **03,** 296; **04,** 309; **05,** 317; **06,** 341; **07,** 356; **08,** 378; **09,** 395; **10,** 444; **11,** 473; **12,** 583.

In charge:
Maj. W. R. King, 1878–80. **R., 80,** 1705; **82,** 1875.
Maj. A. N. Damrell, 1880–85. **R., 80,** 1070; **81,** 1182; **82,** 1259; **83,** 973; **84,** 1167.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1303; **86,** 1168; **87,** 1283; **88,** 1181.
Capt. P. M. Price, 1889–93. **R., 89,** 1393; **90,** 1645; **91,** 1702; **92,** 1405; **93,** 1698.
Maj. F. A. Mahan, 1894–98. **R., 94,** 1258, 1261; **95,** 1619, 1623; **96,** 1356, 1364; **97,** 1616, 1620; **98'** 1387, 1393.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1660, 1663; **00,** 2106, 2110.
Capt. W. V. Judson, 1901. **R., 01,** 1775, 1777, 1793.
Lt. R. R. Raymond, 1902. **R., 02,** 1263.
Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1218; **04,** 1773; **05,** 1332; **06,** 1251; **07,** 1345.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1405; **09,** 1393; **10,** 1539.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1676; **12,** 1893.

Assistants:
B. W. Frobel. **R., 80,** 1708.
D. L. Sublett. **R., 80,** 1719.
T. Robinson. **R., 89,** 1395; **90,** 1646; **91,** 1758.

OPERATIONS.

1879–80. Barge, magazine boat, and scow built; 2,693 l. f. j. built; 51 snags and 580 c. y. r. removed, **80,** 1071.
1880–81. 2 barges built, 1 steamer repaired, 1,769 c. y. r. removed, **81,** 1183.
1881–82. 640 snags and trees removed, 1,682 l. f. j. built, and 77 l. f. repaired; 2,614 c. y. r. removed, 960 cords brush fascines constr., **82,** 1259.
1882–83. 292 snags and trees and 1,968 c. y. r. removed; 2,060 l. f. j. built, **83,** 973.
1883–84. 634 snags and trees and 2,531 c. y. r. removed; 2,377 l. f. of brush js. built; 2 barges, 2 skiffs, and 3 bateaux built, **84,** 1168.
1884–85. 1,100 snags, logs, and trees, 3 wrecks from chan., and 3,764 c. y. r. removed, **85,** 1304.
1885–86. 4,473 c. y. r. removed; steam snag boat completed and equipped, **86,** 1168.
1886–87. 1,733 logs and trees removed by US. snag boat; 3,007 c. y. marl excavated at Uchee Shoals, **87,** 1284.
1887–88. 3,818 c. y. marl and 1,354 snags, logs, and trees removed; repairs made to js. at Mound Bar, **88,** 1182
1888–89. 753 c. y. r. and 2,225 logs, snags, and overhanging trees removed, **89,** 1395.
1889–90. 576 c. y. r. and 904 snags and logs removed, **90,** 1647.

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* Allotment.
[1] See Projects. $5,000 used between West Point and Franklin.
[2] $20,000 used between West Pt. and Franklin, Ga., and $2,000, app. of 1835, carried to surplus fund, **10,** 1540.

1890-91. 25 trees cleared from the banks, 10 snags and 166 c. y. marl removed from chan., and extensive repairs made to snag boat *Chattahoochee*, **91,** 1702.

1891-92. 366 snags and 1,500 c. y. gravel removed from chan.; 1,100 l. f. pile-and-brush bank protection and j. work built, **92,** 1406.

1892-93. 1,500 obstr. removed, 805 c. y. gravel and 567 c. y. r. removed; 1,700 l. f. dams and 400. s. y. protection mats constr., and the hull of an old boat sunk to form a j. 135 l. f. l., **93,** 1699, 1702.

1893-94. 66 obstr. removed from the banks and stream, and 270 c. y. r. excavated and removed, 2 spur dams built and repairs made to snag boat, and 178 l. f. training dams built, **94,** 1259, 1263.

1894-95. 450 obstr. removed, 257 c. y. r. removed, 11,282 c. y. gravel and sand removed, 600 s. y. bank protection built, and 1,953 l. f. dams repaired, **95,** 1621, 1625.

1895-96. 29 obstr. removed, 4,165 s. y. plowed, 695 c. y. gravel removed by scrapers, 230 l. f. longitudinal dikes and 30 l. f. shore protection built; repairs made to dikes, rebuilding of snag boat in progress, and 395 c. y. r. excavated and removed, **96,** 1361, 1362, 1364.

1896-97. About 1,600 obstr. and 102 c. y. r. removed, and rebuilding of snag boat in progress, **97,** 1617.

1897-98. About 2,000 obstr. removed, 25 c. y. r. and about 3,000 c. y. gravel also removed; 43 c. y. r. placed as ballast in an old hull, 297 s. y. landslides plowed, 10 cords of brush used in making bank protection, 1,950 l. f. bank protection, 1,430 l. f. dams and js., and 230 l. f. old dams repaired **98,** 1390.

1898-99. Snag boat *Chattahoochee* repaired, and some obstr. in chan. between Columbus and Burdocks Landing removed, **99,** 1661.

1899-00. 4,574 snags and overhanging trees, 2,942 c. y. r. and clay, and a wreck removed from banks and chan.; js. repaired and willows planted for shore protection, **00,** 2107, 2108.

1900-01. Gravel, sand, and r. shoals removed, overhanging trees trimmed and removed, and 825 c. y. r. deposited in old and new js., **01,** 1776.

1901-02. 1,198 logs, trees, and other obstr., and 775 c. y. marl, gravel, and sand removed, **02,** 1263.

1902-03. 5,436 logs, snags, and other obstr. removed, and 1,346 l. f. j., etc., built at Jenny Isld., **03,** 1218.

1903-04. 2,341 logs, snags, and other obstr. removed, 35,928 c. y. sand and gravel dr., and 3,016 l. f. j. constr., **04,** 1774.

1904-05. 1,949 logs, snags, and other obstr. removed, 120,134 c. y. sand and gravel dr., 9,191 l. f. j. constr., and 790′ repaired, **05,** 1333.

1905-06. 605 logs, snags, and other obstr. removed, 76,631 c. y. sand and gravel dr., and 7,679 l. f. js. constr., **06,** 1251.

1906-07. 2,821 logs, snags, and other obstr. removed, 20,225 c. y. marl and 35,065 c. y. sand and gravel dr., and 721 l. f. js. partially constr., **07,** 1346.

1907-08. 148 logs, snags, and other obstr. removed, 73,062 c. y. marl and gravel dr., and 13,700 l. f. js. constr., **08,** 1405.

1908-09. 9,118 snags and other obstr. removed, 83,925 c. y. dr., and 11,617 l. f. js. built, **09,** 1393.

1909-10. 8,331 snags and other obstr. removed, 53,448 c. y. dr., and 10,162 l. f. js. built and repaired, **10,** 1539.

1910-11. 214 snags and trees removed, 13,124 l. f. js. built and repaired, 99,655 c. y. dr., and repairs made to dr., **11,** 1677.

1911-12. Repairs made to plant; 322 snags, 156 trees and 128 stumps removed; 10,065 l. f. js. built and repaired; 95,499 c. y. dr.; proj. about 95% completed in upper section and 10% in lower section **12,** 594, 1894.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1618; **98,** 1387, 1390.

Description of, West Pt. to Franklin, **93,** 1701; **94,** 1261.

Unusual and prolonged drought stopped all navigation in summer of 1904, **04,** 310.

Chan. for 32 m. below Columbus regulated by js., and most serious bars in R. kept open by dr.; Columbus has become head of navigation; increased d. since adoption of proj., 2′, **12,** 584.

Columbus, Ga., 223 m. above junction of Chattahoochee with Flint R., and 360 m. above mouth of Apalachicola R., which is formed by confluence of the Chattahoochee and Flint. Chattahoochee rises in n. part of Ga., and its mouth at junction with Flint R. is at sw. cor. of Ga. Its l. is about 400 m. Proj. section is from mouth to Columbus, **12,** 583.

PLANS. (See Projects.)

By Maj. King, 1880, Chattahoochee R., excavation of chan. through ledges and bars, removal of isolated and projecting r., and the building of j. dams to contract the chan. to its normal w. Also by the constr. of locks and dams where the fall is too great to be overcome by open-chan. navigation; est., $6,403,811, **80,** 1708, 1721.

By Maj. King, 1882, West Pt. to Bolton, 108 m., slackwater navigation by dr., wing and riprap dam constr., and the constr. of 8 locks; est., $486,474, **82,** 1876.

Capt. Judson recom., 1901, that imp. of section between West Pt. and Franklin be discontinued, **01,** 1777.

PRIVATE (CORPORATE) WORK.

The Chattahoochee Navigation Co. caused a sur. to be made of the R. West Pt. to Franklin, 1890, **93,** 1702.

PROJECTS. (See Plans.)

By Capt. Damrell, 1873, Chattahoochee R., mouth to Columbus, 224 m., formation of chan. 4′ x 100′ at l. w., by blasting, dr., removal of snags and logs, and the constr. of wing dams, **73,** 700; **80,** 1070; **86,** 200. Orig. est., $385,247.66, **86,** 1169; **87,** 1283.

Acts of 1892, 1894, 1896, 1899 each app. $5,000 for between West Pt. and Franklin.

By Capt. Price, 1892, removal from the R. between West Pt. and Franklin of the lesser r. shoals, sand, and gravel bars by excavation and by works of contraction; removal of overhanging trees from the banks, and snags, logs, and other obstr. from the chan., and the constr. of locks and dams to overcome the more serious obstr. to give a min. d. of 3′ at l. w.; est., $364,340.43, **93,** 1702, 1703. This proj. was abandoned with the exception of clearing obstr., and in 1895 Maj. Mahan recom. whole work be abandoned on account of the poor results, **95,** 1625.

SURVEYS.

Sur. above Columbus au. act June 18, 1878; made by Maj. King, 1880, **80,** 1705.

Sur. between West Pt. and Bolton au. act Mar. 3, 1879; made, 1881, by Capt. Damrell, **81,** 189.

Ex. between West Pt. and Bolton au. act Mar. 3, 1881; made, 1882, by Maj. King, **82,** 1875.

Ex. between West Pt. and Franklin au. act Sept. 19, 1890; made, 1890, by Capt. Price (Col. Comstock's **R.** unfav.), **91,** 1757.

Sur. of Chattahoochee R., Ga., West Pt. to Franklin, au. act Mar. 3, 1899, **00,** 344; made, 1900, by Capt. Flagler; est., $1,149,914,[1] **01,** 363, 1793; **02,** 293.

Maps. **80,** 1708; **93,** 1700; **98,** 1392.

[1] H. D. 111, 56th, 2d.

Part(c), Q-23 Flint River, Ga.

APPROPRIATIONS.

1880,	$20,000,	**80,** 1075.
1881,	15,000,	**81,** 1188.
1882,	25,000,	**82,** 1263.
1884,	20,000,	**84,** 1173.
1886,	20,000,	**86,** 1164.
1888,	20,000,	**88,** 1177.
1890,	20,000,	**90,** 1639.
1892,	15,000,	**92,** 1404.
1894,	8,000,	**95,** 1619.
1896,	8,000,	**96,** 1355.
1899,	5,000,	**99,** 1658.
1902,	25,000,	**02,** 1261.
1905,	20,000,	**05,** 1331.
1907,	25,000,	**07,** 1344.
1909,	*25,000,	**09,** 1391.
1910,	25,000,	**10,** 1537.
1911,	7,500,	**11,** 1675.
1912,	10,000,	**12,** 1892.

Total, 313,500 (incl. $35,000 app. prior to 1879 under Part(a), $348,500, **12,** 1892).

COMMERCE.

Important, **83,** 977.
Increase in R. business due to imp., **88,** 1178.
Comparatively unimportant, **93,** 1697.
Combined with that of Chattahoochee and Apalachicola Rs.; effect of imp. on rates can not be determined, **10,** 443.
See Part(b).

CONTRACTS.

1888. M. A. Sweeney & Bro., snag boat, dumping flat, and drilling barge, $4,800, $600, and $3,400, resp., **89,** 1389.
1903. M. A. Sweeney Shipyard & Foundry Co., constr. and equipping snag boat, $7,460, and drilling barge, $2,960, **03,** 1216.

ENGINEERS.

Chief of Engineers. R., 80, 134; **81,** 182; **82,** 178; **83,** 188; **84,** 196; **85,** 201; **86,** 199; **87,** 167, 171; **88,** 155; **89,** 180, 185; **90,** 161; **91,** 198; **92,** 194; **93,** 213; **94,** 198; **95,** 225; **96,** 200; **97,** 255; **98,** 251; **99,** 292; **00,** 332; **01,** 354; **02,** 285; **03,** 295; **04,** 308; **05,** 316; **06,** 340; **07,** 354; **08,** 377; **09,** 394; **10,** 442; **11,** 472; **12,** 581.

In charge:
Maj. A. N. Damrell, 1873–85. **R., 80,** 1073; **81,** 1186; **82,** 1261; **83,** 975; **84,** 1170.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1298; **86,** 1162; **87,** 1278, 1290; **88,** 1175.
Capt. P. M. Price, 1889–93. **R., 89,** 1385, 1420; **90,** 1637; **91,** 1698; **92,** 1402; **93,** 1695.
Maj. F. A. Mahan, 1894–98. **R., 94,** 1255; **95,** 1617; **96,** 1351; **97,** 1612; **98,** 1383.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1657; **00,** 2101.
Capt. W. V. Judson, 1901. **R., 01,** 1773.
Lt. R. R. Raymond, 1902. **R., 02,** 1260.
Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1215; **04,** 1770; **05,** 1329; **06,** 1248; **07,** 1342.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1402; **09,** 1391; **10,** 1536.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1674; **12,** 1890.

Assistants:
P. M. Slaughter. **R., 87,** 1290.
T. Robinson. **R., 89,** 1387, 1422; **90,** 1638; **91,** 1699; **92,** 1403.

OBSTRUCTIONS.

2 brs. without draw openings above Albany in 1895 prohibited SS. navigation at higher stages of the w., **95,** 1617.

OPERATIONS.

1879-80. 1,280 c. y. r. and 103 snags removed; 2 barges built and 1 repaired, **80,** 1074.
1880-81. 390 l. f. of dam built; 2,393 c. y. r. removed, **81,** 1187.
1881-82. 2,627 c. y. r. removed; 350 l. f. st. dam built; 3,460 snags and trees cut and removed, **82,** 1262.
1882-83. 4,821 trees and snags removed; 2,439 c. y. r. removed, **83,** 976.
1883-84. 2,392 snags removed; 2,954 c. y. r. removed, **84,** 1171.
1884-85. 12,961 snags and 2,202 c. y. r. removed, **85,** 1299.
1885-86. 1,254 snags and 5,477 c. y. r. removed, **86,** 1163.
1886-87. 3,232 trees, logs, and snags and 4,261 c. y. r. removed, **87,** 1280.
1887-88. 585 snags and trees and 5,325 c. y. r. removed, **88,** 1177.
1888-89. 450 snags, 1,815 c. y. solid r., and 817 c. y. bowlders and loose r. removed from chan., and 1,461 trees cut from the banks, **89,** 1388.
1889-90. 980 snags, 1,412 c. y. r., ferryboat wreck, and steamer's boiler removed from chan., **90,** 1638, 1639.
1890-91. 320 snags and 15 c. y. r. removed from chan., and 1,723 trees cleared from the banks, **91,** 1699.
1891-92. 2,229 snags and 3,203 c. y. r. removed from chan.; 2,160 trees cleared from the banks, **92,** 1403.
1892-93. About 2,800 obstr. removed from banks and chan., and 177 l. f. training dams constr., **93,** 1697.
1893-94. About 1,300 obstr. removed, **94,** 1256.
1894-95. 74 obstr. and 413 c. y. r. removed, and 247 c. y. r. deposited in dams, **95,** 1618.
1895-96. About 130 obstr. and 1,667 c. y. r. removed, and 1,033 c. y. r. deposited in spur dams, **96,** 1354.
1896-97. About 80 obstr. and 1,510 c. y. r. removed, and 842 c. y. deposited in spur dams, **97,** 1613.
1898-99. Drilling barge repaired and a few isolated bowlders removed, **99,** 1658.
1899-00. 901 snags and other obstr. removed from banks and chan.; 1,835 c. y. r. dr., **00,** 2103.
1902-03. 300 c. y. r. excavated and 39 overhanging trees trimmed and removed, **03,** 1215.
1903-04. 2,452 c. y. r. excavated in removal of r. shoals, **04,** 1770.
1904-05. 2,325 c. y. r. excavated, 18 bowlders and 180 snags and logs removed, providing a clear chan. 3′ x 60′ between Albany and Newton, **05,** 1329, 1330.
1905-06. 3,344 c. y. r. excavated, completing chan. 3′ x 60′ between Keaton Shoals and Flat Rock Shoals, **06,** 1248.
1906-07. 3,349 c. y. r. excavated, and 807 logs, snags, and other obstr. removed, **07,** 1343.
1907-08. 3,092 c. y. r. excavated, **08,** 1402.
1908-09. 11,968 c. y. r. excavated by barge No. 16 and dr. No. 5, **09,** 1391.
1909-10. 12,809 c. y. r. excavated and 69 bowlders, snags, and other obstr. removed, **10,** 1536.
1910-11. 20,412 c. y. removed above Bainbridge, and 17,800 c. y. r. blasted below Bainbridge, **11,** 1674.
1911-12. 10,838 c. y. removed above Bainbridge, and 27 snags and 28 trees below Bainbridge; proj. about 88% completed, **12,** 1891.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1612; **98,** 1383.
F. R. rises in n. part of Ga., flows sw. Its mouth is at sw. cor. of Ga., where it unites with Chattahoochee to form Apalachicola R. L., 360 m. Proj. section, mouth to Montezuma, 182 m., **12,** 581.

PLANS. (See Projects.)

By Capt. Hoxie, 1887, extension of the imp. from Montezuma to Old Agency by removal of obstr.; est., $25,000, **87,** 1290, 1291.
In 1889 Capt. Price reported it advisable to postpone removal of the r. reefs at Albany until the completion of the imp. above, **89,** 1421.

* Allotment.

PROJECTS. (See Plans.)

By Capt. Damrell, 1873, modified in 1880 after more detailed surs., l.-w. navigable chan. 3′ x 100′, mouth to Albany, Ga., 105 m., and a navigable chan. for light-draft SS., at moderate stages of w., Albany to Montezuma, 100 m., by removal of snags scouring bars, by works of contraction, and cutting through r. reefs; est., $199,962, **73,** 707, 721; **80,** 1073; **86,** 1162; **87,** 1278; **91,** 1700.

SURVEYS.

Ex. Montezuma to Old Agency au. act Aug. 5, 1886; made by Capt. Hoxie, **87,** 1290.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Price, **89,** 1420.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 582.

Maps. **93,** 1696.

Q-25 GULF OF MEXICO, NORTH SHORE. (Waterway.)

APPROPRIATION.

July 4, 1832 (sur.), $3,000.
(See O-510(b).)

SURVEY.

Sur., canal between the pass of St. Andrews and R. and B. of Chattahoochee, and between Pensacola B. and Bon Secour, along the n. coast of the Gulf of Mexico (Treas. Doc. 373, 1882.)

Q-26 APALACHICOLA RIVER AND ST. ANDREWS BAY, FLA. (Channel between.)

APPROPRIATIONS.

1910,	$100,000,	**10,** 1541.
1911,	150,000,	**11,** 1679.
1912,	70,000,	**12,** 1896.
Total,	320,000,	**12,** 1896.

COMMERCE.

Actual value of imp. to C. unknown until imp. completed, **12,** 585.

CONTRACTS.

1910. Southern Dredging Co., dr., 12.7¢ c. y.; Ellicott Machine Co., cutter machinery, etc., 15″ hydraulic dr., $33,800, **11,** 1679.

ENGINEERS.

Chief of Engineers. R., 10, 445, 459; **11,** 474; **12,** 585.

In charge:
Capt. H. B. Ferguson, 1910. **R., 10,** 1541.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1678; **12,** 1895.

OPERATIONS.

1910-11. 124,101 c. y. removed under contract from w. end of imp., completing 11,104 l. f. of chan.; 63,120 c. y. removed by U. S. plant and hired labor from e. portion in Lake Wimico, **11,** 1679.

1911-12. 242,792 c. y. removed from w. end, and contract terminated, **12,** 1895. U. S. dr. *Blackwater* removed 194,816 c. y. from w. end, at 11.8¢ c. y.; U. S. dr. *Muscogee* removed 111,157 c. y. and dipper dr. *Upatoi* 38,291 c. y. from e. end, at 9.7¢ and 8¢ c. y., resp.; 726 stumps and 6,640 trees removed from e. end, **12,** 1896.

PHYSICAL CHARACTERISTICS.

Details of, **10,** 445; **12,** 585.

Proposed route about 32 m. l. Passes through various creeks, swamps, etc. Expected to provide outlet for Chattahoochee-Flint-Apalachicola-Chipola system, **12,** 585.

PROJECTS.

By Capt. Ferguson, 1910, chan. 5′ x 65′ by way of Lake Wimico, Searcy Creek, and s. prong of Wetappo Creek; est., $450,000,[1] **10,** 446, 459.

SURVEYS.

Ex. and sur. for chan. between Apalachicola R., and St. Andrews B.; made, 1909–10, by Capt. Ferguson; est., $450,000 (see Projects),[1] **10,** 459.

Maps. **11,** 1678.

Q-28 ST. JOSEPHS BAY, FLA. (Entrance to.)

APPROPRIATIONS.

1912, $20,000, **12,** 1890.

COMMERCE.

Principally timber and its products, est. at about $900,000 per an., **12,** 581.

ENGINEERS.

Chief of Engineers. R., 08, 392; **12,** 580, 606

Boards. BERH. reviews **Rs.** of local officer; concurs in recom. (see Surveys), **12,** 606.

In charge:
Capt. J. B. Cavanaugh, 1908. **08,** 392.
Lt. Col. G. D. Fitch, 1912–. **R., 12,** 1890.

PHYSICAL CHARACTERISTICS.

Ordinary range of tide about 1.4′, **12,** 581.

PROJECTS.

Act July 25, 1912, au. chan. 24′ x 300′ over the bar; est., $40,000, $20,000 of which is to be provided by private interests,[2] **12,** 580.

SURVEYS.

Ex. au. act Mar. 2, 1907; made, 1907, by Capt. Cavanaugh[3] (**R.** unfav.), **08,** 392.

Pre. ex. and sur. au. act June 25, 1910, with view to securing increased d. at entrance to B. **R.** by Col. Fitch, 1911 and 1912; est., $40,000 (local interests contribute one-half of said amount),[2] **12,** 606.

Map.[2] (Photo of RR. pier.)

[1] H. D. 670, 61st, 2d. [2] H. D. 660, 62d, 2d. [3] H. D. 464, 60th, 1st.

Q-29 ST. ANDREWS BAY, FLA.

APPROPRIATIONS.

1910, $75,000, **10,** 1541.
1911, 128,560, **11,** 1680.

Total, 203,560

COMMERCE.

Probable increase, should 21′ be obtained on bar, **04,** 1801.
Description of, and value, **04,** 1800.
1911, value, $45,556, **12,** 586.

CONTRACTS.

1910. Home Dredging Co., dr., 12.23¢ c. y., **11,** 1680.
1911. Home Dredging Co., dr. chan. in B., using 500′ instead of 1,000′ pipe line, modifying orig. contract, 11.73¢ c. y., **11,** 1680.

ENGINEERS.

Chief of Engineers. **R., 89,** 185; **04,** 322, 1797; **09,** 409; **10,** 446; **11,** 475; **12,** 586.

Boards. BERH. **R., 04,** 1802.

In charge:
Capt. P. M. Price, 1888–89. **R., 89,** 1414.
Lt. R. R. Raymond, 1904. **R., 04,** 1798.
Capt. H. B. Ferguson, 1910. **R., 10,** 1541.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1680; **12,** 1897.

OPERATIONS.

1910-11. 333,531 c. y. dr., completing contract. U. S. dr. *Caucus* removed 46,066 c. y., May 25 to June 30, 1911, **11,** 1680.

1911-12. 738,759 c. y. removed by U. S. dr. *Caucus*, **12,** 1897.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1414; **04,** 1798, 1800.
D. of the entrance sufficient, 1889, **89,** 1415.

PROJECTS.

Lt. Raymond, 1903, of opinion that 21′ chan. could be secured at cost not to exceed $150,000,[1] **04,** 1799.
By Capt. Ferguson, 1909, chan. 22′ x 200′ through East Pass; est., $203,560, and $20,000 an. mainten.,[2] **09,** 409; **10,** 446.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Price, **89,** 1414.
Ex. of 2 entrances, and up to town of St. Andrew au. act June 13, 1902; made, 1903, by Lt. Raymond[1] (**R.** unfav.), **04,** 322, 1797.
Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Capt. Ferguson, Nov. 15, 1907, Oct. 10 and Nov. 5, 1908, and Mar. 1, 1909; est., $203,560,[2] **09,** 409.
Of water fronts of towns of St. Andrew and Panama City, with view to estab. of H. lines, **11,** 1680.
Cong. docs., etc., relating to ex., surs., plans etc., **12,** 586.
Map.[3]

Q-30 ST. ANDREWS BAY, FLA., TO CHOCTAWHATCHEE RIVER AND BAY. (Canal.)[3]

Q-31 CHOCTAWHATCHEE BAY, INCLUDING SANTA ROSA SOUND CHANNEL, FLA.

APPROPRIATIONS.

1910, $24,000. **10,** 1544.

COMMERCE.

Description of; value estimated at $800,000 per annum, **93,** 1741.
Details, **11,** 1683; C. combined with that of Choctawhatchee and Holmes Rs.

ENGINEERS.

Chief of Engineers. **R., 93,** 228; **10,** 449, 459; **11,** 478; **12,** 590, 606.

In charge:
Capt. P. M. Price, 1889–93. **R., 93,** 1741.
Capt. H. B. Ferguson, 1910. **R., 10,** 1544.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1683; **12,** 1900.

Assistant. J. E. Turtle. **R., 93,** 1742.

OPERATIONS.

1910-11. Late in June, 1911, the plant was put in condition and assembled at entrance to Choctawhatchee Bar, **11,** 1683.

1911-12. U. S. dr. removed 215,118 c. y., completing proj., **12,** 1900.

PHYSICAL CHARACTERISTICS.

Description of; Santa Rosa Sound is a narrow body of water, about 14 m. l., between Santa Rosa Isld. and the mainland, connecting Pensacola B. with Choctawhatchee B., **93,** 1741.
Range of tide, 1.1′, **11,** 479.

PROJECTS.

By Capt. Ferguson, 1909, for chan. 6′ through narrows of Santa Rosa Sound; est., $24,000,[4] **10,** 449, 459; au. act June 25, 1910, **12,** 590.

SURVEY.

Ex. of bar at the junction of Choctawhatchee B. and Santa Rosa Sound, Fla., au. act July 13, 1892; made by Capt. Price, 1893 (**R.** fav.), **93,** 1741.
Ex. au. act Mar. 3, 1909; made, 1909, by Capt. Ferguson,[4] **10,** 459.
Ex. and sur. of Choctawhatchee B. for chan. to Gulf of Mexico, au. act June 25, 1910. **R.,** Lt. Col. Fitch, 1911 (unfav.),[5] **12,** 606.

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[1] H. D. 250, 58th, 2d.
[2] H. D. 12, 61st, 1st.
[3] Ex.—**R.** (fav.), Oct. 14, 1833. (H. D. 482, 55th, 2d.)
[4] H. D. 565, 61st, 2d.
[5] H. D. 424, 62d, 2d.

Q–32 CHOCTAWHATCHEE RIVER, FLA. AND ALA.[1]

APPROPRIATIONS.

1833, $5,000, act Mar. 2.
1844, [2] 10,000, act June 5.
1874, 5,000, **74,** 75, 896. (Sur.)
1875, 5,000, **75,** 81, ii, 9.
1876, 5,000, **76,** 72, 494; **77,** 71, 414.
1879, 5,000, **79,** 103, 827.
1880, 7,000, **80,** 1079.
1881, 10,000, **81,** 1197.
1882, [3] 18,000, **82,** 1275.
1884, 15,000, **84,** 1184.
1886, 15,000, **86,** 1177.
1888, 10,000, **88,** 1168.
1890, 12,500, **90,** 1633.
1892, 12,500, **92,** 1411.
1894, 6,000, **95,** 1628.
1896 5,000, **96,** 1371
1899, 16,000, **99,** 1065.
1902 { 16,000, **02,** 1266.
*3,000, **04,** 1778.
1905 { 10,000, **05,** 1336.
*2,000 } **06,** 1254.
*300 }
1907, 10,000, **07,** 1349.
1909, *5,000, **09,** 1395.
1910, 5,000, **10,** 1543.
1911, 5,000, **11,** 1682.
1912, 8,000, **12,** 1899.

Total, 226,300, **12,** 1899.

COMMERCE.

Requirements, **72,** 64, 588, 640.
Amount of, to be benefited by imp., **80,** 1080.
Increase of, consequent upon imp., **81,** 1195.
Increase in cotton shipments, **89,** 1382.
Important, **95,** 1628.
None above Geneva, **04,** 311.
With the exception of movement of logs, said to be valued at $2,000,000, there is no C. above the mouth of Holmes R., **11,** 477.

CONTRACTS.

M. A. Sweeney, snag-boat constr., $4,800, **89,** 1383.

ENGINEERS.

Chief of Engineers. R., 71, 69; **72,** 63; **74,** 75; **75,** 80; **76,** 72; **77,** 70; **78,** 79; **79,** 103; **80,** 136, 140; **81,** 184; **82,** 180; **83,** 190; **84,** 198; **85,** 205; **86,** 203; **87,** 165; **88,** 153; **89,** 178, 185; **90,** 160; **91,** 201; **92,** 197; **93,** 218; **94,** 202; **95,** 228; **96,** 202; **97,** 257; **98,** 254; **99,** 294; **00,** 335; **01,** 357; **02,** 287; **03,** 298; **04,** 311; **05,** 319; **06,** 343; **07,** 358; **08,** 380, 392; **09,** 397; **10,** 447; **11,** 476; **12,** 587.

In charge:
Col. J. H. Simpson, 1871. **R., 72,** 588, 640.
Lt. Col. W. F. Raynolds, 1872. **73,** 66.
Capt. A. N. Damrell, 1873–85. **73,** 66. **R., 74,** 896; **75,** ii, 8; **76,** 493; **77,** 413; **78,** 590; **79,** 824; **80,** 1079, 1081; **81,** 1194; **82,** 1270; (Maj.) **83,** 988; **84,** 1180.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1311; **86,** 1176; **87,** 1271; **88,** 1166.
Capt. P. M. Price, 1889–93. **R., 89,** 1380, 1423; **90,** 1631; **91,** 1707; **92,** 1409; **93,** 1706.
Maj. F. A. Mahan, 1894–98. **R., 94,** 1263; **95,** 1626; **96,** 1365; **97,** 1621; **98,** 1394.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1664; **00,** 2112.
Capt. W. V. Judson, 1901. **R., 01,** 1778.
Lt. R. R. Raymond, 1902. **R., 02,** 1265.
Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1220; **04,** 1776; **05,** 1335; **06,** 1253; **07,** 1348.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1407; **09,** 1395; **10,** 1542.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1681; **12,** 1899.

Assistants:
J. Burney. **R., 72,** 641.
W. S. Simpson, **72,** 588.
H. Haines. **R., 80,** 1081.
W. A. Gould. **R., 90,** 1633.
W. G. Williamson. **R., 89,** 1425.
J. E. Turtle. **R., 91,** 1708; **92,** 1410.

LEGISLATION.

Law passed by Alabama to prohibit the driving of loose logs in the Choctawhatchee R. within the State, **89,** 1382.

OBSTRUCTIONS.

Draw to be placed in Hollis Br. before imp. of R. above it, **96,** 1366.

OPERATIONS.

1874–75. Obstr. removed from R. for 48 m. from mouth, **75,** 81, ii, 8.
1875–76. Removal of obstr.; 3′ chan. obtained from mouth to Buzzards Bar; wagon road cut around the bar, **76,** 72, 493.
1876–77. Chan. 3′ in d. obtained for about 75 m. of the lower part of the R. by removal of obstr., **77,** 70, 413.
1877–78. Obstr. removed; removal of gravel and drift at Millers Field, **78,** 79, 590.
1879–80. 20 m. of R. between Geneva and mouth cleaned of snags and obstr.; cut-off opened; Buzzards Bar Cut-off cleaned out; portion of wreck of steamer *Boston* removed, **80,** 1079.
1880–81. 14,256 snags, stumps, and trees removed; 252 c. y. sand excavated, **81,** 1195.
1881–82. 10,169 snags, stumps, etc., removed; 330 y. of bank protected by brush, **82,** 1272.
1882–83. 34 m. wholly and 161 m. partially imp. by removal of 15,074 snags and trees, protection of 4,940 l. y. of bank, and closure of 6 cut-offs, **83,** 990.
1883–84. 29,819 snags, stumps, and trees removed; 990 l. f. bank protected, **84,** 1181.
1884–85. Operations of snag boat, **85,** 1311.
1885–86. 8,787 snags, logs, and trees removed, clearing 32 m. of R., **86,** 1176. Imp. completed from mouth of R. to 27 m. above Geneva, **86,** 1176.
1886–87. Operations of snag boat; removal of rs. and bowlders, **87,** 1272.
1887–88. 5,772 logs and snags removed from the chan., **88,** 1168.
1888–89. 3,183 trees, logs, and snags removed from chan., and 695 trees from the banks, **89,** 1382.
1889–90. Removal of snags, stumps, and chan. obstr. continued, **90,** 1633.
1890–91. Removal of snags and similar obstr. continued, **91,** 1708.
1891–92. 2,142 snags removed from chan., and 386 trees cleared from the banks, **92,** 1410.
1892–93. 1,248 obstr. removed from banks and stream, and 1,654 l. f. dams completed, **93,** 1709.
1893–94. 1,781 obstr. removed, and 3,261 l. f. dams constr., **94,** 1267.
1894–95. 1,281 obstr. removed, **95,** 1627.
1895–96. 2,381 obstr. removed, **96,** 1371.
1896–97. A few obstr. removed, **97,** 1623.
1899–00. Over 4,400 obstr. removed, **00,** 2113.
1900–01. 4,139 logs and other obstr. removed, 126 c. y. marl, dr., and 77 cords wood cut, **01,** 1778.
1902–03. 6,636 c. y. dr. from cut through bar at Cypress Top, and 2,383 l. f. protection bulkhead placed on both sides of dr. cut, **03,** 1221.

* Allotment.
[1] Ex.—**R.** (fav.) Jan. 28, 1845. (H. D. 482, 55th, 2d.)
[2] Choctawhatchee and Holmes Rs.
[3] Part of $20,000, $2,000 of which was for Lagrange Bayou.

1903-04. 1,782 logs and other obstr. removed, 252 c. y. marl dr. and 34 cords wood cut between Newton and Geneva; 3,205 c. y. removed in redrg. chan. through bar at mouth of R. and 800 l. f. bulkhead constr.; 1,546 logs and other obstr. removed from lower 53 m. of R., **04,** 1776.

1904-05. 129 c. y. marl and 6 snags and other obstr. removed from R. between Newton and Geneva; 2,905 snags and other obstr. removed below Holmes, **05,** 1335.

1905-06. 1,438 c. y. marl dr. and 1,043 logs and other obstr. removed from R. between Newton and Geneva; 400 l. f. j. constr. at mouth of Cow Ford R.; wooden bulkhead repaired at Cypress Top outlet and chan. redr. to 6′ x 75′, **06,** 1253.

1907-08. 1,273 snags and other obstr. removed, **08,** 1407; proj. completed; addl. work is for mainten., **08,** 380.

1908-09. 3,458 logs and other obstr. and 2,086 c. y. sand and gravel removed, **09,** 1395.

1909-10. 1,514 snags and other obstr. removed, 117′ bulkhead constr., and 7,236 c. y. dr. at Cypress Top outlet, **10,** 1542.

1910-11. 1,179 snags and other obstr. removed, **11,** 1681.

1911-12. 260 snags and other obstr. removed in a distance of about 67 m. above the mouth, and excavated 4,441 c. y. at Cedar Creek Shoal and Strickland Lake Bar, **12,** 1898.

PHYSICAL CHARACTERISTICS.

Description, **72,** 63, 588, 640-645; **79,** 826; **96,** 1365; **97,** 1621; **98,** 1394; **12,** 587, 588.

Description of R. obstr., **80,** 1081.

Comparison of cross sections at Buzzard Bar Shoals, Gumfields Shoals, Busby Shoals, **93,** 1708; Haverstons Whirl, and Cut-off, **94,** 1266.

Source, se. Ala., thence flows s. and sw. to C. Bay, an arm of Gulf of Mexico. Length of proj. about 162 m., mouth to Newton, **12,** 587.

PLANS. (See Projects.)

By J. Burney, 1872, thorough imp. R.; est., $98,716.80. To meet present and prospective requirements of C., $52,291.20. Removal of obstr. which seriously interfere with trade, $34,332; the last recom. by Col. Simpson, **72,** 64, 589, 640, 646.

By Capt. Price, 1889, chan. 3′ x 60′, Geneva to Newton, by dr. shoals and removing snags and logs; est., $57,125, **89,** 1424.

PROJECTS. (See Plans.)

By Col. Simpson, 1872, mouth to Geneva, 212 m. by removal of snags, sunken logs, etc.; est., $34,332, **72,** 63, 589, 641; **74,** 896; **81,** 1194.

By Capt. Damrell, 1880, Geneva to Newton, 40 m., removal of obstr. and constr. of 3 locks and dams; est., $78,500, **80,** 1081; making an aggregate of $122,832 for the imp. of the R., mouth to Newton, **86,** 1177; **87,** 1272.

Amended, 1896, to require a draw to be placed in Hollis Br. before any money could be spent above this br., **96,** 1366.

Amended, 1899, to extend the imp. to Newton, Ala., **99,** 1664.

Proj. amended, 1902, to include imp. of Cypress Top outlet, **12,** 587.

Capt. Cavanaugh, 1904, considered section of R. between Newton and Geneva unworthy of further imp., **04,** 1777.

SURVEYS.

By J. Burney and W. Simpson, 1871-72, under direction of Col. Simpson. **R., 72,** 588, 641.

Ex., Geneva to Newton, au. act Mar. 3, 1879; made by Capt. Damrell, 1880. Recom. to defer imp., **80,** 1081.

Ex. for a l.-w. chan., mouth to Geneva, and h. w. chan. thence to Newton, au. act Aug. 11, 1888; made, 1889, by Capt. Price, **89,** 1423.

Pre. ex. for 3′ chan. up to Newton, Ala., au. act Mar. 2, 1907; made by Capt. Ferguson (unfav.),[1] **08,** 392.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 587.

Maps. **93,** 1708; **94,** 1266.

Q-33 HOLMES RIVER, FLA. AND ALA. (AND LAGRANGE BAYOU, FLA.).[2]

Part.	Title.	Period.	Appropriations.
a	Holmes R., Fla. and Ala.	1880–1882	.....
b	(Lagrange Bayou and) Holmes R., Fla.	1881–1904	$10,000.00
c	Holmes R., Fla., from Vernon to its mouth.	1905–1912	13,000.00
	Total	.....	23,000.00

Part (a), Q-33 Holmes River, Fla. and Ala.[3]

ENGINEERS.

Chief of Engineers. **R., 80,** 141; **81,** 189; **82,** 185.

In charge. Capt. A. N. Damrell. **R., 82,** 1308.

Assistant. H. Haines. **R., 82,** 1308.

PLANS.

By Capt. Damrell, 1881, removing snags and similar obstr. from the mouth of the R. to a point 35 m. above; est., $5,000, **82,** 1308.

SURVEY.

Au. act June 14, 1880; made, 1880, by Capt. Damrell (**R.** fav.), **82,** 1308.

[1] H. D. 876, 60th, 1st.

[2] See Physical Data, Q-(33b).

[3] Ex.—**R.** (fav.), Jan. 28, 1845. (H. D. 482, 55th, 2d.)

Part (b), Q-33 (Lagrange Bayou and) Holmes River, Fla.

APPROPRIATIONS.

1882,	[1] $2,000, **83,** 1000.
1886,	2,000, **86,** 1179.
1888,	[2] 3,000, **88,** 1163.
1890,	[3] 3,000, **90,** 1626.
Total,	[4] 10,000

COMMERCE.

Amount of, to be benefited by imp., **82,** 1318.
Small, 1893, **93,** 1706.

ENGINEERS.

Chief of Engineers. R., 81, 189; **82,** 185; **83,** 192; **84,** 201; **85,** 206; **86,** 204; **87,** 164; **88,** 152; **89,** 176; **90,** 158; **91,** 200; **92,** 196; **93,** 217; **99,** 295; **00,** 336; **01,** 358; **02,** 288; **03,** 298; **04,** 312.

In charge:
Maj. A. N. Damrell, 1881–85. **R., 82,** 1318; **83,** 1000; **84,** 1192.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1312; **86** 1179; **87,** 1268; **88,** 1162.
Capt. P. M. Price, 1889–93. **R., 89,** 1375; **90,** 1625; **91,** 1704; **92,** 1407; **93,** 1705.
Capt. C. A. F. Flagler, 1899–1901. **R., 99,** 1666; **00,** 2116.
Capt. W. V. Judson, 1901. **R., 01,** 1780.
Lt. R. R. Raymond, 1902. **R., 02,** 1267.
Capt. J. B. Cavanaugh, 1903–04. **R., 03,** 1222; **04,** 1778.

Assistants:
H. Haines. **R., 82,** 1318.
J. E. Turtle. **R., 91,** 1705.
Lt. L. H. Rand, **01,** 350.
Lt. G. R. Lukesh, **01,** 350.

OPERATIONS.

1883–84. 208 snags, logs, and trees, and 3,519 c. y. mud removed. **84,** 1192.

1884–85. Dr. and removal of obstr. continued, **85,** 1312.

1890–91. 2,671 overhanging trees cleared from the banks and 270 snags and logs removed from the banks, **91,** 1706.

1889–00. Over 8,000 snags and other obstr. removed, **00,** 2117.

1903–04. Snags, trees, and other obstr. removed, **04,** 1778.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1375; **90,** 1626; **99,** 1666.
As there is no logical connection of Lagrange B. and Holmes R., "designation should be Holmes R., etc.," **04,** 312.

PLANS.

By Capt. Price, 1889, 4½′ navigation through Lagrange Bayou, and clearing snags and logs from Holmes R.; est., $15,222, **89,** 1375.

PROJECTS.

By Capt. Damrell, 1881, imp. of the bayou, by d. the chan. through it to 4½′ existing through the "Narrows" est., $19,944; **82,** 1318; **87,** 1268.
In 1891, after the expend. of $10,000, Capt. Price recom. no further app. be made until the necessities of C. requires it, **91,** 1705; **92,** 1408.

SURVEY.

Ex. au. act Mar. 3, 1881; made, 1881, by Capt. Damrell, **82,** 1318.
Ex., Lagrange Bayou and Holmes R., au. act Aug. 11, 1888; made, 1889, by Capt. Price, **89,** 1375.

Part (c), Q-33 Holmes River, Fla., from Vernon to its mouth.

APPROPRIATIONS.

1905	$2,000 / *2,000 **05,** 1337.
1907,	2,000, **07,** 1350.
1909,	2,000, **09,** 1336.
1910,	2,000, **10,** 1543.
1911,	1,000, **11,** 1682
1912,	2,000, **12,** 1900.
Total,	13,000

COMMERCE.

Importance of, **06,** 345.
Rapidly increasing; R. only means of transportation, **12,** 589.
In 1911, C. value, $850,000, **12,** 589.

ENGINEERS.

Chief of Engineers. R., 05, 320; **06,** 344; **07,** 359; **08,** 381; **09,** 398; **10,** 448; **11,** 477; **12,** 589.

In charge:
Capt. J. B. Cavanaugh, 1905–08. **R., 05,** 1337; **06,** 1254; **07,** 1350.
Maj. W. E. Craighill, **06,** 347.
Maj. H. Jervey, **06,** 347; **11,** 464.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1408; **09,** 1396; **10,** 1542.
Maj. J. B. Cavanaugh, **11,** 464.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1682; **12,** 1899.

OPERATIONS.

1905–06. 6 spur js. built, **06,** 1254.
1905–11. Obstr., snags, trees, etc., removed. (For details, see an. **Rs.** for each year.)
1911–12. 252 obstr. removed; 5,439 c. y. dr., **12,** 1899.

PHYSICAL DATA.

R. empties into Choctawhatchee R. about 40 m. above mouth of latter; it is w. and d. to Vernon, 25 m. above mouth; l. of R., about 160 m. **12,** 589.

SURVEYS.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 589.

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* Allotment.
[1] Part of $20,000, $18,000 of which was for Choctawhatchee R.
[2] Including Holmes R. to Vernon.
[3] Continuing work on Holmes R.
[4] Act of 1899 reapp. $4,839.20, which had been returned to the Treasury, **99,** 1667.

Q-34 PEA RIVER, ALA.

ENGINEERS.

Chief of Engineers. R., 80, 140.
In charge. Maj. A. N. Damrell, 1879. **R., 80,** 1120.
Assistant. H. Haines. **R., 80,** 1120.

PHYSICAL CHARACTERISTICS.

Description of, obstr., **80,** 1120.

PLANS.

By Maj. Damrell, imp. navigation during h. w., Geneva to Elba, with 2 cribwork locks and dams, 300 l. f. of dike, 500 l. f. of brush dam, dr., and snag removing; est., $56,750, **80,** 1121.

SURVEY.

Au. act Mar. 3, 1879, **79,** 106; made, 1880, by Maj Damrell, **80,** 1120.

Q-36 ALAQUA BAYOU, FLA. (Bar at mouth of.)

COMMERCE.

In 1893, unimportant, **93,** 1739.

ENGINEERS.

Chief of Engineers. R., 93, 228.
In charge. Capt. P. M. Price, 1893. **R., 93,** 1738.
Assistant. J. E. Turtle. **R., 93,** 1739.

PHYSICAL CHARACTERISTICS.

Description, **93,** 1739.

Bayou an indentation of the n. shore of Choctawhatchee B., about 60 m. e. of Pensacola, **93,** 1739.

SURVEY.

Ex. of the bar at the mouth of the bayou at its entrance into Choctawhatchee B. au. act July 13, 1892; made by Capt. Price, 1892 (**R.** unfav.), **93,** 1739.

Q-38 PENSACOLA HARBOR, FLA.[1]

APPROPRIATIONS.

1878,	$20,000.00,	**78,** 79.
1879,	10,000.00,	**79,** 101.
1880,	40,000.00,	**80,** 1068.
1881,	20,000.00,	**81,** 1176.
1882,	50,000.00,	**82,** 1257.
1884,	55,000.00,	**84,** 1164.
1886,	20,000.00,	**86,** 1181.
1888,	35,000.00,	**88,** 1166.
1890,	25,000.00,	**90,** 1630.
1892,	75,000.00,	**92,** 1415.
1894,	100,000.00,	**95,** 1631.
1896,	200,000.00,	**96,** 1390.
1899,	70,000.00,	**99,** 1672.
1902,	220,000.00,	**02,** 1270.
1900,	*5,000.00,	**02,** 1270.
1902,	*956.94,	**05,** 1340.
1905,	100,000.00,	**05,** 1340.
1907,	100,000.00,	**07,** 1353.
1909,	*110,000.00,	**09,** 1398.
1910,	75,000.00,	**10,** 1546.
1911,	25,000.00,	**11,** 1685.
Total,	1,355,956.94	(incl. misc., $1,370,613.70, **12,** 1902).

COMMERCE.

Restrictions of d. upon large vessels, **82,** 1257.
Of Pensacola, **85,** 1315; **91,** 1729, 1734.
Description of, **93,** 1711.
In 1893 there was demand for ships drawing 24′, **93,** 1714.
Very large, **03,** 300.
Diagram of freight, value and apps., **11,** 1685.
1911, exports, $20,742,292, and imports, $1,632,734, **12,** 595.

"The commerce of this port is very large. For the fiscal year ended June 30, 1903, the foreign exports were reported at $13,741,540, no record of the coastwise exports being available; in 1904, as $15,893,456; in 1905, exports as $15,295,067 and imports as $985,840; in 1906, exports as $18,432,931 and imports as $386,377; in 1907, exports as $20,229,414 and imports as $618,363; in the fiscal year 1908, exports as $20,322,649 and imports as $675,503; in the calendar year 1908, exports as $16,306,056 and imports as $1,188,925; in the calendar year 1909, exports as $20,960,154 and imports as $1,500,801; in the calendar year 1910, exports as $20,489,291 and imports as $2,123,678; and in the calendar year 1911, exports as $20,742,292 and imports as $1,632,734.

"The completion of the project will give greatly increased facilities to the large commerce of Pensacola, but will not materially affect freight rates." **12,** 594.

CONTRACTS.

1878. G. W. Le Gallais, removal of 4 wrecks **79,** 801.
1881. E. H. Farquhar, dr., 40¢ c. y., **82,** 1255. Annulled, **83,** 969. D. F. Sullivan, r. ballast. $1 t., **82,** 1256. W. H. Baker, brush, $1.25 cord, **82,** 1256.
1882. S. N. Kimball, dr., 79.7¢ c. y., **83,** 969.
1884. G. W. Adams, suction-dr. hire, $333.33 per day, **85,** 1314.
1886. F. H. Smith, st., **87,** 1271.
1892. R. Moore, dr., 63¢ c. y., **93,** 1715.
1897. Rittenhouse Moore Dredging Co., dr. 15¢ c. y. ($40,000), **98,** 1402.
1898. Rittenhouse Moore Dredging Co., dr., 15¢ c. y., **00,** 2125.
1900. Rittenhouse Moore Dredging Co., dr., 15¢ c. y., **00,** 2126.
1906. Cary & Co. (Inc.), coal, $4,187.50, **07,** 1353.
1908. Guy F. Palmes, coal $3.24 t., **08,** 1411.
1909. Cary & Co., coal, $3.05 t., **10,** 1546.

ENGINEERS.

Chief of Engineers. R., 77, 70, 410; **78,** 79; **79,** 100; **80,** 133; **81,** 181, 1177; **82,** 176; **83,** 187; **84,** 195; **85,** 206, 207; **86,** 204; **87,** 164–171; **88,** 152, 159; **89,** 177, 184; **90,** 159; **91,** 202; **92,** 198; **93,** 219; **94,** 203; **95,** 229; **96,** 203; **97,** 258; **98,** 254; **99,** 296; **00,** 337; **01,** 358; **02,** 288; **03,** 299; **04,** 313; **05,** 321; **06,** 346; **07,** 361; **08,** 383, 392; **09,** 400; **10,** 450; **11,** 480; **12,** 592.

Boards:

Convened, New York, Feb. 12, 1881, to report upon proj. of Capt. Damrell for Pensacola H. imp. **R., 81,** 1177. (Cols. Tower and Newton and Lt. Col. Abbot.)

Convened, Pensacola, Fla., July 16, 1891, by S. O. No. 5, to ex. and report upon proj. for imp. of Pensacola H. **R., 91,** 1723. (Capts. Price, Black, and Carter.)

* Allotment.

[1] Sur.—R. Dec. 16, 1829; est., $106,690. (H. D. 482, 55th, 2d.)

Convened, New York, Aug. 20, 1895, by S. O. No. 29, H. Q. C. E., 1895, to reconsider the proj. for the imp. of Pensacola H., Fla. **R., 95,** 1657; **96,** 1391.

(Col. H. M. Robert, Lt. Col. G. L. Gillespie, Majs. C. W. Raymond and F. A. Mahan, Capt. W. M. Black, **95,** 1657; Capt. O. M. Carter, **96,** 1392.)

In charge:

Capt. A. N. Damrell, 1877–85. **R., 77,** 409, 411; **78,** 588; **79,** 801; (Maj.) **80,** 1067; **81,** 1174; **82,** 1255; **83,** 968; **84,** 1161.

Capt. R. L. Hoxie, 1885–89. **R., 85,** 1314; **86,** 1179; **87,** 1269; **88,** 1163, 1191.

Capt. P. M. Price, 1889–93. **R., 89,** 1376, 1402; **90,** 1627; **91,** 1710, 1713; **92,** 1412; **93,** 1710.

Maj. F. A. Mahan, 1894–98. **R., 94,** 1268; **95,** 1629; **96,** 1372; **97,** 1625; **98,** 1397.

Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1668; **00,** 2118.

Capt. W. V. Judson, 1901. **R., 01,** 1781.

Lt. R. R. Raymond, 1902. **R., 02,** 1267.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1223; **04,** 1779; **05,** 1339; **06,** 1256; **07,** 1352.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1410; **09,** 1397; **10,** 1545.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1684; **12,** 1902.

Assistants:

H. Haines. **R., 79,** 806; **85,** 1316, 1322.

J. E. Turtle. **R., 89,** 1378, 1408; **90,** 1629; **91,** 1715; **92,** 1415.

OPERATIONS.

1878–79. Removal of wrecks by contract, **79,** 101, 801, 802.

1879–80. Removal, under contract, of 4 wrecks completed, **80,** 1067.

1881–82. Quarters for overseer and workmen completed; mattress sheds and tramways, 4 extra cars, and 2 scows built; 60 l. f. of shore end of j. built, **82,** 1255.

1882–83. 8,406 c. y. dr. from the inner bar; Jetty A completed; shore protection n. of same partly completed; 400 l. f. of pier built with wharf at extremity; 1,836 t. r. ballast delivered at Fort McRae, **83,** 969.

1883–84. 24,966 c. y. dr. from the inner bar; st. protection completed to 220′; tramway built and approaches constr. for another shore protection, **84,** 1162.

1884–85. Close-piling shore protection replaced; mattress filling raised and whole extended 217′; trestle and tramway approach rebuilt, and 80′ spur built on s. side of same; exposed face of work and outer and inner 115′ of Jetty A revetted; 53,369 c. y. dr. from outer and inner bars, **85,** 1314.

1885–86. Extensive repairs to shore protection; 55,355 c. y. dr. from chan., **86,** 1180.

1886–87. 446 t. st. delivered for js.; repairs made to plant, **87,** 1270.

1887–88. 1,716 t. st. received, of which 1,187 t. were placed in the n. j., **88,** 1165.

1888–89. 839 t. st. placed in n. j.; 345 c. y. concrete blocks manufactured; piles driven and repairs made to plant, **89,** 1379.

1889–90. Operations upon n. and s. js. continued, **90,** 1629.

1891–92. 14,151 c. y. dr., **92,** 1415.

1892–93. 27,852 c. y. dr., **93,** 1714.

1893–94. 92,505 c. y. dr., **94,** 1272.

1894–95. Proj. prepared by Maj. Mahan for imp. of the H. by dr., and bids received for constr. of w. j. at entrance to the H., **95,** 1634, 1660.

1895–96. 391,646 c. y. dr., **96,** 1379; and an exhaustive study of the cost of dr. made, **96,** 1379–1389.

1896–97. Dr. continued by US. dr. and by contractor, and specifications drawn up for the constr. of a US. dr., **97,** 1628.

1897–98. In connection with previous year, 519,211 c. y. dr., **98,** 1400.

1898–99. 370,647 c. y. dr., **99,** 1670.

1899–00. 479,088 c. y. dr., **00,** 2120.

1900–01. 324,495 c. y. dr., **01,** 1781.

1901–02. 184,753 c. y. dr. by US., **02,** 1268.

1902–03. Boathouse moved, **03,** 1223.

1904–05. 200,108 c. y. dr., **05,** 1339.

1905–06. New dr. *Caucus* received; 592,018 c. y. dr., **06,** 1256. Chan. marked; storehouse built, and wharf repaired, **06,** 1257.

1906–07. 285,907 c. y. dr.; office and boathouse, destroyed by storm, rebuilt; dr. *Caucus* employed by Navy Dept. on salvage work, **07,** 1352.

1907–08. 854,305 c. y. dr.; repairs made to dr., **08,** 1410.

1908–09. 306,908 c. y. dr., restoring chan. to 30′ x 300′, **09,** 1397.

1909–10. 381,248 c. y. dr., **10,** 1545.

1910–11. 955,142 c. y. dr., **11,** 1684.

PHYSICAL CHARACTERISTICS.

Description of, **77,** 409, 410; **79,** 101, 802, 806, 807; **93,** 1714; **95,** 1634, 1647; **98,** 1397.

List of obstr., **77,** 409, 410, 412; **79,** 810.

Description of Pensacola B., **89,** 1404, 1410; **91,** 1723.

Winds, tides, currents, and tidal discharge, **89,** 1405, 1408, 1412; **91,** 1724, 1726.

Movement of beach line, **91,** 1718, 1727.

Current velocities, **91,** 1719.

H. considered one of the best on the coast, **94,** 1274.

Table of areas of sections of Caucus, East Bank, and Middle Ground Shoals, entrance to the H., **95,** 1655.

Shoaling, as shown by exs., **01,** 1781; **03,** 1223.

Shipping damaged and chan. shoaled by hurricane, **07,** 1352.

PLANS. (See Projects.)

By Capt. Price, 1889 chan. through the outer and inner bars of Pensacola H. by concrete j. on Calafaytas Shoals extending from the shore to the 23′ curve and built to height m. h. w.; est., $2,295,719, **89,** 1406.

PROJECTS. (See Plans.)

By Capt. Damrell, 1878, removal of 4 wrecks; est., $20,000, **77,** 411; **78,** 79, 588.

By Capt. Damrell, 1879, as modified by BE., 1881, reestab. of old shore line by 4,000 l. f. brush and st. js. in front of Fort McRae, and d. the chan. across the inner bar by dr. to 24′ x 300′; est., $150,000, **79,** 101, 803, 810; **81,** 1175; **84,** 1161; **86,** 1180. Failure of tides to maintain dr. chan. Total amount app., 1878 to 1886, incl., $215,000; est. of completion, $40,000, **87,** 1269.

In 1888 est. $60,000 would be required for completion, making the total cost $275,000, **88,** 1164. Est. increased by $81,000 in 1890, **90,** 1630.

By BE., 1891, chan. 24′ d. m. l. w. over the inner and outer bars by raising the shore arm of the w. j to h. w.; raising the crest of the j. from the shoulder to 5,000′ out to the mean h. of the beginning of ebb outflow; for the next 4,300′ the crest to be brought up to m. l. w.; shore arm of the e. j. to be raised to h. w., crest of the j. then to sink within 1,200′ to the level of the foundation course; js. to be constr. with a foundation course of brush mattress 100′ w. and a superstr. of rubblest. capped with concrete; total est., incl. removal of 500,000 c. y. of material from chan. between js., $1,830,400, **91,** 1731, 1732.

By BE., 1895, amending proj. of 1891 to provide for deferring constr. of j. for mainten. of chan. across Caucas Shoals until the chan. should be obtained by dr., **96,** 1374.

Act Mar. 3, 1899, extended proj. to secure 30′ chan., m. l. w., from Gulf of Mexico to dock line at the e. end of Pensacola, **00,** 2119.

Capt. Judson, 1901, recom. chan. 500′ w.; also securing dr. plant, **01,** 1781–82.

Act June 13, 1902, modified proj. to provide for chan. 30′ x 500′, Gulf of Mexico to dock line at e. end of Pensacola, **02,** 288.

$150,000 of app. of 1902 being used for constr. of a seagoing suction dr., building under direction of Capt. J. C. Sanford, Phila. Dist., **03,** 300.

SURVEYS.

Ex. and partial sur. of bar by H. Haines, 1878, **79,** 101, 802, 806.

Of outer and inner bars at entrance to Pensacola H. au. act July 5, 1884; made, 1884, by Capt. Hoxie, **85,** 1316.
Resur. of outer and inner bars au. act Aug. 5, 1886, **87,** 171; made, 1889, by Capt. Price, **89,** 1403; **91,** 1715.
Sur. of the inner bar made by Maj. Mahan, 1894, **94,** 1272.
Sur. of the entrance begun by Maj. Mahan, 1895, **96,** 1389; **97,** 1629; and completed, 1897, **98,** 1401.
Minor, of entrance, **01,** 1781.
Pre. ex. au. act Mar. 2, 1907, with view to 24′ to quarantine station. **R.** by Capt. Cavanaugh, Nov. 14, 1907[1] (unfav.), **08,** 392.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 592.
Maps. **81,** 1178; **84,** 1162; **90,** 1630; **91,** 1733; **93,** 1714; **11,** 1684.

Q-40 YELLOW RIVER, FLA.

APPROPRIATION.

1839, $500 for sur. to ascertain practicability and cost of removing rafts obstr. stream. (Treas. Doc. 373, 1882.)

SURVEY.

Ex.—**R.** fav., Jan. 25, 1840. (H. D. 482, 55th, 2d.)

Q-41 BLACKWATER RIVER, FLA. AND ALA. (Including Blackwater and East Bays.)

APPROPRIATIONS.

1899,	$5,000,	**99,** 1673.
1905,	10,000,	**05,** 1339.
1907,	5,000,	**07,** 1351.
1910,	25,000,	**10,** 1544.
Total,	45,000,	**12,** 1901.

COMMERCE.

Benefit of imp., **82,** 1312.
Details of, **11,** 480.
Valued at $800,000, 1905; dry dock and marine railway at Milton, **05,** 321; $1,350,000, 1908, **08,** 383; $2,000,000, incl. naval stores, 1912, **12,** 592.

ENGINEERS.

Chief of Engineers. **R., 80,** 141; **81,** 189; **82,** 185; **99,** 297; **00,** 338; **01,** 359; **04,** 322, 1792, 1795; **05,** 320; **06,** 345; **07,** 360; **08,** 382; **09,** 399; **10,** 449; **11,** 479; **12,** 591.

Boards. BERH. **R., 04,** 1795.

In charge:
Capt. A. N. Damrell, 1882. **R., 82,** 1309.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1673; **00,** 2126.
Capt. W. V. Judson, 1901–. **R., 01,** 1784.
Lt. R. R. Raymond, 1904. **R., 04,** 1793.
Capt. J. B. Cavanaugh, 1905–07. **R., 05,** 1338; **06,** 1255; **07,** 1350.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1409; **09,** 1397; **10,** 1544.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1684; **12,** 1901.

Assistant. H. Haines. **R., 82,** 1311.

OPERATIONS.

1899-00. 12,559 c. y. dr., **00,** 2128.
1905-06. Repaired 8″ suction dr., **06,** 1255.
1906-07. Chan. about 70′–80′ x 4,470′ dr.; about 30,000 c. y. removed, **07,** 1351.
1910-11. Preparation of plant for dr., **11,** 1684.
1911-12. 470,388 c. y. dr. by U. S.; proj. 95% done, **12,** 1901.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 1673; **11,** 480.

PROJECTS.

By Capt. Damrell, 1882, 9′ chan. m. l. w., 100′ w.; est., $20,000, **82,** 1310; **99,** 1673; **00,** 2127.
By Lt. Raymond, Blackwater R., from Milton, Fla., to mouth and Blackwater and East Bays, dr. chan. 9 x 100″; est., $15,000 or more, **05,** 321; **08,** 382.
Est. of 1899 inadequate. $25,000, app., 1910, for completion of proj. and mainten., **10,** 450.

SURVEYS.

Au. act of Mar. 3, 1879, **80,** 141; made, 1880, by Capt. Damrell, **82,** 1309.
Minor surs., **00,** 2127, 2128.
Pre. ex. by Lt. R. R. Raymond, au. act June 13 1902. **R.,** 1902; est., $15,000,[2] **04,** 322, 1793.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 480.

Q-43 ESCAMBIA AND CONECUH RIVERS, FLA. AND ALA.

Part.	Title.	Period.	Appropriations.
a	Escambia R., Fla.	1833–1879	$10,500
b	Conecuh R., Ala.	1878–1879	.....
c	Escambia and Conecuh Rs.	1880–1912	180,000
	Total	.....	[3] 190,500

[1] H. D. 665, 60th, 1st. [2] H. D. 193, 58th, 2d. [3] $5,500 carried to surplus fund (1838).

Part (a), Q-43 Escambia River, Fla.

APPROPRIATIONS.

1833,	$5,000, act Mar. 2.
1836,	5,500, act July 2.
Total,	10,500

COMMERCE.

Important, **79,** 854.

ENGINEERS.

Chief of Engineers. **R., 78,** 81; **79,** 106.

In charge. Capt. A. N. Damrell, 1878–85; **78,** 81. **R., 79,** 852.

Assistant. H. Haines. **R., 79,** 853.

PHYSICAL CHARACTERISTICS.

Obstr., snags, logs, overhanging timber, and a bar at the mouth, **79,** 853, 856.
Season of high water, **79,** 853.
Tides, **79,** 856.

SURVEY.

By H. Haines, 1878–79. **R., 79,** 853.

Part (b), Q-43 Conecuh River, Ala.

COMMERCE.

Important, **79,** 843, 847.

ENGINEERS.

Chief of Engineers. **R., 78,** 81; **79,** 106.

In charge. Capt. A. N. Damrell, 1878–85; **78,** 81; **79,** 106. **R., 79,** 843.

Assistant. H. Haines. **R., 79,** 844.

PHYSICAL CHARACTERISTICS.

General, **79,** 844, 846.
Obstr., snags, etc., **79,** 843, 845–847.

PLANS.

By H. Haines, complete imp. by removal of snags, r. excavation, dr., and locks and dams; est., $241,865, **79,** 845, 848. For a partial imp. by removal of snags and rs.; est., $62,430; **79,** 849. Removal of obstr. from Murder Creek, Sepulgah R., and their branches; est., $8,000, **79,** 850.

SURVEY.

Ex., 1878–79, by H. Haines. **R., 79,** 844.

Part (c), Q-43 Escambia and Conecuh Rivers, Fla. and Ala.

APPROPRIATIONS.

1880,	[1] $8,000, **80,** 1082.
1881,	[1] 5,000, **81,** 1199.
1882,	12,000, **82,** 1278.
1884	[1] 3,000, **84,** 1198.
	[2] 12,000, **84,** 1200.
1886,	12,000, **86,** 1176.
1888,	10,000, **88,** 1170.
1890,	7,500, **90,** 1636.
1892,	8,000, **92,** 1418.
1894,	6,000, **95,** 1663.
1896,	4,000, **96,** 1396.
1899,	5,000, **99,** 1675.
1900,	*1,500, **01,** 1785.
1902,	5,000, **02,** 1271.
1905,	10,000, **05,** 1342.
1905,	*5,000, **07,** 1356.
1907,	15,000, **07,** 1356.
1907,	[3] 31,000, **07,** 1356.
1909,	5,000, **09,** 1400.
1910,	5,000, **10,** 1548.
1911,	5,000, **11,** 1687.
1912,	5,000, **12,** 1904.
Total,	180,000

COMMERCE.

More than $2,000,000 an., 1897. Sums required for imp. only nine-tenths of 1% of the an. C., **97,** 1632.
Mainly timber, lumber, and saw logs, **06,** 349.
Work completed influences transportation, permitting rafting on stages 3′ less than formerly, **09,** 404.
Value, timber rafted, $2,000,000. R. rate 50% of rail rate, **12,** 596–7.

CONTRACTS.

1881. W. A. Alexander, dr., 47½¢ per c. y., **81,** 1199.

ENGINEERS.

Chief of Engineers. **R., 80,** 137; **81,** 185; **82,** 182; **83,** 194; **84,** 202; **85,** 205; **86,** 203; **87,** 165; **88,** 153; **89,** 179; **90,** 161; **91,** 203; **92,** 199; **93,** 221; **94,** 204; **95,** 230; **96,** 204; **97,** 259; **98,** 255; **99,** 298; **00,** 339; **01,** 360; **02,** 290; **03,** 301; **04,** 315; **05,** 323; **06,** 348, 354; **07,** 363; **08,** 386; **09,** 403; **10,** 452; **11,** 482; **12,** 595, 606.

In charge:

Maj. A. N. Damrell, 1878–85. **R., 80,** 1082; **81,** 1198; **82,** 1277; **83,** 1006, 1007; **84,** 1197.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1309; **86,** 1175; **87,** 1273; **88,** 1169.
Capt. P. M. Price, 1889–93. **R., 89,** 1384; **90,** 1634; **91,** 1736; **92,** 1416; **93,** 1716.
Maj. F. A. Mahan, 1894–98. **R., 94,** 1275; **95,** 1661; **96,** 1393; **97,** 1631; **98,** 1403.
Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1674; **00,** 2129.
Capt. W. V. Judson, 1901. **R., 01,** 1784.
Lt. R. R. Raymond, 1902. **R., 02,** 1270.
Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1226; **04,** 1781; **05,** 1341; **06,** 1258; **07,** 1354.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1412; **09,** 1399; **10,** 1547.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1686; **12,** 1903.

Assistant. J. E. Turtle. **R., 89,** 1384; **90,** 1635.

* Allotment. [1] Escambia. [2] Conecuh. [3] Conecuh R. (separate proj.).

OPERATIONS.

1881-82. Chan. 5½′ x 100′ x 3,240′ m. l. w. dr. through the bar (Escambia), **82,** 1277.

1882-83. 1,216 trees, snags, and stumps removed (Conecuh), **83,** 1007.

1883-84. Snags, trees, and obstr. removed throughout 85 m. of Escambia, **84,** 1198. Obstr. removed from 33 m. of Conecuh, **84,** 1199.

1884-85. 15,472 snags and trees removed from Conecuh, **85,** 1310.

1885-86. 10,943 logs, snags, and trees, and 105 c. y. r. removed from Conecuh and Escambia Rs., **86,** 1175.

1886-87. 2,569 trees, logs, and stumps, and 45 c. y. r. removed from chan., **87,** 1274.

1887-88. 2,998 logs and snags removed from chan., **88,** 1170.

1888-89. Removal of logs, snags, and similar obstr., **89,** 1385.

1889-90. 530 snags and 153 c. y. r. and gravel removed from chan., 20 trees cut from the banks, and 2,353 c. y. sand dr., **90,** 1636.

1890-91. Repairs to snagging plant, **91,** 1736.

1891-92. 3,523 snags cleared from chan., 19 c. y. gravel dr., and 1,015 logs on banks cut up, **92,** 1417.

1892-93. 1,450 obstr. removed from banks and stream, **93,** 1717.

1893-94. About 600 obstr. removed, **94,** 1276.

1894-95. About 250 obstr. removed, **95,** 1662.

1895-96. About 2,200 obstr. removed, **96,** 1395.

1896-97. About 1,800 obstr. and 20 c. y. clay removed, **97,** 1632.

1899-00. Snag boat built and 1,421 snags and other obstr. removed from chan., **00,** 2130.

1900-01. 461 snags, piling, and other obstr. removed from chan., **01,** 1784.

1902-03. 1,003 snags, logs, etc., removed, **03,** 1226.

1904-05. 211 snags, etc., removed, **05,** 1341.

1905-06. 545 snags, etc., removed, **06,** 1258.

1906-07. 336 snags, etc., removed under general imp. For work on Conecuh R. a new quarter-boat and derrick boat completed, **07,** 1355.

1907-08. 1,790 snags, logs, and trees removed under general imp. Conecuh R.—3,286 c. y. r. and gravel and 979 obstr. removed, **08,** 1412.

1908-09. General imp.—2,311 snags and trees removed. Conecuh R.—1,666 obstr. removed, trees cut, etc., **09,** 1400.

1909-10. General imp.—914 snags and trees removed. Conecuh R.—5,571 snags, overhanging trees, logs, etc., removed; 178 c. y. gravel and sand removed; proj. completed, **10,** 1547.

1910-11. 3,400 snags, trees, and stumps removed, **11,** 1686.

1911-12. 3,011 snags, trees, and stumps removed; proj. on general imp. completed, **12,** 1903.

PHYSICAL CHARACTERISTICS.

Escambia, Fla., and Conecuh, Ala. The names apply to one and the same stream; change in name occurs at boundary line of 2 States; flows through a heavily timbered country. Length, 300± m.; proj. section, 195 m., **12,** 595.

PROJECTS.

By Capt. Damrell, 1879, imp. Escambia R., mouth to State line, by dr. chan. 5½′ x 150′ m. l. w. through bar at the mouth, removing snags and similar obstr., and by shore protection and wing-dam constr. to obtain a 5′ l.-w. chan. throughout the length of the R.; est., $25,000, **79,** 853, 856; **80,** 1082.

In 1882, $12,000 app. for the Escambia and Conecuh Rs., when it was proposed to extend navigation to Indian Creek, 273 m. above the mouth of the R., by removal of obstr., closing cut-off, and r. removal, at addl. est. of $62,430 over the est. of 1879, **83,** 1007; **87,** 1273. Total est., $87,430; **88,** 1169.

Act Mar. 2, 1907, au. proj. for Conecuh R., from mouth of Patsaliga Creek to Fla.-Ala. State line, by removing snags, bowlders, etc.; est., $31,000,[1] **07,** 364; **12,** 596.

SURVEYS.

Ex. au. act Mar. 3, 1905, Conecuh R. **R.,** Capt. Cavanaugh, Nov. 3, 1905; est., $31,000,[1] **06,** 354.

Ex. au. act June 25, 1910, Escambia and Conecuh Rs. **R.,** Lt. Col. Fitch, 1911 (unfav.),[2] **12,** 606.

Maps. **84,** 1198.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 596.

Q-44 PATSALIGA RIVER, ALA.

COMMERCE.

Important, **79,** 851.

ENGINEERS.

Chief of Engineers. **R.,** **78,** 81; **79,** 106.

In charge. Capt. A. N. Damrell, 1878. **R.,** **79,** 850.

Assistant. H. Haines. **R.,** **79,** 851.

PHYSICAL CHARACTERISTICS.

General descriptions, **79,** 851.

Obstr.: Drift timber, shoals, etc., **79,** 850, 751.

PLANS.

By H. Haines: (1) Removing obstr., making complete imp. of the R.; est., $23,500; (2) removing obstr. that form impediments to moderately h.-w. navigation; est., $8,700, **79,** 852.

SURVEY.

Ex. by H. Haines, 1878-79, under the direction of Capt. Damrell. **R.,** **79,** 850, 851.

Q-46 PENSACOLA BAY, FLA., TO BON SECOUR BAY, ALA. (Canal.)

SURVEY.

R., Oct. 14, 1833; est., $1,161,152 and $2,197,614. (H. D. 482, 55th, 2d.)

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[1] H. D. 159, 59th, 1st.

[2] H. D. 261, 62d, 2d.

Q-49 ALABAMA RIVER, ALA.

APPROPRIATIONS.

1878,	$25,000,	**78,** 81.
1879,	30,000,	**79,** 104.
1880,	25,000,	**80,** 1083.
1881,	20,000,	**81,** 1200.
1882,	20,000,	**83,** 1009.
1884,	10,000,	**85,** 1307
1886,	15,000,	**86,** 1172.
1888,	20,000,	**88,** 1188.
1890,	20,000,	**90,** 1657.
1892,	70,000,	**92,** 1421.
1894,	50,000,	**95,** 1669.
1896,	40,000,	**96,** 1406.
1899,	50,000,	**99,** 1681.
1902,	20,000,	**02,** 1273.
1904,	*4,000,	**04,** 1784.
1905,	100,000,	**05,** 1344.
1907,	200,000,	**07,** 1358.
1909,	*110,000,	**09,** 1402.
1910,	[1] 85,000,	**10,** 1550.
1911,	[1] 75,000,	**11,** 1689.
1912,	75,000,	**12,** 1906.

Total, 1,064,000 ($1,064,145.50, incl. sales, etc., **12,** 1906.

COMMERCE.

Restrictions to C., **76,** 507; **79,** 827.

Advantages arising from imp., **76,** 498, 507; **79,** 829; **80,** 1085; **81,** 1203; **83,** 1010; **85,** 1306; **86,** 1171.

Present and prospective demands of C., **91,** 1765.

1895, valued at $4,813,000 per year, **95,** 1669.

Almost entirely local, **05,** 1368.

Imp. facilities would reduce rates, **10,** 455.

Details of, **12,** 599; tonnage, 110,231, **12,** 1907.

"The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizers, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all description, the value of which for the year 1911 is reported at 110,231 short tons, valued at $8,253,948. This, however, is but a part of the freight movement that is affected by the improvement, for the actual shipments by water have been relatively small, and, with a river improved for continuous navigation, it is estimated that at least 100,000 tons of the present all-rail freight movement would either go by river or at river rates, and the resulting saving would be very large. In addition, improved facilities would render possible an actual reduction in rates on freight now carried by river.

"During the fiscal year 1909 the municipality of Montgomery established a modern wharf at Montgomery, which permits loading and unloading at any stage of the river. There was one barge line established in 1910 for traffic between Mobile and Montgomery and points along the river. This barge line has since been abandoned." **12,** 599.

CONTRACTS.

1900. M. A. Sweeney Shipyard & Foundry Co., dipper dr., $13,440, **00,** 2136.

1905. Robert Middleton, 2 quarterboats and 1 pile-driver barge; James M. Campbell, 4 barges, **06,** 1261.

1907. Gulf City Boiler Works Co., 2 boilers and fixtures on snag boat *Wm. J. Twining;* est., $3,810; Gulf Dry Dock Co., 4 wooden barges; est., $11,900, **07,** 1358.

1908. Gulfport Creosoting Co., 1 creosoted wooden hull, $10,960; The Bucyrus Co. (emergency), 1 15-inch centrifugal dr. pump and engines, suction discharge pipe, and extra parts, $8,800; Hartley Boiler Works (emergency), 1 battery of 3 steel boilers and accessories, $4,030; Ellicott Machine Co., 1 revolving cutter, with shafting, gearing, auxiliary engines and extra parts, for 15" suction dr., $6,500, **08,** 1416.

1911. Gulf City Boiler Works Co., battery of 3 boilers, $1,780, **11,** 1689.

ENGINEERS.

Chief of Engineers. R., 76, 74; **78,** 81; **79,** 104; **80,** 137; **81,** 186; **82,** 182; **83,** 194; **84,** 203; **85,** 203; **86,** 201; **87,** 170; **88,** 158; **89,** 183; **90,** 166; **91,** 204, 211; **92,** 200; **93,** 222; **94,** 205; **95,** 231; **96,** 205; **97,** 260; **98,** 256; **99,** 299; **00,** 340; **01,** 361; **02,** 291; **03,** 302; **04,** 316; **05,** 324, 1351, 1368; **06,** 349; **07,** 365; **08,** 387; **09,** 404; **10,** 454; **11,** 484; **12,** 597, 606.

In charge:

Capt. A. N. Damrell, 1876–85. **R., 76,** 498; **78;** 594; **79,** 827; (Maj.) **80,** 1083; **81,** 1200; **82,** 1278; **83,** 1008; **84,** 1200.

Capt. R. L. Hoxie, 1885–89. **R., 85,** 1306; **86,** 1171; **87,** 1288; **88,** 1187.

Capt. P. M. Price, 1889–93. **R., 89,** 1400; **90,** 1654; **91,** 1738; **92,** 1418; **93,** 1718.

Maj. F. A. Mahan, 1894–98. **R., 94,** 1277; **95,** 1663; **96,** 1396; **97,** 1633; **98,** 1405.

Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1676; **00,** 2132.

Capt. Wm. V. Judson, 1901. **R., 01,** 1786.

Lt. R. R. Raymond, 1902, **02,** 1272.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1228; **04,** 1782; **05,** 1343, 1354, 1384; **06,** 1259; **07,** 1357.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1414; **09,** 1401; **10,** 1548.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1687; **12,** 1904.

Assistants:

Gavin B. Yuille. **R., 76,** 499.

C. B. Percy. **R., 89,** 1401; **90,** 1655; **91,** 1739, 1764, 1766; **92,** 1419.

N. A. Yuille. **R., 05,** 1369.

D. M. Andrews. **R., 05,** 1371.

OPERATIONS.

1878–79. Snag boat purchased, by which 320 logs removed; dam built at "Cut-off," **79,** 104, 827, 829.

1879–80. Completion of dam across "Cut-off;" 3 chutes closed at Haynes Isld.; partial closure of chutes at Erwins Bar, Hobbs Bar, and Yellow Jacket Bar, and the removal of 490 snags, **80,** 1084.

1880–81. Completion of imp. Gardners Isld., Coxs Bar, Hadnots Bar, Three Chutes, and bar below Cut-off, **81,** 186, 1201.

1881–82. Repair of dam at Cut-off and Hobbs Isld.; completion of dam at Gardners Isld., **82,** 1279.

1883–84. Removal of overhanging trees and snags, **84,** 1201.

1884–85. Removal of snags and logs, **85,** 1306.

1885–86. Removal of snags and logs and closing l.-w. chute by brush dam near Gardners Isld., **86,** 1171.

1886–87. Removal of obstr. between mouths of the Alabama and Tallapoosa Rs., **87,** 1288.

1887–88. 1,333 logs and snags removed from chan. and 533 overhanging trees cut from banks, **88,** 1188.

1888–89. 2,200 logs and snags and 1 wreck removed from chan.; 4,730 trees and stumps removed from banks, **89,** 1401.

1889–90. 1,706 logs and snags removed from chan.; 4,111 trees and stumps removed from banks; repairs to snagging plant, **90,** 1656.

1890–91. Snagging continued, **91,** 1739.

1891–92. 962 snags, 25 bowlders, 1,550 c. y. gravel. removed from chan.; 2,710 trees cleared from banks, and 181 l. f. of r. and brush j. built, **92,** 1420.

1892–93. About 3,000 obstr. removed, 4,281 l. f. dams built, and 75 l. f. rebuilt; 335 l. f. shore protection constrd., and 230 bowlders removed from banks and stream, **93,** 1721.

1893–94. 80 l. f. old dams torn out, 6,666 l. f. dam constrn. in progress, 943 s. y. shore protection

* Allotment.

[1] In the discretion of the Sec. of War this sum may be expended to include Alabama and Coosa Rs., Montgomery to Wetumpka.

constrd., 1,444 l. f. bar protection constrd., and 1,881 obstr. removed, **94,** 1282.

1894-95. 4,530 l. f. dikes under repair and constrn., 4,085 s. y. shore protection under constrn. and repair, and about 800 obstr. removed, **95,** 1667.

1895-96. About 1,000 obstr. and part of a wreck removed; dike constrn. and repair in progress, **96,** 1400, 1401.

1896-97. 2,498 obstr. and wreck of flatboat removed, 2,205 l. f. dike built, and repairs made to U. S. craft, **97,** 1636, 1637.

1897-98. About 3,000 obstr. removed, **98,** 1408.

1898-99. About 670 snags and other obstr. removed, **99,** 1678.

1899-00. Over 3,000 snags and other obstr. removed, **00,** 2133.

1900-01. 916 snags and other obstr. removed; dr. boat with dipper capacity of 1½ c. y. nearly completed, **01,** 1786.

1901-02. 892 snags and other obstr. removed; dr. boat completed and towed to Montgomery, Ala., **02,** 1272.

1902-03. 1,332 snags and other obstr. removed, **03,** 1228.

1903-04. 1,441 snags and other obstr. removed, **04,** 1783.

1904-05. 1,056 snags and other obstr. removed, **05,** 1343.

1905-06. 971 snags and other obstr. removed; 42,689 c. y. dr. from chan. through bars; 1 pile driver barge constrd. by hired labor; towboat *John Mills* (name changed to *Alabama*) reconstrd., **06,** 1260.

1906-07. 329 snags and other obstr. removed; 8,750 c. y. dr. from Upper Gauses Bar; j. 240′ long constrd. at Upper Gauses Bar and j. partially constrd. at Lower Gauses Bar; floating plant repaired, **07,** 1357.

1907-08. 398 snags and other obstr. removed; 43,135 c. y. sand and gravel, 280 t. r. and sand, 8 piles and 18 sunken logs removed from chan., and 2,775 l. f. of js. built and 278 l. f. repaired at different points on the R., **08,** 1414.

Installation of boilers in snag boat completed; 4 creosoted barges delivered, and constr. of 15″ hydraulic dr. 60% completed, **08,** 1415.

1908-09. 1,149 snags and other obstr., and 23,929 c. y. sand and gravel removed from chan.; Dam No. 2 at Silver Creek Shoals, consisting of 6,715 c. y. sand and gravel, 1,185 t. st., and 209 piles, removed; 4,471 l. f. of js. built and 1,257 l. f. repaired at different points on the R., **09,** 1401.

New 15″ hydraulic dr. *Pettus* completed; other floating plant repaired, **09,** 1402.

1909-10. The snag boat *Wm. J. Twining* removed 7,421 snags and other obstr.; dipper dr. removed 38,395 c. y. st., sand, and gravel; 5,545 l. f. of js. built, and 305,173 c. y. of material removed by dr. *Pettus* over 170 m. below Montgomery, at average cost of 12.6¢ c. y. for dr., and $6.51 l. f. for js.; pontons for pipe line for *Pettus*, and 2 creosoted barges built, and snag boat *Twining* repaired, **10,** 1548, 1549.

1910-11. 4,366 snags and other obstr. removed, **11,** 1687. Material removed from different localities by dipper and hydraulic drs. and js. built and repaired, given in tables; new boilers and stacks installed in towboat, and minor repairs made to other floating plant, **11,** 1688.

1911-12. Summary of work done by snag boat *Wm. J. Twining*, **12,** 1904. Work done by drs. *Autauga* and *Pettus;* cost of dr., 14.9¢ c. y.; js., $4.52 l. f., **12,** 1905.

PHYSICAL CHARACTERISTICS.

General, **76,** 500, 501. List of bars, shoals, and reefs in Alabama R., **76,** 503. Tide statistics, **79,** 829.

General w. and d., **82,** 1279.

Character of the banks and R. bed, **79,** 827; **89,** 1400; **90,** 1654; **91,** 1761, 1762.

Condition of chan. at the various bars, islands, and shoals, from the mouth to the junction of the Coosa and Tallapoosa Rs., **91,** 1768.

Details, **96,** 1402–1405; **97,** 1633; **98,** 1408.

Variation of water level, 0.0 to 59′ at Montgomery, Ala., **03,** 303.

Geology and resources of the Coosa Valley, by U. S. Geol. Survey, **05,** 1378, 1379.

Max. d. carried to Montgomery, 3′ at l. w., **11,** 485.

PLANS.

Gavin B. Yuille, removal of snags, logs, etc., and constr. of dams and js., to make chan. 6′ x 150′ m. l. w., $459,773.25, **76,** 498, 502, 507.

Capt. Damrell, for an. operations of snag boat, $10,000 per year, **79,** 829.

PROJECTS.

By Capt. Damrell, 1876, imp. from mouth, 50 m. above Mobile, to Wetumpka, Ala., 323 m.; by removal of logs and snags, and constr. of wing dams and js., to give chan. 200′ w. and 4′ d. at m. l. w.; est., $229,741, **76,** 498, 507; **85,** 203.

In 1891, the proj. of 1876 having been completed at cost of $172,000, Capt. Price proposed increasing chan. d. to 6′; est., $386,251, **91,** 1740, 1765; provided $100,000 be app. an., and $10,000 used for mainten., **12,** 597.

Proj. prepared under au. act June 13, 1902, imp. Coosa and Alabama Rs., 6′ navigation; est., $500,000 and $40,000 an. mainten., **04,** 316, 317.

By Capt. Cavanaugh, 6′ navigation, Coosa and Alabama Rs., throughout the year; est., $10,024,706, Coosa R. between Gadsden and Wetumpka, Ala.; and $1,000,000 between Wetumpka and mouth Alabama R., **05,** 1367. The BERH. believes 6′ navigation, Coosa R., not immediately desirable, and that imp. Alabama R. should be limited to removal of snags and other obstr., and constr. of works of regulation, **05,** 1391. Recom. that water-power rights should be reserved by U. S., **05,** 1367.

By Capt. Cavanaugh, 4′ chan., Montgomery to mouth of R.; est., $650,000, and $50,000 an. mainten.,[1] **06,** 354; **12,** 598.

Plan; est., $36,000,[2] with $5,000 an. for mainten.; for 4′ chan. through Ala. and Coosa Rs. to Wetumpka, **09,** 409; **11,** 485; **12,** 598.

SURVEYS.

By Gavin B. Yuille, 1875, **76,** 74. **R.,** **76,** 499.

Ex. for 6′ chan., mouth to Wetumpka, au. act Sept. 19, 1890; made, 1890, by Capt. Price, **91,** 1761.

Minor surs., **94,** 1282; **95,** 1667; **96,** 1402; **97,** 1638.

Ex. Coosa and Alabama Rs., Wetumpka, Ala., to mouth of Alabama R., au. act June 13, 1902, **04,** 316, 318, 322.

Of Coosa and Alabama Rs., Ga. and Ala., with view to securing 6′ navigation; **R.,** Capt. Cavanaugh,[3] **05,** 329, 1354, 1384.

Ex. for 4′ navigation, mouth to Montgomery and from Montgomery to Wetumpka (on Coosa R.), au. act Mar. 3, 1905; made, 1905; **R.,** Capt. Cavanaugh,[1] **06,** 354.

Of Alabama and Coosa Rs., Montgomery to Wetumpka, Ala., au. act Mar. 2, 1907, **08,** 393.

Pre. ex. and sur., Alabama and Coosa Rs., between Montgomery and Wetumpka; **R.,** Capt. Ferguson, 1908; plan and est. presented,[2] **09,** 409.

Ex. and sur. with view to constr. of lock and dam between Montgomery and Selma, au. act Feb. 27, 1911 (**R.** to come), **12,** 606.

Detailed sur. made from m. 277½ to m. 286 above mouth, **12,** 1905.

Maps.[2] **84,** 1202; **94,** 1280; **95,** 1668.

[1] H. D. 378, 59th, 1st.
[2] H. D. 1089, 60th, 2d.
[3] H. D. 219, 58th, 3d.

Q-50 TALLAPOOSA RIVER, ALA. AND GA.

APPROPRIATIONS.

1882,	$15,000,	**83,** 999.
1884,	10,000,	**84,** 1191.
1886,	7,500,	**86,** 1173.
1888,	7,500,	**88,** 1185.
1890,	4,000,	**90,** 1651.
Total,	44,000	

COMMERCE.

In 1893 not believed that any C. benefit would be derived by continuing the imp., **93,** 1724.

ENGINEERS.

Chief of Engineers. R., 80, 141; **81,** 189; **83,** 192; **84,** 200; **85,** 203; **86,** 201; **87,** 169; **88,** 156; **89,** 182; **90,** 165; **91,** 206; **92,** 201; **93,** 223; **10,** 460; **11,** 490; **12,** 605.

In charge:
Maj. A. N. Damrell, 1880–85. **R., 81,** 1223; **83,** 998; **84,** 1189.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1307; **86,** 1172; **87,** 1285; **88,** 1184.
Capt. P. M. Price, 1889–93. **R., 89,** 1396; **90,** 1649; **91,** 1741; **92,** 1422; **93,** 1723.
Capt. H. B. Ferguson, **10,** 435.
Maj. H. Jervey, **11,** 464.
Lt. Col. G. D. Fitch, **12,** 572.

Assistants:
G. B. Yuille. **R., 81,** 1224.
C. B. Percy. **R., 89,** 1398; **90,** 1650; **92,** 1423.

OPERATIONS.

1883-84. 2,086 logs and snags and 34 overhanging trees removed, **84,** 1190.

1884-85. New snag boat with steam capstan, etc., built and a limited amount of work done, **85,** 1307.

1885-86. 2,423 snags, logs, and trees removed, clearing 12 m. of R., **86,** 1172.

1886-87. 4,053 logs, snags, and trees, and 33 c. y. r. removed from chan.; 320 l. f. of temporary dam work built, **87,** 1286.

1887-88. 2,510 logs and snags and 41 c. y. marl removed from chan. and 214 overhanging trees cut from banks, **88,** 1185.

1888-89. 2,124 logs and snags removed from chan., and 4,293 overhanging trees from banks, **89,** 1398.

1889-90. 1,184 logs and snags and 1 sunken ferryboat removed from chan. and 564 overhanging trees cut from banks, **90,** 1650.

1891-92. 185 snags removed from chan. and 57 trees cleared from banks, **92,** 1423.

PHYSICAL CHARACTERISTICS.

Description of the R., **81,** 1224.
Character of the R. bottom and banks, **89,** 1397; **90,** 1649.

PROJECTS.

By Maj. Damrell, 1881, imp. from foot of Tallassee Reefs to mouth, 48 m., giving 3′ x 60′ in soft rock cuts, and 200′ in open R., by removal of snags, logs, and similar obstrs.; bank protection, dike and wing-dam constr.; and gravel and soft-rock excavation; est., $40,125, **81,** 1230; **87,** 1285. Up to 1890 $44,000 expend. on imp. over the orig. est., being due to insufficient app., **90,** 1649.

SURVEY.

Au. act June 14, 1880; made, 1881, by Maj. Damrell, **81,** 1223.

Pre. ex. and sur. au. act Mar. 3, 1909, of Tallapoosa R., in connection with Etowah and Coosa R., with view to imp. for navigation, etc., **10,** 460; **11,** 490 (**R.** to come), **12,** 605.

Q-52 COOSA RIVER, ALA. AND GA.

(NOTE.—Coosa R. is formed at Rome, Ga., by junction of Oostenaula and Etowah Rs.; it flows sw. to its junction with the Tallapoosa and Alabama Rs., 325 m. Length under imp. about 211 m. Proj. covers section from Rome, Ga., to mouth. Coosa R. has always been navigable for light draft packets—Rome to Greensport (162 m.), but 1 low lift lock being needed. Greensport to Wetumpka (142 m.) locks and dams required, in conjunction with works of contraction and chan. excavation to permit navigation. Wetumpka to junct. of Tallapoosa R. navigable at all stages, **12,** 600.)

Part.	Title.	Period.	Appropriations.
a	Appropriations	1876–1912	.....
b	Coosa R., Ala. and Ga	1870–1900	$983,700.00
c	Coosa R., between Rome, Ga., and East Tenn., Va. & Ga. RR. br	1901–1912	830,039.00
d	Coosa R., between Wetumpka and East Tenn., Va. & Ga. RR. br	1901–1912	414,000.00
e	Coosa R., Ala. and Ga—Operation and care of canal	1893–1912	200,777.33
	Total	.....	2,428,516.33

Part (a), Q-52 Coosa River—Appropriations.

Coosa R., Ala. and Ga.:

1876, $30,000, **77,** 91.
1878, 75,000, **78,** 104, 763.
1879, 45,000, **79,** 141, 1271.
1880, 75,000, **80,** 1690.
1881, 60,000, **81,** 1873.
1882, 83,700, **82,** 1857.
1884, 50,000, **84,** 1656.
1886, 45,000, **86,** 1167.
1888, 60,000, **88,** 1180.
1890, 150,000, **90,** 1644.
1892, 130,000, **92,** 1427, 1430.
1894, 110,000, **95,** 1674, 1678.
1896, 50,000, **96,** 1417, 1422.
1899, 20,000, **99,** 1687.

$983,700

Coosa R. between Rome, Ga., and East Tenn., Va. & Ga. RR. br.:

1902, [1] $35,000, **02,** 292, 1275.
1902, [2] 10,000, **02,** 292, 1275.
1904, * 7,500, **04,** 1787.
1905, 25,000, **05,** 1348.
1907, 50,000, **07,** 1360; **12,** 1909.
1909, * 40,000, **09,** 1404; **12,** 1909.
1910 { [3] 52,500; [4] 120,000; [5] 75,000 } **10,** 1552.
1911 { [4] 121,039; [6] 150,000 } **11,** 1692.
1912 { [6] 20,000; [7] 124,000 } **12,** 1909.

830,039

(Less $7,155.80 trans. to Oostenaula and Coosawattee Rs., and $4,000.00 trans. to lower section, and incl. $1,448.05 from sales, $820,-331.25, **12,** 1909, 1910.)

Coosa R. between Wetumpka and East Tenn., Va. & Ga. RR. br.:

1890, $150,000, **90,** 1644.
1892, 100,000, **92,** 1427, 1430.
1894, 110,000, **95,** 1674, 1678.
1896, 50,000, **96,** 1417, 1422.
1907, * $2,000, **07,** 1362.
1909, * 2,000, **09,** 1405.

[8] $414,000

(Less $10,000 trans. to upper division of R., and incl. $455.82 from sales, $404,-455.82, **12,** 1911.)

Coosa R., Ala. and Ga., operation and care of canals:

1890, $326.42
1891, 2,530.67
1892, 6,137.49
1893, 9,366.56
1894, 3,418.16
1895, 3,982.66
1896, 8,797.12
1897, 6,137.92
1898, 2,281.98
1899, 7,141.60
1900, 5,907.16
} H. D. 421, 57th, 2d.
1901, 8,510.75, **01,** 1792.
1902, 42,106.40, **02,** 1279.
1903, 22,638.72, **03,** 1235.
1904, 5,572.81, **04,** 1792.
1905, 8,442.57, **05,** 1351.
1906, 9,016.35, **06,** 354.
1907, 11,444.11, **07,** 1364.
1908, 16,037.14, **08,** 1420.
1909, 5,218.84, **09,** 1405.
1910, 6,064.20, **10,** 1554.
1911, 3,777.92, **11,** 1695.
1912, 5,919.78, **12,** 1913.

200,777.33

(Grand total, less $7,155.80 trans. to Oostenaula and Coosawattee Rs. and $10,000 to upper division of R., and $4,000.00 trans. to lower R. and incl. $1,903.87 from sales, $2,208,487.07, **12,** 1909–11.)

Grand total..... 2,428,516.33

Part (b), Q-52 Coosa River, Ala. and Ga.

APPROPRIATIONS. (See preceding.)

COMMERCE.

Important, **71,** 564, 570; **72,** 540; **75,** ii, 663; **79,** 1270.

C. necessity for imp.; value of timber lands and coal and iron deposits; natural importance of the work, **88,** 1181; **90,** 1660, 1665, 1673.

Description of, **99,** 1692; **00,** 2145.

CONTRACTS.

1893. F. Baldwin, 1891–92, 900 c. y. cut st.; annulled, **93,** 1731. Rodgers, Haller & Farrel, 2 concrete mixers, $750; 1 horizontal engine, $360. T. Carlin's Sons, 1 cement elevator, $153.50; 2 cages for elevator, $105.50; 1 gravity hoisting drum, $205. Ryan-Macdonald Manf. Co., 12 dump cars for concrete, $936; 4 dump cars for sand, $252; 4 dump cars for broken st., $292. **93,** 1733.

1895. Sinclair & Babson, 18,000 bbls. cement, $2.89 and $2.72 per bbl., **95,** 1679.

ENGINEERS.

Chief of Engineers. R., 70, 31, 63; **71,** 64, 561; **72,** 59; **77,** 90; **78,** 104; **79,** 106, 140; **80,** 140, 188; **81,** 189, 255; **82,** 248; **83,** 256; **84,** 256; **85,** 201; **86,** 200; **87,** 168; **88,** 156; **89,** 180, 185; **90,** 162, 167; **91,** 207, 208, 210; **92,** 202; **93,** 224; **94,** 206; **95,** 233; **96,** 205; **97,** 261; **98,** 257; **99,** 300, 301; **00,** 341, 342.

Boards:

Convened, Nashville, Tenn., Aug. 26, 1896, by S. O. No. 21, Aug. 3, 1896, for consideration of proj. for constr. of Lock No. 4. **R., 96,** 1423. (Maj. F. A. Mahan, Maj. W. L. Marshall, and Capt. John Biddle.)

Convened, Baltimore, Md., Jan. 5, 1897, by S. O. Nos. 42 and 48, H. Q. C. E., Nov. 19, 1896, and Dec. 29, 1896, respectively, to consider and **R.** on imp. of Coosa R. between Wetumpka, Ala., and the East Tenn., Virginia & Georgia RR. br. **R., 97,** 1650 (Col. P. C. Hains, Maj. R. L. Hoxie, Maj. Wm. T. Rossell, and Lt. W. E. Craighill.)

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* Allotment.
[1] $10,000 to be expended on Oostenaula and Coosawattee Rs.
[2] Trans. from lower section.
[3] Imp. between Rome, Ga., and Lock No. 4.
[4] Lock and dam at Mayos Bar, near Rome, Ga.
[5] Lock in Dam No. 4, and site for Dam No. 5.
[6] Rome, Ga., and Dam No. 4, Ala.
[7] Lock and Dam No. 4, and Dam No. 5.
[8] $10,000 trans. to upper division of R.

In charge:
Maj. C. B. Reese, 1870. **70,** 63.
Capt. A. N. Damrell, 1870. **70,** 63.
Col. J. H. Simpson, 1870. **R., 71,** 561.
Maj. W. McFarland, 1871–75. **R., 72,** 502, 516; **75,** ii, 661.
Capt. W. R. King, 1877–85. **R., 77,** 597; **78,** 762; **79,** 1269; (Maj.), **80,** 1689; **81,** 1870; **82,** 1855; **83,** 1501; **84,** 1654.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1301; **86,** 1165; **87,** 1281; **88,** 1178.
Capt. P. M. Price, 1889–93. **R., 89,** 1389, 2797; **90** 1640, 1658; **91,** 1743, 1753; **92,** 1424; **93,** 1724.
Maj. F. A. Mahan, 1893–98. **R., 94,** 1285, 1286, 1291; **95,** 1670, 1671, 1674; **96,** 1407, 1418; **97,** 1642, 1647; **98,** 1413, 1418.
Capt. C. A. F. Flagler, 1899–. **R., 99,** 1682, 1689; **00,** 2137, 2143.

Assistants:
H. C. Fillebrown. **R., 71,** 564.
J. C. Long. **R., 72,** 536.
B. W. Frobel. **R., 75,** ii, 662.
R. C. McCalla. **R., 78,** 763.
Lt. W. L. Marshall. **R., 77,** 597; **78,** 763; **79,** 1269; **80,** 1690.
D. M. Andrews. **R., 89,** 1391; **90,** 1643.
C. Firth. **R., 90,** 1674; **91,** 1748; **92,** 1428.
Lt. W. E. Craighill. **R., 93,** 1726.

ESTIMATES. (See Plans and Projects.)

By Col. Simpson, 1871, completion of sur., $6,000 **71,** 563.

By H. C. Fillebrown, 1871, removing obstr. from R., 77 m., Greensport to Selma, Rome & Dalton RR. crossing, $278,484.50, **71,** 570–572.

By Maj. McFarland, 1872, chan. for vessels drawing 3′, from Greensport to Wetumpka, 134 m., $2,340,746.75, **72,** 505; from Wetumpka to Selma Rome & Dalton RR. crossing, $1,923,020, **72,** 507.

By Maj. McFarland, 1874, 4′ chan., Rome to Wills Creek, $180,000, **75,** ii, 662.

By B. W. Frobel, 1875, chan. 4′ x 80′, Rome, Ga., to mouth of Great Wills Creek, 120 m., $81,679, **75** ii, 664–668.

By J. C. Long, 1872, chan. from near Wilsonville to Greensport, 94 m., $470,668, **72,** 543.

By Lt. Marshall, 1877, 3′ chan., Selma, Rome & Dalton RR. br. to Greensport, $313,000, **77,** 598.

By Lt. Marshall, 1878, dams, locks, and riprapping at Whistenants and Ten Isld. Shoals, $155,616.23, **78,** 766.

By Capt. King, 1879, completion of existing proj., $402,347, **79,** 1271.

LEGAL PROCEEDINGS.

Title to land at Lock No. 31 obtained by condemnation proceedings, 1893, **93,** 1730.

OBSTRUCTIONS.

Br. obstr. navigation, **89,** 2797.

OPERATIONS.

1876-77. Begun at Horseleg Shoals, near Rome, **77,** 597.

1877-78. At various shoals between Rome and Greensport, **79,** 140, 1269.

1879-80. 1,039 c. y. r. excavated from chan.; 6,124 c. y. r. quarried; 3,714 c. y. r. placed in dams; 3,350 c. y. gravel, etc., excavated; 12,756 c. y. earth embankment raised, **80,** 1689.

1880-81. 4,219 c. y. masonry laid; 1,362 c. y. st. quarried; 1,945 c. y. solid and 12,645 c. y. loose r. excavated; 7,040 c. y. earth embankment raised, **81,** 1872.

1881-82. 3,154 c. y. masonry laid; 610 c. y. dimension st. cut; 9,191 c. y. st. quarried, and 14,312 c. y. st. placed in dams and locks; 10,898 c. y. earth and gravel placed in dams and embankments; 740′ cribbing built, **82,** 1856.

1882-83. 7,686 c. y. st. cut and quarried; 18,597 c. y. st. and gravel placed in riprap dams; 359 c. y. solid r. excavated; 1,140 c. y. loose r. and gravel excavated; 2,106 c. y. earth excavated, **83,** 1502.

1883-84. 634 c. y. st. and gravel placed in riprap dams; 1,169 c. y. solid r. excavated; 474 c. y. gravel etc., excavated; lock gates for Lock No. 1 completed, **84,** 1655.

1884-85. 6,363 c. y. st. cut; 4,406 c. y. st. built into locks; 1,922 c. y. st. built into rubble dams; 3,093 c. y. solid r. excavated; 9,846 c. y. earth excavated, **85,** 1302.

1885-86. 1,055 c. y. st. quarried and dressed 143 c. y. solid r. excavated from chan., **86,** 1166.

1886-87. Progress on l. and d. constr. at Ten Isld. Shoals, and at Lock and Dam No. 4, **87,** 1282.

1887-88. Constr. of Lock and Dam No. 4 continued, **88,** 1180.

1888-89. 8,583 c. y. drd.; 306 c. y. loose r. and 90 c. y. solid r. removed; 1,828 c. y. masonry and concrete laid; 3,305 c. y. st. quarried, and 268 logs and snags removed, **89,** 1392.

1889-90. Lock No. 1 completed and opened to navigation; operations continued upon Locks Nos. 2 and 3; obstrs. removed fr. between Locks 1 and 2, **90,** 1643, 1644.

1890-91. Lock No. 2 completed; operations continued upon Lock No. 3; work begun upon Lock No. 4; excavation of chan. through Lonnergan Reef in progress, **91,** 1746.

1891-92. Upper section, between Rome and the East Tennessee, Virginia & Georgia RR. br.: Repairs to dam at Lock No. 3, and guide crib above the lock filled with st.; 222 l. f. st. dam built at foot of Wood Isld.; 1,096 c. y. r. removed from the chan. at Lonnergan Reef, and timber guide cribs built; dam abutment, cofferdam, and lock house completed at Lock No. 4, **92,** 1425, 1426. Lower section, between Wetumpka, Ala., and the East Tennessee, Virginia & Georgia RR. br.: Erection and preparation of plant and commencement of r. excavation in constr. of lock at Wetumpka, **92,** 1428.

1892-93. Constr. of Lock No. 4 in progress; 3,208 c. y. r. excavated at Box Shoals; repair and constr. of Lock No. 31 in progress, and 6,266 c. y. r. excavated at the head of the lock, **93,** 1728, 1732.

1893-94. Constr. of Lock No. 4 in progress and chan. at Box Shoals d., **94,** 1287, 1288; constr. of Lock No. 31 continued, and 14,505 c. y. excavated in the vicinity of the lock. A RR. also built to connect the site of the lock with the head of the rapids, **94,** 1294.

1894-95. Work continued on Lock No. 4, **95,** 1672; repairs made to wing and training dams at Horseleg Shoals, and obstr. removed; blasting and drg. done between Locks Nos. 3 and 4, **95,** 1673; work on Lock No. 31 continued, and 8,199 c. y. r. excavated above the lock, **95,** 1675, 1676.

1895-96. Work at Lock No. 31 continued, and 11,131 c. y. r. excavated from chan. above, **96,** 1420, 1422.

1896-97. Repairs made to dam No. 4, and preparations for work at Lock No. 4 made; 6,542 c. y. drd. from the chan., and some blasting done at Box Shoals, **97,** 1645; works of constr. removed from Lock No. 31, **97,** 1648.

1897-98. Dam constr. in progress at Horseleg Shoals; drg. was done at and obstrs. removed from the chan. at Shorters Isld. and Mayos Bar; sand and gravel for concrete were drd., and the chan. at the head of Box Shoals drd.; the constr. of Lock No. 4 was continued, **98,** 1415, 1416.

1898-99. 1,040 l. f. dam built at Horseleg Shoals; blasting, drg., and building dams between Locks Nos. 3 and 4, **99,** 1685.

1899-00. 1,305 l. f. dam built at Lonnergan Reef; 640 l. f. built at Whiteside Bar, and blasting, drg., and building dams between Locks Nos. 3 and 4 **1900,** 2140, 2141.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 563, 570; **72,** 502, 536, 540; **77,** 598; **78,** 763; **90,** 1659–1666, 1669; **91,** 1744; **98,** 1413, 1418; **99,** 1688.

Character of banks and slope of R. bed, **89,** 1390.

Description of the locality surv. for Locks Nos. 9 and 10 in 1898–1899, **98,** 1420.

PLANS. (See Estimates and Projects.)

By Capt. Damrell, 1880, Selma, Rome & Dalton RR. br. to city of Wetumpka, Ala., system of ls., ds., short stretches of canal, and removal of rs. from chan. at various points; est., $2,649,949, **81,** 1222.

PROJECTS. (See Estimates and Plans.)

For version of proj. up to 1912, see Q 42(b), Projects.

By Capt. King, 1877, imp. Greensport to Selma, Rome & Dalton RR. br. by excavation of chan. 4′ x 80′ at extreme l. w., and by a system of ls. and ds. around Ten Isld. Shoals; est., $560,663, **77,** 598; **81,** 1871; **87,** 1281.

By Capt. King and Lt. Marshall, 1878, ds. and ls. at Whistenants Mill and Ten Isld. Shoals; est. $155,616.23, **78,** 766.

Est. of the cost of this work increased from time to time on account of inadequate app. and modifications of the original proj., consisting mainly of the adoption of a better quality of work for the locks, cut-st. masonry being substituted for wooden cribs. In 1889, est. for completion was $225,000, making a total est. $748,700. **89,** 1390, 1391; **12,** 602.

By Capt. Price, 1889, imp., rapids at Wetumpka to imps. already completed above the Ten Islds., giving a complete system of slack-water navigation, with a minimum chan. d. of 6′; by removal of r. and the constr. of 27 ls. and ds., the ls. to be 52′ x 320′ between miter sills; est., $6,074,913, **90,** 1670, 1672, 1677, 1686.

In 1890, est. for completion of the imp. between Rome and the East Tennessee, Virginia & Georgia RR. br., exclusive of the app. of 1890, was $971,840, **90,** 1641, 1642, 1644.

For prior projs. see **90,** 1667, 1668.

Act Sept. 19, 1890, making an aggregate app. of $300,000 for imp. of the Coosa R., fixed the dimensions of the ls. at 40′ w., with 210′ between miter sills; est. for completion of 31 ls. and ds., $6,038,214, **91,** 1744, 1747, 1752.

Congress, 1892, removed restrictions as to sizes of ls. imposed by act Sept. 19, 1890, **97,** 1644.

By Capt. Price, 1893, abandonment of cut st. in lock walls of Lock No. 31, except for quoins, and for adoption instead of a facing of concrete, **93,** 1731.

By BE., 1896, for modification of constr. of concrete floor of Lock No. 4, **96,** 1423.

SURVEYS.

By H. C. Fillebrown, 1870–71, under direction of Maj. Reese, Capt. Damrell, Col. Simpson, and Maj. McFarland. **R., 71,** 561, 562, 564; **72,** 502.

By J. C. Long, under direction of Maj. McFarland. **R., 72,** 516, 536.

By B. W. Frobel, 1874, under direction of Maj. McFarland. **R., 75,** ii, 661, 662.

By R. C. McCalla, under direction of Capt. King, and Lt. Marshall. **R., 78,** 762, 763.

By Capt. Damrell, **79,** 106.

Detailed sur. of 24 m. below Lock No. 3, **82,** 1856.

Au. act Mar. 3, 1879; made by Capt. Damrell, 1880, Selma, Rome & Dalton RR. br. to Wetumpka, Ala., **81,** 1221.

Of Coosa R. rapids at Wetumpka to Ten Islds., au. act Aug. 11, 1888; made, 1889, by Capt. Price, **90,** 1658, 1665.

Sur. of the proposed sites for Locks Nos. 9 and 10 commenced, 1898, **98,** 1419.

Maps:
Of Ten Isld. Shoals, **78,** 764.
90, 1644; **91,** 1752; **92,** Atlas, 68, 69; **94,** 1288.
Box Shoals, **93,** 1726.
St. crushing plant at Lock No. 4, **95,** 1678.

Part (c), Q-52 Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad Bridge.

APPROPRIATIONS. (See preceding Q-52(b).)

COMMERCE.

Imp. has resulted in reduction in rates between points on R. of not less than 50%; t., 1907, 124,078 t., **07,** 368; 1910, 88,228 t., **11,** 488; 1911, 40,840 t., **12,** 602.

"The approved project is about 4 per cent completed, resulting in the construction of the lowest lock of the series, known as No. 31, excepting the dam and gates, the excavation of the channel between this lock and the one next above, and the preparation of data and plans for additional locks and dams.

"As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire system.

"The ordinary variation of the water surface at Wetumpka is 0 to 50 feet.

"The river is not navigable, and there is no commerce between Wetumpka and the East Tennessee, Virginia & Georgia Railroad bridge." **12,** 603.

CONTRACTS.

1911. Brewer & Jones, sand, 65¢ c. y., gravel 85¢ c. y.; Southern States Portland Cement Co., 35,000 bbls. Portland cement, 51¢ sack at Lock, Ala., 45¢ sack at Rome, Ga.; Brewer & Jones, 6,000 c. y. sand, 95¢ c. y., **11,** 1693.

ENGINEERS.

Chief of Engineers. R., 01, 362; **02,** 291; **03,** 304; **04,** 318; **05,** 326, 329, 1351; **06,** 351; **07,** 367; **08,** 389; **09,** 406, 409; **10,** 456; **11,** 486; **12,** 600.

Boards. Convened, Montgomery, Ala., Nov. 14, 1904, for consideration of imp. of Coosa R.; decision that further prosecution of existing proj. for ls. and ds. be abandoned, but that partly constr. dam at Lock No. 4 be completed, with revisions (Lt. Col. D. W. Lockwood, Lt. Col. R. L. Hoxie, Capt. C. W. Kutz), **05,** 1386–1391.

In charge:
Capt. W. V. Judson, 1901. **R., 01,** 1788.
Lt. R. R. Raymond, 1902. **R., 02,** 1274.
Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1230; **04,** 1785; **05,** 1346, 1354, 1384; **06,** 1262; **07,** 1359.
Capt. H. B. Ferguson, 1908–10. **R., 08,** 1416; **09,** 1403; **10,** 1551.
Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1690; **12,** 1907.

Assistants:
N. A. Yuille. **R.** on sur., **05,** 1369.
D. M. Andrews. **R., 05,** 1371.

OPERATIONS.

1900–01. Care of plant and mainten. of existing structures, **01,** 1788.

1901–02. Repairs made to Dam No. 4, and new hull built for dr. boat, **02,** 1274.

1902–03. Repairs to Dam No. 4 completed; tow boat *Leota* rebuilt, **03,** 1230.

1903–04. 25,000 c. y. dr., 53 snags removed and 48 trees cut; 900 l. f. cribwork training dam constr. at Horseleg Shoals and filled with 910 c. y. st., **04,** 1786.

1904–05. 35,820 c. y. sand, gravel, and slate removed and 3,210 l. f. j. built and repaired, **05,** 1346.

1905–06. 37,335 c. y. removed and 1,900 l. f. dike built and repaired, **06,** 1262.

1906–07. 7,000 c. y. sand and gravel dr. at Double Isld., 100 l. f. dam built at Crofts Shoals, and 3,000 c. y. sand and gravel removed, **07,** 1359.

1907–08. 59,345 c. y. dr. and 1,495 l. f. js. built, **08,** 1416.

1908–09. 35,800 c. y. dr. and 1,960 l. f. js. built, **09,** 1403.

1909-10. 17,500 c. y. dr. and 2,300 l. f. j. built, **10,** 1551.

1910-11. 7,860 c. y. removed; 1,000 l. f. js. built, 2,233 c. y. filled in above Dam No. 4; 2 barges and 2 quarterboats built; preparations for constr. l. and d. at Mayos Bar begun; work on lock in Dam No. 4 and site for Dam No. 5 in progress; details given, **11,** 1690, 1691.

1911-12. 2,100 c. y. r. removed; 3,260 c. y. filled in above Dam No. 4; repairs to floating plant; work at Mayos Bar l. and d. R. wall nearly completed, land wall 75% completed, lockhouse built; at Dam No. 4 and Dam No. 5, concrete floor finished and part of land wall built, **12,** 1907, 1908. Open chan. work 25% completed; l. and d. at Mayos Bar 50% completed, and lock in Dam No. 4, 50% completed, **12,** 601.

PHYSICAL CHARACTERISTICS.

Max. draft between Rome and Lock No. 4, 3′, except at Horseleg Shoals, 1½ miles below Rome, 2′, **12,** 602.

PRIVATE WORK. (See last paragraph of Projects.)

PROJECTS.

Au. act June 13, 1902, provides for expend. of $10,000 on imp. of Ostenaula and Coosawattee Rs., **02,** 291.

Lt. Raymond recom., 1902, completion of Lock No. 4, and that lift of lock and height of dam be increased 3′; also that dam without a lock be built at site proposed for Lock 5, **02,** 1275.

Act Mar. 3, 1905, au. in accordance with recom. of BE., Jan. 4, 1905, imp. of chan. between Rome, Ga., and Lock No. 4, and completing of Lock and Dam No. 4, **05,** 1347, 1391.

Act June 4, 1906, au. completion of dam and forebay of Lock No. 4 by private interests, with an allowance of 2 years for commencement of work, **06,** 352.

Act June 25, 1910, au. extending orig. proj., and providing for constr. of lock at Mayos Bar, near Rome, Ga.; estimate, $241,039,[1] **10,** 457. Act June 25, 1910, also au. constr. of lock in Dam No. 4, in accordance with plan printed in H. Doc. No. 1421, 60th Cong., 2d sess.; est., $282,000; and acquisition of site for Dam No. 5, recom. to be placed at Choccolocco Shoals, est. $134,000, **10,** 457.

Increase in est. for completion of projs., **12,** 602.

As given in an. **R.,** 1912, orig. proj. au. Aug. 14, 1876, covered section from Rome, Ga., to Willis Creek, Ala.; est., $180,000; provided for crib and timber lock 32′ x 200′ with 3′ lift, and for excavating 4′ chan. Act June 14, 1880, app. funds, presumably based on est. of 1878, of $155,616.23, for 3 locks, Greensport to Woods Isld., at foot of Ten Isld. Shoals, 40′ x 210′, with extreme l. w. d. of 4′ on miter sills, together with 3′ chan. between Locks 1 and 3. Act Sept. 19, 1890, au. 5 ls. and ds. from and including No. 4, to the East Tennessee, Virginia & Georgia RR. br. Plan called for ls. 52′ x 280′, but the act au. 40′ x 210′. The plan also recom. connecting chan. 4′ x 100′, extreme l. w., at total est. of $1,160,491—for the entire imp., $1,496,107.23. Act July 13, 1892, modified act Sept. 19, 1890, removing restrictions as to size of ls. Act Mar. 3, 1905, restricted imp. of upper Coosa for mainten. of chan. between Rome, Ga., and Lock 4, Ala. Act Mar. 2, 1907, au. both imp. and mainten. by open-chan. work between Rome and Lock 4. Act June 25, 1910, au. lock in Dam No. 4, at est. of $282,000, and acquisition of site for Dam No. 5, Ala., recom. to be placed at Choccolocco Shoals (est., $134,000). Same act au. lock 40′ x 272′, with 9′ lift, at Mayos Bar, near Rome, Ga., est. of $241,039. Act Feb. 27, 1911, app. for continuing constr. of lock in Dam No. 4, and for constr. of dam No. 5. Same act au. raising Dam No. 4, 3′ more, to provide for development of waterpower (franchise granted to Ragland Water Power Co., work to be paid by them, to be done under supervision of U. S. coordinately with U. S. imps.), **12,** 600, 601.

SURVEYS.

Au. act June 13, 1902; made by Capt. Cavanaugh for 6′ navigation in Coosa and Alabama Rs. (imp. in manner indicated not deemed advisable),[2] **04,** 322; **05,** 329, 1351.

Pre. ex. and sur., au. act Mar. 2, 1907, of Horseleg Shoals, near Rome, Ga., for l. and d.; **Rs.,** Capt. Ferguson, 1907 and 1908; est., $241,039,[1] **09,** 409.

Ex. and sur. au. by act Mar. 2, 1907, for location and constr. of Dam No. 5; **Rs.,** Capt. Ferguson, 1907 and 1908; est., $134,000,[3] **09,** 409.

Ex. and sur. of Etowah, Coosa and Tallapoosa Rs., au. act Mar. 3, 1909 (**R.** to come), **11,** 490; **12,** 605.

Maps.[1] **11,** 1690.

Part (d), Q–52 Coosa River, Ga., between Wetumpka and East Tennessee, Virginia and Georgia Railroad Bridge.

APPROPRIATIONS. (See preceding Q–52(a).

COMMERCE.

Before any C. can be developed the entire section must be improved; R. not navigable; no C., and at 1912 proj. only 4% done, **01,** 363; **12,** 603.

ENGINEERS.

Chief of Engineers. R., 01, 363; **02,** 292; **03,** 305; **04,** 319; **05,** 327; **06,** 352; **07,** 368; **08,** 391; **09,** 408; **10,** 457; **11,** 488; **12,** 602.

In charge:

Capt. W. V. Judson, 1901. **R., 01,** 1790.

Lt. R. R. Raymond, 1902. **R., 02,** 1276.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1233; **04,** 1788; **05,** 1349; **06,** 1264; **07,** 1361.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1418; **09,** 1404; **10,** 1552.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1694; **12,** 1911.

OPERATIONS.

1900-01. Care and mainten. of plant and property, **01,** 1790.

PHYSICAL CHARACTERISTICS.

Navigation impossible on this part of R., **02,** 292.

PRIVATE WORK. (See last paragraph of Projects.)

PROJECTS.

Owing to insufficiency of funds Lt. Raymond recom., 1902, no further work be done on this section, except care of buildings and property at Wetumpka, Ala., **02,** 1277.

Existing proj. of 1890, modified by acts of 1907 and 1910, specifies 23 ls. and ds. and chan. of 4′; also same d. from Wetumpka to Junction of Alabama and Tallapoosa Rs.; to allow constr. of l. and d. at site of Dam No. 12 by private parties, **12,** 603.

As given in an. **R.,** 1912, orig. proj. au. Sept. 19, 1890, as result of sur. 1889, and modified by act July 13, 1892, contemplates slackwater navigation and provides for constr. of 23 ls. and ds. of varying lifts, of an available l. of 280′ and w. of 52′, with 6′ over miter sills, no lift of l. to exceed 15′. Also, chan. to be cleared of r. reefs and points, to give 4′ d.; est., $5,106,422. Act Mar. 4, 1907, gave franchise to Alabama Power Co., for l. and d. for water

[1] H. D. 1115, 60th, 2d. [2] H. D. 219, 58th, 3d. [3] H. D. 1421, 60th, 2d.

power, at location of Lock and Dam No. 12, as embraced in sur. au. act June 13, 1902. Act June 25, 1910, au. combination of Coosa R. (Wetumpka to its junction with the Alabama and Tallapoosa Rs., 11 m. below Wetumpka) with that of Alabama R. At 1912 proj. about 4% done, resulting in completion of lowest l. of series, No. 31, and some misc. work, **12,** 602, 603.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905, of Alabama R., with est. to provide 4′ navigation from mouth to Montgomery, and on the Coosa R. from Montgomery to Wetumpka (imp. of Coosa R. from Montgomery to Wetumpka not advisable),[1] **06,** 354.

Pre. ex. and sur. au. act Mar. 2, 1907, of Alabama and Coosa Rs., between Montgomery and Wetumpka; **Rs.,** 1907 and 1908; est., $36,000,[2] **09,** 409.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 603.

Maps.[2]

Part (e), Q-52 Coosa River, Ala. and Ga. (Operation and care of canals.)

APPROPRIATIONS.[3]

See Part Q-52(a).

CONTRACTS.

1907. Gulfport Creosoting Co., 2 wooden barges, $6,985, **07,** 1364.

ENGINEERS.

Chief of Engineers. R., 93, 226; **94,** 208; **95,** 235; **96,** 207; **97,** 262; **98,** 259; **99,** 302; **00,** 343; **01,** 363; **02,** 293; **03,** 306; **04,** 321; **05,** 329; **06,** 354; **07,** 369; **08,** 392; **09,** 408; **10,** 459; **11,** 490; **12,** 605.

In charge:

Capt. P. M. Price, 1893. **R., 93,** 1734.

Maj. F. A. Mahan, 1894–98. **R., 94,** 1297; **95,** 1679; **96,** 1423; **97,** 1654; **98,** 1422.

Capt. C. A. F. Flagler, 1899–1900. **R., 99,** 1692, **00,** 2145.

Capt. W. V. Judson, 1901. **R., 01,** 1792.

Lt. R. R. Raymond, 1902. **R., 02,** 1277.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1235, **04,** 1791; **05,** 1350; **06,** 1266; **07,** 1363.

Capt. H. B. Ferguson, 1908–10. **R., 08,** 1420; **09,** 1405; **10,** 1554.

Lt. Col. G. D. Fitch, 1911–. **R., 11,** 1695; **12,** 1912.

OPERATIONS.

1893-00. Repairs and imp. made to ls. and ds. in operation, **93,** 1734; **94,** 1297; **95,** 1679; **98,** 1422; **99,** 1692.

Repairs made to Dam No. 4 and Lock No. 2, **00,** 2145.

1900-01. Guide piers at Locks Nos. 1 and 3 rebuilt; silt removed and repairs made to dwellings, **01,** 1792.

1901-02. Dam and cofferdam of Lock No. 4 repaired; new hull built for dr., and machinery trans.; cofferdam at Lock No. 4 partly destroyed, and repairs made, **02,** 1277.

1902-03. Repairing and raising crest of Dam No. 4 completed; repairs made to Dams Nos. 1 and 2 and entrances dr., **03,** 1235.

1903-04. Break in main dam repaired at Lock No. 4, dr. at entrances and minor plant repaired, **04,** 1791.

1904-05. Dam and valves repaired at Lock No. 1; gate valve repaired and upper gates renewed at Lock No. 2; minor repairs made at Lock No. 3, and entrances dr. at all 3 ls., **05,** 1351.

1905-06. Entrances dr., valves repaired, upper and lower gates renewed at Locks Nos. 2 and 3, and other general repairs, **06,** 1266.

1906-07. Entrances dr., break in Dam No. 2 repaired, repairs to Dam No. 4, and 2 barges built, **07,** 1364.

1907-08. Dr. entrances to ls. and minor repairs made to ls. and dwellings, **08,** 1420.

1908-09. General repairs made to ls. and gates, and entrances dr., **09,** 1405.

1909-10. General repairs made to ls. and ds., and entrances dr. at Locks Nos. 1 and 2, **10,** 1554.

1910-11. Repairs to structures and dr., and removing silt from l. entrances, **11,** 1695.

1911-12. Dr. entrances, and repairs to structures and floating plant, **12,** 1912.

SURVEYS.

Maps, etc.

Safety latch for valve levers, **93,** 1734.

Repairs to Dam No. 4, **02,** 1278.

Q-53 ETOWAH RIVER, GA.

APPROPRIATIONS.

1876, $1,300,[4] **77,** 92, 601; **78,** 105; **79,** 1272.

COMMERCE.

Not unimportant, **80,** 1693.

ENGINEERS.

Chief of Engineers. R., 71, 64; **72,** 59; **77,** 92; **78,** 105; **79,** 141, 142; H. Doc. 17, 46th Cong., 2d sess.; **80,** 189; **81,** 256; **82,** 250; **10,** 460; **11,** 490, **12,** 605.

In charge:

Maj. W. McFarland, 1872. **R., 72,** 481, 516.

Capt. W. R. King, 1877–82. **R., 77,** 601; **78,** 766; **79,** 1272; H. D. 17, 46th Cong., 2d sess.; (Maj.) **80,** 1693, 1694; **81,** 1874; **82,** 1858.

Capt. H. B. Ferguson, **10,** 460; **11,** 490.

Lt. Col. G. D. Fitch, **12,** 606.

Assistants:

R. C. McCalla. **R., 72,** 527–535.

J. C. Long. **R., 72,** 543–551.

Lt. W. L. Marshall. **R., 77,** 602; H. D. 17, 46th ;C., 2d; **80,** 1694.

Ernst Ruhl, **79,** 1272. **R.,** H. D. 17, 46th; 2d; **80,** 1695.

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[1] H. D. 378, 59th, 1st.

[2] H. D. 1089, 60th, 2d.

[3] Expend. under permanent indefinite app. provided by acts July 5, 1884, and Mar. 3, 1900, for operating and keeping in repair canals and other public works.

[4] Part of $10,000; the remainder of app., $8,700, trans. to Coosa R. below Rome, Ga., by act Aug. 2, 1882, **82,** 1858.

PHYSICAL CHARACTERISTICS.

Description, **72,** 532–535, 543–551, H. D. 17, 46th, 2d; **80,** 1694.

PLANS.

By R. C. McCalla, 1872, canal, Owl Creek to Rome, 53 m., $3,732,500, **72,** 535.

By J. C. Long, 1872, 3½′ of water, RR. br., near Cartersville, to Rome, 50 m., by ds. and ls., $274,718, **72,** 481, 548–551.

By Maj. King, 1879, imp. of 63 m., giving a navigable chan. 4′, by constr. of 27 ls. and ds.; est. $2,276,663, **80,** 1698. Imp. not considered justifiable, **80,** 1693.

SURVEYS.

By R. C. McCalla, under direction of Maj. McFarland, from Owl Creek to Rome. **R., 72,** 480, 532–535.

By J. C. Long, under direction of Maj. McFarland, from RR. br. near Cartersville, to Rome. **R., 72,** 481, 543–551; **77,** 601, 602.

By Lt. Marshall, under direction of Capt. King, from Cartersville to Rome. **R., 77,** 601, 602.

By E. Ruhl, 1879, under direction of Maj. King, and Lt. Marshall, from Little River to Rome. **R.** H. D. 17, 46th C., 2d; **80,** 1694–1701.

Au. act June 18, 1878; made, 1879, by Maj. King (see Plans), **80,** 1694.

Pre. ex. au. act Mar. 3, 1909, with view to imp. (**R.** to come), **10,** 460; **11,** 490; **12,** 605.

Q-54(a) OOSTENAULA AND COOSAWATTEE RIVERS, GA.[1]

APPROPRIATIONS.

1874,	[2]$10,000.00,	**75,** 77, 794.
1875,	5,000.00,	**75,** 77, 794.
1878,	4,000.00,	**78,** 104, 766.
1879,	3,000.00,	**79,** 141, 1272.
1880,	2,000.00,	**80,** 1693.
1881,	1,000.00,	**81,** 1874.
1882,	1,000.00,	**82,** 1858.
1902,	[3]7,155.80,	**05,** 1350.
Total,	33,155.80	

COMMERCE.

Unimportant, **75,** 794.

1903, 1,412 t., **04,** 1791.

C. benefits to be derived from imp. very small **04,** 1790.

CONTRACTS.

1903. J. D. Kirkpatrick and W. S. Langford, hire of towboat and crew, quarterboat, and barge, **04,** 1790.

ENGINEERS.

Chief of Engineers. R., 71, 64; **72,** 59; **74,** 71; **75,** 77; **76,** 87; **77,** 91; **78,** 104; **79,** 141; **80,** 188; **81,** 256; **82,** 249; **83,** 257; **84,** 257; **85,** 201; **86,** 199 **87,** 167; **02,** 291; **03,** 305; **04,** 320; **05,** 328; **06,** 351; **07,** 368.

In charge:

Maj. W. McFarland. **R., 71,** 497; **72,** 481; **75,** 792.

Capt. L. C. Overman. **R., 74,** 581.

Capt. W. R. King, 1875–85. **R., 76,** 714; **77,** 601; **78,** 766; **79,** 1271; (Maj.) **80,** 1692; **81,** 1873; **82** 1857; **83,** 1503; **84,** 1656.

Capt. R. L. Hoxie, 1885–89. **R., 85,** 1300; **86,** 1165; **87,** 1278; **88,** 1175.

Capt. P. M. Price, 1889. **R., 89,** 2797.

Capt. W. V. Judson, **02,** 291.

Lt. R. R. Raymond, **02,** 291.

Capt. J. B. Cavanaugh, 1903–07. **R., 03,** 1233 **04,** 1789; **05,** 1350; **06,** 1264; **07,** 1362.

Assistant. R. C. McCalla. **R., 72,** 507.

OBSTRUCTIONS.

Further expend. not recom. till the RR. br. near Rome be provided with a suitable draw, **87,** 1278.

Br. obstr. navigation, **89,** 2797.

OPERATIONS.

1874–75. R. imp. at various places by small riprap ds., removal of snags, gravel, etc., **75,** 77, 792.

1875–76. Removal of obstr. and constr. of ds. by hired labor, **76,** 87, 714.

1878–79. Removal of ob r. and repairing and imp. ds. at 11 different points, **79,** 141, 1272.

1879–80. 472 c. y. r. and bowlders and 313 c. y. gravel excavated and 441 snags and overhanging trees removed, 807 c. y. r. quarried, and 1,513 c. y. r. placed in ds., **80,** 1692.

1880–81. 3,042 c. y. gravel, loose r., and 111 c. y. solid r. excavated; 133 c. y. st. quarried; 287 c. y. st. placed in dams; 46 snags and trees removed, **81,** 1874.

1881–82. 131 c. y. solid r. and 366 c. y. loose r. and gravel excavated; 26 snags removed, **82,** 1857.

1903–04. Work was begun Sept. 24, 1903, and completed Jan. 2, 1904; chan. cleared of obstr. from Rome to Carters Mill, Ga., to 2′, m. l. w., and min. w. of 30′; 2,867 snags and other obstr. were removed, **04,** 1790.

PHYSICAL CHARACTERISTICS.

Description, **72,** 507; **74,** 582.

The Oostenaula is formed by the junction of Coosawattee and Conasauga Rs., 60 m. nw. of Rome, Ga. Both streams are navigable for light draft boats from Rome to Carters Landing, 105 m., **02,** 291.

PLANS.

By R. C. McCalla, 1872, 3′ water from Resaca to Rome, $10,000 to $12,000, **72,** 509.

By Capt. Overman, 1874, removing snags, bars, etc., to obtain 2′–3′ from Resaca to Carters Mills for 7 months, $5,290; for 8 months, $10,335; for 9 months, $16,208.50, **74,** 582.

By Capt. King, 1879, completing proj., $6,208.50, **79,** 141, 1272.

PROJECTS.

By Maj. McFarland, 1874, building dams, removal of snags, r., etc., with hired labor, **75,** 77, 792.

By Capt. Overman, 1874, 3′ d. of chan. in the Oostenaula, and on the Coosawattee good navigation for boats drawing 2′ during 9 months of the year, the imp. to be accomplished by the removal of snags and trees, gravel and r. bars; est. cost for Oostenaula, $12,000, and for the Coosawattee, $16,208.50, **74,** 583; **75,** 794; **80,** 1693.

Capt. Hoxie, 1888, stated that the existing chans. sufficed necessities, **88,** 1175.

Act June 13, 1902, app. $10,000 for these 2 Rs. This sum, or so much thereof as might be necessary, be expend. in renewing works of contraction, removing snags and other obstr. from chan., and cutting overhanging trees from the banks where they obstr. navigation, **03,** 306.

[1] Oostenaula formed by the junction, 4 m. above Resaca, of the Conasauga and Coosawattee.
[2] Oostenaula R.
[3] Trans. from app. for Coosa, Oostenaula and Coosawattee Rs.

In the absence of any ex. or sur. impossible to submit exact est.; there should be provided for this and any future work a small, light draft snag boat and 2 light draft barges, **03,** 1234.
No further app. recom. until the fixed brs. obstr. the Rs. are modified, **07,** 1362.

SURVEYS.
By R. C. McCalla, 1872, under direction of Maj. McFarland, Resaca to Rome. **R., 72,** 481, 507.
By Capt. L. C. Overman, 1874, Resaca to Carters Mills. **R., 74,** 581.

Q-60 CAHABA RIVER, ALA.

APPPROPRIATIONS.

1882,	$20,000,	**83,** 998.
1884,	10,000,	**84,** 1189.
1886,[1]	7,500,	**86,** 202.
1892,	7,500,	**92,** 1434.
Total,	45,000	

COMMERCE.
Important, **75,** ii, 16.
Benefits to be derived from imp., **81,** 1233, 1236.
Increase of C. caused by imp., **85,** 1309.

ENCROACHMENTS.
Brs. crossing R. without draws, **87,** 1287.

ENGINEERS.
Chief of Engineers. R., 75, 82; **80,** 141; **81,** 189; **83,** 191; **84,** 199; **85,** 204; **86,** 202; **87,** 170; **88,** 157; **89,** 183; **90,** 165; **91,** 210; **92,** 204; **93,** 226; **94,** 209; **10,** 460.

In charge:
Capt. A. N. Damrell, 1875–85. **R., 75,** ii, 11; **81,** 1232; **83,** 995; **84,** 1186.
Capt. R. L. Hoxie, 1885–89. **R., 85,** 1295; **86,** 1173; **87,** 1287; **88,** 1185.
Capt. P. M. Price, 1889–93. **R., 89,** 1398; **90,** 1651; **91,** 1754; **92,** 1432; **93,** 1735.
Maj. F. A. Mahan, 1894. **R., 94,** 1298.
Capt. H. B. Ferguson, 1910. **R., 10,** 460.

Assistants:
M. J. Mack. **R., 75,** ii, 11.
T. W. Nicoll, **75,** ii, 11.
C. B. Percy. **R., 81,** 1233; **91,** 1755; **92,** 1433.
Lt. C. L. Potter. **R., 90,** 1653.

OBSTRUCTIONS.
Brs. obstr. navigation upon the Cahaba, **75,** ii, 13; **88,** 1186; **90,** 1653.
Description of, **93,** 1737.
Navigation completely blocked by 2 brs., **93,** 1737.

OPERATIONS.
1882–83. 5,832 overhanging trees, stumps, logs, and snags removed, **83,** 997.
1883–84. 19,750 overhanging trees, stumps, logs, and snags removed, 220 l. f. brush js. built, **84,** 1187.
1884–85. Snag boat constr., **85,** 1308.
1885–86. 1,516 snags, logs, and trees removed, clearing the R. for about 19½ m., **86,** 1174.
1890–91. Act Sept. 19, 1890, having removed the restriction upon the expend. of available funds, constr. of light-draft log boat begun, **91,** 1755.
1891–92. 1,613 snags and logs removed from the chan.; 277 c. y. gravel excavated; 1,550 l. f. willow j. constr., **92,** 1433.
1892–93. 7,176 obstr. from banks and stream, 23 c. y. r., and 1 RR. br. truss removed, **93,** 1736.
1893–94. 7,515 obstr. and wreck removed, **94,** 1300.

PHYSICAL CHARACTERISTICS.
Table of shoals and other obstr., **75,** ii, 14.
Description of, **75,** ii, 12; **81,** 1233.
Character and slope of R. bed, **88,** 1186.

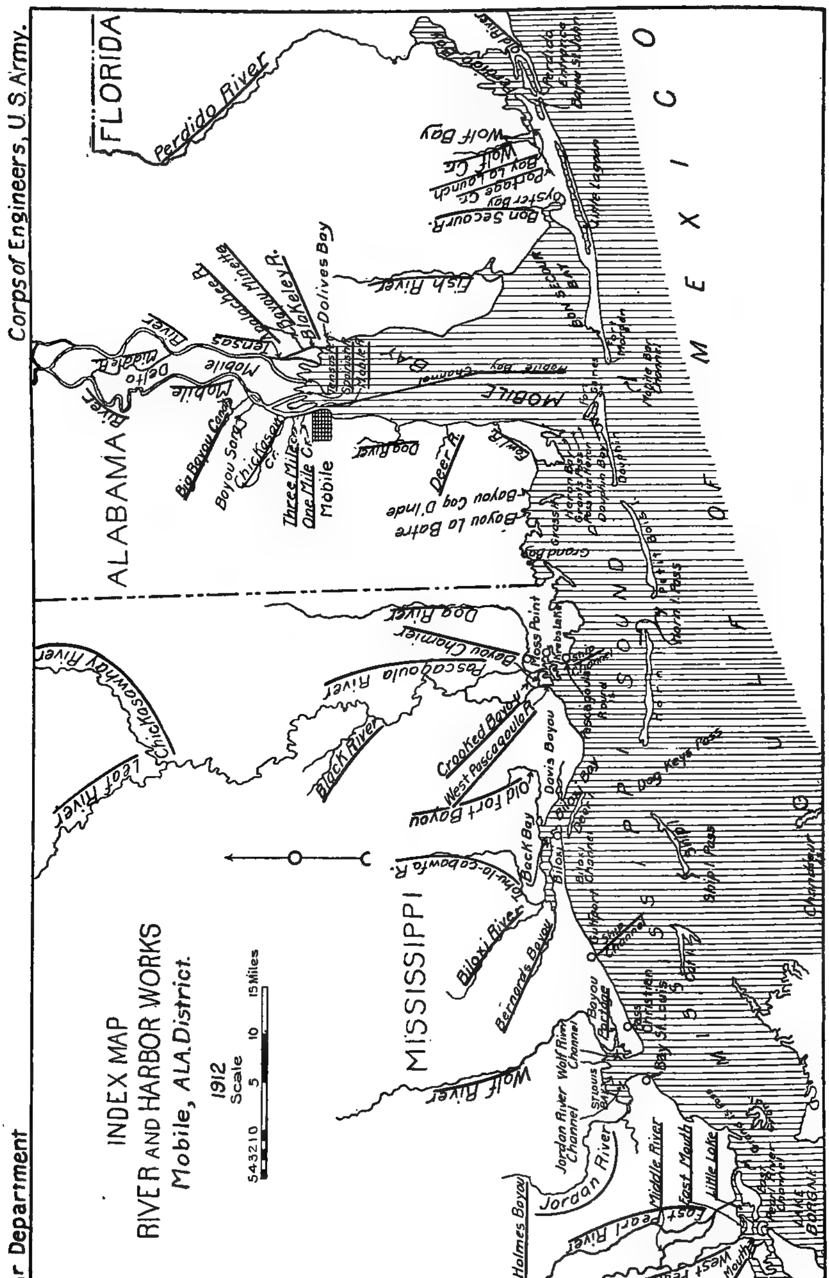
PLANS. (See Projects.)
By M. J. Mack: (1) Safe flat-boat navigation, Centerville down, stage of 3′ above l. w., by operations of a snag boat; est., $40,000. (2) Navigation, enabling SS. drawing not over 3′ to ascend as far as Centerville at all seasons by the operations of a snag boat, by dr., r. excavation, and constr. of dams; est. $194.598.75. (3) Lock and dam imp. to reach Cahaba coal fields. Comparison of various plans. **75,** ii, 13, 14, 15, 16.
By Maj. Damrell, 1883, to Lower Cahaba R. navigable chan. from mouth to Centerville, 88 m., giving 3′ l. w. and a w. in open R. of 100′, and in soft r. and bar cuts 60′; by removal of snags, dr. through soft r. and gravel bars, and by contracting and regulating chan.; est., $195,000, **83,** 996; **86,** 202; **87,** 1287, **92** 1432.
In 1894 Maj. Mahan recom. discontinuing imp. on account of the inability to prevent several brs. from obstr. the stream, **94,** 1300.

SURVEYS.
By M. J. Mack, 1874. **R., 75,** ii, 11.
From Centerville to Shades Creek, **81,** 1232.
Pre. ex. mouth to Centerville, au. act Mar. 3, 1909. **R.,** Capt. Ferguson, 1909 (unfav.),[2] **10,** 460.

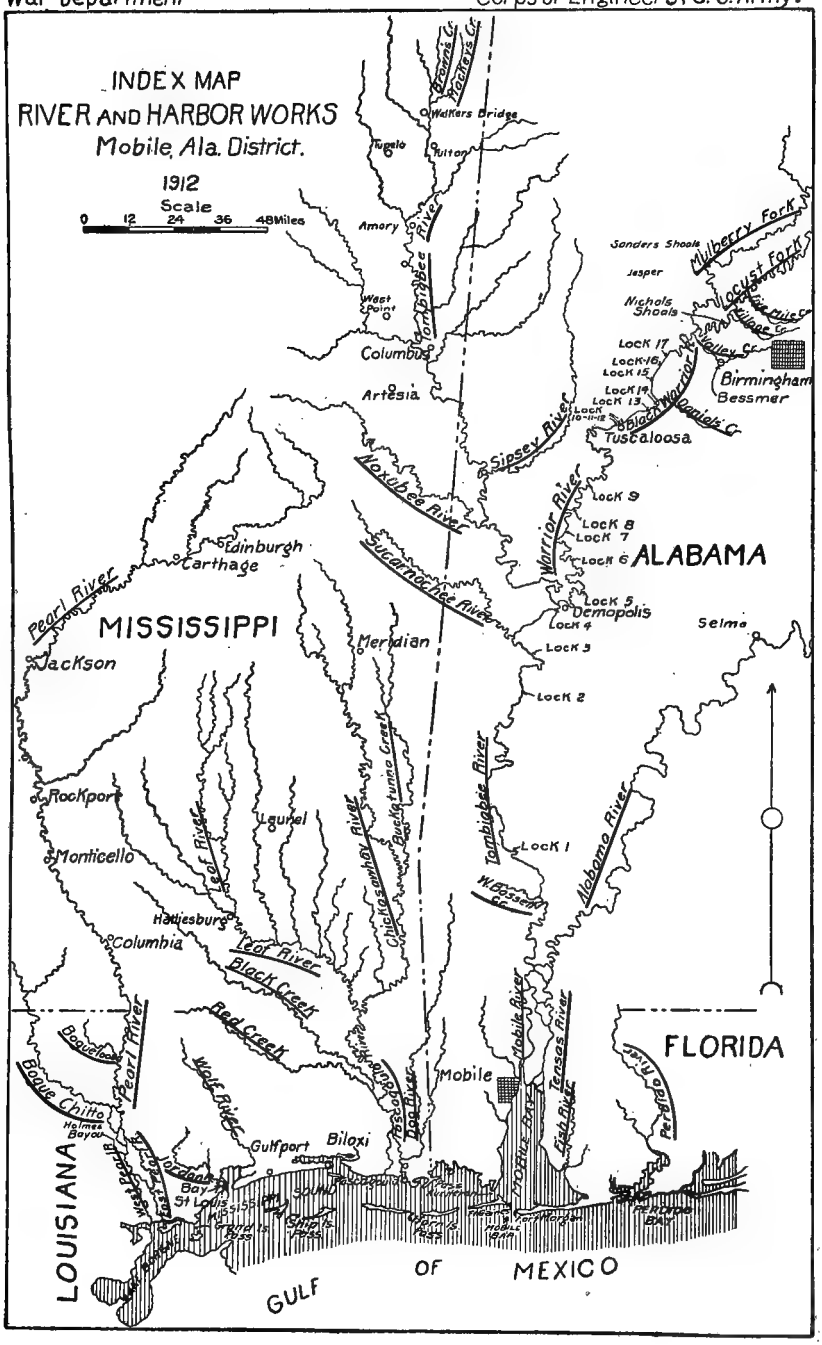
[1] The act of 1886 provides that no part shall be expend. until brs. crossing the R. are provided with suitable draws, **87,** 1287.
[2] H. D. 697, 61st, 2d.

RIVER AND HARBOR WORKS—GULF OF MEXICO.

R.—MOBILE, ALA., DISTRICT.


War Department
Corps of Engineers, U.S. Army.
INDEX MAP
RIVER AND HARBOR WORKS
Mobile, ALA. District.
1912
Scale
15 Miles
ALABAMA
MISSISSIPPI
FLORIDA
GULF OF MEXICO
MISSISSIPPI SOUND
MOBILE BAY

War Department Corps of Engineers, U. S. Army.



R.—MOBILE, ALA., DISTRICT.

In charge of U. S. Engineer Office,
Mobile, Ala.

R 1 Gulf of Mexico.
R 2 Little Lagoon, Ala. (1)
R 3 Mobile Bar Chan., Ala. (1) (4)
R 4 Mobile B., Ala. (1) (55)
R 5 Bon Secours B., Ala. (4)
R 6 Bon Secours R., Ala. (5)
R 7 Oyster B., Ala. (6)
R 8 Fish R., Ala. (5) (9)
R 9 Weeks B., Ala. (8)
R 10 D'Olives B., Ala. (4)
R 11 Blakeley R., Ala. (4) (12) (13) (16)
R 12 Bayou Minette, Ala. (11)
R 13 Tensaw R., Ala. (4) (11) (14) (15) (17) (18)
R 14 Middle R., Ala. (13) (21)
R 15 Raft R., Ala. (13) (18) (19)
R 16 Appalachee R., Ala. (4) (11)
R 17 Conway Bayou, Ala. (4) (13)
R 18 Crab Creek, Ala. (13) (15) (19)
R 19 Spanish R., Ala. (4) (15) (18) (20) (21)
R 20 Mobile R., Ala. (junction) (19) (21)
R 21 Mobile R., Ala. (4) (19) (22) (23)
R 22 Alabama R., Ala. (District Q) (21) (23)
R 23 Tombigbee R., Ala. and Miss. (21) (22) (24)
R 24 Warrior R., Ala. (23) (25)
R 25 Black Warrior, Ala. (24)
R 26 Daniels Cr., Ala. (25)
R 27 Valley Cr., Ala. (25)
R 28 B. W.—Locust Fork, Ala. (25) (31)
R 29 Village Cr., Ala. (28)
R 30 Fivemile Cr., Ala. (28)
R 31 B. W.—Mulberry Fork, Ala. (25) (28)
R 32 Sipsey Fork, Ala. (31)
R 33 Sipsey R., Ala. (23)
R 34 T.—East Fork, Miss. (23) (37)
R 35 Mackeys Cr., Miss. (34) (36)
R 36 Browns Cr., Miss. (34) (35)
R 37 T.—West Fork, MIss. (23) (34)
R 38 Old Town Cr., Miss. (37)
R 39 Noxubee R., Ala. and Miss. (23)
R 40 Sucarnoochee R., Ala. and Miss. (23)
R 41 West Bassetts Cr., Ala. (23)
R 42 Big Bayou Canal, Ala. (21)
R 43 Bayou Sara, Ala. (21)
R 44 Chickasaw Cr., Ala. (21)
R 45 Threemile Cr., Ala. (21) (46)
R 46 Bayou Marmotte, Ala. (45) (47)
R 47 Onemile Cr., Ala. (21) (46)
R 48 Mobile H, Ala. (4) (21)
R 49 Dog R., Ala. (4)
R 50 Deer R., Ala. (4)
R 51 Fowl R., Ala. (4) (57)
R 52 Grants Pass, Ala. (4) (55)
R 53 Pass aux Herons, Ala. (4) (55)
R 54 Dauphin Isld. B., Ala. (55)
R 55 Mississippi Sound, Ala. and La. (1) (4)
R 56 Heron B., Ala. (55)
R 57 Fowl R. B., Ala. (51) (55)
R 58 Bayou Coq d'Inde, Ala. (55)
R 59 Bayou Labatre, Ala. (55)
R 60 Grand B., Ala. (55)
R 61 Horn Isld. Pass, Miss. (1) (55)
R 62 Pascagoula Ship Chan., Miss. (55) 63)
R 63 Pascagoula R., Miss. (62)
R 64 Krebs Lake, Miss. (63)
R 65 Dog R., Ala. and Miss. (63)
R 66 Chickasahay R., Miss. (63) (67)
R 67 Leaf R., Miss. (63) (66)
R 68 Black Cr., Miss. (63)
R 69 Red Cr., Miss. (68)
R 70 Bluff Cr. Miss. (71)
R 71 W. Pascagoula R., Miss. (55) (63)
R 72 Crooked Bayou, Miss. (63)
R 73 Bayou Chamier, Miss. (63) (71)
R 74 Bellfontaine Bayou, Miss. (63)
R 75 Biloxi B., Miss. (55) (78) (83)
R 76 Davis B., Miss. (75)
R 77 Old Fort Bayou, Miss. (75)
R 78 Back Bay, Biloxi, Miss. (75) (79)
R 79 Big Lake, Miss. (78) (80)
R 80 Biloxi R., Miss. (79)
R 81 Tchula Cabawfa R., Miss. (80)
R 82 Bernards Bayou, Miss. (79)
R 83 Biloxi H., Miss. (75) (84)
R 84 Biloxi Chan., Miss. (55) (83)
R 85 Dog Keys Pass, Miss. (1) (55)
R 86 Ship Isld. Pass, Miss. (1) (55)
R 87 Gulfport Ship Chan., Miss. (55) (88)
R 88 Gulfport H., Miss. (87)
R 89 Bay St. Louis, Miss. (55)
R 90 Bay Portage, Miss. (89)
R 91 Wolf R. Chan., Miss. (89) (92)
R 92 Wolf R., Miss. (91)
R 93 Jordan R. Chan., Miss. (89) (94)
R 94 Jordan R., Miss. (93)
R 95 Grand Isld. Pass, Miss. and La. (55) (96)
R 96 Lake Borgne, Miss and La. (95)
R 97 E. Pearl R., Miss. (96) (98)

R 98 Pearl R., Miss. and La. (97) (101)
R 99 Bogue (Lusa) Loosa Cr., La. (98)
R 100 Bogue Chitto, La. (98)
R 101 W. Pearl R., La. (97) (98) (104) (105)
R 102 Holmes Bayou, La. (97) (101)
R 103 Middle R., La. (97) (101)
R 104 Pearl R. (w. mouth), La. (101) (105) (110)
R 105 Pearl R. (e. mouth), La. (101) (104) (106)
R 106 North Pass, La. (105) (107)
R 107 Little Lake, La. (106) (108) (109)
R 108 Little Lake Pass, La. (97) (107)
R 109 East Pass, La. (107) (110)
R 110 Rigolets, La. (96) (111)
R 111 Lake Pontchartrain, La. (110)

NOTE.—The following list includes all the waterways, important and less important, in R District, following Pearl River, to East Pass:

98 Pearl R., La. and Miss. (96)
98 (a) Ards Cr. La. (98)
98 (b) Pushepetappa Cr., La. (98)
98 (c) Muster Ground Cr., La. (b)
98 (d) Adams Cr., La. (98)
98 (e) Coburn Cr., La. (98)
98 (f) Peters Cr., La. (e)
98 (g) Bogue (Loosa) Lusa, La. (98)
98 (h) Richardson Cr., La. (g)
98 (i) Lees Cr., La. (98)
98 (j) Bogue Chitto, La. and Miss. (98)
98 (k) Wright Cr., La. (j)
98 (l) Tallys Cr., La. (j)
98 (m) Perrys Cr., La. (j)
98 (n) Millers Cr., La. (j)
98 (o) Blackwells Cr., La. (j)
98 (p) Warners Cr., La. (j)
98 (q) Lawrence Cr., La. (j)
98 (r) Hays Cr., La. (j)
98 (s) Leatherwood Cr., Miss. (j)
98 (t) Carters Cr., Miss. (j)
98 (u) Otapasse Cr., Miss. (j)
98 (v) Silver Cr., La. (j)
98 (w) Black Cr., La. (j)
98 (x) Mill Cr., La. (w)
98 (y) Tallisheek Cr., La. (98)
98 (z) English Bayou, La. (98)
98 (aa) Waste House Bayou, La. (98)
98 (bb) Old R., La. (98)
98 (cc) Little Lake, La. (96) (98)
98 (dd) Middle R., La. (cc)
98 (ee) W. Pearl R., La. (cc) (110)
98 (ff) Holmes Bayou, La. (ee)
98 (gg) Porters Bayou, La. (ee)
98 (hh) East Pass, La. (cc) (110)

R-1(a) MISSISSIPPI COAST HARBORS. (Dredge for.)

APPROPRIATIONS.

1907, [1]$75,000, **07,** 394.
1908, 125,000, **08,** 1454.

Total, 200,000 (incl. sales, $200,002.10, **11,** 1730).

CONTRACTS.

1908. Ellicott Machine Co., 20″ hydraulic dr., $144,000 delivered, **09,** 1437.
1909. Ellicott Machine Co., suppl., for changes in hydraulic dr., decreasing total cost $400. Thos. M. Favre, 61 wooden pontoons, $9,120.22, **09,** 1437.

ENGINEERS.

Chief of Engineers. R., 07, 394; **08,** 419; **09,** 438; **10,** 487; **11,** 525.

In charge:
Capt. J. B. Cavanaugh, **07,** 369.
Maj. W. E. Craighill, **07,** 369.
Maj. H. Jervey, 1907–10. **R., 08,** 1454; **09,** 1436; **10,** 1588.
Maj. C. A. F. Flagler, 1911. **R., 11,** 1730.

OPERATIONS.

1907-08. Plans and specifications for dr. constr. prepared, **08,** 1454.
1908-09. Dr. about 80% completed; work on pontoons for pipe line 70% completed, **09,** 1436.
1909-10. Dr. and pontoons for pipe line completed. Dr. named *Pascagoula*. Proj. completed, **10,** 1588.

PROJECTS.

Act Mar. 2, 1907, au. constr. of dr. for Hs. on coast of Miss., and adjacent chans.; cost $200,000, **07,** 394.

R-3 MOBILE BAR, ALA.

APPROPRIATIONS.

1902, $50,000, **05,** 1400.
1905, 50,000, **05,** 1400.
1907, 50,000, **07,** 1370.
1909, *23,000, **09,** 1412.
1910, 9,000, **10,** 1559
1911, 5,000, **11,** 1702.
1912, 10,000, **12,** 1920.

Total, 197,000 (incl. misc., $197,004.55, **12,** 1920).

COMMERCE.

Statistics allied with Mobile H.

CONTRACTS.

1903. Rittenhouse Moore, drng., 30¢ c. y., **04,** 1807.
1905. Southern Dredging Co., drng., 30¢ c. y., s. m., **06,** 1272.

ENGINEERS.

Chief of Engineers. R., 05, 332; **06,** 357; **07,** 372; **08,** 396; **09,** 413; **10,** 463; **11,** 494; **12,** 611.

In charge:
Maj. W. E. Craighill, 1905. R., **05,** 1399.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1271.
Maj. H. Jervey, 1907–10. **R., 07,** 1370; **08,** 1427; **09,** 1412; **10,** 1559.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1701; **12,** 1920.

OPERATIONS.

1904-05. 43,697 c. y. dr., **05,** 1399.
1905-06. 144,412 c. y. dr., **06,** 1271.
1907-08. 185,683 c. y. dr. by U. S. dr. *Charleston*, **08,** 1427.
1908-09. U. S. dr. *Charleston* removed shoals from center of chan. and increased the available d.

* Allotment.
[1] $25,000 allotted from Gulfport H. and $50,000 from Pascagoula R.

from 27½′ to 30′; d. 30′ to 35′ throughout chan., **09,** 1412.

1909-10. 121,640 c. y. dr. by U. S. dr. *Charleston,* **10,** 1559.

1910-11. U. S. dr. *Charleston* removed shoals from previously dr. chan. and d. unfinished parts, removing 32,184 c. y., **11,** 1701.

1911-12. 63,852 c. y. dr. by U. S. dr. from outer bar and lower end of H. chan., **12,** 1920.

PROJECTS.

D. and w. chan. through Mobile Bar made a separate proj., **05,** 1399.

Original proj. au. act June 13, 1902, provided for chan. 30′ x 300′ across Mobile Bar; est., $91,250. This formed part of Mobile H. proj. until act Mar. 3, 1905, made it a separate proj.; limit of cost increased to $100,000, **05,** 332.

R-8 FISH RIVER, ALA.

COMMERCE.

Incoming, not over 3,000 t. an.; outgoing, 4,000,000± f. b. m., manufactured lumber, **04,** 1861

ENGINEERS.

Chief of Engineers. **R.,** **04,** 343.

Boards. BERH. reviews Capt. Cosby's **R.** on ex.; concurs as to inadvisability of imp., **04,** 1862.

In charge. Capt. Spencer Cosby, 1904. **R.,** **04,** 1859.

PHYSICAL CHARACTERISTICS.

Details, **04,** 1859.

SURVEY.

Pre. ex. au. act June 13, 1902. **R.,** Capt. Cosby Feb. 6, 1903 (unfav.)[1] **04,** 343, 1859.

R-21 MOBILE RIVER AND HARBOR, ALA.[2]

APPROPRIATIONS.

1826,	$10,000.00, act May 20.
1829,	20,000.00, act Mar. 2.
1834,	10,000.00, act June 24.
1835,	17,997.60, act Mar. 3.
1837,	50,000.00, **72,** 602.
1838,	50,000.00, **72,** 602.
1852,	50,000.00, act Aug. 30.
1857,	20,833.00, act Mar. 3.
1870,	50,000.00, **70,** 63; **71,** 68, 559.
1871,	50,000.00, **71,** 68, 561.
1872,	75,000.00, **72,** 62, 575.
1873,	100,000.00, **73,** 67, 694.
1874,	100,000.00, **74,** 75, 892.
1875,	26,000.00, **75,** 80, ii, 5.
1878,	10,000.00, **78,** 79, 588.
1879,	100,000.00, **79,** 100.
1880,	125,000.00, **80,** 1051.
1881,	100,000.00, **81,** 1172.
1882,	125,000.00, **82,** 1251.
1884,	200,000.00, **84,** 1158.
1886,	90,000.00, **86,** 1189.
1888,	250,000.00, **88,** 1196.
1890,	350,000.00, **90,** 1695.
1892,	212,500.00, **92,** 1439.
1893,	500,000.00, **93,** 1750.
1894,	390,000.00, **95,** 1690.
1895,	291,300.00, **95,** 1690.
1896,	220,000.00, **96,** 1430.
1897,	25,000.00, **97,** 1665.
1898,	30,000.00, **99,** 1699.
1899,	100,000.00, **99,** 1699.
1900.	500,000.00, **00,** 2164.
1902,	[3] 300,000.00, **02,** 1283.
1903,	200,000.00, **03,** 1240.
1904,	*50,000.00, **04,** 1807.
1905,	200,000.00, **05,** 1396.
1907,	200,000.00, **07,** 1367.
1908,	160,000.00, **08,** 1424.
1909,	310,000.00, **09,** 1409.
1910,	455,000.00, **10,** 1557.
1911,	505,000.00, **11,** 1699.
1912,	403,000.00, **12,** 1917.
Total,	7,031,630.60 (less $50,000 used in d. chan. over outer bar, and incl. misc., $6,983,345.77, **12,** 1917).

COMMERCE.

Obstr. to C., **66,** 53.

Benefits of imp. to C., **66,** 53; **72,** 581, 592; **77,** 408; **86,** 1189.

C. necessities of Mobile demand further imp., **77,** 70; **78,** 587.

C. port of Mobile, **80,** 1056.

Amount of, dependent upon imp., **80,** 1057.

Proj, effected an average reduction of 20% on rail rates from Atlantic seaport cities, and direct water rates to foreign ports, **05,** 332.

Diagram showing relation of freight, tonnage, value and app., **11,** 1698. 1911, 1,412,350 t., **12,** 1919.

"The combined commerce, foreign and domestic, using Mobile Harbor during the calendar year 1911 aggregated 2,203,712 short tons, valued at $59,027,974. Cotton and cotton products, breadstuffs, lumber, and timber were the principal articles of export, and bananas and sisal grass the most important imports.

"The effect of the improvement has been to give Mobile quite a large reduction on rail freight rates from Atlantic seaport cities, and to afford direct water freight rates from Mobile to foreign ports." **12,** 609.

CONTRACTS.

1870. J. Grant, dr., 50¢ c. y., **71,** 559; contract extended, **71,** 560; **72,** 574.

1871. S. N. Kimball & Co., dr., 39½¢ c. y., **71,** 561; **72,** 574.

1872. J. Grant, dr., 30¢ c. y., **73,** 692.

1873. J. Grant, dr., 23¢ c. y., **74,** 889. J. E. Slaughter, dr., 45¢ c. y., **74,** 890.

1874. J. P. Stewart, dr., 18¾¢ c. y., **75,** ii, 4.

1875. S. N. Kimball, dr., 17¢ c. y., **76,** 491. Contract extended, **76,** 491.

1880. G. C. Fobes & Co., dr., 12$\frac{1}{10}$¢ c. y., **81,** 1170.

1881. G. L. Long, dr., 11.7¢ c. y., **82,** 1247.

1882. R. Moore, dr., 12½¢ c. y., **83,** 960.

1884. T. Burke, dr., 9¢ c. y., **85,** 1337.

1886. R. Moore, dr., 9½¢ c. y., **87,** 1297.

1888. Alabama Dredging & Jetty Co., dr., 9¢ c. y., **89,** 1429.

1890. National Dredging Co., dr., 8⅝¢ c. y., **91,** 1773.

[1] H. D. 234, 58th, 2d.

[2] Mobile B. and H., Ala.: Sur.—**R.** Nov. 15, 1826; est., $10,000. Mobile H., Ala.: Ex.—**R.** (fav.) Nov. 25, 1852. (H. D. 482, 55th, 2d.)

[3] $50,000 of this app. to be used in d. chan. over outer bar, **02,** 1281.

* Allotment.

1890. Alabama Dredging Co., dr., 422,691 c. y., 15¢ c. y., s. m., **93,** 1745.

1892. National Dredging Co., dr., 2,433,180 c. y., $7\frac{1}{16}$¢ c. y., s. m., **93,** 1745; Rittenhouse Moore Dredging Co., dr. 44,684 c. y., 16½¢ c. y., p. m., **94,** 1304.

1896-98. National Dredging Co., hire of dr. plant, $230 per day, **97,** 1666; **98,** 1429; **99,** 1700.

1899. National Dredging Co., dr., 7¢ c. y., **99,** 1701.

1902. National Dredging Co., dr., 8.3¢ c. y., s. m., **03,** 1240.

1903. Rittenhouse Moore, dr., on outer bar, 30¢ c. y., s. m., **04,** 1807.

1904. Rittenhouse Moore, dr., **05,** 1394.

1905. Geo. G. Barker, dr., 8.3¢ c. y., s. m.; Bowers Southern Dredging Co., dr., 9¢ c. y., p. m., **06,** 1269.

1906. Geo. G. Barker, dr., 8¢ c. y., s. m., **07,** 1368.

1907. Geo. G. Barker, dr., 7½¢ and 10¢ c. y., s. m. and p. m., respectively, **08,** 1425.

1909. Bowers Southern Dredging Co., dr., 9.95¢ c. y., p. m., **09,** 1409.

1910. Thos. M. Favre, wooden barge, $4,250; S. E. Krebs and T. C. Gatti, 61 wooden pontoons, $8,575.07; Atlantic Gulf and Pacific Co., dr. about 2,071,000 c. y. from Mobile B., 5.90¢ c. y., p. m., and 981,000 c. y. from Mobile R., 8.40¢ c. y., p. m., **11,** 1699.

1911. Coastwise Dredging Co., dr. 2,600,000 c. y., 5.38¢ c. y.; Southern Dredging Co., dr. 1,650,000 c. y., 5.45¢ c. y.; Home Dredging Co., dr. 600,000 c. y., 11.99¢ c. y., **12,** 1917. J. W. Gilbert, constr. bulkhead in Pinto Pass; prices listed, **12,** 1917–18.

1912. Thos. M. Favre, sur. motor boat, $16,900, **12,** 1918.

ENGINEERS.

Chief of Engineers. R., 63, 2, 3; **70,** 63,381; **71,** 68; **72,** 62; **73,** 66; **74,** 75; **75,** 80; **76,** 71; **77,** 69; **78,** 79; **79,** 100; **80,** 133, 1059; **81,** 180; **82,** 176; **83,** 186; **84,** 194; **85,** 207, 214; **86,** 205; **87,** 171; **88,** 159; **89,** 186; **90,** 168; **91,** 211; **92,** 206; **93,** 228; **94,** 210; **95,** 235; **96,** 207, 214; **97,** 263; **98,** 259; **99,** 303; **00,** 344; **01,** 364, 378, 1854, 1856; **02,** 293; **03,** 307; **04,** 322; **05,** 330; **06,** 355, 380; **07,** 369; **08,** 393; **09,** 409; **10,** 460; **11,** 491; **12,** 607.

Boards:

Convened, Mobile, Feb. 3, 1872, to prepare plan for imp. of Mobile H. and B.; also to report their views as to probable effect of work proj. by State board of harbor commissioners. Board of opinion that chan. 13′ d. over Choctaw and Dog R. Bar, for 9 m. from the inner H. of Mobile, should be dr., **72,** 590. Projs. proposed by the State board for the imp. of R., H., and B. of Mobile would be detrimental to the work in progress by the U. S., **72,** 576, 593. **R., 72,** 589. (Col. J. H. Simpson and Lt. Cols. Z. B. Tower and H. G. Wright.)

State board for imp. of R., H., and B. of Mobile organized, **72,** 574.

BE. convened, New York, Dec. 10, 1873, to consider and report upon questions relating to the imp. of Mobile H., Ala.; board recom. removal of 200′ of lower extremity of Pinto Pt. Jetty, to be followed by further removal if subsequently judged necessary. **R., 74,** 893. (Col. Simpson and Lt. Cols. Tower and Wright.)

Convened, New York, Feb. 28, 1880, to report upon plans and est. by Capt. Damrell for 17′ and 22′ chan. from fleet anchorage through B., into Mobile R. **R., 80,** 1060. (Cols. Tower and Newton and Maj. Abbot.)

In charge:

Capt. W. E. Merrill, 1866. **R., 66,** 52.

Maj. C. B. Reese, 1870; **70,** 63; **71,** 559.

Capt. A. N. Damrell, 1870; **70,** 63; **71,** 559.

Col. J. H. Simpson, 1870–72. **R., 71,** 560; **72,** 574, 589; **73,** 66.

Lt. Col. W. F. Raynolds, 1872–73, **73,** 66.

Capt. A. N. Damrell, 1873–95. **R., 73,** 691; **74,** 889, 893; **75,** ii, 3; **76,** 490; **77,** 407; **78,** 587; **79,** 799; **80,** 1049; **81,** 1169; **82,** 1245; (Maj.) **83,** 957; **84,** 1151; **85,** 1336, 1374, 1375; **86,** 1183; **87,** 1293; **88,** 1193; **89,** 1428; **90,** 1691; **91,** 1771; **92,** 1435; **93,** 1743; **94,** 1301; **95,** 1683.

Maj. W. T. Rossell, 1896–1901. **R., 96,** 1425, 1463; **97,** 1662; **98,** 1425; **99,** 1695; **00,** 2161; **01,** 1809, 1854, 1856.

Capt. Spencer Cosby, 1902. **R., 02,** 1281.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1237; (Maj.) **04,** 1803; **05,** 1393.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1267.

Maj. H. Jervey, 1907–10. **R., 07,** 1365; **08,** 1421; **09,** 1407; **10,** 1555.

Maj. C. A F. Flagler, 1911–13. **R., 11,** 1697; **12,** 1915.

Assistants:

Capt. Damrell, **70,** 63.

R. Rauchenstein, **72,** 581.

P. C. Boudousquie. **R., 96,** 1466.

David G. Anderson. **R., 03,** 1242; **04,** 1810.

ESTIMATES. (See Plans and Projects.)

1837–38. For completion, $150,000, **72,** 603.

By Capt. Merrill, 1866, Mobile H., $91,208, **66,** 54.

By W. D. Mann, 1870, dr., $500,000, **70,** 382.

By Maj. Reese, 1870, dr., $656,800, **71,** 559; **77,** 408.

By Col. Simpson, 1871, dr. and removal of obstr., $774,315.52, **71,** 561; **72,** 598; **77,** 408. Completion $451,908.85, **72,** 576.

By BE., 1872, Mobile H. and B., $609,847.87, **74,** 891.

By Capt. Damrell, 1873, completion, $589,237.69, **77,** 69, 408.

By Capt. Damrell, 1878, chan. 17′ x 200′, $826,107.66, **79,** 800. Chan. 21′ x 200′, $2,088,137.18, **79,** 800.

LEGISLATION.

Alabama, 1869, created a commission for imp. of H., **71,** 68, 561.

Bonds issued by Mobile Co. to amount of $45,000 (under act of legislature) for removal of obstr. in the H., **71,** 561.

OPERATIONS.

1837–38. **70,** 382.

1870–71. 38,500 c. y. dr., **71,** 560; **77,** 408.

1871–72. 107,963 c. y. dr., **72,** 575; **77,** 408.

1872–73. 163,269 c. y. dr., **73,** 692, 693; **77,** 408.

1873–74. 700′ of dike and j. removed; 373,389 c. y. dr., **74,** 890, 891; **77,** 408.

1874–75. Wrecks removed; 353,752 c. y. dr., **75,** ii, 4; **77,** 408.

1875–76. 220,575 c. y. dr., **76,** 491; **77,** 408.

1876–77. 46,133 c. y. dr., **77,** 407, 408.

1877–78. **78,** 587.

1878–79. Repairs to vessels and ex. and sur. of H., **79,** 100, 799.

1880–81. 143,149 c. y. dr., **81,** 1170.

1881–82. 1,315,604 c. y. dr., **82,** 1247, 1248.

1882–83. 1,138,447 c. y. dr., **83,** 961.

1883–84. 888,093 c. y. dr., **84,** 1153.

1884–85. 1,296,841 c. y. dr., **85,** 1337.

1885–86. 623,597 c. y. dr., **86,** 1185.

1886–87. 829,854 c. y. dr., **87,** 1295. Statement of total dr. done 1879 to 1886, **87,** 1295.

1888–89. 1,426,390 c. y. dr. and 26 pile clusters placed; repairs to U. S. steam propeller, **89,** 1429.

1889–90. 886,005 c. y. dr., **90,** 1693.

1890–91. 896,964 c. y. dr., **91,** 1773.

1891–92. 2,559,346 c. y. dr., **92,** 1437.

1892–93. Over 2,460,180 c. y. dr., **93,** 1745.

1893–94. 5,323,339 c. y. dr., **94,** 1304.

1894–95. 6,842,271 c. y. dr., **95,** 1686.

1895–96. 2,903,990 c. y. dr., **96,** 1428.

1896–97. 1,314,286 c. y. dr., **97,** 1662.

1897–98. 464,010 c. y. dr., **98,** 1426.

1898–99. 361,710 c. y. dr. and deadheads removed from chan., **99,** 1696, 1697.

1899–00. 4,226,671 c. y. dr. and deadheads removed from chan., **00,** 2162.

1900–01. 3,637,739 c. y. dr., **01,** 1810.

1901–02. Snags and other obstr. removed from chan., **02,** 1281.

1902-03. 2,409,939 c. y., s. m., dr., **03,** 1243. Snags and other obstr. removed from chan.; no bids received for work on outer bar, **03,** 1244.

1903-04. 2,081,897 c. y., s. m., dr. from chan in Mobile R. and B., **04,** 1810. 100,433 c. y., s. m., dr. from outer bar; dr. *Jumbo* lost on outer bar, **04,** 1812. Snags and other obstr. removed from R., **04,** 1805.

1904-05. 498,739 c. y., s. m., dr., and snags and other obstr. removed from chan., **05,** 1394.

1905-06. 867,905 c. y. dr., and 1,470 snags and other obstr. removed from chan., **06,** 1268.

1906-07. 1,109,410 c. y. dr., and snags and other obstr. removed from R., **07,** 1366.

1907-08. 3,464,943 c. y. dr., and 1,833 snags and other obstr. removed from chan., **08,** 1422.

1908-09. 2,168,533 c. y. dr., and 355 snags and other obstr. removed from chan., **09,** 1408.

1909-10. 350,221 c. y. dr., **10,** 1555. 594 snags and other obstr. removed from chan., **10,** 1556.

1910-11. 1,005,935 c. y. dr. from cut-off chan. (U. S.) and 1,620 544 c. y. dr. by contract; 1,253 snags and other obstr. removed from cut-off chan. in B. and 368 snags, etc., from R., by U. S., **11,** 1698.

1911-12. Total of 5,434,090 c. y. dr. by contract, and 3,748,365 c. y. by U. S. drs., **12,** 1915. Bulkhead in Pinto Pass 150′ x 500′ w. completed; U. S. snag boat *Demopolis* removed 3,142 snags and other obstr., **12,** 1916.

PHYSICAL CHARACTERISTICS.

Light drifting sand, **72,** 602, 603.

Description of, **72,** 590, 591; **80,** 1060; **96,** 1428, 1465.

Tabular statement showing condition of the dr. chan., **93,** 1747; **94,** 1306; **95,** 1687; **96,** 1429; **97,** 1663; **98,** 1427; **99,** 1697.

Filling of the dr. chans. to be constantly expected. Filling ex. 1895–96 so soft as to be easily moved by the action of waves, **96,** 1428.

Rapid shoaling of chan. since 1906, **07,** 371.

PLANS. (See Estimates, Private Work, and Projects.)

By Capt. Merrill, removal of sunken ironclads and piles placed in the H. by the Confederates, **66,** 52, 53.

By Col. Simpson, dr. cut 200′ w. through Choctaw Bar and 250′ w. through Dog R. Bar, **71,** 560.

By State board of harbor commissioners, 5,400 l. f. of js.; also canal through Pinto Isld., with 3 auxiliary canals, **72,** 576, 593, 594, 597. Imp. of Mobile compared with various other works, **72,** 601, 603.

By Capt. Damrell, 1878, chan. 21′ x 200′; est. $2,088,187.18, **79,** 100, 800.

By Capt. Damrell, 1879, chans. 17′ and 22′ d., **79,** 800; **80,** 1059.

Consideration of, by BE. of 1880, **80,** 1060, 1066.

PRIVATE (CORPORATE, COUNTY, AND STATE) WORK.

$45,000 expend. removing obstr. from H. by Mobile Co., **71,** 559, 561; **72,** 598.

Work under direction of the State board for imp. of the R., H., and B. of Mobile, **72,** 598. State board abolished, **73,** 693. Total expend. by State board, $72,025.95, **74,** 891; **77,** 70, 408.

Mobile Bay Breakwater Co. chartered by legislature, **77,** 408. Commenced work, **77,** 408.

PROJECTS. (See Estimates and Plans.)

Earliest app. made 1826; continued at irregular intervals to 1857, at which time there had been app. $228,830.60. Resulted in a dr. chan. 10″ x 200 through Pass and Dog R. Bar. **82,** 1246.

By Maj. Reese, chan. 11′ x 300′ through Choctaw Pass and Dog R. Bar, and dr. below Dog R. Bar to lower B.; est., $656,800, **71,** 559. Appr. by Chief of Engineers, **72,** 574.

By BE., 1872, chan. 13′ x 200′ through Choctaw and Dog R. bars, 9 m.; est., $609,847.87, **72,** 592; **73,** 692; **74,** 891. Appr. by Chief of Engineers and Sec. of War, **73,** 692.

By BE., 1872, removal of 200′ of j. built by State board, **74,** 894.

By Capt. Damrell, 1878, chan. 17′ x 200′; est., $826,107.66, **79,** 100, 800; **80,** 1062.

BE. of 1880 recom. that if such a d. should satisfy shipping interests it be attained by dr. existing chan., **80,** 1065; **82,** 1246. Subsequent modifications in w. and direction at 2 points, **82,** 1247.

In 1878 sur. was directed to be made to determine whether existing chan. could be improved to 22′. In Mar., 1880, decided to continue former imp. by dr. 17′ with uniform w. of 200′ from 17′ curve in Mobile R. to same d. in lower B.; est., $820,000, **88,** 1194. Between 1881 and 1888 a total of $765,000 was app. for this proj., **88,** 1194, 1196.

In 1885 proj. submitted by Maj. Damrell for imp. of Mobile R. and H., securing 23′ d. by dr. chan. which, since 1870, had been imp. first from 9′ to 13′, then from 13′ to 17′; chan. w. to be 280′; est., $1,980,000, **89,** 1429, 1430.

App. of $250,000 in 1888 being made specifically for the furtherance of proj. of 1885, imp. of H. continued 1888 under that proj., **89,** 1429.

In 1891 the cost of completing 17′ chan., dr. chan. 23′ x 280′, removing fill during the progress of work, and dr. chan. in Mobile R. up to Chickasabogue 23′ x 280′ est. at $2,043,800, with $60,000 an. mainten., **91,** 1773–1775; **92,** 1437.

In 1896 Maj. Rossell est. $1,640,000 to d. and w. chan. to give bottom w. of 100′, and $60,000 an. mainten., **96,** 1465, 1466.

By Maj. osseRll, 1900, d. and w. chan. through outer bar to 30′ x 300′; est., $91,250, **01,** 1854, 1857; **02,** 1282.

Proj. modified in act Mar. 2, 1907, to include completion of existing proj. at est. of $560,000, and prosecution of operations to provide increased d. with app. of $100,000 an. for 5 years; act au. continuing contracts in sum of $360,000, and application of $10,000 for removal of obstr.; constr. of a dr., recom. at various times since 1903, was also au., **07,** 370.

Amount heretofore au. by Congress for constr. of dr., with exception of $5,000 for plans; may be used in dr. said H.;[1] design of dr. undertaken, **08,** 394, 1423.

By Maj. H. Jervey, dr. to 27′ x 200′ in B. and 300′ w. in R., straightening and otherwise imp. chan., au. act June 25, 1910; est., $1,802,548,[2] and the purchase of a dr. at cost of $450,000, **08,** 1423; **10,** 461.

SURVEYS.

Mobile H., 1860, **70,** 382; 1870, **71,** 559, 578, **80,** 1052.

Chan. resur., 1873, **73,** 693.

$10,000 app., 1878, for tests, sur., and borings in Mobile B., **78,** 79.

Ex. and sur. by Capt. Damrell, 1878, **79,** 100, 799.

Chan., 1885, **85,** 1338.

Ex., 1884, for 23′ chan., **85,** 1374.

Sur. of H., au. act of Aug. 17, 1894; made by Capt. Rossell, 1895 (see Projects), **96,** 1463.

Pre. ex. and sur. au. act June 6, 1900, made by Maj. Rossell,[3] **01,** 1854.

Sur. of H. completed Sept., 1902, results of tidal observations, **03.** 1243.

Surs. of chan. and water front; tidal observations, **04,** 1811.

H. line sur. completed, **05,** 1395.

Sur. for 27′ chan., au. act Mar. 3, 1905; made, 1905, by Maj. Craighill,[1] **06,** 380.

Pre. ex. and sur., au. act of 1909; made by Maj. Jervey,[4] **10,** 488.

Ref. to ex. and sur. **R., 11,** 493; **12,** 608.

Maps.[1] **66,** i; **80,** 1066; **84,** 1158; **96,** 1432; **97,** 1666; **98,** 1426; **99,** 1698; **00,** 2166; **12,** 1916.

[1] H. D. 647, 59th, 1st.
[2] Based on sur. printed in H. D. 657, 61st, 2d.
[3] H. D. 219, 56th, 2d.
[4] H. D. 657, 61st, 2d.

R-23 BLACK WARRIOR, WARRIOR, AND TOMBIGBEE RIVERS, ALA. AND MISS.

Part.	Title.	Period.	Part.	Title.	Period.
a	General data		g	Tombigbee R., above Columbus	1880–1884
b	Appropriations	1870–1912	h	Tombigbee R., Columbus to Walkers Br	1903–1912
c	Black Warrior, Warrior, and Tombigbee Rs., Ala. and Miss.	1870–1912	i	Tombigbee R., Walkers Br. to Fulton	1893–1902
d	Tombigbee R., below Demopolis, Ala	1893–1912	j	Warrior R	1893–1902
e	Tombigbee R., Demopolis to Columbus	1893–1912	k	Black Warrior R	1880–1912
f	Tombigbee R., Columbus to Fulton	1893–1902	l	Lock and dam building	1903–1912
			m	Operation and care of locks and dams	1897–1912

Part (a), R-23 General Data.

COMMERCE.

The Black Warrior, Warrior, and Tombigbee Rs., together with the Mobile R., connect the Warrior coal fields with the Gulf of Mexico.

Traffic, 1911–12, 200,000 t., **12,** 1928, 1930, 1931, 1936.

Tombigbee R.—Mouth to Demopolis:

"The work of lock and dam construction has thus far had a marked effect on traffic. What effect the all-year-round 6-foot navigation will have when obtained can not be definitely stated until the project is completed, but indications are that it will cause great reduction in freight rates and develop an extensive traffic between the coal fields of western Alabama and the Gulf of Mexico." **12,** 616.

"Commerce on this section during the fiscal year ending June 30, 1912, amounted to 149,900 short tons, principally logs, lumber, cotton, fertilizer, and general merchandise, valued at $3,930,516.31.

"This project has directly resulted in affording water and lower rail rates from Mobile to points on the river below Demopolis, Ala." **12,** 619.

Tombigbee R. from Demopolis, Ala., to Columbus, Miss.:

"This entire section of Tombigbee River is open to steamboat navigation throughout the year, except during the period of extreme low water in the fall of the year. At present the regular packet steamers out of Mobile navigate this part of the river during the winter and spring seasons, and it is reported that one steamboat line intends to build a light draft steamer to operate the balance of the year.

"Commerce on this section during the calendar year 1911 amounted to 45,399 short tons, valued at $503,086, being principally cotton, cotton seed, fertilizer, hardware, logs, staves, and miscellaneous.

"The project results in affording lower rail rates from Mobile to points on the Tombigbee River above Demopolis for several months each year." **12,** 621.

Tombigbee R. from Columbus to Walkers Br., Miss.:

"The total amount expended on improvement of this section of river up to the close of the fiscal year ending June 30, 1912, was $90,120.55, of which $56,309.71 was for maintenance.

"Commerce on this section during the calendar year 1911 amounted to 1,080 short tons of logs and 1,346 short tons of general merchandise, valued at $30,145.

"The project has had no effect on freight rates." **12,** 623.

Ls. and ds. on Black Warrior and Tombigbee Rs., Ala.:

"The total amount of commerce using the locks during the fiscal year ending June 30, 1911, was 424,949 short tons, while that for the fiscal year ending June 30, 1912, was 414,114 short tons, principally coal, stone, corn, cotton, logs, staves, and general merchandise. In addition to this there was considerable traffic in logs in the pool between Locks 4 and 5, and considerable coal was handled on the pool between Locks 12 and 13." **12,** 625.

LOCKAGE LOCATIONS OR STRETCHES LISTED FROM MOBILE B. TO SOURCES.

Mobile R., Ala.
Tombigbee R., Ala. and Miss., including Locks 1 to 4.
Warrior R., Ala., including Locks 5 to 9.
Black Warrior R., Ala., including Locks 10 to 17
Mulberry Fork, Ala., includes Lock 20.
Locust Fork, Ala.

PHYSICAL CHARACTERISTICS.

The Black Warrior is formed by the junction of Mulberry and Locust Forks.

At Tuscaloosa the name changes to Warrior. The Warrior flows into the Tombigbee about a m. above Demopolis.

The Tombigbee and Alabama Rs. form the Mobile R. about 45 m. above Mobile.

The total length from Mulberry and Locust Forks to terminus is 408 m., and the total fall 214½'.

PROJECT.

To 1903 Congress au. total of about $2,500,000 for slack-watering the system. Of the 20 locks required 10 were built—1 building. BE. at that date rendered opinion that to render effective the proj. for the system would require $1,200,000 to complete ls., etc., Tombigbee R.; $710,000 complete Locks 5 and 6, Black Warrior R.; $94,466 complete Locks 1, 2, 3, Warrior R.; $150,000 for dr., etc., $1,500,000 (tentatively) for 5 addl. ls., **04,** 1845.

Special review of history of system, **04,** 1845.

Part (b), R-23 Appropriations.

Black Warrior R., Tuscaloosa to Daniels Creek:

1884,	$50,000.00, **85,** 1354.	
1886,	56,250.00, **86,** 1200.	
1888,	100,000.00, **88,** 1199.	
1890,	150,000.00, **90,** 1698.	
1892,	200,000.00, **92,** 1444.	
1894,	37,500.00, **95,** 1691.	
1896,	10,000.00, **96,** 1434.	
1899,	50,000.00, **99,** 1703.	
1900,	86,824.00, **00,** 2169.	
1901,	53,676.00, **01,** 1819.	
		$794,250.00

Warrior R.:

1880,	$20,000.00, **80,** 1086.	
1881,	10,638.30, **81,** 1211.	
1884,	12,000.00, **84,** 1206.	
1890,	45,000.00, **90,** 1700.	
1892,	75,000.00, **92,** 1446.	
1894,	40,000.00, **95,** 1693.	
1896,	70,000.00, **96,** 1436.	
1899,	220,000.00, **99,** 1710.	
		492,638.30

Warior R., below Tuscaloosa:

1882,	$10,000.00, **82,** 1294.	
1886,	18,750.00, **86,** 1196.	
1888,	18,000.00, **88,** 1203.	
1900,	200,000.00, **00,** 2182.	
	3,691.24, **01,** 1831.	
1901,	240,000.00, **01,** 1831.	
		490,441.24

Warrior and Tombigbee Rs. below Tuscaloosa and Demopolis, Ala.:

1875,	$25,000.00, **75,** 19.	
		25,000.00

Warrior and Tombigbee Rs.:

1876,	$15,000.00, **76,** 13.	
1878,	28,000.00, **78,** 593.	
		43,000.00

Warrior and Tombigbee Rs. below Columbus:

1879,	$20,000.00, **79,** 833.	
		20,000.00

Tombigbee R., Miss. and Ala.:

1870,	$4,800.00, **71,** 573 (sur.).	
1872,	10,000.00, **73,** 67	
1890,	55,000.00, **90,** 1700.	
1892,	125,000.00, **92,** 1450.	
1894,	75,000.00, **95,** 1694.	
1896,	75,000.00, **96,** 1437.	
1899,	50,000.00, **99,** 1712.	
		394,800.00

Tombigbee R., above Columbus, Miss.:

1878,	$12,000.00, **78,** 81, 594.	
1879,	10,000.00, **79,** 105.	
1880,	4,000.00, **80,** 1092.	
1881,	1,000.00, **81,** 1212.	
1882,	1,000.00, **82,** 1295.	
		28,000.00

Tombigbee R., Columbus, Miss., to Vienna:

1880,	$12,000.00, **80,** 1090.	
1881,	6,382.98, **81,** 1211.	
1882,	7,500.00, **82,** 1294.	
		25,882.98

Tombigbee R., below Vienna, Ala.:

1880,	$15,000.00, **80,** 1090.	
1881,	7,978.72, **81,** 1208.	
1884,	15,000.00, **84,** 1210.	
1886,	11,250.00, **86,** 1199.	
1888,	6,000.00, **88,** 1208.	
		55,228.72

Tombigbee R., Demopolis to Vienna:

1882,	$7,500.00, **82,** 1294.	
		$7,500.00

Tombigbee R., below Demopolis:

1882,	$5,000.00, **82,** 1294.	
		5,000.00

Tombigbee R., Fulton, Miss., to Vienna, Ala.:

1884,	$10,000.00, **84,** 1210.	
1886,	7,500.00, **86,** 1199.	
1888,	6,500.00, **88,** 1205.	
1890,	6,000.00, **90,** 1702.	
		30,000.00

Tombigbee R., Walkers Br. to Fulton, Miss.:

1888,	$4,000.00, **88,** 161.	
1890,	4,000.00, **90,** 1701.	
1892,	3,000.00, **92,** 1448.	
1894,	1,000.00, **95,** 1698.	
1896,	1,000.00, **96,** 1446.	
1899,	1,000.00, **99,** 1715.	
		14,000.00

Tombigbee R., Demopolis, Ala.-Columbus, Miss.:

1890,	$15,000.00, **91,** 215, 1784.	
1892,	35,000.00, **92,** 1451.	
1894,	50,000.00, **95,** 1696.	
1896,	50,000.00, **96,** 1443.	
1899,	10,000.00, **99,** 1713.	
1905,	*10,000.00, **05,** 1409.	
1907,	*12,000.00, **07,** 1377.	
1910,	11,000.00, **10,** 1568.	
		193,000.00

Tombigbee R., Fulton-Columbus, Miss.:

1892,	$6,000.00, **92,** 1449.	
1894,	4,000.00, **95,** 1697.	
1896,	8,000.00, **96,** 1445.	
1899,	5,000.00, **99,** 1714.	
		23,000.00

Tombigbee, mouth to Demopolis:

1900,	$3,980.81, **01,** 1836.	
1902,	16,000.00, **02,** 1297.	
1902.	3,776.31, **04,** 1819.	
1905,	15,000.00, **05,** 1408.	
1907,	16,000.00, **07,** 1376.	
1909,	10,000.00, **09,** 1418.	
1910,	13,000.00, **10,** 1567.	
1911,	15,000.00, **11,** 1707.	
1912,	10,000.00, **12,** 1928.	
		102,757.12

Tombigbee R., Columbus to Walkers Br.:

1902,	$4,000.00, **02,** 1297.	
1905,	*2,000.00, **05,** 1409.	
1907,	*2,000.00, **07,** 1378.	
1909,	*3,000.00, **09,** 1420.	
1910,	10,000.00, **10,** 1570.	
		21,000.00

Tombigbee R., Demopolis to Walkers Br.:

1911,	$5,000.00, **11,** 1708.	
1912,	8,000.00, **12,** 1929.	
		13,000.00

*Allotment.

Black Warrior, Warrior, Tombigbee Rs.:

1902, $374,000.00, **02,** 1293.
1903, 200,000.00, **03,** 1248.
1904, 225,000.00, **04,** 1816.
1905, 100,000.00, **05,** 1405.
15,000.00, **05,** 1405.
1906, 603,466.00, **06,** 1275, 6.
1907, 350,000.00, **07,** 1375.
238,000.00, **07,** 1375.
1908, 530,000.00, **08,** 1433.
1909, 1,000,000.00, **09,** 1416.
1910, 500,000.00, **10,** 1565.
312,000.00, **10,** 1565.
1911, $100,000.00, **11,** 1705.
250,000.00, **11,** 1705.
1912, 465,000.00, **12,** 1924. $5,262,466.00

8,040,964.36

Total (**12,** 1924, 28, 29, 30), $8,036,164.36, includes sales, $3,300.80, but omits item, Tombigbee R., 1870, $4,800.

Add to the foregoing the total for operation and care of canals, etc., 1897–1912 (see p. 661) 842,867.84

Total 8,883,832.20

Part (c), R-23. Black Warrior, Warrior, and Tombigbee Rivers, Ala. and Miss. (Including survey for water communication with the Tennessee by way of Big Bear Creek.)

APPROPRIATIONS. (See preceding.)

COMMERCE.

Important, **73,** 552; **75,** ii, 16, 24, 27; **79,** 832.

Benefit of imp., **81,** 1205, 1208, 1210; **82,** 1294; **83,** 1015; **85,** 1348.

Timber shipments on Tombigbee, 1888 to 1890; decrease in freight and transportation expenses, **89,** 1438; **90,** 1701.

Importance of the imp. to the coal and iron interests on the Warrior R., **92,** 1443.

CONTRACTS.

1888. Wm. Miller, constr. locktender's house (Black Warrior), $1,990, **88,** 1199.

ENGINEERS.

Chief of Engineers. **R., 70,** 31; **71,** 69; **73,** 62, 67; **74,** 70; **75,** 76, 77; **76,** 73; **77,** 72; **78,** 81; **79,** 104, 105, 106; **80,** 138; **81,** 186; **82,** 183; **83,** 195; **84,** 203; **85,** 208; **86,** 206; **87,** 173–178; **88,** 160–166; **89,** 187–194; **90,** 168–175; **91,** 212–215; **92,** 206–209.

In charge:

Maj. C. B. Reese, 1870, **71,** 68, 572.
Capt. A. N. Damrell, 1870. **71,** 68, 572.
Col. J. H. Simpson, 1870–72. **R., 71,** 572, 573.
Lt. Col. W. F. Raynolds, 1873, **73,** 66.
Capt. A. N. Damrell, 1873. **R., 73,** 697.
Maj. W. McFarland, 1872–75. **R., 73,** 548; **74,** 579; **75,** 791, 803.
Capt. A. N. Damrell, 1875. **R., 75,** ii, 16; **76,** 496; **77,** 416; **78,** 593, 594; **79,** 830, 833; **80,** 1085; **81,** 1203; **82,** 1282; (Maj.) **83,** 1011; **84,** 1204; **85,** 1345; **86,** 1193; **87,** 1322; **88,** 1198–1227; **89,** 1433–1440; **90,** 1696–1716; **91,** 1776–1784; **92,** 1440–1451.

Assistants:

Henry C. Fillebrown. **R., 71,** 574, 575.
T. Pearsall, **71,** 572.
P. Robinson. **R., 73,** 548; **74,** 580; **75,** 806.
Horace Harding. **R., 75,** ii, 17.

ESTIMATES. (See Plans and Projects.)

By P. Robinson, 1873, removing obstr. from Aberdeen to Columbus, chan. 2½′ x 60′, $92,500, **73,** 549. Slack-water navigation, $300,000, **73,** 550. Slack-water navigation between Tombigbee and Tennessee Rs., $1,705,312, **75,** 805, 808.

By H. Harding, 1875, imp. of lower Black Warrior, $36,450, $151,103, **75,** ii, 17, 20, 23. Imp. of upper Black Warrior R., $431,000, **75,** ii, 24.

By Capt. Damrell, 1876, imp. of Tombigbee and Black Warrior Rs., $172,603, **76,** 497. Foregoing est. increased to, 1879, $250,000, **79,** 832.

OPERATIONS.[1]

1872–73. Removal of 250 snags from Tombigbee R., between mouth and Demopolis, **73,** 67, 697.

1873–74. Removal of obstr. from Tombigbee R., between Aberdeen and Cotton Gin Port, **74,** 70, 580.

1874–75. Removal of obstr. continued to Barris Ferry, **75,** 76, 791.

1875–76. On Tombigbee, 417 snags removed, 361 c. y. of r. excavated, 4,708 c. y. dr., and 4,533 l. f. of js. and 1,228 l. f. of ds. built; also 791′ of shore protection constr.; 21 bars improved, **76,** 73, 497.

1876–77. On Tombigbee, 798 snags removed, 400 c. y. dr., and 5,076 l. f. js. constr.; also 1 wreck removed; 12 bars improved, **77,** 72, 417.

1877–78. Warrior R. cleared of obstr. to Log Shoals; chan. 2½′ d. from mouth to Eastport, **78,** 81, 593.

1878–79. On Warrior R., 713 snags removed, 2,190 l. f. of js. built, and 7 bars improved. On Tombigbee R., 911 snags removed and 3,305 l. f. of js. built, **79,** 831, 833.

1879–80. Obstr. removed and wing ds. built on Tombigbee between Columbus and Demopolis, **80,** 1088; **82,** 1288.

1880–81. 586 trees and logs removed and 851 l. f. wing ds. built on the Black Warrior R., **81,** 1204. On Tombigbee R., between Columbus and Vienna, 5,656 l. f. of wing ds. built, 1,541 l. f. shore protection placed, and 2,482 trees and logs removed, **81,** 1207.

1881–82. On Black Warrior, 10,111 l. f. of ds. and js. built, 4,608 logs and trees removed, **82,** 1284. On Tombigbee, below Columbus, 9,336 l. f. of wing ds. built, 6,406 logs and trees removed, 1,100 c. y. r. blasted, **82,** 1290.

1882–83. On Black Warrior, 7,969 l. f. js. built and repaired, 3,200 l. f. bank protected, 2,607 trees and logs removed, **83,** 1014. On Tombigbee, below Columbus, 1,020 l. f. wing ds. built, 5,281 trees and logs, and 1,900 c. y. of r. removed, **83,** 1018.

1883–84. On Black Warrior, 1,354 logs and trees removed, **84,** 1204. On Tombigbee, below Columbus, 800 snags and trees removed and 1,685 l. f. of wing ds. built, **84,** 1208.

1884–85. On Black Warrior, 267 trees and snags removed and 500 cords of brush cut and piled, **85,** 1346. On Tombigbee, a barge was built, 6,027 trees and logs removed, and one-half m. of bank protected, **85,** 1350.

1885–86. On Black Warrior, 250 logs removed and caving bank protected, **86,** 1193. On Tombigbee, 1,333 logs and trees removed, **86,** 1197.

1886–87. On Warrior R. sur. in progress, **87,** 1324.

1887–88. 1,107 snags removed from chan., and 432 trees cut from the banks on Tombigbee below Vienna, **88,** 1,207. 871 snags and stumps removed from chan. and 242 trees from banks, clearing 25 m.

[1] Above Columbus, from Aberdeen to Waverly, 63 m., high-water navigation obtained at 1870, **79,** 105, 831, 833. History of operations, to 1879, **74,** 579; **79,** 830, 833.

of R. and completing the proj. imp. between Vienna and Fulton, **88,** 1205; 2,137 snags removed from chan., and 682 trees cut from the banks on Black Warrior between Demopolis and Tuscaloosa, **88,** 1202. Constr. of Lock and Dam No. 1 begun on Black Warrior between Tuscaloosa and Daniels Creek, **88,** 1199.

1888-89. Snags and trees removed on Tombigbee between Fulton and Walkers Br., **89,** 1438. 7,811 c. y. st. quarried, 2,364 c. y. st. cut, 1,434 c. y. st. laid, and 816 c. y. r. and 1,500 c. y. earth excavated in l. and d. constr. on Black Warrior between Tuscaloosa and Daniels Creek, **89,** 1434.

1889-90. Removal of obstr. continued in Tombigbee between Walkers Br. and Fulton, **90,** 1701. 7,510 c. y. masonry laid, 4,100 c. y. st. quarried, 950 c. y. st. cut, 1,541 c. y. r. and 3,780 c. y. earth excavated, and 2,341 c. y. r. and earth backing placed behind bank wall in l. and d. constr. on Black Warrior between Tuscaloosa and Daniels Creek, **90,** 1697.

1890-91. Constr. and repair of plant for snagging on the Warrior R., **91,** 1778. 454 trees pulled, 2,886 trees cut, and 1,725 logs and stumps removed on Tombigbee between Walkers Br. and Fulton, **91,** 1779. Preparation of plant for work on Tombigbee between Fulton and Vienna, **91,** 1781. Snags, logs, and trees removed from Tombigbee from its mouth up to Demopolis, **91,** 1783. 3,446 c. y. of st. quarried, 1,038 c. y. cut, and 567 c. y. laid; 1,255 c. y. r. excavation in lock pit; 3,700 c. y. of earth and r. filling behind lock wall in constr. of lock and dam in Black Warrior R. between Tuscaloosa and Daniels Creek, **91,** 1786.

1891-92. 960 c. y. r. and 440 s. y. of paving used in bank revet. and dam at Lock No. 1; 2,793 c. y. r. and earth excavated in foundation; 3,475 c. y. r. quarried, and 6,121 c. y. of masonry laid at Lock No. 2; 681 c. y. st. quarried, at Lock No. 3, Black Warrior, Tuscaloosa to Daniels Creek, **92,** 1442. 766 snags and 384 overhanging trees removed on Warrior and Tombigbee Rs., **92,** 1446. 3,277 snags removed from chan., and 4,101 trees cleared from banks on Tombigbee bet. Fulton and Vienna, **92,** 1449. 600 snags, 511 overhanging trees, 2,944 c. y. of r., and 3 wrecks removed, and 1,585 l .f. of j. repaired on Tombigbee from its mouth up to Demopolis, **92,** 1450. 2,627 snags and 7,406 overhanging trees removed from Tombigbee bet. Demopolis and Columbus, **92,** 1451.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 573, 575; **73,** 551.

Obstr. to navigation, **71,** 576.

Description of, Black Warrior R., **75,** ii, 16, 17, 18–23; **83,** 1011.

Tables of distances, **73,** 551; **85,** 1347.

Table of water levels and distances on Tombigbee R., **75,** 804, 807.

Lowest summit level, **75,** 806.

Caving banks on Tombigbee R., **80,** 1089.

Description of Tombigbee and Black Warrior Rs., **88,** 1200, 1206; **90,** 1716.

PLANS. (See Estimates and Projects.)

T. Pearsall, 1871, reported that from Columbus, Miss., to Demopolis (the confluence of the Tombigbee with the Mobile R.) no permanent imp. to navigation could be made, **71,** 572.

H. C. Fillebrown, 1871, reported that the R. could be temporarily imp. by removal of snags and sawyers; est., $21,500, **71,** 573, 576, 577.

By Col. Simpson, 1871, removal of RR. br. at Jones Bluffs to a point 300 y. farther down the R., **71,** 573.

P. Robinson, 1873, Fulton to Columbus, Miss., slack-water navigation or excavating chan. reported impracticable, **73,** 549, 550. Slack-water navigation, 1875, bet. Tombigbee and Tennessee Rs.; est., $1,705,312, **75,** 803, 807; reported impracticable, **75,** 805, 809.

By H. Harding, slack-water navigation on the upper Warrior R. by locks and dams and by canal; est., $431,000, **75,** ii, 23, 24. Imp. of the lower Black Warrior, Demopolis to Tuscaloosa, to procure chan. 80′ x 4′ d. by removal of obstr. and constr. of js., est., $151,103; or for chan. 3′ x 50′, est., $36,450, **75,** ii, 22, 23.

Imp., Demopolis to Tuscaloosa, on Black Warrior R., by constr. of dams and pneumatic gates, snagging, bank revet., and bar imp.; est., $577,000, **91,** 1778.

PRIVATE (STATE) WORK.

State of Alabama contracted with Mr. McCarty for removal of obstr. from Tombigbee R. for $20,000, **71,** 575.

PROJECTS. (See Estimates and Plans.)

P. Robinson, 1873, reported impracticability of permanent imp. above Columbus; proposed temporary imp. by removal of snags, logs, etc.; est., $35,000; approv. by Maj. McFarland, **73,** 548.

By Col. Simpson, removal of obstr., snags, sawyers, etc., from mouth to Columbus, approv. by Chief of Engineers, **73,** 697.

Capt. Damrell, 1875, recom. H. Harding's plan for imp. of lower Black Warrior and the Tombigbee, by removal of obstr. and constr. of js. and parallels and by protection of the shore; est. for chan. 80′ x 4′ Black Warrior R., $151,103; Tombigbee R., $21,500 (see Plans), **75,** ii, 17; **76,** 496; approv. by Chief of Engineers, **75,** ii, 17; **76,** 496; **80,** 1085.

Orig. proj. amended, 1879, to provide 3′ chan. m. l. w. on Tombigbee R., bet. Demopolis and Columbus; est., $250,000, **79,** 832; **80,** 1088.

By Maj. Damrell, 1889, slack-water navigation, mouth of Tombigbee R. to Demopolis, with 3 locks and dams, dr., bank revet., and snagging; est., $508,808, **92,** 1450.

By Capt. Damrell, 1873, imp. of Tombigbee R. bet. Fulton and Columbus, 144 m., by removing snags and overhanging trees, to secure h. w. navigation.

In 1879, Capt. Damrell proposed imp. of section bet. Columbus and Vienna, to give l. w. chan. with min. d. of 3′ and w. of 40′ by clearing R. bed and banks of obstr., and d. bars by dikes and js.; total required for completion of imp., mouth to Fulton, $205,000, **88,** 1204; **89,** 1439; **90,** 170.

By Maj. Damrell, 1888, to secure chan. for h. w. navigation, Fulton up to Walkers Br., by removing snags and overhanging trees; est., $11,000, **89,** 1438.

By Capt. Damrell, 1875, imp. of Black Warrior R., forming chan. 4′ x 80′ from junction with the Tombigbee at Demopolis to Tuscaloosa, 140 m., by removing obstr., dr., blasting, and wing-dam constr.; est., $151,103, **75,** 17; **80,** 1085.

By BE., 1886, slack-water navigation, bet. Tuscaloosa and Daniels Creek, 15 m., with 5 locks and fixed dams; est., $741,670, **88,** 1198.

By Maj. Damrell, 1889, slack-water imp., Demopolis to Columbus on the Tombigbee, with dam with pneumatic gates, and bank revet., snagging, and bar imp.; est., $779,400, **90,** 1720, 1721; **92,** 1451.

SURVEYS.

By H. C. Fillebrown, 1870, Tombigbee R., mouth to head of navigation. (See Appropriation, 1870.) **71,** 573, 574. Ex. by T. Pearsall, **71,** 31, 572.

Of Tombigbee, 1872, by P. Robinson, bet. Fulton and Columbus, **73,** 62, 548.

By H. Harding, 1874, of Black Warrior R., **75,** ii, 16, 17.

By P. Robinson, 1875, water communication from Tombigbee R. to the Tennessee R., by way of Big Bear Creek, **75,** 77, 803, 806.

Of Warrior R., 1879, Tuscaloosa to Forks of the Sipsey R., **79,** 106.

Ex. for continuous navigation Vienna, Ala., to Walkers Br., Miss., au. act Aug. 5, 1886; made, 1887, by Maj. Damrell, **88,** 1226, 1227.

Sur. of Warrior R. from Tuscaloosa to Demopolis, and of the Tombigbee R. from mouth up to Cotton Gin, au. act Aug. 11, 1888; made, 1889, by Maj. Damrell, **90,** 1719.

Part (d), R-23. Tombigbee River, below Demopolis, Ala. (Mainly maintenance and lock and dam construction.)

APPROPRIATIONS. (See p. 652.)

COMMERCE.

Description of; large C. in timber products, cotton and general merchandise, **96,** 1442.

Rates reduced between Mobile and lower Tombigbee R. points, **06,** 365.

Value, 1912, $3,930,516.31; tons, 149,900, **12,** 619.

CONTRACTS.

1908. Ed. J. Howard, building and delivering 2 self-propelling, stern-wheel snag boats for $38,000, $12,000 of which is to be paid for from this app. and the balance from other app., **08,** 1435.

ENGINEERS.

Chief of Engineers. **R., 93,** 230; **94,** 212; **95,** 237; **96,** 209; **97,** 266; **98,** 262; **99,** 306; **00,** 347; **01,** 367; **02,** 297; **03,** 311; **04,** 327; **05,** 336; **06,** 364; **07,** 378; **08,** 402; **09,** 418; **10,** 467; **11,** 501; **12,** 618

In charge:

Maj. A. N. Damrell, 1893–95. **R., 93,** 1758; **94,** 1313; **95,** 1694.

Maj. W. T. Rossell, 1896–01. **R., 96,** 1437; **97,** 1678, 1685; **98,** 1434, 1436; **99,** 1711; **00,** 2202; **01,** 1835.

Capt. Spencer Cosby, 1902. **R., 02,** 1296.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1248; (Maj.) **04,** 1818; **05,** 1406.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1277.

Maj. H. Jervey, 1907–10. **R., 07,** 1376; **08,** 1434; **09,** 1417; **10,** 1567.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1706; **12,** 1927.

Assistants:

T. W. Nicol. **R., 96,** 1439.

Lt. M. L. Walker, **01,** 364.

First Lt. Wm. G. Caples, **08,** 393; **09,** 409.

Capt. C. O. Sherrill, **11,** 490.

OPERATIONS.

1892-93. Over 900 obstr. removed, 841 piles cut for js., and about 1,772 c. y. dr., **93,** 1758.

1893-94. About 1,100 obstr. removed, 631 l. f. old js. repaired, 257 l. f. shore protection constr., and 19,142 c. y. dr., **94,** 1314.

1894-95. Over 7,000 obstr. removed, 16,659 c. y. dr., and 1,294 l. f. old js. repaired, **95,** 1695.

1895-96. Work commenced on Lock and Dam No. 1, about 2,600 obstr. removed, 11,708 c. y. dr., and 585 trees trimmed, **96,** 1438.

1896-97. Work on Lock No. 1 continued, over 3,000 obstr. removed, and 8,178 c. y. dr., **97,** 1686.

1897-98. 1,368 obstr. removed, 2,218 c. y. excavated and removed, and work continued on Lock No. 1, **98,** 1437.

1898-99. 155 c. y. r., 127 snags, and other obstr. removed from chan., and borings made for locksites, **99,** 1711.

1899-00. Constr. of lock at McGrews Shoals in progress, **00,** 2203.

1900-01. Removed 335 snags, 190 sunken trees, 6 stumps, and 53 trees; care and preservation of public property; lock at McGrews Shoals practically completed, **01,** 1835.

1901-02. Care and preservation of public property, **02,** 1296.

1902-03. Warrior and Tombigbee Rs.; snagging operations continued, **03,** 1248.

1903-04. Mainten. operations by snagging continued, **04,** 1818.

1904-05. New shore connection for the Osage Bar Dike constr.; mainten. work continued; repairs made to snag boat, **05,** 1406.

1905-06. Mainten. work by snagging continued, **06,** 1277.

1906-07. 400 obstr. removed, **07,** 1376.

1907-08. Occasional snagging, and care and preservation of property; snag boat under constr. for use in this section of R., **08,** 1434.

1908-09. 1,028 obstr. removed; new snag boat *Tombigbee* completed and received, **09,** 1418.

1909-10. Mainten. work continued over 185 m. of R., removing 4,445 logs, snags and stumps; repairs made to snag boat, **10,** 1567.

1910-11. 54,104 obstr. removed from chan. and banks of R., **11,** 1707.

1911-12. 22,519 snags and other obstr. removed; work of dike constr. performed at mouth of West Bassetts Creek, **12,** 1927.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 1439.

R. navigable for SS. drawing not more than 3′ all year, except at periods of extreme l. w.; flood stages rise to 60′ above l. w., **11,** 502.

PROJECTS.

Maj. Damrell, 1895, est., $10,000 an. for mainten., **95,** 1695.

Act Mar. 2, 1902, modified proj. of this section so as to make work of lock and dam constr. a part of proj. for imp. of Black Warrior, Warrior and Tombigbee Rs., **03,** 1248.

Act June 13, 1902, au. proj. for mainten. chan. by removing obstr., etc., and repair of dikes, **03,** 312.

SURVEYS.

Ex. for sites of locks and dams, made in 1892 by Maj. Damrell, **93,** 1758; **11,** 1708.

Maps. **96,** 1442.

Part (e), R-23. Tombigbee River, Demopolis to Columbus, Ala. and Miss.

APPROPRIATIONS. (See p. 652.)

COMMERCE.

1911, 45,399 t.; value, $503,086, imp. induces low rates on adjacent railways, **12,** 621.

CONTRACTS.

S. E. Krebs and T. C. Gatti, building snag boat, $7,224.05, **11,** 1709.

ENGINEERS.

Chief of Engineers. **R., 93,** 231; **94,** 213; **95,** 238; **96,** 209; **97,** 267; **98,** 263; **99,** 307; **00,** 349; **01,** 368; **02,** 298; **03,** 312; **04,** 329; **05,** 338; **06,** 365; **07,** 380, 395; **08,** 404; **09,** 420; **10,** 469; **11,** 503; **12,** 620.

In charge:

Maj. A. N. Damrell, 1893–95. **R., 93,** 1759; **94,** 1315; **95,** 1695.

Maj. W. T. Rossell, 1896–1901. **R., 96,** 1443; **97,** 1678, 1687; **98,** 1434, 1438; **99,** 1712; **00,** 2205; **01,** 1836.

Capt. Spencer Cosby, 1902. **R., 02,** 1297.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1249; (Maj.) **04,** 1820; **05,** 1408.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1278.

Maj. H. Jervey, 1907–10. **R., 07,** 1377; **08,** 1435; **09,** 1419; **10,** 1568.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1708; **12,** 1928.

Assistants:
Lt. M. L. Walker, **01,** 364.
1st Lt. Wm. G. Caples, **08,** 393; **09,** 409.
Capt. C. O. Sherrill, **11,** 491.

OPERATIONS.

1892-93. About 19,000 obstr. removed, **93,** 1760.
1893-94. About 6,000 obstr. removed and 520 l. f. js. repaired, **94,** 1315.
1894-95. Continuation of work of previous year, **95,** 1696.
1895-96. About 17,000 obstr. removed, 10 c. y. r. excavated and removed, and 300 l. f. js. repaired, **96,** 1444.
1896-97. Over 8,000 obstr. removed, 418 l. f. js. repaired, and j. work in progress, **97,** 1688.
1897-98. About 5,000 obstr. removed, 90 l. f. old js. repaired, 1,507 c. y. gravel, sand, and clay excavated, and j. work in progress, **98,** 1438.
1898-99. 2,125 c. y. r., about 31,000 snags and other obstr. removed from chan., and js. repaired, **99,** 1713.
1899-00. Over 1,000 c. y. gravel, clay, and sand, and about 19,000 snags and other obstr. removed from chan., **00,** 2205.
1900-01. 2,107 logs, snags and stumps removed from chan., and 22,475 logs, trees and bushes cut and removed from banks, **01,** 1837.
1901-02. Snag boat *Demopolis* repaired, **02,** 1297.
1902-03. Mainten. by snagging, **03,** 1249.
1903-04. Chan. obstr. removed, **04,** 1820.
1904-05. Snagging work continued; snag boat repaired, **05,** 1408.
1905-06. Snagging operations continued over 47 m. of R., **06,** 1278.
1906-07. Mainten. continued by snag boat *Vienna*, working over about 110 m. of R.; snag boat repaired, **07,** 1377.
1907-08. 3,409 obstr. removed, 995 piles driven and 1,905 sq. ft. mattresses laid, **08,** 1436.
1908-09. 1,588 obstr. removed, **09,** 1419.
1909-10. 1,469 obstr. removed, **10,** 1568.
1910-11. 10,787 obstr. removed, mostly from banks, **11,** 1708.
1911-12. 12,361 snags and other obstr. removed from chan. for 136½ m., **12,** 1928.

PHYSICAL CHARACTERISTICS.

M. l. w. draft 2′; flood stages rise to 60′, **11,** 503.

PROJECTS.

In 1893, Maj. Damrell, est., $10,000 an. for mainten., **93,** 1760.
As imp. of R. above Aberdeen is impracticable, app. should be made for "Tombigbee R., from Demopolis, Ala., to Aberdeen, Miss.," **11,** 504.

SURVEYS.

Pre. ex., Demopolis to Columbus, with a view to obtaining continuous chan. 4′ d., au. act Mar. 3, 1905; **R.** by Maj. Craighill, Dec. 9, 1905 (unfav.),[1] **07,** 395.
Cong. docs., etc., relating to ex's., surs., plans, etc., **12,** 620.

Part (f), R–23. Tombigbee River, Fulton to Columbus, Miss.[2]

APPROPRIATIONS. (See p. 652.)

ENGINEERS.

Chief of Engineers. **R., 93,** 231; **94,** 213; **95,** 238; **96,** 210; **97,** 268; **98,** 264; **99,** 308; **00,** 349; **01,** 369; **02,** 299.

In charge:
Maj. A. N. Damrell, 1893–95. **R., 93,** 1760; **94,** 1316; **95,** 1697.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1445; **97,** 1678, 1689; **98,** 1434, 1439; **99,** 1714; **00,** 2206; **01,** 1837.
Capt. Spencer Cosby, 1902. **R., 02,** 1298.

Assistant. Lt. M. L. Walker, **01,** 364.

OPERATIONS.

1892-93. About 7,500 obstr. removed, **93,** 1761.
1893-94. Over 3,000 obstr. removed, **94,** 1316.
1895-96. A few obstr. removed, 1,080 c. y. gravel and clay, 291 fascines and 90 piles used in closing a slough, a small br. for constr. purposes was built, and 180 l. f. old js. repaired, **96,** 1446.
1896-97. Over 1,100 obstr. removed, **97,** 1689.
1897-98. Over 12,110 obstr. removed, 284 l. f. shore protected, and 36 c. y. r. excavated, **98,** 1439.
1899-00. About 6,300 snags and other obstr. removed from the R., and banks protected, **00,** 2206.
1900-01. 5,032 stumps, snags, logs, trees and bushes cut and removed, **01,** 1838.

PROJECTS.

Maj. Damrell, 1893, est., $5,000 an. for mainten., **93,** 1761.
Act June 13, 1902, au. $4,000 from app. for Tombigbee R., mouth to Demopolis, to maintain chan between Fulton and Columbus, removing snags. etc., **02,** 299.

Part (g), R–23. Tombigbee River, above Columbus, Miss.

APPROPRIATIONS. (See p. 652.)

ENGINEERS.

Chief of Engineers. **R., 80,** 139; **81,** 187; **82,** 184; **83,** 196; **84,** 204.

In charge:
Capt. A. N. Damrell, 1880–84. **R., 80,** 1091; **81,** 1211; **82,** 1294, 1312; (Maj.) **83,** 1022; **84,** 1210.
Assistant. H. Harding. **R., 82,** 1313.

OPERATIONS.

All operations with hired labor.

1879-80. Removal of snags and logs, **80,** 1091.
1880-81. 9,074 logs, trees, and stumps removed, **81,** 1212.
1881-82. Removal of snags and logs, **82,** 1295.
1882-84. Preservation of work, **83,** 1022; **84,** 1211.

PLANS.

By Capt. Damrell for an imp. between Fulton and the junction of Browns and Mackeys Creeks by removing logs, snags, and trees. Est. cost, $11,000. **82,** 1312, 1313.

[1] H. D. 334, 59th, 2d.
[2] Act June 13, 1902, consolidated this section with the section "Walkers Br. to Fulton, Miss.," under the head "Columbus to Walkers Br., Miss.," under which head it is carried after 1902.

PROJECTS.

By Maj. McFarland, 1873, temporary imp. of Tombigbee above Columbus and to Fulton by removing obstr. Est., $35,000. **73,** 548; **80,** 1092; **81,** 1211. Proj. completed, 1882, **82,** 1295.

SURVEYS.

From Fulton to Warren's mill, by Capt. Damrell, 1882, **82,** 1312.

Part (h), R-23 Tombigbee River, Columbus to Walkers Bridge, Miss.[1]

APPROPRIATIONS. (See p. 652.)

COMMERCE.

Section not considered worthy of imp. owing to lack of C., **05,** 1409.

ENGINEERS.

Chief of Engineers. **R., 03,** 313; **04,** 330; **05,** 339; **06,** 366; **07,** 381; **08,** 405; **09,** 421; **10,** 470; **11,** 504; **12,** 621.

In charge:
Capt. W. E. Craighill, 1903–05. **R., 03,** 1250; (Maj.) **04,** 1821; **05,** 1409.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1279.
Maj. H. Jervey, 1907–10. **R., 07,** 1378; **08,** 1437; **09,** 1420; **10,** 1569.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1709; **12,** 1930.

Assistants:
D. G. Anderson. **R., 03,** 1252.
1st Lt. Wm. G. Caples, **08,** 393; **09,** 409.
Capt. C. O. Sherrill, **11,** 491.

OPERATIONS.

1902–03. Mainten. by obstrn. removal, **03,** 1251.
1903–04. Snagging operations continued, **04,** 1821.
1904–05. Snagging operations resumed June 16, 1905, and 2 m. of R. covered, **05,** 1409.
1905–06. Mainten. over about 50 m. of R., **06,** 1279.
1907–08. Snagging operations continued over 60 m. of R. and 28,335 obstr. removed, **08,** 1437.
1908–09. 102 obstr. removed, trees felled and cut up, **09,** 1420.
1909–10. 4,720 logs, snags, and stumps removed, **10,** 1570.
1911–12. Snag boat *Vienna* repaired and cared for, etc., **12,** 1930.

PHYSICAL CHARACTERISTICS.

R. above Aberdeen full of obstrs., **11,** 1710.

PROJECTS.

Act of June 13, 1902, consolidated impt. of the 2 upper sections of the Tombigbee R., viz, "Fulton to Columbus" and "Fulton to Walkers Bridge," under the head of "Columbus to Walkers Bridge"; act also provided for an allotment of $4,000, not exceeding, for imp. of this section, to be drawn from app. for imp. Tombigbee R., mouth to Demopolis, **03,** 1250.

Maj. Craighill did not consider this section of the R. worthy of further imp. by the U. S.; small C. and few persons benefited, **05,** 1409.

Chief of Engineers, Apr. 14, 1911, directed work be restricted to imp. at and below Aberdeen, **12,** 622.

SURVEYS.

Ex. of R. by Maj. Flagler to determine whether further expend. be advisable; found unworthy of mainten. above Aberdeen, Miss., **11,** 1709.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 622.

Part (i), R-23 Tombigbee River, Walkers Bridge to Fulton, Miss.[2]

APPROPRIATIONS. (See p. 652.)

ENGINEERS.

Chief of Engineers. **R., 93,** 232; **94,** 214; **95,** 239; **96,** 210; **97,** 268; **98,** 264; **99,** 308; **00,** 350; **01,** 370; **02,** 300.

In charge:
Maj. A. N. Damrell, 1875–95. **R., 93,** 1762; **94,** 1317; **95,** 1698.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1446; **97,** 1678, 1690; **98,** 1434, 1440; **99,** 1715; **00,** 2207; **01,** 1839.
Capt. Spencer Cosby, 1902. **R., 02,** 1299.

Assistant. Lt. M. L. Walker, **01,** 370.

OPERATIONS.

1892–93. 2,883 obstr. removed from banks and stream, **93,** 1762.
1893–94. About 2,000 obstr. removed, **94,** 1318.
1896–97. About 1,500 obstr. removed, **97,** 1690.
1898–99. About 1,800 snags and other obstr. removed from the chan. and banks of R., **99,** 1715.
1899–00. 152 snags and other obstr. removed from chan., **00,** 2207.

PROJECTS.

Maj. Damrell, 1893, est. $2,500 an. for mainten., **93,** 1762.

Act June 13, 1902, au. $4,000 from app. for Tombigbee R., mouth to Demopolis, for mainten. chan. between Walkers Br. and Fulton, removing snags, etc., **02,** 300.

[1] Continuation of Part f and Part i, combined.
[2] Act June 13, 1902, consolidated this section with the section "Fulton to Columbus, Miss.," under the head "Columbus to Walkers Bridge, Miss.," under which head it is carried after 1902.

Part (j), R-23 Warrior River, Ala.

APPROPRIATIONS. (See p. 652.)

COMMERCE.

Details of, **97,** 1682; **01,** 1830.
Large traffic in coal growing, **97,** 1682.
Large rafting business done, 1900, on the lower part of the R. for mills in Demopolis, **00,** 2182.

CONTRACTS.

1900. Christie, Lowe & Heyworth, constr. Locks and Dams Nos. 4, 5, and 6, $417,230.20, **00,** 2185.

1901. Chattanooga Car & Foundry Co., castings, heel posts and sockets, 3.72¢ lb., **01,** 1831.

1902. Christie, Lowe & Heyworth, increase in materials to be furnished in constr. of Locks and Dams Nos. 4, 5, and 6, and for increase in price of excavation at Lock No. 5, **02,** 1293.

ENGINEERS.

Chief of Engineers. R., 93, 230; **94,** 212; **95,** 237; **96,** 208; **97,** 265; **98,** 261; **99,** 305; **00,** 346; **01,** 366, 378; **02,** 296.

In charge:
Maj. A. N. Damrell, 1875–95. **R., 93,** 1755; **94,** 1311; **95,** 1692.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1435; **97,** 1678; **98,** 1434; **99,** 1708; **00,** 2178; **01,** 1824, 1859, 1861.
Capt. Spencer Cosby, 1902–03. **02,** 1289, 1294.

Assistants:
R. C. McCalla. **R., 97,** 1681.
Lt. M. L. Walker, **01,** 364.
N. A. Yuille. **R., 01,** 1831.

OPERATIONS.

1892-93. Over 8,000 obstr. removed and 3 dams built, **93,** 1757.

1893-94. About 12,000 obstr. removed, 2,575 c. y. r. excavated, 25,099 c. y. drd., 1,428 l. f. dams and js. built, and 4,167 trees cut and burned in clearing, **94,** 1313.

1895-96. Over 10,000 obstr. removed, 9,550 c. y. gravel and 358 c. y. r. removed, 587 l. f. js. built and repaired, 150 l. f. shore protection built, 285 l. f. dams built, and 2,500 c. y. earth excavated, **96,** 1437.

1896-97. Dr. in progress; over 28,000 obstr. removed, 57,180 c. y. r., clay, and gravel excavated, and 2,743 l. f. training walls and dams built, **97,** 1685.

1897-98. Continuance of work of previous year, **98,** 1435.

1898-00. Borings for lock sites, **99,** 1708; **00,** 2179.

1900-01. Locks 4, 5 and 6: Cofferdams built, excavation done, material prepared and delivered at lock sites, borings for new locks made; work retarded by floods, **01,** 1825, 1826.

1901-02. Work on Lock No. 4 is 55%, Lock 5 71%, and Lock 6 83½% completed; summary of work done given, **02,** 1290, 1291.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1681.
Gauge readings, **97,** 1681; **99,** 1708.
Borings, **99,** 1708; **00,** 2179.
Rainfall, Apr. 15–16, 1900, caused highest flood known, **00,** 2178, 2186.
Borings for Locks Nos. 1, 2, and 3, **01,** 1828–31.
Condition of work, **01,** 1827.

PROJECTS.

1897, est. of $1,320,000 made for 6 locks and dams, Warrior R., lifting 60.2′, giving chan. 6′. R. and H. act, Mar. 3, 1899, au. 3 l. and d., cost not over $660,000, **01,** 366.

R. and H. act, June 13, 1902, au. constr. of Locks and Dams Nos. 1, 2, and 3, Warrior R., Ala., at a cost not exceeding $874,000,[1] **02,** 1293; revised est. made by Capt. Cosby, **02,** 296.

SURVEYS.

Minor sur. made by Maj. Rossell, **98,** 1435; **99,** 1708; **00,** 2178.
Bench marks, **00,** 2187.
Ex. and sur., Warrior and Tombigbee Rs., Ala., with view to constr. of Locks and Dams Nos. 1, 2, and 3, below Tuscaloosa; reports dated June 25, and Dec. 4, 1900, resp., by Maj. Rossell; plans submitted, cost $760,000,[2] **01,** 378, 1858. Revised est. submitted by Capt. Cosby ($874,000),[1] **02,** 1294.
Cong. docs., etc., relating to exs., surs., plans, etc., **02,** 296, 1294.

Maps. **96,** 1436 (Plans of dikes); **97,** 1684; **98,** 1436; **00,** 2182 (Photographs); **02,** 1304.

Part (k), R-23 Black Warrior River, Ala.

APPROPRIATIONS. (See p. 652.)

COMMERCE.

Important, **80,** 1086; **85,** 1354.
Description of, **93,** 1753; **97,** 1674.
Large and important C. in mineral products likely to spring up, **93,** 1753, 1754.

CONTRACTS.

1899. Willard & Cornwell, constr. Lock and Dam No. 4, $163,348, **00,** 2170.

1900. G. T. Eckert, constr. lock tender's house at Lock No. 4, $1,400, **00,** 2170.

1907. Dravo Contracting Co., constr. Locks and Dams Nos. 14 and 15, unit prices listed; and a lock tender's house at each lock at $3,000 each, **08,** 1434.

1908. B. H. Hardaway, building Lock and Dam No. 16, unit prices listed; and lock tender's house, $3,000, **09,** 1417.

1910. B. H. Hardaway, building Lock and Dam No. 17, unit prices listed; lock tender's house, $4,000, **11,** 1706.

1911. B. H. Hardaway, covering advance payments for materials delivered under orig. contract (suppl.), **11,** 1706.

Geo. Vise, building lock tenders' houses and privies at Locks 5 ($2,750), 7 ($2,749.85), 8 ($2,754), and 9 ($2,750), **12,** 1927.

1912. B. H. Hardaway, for 63′ dam with 2 locks at site of Lock No. 17 (suppl.), unit prices listed; Strickland Bros. Mach. Co. (Inc.), iron castings, 3.17¢ and 2.59¢ lb.; Strickland Bros. Mach. Co. (Inc.), cylindrical valves with shells, 4.40¢ lb.; Woodward, Wright & Co. (Ltd.), galvanized pipe and flanges, $1,810.62; Carnegie Steel Co., 77,822 lbs. plates, shapes, and bars, at 2⅛¢ lb.; Coffin Valve Co., four 24″ valves, $688, **12,** 1926. Coldwell-Wilcox Co., 3 sets sluice gates, $1,482; Holloman & Rodgers, building lock tenders' houses and privies at Locks 10, 11, and 12, for the lump sum of $5,895; Straiton Bros., building lock tenders' houses and privies at Lock 6 ($2,660); Lock 13 ($2,695); Lock 14 ($2,945); Lock 15 ($2,950); Lock 16 ($2,950); Lock 17 ($3,000), **12,** 1927.

ENGINEERS.

Chief of Engineers. R., 81, 189; **85,** 210; **86,** 208; **87,** 172; **93,** 229; **94,** 211; **95,** 236; **96,** 208, 214; **97,** 264; **98,** 260; **99,** 304; **00,** 346; **01,** 365; **02,** 295; **03,** 309; **04,** 325, 343; **05,** 333; **06,** 358; **07,** 373; **08,** 397; **09,** 414; **10,** 463; **11,** 495; **12,** 612.

[1] H. D. 165, 57th, 1st.

[2] H. D. 178, 56th, 2d.

Boards. Convened, S. O. No. 9, C. of E., 1886, to consider imp. of Black Warrior R., Ala. **R., 87,** 1302.

(Col. Craighill, Lt. Col. Merrill, Majs. King, Damrell, and Post.)

BERH. reviews Capt. Craighill's sur. for lock and dam sites, and submits est. of $3,654,466 for completing proj. **R., 04,** 1845. (Lt. Col. A. M. Miller, Maj. R. L. Hoxie, Capt. H. C. Newcomer, and Capt. W. V. Judson.)

In charge:

Capt. A. N. Damrell, 1875–95. **R., 81,** 1218; (Maj.) **85,** 1354; **86,** 1199; **87,** 1299; **93,** 1751; **94,** 1310; **95,** 1691.

Maj. W. T. Rossell, 1896–1901. **R., 96,** 1433, 1461; **97,** 1667; **98,** 1430; **99,** 1702; **00,** 2167; **01,** 1816.

Capt. Spencer Cosby, 1902. **R., 02,** 1285.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1244; (Maj.) **04,** 1812, 1840; **05,** 1400.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1272.

Maj. H. Jervey, 1907–10. **R., 07,** 1370; **08,** 1428; **09,** 1412; **10,** 1560.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1702; **12,** 1921.

Assistants:

E. A. Smith. **R., 81,** 1218.

R. C. McCalla, jr. **R., 97,** 1669.

1st Lt. Wm. G. Caples, **08,** 393; **09,** 409.

Capt. C. O. Sherrill, **11,** 490.

LEGAL PROCEEDINGS.

Purchasing of sites for locations of proposed Locks 14 and 15; deeds delivered to Dept. of Justice for ex., **07,** 1370.

OPERATIONS.

1893-95. Constr. of Locks Nos. 1, 2, and 3 in progress, **93,** 1753; **94,** 1310; **95,** 1692.

1895-96. Locks Nos. 1, 2, and 3 completed, and preparations in progress for constr. of Lock No. 4, **96,** 1434.

1896-97. Preparations continued for work on Lock No. 4, **97,** 1668.

Detailed description of work done on other locks given, **97,** 1668, 1669.

1897-98. U. S. Engineer office in Tuscaloosa connected with Locks Nos. 1, 2, and 3 by telephone, **98,** 1430.

1898-99. Gauges read daily; plant cared for, and plan and specifications for Lock and Dam No. 4 prepared, **99,** 1702.

1899-00. Constr. of Lock and Dam No. 4 in progress, **00,** 2167.

1900-01. Work on Lock No. 4 in progress, 36.8% completed; lock tender's house completed, **01,** 1816.

1901-02. Building of bank wall and R. wall of lock continued, masonry 84% completed; cofferdam constr. begun, dam 16% done, **02,** 1286.

1902-03. Constr. of Lock No. 4 continued; dam about 80% completed, **03,** 1245.

1903-04. Work on Lock No. 4 (to be known as No. 13 when completed) continued; summary given, **04,** 1812.

1904-05. Work on Lock No. 13 (formerly No. 4) completed in May, 1905; lock gates erected and 296 c. y. st. placed as riprap, **05,** 1401.

1905-06. Lock No. 13 was opened for traffic on July 4, 1905; bank below abutment graded and 2,062 c. y. st. placed as riprap, **06,** 1272.

1907-08. Constr. of Locks Nos. 14 and 15 commenced; contractor's plant on ground; RR. built for delivery of material, **08,** 1428.

1908-09. Constr. of Locks Nos. 14 and 15 continued, 55% completed; Lock No. 16 begun; site purchased for Lock No. 17; survey for Locks Nos. 18 and 19 completed and plans prepared, **09,** 1412, 1413.

1909-10. Locks Nos. 14 and 15 completed and opened for traffic; constr. of Lock No. 16 continued and about 30% completed; lock tender's house built, **10,** 464, 1560.

1910-11. Constr. of Lock No. 16 continued; preliminary work of excavation, etc., commenced at Lock No. 17; repairs made to snagboat *R. C. McCalla;* carpenter shop built at boatways, Lock No. 12; proj. for R. 60% done, **11,** 1702.

1911-12. Work on Lock No. 16 continued; building of cofferdam, excavating, and erection of concrete plant in progress at Lock No. 17, **12,** 1921.

PHYSICAL CHARACTERISTICS.

Description of **96,** 1433, 1462; **04,** 1845.

Condition of works, **01,** 1817.

Completion of 6 locks affords 6′ navigation at l. w. for 25 m.; chan. w. 250′, **11,** 496.

PLANS.

By Capt. Damrell, 1880, slack-water navigation between Tuscaloosa and forks of Sipsey and Mulberry, with locks and dams. Est. cost, $1,200,000. **81,** 1218, 1220; **85,** 1354; **86,** 1199.

By Maj. Damrell, 1885, slack-water navigation between Tuscaloosa and Daniels Creek, with movable locks and dams. Est. cost, $245,786. **85,** 1354.

PRIVATE WORK.

Warrior Southern R. R. Co. built retaining wall along their tracks, **06,** 1272.

PROJECTS.

By BE., 1886, slack-water navigation bet. Tuscaloosa and Daniels Creek, with locks[1] and fixed dam. Est. cost, $566,104. **86,** 1200; **87,** 1300, 1301, 1303. Given as $741,670, **03,** 309.

In 1896, Capt. Rossell est. $1,750,000 to constr. 8 locks and dams bet. Daniels Creek and the Mulberry and Locust Forks, **96,** 1462.

Act Mar. 3, 1899, au. constr. of Lock No. 4, at cost not to exceed $190,500, **01,** 365. Found, later, that Lock No. 4 could not be completed for $190,500, and act June 13, 1902, au. trans. of $14,000 from unexpend. balance of app. for Warrior R.; same act extended upper limit of imp. to junction of the Mulberry and Locust Forks of the R. 46½ m. above Tuscaloosa, and au. sur. for Locks 5 and 6, **02,** 295. Capt. Cosby submits revised est. of total cost of completing Lock and Dam No. 4 ($204,500),[2] **02,** 1288.

Act Mar. 2, 1907, au. constr. of Locks and Dams Nos. 14, 15, 16, and 17; est., $1,409,000, to be provided under continuing contract au., **07,** 374.

In 1907–8 it was decided to use 2 locks, 16 and 17, of 21′ lift instead of 3 of 14′ lift each, on Squaw Shoals, reducing the number needed to 19, **08,** 398; **09,** 414.

Act Aug. 22, 1911, changed lift of Lock No. 17 to 63′, thus further reducing the number of locks below the Locust and Mulberry Forks to 18, extending slack water to Sanders Ferry, 36 m. above the forks, on the Mulberry, and to Nichols Shoals, 16 m. above the forks, on the Locust, and dispensing with 1 lock on each fork, **12,** 612.

SURVEYS.

Au. act of Mar. 3, 1879; made by Capt. Damrell, 1879, **81,** 1218.

Sur. of the R. from Tuscaloosa to the Mulberry and Locust Forks au. act Aug. 17, 1894; made in 1895 by Capt. Rossell (see Projects), **96,** 1463.

Minor sur. made, 1899, **99,** 1702.

Au. act June 13, 1902, for location of Locks Nos. 5 and 6 (now Nos. 14 and 15) on Black Warrior, and locks on Tombigbee R., made and **R.,** dated Nov. 13 and Dec. 28, 1903, submitted by Capt. Craighill, with revised est. for constr. of locks and dams, **04,** 343, 1840–1842.

Location sur. and foundation borings for Locks Nos. 16, 17, 18, and 19, **08,** 1428.

Ex. and sur. of Mulberry and Locust Forks, B. W. R.—up Mulberry to Sanders Ferry and up Locust to Five Mile Creek—made. **R.** made, 1909 and 1910,[3] **11,** 496.

Cong. docs., etc., relating to ex., sur., plan, etc., **02,** 296; **11,** 496; **12,** 613.

Maps. **96,** 1434; **00,** 2170; **11,** 1702;

[1] Numbering of locks changed, 1903, to be in series from Mobile to head of Black Warrior R., **04,** 1840.
[2] H. D. 239, 57th, 1st.
[3] H. D. 72, 62d, 1st.

Part (1), R-23 Black Warrior, Warrior, and Tombigbee Rivers, Ala. and Miss. (Locks and dams building.)

APPROPRIATIONS. (See p. 652.)

COMMERCE.

Lock and dam system has marked effect upon traffic, **10,** 466.

Indications are that imp. will cause great reduction in rates and develop extensive traffic between coal fields of western Alabama and the Gulf of Mexico, **12,** 616.

CONTRACTS.

1903. M. T. Lewman & Co., constr. of Locks and Dams Nos. 1, 2, and 3, at $266,414, $215,641, and $235,436, resp., abandoned work, **03,** 1248.

1905. P. H. O'Brien, excavation work, hire of teams and outfits in connection with constr. of Locks and Dams Nos. 1, 2, and 3, prices listed; Southeastern Lime & Cement Co., 7,500 bbls. Portland cement, at $1.45 bbl.; W. K. Saulsbury, furnishing and delivering 16,000 t. st., $1.75 short t., **05,** 1406.

1906. W. K. Saulsbury, providing for the payment of $1.25 t. for st. delivered at Demopolis, the balance of 50¢ to be paid upon completion of delivery at site of Lock No. 1; Southeastern Lime & Cement Co., 15,000 bbls. Portland cement, $1.50 bbl., **06,** 1276. Fordyce Lumber Co., lumber delivered at Locks Nos. 1, 2, and 3, prices listed, **06,** 1277.

1907. George Vise, erecting telephone poles for line from Lock No. 1 to Lock No. 2, Tombigbee R., thence to Jackson, Ala., at $1.75 per pole and 75¢ each for erection, **07,** 1376.

1908. P. H. O'Brien, building Locks and Dams Nos. 2 and 3, Tombigbee R., and lock tender's house at Lock No. 3; prices listed, **08,** 1433.

1909. Levi Frisbie, building lock tender's house at Lock No. 2, Tombigbee R., $1,792, **09,** 1417.

1910. Levi Frisbie, building lock tender's house at Lock No. 3, Tombigbee R., $2,132, **10,** 1507.

1911. P. H. O'Brien (suppl.), covering advance payments on material delivered under orig. contract; R. P. Prowell, building lock tender's house at Lock No. 4, Tombigbee R., **11,** 1706.

ENGINEERS.

Chief of Engineers. R., 03, 309; **04,** 325; **05,** 334; **06,** 360; **07,** 374; **08,** 398; **09,** 415; **10,** 464; **11,** 496; **12,** 614.

Boards. BERH. **R.** of Capt. Craighill's reviewed and est. concurred in, for cost of constr. necessary locks and dams on Warrior and Tombigbee Rs., **04,** 1846.

In charge:

Capt. W. E. Craighill, 1903–05. **R., 03,** 1245; (Maj.) **04,** 1813, 1842; **05,** 1401.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1273.

Maj. H. Jervey, 1907–10. **R., 07,** 1371; **08,** 1429; **09,** 1414; **10,** 1561.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1703; **12,** 1922.

Assistants:

1st Lt. Wm. G. Caples, **08,** 393; **09,** 409.

Capt. C. O. Sherrill, **11,** 490.

LEGAL PROCEEDINGS.

Condemnation proceedings instituted to acquire land for Lock No. 2, **06,** 362.

Land for Lock No. 2 purchased; condemnation proceedings for Locks Nos. 1 and 3 instituted, **07,** 1372.

OPERATIONS.

1902–03. Work on Locks Nos. 1,2, and 3 begun; summary of work given; work on Lock No. 4, 95% completed; Locks 5 and 6 completed and trans. to U. S. Dec., 1902; snagging carried on by snag boat *Demopolis* below Lock No. 4, **03,** 1245, 1246.

1903–04. Cofferdams for Locks Nos. 1 and 3 completed, for Lock No. 2 about 75% completed; concrete work done on R. wall, Lock No. 1; snag boat worked over R. from Lock No. 7 to Demopolis, removing snags, etc., **04,** 326, 1813.

1904–05. Constr. of Locks Nos. 1, 2, and 3 continued until Dec. 31, 1904, when contractors abandoned work, about 26% completed. In Feb., 1905, completion of these locks by hired labor au., **05,** 1401.

1905–06. Work on Locks Nos. 1, 2, and 3, Warrior R., continued; about 60% completed, **06,** 1273. Bids for constr. of Lock No. 1, Tombigbee R., rejected as too high; gates built and most of material assembled for commencing work by hired labor for constr. of Lock and Dam No. 1; lock tender's house built, **06,** 1274.

1906–07. Constr. of Locks Nos. 1, 2, and 3, Warrior R., continued; about 85% completed, **07,** 1371. Site for Lock No. 1, Tombigbee R., cleared and grubbed, guard cribs placed and cofferdam commenced; site for Lock No. 2 purchased, and site for Lock No. 3 being acquired through condemnation proceedings; lock tender's house built at Lock No. 2; dr. built and launched, **07,** 1372.

1907–08. Constr. of Locks Nos. 1, 2, and 3, Warrior R., continued, and gates installed at 2 of the locks; 2 open for traffic; work on dams in progress, **08,** 1429. Constr. work on Lock No. 1, Tombigbee R., continued; 260 l. f. of concrete dam built, filling and riprap placed; erection of all lock gates and valves completed Aug. 20, 1907, and first boat was locked through on Nov. 24, 1907; work on Lock No. 3 begun, **08,** 1430. Lock tender's house built at Lock No. 3, **08,** 1431.

1908–09. Constr. of Locks Nos. 1, 2, and 3 completed by hired labor, opened to traffic as Lock No. 4, Tombigbee R., and Locks Nos. 5 and 6, Black Warrior R., **09,** 415. Lock No. 1, Tombigbee R., completed but for a small amount of excavation; opened Sept. 6, 1908; work on cofferdams for Locks Nos. 2 and 3, Tombigbee R., and on excavation continued, and plant and materials assembled, **09,** 1414, 1415.

1909–10. Lock No. 1, Tombigbee R., completed Sept. 30, 1909; work continued at Locks Nos. 2 and 3, 28% and 33%, resp., completed; lock tender's house at Locks Nos. 2 and 3 completed, **10,** 1564.

1910–11. Warrior R.: Lock tender's house built at Lock No. 4, and an artesian well drilled, **11,** 1703. Tombigbee R.: At Lock No. 2, building cofferdams, excavating and placing concrete, and bank and wing walls completed; at Lock No. 3, concrete laid in R. wall, and cofferdam, 50% bank and upper wing walls completed, **11,** 1704.

1911–12. Warrior R.: Lock tender's houses at Locks Nos. 5 and 7 constr.; house at Lock No. 8 about 90% completed, **12,** 1922. Tombigbee R.: Work of excavating, placing concrete, and delivering material at Locks Nos. 2 and 3 in progress; 1,700 c. y. dr. from shoal at West Bassetts Creek by hired labor, **12,** 1922.

PROJECTS.

Act Mar. 3, 1905, provides for completion of Lock and Dam No. 1, Tombigbee R., and constr. of Lock and Dam No. 2, at cost not to exceed $717,000, **05,** 335.

Changes in foundations, due to physical condition at sites of locks, greatly increased cost of work; amount au. would be insufficient. Act Mar. 3, 1905, au. completion of Locks Nos. 4, 5, and 6, Warrior R., and the constr. of Locks and Dams Nos. 1 and 2, Tombigbee R., at cost not to exceed $881,466; also that not more than $40,000 of this amount should be used for constr. of a dr., and not more than $30,000 for constr. of lock houses, **06,** 360; **07,** 375. R. and H. act, Mar. 2, 1907, au. completion of 3 Warrior R. locks, **07,** 375.

Act of Mar. 2, 1907, au. constr. of Lock and Dam No. 3, Tombigbee R., at cost not exceeding $483,000, **08,** 400.

Act of Aug. 22, 1911, au. Sec. of War to change height of Lock and Dam No. 17 to 63′ above pool level of Lock No. 16, making unnecessary Locks Nos. 18 and 19, and providing for extension of slack water up to Sanders and Nichols Shoals, **11,** 499.

SURVEYS.

Au. act June 13, 1902, for location of Locks Nos. 2 and 3, and completion of Lock No. 1 in the Tombigbee R., made by Capt. Craighill, 1903; est. $1,200,000, **04,** 1842.

For securing more economical location for Locks Nos. 2 and 3, **05,** 335.

Maps. **11,** 1702.

Cong. docs., etc., relating to exs., surs., plans, etc., **04,** 326; **05,** 335; **08,** 400; **11,** 497.

Part (m), R-23 Black Warrior, Warrior and Tombigbee Rivers, Ala. (Operating and care of locks and dams.)[1]

APPROPRIATIONS.[2]

1897,	$5,564.43,	**97,** 1677.
1898,	4,782.01,	**98,** 1433.
1899,	5,428.92,	**99,** 1705.
1900,	8,505.24,	**01,** 2175.
1901,	8,623.76,	**01,** 1821.
1902,	16,417.87,	**02,** 1301.
1903,	43,697.33,	**03,** 1253, 1257.
1904,	71,104.16,	**04,** 1824.
1905,	49,712.48,	**05,** 1411.
1906,	24,608.58,	**06,** 1281.
1907,	48,721.15,	**07,** 1380.
1908,	55,974.58,	**08,** 1439.
1909,	90,776.78,	**09,** 1423.
1910,	126,034.46,	**10,** 1573.
1911,	147,519.83,	**11,** 1713.
1912,	135,396.26,	**12,** 1934.
Total,	842,867.84,	**12,** 625.

CONTRACTS.

1910. Levi Frisbie, building storehouse at Lock No. 1, Tombigbee R., $3,333, **11,** 1713.

ENGINEERS.

Chief of Engineers. R., 97, 265; **98,** 261; **99,** 305; **00,** 346; **01,** 366; **02,** 300; **03,** 315; **04,** 332; **05,** 340; **06,** 368; **07,** 382; **08,** 406; **09,** 423; **10,** 472; **11,** 506; **12,** 623.

In charge:

Maj. W. T. Rossell, 1897–1901. **R., 97,** 1675; **98,** 1431; **99,** 1703; **00,** 2171; **01,** 1819.

Capt. Spencer Cosby, 1902. **R., 02,** 1300.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1253; (Maj.) **04,** 1822; **05,** 1410.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1279.

Maj. H. Jervey, 1907–10. **R., 07,** 1379; **08,** 1438; **09,** 1421; **10,** 1570.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1711; **12,** 1931.

Assistants:

Lt. M. L. Walker, **01,** 364.

1st Lt. Wm. G. Caples, **08,** 393; **09,** 409.

Capt. C. O. Sherrill, **11,** 490.

OPERATIONS.

1896-97. A lock master, 3 lock hands, and 3 assistant lock hands appointed July 1, 1896, **97,** 1675. Pool above Lock No. 3, 7 m. l. lowered 5½′ for few days, on petition of mine owners and others interested, to allow certain repairs to be made. Repairs made to house, etc., at Lock No. 1, and to Dams Nos. 1, 2, and 3, **97,** 1675, 1676. 1,227 lockages made, **97,** 1677.

1897-98. Filling above dams to reduce leakage and repairs made to Lock No. 1 and to shore protection, **98,** 1432. Over 2,000 lockages made, **98,** 1433.

1898-99. Fences, inclosing U. S. land, built at Locks Nos. 1 and 3; at Lock No. 1, leak repaired, and 6 new steel balanced gate valves built, **99,** 1704.

1899-00. Repairs made to Locks Nos. 1, 2, and 3, and a total of 408 c. y. flood deposit and 11 barge loads of logs removed from the 3 locks, **00,** 2174.

1900-01. Flood deposit removed from Locks Nos. 1 and 2; repairs to structures; derrick boat completed, **01,** 1820.

1901-02. Repairs to gate at Lock No. 1; guard cribs built at Locks Nos. 1, 2, and 3; materials ordered for constr. of 4 wooden deck barges, 24′ x 90′, to be built by hired labor, **02,** 1300.

1902-03. Locks Nos. 1, 2, and 3, Black Warrior R., repaired and 1,718 c. y. flood deposit removed from lock chambers; 4 barges completed at cost of $8,200, **03,** 1253. Lock No. 5, Warrior R., not in operation owing to noncompletion of gates before flood season; Lock No. 6 in operation since Oct., 1902; 12,562 t. st. placed along R. walls and back of abutments; 1 wooden and 1 wood and steel barge built at cost of $5,443, and misc. repairs made to plant, **03,** 1256.

1903-04. Locks Nos. 10, 11, and 12 (formerly Nos. 1, 2, and 3): Steel work painted, valves repaired, and 4,570 c. y. of flood deposit dr. from approaches, **04,** 1822. Locks Nos. 7, 8, and 9 (formerly Nos. 4, 5, and 6): Lock No. 7 completed and opened for traffic in Nov., 1903, Lock No. 8 in Oct., 1903, and Lock No. 9 in operation since Oct., 1902; large leak in Lock No. 8 repaired by using 25,000 sand bags; about 13,589 t. st. quarried and placed at the 6 locks in required places, **04,** 1822.

1904-05. General repairs made to all locks; leak developed at Lock No. 8, necessitating closing of lock for 26 days Nov., 1904, **05,** 1410.

1905-06. Locks Nos. 7, 8, 9, 10, 11, 12, and 13 (formerly No. 4) repaired by riprapping banks; guide clusters replaced; gate mechanism repaired; flood deposits removed; Lock No. 13 (formerly No. 4) opened July 4, 1905; 2 addl. timber cribs filled with st. constr. at Lock No. 13, **06,** 1280.

1906-07. Locks 7 to 13, incl., Black Warrior R., maintained, banks graded and riprapped, flood deposits dr. from approaches and chambers, guide cribs built, etc., **07,** 1379.

1907-08. At Locks 7 to 13, incl., general repairs made, flood deposits removed, banks riprapped, fender clusters built, 7 m. of telephone line built connecting Locks Nos. 12 and 13, 40 m. of chan. bet. Locks Nos. 9 and 10 cleared of obstr., and 2,152 c. y. material dr. from Trussells Bar, **08,** 1438.

1908-09. Locks 1 to 6, incl., became a charge under "Operating and care of locks and dams" in 1908; general repairs made to Locks Nos. 1 to 13, incl., banks riprapped, leaks stopped, and 31,058 c. y. material removed from bars in chan. and from locks and approaches; repairs made to plant, and new snag boat *R. C. McCalla* placed in commission, **09,** 1422.

1909-10. Mainten. work continued at Locks Nos. 1 to 15, incl., Lock No. 14 opened Mar. 29, 1910, and Lock No. 15 May 2, 1910, when these locks became a charge under "Operating and care of locks and dams;" snag boat *R. C. McCalla* worked over R. from Lock No. 4 to Lock No. 15, removing the worst snags and obstr.; chan. through the worst bars dr. by dr. *Chas. Humphreys;* tug *Nugent* overhauled and general repairs made to plant, **10,** 1570–72.

1910-11. General repairs to locks and lock machinery; flood deposits removed from lock chambers; 18,121 snags removed and 122,576 c. y. dr.; repairs made to floating plant and new boat ways built at Lock No. 12, **11,** 1711.

1911-12. Flood deposit removed from lock chambers; banks protected by riprap; general repairs made to structures and machinery; 20,413 snags and other obstr. removed; 151,512 c. y. material dr., and extensive changes and repairs made to floating plant, **12,** 1931–33.

PHYSICAL CHARACTERISTICS.

On Apr. 16–17, 1899, arose the highest and most violent flood ever known in this region, the rainfall being 8.40 inches at Tuscaloosa in a continuous rain lasting about 32 hours, **00,** 2172.

Wreck of towboat *Daisy*, **01,** 1821.

Accident to gate at Lock No. 1, **02,** 1300.

[1] Numbering of locks changed, 1903, to be in series from Mobile to head of Black Warrior R., **04,** 1840.

[2] Expend. under the permanent-indefinite app. provided by acts of July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

R-23(n) BIRMINGHAM, ALA., CANAL FROM, TO THE WARRIOR RIVER.

ENGINEERS.

Chief of Engineers. **R., 97,** 275.

In charge. Maj. W. T. Rossell, 1897. **R., 97,** 1704.

NOTE.—Abstract R-23 (n) probably refers to the same proposed waterway covered by Abstract R-23 (o) following. See **R., 97,** 1704.

R-23(o) BLACK WARRIOR RIVER AND FIVE-MILE CREEK, ALA. (Canal, via Valley Creek, to connect.)

COMMERCE.

Description of, **97,** 1705; **99,** 1749.

In 1896 it seemed safe to assume that there would be heavy shipments by the proposed canal if it were built and thrown open to traffic by the U. S., **97,** 1705.

ENGINEERS.

Chief of Engineers. **R., 97,** 275; **98,** 269; **99,** 317.

In charge. Maj. W. T. Rossell, 1897–99. **R., 97,** 1704; **98,** 1446; **99,** 1730.

Assistants:
J. Ripley. **R., 99,** 1735.
O. W. Ferguson. **R., 99,** 1765.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1705, 1706; **99,** 1735.

PROJECTS.

Maj. Rossell est., 1898, either $4,000,000 or $4,500,000 for imp. desired, **99,** 1731.

SURVEYS.

Ex. au. act June 3, 1896; made by Maj. Rossell, 1896 (sur. recom. at probable cost of $15,000), **97,** 1705.

Sur. for a canal bet. Black Warrior R. and Five-mile Creek au. act June 4, 1897; made, 1898, by Maj. Rossell (see Projects), **99,** 1731.

Bench marks, **99,** 1761, 1770.

R-33 SIPSEY RIVER, ALA.

COMMERCE.

None, **81,** 1221.

ENGINEERS.

Chief of Engineers. **R., 80,** 140; **81,** 189; **89,** 193; **90,** 175; **08,** 421.

In charge:
Capt. A. N. Damrell, 1879–90. **R., 81,** 1221; (Maj.) **90,** 1722.
Maj. H. Jervey, **08,** 393.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1723.

PLANS.

By Maj. Damrell, 1890, imp. R., Tombigbee R. at Vienna to Texas, giving a 4-months' navigation by removing snags, logs, and similar obstr., and constr. construction works; est., $100,000, **90,** 1724.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 106; made, 1880, by Capt. Damrell, **81,** 1221.

Sur., Tombigbee R. at Vienna to Texas, au. act Aug. 11, 1888; made, 1890, by Maj. Damrell, **90,** 1722.

Pre. ex., from mouth to Fayette, au. act Mar. 2, 1907. **R.** by Maj. Jervey, Mar. 30, 1908[1] (unfav.), **08,** 420.

R-38 OLD TOWN CREEK, MISS.

APPROPRIATION.

1882, $3,000, **83,** 1000.

COMMERCE.

Prospective benefits to C. consequent upon opening waterway, **83,** 1000.

ENGINEERS.

Chief of Engineers. **R., 81,** 213; **82,** 186; **83,** 192; **84,** 200; **85,** 210; **86,** 208; **87,** 174.

In charge. Capt. A. N. Damrell, 1881–87. **R., 82,** 1326; (Maj.) **83,** 999; **84,** 1191; **85,** 1355; **86,** 1200; **87** 1327.

Assistant. H. Harding. **R., 82,** 1326.

OPERATIONS.

1883–84. 13,016 trees cut and removed from banks and 853 logs and stumps removed from bed of stream, **84,** 1191.

PROJECTS.

By Capt. Damrell, 1882, imp. Old Town Creek for high-water navigation, mouth up to City Pt., 30 m., by removing overhanging and fallen trees, snags, and accumulated drift; est., $10,000, **82,** 1326, 1327.

SURVEY.

Ex. au. act Mar. 3, 1881; made, 1882, by Capt. A. N. Damrell, **82,** 1326.

[1] H. D. 909, 60th, 1st.

R-39 NOXUBEE RIVER, ALA. AND MISS.

APPROPRIATIONS.

1880,	$12,000,	**80,** 1093.
1881,	8,000,	**81,** 1214.
1882,	10,000,	**82,** 1298.
1884,	7,500,	**84,** 1214.
1886,	7,500,	**86,** 1203.
1888,	5,000,	**88,** 1210.
1890,	3,000,	**90,** 1705.
1892,	3,000,	**92,** 1453.
1894,	3,000,	**95,** 1699.
1896,	3,000,	**96,** 1448.
Total,	62,000	

COMMERCE.

Est. value of C. to be benefited, **81,** 1214.
Beginning of traffic after imp., **83,** 1024.
Reduction in rates est. to follow imp. of R., **88,** 1210.
1893, reduction in rates on account of imp. R. est. at over $20,000 an., **93,** 1764.
No C. 1898, **98,** 1441.

ENGINEERS.

Chief of Engineers. R., 80, 139, 140; **81,** 188; **82,** 184; **83,** 196; **84,** 204; **85,** 211; **86,** 208; **87,** 175; **88,** 163; **89,** 190; **90,** 171; **91,** 217; **92,** 210; **93,** 232; **94,** 214; **95,** 239, 244; **96,** 210; **97,** 269; **98,** 264; **99,** 309; **00,** 351; **01,** 370; **02,** 301.

In charge:
Capt. A. N. Damrell, 1879–95. **R., 80,** 1092, 1093, **81,** 1212; **82,** 1296; (Maj.) **83,** 1022; **84,** 1211; **85** 1356; **86,** 1201; **87,** 1328; **88,** 1208; **89,** 1441; **90,** 1704; **91,** 1787; **92,** 1452; **93,** 1763; **94,** 1318; **95,** 1699, 1715.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1447; **97,** 1691; **98,** 1440; **99,** 1716; **00,** 2208; **01,** 1840.
Capt. Spencer Cosby, 1902. **R., 02,** 1304.

Assistant. J. P. Fresenius. **R., 80,** 1093.

OBSTRUCTIONS.

Two br. crossed R., 1895, bet. Macon and Hashuqua Creek with no draw or other arrangement for passing of boats, **95,** 1716.

OPERATIONS.

1880–81. 13,416 trees, stumps, and logs removed from chan., carrying the work of imp. over 38 m. of R.; 1 snag and 1 quarter boat built, **81,** 1213.
1881–82. 27,991 snags, logs, trees, and other obstr. removed, **82,** 1297.
1882–83. 12,827 logs, trees, and snags removed, **83,** 1023.
1884–85. 12,317 trees, logs, snags, and stumps removed, **85,** 1357.
1885–86. 5,189 trees, stumps, and snags removed, making 55.5 m. of R. wholly and 36 m. partly imp., **86,** 1202.
1886–87. 750 snags, logs, and stumps removed, and 385 trees cut, **87,** 1329.
1887–88. 4,108 logs, trees, and stumps removed from chan., and 4,256 trees cut from banks, clearing 65½ m. of R., **88,** 1209.
1888–89. 4,280 snags and logs removed from chan.; 1,174 trees and logs cleared from banks, **89,** 1442.
1889–90. 2,019 snags and logs removed from the chan.; 456 trees and logs removed from banks, **90,** 1705.
1893–94. About 1,700 obstr. removed from banks and stream, **94,** 1319.
1894–95. Continuation of work of preceding year, **95,** 1699.
1898–99. Over 11,000 snags and other obstr. removed from banks and chan., **99,** 1716.
1899–00. 33,495 snags and other obstr. removed from banks and chan., **00,** 2209.

PHYSICAL CHARACTERISTICS.

Condition of R., and obstr. therein, **80,** 1096.
Between Macon and mouth of Hashuqua Creek stream very small, having average w. of 30′ and min. d. of 8″ at l. w., **95,** 1716.
Navigation possible on 6′ stage, mouth to State line, Miss., thence to Macon during higher stages, although many obstr. lodged in R. since suspension of work in Nov., 1899, **02,** 1304.

PROJECTS.

By Capt. Damrell, 1880, imp., Macon to mouth, 69 m., by removing snags, logs, trees, and similar obstr.; est., $65,245, **80,** 1093; **87,** 1329, 1343.
Proj. completed, 1890; cost, $53,000, **90,** 1705. Est. an. cost of mainten., $3,000, **91,** 1788; **93,** 1764.

SURVEYS.

Au. act Mar. 3, 1879; made, 1880 by Capt. Damrell, **79,** 106; **82,** 1296.
Ex. for imp. by locks and dams au. act Aug. 5, 1886; made by Maj. Damrell (**R.** unfav.), **87,** 1343.
Ex., Macon to mouth of Hashuqua Creek, au. act Aug. 17, 1894; made by Maj. Damrell, 1894 (**R.** unfav.), **95,** 1715.
Maps. **84,** 1212.

R-40 SUCARNOOCHEE RIVER, ALA.

ENGINEERS.

Chief of Engineers. R., 91, 221.
In charge. Maj. A. N. Damrell, 1890. **R., 91,** 1801.

PLANS.

In 1890. Removing snags and similar obstr. would cost $35,000. **91,** 1802.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Damrell (Div. E, **R.** unfav.), **91,** 1801.

R-44 CHICKASAW CREEK, ALA.

ENGINEERS.

Chief of Engineers. R., 10, 488.
In charge. Maj. H. Jervey, 1910. **10,** 460.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, for removing bar at mouth in Mobile R. **Rs.,** Maj. Jervey, May 11 and Dec. 3, 1909 (unfav.),[1] **10,** 488.

[1] H. D. 712, 61st, 2d.

R-51 FOWL RIVER, ALA.

ENGINEERS.

Chief of Engineers. **R., 10,** 488.
In charge. Maj. H. Jervey, **10,** 460.

SURVEY.

Ex., in connection with proposed intracoastal waterway, au. act Mar. 3, 1909; made, 1909, by Maj. Jervey (**R.** unfav.),[1] **10,** 488.

R-52 (a) MOBILE BAY AND MISSISSIPPI SOUND, ALA. (Channel connecting.)

APPROPRIATIONS.

1912, $50,000, **12,** 1938.

COMMERCE.

Important, **84,** 1228. Description of; waterway transportation from the Alabama mineral fields to Mobile B. would be of great value, **95,** 1717.

Nearly all the C. uses Grants Pass, which is owned by private parties, and tolls are charged, **12,** 626.

ENGINEERS.

Chief of Engineers. **R.,84,** 206; **95,** 244; **08,** 420; **12,** 626.

In charge:
Maj. A. N. Damrell, 1882–95. **R., 84,** 1227, 1228; **95,** 1716.
Maj. H. Jervey, **08,** 393.
Maj. C. A. F. Flagler, 1912–. **R., 12,** 1938.

Assistant. C. B. Percy. **R., 84,** 1229.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1229; **95,** 1719–1721.

PLANS.

By Maj. Damrell, dr. chans. through either Pass Aux Herons or Grants Pass, **84,** 1229, 1231.

PROJECTS.

Maj. Damrell est., 1894, $91,327.80 by Pass Aux Herons or $84,772.80 by Grants Pass (not including cost of purchasing pass) for proposed chan., **95,** 1719.

Act July 25, 1912, au. chan. 100′ w. at bottom, 10′ d. at m. l. w., from Mobile B. to Mississippi Sound,[2] **12,** 626.

SURVEYS.

Dauphin Isld. and Cedar Pt., Ala., shoal between. Sur. and ex. au. act Aug. 2, 1882; made by Maj. Damrell, **84,** 1228.

Sur. to ascertain the best point for, and the cost of a sufficient chan. between Mobile B. and Mississippi Sound, au. act Aug. 17, 1894; Maj. Damrell submitted **R.,** 1894, containing copies of **R.** of an ex. made, 1882, and a sur. made, 1884, for the same purpose (see Projects), **95,** 1716.

Preliminary ex. and sur. au. act Mar. 2, 1907; made by Maj. H. Jervey;[2] est., $50,000, **08,** 420.

R-53 PASS AU HERONS, ALA.[3]

R-59 LA BATRE BAYOU, ALA.

ENGINEERS.

Chief of Engineers. **R., 10,** 488.
In charge. Maj. H. Jervey, **10,** 460.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.,** Maj. Jervey, June 2, 1909 (unfav.),[4] **10,** 488.

R-63 PASCAGOULA RIVER AND HARBOR, HORN ISLAND HARBOR, AND HORN ISLAND PASS, MISS.[5]

Part.	Title.	Period.	Appropriations.
a	Pascagoula R. and H	1827–1900	$200,500
b	Horn Isld. Pass	1882–1912	76,980
c	Pascagoula R. and Horn Isld. H	1897–1912	955,600
d	Paxagoula R. above mouth of Dog R	1901–1912	22,750
	Total		1,255,830

[1] H. D. 299, 61st, 2d.
[2] H. D. 967, 60th, 1st.
[3] App.: 1828, $18,000. This was for d. the chan. through the pass, and $6,050 of this sum was reapp. for the same purpose in 1832. (Treas. Doc. 373, 1882.)
[4] H. D. 316, 61st, 2d.
[5] Pascagoula R., Miss.: Sur.—**R.** July 8, 1828; est. $25,500. E. Pascagoula R., Miss.: Sur.—**R.** Jan. 23, 1854; est. $9,900. (H. D. 482, 55th, 2d.)

Part (a), R-63 Pascagoula Harbor and River, Miss.

APPROPRIATIONS.

1827,	$8,000,	act Mar. 2.
1828,	17,500,	act May 23.
1852,	5,000 (sur.),	act Aug. 30.
1878,	10,000,	**79,** 834, 835.
1879,	14,000,	**79,** 105.
1880,	20,000,	**80,** 1099.
1881,	4,000,	**81,** 1216.
1882,	8,000,	**82,** 1299.
1884,	3,000,	**84,** 1215.
1886,	[1] 25,000,	**86,** 1205.
1888,	27,000,	**88,** 1212.
1890,	20,000,	**90,** 1708.
1892,	20,000,	**92,** 1455.
1894,	13,000,	**95,** 1701.
1896,	6,000,	**96,** 1449.
Total,	200,500	

COMMERCE.

Important, **74,** 759; **79,** 839, 840.
Benefit resulting from imp., **81,** 1216.
Description of, Horn Isld. Pass; increased, **97,** 1717, 1720.

CONTRACTS.

1880. S. N. Kimball, dr., 32¼¢ c. y., **80,** 1099. W. G. Mitchell, dr., 27¢ c. y., **81,** 1216.
1890. G. C. Fobes & Co., dr., 16.2¢ c. y., **90,** 1707. Alabama Dredging & Jetty Co., dam constr., $3,350, **90,** 1707.
1891. Alabama Dredging & Jetty Co., dr., 22¢ c. y., **91,** 1791.
1892. Alabama Dredging & Jetty Co., dr., 18¢ c. y., s. m., **93,** 1766.
1897. Rittenhouse-Moore Dredging Co., dr., 18,616 c. y., at 40¢ c. y., **97,** 1695.

ENGINEERS.

Chief of Engineers. R., 73, 66; **74,** 74; **78,** 81; **79,** 105; **80,** 140; **81,** 188, 189; **82,** 185, 186; **83,** 197; **84,** 205; **85,** 211; **86,** 209, 211; **87,** 175; **88,** 163; **89,** 190; **90,** 172; **91,** 217; **92,** 210; **93,** 232; **94,** 215; **95,** 239; **96,** 211; **97,** 269; **98,** 265, 269; **99,** 309; **00,** 351.

In charge:
Capt. C. W. Howell, 1873–78. **R., 74,** 754.
Capt. A. N. Damrell, 1878–95. **R., 79,** 834; **80,** 1098; **81,** 1214; **82,** 1298, 1324; (Maj.) **83,** 1025; **84,** 1214; **85,** 1358; **86,** 1203; **87,** 1330; **88,** 1210; **89,** 1443; **90,** 1706; **91,** 1788; **92,** 1453; **93,** 1765; **94,** 1319; **95,** 1700.
Maj. W. T. Rossell, 1896–. **R., 96,** 1448; **97,** 1692, 1716; **98,** 1441; **99,** 1717; **00,** 2209.

Assistants:
Lt. J. B. Quinn. **R., 74,** 755.
P. Robinson. **R., 79,** 837.
T. L. Harrison. **R., 82,** 1325.
R. Rauchenstein. **R., 86,** 1217.

ESTIMATES. (See Plans.)

By Lt. Quinn, js. and dr., $42,374.10, **74,** 757.

LEGISLATION.

Charter granted to A. A. Green, by the State of Mississippi, enabling him to constr. a canal across the bar at the mouth of the R., and also permitting him to exact tolls from vessels passing out through it, **74,** 756, 758; $25,000 app. by legislature of Mississippi for the imp. of the mouth, **74,** 756, 760. State app. annulled, **79,** 837.

OPERATIONS.

1880–81. 75,155 c. y. dr. from the chan., **81,** 1215.
1881–82. 106,841 c. y. dr. from the chan., **82,** 1298.
1882–83. 1,083 snags and 5,667 trees cut and removed, **83,** 1026.
1883–84. 953 snags and 3,079 trees removed, and 854 deadened, **84,** 1215.
1884–85. 1,115 snags removed from R., **85,** 1359.
1887–88. Dr. under contract continued, **88,** 1211.
1889–90. 52,685 c. y. dr., **90,** 1707.
1890–91. 131,656 c. y. dr., **91,** 1790.
1891–92. 28,561 c. y. dr., 205 snags and logs cleared from the chan., and 269 trees cleared from the banks, **92,** 1455.
1892–93. 99,977 c. y. dr., and about 2,000 obstr. removed from banks and stream, **93,** 1766, 1767.
1893–94. A few obstr. removed, **94,** 1321.
1894–95. Removal of obstr. continued, **95,** 1702.
1895–96. About 2,000 obstr. removed, **96,** 1450.
1896–97. Over 4,000 obstr. removed, and 18,616 c. y. dr. from Horn Isld. Pass, **97,** 1693, 1694.

PHYSICAL CHARACTERISTICS.

General, **74,** 755; **79,** 835, 837–839.
Obstr., **74,** 757; **79,** 835, 838.
Description of, **97,** 1693, 1719; vicinity of Horn Isld. Pass, **97,** 1717; vicinity of Dog R. and of a part of Dog R., **97,** 1719.

PLANS. (See Estimates and Projects.)

By Lt. Quinn, js. of cement-covered gabions, 3,500 and 4,000′ l.; also dr. chan. to w. of 7′ x 100′; **74,** 757.
By Capt. Damrell, imp. of H. by excavation of chan. 21′ x 100′ through "the Pass;" est., $326,816, **82,** 1324.

PRIVATE, STATE, AND CORPORATE WORK. (See Legislation.)

Noyes Canal, built under a charter from Mississippi; cost, $27,000, **74,** 756, 759; $25,000 app. by the State, and $5,000 by the citizens of Pascagoula, for imp. of the mouth, **74,** 756, 760. State app. annulled, **79,** 837.

PROJECTS.

By Capt. Damrell, 1879, dr. chan. through bar at, the mouth 7′ x 200′, and removing snags and overhanging trees from the R. for its entire l.; est., $53,800, **74,** 757; (orig. est., $57,292.40), **79,** 834.
In 1886, proposed to form, by dr., chan. 12′ d. from the mills at Moss Pt. to anchorage in the B., 1½ m.; est., $78,100, **86,** 1217.
Owing to increased cost of excavation est. raised $141,000, with $69,000 for completion in 1890, **90,** 1708.
By Maj. Rossell, 1897, dr. chan. 21′ d. m. l. w. through Horn Isld. Pass; cost, not to exceed $8,000, **97,** 1694.

SURVEYS.

Of Pascagoula H., by Lt. Quinn, 1873. **R., 74,** 755.
Of Pascagoula R., by P. Robinson, 1878–79. **R., 79,** 837.
For H., Pascagoula, au. act Mar. 3, 1881; made, 1882, by Maj. Damrell, **82,** 1324.
Of Pascagoula R., mills at Moss Pt. down to anchorage in B., au. act July 5, 1884; made, 1884, by Maj. Damrell, **86,** 1215.
Ex. of shoal in Horn Isld. Pass threatening the main entrance of the port of Pascagoula; made, 1896, by Maj. Rossell, **96,** 1451.
Sur. of Horn Isld. Pass, with view to 23′ l. w., au. act June 3, 1896; made by Maj. Rossell, 1896 (**R.** unfav.) (see Projects), **97,** 1716.
Maps. **97,** 1694; **98,** 1440.

[1] $5,000 of which was reapp. from an app. for Horn Isld. Pass, made 1884, **86,** 454.

Part (b), R-63 Horn Island Pass, Miss.

APPROPRIATIONS.[1]

1884,	$5,000,	**85,** 1362.
1905,	40,480,	**05,** 1422.
1907,	9,000,	**07,** 1390.
1909,	12,000,	**09,** 1431.
1910,	4,500,	**10,** 1581.
1911,	4,000,	**11,** 1722.
1912,	2,000,	**12,** 1943.
Total,	76,980	

COMMERCE.

Important, **95,** 1714.
Supply of lumber, using pass, exhausted in from 25 to 30 years, **04,** 1874.
Reduction in rail rates, **11,** 514.
1911, 266,654 t., **12,** 634.

ENGINEERS.

Chief of Engineers. **R., 81,** 189; **82,** 186; **85,** 212; **86,** 210; **95,** 244; **04,** 343; **05,** 346; **06,** 374; **07,** 388; **08,** 412; **09,** 430; **10,** 478, 488; **11,** 514; **12,** 633.

Boards. BERH. **R., 04,** 1867, 1872.

In charge:
A. N. Damrell. **R., 82,** 1324; (Maj.) **85,** 1361; **86,** 1206; **95,** 1714.
Capt. W. E. Craighill, 1904–05. **R., 04,** 1864; **05,** 1421.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1287.
Maj. H. Jervey, 1907–10. **R., 07,** 1390; **08,** 1447; **09,** 1430; **10,** 1581.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1722; **12,** 1943.

Assistants:
T. L. Harrison. **R., 82,** 1325.
David Sanderson. **R., 04,** 1875.

OPERATIONS.

1905-06. Chief of Engrs. granted au. to have U. S. dr. *Charleston* thoroughly repaired at cost of $7,000; no bids received for doing work, **06,** 1289.

1906-07. U. S. dr. *Charleston*, after repairs, removed 353,230 c. y., **07,** 1390.
1907-08. 184,017 c. y. dr., **08,** 1447.
1909-10. 158,470 c. y. dr., **10,** 1581.

PHYSICAL CHARACTERISTICS.

Description of; bar formed during storm, 1888 **95,** 1714.
Description of, **04,** 1865.
L. w. d. through pass 18′, **05,** 1421.
Condition of bar, 1907, **07,** 1390.

PLANS.

By Capt. Damrell, 1882, dr. chan. through Horn Isld. Pass 21′ x 100′, est., $43,000, **82,** 1324, 1325; **85,** 1362.

PROJECTS.

Act Mar. 3, 1905, made app. with view to chan. 21′ x 300′ across outer bar, and 200′ w. elsewhere; est. $40,480,[2] provided contract or contracts could be made at not to exceed 11¢ c. y., or work could be done by U. S. dr., **05,** 1422.

SURVEY.

Au. act Mar. 3, 1881; made by Capt. Damrell (see Projects), **82,** 1324.
Ex. of the bar formation in the pass au. act Aug. 17, 1894. **R.** submitted, 1894, by Maj. Damrell (**R.** fav.), **95,** 1714.
Pre. ex. and sur. au. act June 13, 1902. **Rs.,** by Capt. Craighill, June 9 and Nov. 7, 1903; est., $40,480, and $9,000 an. for mainten.,[2] **04,** 1863.
Pre. ex. au. act Mar. 3, 1909, from outer bar in Gulf of Mexico through and across Dago Shoals in Mississippi Sound, by most direct and practicable route to 21′ d. n. of Petit Bois Isld. **R.** by Maj. Jervey, Aug. 17, 1909 (unfav.),[3] **10,** 488.
Cong. docs., etc., **12,** 634.

Part (c), R-63 Pascagoula River and Horn Island Harbor, Miss.

APPROPRIATIONS.

1899,	$50,000,	**99,** 1718.
1900,	267,600,	**00,** 2212.
1902,	25,000.	**02,** 1305.
1903,	100,000,	**03,** 1259.
1904,	25,000,	**04,** 1830.
1905,	150,000,	**05,** 1417.
1907,	[4] 150,000,	**07,** 1386.
1909,	75,000,	**09,** 1427.
1910,	93,000,	**10,** 1578.
1912,	20,000,	**12,** 1939.
Total,	955,600	

COMMERCE.

Increasing at Horn Isld. H., **97,** 1717.
In 1896 it warranted no d. chan. than 12′ in the R. and in part of Dog R., **97,** 1718.
1900, 111,912 t., **01,** 1843; 1904, 735,875 t., principally logs, lumber and naval stores, **05,** 343; 1911, 972,944 t., **12,** 1940.
Reduction in rail rates, **05,** 343.
"Commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1911 amounted to 301,538 short tons, principally logs, cross ties, charcoal, and general merchandise, valued at $1,488,500.
"The project has effected a reduction in rail rates for carload shipments of lumber from Merrill, Miss., to the coast during the past year." **12,** 630.
"Commerce using the channel through Horn Island Pass during the calendar year 1911 amounted to about 266,654 short tons of lumber, timber, cross ties, and piling, valued at $1,906,540.
"This improvement in conjunction with that of Pascagoula River, from which it is distant about 9 miles, results in effecting a reduction in rail freight rates between Pascagoula, Miss., and seaboard cities of the Atlantic coast, and in affording direct water freight rates on lumber from Moss Point and Pascagoula to foreign ports." **12,** 634.

CONTRACTS.

1899. A. W. Delmas, dr., 17¢ and 34¢ c. y., **99,** 1719; **00,** 2211.
1901. Albert G. Delmas, dumping dr. material from chan. below mouth of R. s. of Point aux Chenes instead of on marshy islds. bordering R. and sound, 15½¢ c. y. instead of 17¢ (supple. to contract of July 21, 1899), **01,** 1843.

[1] The act of Aug. 5, 1886, directed that the app. be applied to imp. of Pascagoula R., **86,** 210.
[2] H. D. 506, 58th, 2d.
[3] H. D. 314, 61st, 2d.
[4] Not including $50,000 diverted to constr. of a dr.

1903. G. W. Catt, dr. in Dog and Pascagoula Rs. and Mississippi Sound (prices stated), **03,** 1259.
1905. John Anderson, dr. in sec. 2, at 8¢ c. y., **05,** 1418. Southern Dredging Co., dr. in sec. 1, Dog and Pascagoula Rs. and Mississippi Sound, 9.98¢ c. y., **06,** 1286.

ENGINEERS.

Chief of Engineers. R., 97, 276; **99,** 310, 317; **00,** 352; **01,** 371; **02,** 301; **03,** 315; **04,** 333; **05,** 341; **06,** 369; **07,** 383; **08,** 407; **09,** 425; **10,** 474; **11,** 508; **12,** 626.

In charge:
Maj. W. T. Rossell, 1899–1901. **R., 97,** 1718; **99,** 1718, 1784; **00,** 2211; **01,** 1842.
Capt. Spencer Cosby, 1902. **R., 02,** 1305.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1258; (Maj.) **04,** 1828; **05,** 1416.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1285.
Maj. H. Jervey, 1907–10. **R., 07,** 1385; **08,** 1443; **09,** 1426; **10,** 1577.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1717; **12,** 1939.

Assistant. D. G. Anderson. **R., 02,** 1306; **03,** 1260.

OPERATIONS.

1899-00. 50,064 c. y. dr. from anchorage in Horn Isld. H., and 306,260 c. y. dr. from Pascagoula R., **00,** 2211, 2212.
1900-01. 116,658 c. y. dr. from Horn Isld. anchorage; 536,784 c. y. dr. from Pascagoula R. chan., **01,** 1842.
1901-02. 322,209 c. y. dr. from chan. of Pascagoula R., and 66,665 c. y. from Horn Isld. H.; uninterrupted chan. of specified w. and d. throughout limits of proj. obtained, **02,** 1305.
1903-04. 376,249 c. y. dr., making chan. 15′ x 95′ x 22,275′ in sec. 2; 364,391 c. y. dr. from sec. 1, forming, through various shoals, chans. 15′ d., and w. varying from 100′ in lower portion to 75′ in upper portion; aggregate l. 27,344′; 40,618 c. y. also removed from head of sec. 2 where shoal had formed, **04,** 1829.
1905-06. 63,877 c. y. dr. from sec. 1, making d. of 17′ x 125′ x 4,397′; 293,918 c. y. dr. from sec. 2, making 17′ x 125′–150′, and l. of 7,150′; work done by hydraulic dr., **06,** 1285.
1906-07. 740,899 c. y. dr. making 17′ x 38,005′ x 125′–150′, completing contract for sec. 1, May, 1907; in sec. 2, 295,755 c. y. dr. and 73,713 c. y. redr., making 17′ x 125′; chan. dr. 10,450′, and redr. 5,000′, **07,** 1385.
1907-08. 80,394 c. y. removed by U. S. dr. *Barnard,* **08,** 1443.
1908-09. 442,556 c. y. dr. from 22,579′ of chan. under contract; 586,353 c. y. dr. by U. S. dr. *Barnard* from 12,647′ of chan., making 17′ d. m. l. w., **09,** 1426.
1909-10. New U. S. dr. *Pascagoula* dr. 1,233,653 c. y., **10,** 1577.
1910-11. 449,713 c. y. dr. by U. S. dr. *Pascagoula;* 500 l. f. bulkhead built in connection with slip 100′ x 200′, **11,** 1717.
1911-12. 1,097,272 c. y. dr. below RR. br., 102,910 c. y. above RR. br., and 15,697 c. y. from U. S. slip and approach, **12,** 1939. 85 % of approv. proj. finished, **12,** 628.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1718.
Max. l. w. draft, 1902, bet. Mississippi Sound and the lumber mills at Moss Point, 12′, **02,** 303.
Tables illustrating physical characteristics of Pascagoula and Dog Rs.; remarks about shoaling, **02,** 1308–09.
Shoaling, **05,** 343; **11,** 1718.
Available draft, 1908, below RR. br. at Scranton, Miss., 18′, m. l. t., **10,** 1577.

PROJECTS.

By Maj. Rossell, 1896, 12′ x 150′ above and 300′ w. below RR. br., from 3 m. above mouth of Dog R. to 12′ contour in Mississippi Sound, est., $267,600, **97,** 1718; **99,** 1718.
By Maj. Rossell, 1898, 20′ x 500′ in the anchorage of Horn Isld. H., est., $50,000, **99,** 1718, 1785.
Act June 13, 1902, modified and extended existing proj. to provide chan. 17′, from 3 m. above mouth of Dog R. to 17′ contour Mississippi Sound, 150′ w. above RR. br. and 300′ w. below,[1] **02,** 302.
Act June 25, 1910, further modified proj. by extending upper limit about 1 m. farther up Dog R.; cost of proj. increased by $8,000,[2] **10,** 475.

SURVEYS.

Sur. of the R. commencing at d. exceeding 17′ in Mississippi Sound, thence to mouth of, and up R. to intersection of Dog R., thence up Dog R. 3 m., with view to chan. 17′ l. w., au. act June 3, 1896; made by Maj. Rossell, 1896 (**R.** unfav.), (see Projects), **97,** 1718.
Sur., plan, and est. of cost of imp. of the pass leading from Gulf of Mexico into Horn Isld. H., Miss.; and of said H. and of chan. leading to and from said pass, with a view of ascertaining the extent to which the same is worthy of imp., au. act May 7, 1898; made, 1898, by Maj. W. T. Rossell (**R.** fav.), (see Projects), **99,** 1785.
Minor, **02,** 1306–09.
Pre. ex. and sur. au. act Mar. 3, 1909, of Dog R., Miss., to point ½ m. above Pascagoula Northern RR. br. **R.** by Maj. Jervey, 1909 and 1910; est., $8,000,[3] **10,** 488.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 628.
Pre. ex. and sur. au. act June 25, 1910, of mouth of Pascagoula R., Miss., with view to securing increased d. in a continuous chan. from the upper limits of the present proj. in Dog R., to d. w. in the Gulf of Mexico. **R.** by Maj. H. Jervey and Maj. Flagler, Sept. 30, 1910, and Dec. 27, 1911, resp. Est. $383,030 for first constr., and $50,000 an. for mainten.,[3] **12,** 644.

Part (d), R-63 Pascagoula River, Miss. (Above mouth of Dog River.)

APPROPRIATIONS.

1902,	$4,000,	**02,** 1310.
1905,	*6,750,	**05,** 1419.
1907,	*6,000,	**07,** 1388.
1910,	*6,000,	**10,** 1580.
Total,	22,750	

COMMERCE.

See Pascagoula R. and Horn Isld. H., **02,** 304.
Above mouth of Dog R., 1904, 180,250 t., principally logs and naval stores, **05,** 344; 1906, 260,100 t., **07,** 386; 1911, 972,944 t., **12,** 1940.

ENGINEERS.

Chief of Engineers. R., 01, 371; **02,** 303; **03,** 317; **04,** 334; **05,** 343; **06,** 371; **07,** 385; **08,** 409; **09,** 427; **10,** 474, 475, 476, 488, 489; **11,** 510, 526; **12,** 629, 644.

In charge:
Maj. W. T. Rossell, 1901. **R., 01,** 1840.
Capt. Spencer Cosby, 1902. **R., 02,** 1309.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1261; (Maj.) **04,** 1830; **05,** 1419.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1287.

* Allotment.
[1] H. D. 211, 54th, 2d.
[2] H. D. 642, 61st, 2d.
[3] H. D. 682, 62d, 2d.

Maj. H. Jervey, 1907–10. **R., 07,** 1387; **08,** 1445; **09,** 1428; **10,** 1579.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1719; **12,** 1940.

OPERATIONS.

1902–03. Snagging in progress from Oct., 1902, to June, 1903; R. placed in condition for rafting and light draft navigation, **03,** 1261.
1904–05. Repairs made to plant; snagging begun at Moss Pt., Miss., June, 1905, and prosecuted upstream, 40 m. of R. being restored to navigable condition, **05,** 1419.
1905–06. Snagging begun June 7, 1906, at Moss Pt., lower limit of imp., and on June 30, 1906, 27 m. of R. upstream had been cleared of obstr., **06,** 1287.
1906–07. Some of the obstr. brought into the R. by storm of Sept., 1906, were removed in Nov. and Dec., 1906, **07,** 1387.
1907–08. A few obstr. removed, **08,** 1445.
1909–10. Dead Lake, 45 m. above mouth of Pascagoula R. snagged upstream 17½ m.; work suspended Dec. 21, on account of h. w.; snag boat *Demopolis* removed 692 snags, logs, and stumps from R., **10,** 1579.
1910–11. Snag boat *Demopolis* began operations at Dead Lake, 32 m. above mouth of Dog R., working upstream for about 19 m.; work suspended Dec. 22, 1910, on account of h. w.; 28 trees felled, pulled up, cut and trimmed, and 1,630 snags and other obstr. removed, **11,** 1719.
1911–12. U. S. snag boat *Escatawpa* began work at mouth of Leaf R. Nov. 15 and worked downstream until Dec. 14, 1912, and removed 1,193 snags, trees, and other obstr. from R., for 10 m., **12,** 1940.

PHYSICAL CHARACTERISTICS.

Chan. through bar at mouth of R. before imp. had least d. of 3′, while inside mouth for about 10 m. upstream, draft of 6½′ existed, thence to junction of Chickasahay and Leaf Rs. navigation was impossible, except during h. w.; min. w. of this latter portion 60′, and min. d. 1′; in addition chan. was obstr. by snags and overhanging trees, **02,** 303.
Storm of Sept., 1906, brought many obstr. into R., **07,** 1387.
Pascagoula a non-tidal stream, except in its lower reaches; navigable for boat of 5′ draft as far up as Cedar Creek, 55 m., **08,** 410.

PROJECTS.

To maintain a navigable chan. from the junction of the Leaf and Chickasahay Rs., forming the Pascagoula R., down to its junction with the Dog R., by removal of obstr. and overhanging trees, **01,** 1841.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909, of Dog R. from a point ¼ m. above the Denney & Co. RR. br. (now Pascagoula Northern RR. br.). **R.** by Maj. Jervey, 1909 and 1910; plan for imp. presented at est. cost of $8,000,[1] **10,** 488.
Pre. ex. and sur. au. act Mar. 3, 1909, of Leaf and Pascagoula Rs., from mouth of Bowie Creek to junction of Pascagoula and Dog Rs., **10,** 489; **11,** 526; **12,** 644.

R-66 CHICKASAHAY RIVER, MISS.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1792.
1892,	5,000,	**92,** 1456.
1894,	5,000,	**95,** 1703.
1896,	2,000,	**96,** 1452.
1899,	2,500,	**99,** 1720.
1902,	*2,250,	**02,** 1311.
1905,	*2,000,	**05,** 1421.
1907,	*1,500,	**07,** 1389.
1910,	*3,000,	**10,** 1580.
Total,	28,250 (less $3,000 trans. to Leaf R., $25,250, **12,** 1942).	

COMMERCE.

Character of, **79,** 841.
Fine timber lands close to R., **79,** 843.
In 1893 est. that proposed imp. would save producers $50,000 an., **93,** 1770.
All freight of towns along the R. carried by a RR. parallel to the R. to the head of navigation, **96,** 1453.
Imp. has had no effect on rates **10,** 478.
1910, 57,280 t.; 1911, 71,000 t., **12,** 1942.

ENGINEERS.

Chief of Engineers. **R., 78,** 81; **79,** 105; **89,** 193; **91,** 218; **92,** 211; **93,** 233; **94,** 215; **95,** 240; **96,** 211; **97,** 271; **98,** 265; **99,** 311; **00,** 353; **01,** 372; **02,** 304; **03,** 318; **04,** 335, 343, 1854; **05,** 345; **06,** 373; **07,** 387; **08,** 411; **09,** 428; **10,** 478; **11,** 512; **12,** 631.

Boards. BERH. **R., 04,** 1857.

In charge:
Capt. A. N. Damrell, 1877–79, **78,** 81; **79,** 105. **R., 79,** 841.
Maj. A. N. Damrell, 1888–95. **R., 89,** 1463; **91,** 1791; **92,** 1456; **93,** 1769; **94,** 1322; **95,** 1703.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1452; **97,** 1695; **98,** 1442; **99,** 1720; **00,** 2213; **01,** 1844.
Capt. Spencer Cosby, 1902. **R., 02,** 1310.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1261; (Maj.) **04,** 1831, 1854; **05,** 1420.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1287.
Maj. H. Jervey, 1907–10. **R., 07,** 1388; **08,** 1445; **09,** 1428; **10,** 1579.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1720; **12,** 1940.

Assistant. P. Robinson. **R., 79,** 842.

OPERATIONS.

1891–92. 6,000 overhanging trees felled upon the banks, and 6,000 logs cleared, **92,** 1456.
1892–93. Over 36,000 obstr. removed from banks and stream, and a small amount of excavation done, **93,** 1769.
1893–94. About 4,500 obstr. removed, **94,** 1322.
1894–97. Removal of obstr. in progress in 1894–95, **95,** 1703; about 10,000 obstr. removed in 1895–96, **96,** 1452; over 34,000 obstr. removed in 1896–97, **97,** 1696.
1898–99. About 8,000 snags and other obstr. removed from banks and chan. of R., **99,** 1720.
1899–00. About 23,000 snags and other obstr. removed from banks and chan. of R., **00,** 2214.
1903–04. Snagging of entire R. completed, **04,** 1831.
1907–08. 7,372 snags and other obstr. removed, **08,** 1445.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 841, 842, 843; source 205 m. above mouth; follows eastern boundary of Miss.; joins with Leaf R. to form Pascagoula R. at Merril, Miss.; upper limit of imp. about 75 m. above mouth, **12,** 632.
H. w. chan. provided for logs and rafts, **11,** 512.

PLANS. (See Projects.)

By P. Robinson, 1879, removing obstr. to l. w. mark, Shubuta to Winchester, 38 m.; to 2′ below

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* Allotment.

[1] H. D. 642, 61st, 2d.

l. w., Winchester to Warrens Mill, 12 m.; and 3′ below l. w., Warrens Mill to mouth of the Chickasahay, 80 m.; est., $11,500, **79,** 842.

By Maj. Damrell, 1889, chan. 2′ x 65′ Shubuta up to Enterprise; cost, $100,000, **89,** 1465.

PROJECTS. (See Plans.)

By Maj. Damrell, 1889, 3′ navigable chan., mouth up to the RR. br. near Shubuta, 130 m., by removal of logs, snags, and overhanging trees, est., $30,000, **89,** 1465; **91,** 1791; **92,** 1456; act 1896 limited imp. to Bucatunna, Miss. (75 m.).

In 1893, Maj. Damrell est. it would cost $2,000 an. for mainten., **93,** 1770.

By Maj. Craighill, 1904, au. act Mar. 3, 1905, mainten. of chan. by removal of logs, snags, trees, etc., bet. mouth and Bucatunna; est., $2,500 an., **05,** 346.

SURVEYS.

Ex. ordered and in progress, **78,** 81.

Ex. completed by P. Robinson, **79,** 105, 841, 842.

Ex. au. act Aug. 11, 1888; made by Maj. Damrell, **89,** 1463.

Au. act June 13, 1902; made by Capt. Craighill, mouth to Bucatunna, Miss.; est., $2,500 an. for mainten.[1] (see Projects), **04,** 343, 1854.

R-67 LEAF RIVER, MISS.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1793.
1892,	5,000,	**92,** 1458.
1894,	2,500,	**95,** 1704.
1896,	2,500,	**96,** 1453.
1899,	2,500,	**99,** 1721.
1902,	*2,250,	**02,** 1312.
1905,	*3,250,	**05,** 1421.
1907,	*2,500,	**07,** 1388.
1910,	*6,000,	**10,** 1580.
1912,	[2] 3,000,	**12,** 1942.
Total,	34,500	

COMMERCE.

C. to be affected by imp., **89,** 1463.

1911, 167,120 t., but no effect on rates; continuous navigation would lower rates, **12,** 631.

In 1901, 92,481 t., **01,** 1846.

In 1902, 206,000 t., **03,** 319.

In 1911, 167,120 t., **12,** 631.

ENGINEERS.

Chief of Engineers. R., 89, 1462; **91,** 218; **92,** 211; **93,** 234; **94,** 216; **95,** 240; **96,** 212; **97,** 272; **98,** 266; **99,** 312; **00,** 354; **01,** 373; **02,** 305; **03,** 319; **04,** 336; **05,** 344; **06,** 372; **07,** 386; **08,** 410; **09,** 428; **10,** 477, 489; **11,** 511, 526; **12,** 630, 644.

In charge:

Maj. A. N. Damrell, 1888–95. **R., 89,** 1462; **91,** 1792; **92,** 1458; **93,** 1771; **94,** 1323; **95,** 1704.

Maj. W. T. Rossell, 1896–1901. **R., 96,** 1453; **97,** 1697; **98,** 1442; **99,** 1721; **00,** 2215; **01,** 1845.

Capt. Spencer Cosby, 1902. **R., 02,** 1311.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1261; (Maj.) **04,** 1832; **05,** 1419.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1287.

Maj. H. Jervey, 1907–10. **R., 07,** 1387; **08,** 1445; **09,** 1429; **10,** 1579.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1719; **12,** 1941.

OPERATIONS.

1891-92. 1,505 snags, stumps, and logs removed from the chan., and 2,156 overhanging trees cleared from banks, **92,** 1458.

1892-97. About 2,300 obstr. removed from banks and stream in 1892–93, **93,** 1772; 13,000 in 1893–94, **94,** 1324; removal of obstr. in progress during the 2 following years, **95,** 1704; **96,** 1453; and about 5,600 removed in 1896–97, and proj. completed, **97,** 1697.

1898-99. About 2,400 snags and other obstr. removed from banks and chan. of the R., **99,** 1721.

1899-00. About 7,000 snags and other obstr. removed from banks and chan., **00,** 2215.

1902-03. Snagging work done, **03,** 1261.

1903-04. A few obstr. near mouth removed, **04,** 1832.

1905-12. Snags, logs and trees removed, **06,** 1287; **07,** 1388; **11,** 1720; **12,** 1941.

PHYSICAL DATA.

Rises in se. Miss. 135± m. l. Head of imp. at mouth of Bowie Creek, Miss. R. flows se. to junction with Chickashay at Merrill, Miss., the 2 streams forming the Pascagoula R. L. of imp. section, 78.85 m.

PROJECTS.

By Maj. Damrell, 1889, imp. of the R. from its mouth to the mouth of Bowie Creek by removal of snags, logs, overhanging trees, and similar obstr., giving a h.-w. navigation for 5 months of the year; est., $25,000, **89,** 1462; **92,** 1458.

In 1893 Maj. Damrell est. $1,500 an. for mainten., **93,** 1772.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Damrell, **89,** 1462.

Pre. ex. and sur., of Leaf and Pascagoula Rs., au. act Mar. 3, 1909, **10,** 489; **11,** 526; **12,** 644.

R-70 BLUFF CREEK, MISS.

APPROPRIATIONS.

1890, $1,000, **91,** 1792.

ENGINEERS.

Chief of Engineers. R., 89, 193; **91,** 218; **92,** 211; **93,** 234.

In charge. Maj. A. N. Damrell, 1888–93. **R., 89,** 1461; **91,** 1792; **92,** 1457; **93,** 1770.

OPERATIONS.

1891-92. 482 stumps and snags removed from the chan., and 4,000 overhanging trees cleared from banks, **92,** 1457.

PROJECTS.

By Maj. Damrell, 1889, removal of snags, logs, and leaning trees, at est. of $1,000, **89,** 1461. Proj. completed in 1892, **92,** 1457.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Damrell, **89,** 1461.

* Allotment. [1] H. D. 230, 58th, 2d. [2] Trans. from Chickasahay R.

R-77 OLD FORT BAYOU, MISS.

COMMERCE.

In 1893 an. saving to C. by imp. would be small unless a chan. were cut through the flats separating Back B. and Biloxi B., **93,** 1787.

ENGINEERS.

Chief of Engineers. **R., 93,** 238.
In charge. Maj. A. N. Damrell, 1892–93. **R., 93,** 1787.
Assistant. Lt. E. E. Winslow. **R., 93,** 1785.

PHYSICAL CHARACTERISTICS.

Description of: bayou enters the Back B. of Biloxi at e. end, is about 16 m. l., and has an average w. of 100′ and an available d. of 9′, except at the mouth, where d. is 6½′, **93,** 1787.

SURVEYS.

Ex. of chan. at mouth of Old Fort Bayou, Miss., au. act July 13, 1892; made, by Maj. Damrell, 1893 (**R.** unfav.), **93,** 1787.

R-78 BACK BAY, BILOXI, MISS.

COMMERCE.

Description of. In 1893 the an. saving to C. by the imp. proposed would not amount probably to $10,000. **93,** 1784.

ENGINEERS.

Chief of Engineers. **R., 93,** 238.
In charge. Maj. A. N. Damrell, 1893. **R., 93,** 1784.
Assistant. Lt. E. E. Winslow. **R., 93,** 1785.

PHYSICAL CHARACTERISTICS.

Description of: the Back B. of Biloxi is about 10 m. l. with an average w. of about 1 m., **93,** 1785.

SURVEYS.

Ex. of Biloxi B. n. of the town of Biloxi up to the town of Handsboro with a view to removal of bars, au. act July 13, 1892; made, by Maj. Damrell, 1892 (**R.** unfav.), **93,** 1784.

R-78(a) HANDSBORO, MISS. (Back Bay.)

ENGINEERS.

Chief of Engineers. **R., 85,** 214.
In charge. Maj. A. N. Damrell. **R., 85,** 1373

PROJECTS.

In 1884 cost of imp. would probably exceed $140,000, **85,** 1374.

SURVEY.

Ex. au. act July 5, 1884; made by Maj. Damrell (**R.** unfav.), **85,** 1373

R-83 BILOXI BAY AND HARBOR, MISS.

APPROPRIATIONS.

1882,	$5,000,	**83,** 1029.
1886,	12,500,	**86,** 1206.
1888,	18,500,	**88,** 1215.
1890,	9,000,	**90,** 1711.
1902,	10,000,	**02,** 1312.
1905,	9,000,	**05,** 1423.
1907,	9,000,	**07,** 1391.
1910,	5,000,	**10,** 1582.
1912,	4,000,	**12,** 1944.
Total,	82,000 ($617.73 turned into Treas., 1896, **09,** 1431).	

COMMERCE.

Benefit to C. from imp., **88,** 1215; **89,** 1448.
218,000 t. an. at 1904, valued at above $1,937,336, **04,** 338; over $2,500,000 at 1906, **06,** 1290; $795,100, **12,** 636.
Proj. has had little or no effect on rates, **05,** 348; **08,** 414.
Description of, **11,** 515.

CONTRACTS.

1887. G. C. Fobes & Co., dr., 17¢ c. y., **88,** 1215.
1890. Alabama Dredging & Jetty Co., dr., 14⅝¢ c. y., **90,** 1710.
1892. Alabama Dredging & Jetty Co., dr., 18¢ c. y., s. m., **93,** 1774.
1903. R. Moore, dr., 22¢ c. y., p. m., **03,** 1265.
1906. Home Dredging Co., dr., 25½¢ c. y., **07,** 1391.
1908. John Andersen, dr., 12¾¢ c. y., p. m., **08,** 1449.

ENGINEERS.

Chief of Engineers. **R., 81,** 189; **82,** 86; **83,** 197; **84,** 206; **85,** 212; **86,** 209; **87,** 176; **88,** 164; **89,** 191; **90,** 172; **91,** 219; **92,** 212; **93,** 234; **94,** 216; **95,** 241; **02,** 305; **03,** 319; **04,** 337, 1847, 1848; **05,** 347; **06,** 375; **07,** 389; **08,** 413; **09,** 431, 439; **10,** 480; **11,** 515; **12,** 634.

Boards:
BERH. Pre. ex. of chan. from Biloxi to Ship Isld. H., Miss.; unfav., **04,** 1849.
R. on Biloxi H., including Back Bay, Miss.[1] (**R.** unfav.), **09,** 439.

In charge:
Capt. A. N. Damrell, 1882–95. **R., 82,** 1322; (Maj.) **83,** 1029; **84,** 1217; **85,** 1360; **86,** 1205; **87,** 1333; **88,** 1214; **89,** 1447; **90,** 1709; **91,** 1793; **92,** 1458; **93,** 1772; **94,** 1325; **95,** 1705.
Capt. Spencer Cosby, 1902. **R., 02,** 1312.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1264; (Maj.) **04,** 1833; **05,** 1422.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1289.
Maj. H. Jervey, 1907–10. **R., 07,** 1391; **08,** 1448; **09,** 1431; **10,** 1582.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1723; **12,** 1944.

Assistants:
T. L. Harrison. **R., 82,** 1323.
David G. Anderson. **R., 03,** 1266; **04,** 1850–54.

OPERATIONS.

1886–87. Location of chan. made, **87,** 1333.
1887–88. 84,686 c. y. dr., **88,** 1215.

[1] H. D. 1088, 60th, 2d.

1890-91. 97,092 c. y. dr., **91,** 1794.
1892-93. 12,678 c. y. dr. and proj. completed, **93,** 1774.
1901-02. None since Aug., 1893, **02,** 1312.
1903-04. 36,395 c. y., p. m., dr., **04,** 1834.
1906-07. 27,139.3 c. y., p. m., dr., **07,** 1391.
1907-08. 62,370.6 c. y., p. m., dr., **08,** 1448.
1910-11. U. S. dr. *Pascagoula* removed 135,404 c. y., of which 109,088 c. y. within limits of proj. and the only yardage considered; field cost 3.51¢ c. y., p. m.; chan. 7.7′ d. procured, **11,** 1723.

PHYSICAL CHARACTERISTICS.

During 10 years previous to 1902 entrance chan. leading to wharves had shoaled full l., **03,** 1264.
Description of, **11,** 515.
Mainten. required because of shoals, **06,** 348.
Draft available, etc., 7½′ through dr. chan., 1904, **04,** 338; **12,** 635.

PROJECTS.

By Capt. Damrell, 1881, dr. chan. bet. wharves at Biloxi and d. w. in Mississippi Sound to 8′; est., $35,000, **82,** 1322, 1323. Work not considered susceptible of permanent imp., **84,** 1217. Est. increased, 1885, to $55,000, **85,** 1361; **91,** 1793.
Proj. completed, **92,** 1460.
Act June 13, 1902, au. $10,000 for continuance of imp. of Biloxi H., in w. and d. of chan. at Biloxi. after an ex., **02,** 306.

SURVEYS.

Au. act Mar. 3, 1881; made by Maj. Damrell, 1881, **82,** 1322.
Ex. 1893, by Maj. Damrell showed a min. chan. of 9′ x 160′, **94,** 1325.
Au. act June 13, 1902, of Biloxi H., made by Capt. Craighill, **03,** 1264.
Pre. ex. and sur. of chan., Biloxi to Ship Isld. H., Miss., with view to obtaining addl. d. and w.; **R.** by Capt. Cosby,[1] **04,** 343.
Ex. and sur. made, by Maj. Jervey, with view to extending and d. chan. into H. and around the e. end of the peninsula into the sheltered waters of Back B. (**R.** unfav. to plan proposed),[2] **08,** 421; **09,** 439.
Cong. docs., etc., relating to exs., surs., plans, etc., **02,** 306; **04,** 343; **11,** 516; **12,** 635.
Maps.[2]

R-86 SHIP ISLAND HARBOR AND PASS, MISS.

APPROPRIATIONS.

1899, $40,000, **99,** 1723.

COMMERCE.

Description of, **93,** 1783; **97,** 1711, 1726.
In 1893 proposed imp. would probably save not less than $37,000 an. in rates, **93,** 1783.

CONTRACT.

1899. National Dredging Co., dr., 163,401 c. y., at 22½¢ c. y., **99,** 1723; **00,** 2217.

ENGINEERS.

Chief of Engineers. R., 81, 189; **82,** 186; **93,** 237; **97,** 276, 277; **98,** 269; **99,** 313, 317; **00,** 355; **01,** 374; **02,** 307; **06,** 381; **07,** 395.

In charge:
Capt. A. N. Damrell, 1882–93. **R., 82,** 1321; (Maj.) **93,** 1783.
Maj. W. T. Rossell, 1897–01. **R., 97,** 1722, 1808; **99,** 1723, 1787; **00,** 2216; **01,** 1848.
Capt. J. B. Cavanaugh, **07,** 369.
Maj. W. E. Craighill, **07,** 369.

Assistant. T. L. Harrison. **R., 82,** 1321.

OPERATIONS.

163,401 c. y. dr., **00,** 2217.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1783; **97,** 1709, 1723, 1725.
Current and tidal observations, **97,** 1726.
Imp. would probably not be permanent, **97,** 1710.
Orig. d. over outer bar of Ship Isld. Pass sufficient only for vessels drawing about 20′ or 21′, **02,** 307.

PROJECTS.

1897, Maj. Rossell est. $812,500 to constr. chan. 23′ x 300′ m. l. w. from H. to the wharves at Biloxi, and that an. mainten. would probably be $50,000, **97,** 1723.
Maj. Rossell furnished 9 est., from $371,839 to $2,568,134.40, for various routes for proposed waterway (see Surveys, 1898), with from $25,000 to $60,000 for mainten.; also 9 est., $138,296.73 to $277,198.61, for proposed anchorage basins; and est. $40,000 for proposed 26′ chan. through Ship Isld. Pass, **99,** 1790, 1791.

SURVEYS.

Ex. of H. outlet au. act Mar. 3, 1881; made by Capt. Damrell (**R.** unfav.—"not needed"), **82,** 1321.
Ex. of Mississippi Sound outside of the range of islds. of the Mississippi coast with view to making entrance for vessels, au. act July 13, 1892, made, 1893, by Maj. Damrell (**R.** fav.), **93,** 1783.
Ex. with view to chan. 26′ l. w. bet. Gulf of Mexico and Ship Isld. H., and dr. chan. 25′ x 500′ connecting Ship Isld. H. with R.R. pier at Gulfport, au. act June 3, 1896; made by Maj. Rossell, 1896 (**R.** unfav), **97,** 1708.
Sur. of H. to determine most practicable route for d. w. chan. leading to the mainland on coast of Mississippi au. act June 3, 1896; made by Maj. Rossell, 1897 (**R.** unfav.—"cost too great") (see Projects), **97,** 1722.
Surs., plans, and est. for chan. leading from Ship Isld. H., Miss., to R.R. pier at Gulfport, Miss., and from Ship Isld. H. to Biloxi, Miss., also for an anchorage basin at both places, and for chan. 26′ m. l. w. through Ship Isld. Pass, Miss., au. act Congress, June 16, 1898; made, 1898, by Maj. Rossell (**R.** fav.) (see Projects), **99,** 1789.
Sur. au. act Mar. 3, 1905. **R.** by Maj. Craighill and Capt. Cavanaugh, Oct. 16, 1905, and Jan. 27, 1906, resp.[3] (unfav.), **07,** 395.

R-86 (a) SHIP ISLAND to MISSISSIPPI CITY HARBOR, MISS.

ENGINEERS.

Chief of Engineers. R., 71, 67.
In charge. Capt. C. W. Howell. **R., 71,** 547.
Assistant. Lt. H. M. Adams. **R., 71,** 548.

LEGISLATION.

Act incorporating canal co., **71,** 549.

PLANS.

Lt. Adams, 1871, ship canal connecting Mississippi City with Ship Isld. (Mississippi Sound); canal 7 m. l., 20′ x 200′; slopes protected by timber cribs filled with st.; est., $10,305,731; no reason for its constr., **71,** 547, 549.

[1] H. D. 198, 58th, 2d. [2] H. D. 1088, 60th, 2d. [3] H. D. 184, 59th, 2d.

R-87 GULFPORT TO SHIP ISLAND HARBOR, MISS. (Channel from.)

APPROPRIATIONS.

1884, *[1] $1,000.00, **01,** 1847.
1884, *[1] 9,485.04, **02,** 1313.
1902, 150,000.00, **02,** 1313.
1884, *[1] 6,200.00, **03,** 1267.
1884, *[1] 3,797.00, **04,** 1836.
1904, 10,000.00, **04,** 1836.
1884, *[1] 712.00, **05,** 1425.
1907, [2] 110,000.00, **07,** 1393.
1884, *[1] 3,005.81, **07,** 1393.
1908, *10,000.00, **09,** 1433.
1909, 170,000.00, **09,** 1433.
1910, 100,000.00, **10,** 1583.
1911, 100,000.00, **11,** 1725.
1912, 200,000.00, **12,** 1945.

Total, 874,199.85 (incl. $40,000 for Ship Isld. Pass and $179.35 misc., less $2,054.21 returned to Treas. and $25,450 applied to dr. constr., $887,324.99, **12,** 1945).

COMMERCE.

In 1902, 24,450 t. timber exported; 3,792 t. imports, **03,** 321.

Reduction in RR. rates; also affords direct water rates on lumber to foreign ports, **05,** 350; **12,** 639.

Gulf & Ship Island RR. owns only p. in basin, **08,** 1450.

In 1911, 1,027,302 t.; **12,** 639.

CONTRACTS.

1901. Spencer S. Bullis, dr. and mainten. chan. and anchorage basin; terms of contract given, **01,** 1847.

ENGINEERS.

Chief of Engineers. R., 98, 269; **99,** 312; **00,** 355; **01,** 374; **02,** 306; **03,** 320; **04,** 338; **05,** 349; **06,** 376; **07,** 390, 395; **08,** 414; **09,** 432; **10,** 481; **11,** 516; **12,** 636.

In charge:

Maj. W. T. Rossell, 1899–01. **R., 99,** 1722; **00,** 2216; **01,** 1846.

Capt. Spencer Cosby, 1902. **R., 02,** 1312.

Capt. W. E. Craighill, 1903–05. **R., 03,** 1266; (Maj.) **04,** 1835; **05,** 1424.

Capt. J. B. Cavanaugh, 1906. **R., 06,** 1290.

Maj. H. Jervey, 1907–10. **R., 07,** 1392; **08,** 1449; **09,** 1432; **10,** 1582.

Maj. C. A. F. Flagler, 1911–. **R., 11,** 1724; **12,** 1944.

Assistant. D. G. Anderson. **R., 03,** 1268.

OPERATIONS.

1900-01. Dr. in progress, **01,** 1846.
1901-02. Dr. in progress, **02,** 1313.
1902-03. Dr. of chan. to proj. dimensions completed; operations on anchorage basin progressing slowly, **03,** 1266.
1903-04. Dr. anchorage basin, **04,** 1835.
1904-05. Dr. anchorage basin, **05,** 1424.
1905-06. Anchorage basin completed, **06,** 1290.
1907-08. 1,300,000 c. y. dr. by U. S. in mainten. of chan., **08,** 1449.
1908-09. 1,600,000 c. y. dr. by U. S., **09,** 1432.
1909-10. 3,000,000 c. y. dr. and 525 snags, etc., removed from Gulfport Chan. and 400,000 c. y. from Ship Isld. Pass chan. by U. S., **10,** 1582–83.
1910-11. U. S. dr. removed 1,157,000 c. y. in Gulfport Chan., and 1,060,000 c. y. from anchorage basin; bulkhead 1,400′ l. built from w. wall of anchorage basin as a protection against storms and currents, **11,** 1724.
1911-12. 1,560,000 c. y. dr. from Gulfport Chan.; repairs to bulkhead and pipe line of dr. and automatic tide gauge, **12,** 1944.

PHYSICAL CHARACTERISTICS.

Orig. no chan. H. 44 m. from Pascagoula on e. and about 78 m. from New Orleans on w., **12,** 636.

Condition of chans., giving draft, d., w., etc., **07,** 1392.

Vessels of too great draft go aground, stirring up mud with their propellers, making mainten. difficult, **08,** 1450.

Shoaling, **12,** 638.

PROJECTS.

Act Mar. 3, 1899, au. 19′ chan., m. l. w., 300′ w., from the anchorage at Ship Isld. H., on the Gulf of Mexico to Gulfport, Miss., and an anchorage basin of similar d., not less than 1,320′ x 2,640′, at the end of said chan. next the shore, cost not to exceed $150,000, with $10,000 an. for 5 years after completion for mainten., **99,** 1722.

Act Mar. 2, 1907, au. continuing imp. and mainten. of chan. and basin; also Ship Isld. Pass bet. Ship Isld. and Cat Isld., and au. Sec. of War to annul portion of contract relating to mainten. of chan. and basin; **07,** 390.

Act June 25, 1910, au. addl. d. in Gulfport Basin and Chan., not to exceed 23′, and restoring chan. through Ship Isld. Pass to 26′, **10,** 482.

Act Feb. 27, 1911, au. repair and modification of dr. *Barnard;* est., $60,000, **12,** 636.

Act July 25, 1912, au. purchase or constr. of new dr. plant, and retransfer of dr. *Barnard* to Southwest Pass imp., **12,** 636–37.

SURVEYS.

Minor, **05,** 1424.

Ex. and sur. au. act Mar. 3, 1905, of anchorage basin at Gulfport, and chan. therefrom to anchorage at Ship Isld., Miss. **Rs.,** Maj. Craighill and Capt. Cavanaugh, 1905 and 1906, resp. (unfav.),[3] **06,** 381; **07,** 395.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 637, 638.

R. by BERH. Nov. 11, 1907, req. by R. and H. Comm. reviewing former **R.** Recom. dr. plant to cost $200,000 orig. with about $75,000 an. for operation.[4]

Maps: **12,** 1944, 1945.

R-88 GULFPORT HARBOR, MISS.

ENGINEERS.

Chief of Engineers. R., 89, 193.

In charge. Maj. A. N. Damrell, 1888. **R., 89,** 1460.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Damrell (**R.** unfav.), **89,** 1460.

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* Allotment.
[1] From indefinite app. act July 5, 1884.
[2] $25,000 for dr. constr.
[3] H. D. 184, 59th, 2d.
[4] R. and H. Comm., No. 2, 60th, 1st.

R-92 WOLF AND JORDAN RIVERS, MISS.

Part.	Title.	Period.	Appropriations.
a	Jordan R., Miss.	1893	.....
b	Wolf R., Miss.	1893	.....
c	Wolf and Jordan Rs., Miss.	1906–1912	$40,000.00
	Total	.....	40,000.00

Part (a), R-92 Jordan River, Miss.

COMMERCE.

In 1893 an. saving to C. by imp. of the R. would probably be $5,000, **93,** 1789.

ENGINEERS.

Chief of Engineers. **R., 93,** 238.
In charge. Maj. A. N. Damrell, 1892–93. **R., 93,** 1789.

PHYSICAL CHARACTERISTICS.

Description of; the R. has about 16 navigable m. 10′ d., and empties into the nw. extremity of Bay St. Louis; has number of tributaries navigable for short distances, **93,** 1789.

SURVEYS.

Ex. of bar at mouth au. act July 13, 1892; made by Maj. Damrell 1892 (**R.** unfav.), **93,** 1789.

Part (b), R-92 Wolf River, Miss.

COMMERCE.

In 1893, growing less, **93,** 1788.

ENGINEERS.

Chief of Engineers. **R., 93,** 238.
In charge. Maj. A. N. Damrell, 1892–93. **R., 93,** 1787.
Assistant. Lt. E. E. Winslow. **R., 93,** 1788.

PHYSICAL CHARACTERISTICS.

Description of: R., navigable for about 20 m. above its mouth, is 10′ x 150′, flows into Bay St. Louis, **93,** 1788.

SURVEY.

Ex. of bar at mouth au. act July 13, 1892; made by Maj. Damrell, 1893 (**R.** unfav.), **93,** 1787.

Part (c), R-92 Wolf and Jordan Rivers, Miss.

APPROPRIATIONS.

1907,	$30,000,	**07,** 1394.
1910,	5,000,	**10,** 1584.
1912,	5,000,	**12,** 1946.
Total,	40,000	

CONTRACTS.

1908. Southern Dredging Co., dr., 16¢ c. y., **08,** 1451.

ENGINEERS.

Chief of Engineers. **R., 06,** 381; **07,** 391; **08,** 416; **09,** 434; **10,** 483; **11,** 520; **12,** 640.

In charge:
Capt. J. B. Cavanaugh, **06,** 355.
Maj. W. E. Craighill, **06,** 355.
Maj. Henry Jervey, 1906–10. **R., 07,** 1394; **08,** 1451; **09,** 1433; **10,** 1585.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1726; **12,** 1946.

Assistant. 1st Lt. W. G. Caples, **08,** 393; **09,** 409.

OPERATIONS.

1907–08. 161,163.2 c. y. dr., **08,** 1451.
1910–11. 137,087 c. y. dr., **11,** 1726.

PROJECT.

Act Mar. 2, 1907, au. chan. 7′ x 100′; est., $30,000 and $5,000 an. mainten., **07,** 391.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1905, with view to removal of bars at mouths of Rs. **R.** by Maj. Craighill and Capt. Cavanaugh, 1905 and 1906. Plan submitted to dr. chan. 7′ x 100′; est., $30,000, and $5,000 an. mainten.,[1] **06,** 381.
Maps.[1]

[1] H. D. 917, 59th, 1st.

R-98 PEARL RIVER, MISS. AND LA.

Part.	Stretches from mouth up.	Period.	Appropriations.
a	Chan. at mouth	1899–1912	$38,199.80
b	Below Rockport	1902–1912	108,286.39
c	Below Jackson	1880–1899	165,125.00
d	Carthage to Jackson	1879–1902	38,550.00
e	Between Edinburg and Jackson	1902–1911	18,500.00
f	Edinburg to Carthage	1884–1902	17,250.00
g	Edinburg to Lake Burnside	1893, 1907	.....
	Total	.....	385,911.19

Part (a), R-98 Pearl River, Miss. (Channel at mouth of.)

APPROPRIATIONS.

1899, $18,199.80, **99,** 1724.
1910, 20,000.00, **10,** 1585.

Total, 38,199.80 (incl. $5,000 each of app. of Aug. 11, 1888, and Sept. 19, 1890, for Pearl R. below Jackson, and less $345.88 returned to Treas., $47,853.92, **12,** 1947).

COMMERCE.

Description of, **97,** 1728, 1729.
In 1896 it was not believed that the interests involved would allow a greater imp. than chan. 300′ x 9′, **97,** 1729.
1911, 121,856 t. of logs and timber, **12,** 642.

CONTRACTS.

1899. National Dredging Co., dr. 96,700 c. y., 27¢ c. y., **99,** 1725; **00,** 2218.

ENGINEERS.

Chief of Engineers. R., 97, 277; **99,** 313; **00,** 356; **01,** 375; **08,** 420; **10,** 484; **11,** 521; **12,** 641.

In charge:
Maj. W. T. Rossell, 1897–01. **R., 97,** 1727; **99,** 1724; **00,** 2217; **01,** 1848.
Maj. H. Jervey, 1908–10. **R., 10,** 1585.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1727; **12,** 1946.

OPERATIONS.

1899–00. 96,700 c. y. dr., **00,** 2218.
1910–11. U. S. dr. *Pascagoula* removed during year 178,044 c. y., dr. chan. 1.2 m. x 9′–10′ x 200′ 1.2 m. l. w., mouth of R. to 9′ curve in Lake Borgne, **11,** 1727.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1728.

PROJECTS.

By Maj. Rossell, 1896, 9′ chan. m. l. w., 300′ w. from 9′ curve at the mouth of East Pearl R., Miss., across the bar to the 9′ curve in Mississippi Sound; est., $18,199.80, **97,** 1728; **99,** 1724.
Act June 25, 1910, au. restoring chan. at mouth to former d. of 9′, m. l. w., for w. of 200′; est., $34,000 and $6,000 an. mainten.,[1] **10,** 484.

SURVEY.

Sur. with view to 17′ chan. l. w. au. act June 3, 1896; made by Maj. Rossell, 1896, **97,** 1727. (See Projects.)
Minor, **01,** 1849.
Pre. ex. and sur. au. act Mar. 2, 1907, with view to removing bar and restoring chan. at its mouth. **R.** by Maj. Jervey, June 19 and Nov. 19, 1907; est. $34,000,[1] **08,** 420.

Part (b), R-98 Pearl River, Miss. (Below Rockport.)

APPROPRIATIONS.

1902, $7,000.00, **02,** 1315.
1902, *1,286.39, **04,** 1837; **05,** 1427.
1905, 7,000.00, **05,** 1427.
1907, 30,000.00, **07,** 1395.
1909, 15,000.00, **09,** 1435.
1910, 25,000.00, **10,** 1586.
1911, 8,000.00, **11,** 1729.
1912, 15,000.00, **12,** 1948.

Total, 108,286.39

COMMERCE.

SS. running regularly from New Orleans to Columbia carrying freight, **09,** 1434.
Material cuts in rates on RR.; saving to Columbia alone est. to be $25,000 an., **10,** 485.

ENGINEERS.

Chief of Engineers. R., 01, 375; **02,** 308; **03,** 322; **04,** 340; **05,** 350; **06,** 377, 381; **07,** 392, 395; **08,** 417; **09,** 434; **10,** 484; **11,** 522; **12,** 642.

In charge:
Maj. W. T. Rossell, 1901. **R., 01,** 1849.
Capt. Spencer Cosby, 1902. **R., 02,** 1314.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1269; (Maj.) **04,** 1836; **05,** 1426.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1292.
Maj. H. Jervey, 1907–10. **R., 07,** 1395; **08,** 1452; **09,** 1434; **10,** 1585.
Maj. C. A. F. Flagler, 1911–. **R., 11,** 1728; **12,** 1947.

Assistant. D. G. Anderson. **R., 03,** 1270.

* Allotment.

[1] H. D. 328, 60th, 1st.

OPERATIONS.

1902-03. Sur. boat built; 15¾ m. of R. cleared of obstr., **03,** 1269.

1903-04. 31 m. of R. cleared of obstr., **04,** 1837.

1904-05. Revet. built across head of Moores Bayou; 17 m. of R. cleared of obstr., **05,** 1426.

1905-06. 47 m. of R. cleared of obstr.; operations stopped by yellow fever quarantine, **06,** 1292.

1906-07. 86 m. of R. worked over and obstr. removed, **07,** 1395.

1907-08. 10,878 obstr. removed, **08,** 1452.

1908-09. 188½ m. of R. cleared of obstr., **09,** 1434.

1909-10. Two dams, aggregating 362′, built, and 8,456 obstr. removed, **10,** 1586.

1910-11. Snagging carried on from mouth of R. a distance of 116½ m. upstream, removing obstr.; several js. built, dam at East Pearl R. repaired, and 3,174 snags and other obstr. removed, **11,** 1728.

1911-12. U.S. snag boats *Pearl* and *Black Warrior* worked at this section of the R. until Dec. 19, 1911, when work suspended on account of h. w.; chan. worked over from mouth up R. 145 m., 3,682 obstr. being removed, **12,** 1947.

PHYSICAL CHARACTERISTICS.

R. navigable for light draft vessels, mouth to Monticello, 211¾ m.; above this point it is only navigable at h. w., **01,** 1849.

Description of, **02,** 1914.

PROJECTS.

By Capt. Cavanaugh, 1906, revised est. for completing proj., $100,000 within 5 years, and $5,000 an. mainten.,[1] **07,** 395.

SURVEYS.

Ex., mouth to Rockport, au. act Mar. 3, 1905, made, 1906, by Capt. Cavanaugh,[1] **07,** 395.

Part (c), R-98 Pearl River, Miss. (Below Jackson.)

APPROPRIATIONS.

1880,	$30,000,	**80,** 1155.
1881,	25,000,	**81,** 1279.
1882,	15,000,	**82,** 1372.
1884,	10,000,	**84,** 1263.
1886	13,125,	**86,** 1210.
1888,	15,000,	**88,** 1225.
1890,	20,000,	**90,** 1716.
1892,	15,000,	**92,** 1462.
1894,	5,000,	**95,** 1706.
1896,	10,000,	**96,** 1456.
1899,	7,000,	**99,** 1726.
Total,	165,125	

COMMERCE.

Statistics, **83,** 1102.

Benefit from imp., **86,** 1209; **90,** 1716.

Reduction in rates consequent upon imp., **88,** 1224.

Imp. has reduced rates considerably, **93,** 1776.

In 1893 the interests involved did not appear of sufficient importance to warrant the U. S. in diverting the course of the R. to make it flow through the Tanyard Branch, near Jackson, **93,** 1792.

CONTRACTS.

1880. S. N. Kimball, removal of obstr., **81,** 1278.

1881. G. A. Meyer, removal of obstr., **82,** 1371.

ENGINEERS.

Chief of Engineers. R., 80, 142; **81,** 192; **82,** 188; **83,** 206; **84,** 209; **85,** 212; **86,** 210; **87,** 177; **88,** 165; **89,** 192; **90,** 174; **91,** 219; **92,** 212; **93,** 235, 238; **94,** 217; **95,** 241; **96,** 212; **97,** 272; **98,** 266; **99,** 314; **00,** 356; **10,** 488.

In charge:

Maj. C. W. Howell, 1878–82. **R., 80,** 1155; **81,** 1277.

Maj. A. Stickney, 1882–84. **R., 82,** 1370; **83,** 1101; **84,** 1262.

Maj. A. N. Damrell, 1884–95. **R., 85,** 1363; **86,** 1207; **87,** 1339; **88,** 1221; **89,** 1455; **90,** 1714; **91,** 1795; **92,** 1460; **92,** 1774, 1792; **94,** 1326; **95,** 1706.

Maj. W. T. Rossell, 1896–1900. **R., 96,** 1454; **97,** 1698; **98,** 1443; **99,** 1725; **00,** 2218.

Maj. H. Jervey, **10,** 460.

OPERATIONS.

1881-82. 104 m. below Jackson cleared of obstr., **82,** 1370.

1882-83. 191 m. below Jackson cleared of snags, trees, logs, and similar obstr., **83,** 1101.

1883-84. Removal of obstr. continued, **84,** 1262.

1884-85. 7,568 snags, stumps, logs, etc., 1,865 standing and overhanging trees, and 7,360 c. y. sand and clay removed, **85,** 1365.

1885-86. 5,776 stumps, roots, snags, logs, any trees, 8,382 overhanging trees, and 2,752 c. y. clad and sand removed, **86,** 1209.

1887-88. 215 snags and logs removed from chan., 256 piles driven, and 406 cords of willow mattress placed, **88,** 1223.

1888-89. 1,960 snags, logs, and trees removed from the chan., and 1,647 trees and logs sunk in Old River Bulkhead; 700 cords of willow mattress placed, **89,** 1458.

1889-90. 3,048 snags, stumps, and trees removed from the chan., and 2,535 trees removed from the banks, **90,** 1715.

1890-91. Log flat built, **91,** 1796.

1891-92. 12,033 snags and 8 drift piles removed from the chan., and 13,384 trees cleared from the banks, **92,** 1463.

1892-93. About 8,132 obstr. removed from banks and stream, **93,** 1775.

1893-94. About 12,941 obstr. removed, **94,** 1326.

1894-95. Removal of obstr. in progress, **95,** 1707.

1895-96. Over 1,000 obstr. and about 200 c. y. dr., **96,** 1456.

1896-97. 3,625 obstr. removed, **97,** 1699.

1897-98. 8,410 obstr. removed, **98,** 1443.

1898-99. About 3,100 snags and other obstr removed from banks and chan., **99,** 1725.

1899-00. About 6,000 snags and other obstr removed from banks and chan., **00,** 2218.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 1454.

In vicinity of Tanyard Branch, near Jackson, **93,** 1792.

PROJECTS.

By Maj. Howell, 1879, imp., Jackson to the mouth, by removal of all trees, snags, logs, and similar obstr., to 5′ below l. w. mark; also removal of overhanging trees from the banks; est., $95,940; **80,** 1155; **87,** 1339.

Proj. modified, 1885, to provide for dr. chan. 12′ d. m. l. w. over the bar at the mouth of East Pearl R., **85,** 1367; **87,** 1341.

Amount app., 1880 to 1886, incl., $93,125; amount est. to complete proj., $70,000, **87,** 1339, 1342.

In 1892, est. that an. expend. of $5,000 would be required to maintain imp., **92,** 1462.

SURVEYS.

Ex. to determine whether it would be advantageous to divert the course of the R. to make it flow through Tanyard Branch, near Jackson, and to ascertain the cost, au. by the Chief of Engineers, 1892; **R.,** 1893, by Maj. Damrell (unfav.), **93,** 1792.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Jervey, Nov. 6, 1909[2] (unfav.), **10,** 488.

[1] H. D. 183, 59th, 2d.

[2] H. D. 468, 61st, 2d.

Part (d), R-98 Pearl River, Miss. (Carthage to Jackson.)

APPROPRIATIONS.

1879,	$6,000,	**79,** 107.
1880,	7,500,	**80,** 1155.
1881,	2,500,	**81,** 1277.
1882,	2,500,	**82,** 1370.
1886,	2,250,	**86,** 1213.
1888,	2,500,	**88,** 1220.
1890,	3,000,	**90,** 1714.
1892,	5,000,	**92,** 1464.
1894,	2,400,	**95,** 1709.
1896,	2,400,	**96,** 1457.
1899,	2,500,	**99,** 1727.
Total,	38,550	

COMMERCE.

Benefit of imp., **79,** 880, 885.
Obstr. to navigation, 2 br. at Jackson, Miss., **79,** 884.
C. facilities of vicinity, **79,** 899.
Amount of transportation, **83,** 1100.
Reduction in freight and insurance rates consequent upon imp., **88,** 1220; **94,** 1328.

CONTRACTS.

1879. J. S. Hamilton & Co., removal of obstr., **80,** 1154.
1880. J. S. Hamilton, removal of obstr., **81,** 1276.
1881. J. S. Hamilton, removal of obstr., **82,** 1369.

ENGINEERS.

Chief of Engineers. R., 78, 85; **79,** 107, 111; **80,** 142; **81,** 191; **82,** 187; **83,** 205; **84,** 209; **85,** 213; **86,** 210; **87,** 177; **88,** 165; **89,** 192; **90,** 173; **91,** 220; **92,** 213; **93,** 235; **94,** 217; **95,** 242; **96,** 212; **97,** 273; **98,** 267; **99,** 315; **00,** 357; **01,** 376; **02,** 309.

In charge:
Capt. C. W. Howell, 1878–81; **78,** 85. **R., 79,** 878; (Maj.), **80,** 1151; **81,** 1276.
Maj. A. Stickney, 1882–85. **R., 82,** 1368; **83,** 1099; **84,** 1259.
Maj. A. N. Damrell, 1885–95. **R., 85,** 1369; **86,** 1212; **87,** 1336; **88,** 1218; **89,** 1452; **90,** 1713; **91,** 1797; **92,** 1462; **93,** 1777; **94,** 1328; **95,** 1708.
Maj. W. T. Rossell, 1896–01. **R., 96,** 1457; **97,** 1700; **98,** 1444; **99,** 1727; **00,** 2220; **01,** 1850.
Capt. Spencer Cosby, 1902. **R., 02,** 1315.

Assistant. H. C. Collins. **R., 79,** 880, 886; **84,** 1260.

OPERATIONS.

1879–80. Removal of obstr., trees, etc., commenced, **80,** 1154.
1880–81. Removal of obstr. continued, **81,** 1276.
1881–82. Removal of obstr. continued, **82,** 1369.
1883–84. Removal of obstr. completed to within 5 m. of Carthage, **84,** 1260.
1884–85. 10,8112 snags, roots, logs, and stumps removed from the R.; also 6,851 overhanging trees cut and 700 c. y. bank protected with brush and willow, **85,** 1370.
1886–87. 721 snags, logs, and stumps and 216 overhanging trees removed **87,** 1337.
1887–88. 27,000 snags, stumps, and sunken logs removed from the chan., and 746 overhanging trees removed from the banks, **88,** 1220.
1888–89. 27,532 snags, stumps, and sunken logs removed from the chan., and 372 overhanging trees removed from the banks, **89,** 1454.
1890–91. 10,347 snags cleared from the chan., and 16 trees cleared from the banks, **91,** 1798.
1891–92. 10,330 snags removed from the chan., and 5,712 trees cleared from the banks, **92,** 1463.
1892–93. Over 3,000 obstr. removed from banks and stream, **93,** 1778.
1893–94. 91,709 obstr. removed, **94,** 1328.
1894–95. Obstr. removal continued, and proj. completed, **95,** 1709.
1895–96. About 7,500 obstr. removed, **96,** 1458.
1896–97. Obstr. removal continued, **97,** 1701.
1897–98. About 30,000 obstr. removed, **98,** 1444.
1898–99. About 10,000 snags and other obstr removed from banks and chan., **99,** 1727.
1899–00. About 35,000 snags and other obstr. removed from banks and chan. of the R., **00,** 2220.

PHYSICAL CHARACTERISTICS.

General, **79,** 880, 881, 887.
Obstr.—overhanging and fallen trees and willows, logs, snags, etc., **79,** 880, 881, 888. Location of obstr., **79,** 882–898.
Rise of R., **79,** 884.
Tendency to form cut-offs, **79,** 884. Effect of the flood of 1874, **79,** 887.
Navigation impossible except at h. w. Min. w. of R., 1901, 100′, of chan. 40′; min. d. 1′, **01,** 376.

PLANS.

By Maj. Howell, for removal of snags, logs, overhanging trees, etc., from the R. (1) between Jackson and the mouth ($91,740) and (2) between Carthage and the mouth of the West Pearl R. ($116,940), **79,** 898,900.

PRIVATE (STATE AND CORPORATE) WORK.

Dam built across Farrs Slough, by Capt. Poiterent, for State of Miss., **79,** 896. Unsuccessful attempt on the part of La. to cut through the bayous and swamps to the R. above referred to, **79,** 897.

PROJECTS.

By Maj. Howell, 1879, imp. bet. Carthage and Jackson, 105 m., providing for a clear chan. 5′ d. at low stage of the R., by removal of snags, logs, etc.; est., $21,000, **79,** 878, 900; **87,** 1336. Revised, 1887 to $50,000, **87,** 1336; **91,** 1797.
In 1893 Maj. Damrell est. $2,400 an. mainten., **93,** 1778.
Act June 13, 1902, combines sections "Edinburg to Carthage" and "Carthage to Jackson" into one mp., "Edinburg to Jackson" (see latter title for iurther details), **02,** 1315.
f

SURVEY.

By H. C. Collins, 1878–79. **R.** on sur. above Jackson, **79,** 880; on sur. below Jackson, **79,** 886.

Part (e), R-98 Pearl River, Miss. (Between Edinburg and Jackson.)

APPROPRIATIONS.

1902,	$3,000,	**02,** 1315.
1905,	4,000,	**05,** 1428.
1907,	3,500,	**07,** 1397.
1909,	3,000,	**09,** 1436.
1910,	5,000,	**10,** 1587.
Total,	18,500	

COMMERCE.

If R. was kept open C. would probably increase, as water rates are much less than those by rail; R. only means of reaching markets from some parts, **06,** 379.
1910, 199 t., **11,** 1730.

ENGINEERS.

Chief of Engineers. **R., 02,** 309; **03,** 323; **04,** 341; **05,** 352; **06,** 378; **07,** 393; **08,** 418; **09,** 436; **10,** 486; **11,** 524.

In charge:
Capt. Spencer Cosby, 1902. **R., 02,** 1315.
Capt. W. E. Craighill, 1903–05. **R., 03,** 1270; (Maj.) **04,** 1838; **05,** 1427.
Capt. J. B. Cavanaugh, 1906. **R., 06,** 1293.
Maj. H. Jervey, 1907–10. **R., 07,** 1396; **08,** 1453; **09,** 1435; **10,** 1587.
Maj. C. A. F. Flagler, 1911. **R., 11,** 1729.

Assistant. D. G. Anderson. **R., 03,** 1271.

OPERATIONS.

1902-03. 43 m. of R. cleared of obstr., **03,** 1271.

1903-04. Lower half of section under imp. cleared of obstr., **04,** 1838.

1905-06. Operations hindered by quarantine restrictions; 2 m. of R. cleared of obstr., **06,** 1293.

1906-07. 70 m. of R. cleared of obstr., **07,** 1396.

1907-08. 8,339 obstr. removed, **08,** 1453.

1908-09. 7,973 obstr. removed, **09,** 1435.

1909-10. 15,648 obstr. removed, **10,** 1587.

PROJECTS.

Maj. Craighill, 1905, did not consider this section worthy of further imp., **05,** 1427.

Owing to excessive cost of imp. and small amount of traffic involved, it was decided to discontinue further work, and balance of app. turned into Treas., **11,** 524.

Part (f), R-98 Pearl River, Miss. (Edinburg to Carthage.)

APPROPRIATIONS.

1884,	$2,500,	**85,** 1372.
1886,	2,250,	**86,** 1215.
1888,	5,000,	**88,** 1218.
1890,	5,000,	**90,** 1712.
1892,	500,	**92,** 1466.
1894,	500,	**95,** 1710.
1896,	500,	**96,** 1459.
1899,	1,000,	**99,** 1728.
Total,	17,250	

COMMERCE.

Reduction in freight and hauling rates due to imp., **88,** 1217; **89,** 1451.

In 1893 the reduction in freight and insurance rates considerable, due to the imp., **93,** 1780.

In 1896 there did not appear to be any C. on the R., though freight rates by rail were kept low, due to the R. navigable condition, **96,** 1459.

ENGINEERS.

Chief of Engineers. **R., 84,** 216; **85,** 213; **86,** 211; **87,** 176; **88,** 164; **89,** 191; **90,** 173; **91,** 220; **92,** 214; **93,** 236; **94,** 218; **95,** 242; **96,** 213; **97,** 274; **98,** 267; **99,** 315; **00,** 358; **01,** 377; **02,** 309.

In charge:
Maj. A. M. Stickney, 1882–85. **R., 84,** 1286.
Maj. A. N. Damrell, 1885–95. **R., 85,** 1371; **86,** 1214; **87,** 1334; **88,** 1216; **89,** 1450; **90,** 1711; **91,** 1799; **92,** 1465; **93,** 1779; **94,** 1329; **95,** 1710.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1459; **97,** 1702; **98,** 1445; **99,** 1728; **00,** 2221; **01,** 1851.
Capt. Spencer Cosby, 1902. **R., 02,** 1316.

Assistant. W. H. Hoffman. **R., 84,** 1287.

OPERATIONS.

1884-85. 400 snags, logs, and stumps removed, 1,048 trees cut, and 6,491 y. of bank cleared of brush, **85,** 1371.

1885-86. 70 stumps blasted and removed, 100 sunken logs and trees cut, and 172 overhanging trees removed, **86,** 1214.

1886-87. 1,143 snags, stumps, and logs, and 760 overhanging trees removed, **87,** 1335.

1887-88. 4,010 snags, trees, and stumps removed from the chan., and 128 overhanging trees from the banks, **88,** 1217.

1888-89. 7,970 logs, snags, and stumps removed from chan., and 826 overhanging trees from the banks, **89,** 1451.

1889-90. 3,812 logs, snags, and stumps removed from chan., and 3,965 overhanging trees cut from the banks, **90,** 1712.

1891-92. 22,884 snags and stumps and 31 piles of drift removed from chan., and 9,727 trees and logs cleared from the banks, **92,** 1465.

1892-93. 46,549 obstr. removed from banks and stream, **93,** 1780.

1893-94. Obstr. removal continued, **94,** 1330.

1894-95. Obstr. removal continued, **95,** 1710.

1895-96. About 8,000 obstr. removed, **96,** 1459.

1896-97. Obstr. removal continued, and proj. completed, **97,** 1702.

1898-99. About 11,000 snags and other obstr. removed from banks and chan., **99,** 1728.

1899-00. About 1,400 snags and other obstr. removed from banks and chan., **00,** 2221.

PHYSICAL CHARACTERISTICS.

Description of the R. and its obstr., **84,** 1288.

PROJECTS.

By Maj. Stickney, 1884, imp. bet. Carthage and Edinburg, 25 m., giving a h. w. chan. for 6 months of the year, by removal of snags, logs, and similar obstr.; est., $13,464, **84,** 1289; **85,** 1371; **87,** 1334; **88,** 1216. Proj. completed, 1890; cost, $14,750, **90,** 1712. An. expend. of $500 required for mainten., **92,** 1466.

Maj. Damrell, 1893, est. $500 an. for mainten., **93,** 1780.

Act June 13, 1902, combines this section with section "Carthage to Jackson" under head "Edinburg to Jackson" (see latter title for further details), **02,** 377.

SURVEY.

Ex. au. act Aug. 2, 1882; made, 1882, by Maj. Stickney, **84,** 1286.

Part (g), R-98 Pearl River, Miss. (Edinburg to Lake Burnside.)

COMMERCE.

Description of, **93,** 1791.

In 1893, est. that an. saving to C. by imp. of this part of the R. would be $25,000, and it was thought worthy of imp. up to Yates Br., **93,** 1791.

ENGINEERS.

Chief of Engineers. **R., 93,** 238; **07,** 395.
In charge:
Maj. A. N. Damrell, 1892–93. **R., 93,** 1791.
Capt. J. B. Cavanaugh, **07,** 369.

PHYSICAL CHARACTERISTICS.
Description of, **93,** 1791.

SURVEY.
Ex. from Edinburg to Lake Burnside au. act July 13, 1892; made, 1893, by Maj. Damrell (**R.** fav.), **93,** 1791.
Pre. ex. au. act Mar. 2, 1905. **R.** by Capt. Cavanaugh, June 12, 1906[1] (unfav.), **07,** 395.

R-100 BOGUE CHITTO, LA.

APPROPRIATIONS.

1890,	$5,000,	**91,** 1800.
1892,	5,000,	**92,** 1466.
1894,	5,000,	**95,** 1711.
1896,	5,000,	**96,** 1460.
1899,	5,000,	**99,** 1729.
1902,	3,000,	**03,** 1301.
Total,	28,000	(less $157.46 trans. to Tickfaw R. and tributaries, $27,842.54, **10,** 1616).

COMMERCE.
The work proposed in 1893 would probably make an an. saving of $30,000 in rates, **93,** 1782.
Imp. of stream facilitates rafting of logs only; no boat traffic, **06,** 395.

ENGINEERS.
Chief of Engineers. R., 80, 146; **81,** 197; **83,** 212; **89,** 193; **91,** 220; **92,** 214; **93,** 237; **94,** 218; **95,** 243; **96,** 213; **97,** 274; **98,** 268; **99,** 316; **00,** 358; **01,** 377; **02,** 311; **03,** 336; **04,** 354; **05,** 366; **06,** 394; **07,** 410; **08,** 433; **09,** 454; **10,** 508.

In charge:
Maj. A. Stickney, 1883. **R., 83,** 1133.
Maj. A. N. Damrell, 1888–95. **R., 89,** 1465; **91,** 1800; **92,** 1466; **93,** 1781; **94,** 1331; **95,** 1711.
Maj. W. T. Rossell, 1896–1901. **R., 96,** 1460; **97,** 1703; **98,** 1445; **99,** 1729; **00,** 2222; **01,** 1852.
Capt. Spencer Cosby, 1902. **R., 02,** 1316.
Capt. Chas. S. Bromwell, 1903. **R., 03,** 1300.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1904.
Capt. J. F. McIndoe, 1905–08. **R., 05,** 1458; **06,** 1312; **07,** 1432; (Maj.) **08,** 1486.
Lt. Col. Lansing H. Beach, 1909–. **R., 09,** 1470; **10,** 1615.

Assistant. H. C. Collins. **R., 83,** 1133.

OPERATIONS.
1891-92. Preparing plant, **92,** 1466.
1892-93. Snag boat finished, **93,** 1782.
1893-94. About 9,000 obstr. removed from banks and stream, 150 c. y. sand removed, and j. and shore protection work in progress, **94,** 1331.
1894-95. About 11,000 obstr. removed, 156 c. y. sand excavated and removed, and j. and shore protection work continued, **95,** 1711.
1895-96. About 6,000 obstr. removed, and 300 l. f. bank protection completed, **96,** 1460.
1896-97. About 800 obstr. removed, and 58 c. y. sand, etc., excavated and removed, **97,** 1703.
1897-98. About 7,000 obstr. removed, **98,** 1446.
1898-99. About 17,000 snags and other obstr. removed from banks and chan. of the R., and 2,389 c. y. gravel and sand excavated and deposited in dams, **99,** 1729.
1899-00. About 13,000 snags and other obstr. removed from banks and chan. of the R., **00,** 2222.
1902-03. 7,231 snags and other obstr. removed, **03,** 1301.

PROJECTS.
By Maj. Damrell, 1889, chan. 3′ d., by removing snags, logs, overhanging trees, and fish traps, and closing the w. mouth from its junction up to Alfords Br.; est., $55,000, **89,** 1466; **91,** 220; **92,** 1466; inadequacy of funds prevented imp. above Cross R., about 80 m. above mouth, **03,** 336.
Proj. approv. July 31, 1902, provides for mainten., **03,** 337.

SURVEY.
Au. act June 14, 1880, **80,** 146; made by Maj. Stickney (**R.** unfav., cost too great), **83,** 1133.
Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Damrell, **89,** 1465.

R-101 WEST PEARL RIVER, LA.

ENGINEERS.
Chief of Engineers. R., 80, 146; **81,** 197; **83,** 212.
In charge. Maj. A. Stickney, 1880. **R., 83,** 1130.
Assistant. H. C. Collins. **R., 83,** 1131.

PHYSICAL CHARACTERISTICS.
Description, **83,** 1131.

SURVEY.
Ex. au. act June 14, 1880; made, 1883, by Maj Stickney (**R.** unfav.), **83,** 1130.

R-110 THE RIGOLETS, LAKE PONTCHARTRAIN, AND ST. JOHN BAYOU. (Connecting ship canal.)

ENGINEERS.
Chief of Engineers. R., 70, 31; **71,** 66.
In charge. Capt. C. W. Howell, 1870. **R., 71,** 524.

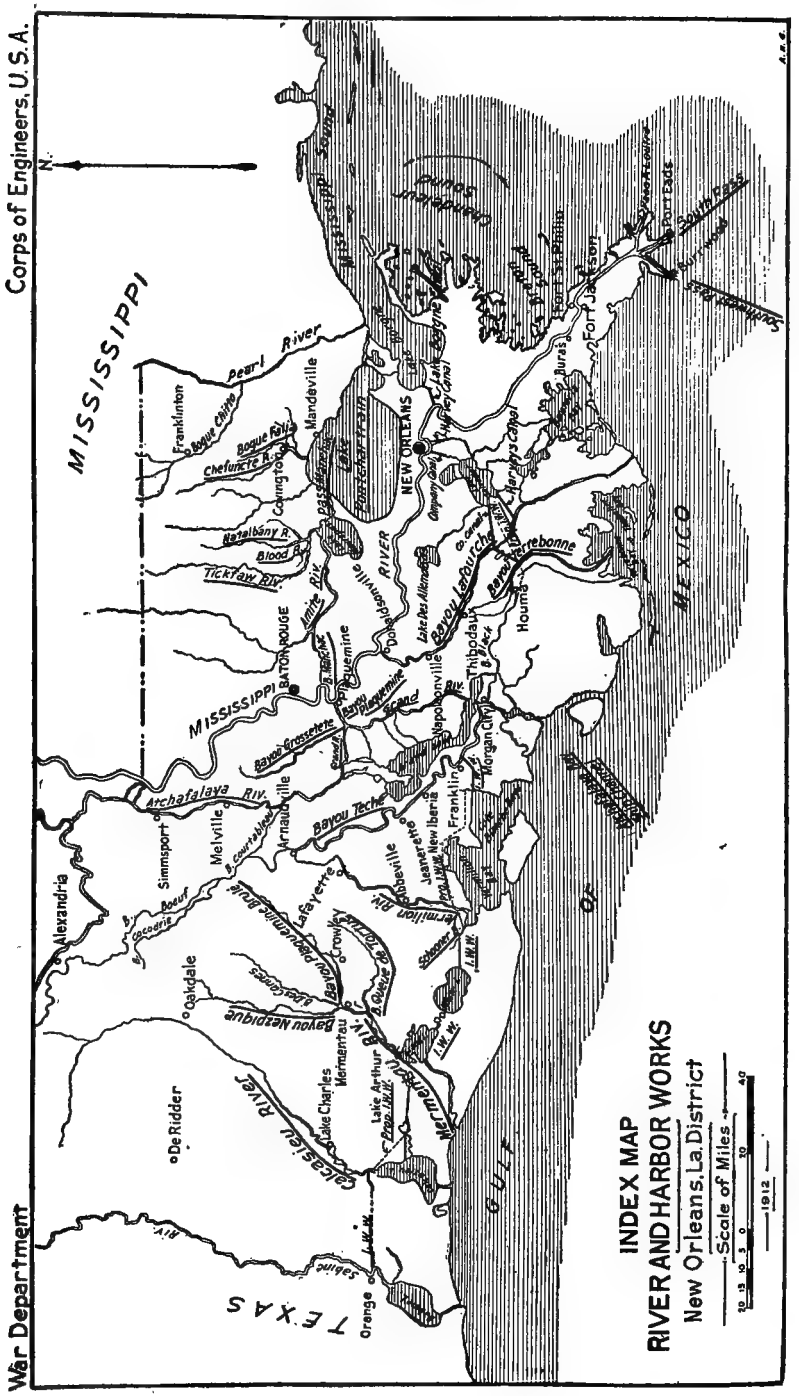
PHYSICAL CHARACTERISTICS.
Description of, **71,** 525.

PLANS.
By the New Orleans and Ship Island Canal Co., canal from the mouth of Bayou St. John, through Lake Pontchartrain and the Rigolets, to Ship Isld., **71,** 524. Capt. Howell considers this route unfav. for a ship canal owing to the excavation required through an unstable material exposed to the action of the waves and currents, **71,** 66.

[1] H. D. 179, 59th, 2d.

RIVER AND HARBOR WORKS—GULF OF MEXICO.

S.—NEW ORLEANS, LA., DISTRICT.


Corps of Engineers, U.S.A.
War Department
INDEX MAP
RIVER AND HARBOR WORKS
New Orleans, La. District
Scale of Miles
1912
MISSISSIPPI
MISSISSIPPI
TEXAS
GULF OF MEXICO
NEW ORLEANS
BATON ROUGE
Pearl River
Franklinton
Mandeville
Covington
Natalbany R.
Blood R.
Tickfaw Riv.
Amite Riv.
Donaldsonville
Plaquemine
Napoleonville
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Mermentau Riv.
Calcasieu River
Orange
Sabine Riv.
Bayou Lafourche
Bayou Terrebonne
Harveys Canal
Fort St. Philip
Fort Jackson
Fort Pike
Fort Pass
South Pass
Burrwood
Southwest Pass
Chandeleur Sound
Mississippi Sound
Lake Pontchartrain
Lake Borgne
Company Canal
Hurley Canal
Lake Des Allemands
Bayou Grosstete
Bayou Plaquemine
Bayou Plaquemine Brulé
Bayou Des Cannes
Bayou Boeuf
Bayou Cocodrie
Bayou Courtableau
Atchafalaya Riv.
Pearl Riv.
Bogue Chitto
Bogue Falia
Chefuncte R.
Tchefuncte R.
Schooner Bayou
I.W.W.
Prop. I.W.W.

S.—NEW ORLEANS, LA., DISTRICT.

In charge of U. S. Engineer Office,[1]
Customhouse, New Orleans, La.

NOTE.—The waterways of the Louisiana district are of a most involved character. For the sake of convenience they might be grouped into those—

(a) La. waterways east of the Mississippi.
(b) La. waterways tributary to the Mississippi.
(c) La. waterways west of the Mississippi.

(a) LOUISIANA WATERWAYS EAST OF THE MISSISSIPPI.

S 1 Gulf of Mexico.
S 2 Louisiana waters.
S 3 Mississippi Sound, La. and Miss. (1)
S [2]4 Lake Borgne, La. (3)
S [2]5 Rigolets, La. (4)
S 6 Lake St. Catherine, La. (5)
S 7 Little Rigolets, La. (5) (4)
S [2]8 Lake Pontchartrain, La. (5) (141)
S 9 Salt Bayou, La. (8)
S 10 Bayou Bonfouca or Vincent, La. (8)
S 11 Bayou Liberty, La. (5) (10)
S 12 Bayou Paquet, La. (11)
S 13 Bayou Lacombe, La. (8)
S 14 Cypress Bayou, La. (13)
S 15 Bayou Rouville, La. (13)
S 16 Cane Bayou, La. (8)
S 17 Big Bayou Castaing, La. (8)
S 18 Little Bayou Castaing, La. (8)
S 19 Bayou Chinchuba, La. (8)
S 20 Chefuncte R. (Tchefuncte R.) (8)
S 21 Pontchatalawa Cr., La. (20)
S 22 Bogue Falia, La. (20)
S 23 Abita R., La. (22)
S 24 Little Abita R., La. (23)
S 25 Little Bogue Falia, La. (22)
S 26 Bagleys Cr., La. (25)
S 27 Taylors Branch, La. (20)
S 28 Snow Cr., La. (20)
S 29 Tangipahoa R., La. (8)
S 30 Bedico Cr., La. (29)
S 31 Pocasin Cr., La. (29)
S 32 Simms Cr., La. (29)
S 33 Washley Cr., La. (29)
S 34 Chappepeela Cr., La. (29)
S 35 Squirrel Cr., La. (34)
S 36 Coopers Cr., La. (34)
S 37 Water Cr., La. (29)
S 38 Big Cr., La. (29)
S 39 Spring Cr., La. (29)
S 40 Irvings Branch, La. (29)
S 41 Terrys Cr., La. (29)
S 42 Cools Cr., La. (41)
S 43 Beaver Cr., La. (29)
S 44 Skull Cr., La. (29)
S 45 Pass Manchac, La. (8)
S 46 North Pass, La. (45)
S 47 Stinking Bayou, La. (46)
S 48 Middle Bayou, La. (46)
S 49 Owl Bayou, La. (46)
S 50 Lake Maurepas, La. (45)
S 51 Tickfaw R., La. (50)
S 52 Natalbany R., La. (51)
S 53 Ponchatoula R., La. (52)
S 54 Yellow R., La. (53)
S 55 Little Natalbany R., La. (52)
S 56 Blood R., La. (51)
S 57 Lizard Cr., La. (56)
S 58 Joseph Branch, La. (51)
S 59 12-Mile Cr., La. (51)
S 60 East Hog Branch, La. (51)
S 61 West Hog Branch, La. (60)
S 62 Amite R., La. (50)
S 63 Bayou Barbary, La. (62)
S 64 Colyell Bayou, La. (62)
S 65 Middle Colyell Bayou, La. (64)
S 66 West Colyell Bayou, La. (65)
S 67 Grays Cr., La. (62)
S 68 Coulton Cr., La. (62)
S 69 Beaver Cr., La. (62)
S 70 Milton Branch, La. (62)
S 71 Olive Cr., La. (62)
S 72 Ludley Cr., La. (62)
S 73 Darling Bayou, La. (62)
S 74 Black Cr., La. (73)
S 75 Sandy Bayou, La. (73)
S 76 Rock Cr., La. (62)
S 77 Turkey Cr., La. (62)
S 78 East Fork, La. (62)
S 79 West Fork, La. (78)
S 80 Big Beaver Cr., La. (62)
S 81 Little Beaver Cr., La. (80)
S 82 Bluff Cr., La. (62)
S 83 Sandy Cr., La. (62)

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[1] This office has charge of some works of improvement on the Mississippi below the head of the Passes, the locations of which are listed above among the other waterway units of the district, but abstracts of data concerning any work done on these Mississippi delta points are gathered together in combination with all other abstracts of Mississippi R. work, under HH.
[2] See note on p. 647.

S 84 Webbs Bayou, La. (83)
S 85 Little Sandy Cr., La. (83)
S 86 Beaver Pond Bayou, La. (85)
S 87 Comite R., La. (62)
S 88 Draughans Bayou, La. (87)
S 89 Beaver Bayou, La. (87)
S 90 Black Water Bayou, La. (87)
S 91 Pretty Cr., La. (87)
S 92 Opossum Cr., La. (87)
S 93 Norwoods Cr., La. (87)
S 94 Dixon Branch, La. (87)
S 95 White Branch, La. (87)
S 96 Olive Branch, La. (87)
S 97 Redwood Cr., La. (87)
S 98 Doyles Bayou, La. (97)
S 99 White Bayou, La. (87)
S 100 Black Cr., La. (99)
S 101 Cypress Bayou, La. (87)
S 102 Jones Cr., La. (62)
S 103 Bayou Manchac, La. (62)
S 104 Wards Cr., La. (103)
S 105 Dawson Cr., La. (104)
S 106 Fountain Bayou, La. (103)
S 107 Elbow Bayou, La. (106)
S 108 Alligator Bayou, La. (103)
S 109 Spanish Lake, La. (108)
S 110 Bayou Paul, La. (109)
S 111 Bayou Braud, La. (109)
S 112 Blind R., La. (50)
S 113 Bayou Chene Blanc, La. (112)
S 114 Little Amite R., La. (112)
S 115 Bayou Fusil, La. (112)
S 116 New R., La. (112)
S 117 Bayou Conway, La. (112)
S 118 Bayou des Acadiens, La. (112)
S 119 Alligator Bayou, La. (112)
S 120 Dutch Bayou, La. (112)
S 121 Mississippi Bayou, La. (120)
S 122 Bayou La Branche, La. (8)
S 123 Bayou Trepagnier, La. (122)
S 124 Bayou Traverse, La. (122)
S 125 Walkers Canal, La. (8)
S 126 Double Bayou, La. (8)
S 127 Alligator Bayou, La. (8)
S 128 Bayou Laurier, La. (8)
S 129 Bayou La Barre, La. (8)
S 130 Bayou Tchoupitoulas, La. (8)
S 131 Indian Bayou, La. (8)
S 132 Seventeenth Street Canal, La. (8)
S 133 New Basin Canal, La. (8)
S 134 Bayou St. John, La. (8)
S 135 Carondelet Canal, La. (134)
S 136 Bayou Couchon, La. (8)
S 137 Little R., La. (8)
S 138 Castiglione Bayou, La. (8)
S 139 Turtle Bayou, La. (8)
S 140 Irish Bayou, La. (8)
S 141 Chef Menteur, La. (4)
S 142 Bayou Sauvage, La. (141)
S 143 Bayou Dupont, La. (141)
S 144 Cedar Bayou, La. (141)
S 145 Bayou Bienvenue, La. (4)
S 146 Bayou Mercier, La. (4)
S 147 Bayou Maxent, La. (146)
S 148 Bayou Dupre, La. (4)
S 149 Lake Borgne Canal, La. (148) (314)
S 150 Bayou Ysclosky, La. (4)
S 151 Bayou St. Malo, La. (4)
S 152 Bayou Hasouse, La. (4)
S 153 Bayou Padra, La. (4)
S 154 Grand Bayou, La. (4)
S 155 Biloxi Bayou, La. (4)
S 156 Nine Mile Bayou, La. (3)
S 157 Bayou Boudreau, La. (3)
S 158 Johnsons Bayou, La. (3)
S 159 Chandeleur Sound, La. (1)
S 160 Breton Sound, La. (1)
S 161 Bay Boudreau, La. (159)
S 162 Indian Mound B., La. (159)
S 163 Lawson Lake, La. (162)
S 164 Lake Eugenie, La. (163)
S 165 Fishing Smack Lake, La. (159)
S 166 Live Oak B., La. (159)
S 167 Drum B., La. (159)
S 168 Morgans H., La. (159)
S 169 Christmas Camp Lake, La. (168)
S 170 Eloi B., La. (160)
S 171 Bayou la Loutre, La. (170)
S 172 Lake Eloi, La. (170)
S 173 Lake Athanasia, La. (170)
S 174 Lake la Fortuna, La. (160)
S 175 Lake Machias, La. (174)
S 176 Lake Coquille, La. (175)
S 177 Lake Callebasse, La. (174)
S 178 Lake Jean Louis Robin, La. (176)
S 179 Bayou Jean Louis Robin, La. (178)
S 180 Lake Amede, La. (179)
S 181 Black B., La. (160)
S 182 Bayou Terre au Boeufs, La. (181)
S 183 Bayou Lery, La. (182)
S 184 Lake Lery, La. (183)
S 185 Bayou Canard Frungais, La. (184)
S 186 Bayou Mandeville, La. (184)
S 187 Bayou Duhuy, La. (184)
S 188 Bayou Centilly, La. (182)
S 189 Bayou Long, La. (181)
S 190 River au Chenes, La. (181)
S 191 Grand Lake, La. (188) (189) (190)
S 192 California B., La. (160)
S 193 August B., La. (192)
S 194 Cox B., La. (193)
S 195 Harris Bayou, La. (193)
S 196 Bayou Lamoque, La. (192)
S 197 Quarantine B., La. (192)
S 198 Bardel Canal, La. (197)
S 199 Little Coquille B., La. (160)
S 200 Fort Bayou, La. (199)
S 201 Grand Coquille B., La. (160)
S 202 Grand B., La. (1)
S 203 Lucas Canal, La. (202)
S 204 Bird Island Sound, La. (1)
S 205 Baptist Colets Bayou, La. (204)
S 206 Main Pass, La. (1) (245)
S 207 Octave Pass, La. (1) (245)
S 208 Twenty Seven Pass, La. (1) (245)
S 209 Raphaels Pass, La. (1) (245)
S 210 Bull B., La. (1)
S 211 Paddys B., La. (210)
S 212 North Pass, La. (1) (213)
S 213 Pass a Loutre, La. (1) (244)
S 214 Blind B., La. (1)
S 215 Jackass B., La. (214)
S 216 Northeast Pass, La. (1) (213)
S 217 Mississippi Bayou, La. (1)

S 218 Southeast Pass, La. (213) (217)
S 219 Red Fish B., La. (1)
S 220 Balize Bayou, La. (1)
S 221 Garden Island B., La. (1)
S 222 Chenier Pass, La. (221) (227)
S 223 Cognevichs Pass, La. (221) (227)
S 224 Loomis Pass, La. (221) (227)
S 225 Taylors Pass, La. (221) (227)
S 226 Howards Pass, La. (221) (227)
S 227 Pass a Loutre Crevasse, La. (213)
S 228 South Pass, La. (1) (244)
S 229 Whale B., La. (1)
S 230 Grand Bayou, La. (1)
S 231 East B., La. (1)
S 232 Joseph Bayou, La. (231) (240)
S 233 Customhouse Bayou, La. (231) (240)
S 234 Pilottown Bayou, La. (231) (240)
S 235 Flat Boat Bayou, La. (231) (240)
S 236 Second Bayou, La. (231)
S 237 Middle Ground Bayou, La. (231)
S 238 Cutoff Bayou, La. (231) (240)
S 239 Deadmans Bayou, La. (231) (240)
S 240 Southwest Pass, La. (1) (244)
S 241 Double Bayou, La. (240) (304)
S 242 Upper Lighthouse Bayou, La. (240) (304)
S 243 Lower Lighthouse Bayou, La. (240) (304)

(b) LOUISIANA DISTRICT WATERWAYS TRIBUTARY TO THE MISSISSIPPI.

S 244 Mississippi R., La. (213) (228) (240)
S 245 Cubits Gap, La. (244) (206)
S 246 Lake Gracie, La. (244)
S 247 Thompsons Cr., La. (244)
S 248 Sandy Bayou, La. (247)
S 249 Karrs Cr., La. (247)
S 250 McKowen Cr., La. (247)
S 251 Beaver Dam Cr., La. (247)
S 252 Lost Cr., La. (247)
S 253 Hurricane Cr., La. (247)
S 254 Jews Cr., La. (247)
S 255 Casin Cr., La. (247)
S 256 Middle Fork, La. (247)
S 257 West Fork, La. (256)
S 258 Mill Cr., La. (257)
S 259 Sandy Cr., La. (257)
S 260 Dry Cr., La. (257)
S 261 Vaughn Cr., La. (247)
S 262 Hammer Cr., La. (247)
S 263 Chaney Cr., La. (247)
S 264 Laurel Fork, La. (263)
S 265 Alligator Bayou, La. (247)
S 266 Grant Bayou, La. (265)
S 267 Alexander Cr., La. (265)
S 268 Wickliffe Cr., La. (267)
S 269 Bayou Sara, La. (244)
S 270 Williams Cr., La. (269)
S 271 Scotts Cr., La. (269)
S 272 Gales Cr., La. (269)
S 273 Sandy Cr., La. (269)
S 274 Little Bayou Sara, La. (269)
S 275 Lucy Cr., La. (274)
S 276 Crooked Cr., La. (274)
S 277 Spring Branch, La. (274)
S 278 Buffalo R., Miss. (244)
S 279 Percys Cr., Miss. (278)
S 280 Fords Cr., Miss. (278)
S 281 Pine Cr., Miss. (278)
S 282 Homochitto R., Miss. (244)
S 283 Old R., Miss. (282)
S 284 Ellis Lake, Miss. (282)
S 285 Wells Cr., Miss. (282)
S 286 Sandy Cr., Miss. (282)
S 287 Town Cr., Miss. (282)
S 288 Sammys Cr., Miss. (282)
S 289 Dry Bayou, Miss. (282)
S 290 Gallards Lake, Miss. (289)
S 291 Tunica Bayou, La. (244)
S 292 Grand Cutoff Bayou, La. (244)[1] (295)
S 293 Atchafalaya R., La. (244) (295)
S 294 Old R., La. (293)
S 295 Red R., La. (244) (293)
S 296 Lake Raccourci (Old R.), La. (244)[1]
S 297 False R., La. (244)[2]
S 298 Bayou Plaquemine, La. (244) (522)
S 299 Bayou Lafourche, La. (1) (244)[2]
S 300 Company Canal No. 1, La. (244) (366)
S 301 Harveys Canal No. 1, La. (244) (357)
S 302 Doulluts Canal, La. (244) (328)
S 303 The Jump, La. (244) (307)

(c) LOUISIANA DISTRICT WATERWAYS WEST OF THE MISSISSIPPI.

S 304 West B., La. (1)
S 305 Williams Pass, La. (304) (307)
S 306 Solomons Bayou, La. (304) (307)
S 307 Grand Pass, La. (304) (303)
S 308 Tiger Pass, La. (304) (307)
S 309 Red Pass, La. (1) (307)
S 310 Bay Jacque, La. (1)
S 311 Spanish Pass, La. (307) (310)
S 312 Bay Coquette, La. (310)
S 313 Chi Charas, La. (312)
S 314 Bayou Dunn Barr, La. (313)
S 315 Hospital B., La. (314)
S 316 Emile Bayou, La. (315)
S 317 Bayou Grand Lizard, La. (314)
S 318 Scofield B., La. (1)
S 319 Skip Jack B., La. (318)
S 320 Cyprien B., La. (319)
S 321 English B., La. (320)
S 322 Bay Pompadour, La. (321)
S 323 Bayou Boeuf, La. (322)
S 324 Shell Island B., La. (1)
S 325 Bayou Fontanelle, La. (324)
S 326 Bastian B., La. (1)
S 327 Bayou Cook, La. (326)
S 328 Adams B., La. (327)
(*) Doullut Canal (same as 302) (328) (244)
S 329 Bayou Vacherie, La. (328)
S 330 Grand Bayou, La. (326)
S 331 Bay Joe Wise, La. (1)
S 332 Bayou Chalaud, La. (1)
S 333 Bayou La Mer, La. (1)

* Indicates waterway already mentioned.
[1] Has no "present" connection with the Mississippi River.
[2] Has no "present" connection with 244.

S 334 Quartre Bayou Pass, La. (1)
S 335 Bay Long, La. (334)
S 336 Bay Ronquille, La. (334)
S 337 Cay B., La. (336)
S 338 Lake Grand Ecaille, La. (336)
S 339 Barataria B., La. (1)
S 340 Bay Batiste, La. (339)
S 341 Bay Chene Fleur, La. (339)
S 342 Wilkinsons B., La. (339)
S 343 Raquette B., La. (341)
S 344 Chenier B., La. (343) (329)
S 345 Lake Hermitage, La. (344)
S 346 Lake Five, La. (342)
S 347 Round B., La. (346)
S 348 Bayou Dupont, La. (347) (349) (355)
S 349 Bayou St. Denis, La. (339)
S 350 Bayou Cutler, La. (349)
S 351 Spoonbill B., La. (350)
S 352 Lake Villere, La. (349)
S 353 Grand Bayou, La. (339)
S 354 Little Lake, La. (353) (349)
S 355 Bayou Rigolettes, La. (354)
S 356 Harveys Cutoff Canal, La. (352) (355)
S 357 Bayou Barataria, La. (355)
S 358 Bayou au Dies, La. (357)
S 359 Bayou Terre, La. (357)
S 360 Bayou Gazeland, La. (357)
S 361 Bayou Convent, La. (357)
(*) Harveys Canal No. 1 (same as 301) (244) (357)
S 362 Bayou des Familles, La. (357)
S 363 Bayou Villars, La. (357) (365)
S 364 Bayou Perot, La. (355)
S 365 Lake Salvador, La. (363) (364)
S 366 Bayou Segnette, La. (365)
S 367 Bayou Boeuf, La. (366)
(*) Company Canal No. 1 (same as 300) (244) (366)
S 368 Bayou Couba, La. (365)
S 369 Lake Cataouatche (or Netherlands), La. (366) (368)
S 370 La Branche Canal, La. (369)
S 371 Bayou Verret, La. (369)
S 372 Bayou des Saules, La. (369)
S 373 Bayou Piquant, La. (369)
S 374 Bayou Des Allemands, La. (365)
S 375 Black Prince Bayou, La. (374)
S 376 Grand Bayou, La. (375)
S 377 Crocodile Canal, La. (376)
S 378 Crocodile Bayou, La. (376)
S 379 Petit Bayou, La. (374)
S 380 Lake Des Allemands, La. (374)
S 381 Bayou Fortier, La. (380)
S 382 Bayou Bechnel, La. (380)
S 383 Bayou Lassine, La. (380)
S 384 Bayou Chevreuil, and Bayou Tigre, La. (380)
S 385 Bayou Heron, La. (380)
S 386 Coulee Madagale, La. (387)
S 387 Bayou Boeuf, La. (380)
S 388 Bayou Cohabanosse (or Grand Bayou), La. (387)
S 389 Bayou Chegley, La. (387)
S 390 Bayou Verrette, La. (389)
S 391 Lake Boeuf, La. (387)
S 392 Lake Boeuf Canal, La. (391) (419)
S 393 Bayóu Plat, La. (374)
S 394 Bayou de Gruys, La. (374)
S 395 Company Canal No. 2, La. (374) (419)
S 396 Bayou Vacherie, La. (365)
S 397 Bayou Catahoula, La. (365)
S 398 Harvey Canal No. 2, La. (365) (419)
S 399 Amoureaux Canal, La. (365) (400)
S 400 Bayou des Amoureaux, La. (399)
S 401 Bay Lourse, La. (354)
S 402 Lake Brusle, La. (354)
S 403 Round Lake, La. (354)
S 404 Hackberry B., La. (339)
S 405 Creole B., La. (339)
S 406 Round B., La. (339)
S 407 Bay des Illettes, La. (339)
S 408 Bayou Fifi, La. (339)
S 409 Bayou Andre, La. (407)
S 410 Bayou Lourse, La. (407)
S 411 Caminada Pass, La. (1)
S 412 Caminada B., La. (411) (407)
S 413 Bay Tambour, La. (412)
S 414 Southwestern Louisiana Canal, La. (412)
S 415 Bayou Moreau, La. (1) (419)
S 416 Bay Champagne, La. (1)
S 417 Pass Fourchon, La. (1)
S 418 Bay Marchand, La. (1)
S 419 Bayou Lafourche, La. (1)
(*) Southwest Louisiana Canal (same as 414) (419) (412)
S 420 Yankee Canal, La. (419)
S 421 Bayou Rambour, La. (420) (412)
S 422 Cher Ami Canal, La. (419)
(*) Harvey Canal No. 2 (same as 419) (398)
(*) Bayou Lourse, La. (same as (419) (410)
(*) Company Canal No. 2, La. (same as 395) (419) (374)
(*) Lake Boeuf Drainage Canal, La. (same as 392) (419)
S 423 Head of Bayou Lafourche, La. (419)[1] (244)
S 424 Cancienne Canal, La. (419) (509)
(*) Company Canal No. 2, La. (same as 395) (419) (431)
S 425 Dresser Canal, La. (419) (429)
(*) Southwestern Louisiana Canal, La. (same as 414) (419) (429)
S 426 Timbalier B., La. (1)
S 427 Devils B., La. (426)
S 428 Lake Raccouci, La. (426)
S 429 Bayou Leau Bleu, La. (428)
S 430 Catfish Lake, La. (429)
(*) Dresser Canal, La. (same as 429) (425) (419)
S 431 Field Lake, La. (429)
(*) Company Canal No. 2, La. (same as 395) (419) (431) (434) (445)
S 432 Bayou False, La. (431)
S 433 Bayou de Mar, La. (431)
S 434 Lake Long, La. (395)

* Indicates waterway already mentioned. [1] Has no "present" connection with the Mississippi River.

S 435 Bayou Blue, La. (429)
S 436 Grand Bayou, La. (429)
S 437 Bayou Grand Felicity, La. (426)
S 438 Bayou Pointe au Chien, La. (437)
S 439 Lake Felicity, La. (437)
S 440 Lake Chien, La. (439)
S 441 Lake Billot, La. (439)
S 442 Bayou St. Jean Charles, La. (440)
S 443 Terrebonne B., La. (1)
S 444 Lake Barre, La. (443)
S 445 Bayou Terrebonne, La. (443)
S 446 Bayou Portage, La. (445)
S 447 Grand Bayou, La. (446)
S 448 Bayou Cane, La. (445) (449)
S 449 Barrows Canal, La. (445) (499)
S 450 Bush Canal, La. (445) (455)
S 451 Bayou La Cache, La. (445)
S 452 Lake Lagraisse, La. (443)
S 453 Bay Challand, La. (443)
S 454 Bay St. Elaine, La. (443)
S 455 Bayou Little Caillou, La. (443)
(*) Bush Canal, La. (same as 450) (445) (455)
S 456 Boudreau Canal, La. (455) (457)
S 457 Lake Boudreau, La. (456)
S 458 Quitmans Lake, La. (457)
S 459 Robinson Canal, La. (455)
S 460 Lake Pelto, La. (1)
S 461 Bayou Salle, La. (460)
S 462 Four Point Bayou, La. (461)
S 463 Grassy Bayou, La. (461)
S 464 Pelican Lake, La. (460)
S 465 Caillou B., La. (1)
S 466 Bayou Grand Caillou, La. (465)
S 467 Bayou L'Curse, La. (466)
S 468 Bayou Dulac, La. (458) (466)
S 469 Bayou le Carpe, La. (466)
S 470 Caillou Lake, La. (465) (Sister Lake)
S 471 Bayou de Large, La. (1)
S 472 Thibodaux Canal, La. (471) (482)
S 473 Lake Mechant, La. (471)
S 474 Bayou de West, La. (1)
S 475 Bay Junop, La. (474)
S 476 Little Bayou, La. (473) (475)
S 477 Oyster Bayou, La. (1)
S 478 Four League B., La. (477)
S 479 Blue Hammock Bayou, La. (478) (473)
S 480 Pagie Lake, La. (479)
S 481 Lost Lake, La. (479)
S 482 Bayou de Cade, La. (481)
S 483 Lake de Cade, La. (482)
S 484 Drainage (Hatch) Canal, La. (483) (499)
S 485 Lake Hatch, La. (484)
S 486 Lake Theriot, La. (484)[1]
S 487 Lake Allen, La. (483)
S 488 Big Carrion Crow Bayou, La. (478)
S 489 Mosquito Bayou, La. (478)
S 490 Atchafalaya B., La. (1)
S 491 Atchafalaya B. Ship Channel, La. (1) (490)
S 492 Round Bayou, La. (490)
S 493 Lower Atchafalaya R., La. (490)
S 494 Sword Bayou, La. (493)
S 495 Sweet Bay Lake (forms part of lower Atchafalaya R.), La. (493)
S 496 Bayou Shaffer, La. (493)
S 497 Bayou Penchant, La. (496)
S 498 Bayou Chene, La. (497) (500)
S 499 Bayou Black, La. (498)
(*) Barrows Canal (same as 449), La. (445) (499)
(*) Bayou Cane, La. (same as 448) (445) (499)
S 500 Bayou Boeuf, La. (493) (498) (504)
501 Batemans Lake, La. (forms part of Atchafalaya R.) (493)
S 502 Berwick B., La. (forms part of Atchafalaya R.) (493)
S 503 Flat Lake, La. (493)
S 504 Lake Palourde, La. (500) (503)
S 505 Grassy Lake, La. (504)
S 506 Bayou Mellow, La. (504)
S 507 Bayou Long, La. (forms part of Grand R.) (503)
S 508 Bayou Magazille, La. (507)
S 509 Lake Verret, La. (508) (424)
S 510 Grand Bayou, La. (509)
S 511 Bayou Creux, La. (510)
S 512 Bayou Bijou, La. (510)
S 513 Bayou Segur, La. (510)
S 514 Belle R., La. (forms part of Grand R.) (507)
S 515 Big Goddel, La. (forms part of Grand R.) (514)
S 516 Little Goddel, La. (forms part of Grand R.) (515)
S 517 Bay Natchez, La. (forms part of Grand R.) (516)
S 518 Lake Natchez, La. (517)
S 519 Bayou Choctaw, La. (518)
S 520 Bayou Goula, La. (519)
S 521 Chopin Chute, La. (forms part of Grand R.) (517)
S 522 Grand R., La. (298) (293) (521)
(*) Bayou Plaquemine, La. (same as 298) (244) (522)
S 523 Bayou Jacob, La. (298)
S 524 Bayou Grossetete, La. (298)
S 525 Bayou Choctaw, La. (524)
S 526 Bayou Poydras, La. (525)
S 527 Stumpy Bayou, La. (526)
S 528 Caney Bayou, La. (527)
S 529 Grand Bayou, La. (524)
S 530 Bayou Thomas, La. (524)
S 531 Bayou Cotonier, La. (524)
S 532 Bayou Lauquedock, La. (531)
S 533 Bayou Black, La. (524)
S 534 Bayou Portage, La. (533)
S 535 Buckhorn Bayou, La. (534)
S 536 Bayou Fordoche, La. (524)
S 537 Bayou Maringouin, La. (522) (524)
S 538 Cow Bayou, La. (522)
S 539 Ouske B., La. (522)
S 540 Black Bayou, La. (539)
S 541 Bayou de Claise, La. (539) (542)
S 542 Alabama Bayou, La. (293)

* Indicates waterway already mentioned.

[1] Has no "present" connection.

S 543 Little Alabama Bayou, La. (542)
S 544 Bayou des Ourse, La. (539) (542)
(*) Upper Atchafalaya R., La. (same as 293) (295) (244)
S 545 Prentiss Bayou, La. (293)
S 546 Close Bayou, La. (545)
S 547 Cowhead Bayou, La. (293)
S 548 Pay Bayou, La. (547)
S 549 White Vine Bayou, La. (548)
S 550 Bayou Black, La. (548)
S 551 Moores Bayou, La. (550)
S 552 Bayou Latenache, La. (293)
S 553 Robertsons Bayou, La. (552)
S 554 Coyles Bayou, La. (293)
S 555 Gumlog Bayou, La. (554)
S 556 Fishers Bayou, La. (293)
S 557 Bayou Moreau, La. (293)
S 558 Bayou Couteau, La. (293)
(*) Red R., La. (same as 295) (244) (293)
S 559 Lake Long, La. (295)
S 560 Bayou Rouge, La. (295)
S 561 Choctaw Bayou, La. (295) (573)
S 562 Bayou Rapides, La. (295) (563)
S 563 Bayou Boeuf, La. (562) (585)
S 564 Bayou St. Jean de Jean, La. (295)[1] (563)
S 565 Old R., La. (295)
S 566 Cane R., La. (295)
S 567 Bayou Pierre, La. (295)
S 568 Bayou Pierre Lake, La. (567)
S 569 Lake Canisnia, La. (568)
S 570 Wallace Lake, La. (569)
S 571 Wallace Bayou, La. (570)
S 572 Bayou Courville, La. (293)
S 573 Bayou des Glaises, La. (293)
S 574 Yellow Bayou, La. (293) (573)
S 575 Pearl Lake, La. (573)
S 576 Bayou Maillard, La. (293)
S 577 Turners Bayou, La. (293)
S 578 Bayou Currant, La. (293)
S 579 Bayou Rouge, La. (293) (573)
S 580 Bayou Beaklance, La. (579)
S 581 Indian Bayou, La. (579)
S 582 Bayou Misery, La. (293)
S 583 Bayou Petit Prairie, La. (293)
S 584 Bayou D'Arbonne, La. (293)
S 585 Bayou Courtableau, La. (293)
S 586 Bayou Saquette, La. (585)
S 587 Bayou Waxia, La. (586)
(*) Bayou Boeuf, La. (same as 563) (585) (562)
S 588 Bayou Huffpower, La. (563) (579)
S 589 Bayou Robert, La. (563) (562)
S 590 Middle Bayou, La. (563) (562)
S 591 Valentine Bayou, La. (563)
S 592 Bayou Cocodrie, La. (585)
S 593 Lake Cocodrie, La. (592)
S 594 Turkey Cr., La. (592)
S 595 Bayou Chicot, La. (592)
S 596 Bayou Fordoche, La. (585) (628)
S 597 Bayou Mamselle, La. (585)
S 598 English Bayou, La. (585)
S 599 Little Bayou Fordoche, La. (585)
S 600 Little Atchafalaya R., La. (522)
S 601 Tensas Bayou, La. (522)
S 602 Little Tensas Bayou, La. (522)
S 603 Bayou Pigeon, La. (522)
S 604 Bayou Sorrel, La. (522)
S 605 Little Pigeon Bayou, La. (522)
S 606 Pigeon Bayou, La. (522) (617)
S 607 Bayou Postillion, La. (522)
S 608 Bayou Fordoche, La. (522)
S 609 Old R., La. (522)
S 610 Bayou Long, La. (522)
S 611 Bayou Sorrel, La. (522)
S 612 Cypress Island Pass, La. (493) (617)
S 613 Sixmile Lake, La. (503)
S 614 Chocolate Bayou, La. (503)
S 615 Bayou Segge, La. (614)
S 616 Bayou Joe, La. (613)
S 617 Grand Lake, La. (493) (613)
S 618 Bayou Boucie, La. (617)
S 619 Grassy Lake, La. (617)
S 620 Flat Lake, La. (617) (622)
S 621 Cross Bayou, La. (620)
S 622 Lake Chicot, La. (617)
S 623 Bayou Ricaby, La. (622) (625)
S 624 Bayou Chene, La. (622) (625)
S 625 Lake Mongoulois, La. (601) (624)
S 626 Bayou La Rompe, La. (625) (600)
S 627 Bayou Larose, La. (293) (638)
S 628 Opelousas B., La. (293)
S 629 Bayou Berard, La. (628)
S 630 Bayou Portage, La. (629)
S 631 Lake Fausse Pointe, La. (617)
S 632 Bayou Eugene, La. (631) (624)
S 633 Grand Bayou, La. (631) (632)
S 634 Round Lake, La. (633)
S 635 Beau Bayou, La. (634)
S 636 Lake Dauterive, La. (631)
S 637 Bayou L'Embarras, La. (634) (638)
S 638 Lake Long, La. (626) (627) (637)
S 639 Bayou Portage, La. (636)
S 640 Catahoula Lake, La. (627)[2]
S 641 Tete Bayou, La. (631)
S 642 Bayou Teche, La. (493) (585)
S 643 Bayou Maricoquant, La. (642)
S 644 Bayou Carron, La. (643)
S 645 Bayou Petit Passe, La. (644)
S 646 Bayou Bellsire, La. (644)
S 647 Bayou Fusilier, La. (642) (720)
S 648 Bayou Bourbeau, La. (647) (720)
S 649 Keystone Canal, La. (642)
S 650 Spanish Lake, La. (649)
S 651 Hanson Canal, La. (642) (687)
S 652 Little Wax Bayou, La. (493) (665)
S 653 Big Wax Bayou, La. (493) (664)
S 654 Chicken Bayou, La. (493) (652) (653)
S 655 Dollar Bayou, La. (653)
S 656 Fishtrap Bayou, La. (655)
S 657 Shell Island Pass, La. (490)
S 658 Little Hog Bayou, La. (659)
S 659 East B., La. (490)
S 660 Big Hog Bayou, La. (659)
S 661 Myrtle Bayou, La. (653) (664)
S 662 Doctors Bayou, La. (661)
S 663 Nobodys Bayou, La. (662)
S 664 Wax Pass, La. (490)]

[1] Has no "present" connection with 563.
[2] Has no "present" connection.
* Indicates waterway already mentioned.

S 665 Wax Lake, La. (664)
S 666 Towhead Bayou, La. (665)
S 667 Possum Bayou, La. (665)
S 668 Big Oak Bayou, La. (665)
S 669 Bayou Blue, La. (665)
S 670 Bayou Leopard, La. (665)
S 671 Bayou Chaffe, La. (669) (670)
S 672 Bayou Black, La. (670)
S 673 Hog Bayou, La. (665)
S 674 East Cote Blanche B., La. (1)
S 675 Bayou Sale B., La. (674)
S 676 Bayou Sale, La. (675)
S 677 Yellow Bayou, La. (675)
S 678 Jackson Bayou, La. (675)
S 679 West Cote Blanche B., La. (674) (696)
S 680 Bayou Carlin, La. (679)
S 681 Bayou Long, La. (679)
S 682 Jaws or Little B., La. (679)
S 683 Bayou Mascot, La. (682)
S 684 Mud Lake, La. (682)
S 685 Bayou Bartholomew, La. (684)
S 686 Thorgeson Canal, La. (685)
S 687 Bayou Portage, La. (684) (651)
S 688 Franklin Canal, La. (687)
S 689 Bayou Yokely, La. (688)
S 690 Huger Bayou, La. (682)
S 691 Onion Bayou, La. (690)
S 692 Bayou Gregoire, La. (682)
S 693 Bayou Chicot, La. (692)
S 694 Hog Bayou, La. (682)
S 695 Hackberry Lake, La. (694)
S 696 Vermilion B., La. (1) (679) (716)
S 697 Bayou Cypremort, La. (695)
S 698 Shark Bayou, La. (696) (699)
S 699 Weeks B., La. (696)
S 700 Weeks Bayou, La. (699)
S 701 Iberia-St. Mary Canal, La. (700)
S 702 Jeanerette Canal, La. (701)
S 703 Patout Canal, La. (701)
S 704 Weeks Canal, La. (701)
S 705 Bayou Carlin, La. (699)
S 706 New Iberia Southern Drainage Canal, La. (705)
S 707 Bayou Petit Anse, La. (696)
S 708 Bayou Carlin, La. (707)
S 709 Tigre Lagoon, La. (707)
S 710 Petit Anse Canal, La. (707) (696)
S 711 Bayou Parcperdue, La. (707)
S 712 Bayou Tigre, La. (707)
S 713 Delcambre Canal, La. (712)
S 714 Lake Peigneur, La. (713)
S 715 Bayou Portage, La. (707)
S 716 Southwest Pass, La. (Vermilion Pass) (1) (696) (to Vermilion B.)
S 717 Onion Bayou, La. (696)
S 718 Onion Lake, La. (717)
S 719 Green Island Bayou, La. (718)
S 720 Vermilion R., La. (696)
S 721 Flatboat Bayou, La. (720)
S 722 Youngs Coulee, La. (720)
S 723 Darbys Coulee, La. (720)
S 724 Bayou Tortue, La. (720)
S 725 Cypress Island Coulee, La. (724)
S 726 Lake La Pointe, La. (724)
(*) Bayou Fusilier, La. (same as 647) (720) (642)
(*) Bayou Bourbeau, La. (same as 648) (642) (720)
S 727 Bayou Carencro, La. (720)
S 728 Bayou Isle des Cannes (or Sebastopol Coulee), La. (720)
S 729 Kennys Coulee, La. (720)
S 730 Little Bayou, La. (720)
S 731 Little White Lake, La. (696)
S 732 Bayou Chene, La. (696)
S 733 Schooner Bayou, La. (696)
S 734 White Lake Canal, La. (733)
S 735 White Lake, La. (734)
S 736 Turtle Lake, La. (735)
S 737 Alligator Lake, La. (736)
S 738 Collicon Lake, La. (737)
S 739 Blackfish Lake, La. (738)
S 740 Collicon Bayou, La. (738) (751)
S 741 Fresh Water Bayou, La. (1)
S 742 Rollover Bayou, La. (1)
S 743 Constance Bayou, La. (1)
S 744 Heybours Bayou, La. (1)
S 745 Mermentau R., La. (1)
S 746 Mud Lake, La. (part of Mermentau R.) (745)
S 747 Hog Bayou, La. (746)
S 748 Upper Mud Lake, La. (part of Mermentau R.) (745)
S 749 Little Pecan Bayou, La. (748)
S 750 Catfish Lake, La. (745) (751)
S 751 Grand Lake, La. (745) (740) (776)
S 752 Mallard B., La. (771)
S 753 Gueydan Canal, La. (752)
S 754 Lake Arthur, La. (part of Mermentau R.) (745)
S 755 Bayou Roberts, La. (745)
S 756 Bayou Queue de Tortue, La. (745)
S 757 Bayou Grand Marais, La. (756)
S 758 Indian Coulee, La. (756)
S 759 Bayou des Cannes, La. (745)
S 760 Bayou Plaquemine Brulé, La. (759)
S 761 Bayou Wickoff, La. (760)
S 762 Long Point Bayou, La. (760)
S 763 Bayou Jones, La. (760)
S 764 Bayou Pointe au Loups, La. (759)
S 765 Bayou Mallett, La. (759)
S 766 Bayou Maron, La. (759)
S 767 Bayou Joe Marcel, La. (759)
S 768 Bayou Barwick, La. (759)
S 769 Bayou Nezpique, La. (745)
S 770 Cypress Cr., La. (769)
S 771 Beaver Cr., La. (769)
S 772 Bayou Castor, La. (769)
S 773 Caney Cr., La. (772)
S 774 Blue Bayou, La. (769)
S 775 Bayou Rogers, La. (769)
S 776 Lacassine Lake, La. (751) (777)
S 777 Latania Lake, La. (751) (776)
S 778 Lacassine Bayou, La. (776)
S 779 Bayou Chene, La. (778)
S 780 Bayou Misere, La. (776)
S 781 Lake Misere, La. (780)
S 782 Lake Misere Canal, La. (781)

* Indicates waterway already mentioned.

S 783 Sweet Lake, La. (782)
S 784 North American Lumber & Timber Co. Canal, La. (783) (794)
S 785 Willow Lake, La. (783)[1]
S 786 Little Chenier Bayou, La. (745)
S 787 Big Mouth Bayou, La. (745)
S 788 Cowpen Bayou, La. (745)
S 789 Pumpkin Bayou, La. (745)
S 790 Kings Bayou, La. (745)
S 791 Bayou Labauves, La. (745)
S 792 Creole Canal, La. (745)
S 793 Calcasieu Pass, La. (1)
S 794 Calcasieu Lake, La. (793)
S 795 Foret Bayou, La. (794)
S 796 Mangrove Bayou, La. (794)
S 797 Bayou Bois Connie, La. (794)
S 798 Calcasieu R., La. (794)
S 799 Black Bayou, La. (798)
S 800 Bayou Tete Bois, La. (799)
S 801 Moss Lake, La. (part of 798)
S 802 Bayou Guy, La. (798)
S 803 Prien Lake, La. (part of 798)
S 804 Contraband Bayou, La. (798)
S 805 Lake Charles, La. (part of 798)
S 806 English Bayou, La. (798)
S 807 Serpent Bayou, La. (798)
S 808 Bayou Arsene, La. (807)
S 809 Masters Bayou, La. (798)
S 810 Cypress Bayou, La. (798)
S 811 Comrade Cr., La. (810)
S 812 Devils Cr., La. (811)
S 813 Bayou Pointe Coupee, La. (812)
S 814 Burtons Cr., La. (798)
S 815 Cherry Winck Cr., La. (798)
S 816 Mill Cr., La. (798)
S 817 Little Mill Cr., La. (816)
S 818 Black Cr., La. (817)
S 819 Whiskey Chitto Cr., La. (798)
S 820 Ten Mile Cr., La. (819)
S 821 Six Mile Cr., La. (819)
S 822 Brushy Cr., La. (821)
S 823 Little Six Mile Cr., La. (821)
S 824 Sugar Cr., La. (819)
S 825 Drakes Cr., La. (819)
S 826 Sandy Cr., La. (819)
S 827 Bundick Cr., La. (819)
S 828 Black Cr., La. (827)
S 829 Flat Cr., La. (827)
S 830 Palmetto Cr., La. (827)
S 831 Dry Cr., La. (827)
S 832 Little Dry Cr., La. (831)
S 833 Barnes Cr., La. (798)
S 834 Clear Cr., La. (833)
S 835 Right Hand Cr., La. (833)
S 836 Hurricane Cr., La. (833)
S 837 Brushy Cr., La. (833)
S 838 Boggy Cr., La. (833)
S 839 Marsh Bayou, La. (798)
S 840 West Fork (Calcasieu R.), La. (798)
S 841 Indian Bayou, La. (840)
S 842 Hickory Branch, La. (840)
S 843 Wild Cow Cr., La. (842)
S 844 Coles Cr., La. (842)
S 845 Cowpen Cr., La. (842)
S 846 Beckwith Cr., La. (842)
S 847 Little R., La. (840)
S 848 Houston R., La. (840)
S 849 Buxton Cr., La. (848)
S 850 Cowards Gully, La. (849)
S 851 Long Cr., La. (848)
S 852 Bear Head Cr., La. (848)
S 853 Windham Cr., La. (848)
S 854 Indian Cr., La. (848)
S 855 Hurricane Cr., La. (848)
S 856 Bayou D'Inde, La. (798)
S 857 Bayou Choupique, La. (798)
S 858 Inland Waterway Canal, Calcasieu R.-Sabine R., La. (798)
S 859 Kelso Bayou, La. (794)
S 860 Black Lake, La. (859)
S 861 Oyster Bayou, La. (794)
S 863 Mud Lake, La. (1)

S-2 LOUISIANA WATER COURSES. (Remarks on improvement.)

ENGINEERS.
In charge. Maj. C. W. Howell. **R., 80,** 1189.
Assistant. H. C. Collins. **R., 80,** 1190.

SURVEY.
Au. act Mar. 3, 1879; made, 1880, by Maj. Howell, **80,** 1189.

S-2(a) LOUISIANA WATERS. (Removing hyacinths.)

(See p. 572.)

S-8 LAKE PONTCHARTRAIN (Including vicinity of Pass Manchac), LA.[2 3 4 5]

APPROPRIATIONS.

1852,	$25,000, act Aug. 30.
1910,	9,000, **10,** 1627.
Total,	34,000

COMMERCE.
Imported, **93,** 1843.

ENGINEERS.
Chief of Engineers. R., 66, 67; **91,** 221, 1839; **93,** 251; **08,** 449; **10,** 527; **11,** 564; **12,** 684.

[1] Has no "present" connection.
[2] Sur.—For H. of refuge, **R.,** Oct. 9, 1845; est., $30,000. (H. D. 482, 55th, 2d.)
[3] Sur. for breakw'r for H. of refuge, "New Orleans to Pontchartrain R. R. wharf, La.," au. act Mar. 3, 1879, **79,** 112.
[4] Waterway to Mobile, Ala. Sur.—May 11, 1829; est., $37,500. (H. D. 482, 55th, 2d.)
[5] Canal to Mississippi River. Sur.—**R.,** Mar. 1, 1827; est., $974,304. (H. D. 482, 55th, 2d.)

In charge:
Capt. W. L. Fisk, 1890. **R., 91,** 1839.
Maj. J. B. Quinn, 1892–3. **R., 93,** 1842.
Maj. J. F. McIndoe, **08,** 431.
Lt. Col. L. H. Beach, 1910. **R., 10,** 1627.
Maj. H. Burgess, 1911. **R., 11,** 1772.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1990.

Assistants:
1st Lt. Wilbur Willing, **08,** 431.
Capt. R. R. Ralston, **10,** 489; **11,** 526.
1st Lt. R. P. Howell, jr., **11,** 526; (Capt.) **12,** 645.

OBSTRUCTIONS.

Lake Pontchartrain obstr. by old U. S. break'r near Milneburg, on its s. shore, and by partly submerged logs scattered over lake; Pass Manchac obstr. by sunken logs on bars at outlet, **10,** 527–28.

OPERATIONS.

1910-11. Snags, logs, stumps, and piling removed, **11,** 1772.

1911-12. Remaining break'r piles removed, and about 25 snags and overhanging trees, **12,** 1990.

PHYSICAL CHARACTERISTICS.

Description of locality of Harbor of Refuge: At entrance to canals running from the lake to New Orleans, the C. on which is affected at times by storms at the entrance, **93,** 1842.

Description of, **10,** 527.

L. in se. La., 23 x 40 m. and central depth of 16′ decreases regularly to about 6′ near shores. It is connected with L. Maurepas to w. by a chan. called Pass Manchac, 20–50′ x 800′ x 6½ m. (See Obstructions.)

PROJECTS.

Act June 25, 1910, au. removal of old U. S. breakw'r and dangerous deadheads from Lake Pontchartrain. and removal of sunken logs, etc., from bars at outlet of Pass Manchac; est., $18,000 and $750 an, mainten.,[1] **10,** 528.

SURVEYS.

Ex. at or near the old and new basins locality of Harbor of Refuge au. act July 13, 1892; made, 1892, by Maj. Quinn (**R.** fav.), **93,** 1842.

Ex. au. act Sept. 19, 1890, of shoals at Middle Ground; made by Capt. Fisk (**R.** unfav.), **91,** 1839.

Pre. ex. au. act Mar. 2, 1907, from West End to mouth of Bayou St. John and to Milneburg. **R.,** Maj. McIndoe, Dec. 19, 1907 (unfav.),[2] **08,** 449.

Pre. ex. au. act Mar. 2, 1907, from West End, Spanish Fort, Milneburg, to draw of N. O. & N. R.R.; also to Mandeville, Tangipahoa R. and Pass Manchac. **R.,** Maj. McIndoe, Dec. 20, 1907, and Jan. 25, 1908; est., $12,000,[1] **08,** 449.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 685.

S-10 BONFUCA BAYOU, ST. TAMMANY PARISH, LA.

COMMERCE.

Description of, **95,** 1783.

ENGINEERS.

Chief of Engineers. **R., 95,** 260.
In charge. Maj. J. B. Quinn, 1894–95. **R., 95,** 1783.

PHYSICAL CHARACTERISTICS.

Description of: Bayou flows into Lake Pontchartrain with a d. of about 20′ for a distance of nearly 15 m. from its mouth. **95,** 1783.

SURVEY.

Ex. au. act Aug. 17, 1894; made, 1895; Maj. Quinn's **R.** fav., **95,** 1783.

S-17 CASTAING (Chastaing) BAYOU, LA.[3]

ENGINEERS.

Chief of Engineers. **R., 12,** 687.
In charge:
Lt. Col. L. H. Beach, 1912. **12,** 645.
Maj. H. Burgess, 1912. **12,** 645.
Assistant. Capt. R. P. Howell, jr. **12,** 645.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come), **12,** 687.

S-20 CHEFUNCTE (Tchefuncte) RIVER AND BOGUE FALIA (Falaya), LA.

APPROPRIATIONS.

1872,	$6,000,	**73,** 65, 632.
1881,	[4] 1,500,	**81,** 1284.
1882,	1,500,	**82,** 1376.
1886,	[5] 2,500,	**86,** 454.
1890,	1,000,	**90,** 1738.
1892,	1,000,	**92,** 1483.
1894,	1,000,	**95,** 1743.
1896,	1,000,	**96,** 1487.
1899,	1,000,	**99,** 1834.
1902,	*3,000,	**02,** 1319.
1905,	*500,	**05,** 1460.
1907,	*8,000,	**07,** 1433.
1909,	*2,000,	**09,** 1472.
1910,	5,000 / [6] 5,000	**10,** 1616.
1912,	[7] 1,000,	**12,** 1976.

Total, [8] 41,000 (less trans. to Amite R. and Bayou Manchac, $39,805.99, **12,** 1976).

* Allotment.
[1] H. D. 881 and 882, 60th, 1st.
[2] H. D. 557, 60th, 1st.
[3] Sur.—H. of refuge. **R.** Feb. 27, 1880. Est. $3,140. H. D. 482, 55th, 2d.
[4] For Chefuncte R. only.
[5] Imp. Chefuncte R. and Bogue Falia, La.
[6] Trans., Apr. 30, 1910, from allotment for Amite R. and Bayou Manchac.
[7] Trans., June 15, 1912, from allotment for imp. Tickfaw R. and tributaries, La., **12,** 1976.
[8] $1,194.01 trans. to Amite R. and Bayou Manchac, **10,** 1616.

COMMERCE.

Local, **71,** 553; **88,** 1244; **95,** 1785.

Sec. of State Ry. Com. states Covington has reduced rates on account of navigation on R. increasing, **06,** 396; **12,** 666.

Statement C., 1901 to 1911, **12,** 666.

1911, 250,000 t., **12,** 1976.

CONTRACT.

1872. G. Andrews, removing wreck, $4,850, **73,** 633.

1881. W. Fagan, removing obstr., $100 per m., **82,** 1375.

1894. De Witt Dilworth, hire of dr. plant, $125 per day, **95,** 1743.

1902. Jahncke Navigation & Improvement Co., dr.; est., 15,000 c. y., at 17½¢ c. y., **03,** 1301.

1907. M. A. Sweeney Shipyard & Foundry Co., combined dr. and snag boat, at $37,400; supple. agreement, Oct. 24, 1908, with same contractor for certain changes, amounting to $1,750 addl., **09,** 1471, 1472.

1910. Jahncke Navigation Co., dr., 19½¢ c. y., **11,** 1758.

ENGINEERS.

Chief of Engineers. R., 71, 67; **72,** 61; **73,** 65, 632; **79,** 112; **80,** 145, 146; **81,** 193, 197; **82,** 189; **83,** 208; **84,** 211, 216; **85,** 216; **86,** 214; **87,** 179, 188; **88,** 167; **89,** 194, 202; **90,** 175; **91,** 222; **92,** 215; **93,** 239; **94,** 220; **95,** 245, 260; **96,** 215; **97,** 278; **98,** 270; **99,** 318; **00,** 361; **01,** 379; **02,** 312; **03,** 337; **04,** 355; **05,** 367; **06,** 395; **07,** 411; **08,** 433; **09,** 455; **10,** 508; **11,** 546; **12,** 664.

In charge:

Capt. C. W. Howell, 1871–82. **R., 71,** 552; **73,** 632; (Maj.), **80,** 1181; **81,** 1283.

Maj. A. Stickney, 1882–85. **R., 82,** 1375; **83,** 1109; **84,** 1268, 1283.

Maj. W. H. Heuer, 1885–87. **R., 85,** 1394; **86,** 1242; **87,** 1358.

Capt. W. L. Fisk, 1888–91. **R., 88,** 1243; **89,** 1482, 1529; **90,** 1737.

Maj. J. B. Quinn, 1891–99. **R., 91,** 1818; **92,** 1481; **93,** 1808; **94,** 1349; **95,** 1742, 1784; **96,** 1485; **97,** 1751; **98,** 1464; **99,** 1833.

Maj. H. M. Adams, 1900. **R., 00,** 2240.

Lt. E. M. Adams, 1901–02. **R., 01,** 1872.

Lt. Col. H. M. Adams, 1902–03. **R., 02,** 1318.

Capt. Chas. S. Bromwell, 1903. **R., 03,** 1301.

Lt. Col. H. M. Adams, 1904. **R., 04,** 1905.

Capt. J. F. McIndoe, 1905–08. **R., 05,** 1459; **06,** 1312; **07,** 1433; (Maj.) **08,** 1487.

Lt. Col. Lansing H. Beach, 1909–10. **R., 09,** 1471; **10,** 1615.

Maj. H. Burgess, 1911. **R., 11,** 1757.

Lt. Col. L. H. Beach, 1912–. **R., 12,** 1975.

Assistants:

Lt. E. A. Woodruff. **R., 71,** 552.

Mr. Ripley. **R., 73,** 633.

W. H. Hoffman. **R., 80,** 1181.

H. C. Collins. **R., 84,** 1269, 1284.

Lt. O. T. Crosby. **R., 85,** 1395; **86,** 1243; **87,** 1359.

OPERATIONS.

1872-73. Wreck of the *Oregon* removed, **73,** 65, 634.

1881-82. 4 m. of R. cleaned of obstr., **82,** 1376.

1886-87. Chans. through Bogue Falia, bet. Old Landing and Covington, d. **87,** 180.

1891-92. 161 snags and 102 logs removed from the chan., and 143 trees cleared from the banks, **92,** 1482.

1894-95. About 3,600 c. y. dr., **95,** 1743.

1899-00. Bar at mouth of the Chefuncte R., and several shoals, a wreck, and a number of logs and snags from Bogue Falia removed, **00,** 2240.

1900-01. 38 snags and logs removed by W. G. Coyle, of New Orleans, under his proposition to clear the chan. of all obstr. bet. mouth of Chefuncte R. and Old Landing on Bogue Falia, 16 m., **01,** 1872.

1902-03. 10,357 c. y. of material dr. from bar at mouth of Chefuncte R., **03,** 1302.

1907-08. Preparing plans and specifications for snag boat, **08,** 1487.

1908-09. Constr. of combined dr. and snag boat, **09,** 1471.

1909-10. Dr. constr. continued; mainten. by removal of snags and other obstr., **10,** 509, 1615.

1910-11. Chan. 17,000′ l. and 150′ w. at bottom dr. through bar, 30,113.20 c. y. removed; chan. 8′ l. w. dr. through shoal in Bogue Falia, for 4,400′ near Covington, 24,783 c. y. removed, **11,** 1757.

PHYSICAL CHARACTERISTICS.

R., of which Bogue Falia is a tributary, flows into Lake Pontchartrain, La., and is navigable up to Covington, about 12 m., **71,** 552; **73,** 633; **95,** 1785.

Chan. of 7′, Lake Pontchartrain to Covington, **12,** 666.

PLANS. (See Projects.)

By Lt. Woodruff, 1871, removing wrecks, snags, etc.; est., $16,800, **71,** 552.

By Capt. Howell, 1872, cut-off, Abita R. to Chefuncte R., $6,574, **73,** 633.

Maj. Stickney, imp. of Bogue Falia above Covington could not be made at any reasonable cost; below Covington it might be improved by cut-off; est., $1,856, **84,** 1283.

PROJECTS. (See Plans.)

The app. of $6,000 in 1872 was applied to the removal of the wreck of the gunboat *Oregon*, **73,** 65, 634.

By Maj. Howell, 1880, imp. Chefuncte R. by removing snags and similar obstr. from the mouth to Covington, and dr. bar at entrance to Lake Pontchartrain; est., $5,460, **80,** 1182.

By Maj. Stickney, 1884, chan. across the bar 7′x 100′ by dr., and 2,500 l. f. of break'r; est., $20,400, **84,** 270.

In 1889 Capt. Fisk reported the Chefuncte and Bogue Falia as unworthy of any imp. beyond the an. app. of $1,000 for snagging, **89,** 1530.

By Maj. Quinn, 1894, dr. through the bars below Covington to a d. of 6′ x 60′, **95,** 1742.

In 1893 Maj. Quinn est. $1,000 an. for mainten., **93,** 1808.

By Maj. Quinn, 1899, for a 6′ x 60′ chan. through bars at the mouth of the Chefuncte and in the Bogue Falia, **99,** 1834.

For mainten. by dr. a chan. 8′ x 60′ through bar at mouth of Chefuncte R., **02,** 1318.

Approv. May 10, 1905, provided for removal of snags, logs and overhanging trees which interfere with navigation bet. mouth of Chefuncte R. and Covington on the Bogue Falia, **05,** 1459.

By Maj. McIndoe, 1907, constr. of a combined dr. and snag boat; est., $5,000; and mainten. of chan. with same, **08,** 1487.

Orig. proj. modified, 1910, to provide for a chan. 7′ d. at extreme l. w. over the bar at mouth of the Chefuncte R., **10,** 509.

SURVEYS.

By Lt. Woodruff, under direction of Capt. Howell. **R., 71,** 551, 552.

By Mr. Ripley, 1872, under direction of Capt. Howell. **R., 73,** 632.

By Capt. Howell, **79,** 112.

Au. act Mar. 3, 1879; made, 1880, by Maj. Howell, **80,** 1181.

Of Bogue Falia au. act June 14, 1880, **80,** 146.

By Maj. Stickney, 1884. **R.** unfav. in part (see Plans), **84,** 1268, 1283.

Of Bogue Falia from landings to Covington, La., au. act Aug. 5, 1886, **87,** 188; **89,** 1529.

Ex. au. act Aug. 17, 1894; made by Maj. Quinn (**R.** fav.), **95,** 1784.

Of a portion of Bogue Falia and bar at mouth of Chefuncte R., **10,** 510.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 665.

S-23 ABITA RIVER, LA.

ENGINEERS.

Chief of Engineers. R., 12, 687.
In charge. Lt. Col. L. H. Beach, **12,** 645.

SURVEYS.

Ex. au. act June 25, 1910, Abita Springs to Bogue Falia, La.; Lt. Col. Beach reported May 16, 1911, not immediately advisable to imp.,[1] **12,** 687.

S-29 TANGIPAHOA RIVER, LA.

APPROPRIATIONS.

1872,	$2,500,	**73,** 65, 631.
1880,	5,000,	**80,** 1156.
1881,	2,000,	**81,** 1283.
1884,	2,000,	**84,** 1268.
Total,	11,500	

COMMERCE. (See Plans.)

1911, 34,333 logs, value $119,000, **04,** 1965.

CONTRACTS.

1872. O. D. Parmely, removing obstr., **73,** 631.
1880. C. P. Seymer, removing obstr., **81,** 1282.
1883. C. E. Cate, removing obstr., $235 per m., **83,** 1108.

ENGINEERS.

Chief of Engineers. R., 71, 67; **72,** 61; **73,** 64; **80,** 142; **81,** 193; **82,** 189; **83,** 207; **84,** 210; **85,** 215; **86,** 213; **87,** 180; **89,** 202; **04,** 366; **12,** 688.

In charge:

Capt. C. W. Howell, 1871–82. **R., 71,** 552; **73,** 631; **79,** 946; (Maj.) **80,** 1156; **81,** 1282.
Maj. A. Stickney, 1882–85. **R., 82,** 1374; **83,** 1107; **84,** 1266.
Maj. W. H. Heuer, 1885–87. **R., 85,** 1393; **86,** 1241; **87,** 1361.
Capt. W. L. Fisk, 1888–89. **R., 88,** 1245; **89,** 1527.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1963.
Maj. H. Burgess, **12,** 645.
Lt. Col. L. H. Beach, **12,** 645.

Assistants:

Lt. E. A. Woodruff. **R., 71,** 553.
H. S. Douglas. **R., 79,** 947.
H. C. Collins. **R., 84,** 1266.
F. F. Axtell. **R., 04,** 1964.

ESTIMATES. (See Plans and Projects.)

By Lt. Woodruff, 1871, removing obstr. below Wells's Ferry, $5,400, **71,** 554.
By Capt. Howell and H. S. Douglas, 1879, removing obstr., Amite to mouth, $10,700 to $10,000, resp., **79,** 946, 949.

OPERATIONS.

1872-73. Removing snags, overhanging trees, and other obstr., **73,** 64, 631.
1880-81. 6½ m. cleared of obstr., **81,** 1283.
1881-82. Imp. of R. under Seymer's contract completed, 34 m., **82,** 1374.
1882-83. Cate's contract commenced, **83,** 1108.
1883-84. Obstr. removed throughout 7¼ m., **84,** 1266.
1884-85. Cleaning R. continued with hired labor, **85,** 1393.

PHYSICAL CHARACTERISTICS.

Described, **71,** 553; **79,** 948; **89,** 1527.
Stream has w. of 75′–150′, but navigation is hindered by a bar in Lake Pontchartrain, the cost of removal of which would be in excess of value of C., which is of logs only, **04,** 1965.

PLANS. (See Estimates and Projects.)

By Lt. Woodruff, 1871, removing snags and other obstr. with snag boat and hired labor, **71,** 554.
By H. S. Douglas, 1879, removing obstr. and closure of isld. chutes, **79,** 947.
In 1888, imp. as purely local in its benefits, **88,** 1245.
By Capt. Fisk, 1889, removing snags and similar obstr., giving permanent l. w. d. of 3′; est., $5,000, **89,** 1527.

PROJECTS. (See Estimates and Plans.)

By Capt. Howell, 1872, removing snags and other obstr. by contract, **73,** 631.
By Maj. Howell, 1879, junction with Amite to mouth, 53 m., removing snags, logs, trees, and similar obstr.; est., $10,700, **79,** 946, 949; **86,** 1241; **88,** 1245.

SURVEYS.

By Lt. Woodruff, 1871, under direction of Capt. Howell, Wells's Ferry to mouth. **R., 71,** 551, 553.
By H. S. Douglas, 1879, under direction of Capt. Howell, Amite to mouth. **R., 79,** 946, 947.
Au. act Aug. 11, 1888; made, 1889, by Capt. Fisk, **89,** 1527.
Pre. ex. au. act June 13, 1902. **R.,** by Lt. Col. Adams, Aug. 6, 1902[2] (unfav.), **04,** 366, 1963. BERH. concurs, **04,** 1964.
Pre. ex. and sur. au. act Feb. 27, 1911, **12,** 688.

S-51 TICKFAW RIVER (and tributaries), LA.

APPROPRIATIONS.

1881,	$2,000.00,	**81,** 1285.
1882,	2,000.00,	**82,** 1377.
1886,	2,000.00,	**86,** 1245.
1888,	1,000.00,	**88,** 1246.
1890,	1,000.00,	**90,** 1740.
1892,	1,000.00,	**92,** 1485.
1894,	1,000.00,	**95,** 1746.
1896,	1,000.00,	**96,** 1489.
1899,	1,000.00,	**99,** 1836.
1902,	*1,000.00,	**02,** 1320.
1905,	*1,000.00,	**05,** 1461.
1907,	{*6,000.00 / [3]157.46}	**07,** 1435.
1909,	*§2,000.00,	**09,** 1474.
1910,	*3,000.00,	**10,** 1618.
Total,	[4]25,157.46 (less $1,000 trans., $24,157.46, **12,** 1977).	

COMMERCE.

Description of, **95,** 1787.
No point on these streams is reached by RR., and there is no competition in rates, **06,** 397.
Statement of receipts and shipments for 10 years, **12,** 668.
1911, 117,449 t., **12,** 668.

* Allotment.
[1] H. D. 428, 62d, 2d.
[2] H. D. 233, 58th, 2d.
[3] Trans. from allotment for Bogue Chitto, La.
[4] $1,000 trans. to Chefuncte R. and Bogue Falia, La.

CONTRACTS.

1881. W. Fagan, removal of obstr. for 16 m., $80 per m., **82,** 1377.
1896. J. Camors, hire of boat and crew for removal of aquatic plants from streams, $28 per day, **97,** 1755.
1899. G. T. Wibel & P. Usner, furnishing boat, labor, and material for snagging, $29.50 per day of 8 hours ($899.75), **99,** 1836.
1907. M. A. Sweeney Shipyard & Foundry Co., constr. of 1 wooden hull combined hydraulic dr. and snag boat, $37,400; modifications, $1,750, **09,** 1474.

ENGINEERS.

Chief of Engineers. R., 80, 145; **81,** 193; **82,** 190; **83,** 208; **84,** 211; **85,** 217; **86,** 215; **87,** 181; **88,** 167; **89,** 195, 202; **90,** 176; **91,** 222; **92,** 216; **93,** 240; **94,** 221; **95,** 246, 260; **96,** 216; **97,** 279; **98,** 270; **99,** 319; **00,** 362; **01,** 380; **02,** 312; **03,** 338; **04,** 355; **05,** 368; **06,** 396; **07,** 412; **08,** 435; **09,** 457; **10,** 511; **11,** 548; **12,** 667.

In charge:
Maj. C. W. Howell, 1879–81. **R., 80,** 1182.
Capt. W. H. Heuer, 1881–87. **R., 81,** 1284; (Maj.) **85,** 1396; **86,** 1244; **87,** 1362.
Maj. A. Stickney, 1882–85. **R., 82,** 1376; **83,** 1110; **84,** 1271.
Capt. W. L. Fisk, 1888–91. **R., 88,** 1246; **89,** 1483, 1530; **90,** 1739.
Maj. J. B. Quinn, 1891–99. **R., 91,** 1819; **92,** 1484; **93,** 1810; **94,** 1352; **95,** 1744, 1786; **96,** 1488; **97,** 1753; **98,** 1465; **99,** 1835.
Maj. H. M. Adams, 1900. **R., 00,** 2241; (Lt. Col.) **02,** 1319; **04,** 1906.
Lt. E. M. Adams, 1901. **R., 01,** 1873.
Capt. C. S. Bromwell, 1903. **R., 03,** 1303.
Capt. J. F. McIndoe, 1905–08. **R., 05,** 1461; **06,** 1313; **07,** 1434; (Maj.) **08,** 1489.
Lt. Col. L. H. Beach, 1909–10, and 1912–. **R., 09,** 1473; **10,** 1617; **12,** 1977.
Maj. H. Burgess, 1911. **R., 11,** 1759.

Assistants:
H. C. Collins. **R., 80,** 1183; **84,** 1271.
Lt. O. T. Crosby. **R., 87,** 1363.

OPERATIONS.

1881–82. 16 m. of R. cleared of obstr., **82,** 1377.
1883–84. 180 logs and snags and 791 trees removed, clearing 20 m. of R., **84,** 1271.
1886–87. Obstr. cleared from navigable tributaries, **87,** 1362.
1887–88. Snags and obstr. removed, **88,** 1246.
1888–89. Removal of obstr. with U. S. plant continued, **89,** 1483.
1891–92. 83 snags and 14 logs removed from the chan. and 103 trees cleared from the banks, **92,** 1484.
1892–93. About 300 snags and other obstr. removed, **93,** 1810.
1894–95. About 1,500 snags and other obstr. removed, **95,** 1745.
1896–97. Unavailing efforts made to clear the Rs. of hyacinths, **97,** 1754.
1899–00. Chan. cleared of obstr. for 13 m. from the mouth, and obstr. removed from mouth of the Natalbany, **00,** 2242.
1902–03. 74 obstr. removed; work retarded by water hyacinths, **03,** 1303.
1904–05. Obstr. removed, **05,** 1461.
1905–06. Dr. completed, **06,** 1314.
1908–09. Constr. of dr. underway, and three-quarters completed, **09,** 1473.
1910–11. 408 logs, snags and overhanging trees removed by U. S., **11,** 1759.
1911–12. U.S. snag boat completed operations in Natalbany and Tickfaw R s., **12,** 1976.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 1183; **95,** 1787.
R. flows into Lake Maurepas, La., and is navigable for 40 m. Principal tributary, the Natalbany, navigable for about 25 or 30 m., **95,** 1787.
Aquatic plants an obstr. to navigation, **97,** 1753

PLANS. (See Projects.)

After ex. in 1889 Capt. Fisk did not consider the stream worthy of imp. beyond that contemplated in existing proj., **89,** 1531.

PROJECTS. (See Plans.)

By Maj. Howell, 1880, imp. of Tickfaw R. from Van Buren Place to Natalbany and Ponchatoula R., 45 m., by removal of snags, logs, and similar obstr.; est., $10,230, **80,** 1184; **92,** 1484.
In 1893 Maj. Quinn est. $1,000 an. for mainten., **93,** 1811.
By Maj. Quinn in 1896–97, removal of aquatic plants from the streams, **97,** 1753.
By Maj. Quinn, 1899, subproj. for removing obstr. in the streams as far as funds would permit, **99,** 1835.

SURVEYS.

Sur. au. act Mar. 3, 1879; made, 1880, by Maj. Howell, **79,** 112; **80,** 1182.
Ex. au. act Aug. 17, 1894; made by Maj. Quinn in that year (**R.** fav.), **95,** 1786.

S-52 NATALBANY RIVER, LA.

ENGINEERS.

Chief of Engineers. R., 84, 216; **85,** 226.

In charge:
Maj. A. Stickney. **R., 84,** 1289.
Capt. T. Turtle. **R., 85,** 1446.

Assistants:
H. C. Collins. **R., 84,** 1290.
C. D. Anderson. **R., 85,** 1446.

PLANS.

By Maj. Stickney, 1884, removing obstr. from 10 m. of R. chan.; est., $1,800, **84,** 1290; **85,** 1446.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Stickney, **84,** 1289.

S-53 PONCHATOULA RIVER, LA.

ENGINEERS.

Chief of Engineers. R., 12, 688.
In charge. Lt. Col. L. H. Beach, **12,** 645

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come), **12,** 688.

S-62 (a) AMITE RIVER AND BAYOU MANCHAC, LA.[1]

APPROPRIATIONS.

1880, [2]$8,000.00, **80,** 1157.
1881, [2]5,000.00, **81,** 1280.
1886, [2]2,000.00, **86,** 1241.
1888, 5,000.00, **88,** 1248.
1890, 3,800.00, **90,** 1741.
1892, 2,500.00, **92,** 1486.
1894, 2,500.00, **95,** 1748.
1896, 2,500.00, **96,** 1492.
1899, 2,500.00, **99,** 1837.
1902, *2,500.00, **02,** 1321.
1903, [3]1,194.01, **03,** 1305.
1905, *5,000.00, **05,** 1463.
1907, 20,000.00, **07,** 1436.
1909, *1,000.00, **09,** 1476.
1910, 2,000.00, **10,** 1619.

Total, [4]65,494.01 ($60,494.01, **12,** 1979).

COMMERCE.

Dimensions of vessels on Mississippi Sound, **68,** 487.
Benefiting by imp. of the waterways, **95,** 1748.
Comparison of its value with the cost of the imp. effected, **96,** 1491.
Effect of imp. on freight unknown; no RRs. near, **10,** 515; **12,** 670.
Traffic for 10 years, **12,** 670; 41,000 t. 1912, **12,** 1979.

CONTRACTS.

1880. E. Glasscock, removing obstr., **81,** 1279; unsatisfactory progress of contract, **83,** 1103.
1894. De Witt Dilworth, hire of dr. plant, $125 per day, **95,** 1749.
1899. Dilworth-Schudder Dredging Co., dr. $50 per day of 8 hours ($4,500), **99,** 1838.
1902. Jahncke Navigation & Improvement Co., dr., 17½¢ c. y., **03,** 1305.
1905. Jahncke Navigation & Improvement Co., dr., 18,000 c. y. at 25¢, **06,** 1315.
1908. M. A. Sweeney Shipyard & Foundry Co., combined dr. and snag boat, $37,400, **08,** 1491; changes in dr. and snag boat, $1,750, **09,** 1476.
1909. See also **R.** for mouth and passes of Calcasieu R., La., **10,** 1613.
1910. Drackett & Terrebonne, repairs and alterations, US. dr. *Delatour*, **11,** 1762.
1912. Allen Jones (lease) launch *Winola*, $25 per month, **12,** 1979.

ENGINEERS.

Chief of Engineers. R., 68, 55, 486; **79,** 112; **80,** 143, 145, 146; **81,** 192, 197; **82,** 188, 194; **83,** 206; **84,** 210; **85,** 215; **86,** 213; **87,** 181; **88,** 168; **89,** 196, 202; **90,** 177; **91,** 223; **92,** 217; **93,** 241; **94,** 222; **95,** 247; **96,** 216; **97,** 280; **98,** 271; **99,** 320; **00,** 363; **01,** 381; **02,** 313; **03,** 338; **04,** 356; **05,** 369; **06,** 398; **07,** 413; **08,** 436; **09,** 458; **10,** 513; **11,** 550; **12,** 669.

In charge:
Maj. D. D. McAlester, 1868. **R., 68,** 474, 486.
Maj. C. W. Howell, 1879–81. **R., 80,** 1156, 1185; **81,** 1279.
Maj. A. Stickney, 1881–84. **R., 82,** 1372, 1414; **83,** 1103; **84,** 1263.
Capt. T. Turtle, 1884.
Maj. W. H. Heuer, 1885–87. **R., 85,** 1391; **86,** 1239; **87,** 1364.
Capt. W. L. Fisk, 1888–91. **R., 88,** 1247; **89,** 1484, 1513, 1528; **90,** 1740.
Maj. J. B. Quinn, 1891–99. **R., 91,** 1820; **92,** 1485; **93,** 1812; **94,** 1354; **95,** 1747; **96,** 1490; **97,** 1756; **98,** 1467; **99,** 1837.
Maj. H. M. Adams, 1900. **R., 00,** 2243.
Lt. E. M. Adams, 1901. **R., 01,** 1875.
Lt. Col. H. M. Adams, 1902. **R., 02,** 1321.
Capt. C. S. Bromwell, 1903. **R., 03,** 1305.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1907.
Capt. J. F. McIndoe, 1905–08. **R., 05,** 1462; **06,** 1314; **07,** 1435; (Maj.) **08,** 1490.
Lt. Col. L. H. Beach, 1909–10. **R., 09,** 1475; **10,** 1618.
Maj. H. Burgess, 1911. **R., 11,** 1761.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1978.

Assistants:
Lt. J. K. Hezlep, **68,** 486. **R., 68,** 493.
H. S. Douglas. **R., 80,** 1185.
J. C. Buchanan. **R., 82,** 1415.
Capt. D. W. Lockwood. **R., 83,** 1104.
H. C. Collins. **R., 84,** 1264.

OPERATIONS.[5]

1881-82. Obstr. removed from 6½ m. of R., **82,** 1372.
1882-83. Obstr. removed from 36 m. of R., **83,** 1104.
1883-84. Operations by hired labor; 8 m. of R. cleared, **84,** 1264; **85,** 1392.
1888-89. 846 trees and stumps removed, **89,** 1485.
1890-91. Snagging resumed, **91,** 1821.
1891-92. 445 snags, logs, and trees cleared, **92,** 1486.
1892-93. About 200 obstr. removed, **93,** 1812.
1894-95. 4,080 c. y. dr. to form a turning basin, and about 5,000 obstr. removed, **95,** 1748.
1899-00. Sand bars at the mouths of Amite R. and Bayou Manchac removed, shoal places in Bayou Manchac, near Hope Villa, La., dr., and obstr. in Amite R. for 6 m. above Bayou Manchac, and in Bayou Manchac removed, **00,** 2244.
1902-03. 20,648 c. y. dr., bar at mouth of Amite R., **03,** 1305.
1905-06. 14,500 c. y. dr., mouth of Manchac Bayou, and 3,278 c. y. from mouth of Amite R., **06,** 1315.
1907-08. Constr. of combined dr. and snag boat, **08,** 1490.
1909-10. New dr. and snag boat completed, **10,** 1618. 408 logs, snags, and trees removed, **10,** 1619.
1910-11. Snag boat *Pearl* removed 67 logs, snags, and overhanging trees from 5 m. of stream, **11,** 1761.
1911-12. Snag boat *Pearl* removed 4,166 snags and other obstr., **12,** 1978.

PHYSICAL CHARACTERISTICS.

Flood height near New Orleans, **68,** 487, 489, 492; **80,** 1186.
Details, **10,** 513; **11,** 550, 551; **12,** 669, 670.

PLANS.

Maj. McAlester, 1868, continuous chan., l. w. d. of 7′ bet. Mississippi R. and Lake Pontchartrain, via Bayou Manchac, Amite R., Lake Maurepas and Pass Manchac; by canal from Mississippi to head of Crocodile Bayou, thence by R. and lake navigation for 75 m.; est., $3,800,444; considered the least fav. route bet. Mississippi R. and Lake Pontchartrain, **68,** 492, 496. Alternative canal from Mississippi R. near Carrollton to a point near Metaire, thence via the "new canal" to Lake Pontchartrain, 7 m., est., $785,939, **68,** 492, 493, 496.

PRIVATE (STATE) WORK.

$75,000 expend. by State of Louisiana in clearing R. of obstr., **80,** 1187.

PROJECTS.

By Maj. Howell, 1879, imp. of R., Bayou Manchac to Lake Maurepas, giving l. w. d. of 5′ by removal

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* Allotment.
[1] Amite R. and Bayou Manchac, La. Sur.—**R.,** Dec. 17, 1842; est., $6,000 and $13,000. (H. D. 482, 55th, 2d.)
[2] Amite R.
[3] Trans. from allotment for Chefuncte R. and Bogue Falia, La.
[4] $5,000 of this amount trans., 1910, to Chefuncte R. and Bogue Falia, La., **10,** 1619.
[5] Advantage of work done by hired labor, **85,** 1392.

of snags and logs; est., $23,760, **80,** 1157. Imp. not considered permanent, **83,** 1105; **84,** 210.

By Maj. Stickney, 1882, removal of obstr. from lower part of Bayou Manchac, from its junction with the Amite R. to Lake Maurepas, thence to Bobbins; est., $3,450, **82,** 1415.

After ex., 1889, Capt. Fisk reported R. unworthy of imp. for more than 5 m. above mouth of Bayou Manchac; est. for snagging and dr., $5,000, **89,** 1529. Permanent imp. not looked for, **91,** 1821.

Dr. turning basin, 10½ m. above Manchac mouth, au. 1892, **12,** 669.

An. expend. of $2,500 required to maintain R. and bayou navigable, **92,** 1486.

In 1893 Maj. Quinn est. it would cost $2,500 an. for mainten., **93,** 1813.

Engr. property pertaining to the work of imp. sold at auction, 1896, **96,** 1491.

By Maj. Quinn, 1899, subproj. for removing obstr. in Amite R. and Bayou Manchac gathering since 1895, **99,** 1837.

By Col. Adams, 1902, expend. balance, dr. chan. 8′ x 50′ through bar at mouth, **02,** 1321.

By Capt. McIndoe, for dr., mouth of Bayou Manchac, and bar at mouth of Amite R., **05,** 1462.

For constr. of combined dr. and snag boat, **07,** 414.

Proj. completed, 1912; mainten. only required; max. draft, 6½′.

SURVEYS.

By H. S. Douglas, **80,** 1185.

Manchac Bayou and Pass. Au. act June 14, 1880, **80,** 146. **R.,** Maj. Howell, 1881, **82,** 1415.

Ex. Bayou Manchac for water route, Mississippi R. to Mississippi Sound au. act Aug. 11, 1888, made, 1888. **R.,** Capt. Fisk, **89,** 1513.

Ex. Amite R. au. act Aug. 11, 1888. **R.,** Capt. Fisk, **89,** 1528.

Pre. ex. au. act Mar. 2, 1907, of Pass Manchac, bet. Lake Maurepas and Lake Pontchartrain. **R.,** Maj. McIndoe, Dec. 19, 1907, and Jan. 25, 1908; est. $6,000,[1] **08,** 449.

Ex. and sur., mouth of Bayou Manchac to a point w. of Liberty, in Amite Co., Miss., au. act June 25, 910, **12,** 687.

S-134 ST. JOHN BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 202.
In charge. Capt. W. L. Fisk. **R.,** **89,** 1500.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Fisk (**R.** unfav.), **89,** 1500.

S-135 CARONDELET CANAL, LA.

APPROPRIATION.

1809, $25,000.

For deepening, to allow passage of gunboats from Lake Pontchartrain, by way of the Bay on St. John to the city of New Orleans, and, by an extension of the canal, to the Mississippi R., if, after sur., the work be found practicable. Cost to complete the canal est., 1827, at $974,304 (Treas. Doc. 373, 1882). This sur. was probably not made under the direction of the War Dept. (H. D. 482, 55th Cong. 2d, p. 2.)

S-278 BUFFALO RIVER, MISS.

ENGINEERS.

Chief of Engineers. **R.,** **85,** 225.
In charge. Capt. T. Turtle. **R.,** **85,** 1430.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Turtle (**R.** unfav.), **85,** 1430.

S-282 HOMOCHITTO RIVER, MISS.

APPROPRIATIONS.

1899,	$16,000,	**99,** 1863.
1902,	2,000,	**02,** 1318.
1905,	2,000,	**05,** 1458.
1907,	4,000,	**07,** 1432.
Total,	24,000	

COMMERCE.

Description of, **93,** 1840; **97,** 1778.

3,815 t. an., 1899, **00,** 2281.

1903, 500,000′ ± lumber and 1,600 t. ± merchandise transported, **03,** 336.

CONTRACTS.

1899. J. H. Gardner, hire of snagging plant, $62.30 per day of 8 hours ($13,986.35), **00,** 2281.

1908. M. A. Sweeney Shipyard & Foundry Co., combined dr. and snag boat, $37,400, **08,** 1486. M. A. Sweeney Shipyard & Foundry Co., changes in dr. and snag boat under constr., $1,750, **09,** 1482.

ENGINEERS.

Chief of Engineers. **R.,** **85,** 225; **93,** 251; **97,** 291; **98,** 281; **99,** 337; **00,** 382; **01,** 401; **02,** 310; **03,** 335; **04,** 353; **05,** 365; **06,** 392; **07,** 409; **08,** 432, 449; **09,** 464; **10,** 520.

In charge:

Capt. T. Turtle. **R.,** **85,** 1429.

Maj. J. B. Quinn, 1893–99. **R.,** **93,** 1839; **97,** 1777; **98,** 1489; **99,** 1862.

Maj. H. M. Adams, 1900. **R.,** **00,** 2280.

Lt. E. M. Adams, 1901. **R.,** **01,** 1914.

Lt. Col. H. M. Adams, 1902. **R.,** **02,** 1317.

Capt. C. S. Bromwell, 1903. **R.,** **03,** 1299.

Lt. Col. H. M. Adams, 1904. **R.,** **04,** 1904.

Capt. J. F. McIndoe, 1905–08. **R.,** **05,** 1457; **06,** 1311; **07,** 1431; (Maj.) **08,** 1485.

Lt. Col. L. H. Beach, 1909–10. **R.,** **09,** 1481; **10,** 1623.

Assistants:

C. D. Anderson. **R.,** **85,** 1429.

J. L. Brownlee. **R.,** **93,** 1840; **97,** 1778.

OPERATIONS.

1899–00. 5,688 obstr. removed, **00,** 2280.

1900–01. 446 snags removed, 5 log jams broken up, and 7,300 trees felled, **01,** 1914.

1902–03. 727 obstr. removed from chan. and 499 trees felled, **03,** 1300.

[1] H. D. 882, 60th, 1st.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1840; **97,** 1778; **10,** 520.
Bars, snags, etc., obstr., **93,** 1840; **97,** 1778.
Obstr. forming in R. recently imp., **02,** 1317.

PROJECTS.

By Maj. Quinn, 1898, dr. obstr. mouth to the Yazoo & Miss. Valley RR., 60 m., for boats drawing 6'; est., $16,000, **98,** 1489; **99,** 1862.

Au. Apr. 3, 1907, for constr. of combined dr. and snag boat, **08,** 1487.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Turtle (**R.** unfav.), **85,** 1429.

Ex., mouth to Louisville, New Orleans & Texas RR. br., au. act July 13, 1892; made by Maj. Quinn (fav. **R.** by Maj. Quinn, imp. not advised by D. E. and C. E.), 1892, **93,** 1839.

Ex., mouth to Yazoo & Miss. Valley RR., au. act June 3, 1896; made, 1897, by Maj. Quinn (**R.** fav.), **97,** 1777.

Congress called for plan and est. of cost of imp. **R.,** mouth to Yazoo & Miss. RR.; submitted by Maj. Quinn, 1898, **98,** 1489.

Minor, **02,** 1317.

Ex., mouth to Yazoo & Miss. Valley RR., au. act Mar. 2, 1907; made, 1908, by Capt. McIndoe (**R.** unfav.),[1] **08,** 449.

S-298 PLAQUEMINE BAYOU, LA.

Part.	Title.	Period.	Appropriations.
a	Plaquemine Bayou, Grand R. Bayou, and Pigeon Bayous, La	1880–1912	$1,970,000.00
b	Plaquemine Bayou—mouth	1893–1894	(2)
c	Plaquemine Lock, operating and care	1910–1912	56,917.34
	Total		2,026,917.34

Part(a), S 298 Plaquemine Bayou, Grand River, and Pigeon Bayous, La.

APPROPRIATIONS.

1888,	$100,000,	**89,** 1490.
1890,	100,000,	**90,** 1747.
1892,	[3] 150,000,	**92,** 1493.
1894,	[3] 110,000,	**95,** 1759.
1896,	[3] 20,000,	**96,** 1500.
1897,	350,000,	**97,** 1761.
1899,	400,000,	**99,** 1845.
1900,	200,000,	**00,** 2254.
1901,	210,000,	**01,** 1892.
1905,	35,000,	**05,** 1448.
1906,	100,000,	**06,** 1308.
1907	100,000 *10,000 *10,000	**07,** 1426.
1907,	*15,000,	**08,** 1496.
1909,	50,000,	**09,** 1464.
1910,	10,000,	**10,** 1606.

Total, 1,970,000 (incl. $53.54, misc., and less $169.13 returned to Treas., $1,969,884.41, **12,** 1962).

COMMERCE.

Est. future importance when imp. would be completed, **93,** 1820; **96,** 1499.

Rates reduced by opening of Grand R. and Pigeon Bayous route, **94,** 1362.

Increasing in extent and importance, due to imp. effected, **95,** 1758.

From Jan. 1 to Dec. 31, 1900, C. 111,750 t., **00,** 2253.

Decrease in 1906 due to non-operation of oil plant, **07,** 407.

In 1911, 801,419 t., **12,** 1963.

"Comparative statement of receipts and shipments for 10 years.

Calendar years.	Short tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1902	292,000	9,000	
1903	302,500	10,500	
1904	318,000	15,500	

"Comparative statement of receipts and shipments for 10 years—Continued.

Calendar years.	Short tons.	Change in tonnage from previous year.	
		Increase	Decrease.
1905	706,000	388,000	
1906	572,000		134,000
1907	534,744		37,256
1908	553,916	19,172	
1909	937,950	384,034	
1910	742,716		195,234
1911	801,419	58,703	

"As this improvement forms a through water route from Bayou Teche to the Mississippi River, the effect on freight rates is given in the report of that improvement." **12,** 654.

"Bayou Teche, La.—Comparative statement of receipts and shipments for 10 years.

Calendar year.	Short tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1902	404,454	68,871	
1903	450,542	46,088	
1904	362,706		87,836
1905	701,243	338,537	
1906	706,091	4,848	
1907	580,216		125,875
1908	515,679		64,537
1909	999,125	483,446	
1910	857,804		141,321
1911	810,459		47,345

"There is no evidence as yet of any effect on freight rates, but since the opening of the Plaquemine Lock a boat line has been established between Teche points and New Orleans, with rates considerably lower than corresponding railroad rates." **12,** 657.

* Allotment.
[1] H. D. 692, 60th, 1st.
[2] Included in Part (a).
[3] Of which sum $10,000 may be applied to imp. Pigeon Bayou and Grand River.

CONTRACTS.

1895. E. A. Burris, cofferdam, excavating and piling of foundation for lock, $93,250, **95,** 1759. Suppl. contracts, in 1896, etc., **98,** 1471.

1896. H. P. Dillworth, hire of dr. plant, $37.90 per day, **97,** 1761.

1898. Stewart & Co., lock and approaches, $501,757.60, **98,** 1473; annulled, **03,** 1289.

1899. C. Clarke & Co., excavating for impr. Bayou Plaquemine, 13.98¢ c. y. ($143,645.76), **99,** 1846. J. H. Gardner & Co., dr. and crew, $46.49 per day of 8 hours. Otis Elevator Co., machinery and power house for lock, $114,000, **00,** 2254, 2255.

1901. John Short, bank protection; mattress, 57¢ s. y.; and st., $2.58 t., **01,** 1893.

1902. John Short, constr. earth protection levee, 27¢ c. y.; Chas. Clarke & Co., dr., 20¢ c. y., **02,** 1338.

1904. Penn Bridge Co., constr. lock gates; unit prices given; est. cost, $142,028.34, **04,** 1899. C. Clarke & Co., redr., 13.98¢ c. y., **05,** 1449.

1905. C. Clarke & Co., modification of contract of 1899, **05,** 1449. McGee & Co., constr. levee, and filling behind lock walls, 59¢ c. y.; W. O. Burton & Co., excavating and constr. lock approaches, prices given, **05,** 1449.

1906. W. O. Burton & Co., excavation and constr. of R. approach and back fill, unit prices given; C. Clarke & Co., dr., 13.98¢ c. y., **07,** 1427.

1908. A. Baldwin & Co., steel, $2.09 per 100 lbs.; turnbuckles, $2.54 each; W. O. Burton & Co., earth back fill behind lock and wing walls, 95¢ c. y., **08,** 1497. W. O. Burton & Co., constr. 2 pile clusters, $350; excavating for approach, $1.05 c. y.; agreement to annul contract for L. approach, $10,000, **09,** 1465. Variety Iron & Steel Works Co., furn. anchorages for lock gates, 6¢ per lb., **09,** 1465.

1911. Cumberland Telephone & Telegraph Co., rent of telephone, $3.75 per mo., **12,** 1963.

ENGINEERS.

Chief of Engineers. **R., 80,** 146; **81,** 197; **82,** 194; **87,** 188, 1405; **88,** 169; **89,** 198, 203; **90,** 178, 182; **91,** 225, 231; **92,** 218, 223; **93,** 243; **94,** 224; **95,** 249; **96,** 218; **97,** 282; **98,** 272; **99,** 325; **00,** 369; **01,** 387; **02,** 319; **03,** 332; **04,** 350; **05,** 361; **06,** 388; **07,** 404; **08,** 437; **09,** 445; **10,** 496; **11,** 533; **12,** 651.

Boards:

Board convened, New Orleans, July 17, 1891, by S. O. No. 41, to ex. and **R.** upon Maj. Quinn's proj. for lock at the mouth of the bayou. **R., 92,** 1496, 1498. (Col. Craighill and Majs. Mackenzie and Quinn.)

Board constituted by S. O. No. 10, to consider certain questions relative to Plaquemine Lock. Recom. that work be resumed and completed according to orig. plans and contracts; also that sheathing plates be put on gates and 4 embankments built back of wing walls and filled between, under new or suppl. contract, **02,** 1334.

Board constituted by S. O. No. 20, to ex. and **R.** upon certain matters connected with imp., met at New Orleans, May 22, visited work on May 23, and submitted **R.** May 24, 1907, **07,** 407.

Board constituted by S. O. No. 20, reconvened by S. O. No. 51, recom. that back fill behind lock and wing walls be put in as quickly as possible, that during filling back walls should be tied at top with strong rods and turnbuckles, and that after completion of fill lower lock gates should be caulked, lock filled with water, allowed to stand at least a month, emptied and gates readjusted, **08,** 1492.

In charge:

Maj. A. Stickney, 1882–85. **R., 82,** 1416; **85,** 2973.

Capt. T. Turtle, 1885–86. **R., 85,** 1431.

Maj. W. H. Heuer, 1887. **R., 87,** 1406, 1407.

Capt. W. L. Fisk, 1888–91. **R., 89,** 1490; **90,** 1746.

Capt. D. C. Kingman, 1889–91. **R., 89,** 1533; **90,** 1761.

Lt. J. Millis, 1891–92. **R., 91,** 1867; **92,** 1517.

Maj. J. B. Quinn, 1891–99. **R., 91,** 1824; **92,** 1491, 1493; **93,** 1818; **94,** 1361; **95,** 1754; **96,** 1496; **97,** 1759; **98,** 1471; **99,** 1844.

Maj. H. M. Adams, 1900 and 1902–04. **R., 00,** 2251; (Lt. Col.) **02,** 1334; **03,** 1289; **04,** 1895.

Lt. E. M. Adams, 1901. **R., 01,** 1890.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1446; **06,** 1304.

Col. E. H. Ruffner, 1907. **R., 07,** 1419.

Maj. J. F. McIndoe, 1908. **R., 08,** 1492.

Lt. Col. L. H. Beach, 1909–10, and 1912. **R., 09** 1460; **10,** 1605; **12,** 1961.

Maj. H. Burgess, 1911. **R., 11,** 1746.

Assistants:

A. O. Wilson. **R., 85,** 2984.

Lt. O. T. Crosby. **R., 87,** 1407.

W. G. Price. **R., 90,** 1765.

J. I. Conklin. **R., 00,** 2256; **01,** 1894; **02,** 1338; **03,** 1293; **04,** 1900; **05,** 1450.

LEGAL PROCEEDINGS.

Condemnation proceedings for land for site and approaches of lock, **93,** 1819; **94,** 1363.

Land for approach to lock purchased, **02,** 1335.

OPERATIONS.

1888–89. 9,284 c. y. dr., **89,** 1490.

1889–90. 115,127 c. y. mud and 689 snags and logs removed; constr. of submerged spur dikes begun, **90,** 1747, 1764.

1890–91. Dr. continued in the bayou, **91,** 1825.

1891–92. 19,716 c. y. dr. and 170 logs and stumps cleared from the chan., **92,** 1492.

1892–93. Dr. boat raised from where it had sunk, and repaired; 13,826 c. y. dr. and over 6,000 obstr. removed, **93,** 1818, 1819.

1893–94. About 88,000 c. y. dr., about 4,000 obstr. and 4½ m. of raft removed, **94,** 1362.

1894–95. About 32,500 c. y. dr., about 600 obstr. removed, and preparations made for constr. of lock, **95,** 1756, 1757.

1895–96. 83,000 c. y. excavated in the constr. of lock cofferdam, **96,** 1498.

1896–97. 38,635 c. y. dr., and about 1,700 obstr. removed; extra work performed on lock cofferdam, etc., on account of h.-w. damages, **97,** 1760.

1897–98. About 28,000 c. y. dr., and about 500 obstr. removed; constr. of lock begun, **98,** 1471, 1472.

1898–99. Constr. of Plaquemine Lock in progress, **99,** 1844.

1899–00. 233,600 c. y. dr. from Plaquemine Bayou; 2,165 obstr. removed from Grand R. and Pigeon Bayous; banks of the Mississippi R. above Dike No. 1 repaired, and constr. of Plaquemine Lock in progress, **00,** 2252, 2253.

1900–01. Walls of Plaquemine Lock completed, **01,** 1890. 98,530 c. y. dr. from Bayou Plaquemine; bars, drifts, snags, etc., removed from Bayous Pigeon and Posteo, **01,** 1891.

1901–02. 38,400 c. y. dr. from Bayou Plaquemine, **02,** 1335. Banks protected near Plaquemine Lock, **02,** 1336.

1902–03. 282,122 c. y. dr. from chan. through Flat Lake and Bay Natchez, and chan. marked with 82 piles, **03,** 1290. Protection levee at lock completed, **03,** 1290–95.

1903–04. Pumping plant installed at Plaquemine Lock; 8,600 c. y. dr. from Bayou Plaquemine; 87,076 c. y. dr. from chan. through Flat Lake and Bay Natchez, **04,** 1897.

1904–05. Lock walls completed and work commenced on constr. and erection of gates and constr. of power house and installation of machinery; 16,200 c. y. earth placed in protection of levee and fill; dike built in preparation for excavation of approaches, **05,** 1446, 1447. 111,900 c. y. dr. from Bayou Plaquemine; also temporary chan. dr. up to dike, **05,** 1447.

1905–06. Lock floor partly removed on account of settlement of wall; lock gates completed; power house and operating machinery nearly completed, **06,** 1305. 17,700 c. y. earth placed in levee and fill; 35,870 c. y. excavated and 1,672 piles driven in constr. of approaches, **06,** 1306. Work hindered by yellow-fever epidemic, **06,** 1305–06.

1906-07. Power house and operating machinery, and protection levee and fill completed, **07,** 1419, 1423. 49,850 c. y. excavated, 1,351 piles driven, and 7,910 c. y. concrete placed in constr. of approaches, **07,** 1420, 1423, 1424.

1907-08. 24,203 c. y. placed in back fill, gate fitted and lock filled with water for test, **08,** 1493. 28,077 c. y. excavated and placed behind lock walls, 1,941 piles driven, and 4,588 c. y. concrete placed in constr. of approaches, **08,** 1494.

1908-09. Final work done preparatory to opening lock, **09,** 1460. 24,411 c. y. excavated from R. approach, **09,** 1462. 13,830 c. y. dr. from Bayou Plaquemine, **09,** 1462.

1909-10. 30,055 c. y. dr., 2 pile clusters built, and old cofferdam and wrecked barge removed at lock approaches; 309,795 c. y. dr. from Bayou Plaquemine; 1,200 c. y. dr. and 439 obstr. removed from Grand R., **10,** 1605.

1910-11. 428,600 c. y. dr. from Bayou Plaquemine; 4 snags and 17,828 c. y. removed from Flat Lake; 72 snags, and fallen and overhanging trees removed from Bay Natchez, **11,** 1746.

1911-12. 64,163 c. y. dr. from Bayou Plaquemine by contract, and 1,300[1] of chan. dr. by U. S. plant; US. dr. operated between Plaquemine and Flat Lake, removing 4,250 trees, etc., and 25,721 c. y. dr., **12,** 1961.

PHYSICAL CHARACTERISTICS.

Description of bayou, **82,** 1417; **93,** 1818.

Character of bed of bayou, **87,** 1411.

H. w. a cause of damage to works for constr. of lock, **97,** 1760, and made necessary a complete revision of the plans for constr. the lock, **98,** 1472.

The peculiar character of the soil caused, in 1897, the sheet piling surmounting the foundation of the lock to overturn, **98,** 1472.

Record of settlement of lock walls, **07,** 1422; **08,** 1493.

PLANS.

In 1884 Capt. Turtle did not consider Plaquemine Bayou worthy of imp., **85,** 1431.

In 1885 Maj. Stickney considered the imp. of the Plaquemine route via Atchafalaya and Red Rs. feasible; est., $1,708,250, **85,** 2973, 2984; **87,** 1406, 1412.

In 1887 Lt. Crosby est. cost of a lock to connect Plaquemine Bayou with the Mississippi R. at $250,000, **87,** 1407, 1412.

PRIVATE WORK.

Description of work done before commencement of imp. by the U. S., and results, **93,** 1818.

PROJECTS.

By Maj. Stickney, 1885, connecting Plaquemine Bayou with the Mississippi R., via the Atchafalaya and Red Rs., by removing snags, dr., and constr. of a lock at the mouth of the bayou; est., $1,708,250, **85,** 2973, 2984; **87,** 1406, 1412.

By Capt. Kingman, 1889, to prevent further caving at the mouth of the bayou by the constr. of 4 timber and st. spur dikes; est. included in the cost of Maj. Stickney's proj., **90,** 1762.

Details of constr. of lock at the mouth of the bayou as proposed by Maj. Quinn and altered by the BE., **92,** 1494, 1498.

Act July 13, 1892, au. Grand R. and Pigeon Bayous, forming a portion of Plaquemine Bayou, should be imp., **93,** 1819.

By Maj. Quinn, 1894, expend. the app. of that year and the remainder of the old app. for continuing dr., constr. a cofferdam and foundation for proposed lock, and for removing obstr. in Grand R. and Pigeon Bayous, **95,** 1755.

By Maj. Quinn, 1899, completing continuous contract for constr. lock and approaches, $501,757.60; imp. Grand R., La., $25,000; enlarging bed of Plaquemine Bayou, La., from RR. br. to d. w. below Dardennes Bend, for a l.-w. chan. 125′ w. and 10′ d., $222,012.40, and for purchasing a narrow strip of land at Dardennes Bend, in connection with imp. the bayou, $1,230, **99,** 1844.

By Lt. Adams, 1900, chan. 10′ x 60′, Pigeon Bayou to Atchafalaya R. near Morgan City through Bay Natchez, Bayou Long and Flat Lake; est., $52,000, **01,** 1891.

Lt. Col. Adams recom., 1903, further protection to banks at lock at est. cost of $35,000, **03,** 1290.

Lt. Col. Adams, 1904, recom. protection of bank above lock at est. cost of $80,000, **04,** 1898.

SURVEYS.

Au. act June 14, 1880; made by Maj. Stickney, **82,** 1416.

Of mouth of bayou, with a view to connecting with the Mississippi R. by locks.

Also of the bayou and other connecting streams to form the best route to Grand Lake. Au. act Aug. 5, 1886; made by Maj. Heuer (see Projects), **87,** 1405.

Ex. of Big and Little Pigeon Bayous made by Maj. Quinn, 1893, **93,** 1819.

Minor surs. made, 1900, **00,** 2253.

Of Bay Natchez and Flat Lake, from Palfrey Place to mouth of Bayou Godell, **01,** 1891.

Of Plaquemine Lock and R. approach, **10,** 1605.

Maps. **90,** 1766; **92,** atlas, **78**; **00,** 2258.

Part (b), S-298 Plaquemine Bayou, La. (Securing against caving at the mouth of.)

APPROPRIATIONS.[1]

1889–92,	$134,000, **94,** 1386.
1893,	72,000, **94,** 1386.
Total,	206,000

ENGINEERS.

Chief of Engineers. **R., 93,** 252; **94,** 232.

In charge. Capt. J. Millis, 1891–94. **R., 93,** 1857; **94,** 1385.

Assistant. Wm. Garvin. **R., 94,** 1386.

OPERATIONS.

1893-94. Revetment laid which, with the spur dikes, formed a continuous protection 1,400′ below the site of the lock, and 1,200′ above, with an average w. of 400′, **94,** 1386.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1857.

Extensive caving, **94,** 1386.

PROJECTS.

By Capt. Millis, 1893, deferring transfer of the work to Maj. Quinn until needed repairs and strengthening had been accomplished, using mattresses and rock paving for that purpose, **93,** 1858, 1859.

In 1893–94, for constr. continuous revetment between the dikes constr., instead of following the preceding constr. plan; est., $72,000, in addition to the funds on hand, **94,** 1386.

SURVEYS.

Maps. **94,** 1386.

[1] Allotments from app. for Plaquemine, Grand R., and Pigeon Bayous, La.

Part (c), S-298 Plaquemine Lock, La. (Operating and care.)

APPROPRIATIONS.[1]

1910, $18,739.28, **10,** 1609.
1911, 23,471.31, **11,** 1751.
1912, 14,706.75, **12,** 1964.

Total, 56,917.34

COMMERCE.

In 1911, 126,989 t., **12,** 655.

ENGINEERS.

Chief of Engineers. R., 10, 499; **11,** 536; **12,** 654.

In charge:
Lt. Col. L. H. Beach, 1910–12. **R., 10,** 1608; **12,** 1964.
Maj. H. Burgess, 1911. **R., 11,** 1749.

OPERATIONS.

1909-10. 10,000 c. y. dr. from R. approach; electric-light plant installed; explosion of gasoline, **10,** 1608.

1910-12. Organization of force, operation and care of lock, repairs to machinery, etc., and care of grounds and bldgs., **11,** 1749; **12,** 1964.

PHYSICAL CHARACTERISTICS.

Difference of levels for each month of fiscal years 1910, 1911, and 1912, between Plaquemine and Mississippi Rs., **10,** 1609; **11,** 1750; **12,** 1965.
Description of lock, **10,** 499.

S-339 BARATARIA BAY, LA., GRAND PASS TO NEW ORLEANS.

COMMERCE.

Description, **81,** 1313.

ENGINEERS.

Chief of Engineers. R., 80, 146; **81,** 197.
In charge. Maj. C. W. Howell, 1880–81. **R., 81,** 1307.

Assistant. H. S. Douglas. **R., 81,** 1308.

PLANS.

By Maj. Howell, 1881, 5′ navigation, New Orleans to Barataria B., by removal of obstr. and dr., est. cost for route No. 1, $78,486.87, No. 2, $108,158.32, **81,** 1314.

PRIVATE (CORPORATE) WORK.

3 private canals on routes used by C., **81,** 1308, 1313; rate of tolls charged, **81,** 1314.

SURVEYS.

By Capt. G. W. Hughes, **81,** 1307.
By H. S. Douglas, 1880, from New Orleans to Grand Pass, via Harveys Canal (opp. New Orleans), Bayou Barataria, Bayou Rigolets, to Little Lake, though Little Lake, down Bayou St. Denis to Barataria Bay, **81,** 1307, 1308.

S-354 LITTLE LAKE, LA.

ENGINEERS.

Chief of Engineers. R., 80, 146; **81,** 197.
In charge. Maj. C. W. Howell. **R., 81,** 1307.
Assistant. H. S. Douglas. **R., 81,** 1308.

PLANS.

By Maj. Howell, 1881, chan. 50′ x 5′, New Orleans to Barataria.
Route 1. Clearing obstr. from Bayou Barataria and dr. chan. at Pointe le Garde and at head and mouth of Bayou St. Denis; est., $78,486, **81,** 1314.
Route 2. Clearing Bayous Barataria and Dupont, cutting canals at Bayou Dupont, and connecting Bayous Dupont and Cutler; est., $108,158, **81,** 1314.

SURVEY.

Au. act June 14, 1880; made, 1881, by Maj. Howell, **81,** 1307.

S-384 CHEVREUIL BAYOU AND BAYOU TIGRE, LA.

ENGINEERS.

Chief of Engineers. R., 91, 229.
In charge. Capt. W. L. Fisk, 1891. **R., 91,** 1841.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1841.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Fisk (**R.** unfav.), **91,** 1841.

S-409 ANDRÉ BAYOU, LA.

ENGINEERS.

Chief of Engineers. R., 80, 146; **81,** 197.
In charge. Maj. C. W. Howell. **R., 81,** 1305.
Assistant. H. S. Douglas. **R., 81,** 1306.

SURVEY.

Au. act June 14, 1880, **80,** 146. Ex. by Maj. Howell (**R.** unfav. to immediate imp.), **81,** 1306.

[1] Exp. from indef appro., R. and H. act July 5, 1884, as amended by sec. 6, act Mar. 3, 1909.

S-419 LAFOURCHE BAYOU, LA.[1]

APPROPRIATIONS.

1852,	$2,500 (sur.), act Aug. 30.	
1878,	10,000,	**78,** 85.
1879,	10,000,	**79,** 107.
1880,	[2] 5,000,	**80,** 1162.
1884,	5,000,	**84,** 1281.
1888,	50,000,	**88,** 1249.
1890,	50,000,	**90,** 1745.
1892,	50,000,	**92,** 1489.
1894,	40,000,	**95,** 1752.
1896,	25,000,	**96,** 1494.
1899,	7,500,	**99,** 1842.
1902,	7,500,	**02,** 1333.
1910,	7,500,	**10,** 1624.
Total,	270,000 (less app. of 1852, and incl. misc., $265,585.17, **12,** 1985).	

COMMERCE.

C. importance of the bayou, **74,** 766, 768; of country adjacent, **74,** 768; **74,** 769.
List of obstr., **74,** 767.
Importance of imp., **80,** 1161; **84,** 1281.
Interests affected, **86,** 1269, 1274; **87,** 1366.
Increase in vessels following imp., **88,** 1249.
Probable reduction of rates if slack-water navigation were adopted, **88,** 1249.
Description of; in 1894–95 most of it was carried in flatboats, but when steamboats were able to run through the rates were much lower, **95,** 1751.
C. greatly benefited by imp., **97,** 1758.
1902, 133,000±t.; 1906, 60,000±t.; 1909, 70,000±t.; 1911, 116,000±t. Effect on rates not known, **12,** 679.
C. can reach Miss. R. by 2 toll canals, **12,** 679.

CONTRACTS.

1888. J. H. Gardner, dr., 43¢ c. y., **89,** 1487.
1895. E. A. Burris, furnishing dr., $64 per day, **95,** 1752.
1896. H. Camors, furnishing dr., $49 per day, **96,** 1495.
1897. F. Beck, furnishing dr. to work 16 hours each day with 2 crews, $64.50 per 8 hours, **98,** 1470.
1899. J. K. Burriss, hire of dr., $78 per day ($8,592), **00,** 2250.
1900. J. J. Keegan, hire of dr., $65 per day, **00,** 2250; dr., prices given, **01, 1888.**
1901. J. J. Keegan, dr. and removing obstr., $65 per day of 16 hours, **01,** 1889.
1903. J. J. Keegan, dr., $68 per day, **03,** 1288.
1912. Gustave Gashett, hire of launch, $4.75 per day; J. D. Scarbrough, hire of house boat, $2 per day, **12,** 1985.

ENGINEERS.

Chief of Engineers. **R., 73,** 66; **74,** 74; **78,** 84; **79,** 107; **80,** 144; **81,** 196; **82,** 192; **83,** 211; **84,** 214, 216; **85,** 221; **86,** 219; **87,** 182, 188; **88,** 168; **89,** 196, 202; **90,** 177; **91,** 224; **92,** 217; **93,** 242; **94,** 223; **95,** 248; **96,** 217; **97,** 281; **98,** 272; **99,** 323; **00,** 367; **01,** 386; **02,** 318; **03,** 330, 641; **04,** 349, 709; **05,** 359; **06,** 388; **07,** 403, 830; **08,** 428; **09,** 465; **10,** 522; **11,** 558; **12,** 677, 687.

In charge:
Maj. C. W. Howell, 1873–81. **R., 74,** 765; **78,** 613; **79,** 901; **80,** 1161; **81,** 1299.
Maj. A. Stickney, 1881–84. **R., 82,** 1384; **83,** 1126; **84,** 1280, 1291.
Capt. T. Turtle, 1884–85. **R., 85,** 1408.
Maj. W. H. Heuer, 1885–87. **R., 85,** 1408; **86,** 1266; **87,** 1365.
Capt. W. L. Fisk, 1888–91. **R., 88,** 1248; **89,** 1485, 1531; **90,** 1742.
Maj. J. B. Quinn, 1891–99. **R., 91,** 1821; **92,** 1487; **93,** 1814; **94,** 1356; **95,** 1750; **96,** 1493; **97,** 1757; **98,** 1468; **99,** 1842.
Maj. H. M. Adams, 1900. **R., 00,** 2249.
Lt. E. M. Adams, 1901. **R., 01,** 1887.
Lt. Col. H. M. Adams, 1902–04. **R., 02,** 1332; **03,** 1286; **04,** 1894.
Lt. Col. C. B. Sears, 1904–06. **R., 05,** 1444; **06,** 1304.
Col. E. H. Ruffner, 1907–08. **R., 07,** 1418; **08,** 1479.
Maj. J. F. McIndoe, **08,** 421.
Lt. Col. L. H. Beach, 1908–11. **R., 09,** 1482; **10,** 1624.
Maj. H. Burgess, 1911. **R., 11,** 1767.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1984.

Assistants:
R. B. Talfor. **R., 74,** 766.
H. Stewart. **R., 84,** 1292.
Lt. O. T. Crosby, **85,** 1408. **R., 86,** 1267.
Lt. E. M. Adams, **01,** 379.
Lt. P. S. Bond, **02,** 310; **03,** 324.
1st Lt. W. Willing, **09,** 439.
1st Lt. R. R. Ralston, **09,** 439; **10,** 489; **11,** 526.
1st Lt. R. P. Howell, jr., **11,** 526 (Capt.) **12,** 645.

ESTIMATES. (See Plans and Projects.)

By R. B. Talfor, dr. and removal of snags, stumps, and wrecks, $100,100, **74,** 767.

OBSTRUCTIONS.

Navigation complaints about obstr., **08,** 1479; (see Sur., 1912).

OPERATIONS.

1878–79. Wrecking-flat built; 169 obstr. removed from the chan., **79,** 901.
1879–80. 827 snags, stumps, and logs, and 10 wrecks removed by hired labor, **80,** 1161.
1880–81. 771 snags, stumps, and logs removed by hired labor, **81,** 1299.
1881–82. 1,283 obstr. removed by hired labor, **82,** 1384.
1882–83. 487 obstr. removed by hired labor, **83,** 1126.
1884–85. Removal of obstr. by hired labor, **85,** 1408.
1885–86. Completion of sur. ordered in 1882, **86,** 1266.
1888–89. Dr. and removal of obstr. resumed, **89,** 1487.
1889–90. 37,944 c. y. dr.; snags, and flat and steamboat wrecks removed from the chan., **90,** 1743.
1890–91. Dr. by hired labor, **91,** 1822.
1891–92. 95,984 c. y. dr.; 78 stumps and 10 wrecks removed from the chan., **92,** 1488.
1892–93. In connection with preceding year, about 117,000 c. y. dr., and about 600 obstr. and 29 wrecks removed, **93,** 1815.
1893–94. About 86,000 c. y. dr., some obstr. and 6 wrecks removed, **94,** 1357.
1894–95. About 117,000 c. y. dr., 500 obstr. removed, and 16 wrecks also removed, **95,** 1751.
1895–96. 164,000 c. y. dr., about 800 obstr. and 4 wrecks removed, **96,** 1494.
1896–97. About 135,000 c. y. dr. and some obstr. removed, **97,** 1758.
1897–98. 106,000 c. y. dr. and some obstr. removed, most of the work being done by contract, but some by U. S. dr., **98,** 1469.
1898–99. 126,005 c. y. dr. and 199 obstr., including the wrecks of several coal barges, removed, **99,** 1842.
1899–00. Bars, wrecks, and other obstr. bet. Donaldsonville, La., and a point 8 m. below removed, **00,** 2249.
1900–01. 93,319 c. y. dr. (mainten.); snags and wrecks removed, **01,** 1888.
1901–02. 66,919 c. y. dr. under contract (mainten.); snags and wrecks removed, **02,** 1332.
1902–03. 49,380 c. y. dr. (mainten.); snags and obstr. removed, **03,** 1287.
1911–12. 9 abandoned barges, 1 old boiler, and 23 snags removed, **12,** 1984.

[1] Ex.—**R.** (unfav.) Oct. 8, 1845. Sur.—**R.** Feb. 12, 1853; est., $31,500. (H. D. 482, 55th, 2d.)
[2] $500 to be applied to removal of p. at Donaldsonville, **81,** 387.

PHYSICAL CHARACTERISTICS.

Causes of crevasses, **74,** 767.
Continued raising of levees necessary, **74,** 767, 769.
Action of floods in bayous, **86,** 1271.
High-water slopes, **86,** 1272.
Sediment, **86,** 1273.
Description of, **93,** 1814; **95,** 1751.
During 8 months in the year, when the Mississippi is high, the bayou is navigable by the largest SS., but during extreme l. w. navigation is entirely suspended, even for flatboats drawing over 2′, **93,** 1814.
Subject to shoaling, which makes dr. slow and unsatisfactory, **93,** 1814; **94,** 1357; **95,** 1751.
Prior to 1902, B. L. an outlet of Miss. R., head of Donaldsonville, 80 m. above New Orleans; in 1902 au. to close it granted. (See Private work.) From Miss. to mouth in Gulf of Mexico, 107 m.; w. 75′–150′, **12,** 677.

PLANS. (See Estimates and Projects.)

By R. B. Talfor, dr. and removal of snags, stumps, and wrecks, to give a 3′ chan. from Parrs Canal to Donaldsonville, **74,** 767. For the constr. of a lock at the head of the bayou, and converting it into a tidewater canal, **74,** 768.
By Maj. Howell. 1. Constr. of lock and dam at head of bayou. 2. See Proj., **74,** 769. Comparison of different plans, **74,** 769, 770.

PRIVATE WORK.

Sec. of War grants permission, under au. act June 13, 1900, for constr. of dam by the Atchafalaya Basin and Lafourche Basin levee boards, of La. to close bayou head with a dam for 2 yrs. 6 mos pending construct. of a lock there by the levee boards, **12,** 678; at their expense, **03,** 641; **04,** 709; **07,** 830; **09,** 1483.
Time extended twice, to Jan. 1, 1910; lock plans approv., but because of cost, new lock plans made to come under resources of boards, **12,** 678.

PROJECTS. (See Estimates and Plans.)

By Maj. Howell, 1879, relief of flood gorge by removing stumps and snags Thibodaux to Parrs Canal; est., $10,000, **74,** 769, 770. For dr. Upper Bayou to 4′, **79,** 901; **81,** 196.
By Capt. Turtle, 1884, continuation of the proj. of 1879 from the point where work was suspended, 1883.
In 1889 operations were continued under Maj. Heuer's proj. of 1886 for the imp. of Bayou Lafourche by lock at Donaldsonville to connect with the Mississippi R., converting the bayou into a salt-water canal, with dr. in the bayou to form a chan. 5′ x 75′; est., $450,000, with an. mainten. of $8,000, **86,** 1267, 1274, 1275; **87,** 1366; **92,** 1488.
By Maj. Quinn, 1896, modifying proj. of 1886 for lock, etc., to provide for holding that proj. in suspension and for restricting operations to mainten. by dr.; est., $25,000 an., **97,** 1758.
By Maj. Quinn, 1899, subproj. to expend the app. of 1899 to maintain l.-w. navigation, with dr., **99,** 1842.
Proj. further modified, 1900, to permit expend. remaining money on dr. to maintain flatboat navigation during l. w., **00,** 2249.
At 1912, proj. held to be mainten. of 5′ x 75′ chan. at l. w. and lock constr. of levee boards, **12,** 678.
See Private work.

SURVEYS.

By R. B. Talfor, 1873–74. **R., 74,** 766.
Au. act Aug. 2, 1882, **84,** 216; made by Capt. Stickney, 1883, **84,** 1291. Line of levels incomplete, **84,** 1292; completed, **86,** 1266, 1268.
Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Fisk, **89,** 1531.
Sur. to locate drainage ditches and to place responsibility for obstrs., **12,** 679.
Ex. and sur. au. act Feb. 27, 1911, for 20′ at mouth, **12,** 687.
Maps. **86,** 1268.

S-445 TERREBONNE BAYOU, LA.

APPROPRIATIONS.

1880,	$10,000,	**80,** 1158.
1881,[1]	8,800,	**81,** 1299.
1882,	7,000,	**82,** 1384.
1886,	10,000,	**86,** 1265.
1888,	3,000,	**88,** 1251.
1905,	10,000	**10,** 1627.
1910,	25,000	
Total,	73,800 (less $1,736.17 reverted to Treas., $72,063.83, **12,** 1988).	

COMMERCE.

Advantages to C. from imp., **84,** 1280; **85,** 1408.
Amount of C. benefited, **85,** 1407.
Unimportant, **93,** 1846.

CONTRACTS.

H. A. Peeler, constr. of dr. hull, $5,649, **82,** 1383.

ENGINEERS.

Chief of Engineers. **R., 80,** 143, 145; **81,** 195; **82,** 192; **83,** 210; **84,** 214; **85,** 221; **86,** 219; **87,** 182; **88,** 169; **89,** 197, 202; **90,** 178; **91,** 224, 229; **92,** 218; **93,** 243, 251; **94,** 223; **95,** 249; **09,** 469; **10,** 525; **11,** 562; **12,** 682.

In charge:
Maj. C. W. Howell, 1879–81. **R., 80,** 1158, 1179; **81,** 1297.
Maj. A. Stickney, 1881–84. **R., 82,** 1382; **83,** 1125; **84,** 1279.
Capt. T. Turtle, 1884–85, **85,** 1407.
Maj. W. H. Heuer, 1885–87. **R., 85,** 1407; **86,** 1264; **87,** 1367, 1396.
Capt. W. L. Fisk, 1888–92. **R., 88,** 1250; **89,** 1488, 1508; **90,** 1745; **91,** 1843.
Maj. J. B. Quinn, 1891–92. **R., 91,** 1823; **92,** 1490; **93,** 1817, 1845; **94,** 1360; **95,** 1753.
Col. E. H. Ruffner, **09,** 439.
Lt. Col. L. H. Beach, 1910, and 1912–. **R., 10,** 1626; **12,** 1987.
Maj. H. Burgess, 1911. **R., 11,** 1769.

Assistants:
W. H. Hoffman. **R., 80,** 1179.
Lt. O. T. Crosby. **R., 87,** 1396; **91,** 1844.
P. H. Thomson. **R., 93,** 1846.

OPERATIONS.

1880–81. 7½ m. of chan. below Houma d. by hired labor and use of hired dr., **81,** 1298.
1881–82. 8½ m. of chan. 38′ to 40′ w. and 4′ d. obtained by hired labor and use of hired dr.; constr. of dr. hull by contract, **82,** 1382.
1882–83. 4 m. of chan. 6′ x 40′ obtained by hired labor and use of U. S. dr., **83,** 1125.
1886–87. 164,165 c. y. dr. by U. S. dr., **87,** 1367.
1909–10. 5 piling, 126 large trees, and a number of smaller obstr. removed, and attempt made to remove mass of obstr. grass, cane, etc., **10,** 1626.
1910–11. Removal of trees and restoration of chan. depths in progress, **11,** 1769.

PHYSICAL CHARACTERISTICS.

Bayou 11′ w. at upper end of imp., **81,** 1298.
Description of, **93,** 1817.
Permanent imp. doubtful on account of the formation of shoals from the silt that finds its way into the bayou, **93,** 1817.

[1] Dr. hull built in 1881 from joint app. of Bayous Terrebonne and Black, **82,** 1382.

Description of. District examined, 1892, possessing value only as a part of, and as a connecting link in system of tidewater canals from Mississippi to Berwick B. and beyond, **93,** 1846.

Comparative distances, New Orleans to Berwick B., **93,** 1847.

Bayou greatly obstr. by trees, logs, etc., due to severe storm in 1909, **10,** 526.

PROJECTS.

By Maj. Howell, 1879, l. w. chan. 4′ d., Houma to a point about 20 m. below, by removal of overhanging trees from the right bank and the dr. of shoal areas; est., $18,800, **80,** 1158, 1179, 1180. Increased for dr., $15,000, **81,** 1298. Increased for dr., $5,000, **82,** 1383; **87,** 1367. Work not considered permanent, **80,** 1158; **82,** 1383; **87,** 1368.

In 1887 the proj. for imp. of bayou completed; cost, $35,000—$3,000 within the est., **90,** 1745; **92,** 1490.

Act June 25, 1910, au. chan. 6′ d. from Houma to d. w.; est., $50,000[1] (see Surveys, 1907), **10,** 526.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 112; **80,** 145. Ex. made by Maj. Howell 1879, **80,** 1179.

From Houma to Thibodeaux, au. act Aug. 5, 1886; made by Maj. Heuer (**R.** unfav.), **87,** 1396.

Ex. of the bayou above Houma au. act Aug. 11, 1888; made, 1889, by Capt. Fisk (**R.** unfav.), **89,** 1508.

Ex. of bayou from Houma to Thibodeaux au. act Sept. 19, 1890; made, 1890, by Capt. Fisk (**R.** unfav.), **91,** 1843.

Ex. with view to opening shorter and safer inland waterway, Mississippi Valley, via Berwick B., to Texas and Mexico, au. act July 13, 1892; made, 1892, by Maj. Quinn (**R.** unfav.), **93,** 1845.

Pre. ex. au. act Mar. 2, 1907, with view to securing 6′. **R.** by Col. Ruffner, July 13 and Nov. 29f 1907; est., $50,000, provided any needed land be deeded to U. S. free,[1] **09,** 469.

Maps.[1]

S-455 LITTLE CAILLOU BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 146; **81,** 197; **82,** 193.

In charge. Maj. A. Stickney. **R.,** **82,** 1412.

Assistant. H. S. Douglas. **R.,** **82,** 1413.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1413.

PLANS.

By Maj. Stickney, 1882, w. dr. chan. from Boudreaux's Canal to 24 m. above that point, for a further distance of 4 m., 4′ x 30′, together with removing of obstr.; est., $7,392, **82,** 1414.

SURVEY.

Au. act June 14, 1880, **80,** 146; made by Maj. Stickney, 1882, **82,** 1412.

S-466 GRAND CAILLOU BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 146; **81,** 197; **82,** 193.

In charge. Maj. A. Stickney. **R.,** **82,** 1410.

Assistant. H. S. Douglas. **R.,** **82,** 1411.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1411.

PLANS.

By Maj. Stickney, 1882, chan. 4′ x 30′, junction of Bayou Pelton to Woodlawn plantation, 5 m., and removing trees and other obstr. to junction of Bayou du Lac; est., $10,208, **82,** 1412.

SURVEYS.

Au. act June 14, 1880, **80,** 146; made by Maj. Stickney, 1882, **82,** 1410.

S-490 (a) ATCHAFALAYA BAY AND RIVER, LA.

APPROPRIATIONS.

1910, $540,000, **10,** 1627.

COMMERCE.

Important, **71,** 68, 557; **74,** 74, 775, 776.

Tributary to the imp., **85,** 1432, 1434, 1439.

Large falling off attributed to shortage of crops, **00,** 2284.

Traffic, 1911, 58,630 t., **12,** 1990. Opening of chan. caused substantial reduction in rates, **12,** 684.

CONTRACTS.

1910. Atchafalaya Bay Ship Channel Co., constr. chan., $500,000, and maintaining chan. for 3 years, $30,000, **11,** 1771.

ENGINEERS.

Chief of Engineers. **R.,** **71,** 67; **73,** 66; **74,** 74; **80,** 146; **81,** 197; **82,** 193; **84,** 216; **85,** 226; **89,** 202; **97,** 291; **00,** 383; **10,** 527, 529; **11,** 563; **12,** 683.

In charge:

Capt. C. W. Howell, 1870–82; **71,** 67; **73,** 66; **74,** 74. **R.,** **71,** 554; **74,** 771; (Maj.) **82,** 1394.

Maj. A. Stickney, 1882–85. **R.,** **82,** 1393; **84,** 1285.

Capt. T. Turtle, 1885. **R.,** **85,** 1436.

Maj. W. H. Heuer, 1885. **R.,** **85,** 1432.

Capt. W. L. Fisk. **R.,** **89,** 1510.

Maj. J. B. Quinn, 1897–1900. **R.,** **97,** 1779; **00,** 2283.

Maj. H. M. Adams, 1900. **R.,** **00,** 2284.

Lt. Col. L. H. Beach, 1910. **R.,** **10,** 1627.

Maj. H. Burgess, 1911. **R.,** **11,** 1771.

Lt. Col. L. H. Beach, 1912–. **12,** 1989.

Assistants:

G. Dyes, **71,** 67. **R.,** **71,** 555.

F. P. Leavenworth. **R.,** **74,** 771.

Lt. O. T. Crosby. **R.,** **85,** 1436.

J. L. Brownlee. **R.,** **97,** 1780.

P. H. Thomson. **R.,** **00,** 2286.

Capt. R. R. Ralston, **10,** 526.

1st Lt. R. P. Howell, jr., **10,** 526.

[1] H. D. 1163, 60th, 2d.

ESTIMATES.

By G. Dyes, chan. 12′ x 100′, $104,800; 12′ x 150′ $122,300; 12′ x 200′, $140,300, **71,** 554.

By Capt. Howell, removing obstr. to Courtableau Bayou, $14,000, **74,** 776.

OPERATIONS.

1910-11. 49,300 l. f. of chan. completed, 5,184,323 c. y. of material having been removed, incl. that previously dr. in the 14′ chan., **11,** 1771.

1911-12. 34,850 l. f. chan. completed, 1,309,183 c. y. material having been removed, incl. that previously dr. in 14′ chan., **12,** 1989.

PHYSICAL CHARACTERISTICS.

Description of, **74,** 771, 772, 773; **82,** 1395; **97,** 1780; **00,** 2286; **10,** 527.

Table of distances, etc., **74,** 771, 772.

Chan., beginning about 3 m. outside of the R. mouth and extending through the B. to d. w. in the Gulf, about 12½ m.; average w., 100′; ds., 7′ and 10′; the latter, for one-fifth of the distance, created before 1896 by Morgan Steamship Co., **97,** 1780.

Winds and tides, **00,** 2286.

Max. dr. increased from 7′ to 20′ at l. w. to Morgan City.

PLANS.

1874. Of F. P. Leavenworth, to remove snags trees, etc., chan. to mouth of the Courtableau, 60 m., **74,** 775, 776.

PRIVATE (CORPORATE AND STATE) WORK.

R. formerly cleared of logs by La., **82,** 1396.

Morgan's Steamship Co. excavated, 1870–74, a 12′ chan. from d. w. in Atchafalaya R. to the 12′ contour in the Gulf of Mexico, **71,** 68, 554; **00,** 2286.

Two different chans., 12′ and 14′, dr. through A. Bay by private parties; first has deteriorated, **12,** 683.

PROJECTS.

In 1882 Maj. Stickney reported the imp. so intimately connected with the Mississippi that no recom. could be made until the Mississippi R. Commission should act, **82,** 1410. Concurred in, 1885, by Maj. Heuer, **85,** 1435.

In 1884 Capt. Turtle submitted an est. of $20,000 for provisional work, **85,** 1433.

Maj. Adams est., 1900, $1,939,399.08 to make the desired imp., **00,** 2285.

By Lt. Col. Beach, 1910, chan. 200′ x 20′, mouth of R. to Gulf of Mexico; est., $530,000, incl. mainten. for 3 yrs., and $10,000 for inspection and superintendence by the U. S.,[1] **10,** 527, 529.

SURVEYS.

By G. Dyes, 1870, **71,** 67, 555.

Ordered from mouth of Red R. down the Atchafalaya to Brashear, 1873, **73,** 66; completed by F. P. Leavenworth, 1874, **74,** 74, 771.

Under direction of Maj. Howell, R. from Berwick B. to mouth of Red R., 1880, **82,** 1394.

By Capt. Turtle, 1885, R. from Berwicks B. to Red R. (**R.** fav.), **85,** 1432.

Ex. of R. au. act Aug. 11, 1888; made, 1888, by Capt. Fisk (**R.** unfav.), **89,** 1510.

Ex. to ascertain the nature and character of the chan. through the B. and its value to the U. S., au. act June 3, 1896; made, 1897, by Maj. Quinn (**R.** unfav.), **97,** 1779.

Ex. and sur. of Atchafalaya B. from the mouth of Atchafalaya R. to d. w. in the Gulf of Mexico with a view to chan. 12′ d. m. l. w., 200′ w., with an est. of cost, au. act Mar. 3, 1899; ex., 1899, by Maj. Quinn (**R.** fav.); sur., 1900, by Maj. Adams (**R.** unfav.; see Projects), **00,** 2283, 2284.

R. by BERH., Sept. 8, 1908, requested by R. and H. Comm. to review sur. of 1900 (see pp. 2283, 2284, A. R., 1900) and report any change in physical conditions. Atchafalaya Bay Ship Channel Co. has constr. a chan. 14′ x 125′, and offers to enlarge to 20′ x 200′ if U. S. will reimburse theiro rig. expend. of $150,000. New proposed chan. 20′ x 200′ will cost $500,000, with mainten. at $10,000 per an. for not to exceed 3 years.[2]

Ex., Morgan City to Gulf of Mexico, au. act Mar. 3, 1909; made, 1909; by Lt. Col. Beach's **Rs.** dated 1909 and 1910; est., $530,000[1] (see Projects), **10,** 529.

Maps. **12,** 1989.

S-499 BLACK BAYOU, LA.[3]

APPROPRIATIONS.

1881,	$10,000,	**81,** 1289.
1882,	10,000,	**82,** 1380.
1884,	5,000,	**84,** 1277.
Total,	25,000	

COMMERCE.

Local, **85,** 1402; **86,** 1262; **87,** 1370.

ENGINEERS.

Chief of Engineers. R., 80, 146; **81,** 195, 197; **82,** 191; **83,** 209; **84,** 213; **85,** 219; **86,** 217; **87,** 183; **91,** 229.

In charge:

Maj. C. W. Howell, 1880–81. **R., 81,** 1288.

Maj. A. Stickney, 1881–84. **R., 82,** 1379; **83,** 1120; **84,** 1276.

Capt. T. Turtle, 1884–85. **R., 85,** 219.

Maj. W. H. Heuer, 1885–87. **R., 85,** 1400; **86,** 1261; **87,** 1368.

Capt. W. L. Fisk, 1888–91. **R., 88,** 1251; **91,** 1846, 1850.

Assistant. H. S. Douglas. **R., 81,** 1289.

OPERATIONS. (All operations by hired labor.)

1881-82. Dr. hull built from joint apps. of Black and Terrebonne Bayous, **82,** 1380; **83,** 209.

1882-83. 21,000 c. y. removed by US. dr.; 161 logs and 2 wrecks removed, **83,** 1120.

1883-84. 158,403 c. y. material, 755 logs, and 3 wrecks removed by U. S. dr., **84,** 1276.

1884-85. Dr. by U. S. dr., **85,** 1401.

1885-86. Repair of U. S. dr., **86,** 1263.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 1401; **88,** 1251.

PROJECTS.

By Maj. Howell, 1881, for cleaning the bayou of obstr. and dr. a chan. 59′ w. and 6′ d. from Bayou Cane to Tigerville, 24 m.; est. cost, $47,520, **81,** 1288, 1292.

Increased in 1885 to $81,000, **85,** 1402; **87,** 1369.

In 1887 Maj. Heuer considered the imp. of the bayou local in its benefits, **87,** 1370.

SURVEYS.

Au. act June 14, 1880, **80,** 146; made by Maj. Howell, 1881, **81,** 1288.

Ex. of Black Bayou to connect with Terrebonne Bayou au. act Sept. 19, 1890; made, 1890, by Capt. Fisk (**R.** unfav.), **91,** 1846.

[1] H. D. 669, 61st, 2d.

[2] R. and H. Comm. Doc, 17, 61st, 2d.

[3] This is distinct from Black R., La., which, being formed by junction of Ouachita, Tensas, and Little Rs at Trinity, La., enters Red R. near the latter's mouth.

S-502 BERWICK BAY, LA.

ENGINEERS.
Chief of Engineers. **R., 91,** 229, 1847.
In charge. Capt. W. L. Fisk. **R., 91,** 1848.

SURVEY.
Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Fisk (**R.** unfav.), **91,** 1848.

S-524 GROSSETETE BAYOU, LA.

APPROPRIATIONS.
1912, $18,000, **12,** 1990.

COMMERCE.
Description of, **97,** 1781.
No C. at present other than the handling of logs or timber by small craft at h. w., **04,** 1925.

ENGINEERS:
Chief of Engineers. **R., 97,** 292; **04,** 365; **12,** 686, 687.

Boards. BERH. concurs in Lt. Col. Adams's opinion on undesirability of imp., **04,** 1925–26.

In charge:
Maj. J. B. Quinn, 1896–97. **R., 97,** 1781.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1924.
Lt. Col. L. H. Beach, 1912. **R., 12,** 1990.

Assistants:
P. H. Thomson. **R., 97,** 1782.
J. I. Conklin. **R., 04,** 1927.
Capt. R. P. Howell, jr., **12,** 645.

OBSTRUCTIONS.
4 bridges obstructed navigation, 1896, **97,** 1782.

PHYSICAL CHARACTERISTICS.
Description of; a fine stream, 80′ to 100′ w., with an average d. of 10′ at l. t., 1896, **97,** 1782.
Navigable for 30 m. from junction with Bayou Plaquemine to Livonia, parish of Pointe Coupee, **04,** 1925.
One of the most important waterways of the Atchafalaya Basin, lying between that stream and Miss. R. Extends sse. to Bayou Plaquemine, which it enters 7± m. from Miss. R., after a course of 40± m., **12,** 686.

PROJECT.
Au. act July 25, 1912, for removing snags and trees, and dr. chan. 5′ x 60′, mouth to above Melville; est., $18,000, and $500 an. mainten.,[1] **12,** 686.

SURVEYS.
Ex. au. act June 3, 1896; made, 1896, by Maj. Quinn (**R.** fav.), **97,** 1781.
Pre. ex. au. act June 13, 1902. **R.,** Lt. Col. Adams, Sept. 20, 1902 (unfav.),[2] **04,** 365, 1925.
Pre. ex. au. act June 25, 1910, source to Bayou Plaquemine. **Rs.,** Lt. Col. Beach, May 17 and Oct. 10, 1911[1] (see Projects), **12,** 687.

S-563 BAYOU BOEUF, LA.

COMMERCE.
None; bed of stream filled with logs and drift, badly obstr.[3]

ENGINEERS.
Chief of Engineers. **R., 10,** 529.
In charge. Lt. Col. L. H. Beach, **10,** 489.

SURVEYS.
Pre. ex. au. act Mar. 3, 1909. **R.** by Lt. Col. Beach, June 19, 1909 (unfav.),[3] **10,** 529.

S-573 DES GLAISES BAYOU, LA.

COMMERCE.
Benefit of imp., **80,** 1176, 1178.

ENGINEERS.
Chief of Engineers. **R., 80,** 145; **89,** 202; **91,** 230.

In charge:
Maj. Howell. **R., 80,** 1176.
Capt. W. L. Fisk. **R., 89,** 1512; **91,** 1854.

Assistant. H. S. Douglas. **R., 80,** 1176.

PLANS.
By Maj. Howell, 1879, imp. bayou, removing trees, logs, and brush; est., $9,540.
The bayou not susceptible of permanent imp., **80,** 1176, 1178.
In 1890, after ex. for clearing the bayou of obstr. from the Atchafalaya R. to Cottonport, Capt. Fisk est. imp. at $2,500, **91,** 1855.

PHYSICAL CHARACTERISTICS.
Bayou described, **80,** 1176.
Description of, **89,** 1512.

SURVEYS.
Au. act Mar. 3, 1879; made by Maj. Howell, 1879, **79,** 112; **80,** 1176.
Ex. for slack-water navigation au. act Aug. 11, 1888; made, 1889, by Capt. Fisk (**R.** unfav.), **89,** 1512.
Maps. **89,** 1512.

[1] H. D. 348, 62d, 2d. [2] H. D. 245, 58th, 2d. [3] H. D. 409, 61st, 2d.

S-579 ROUGE BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R.,** **87,** 188.

In charge:
Maj. W. H. Heuer, 1887. **R.,** **87,** 1393.
Lt. O. T. Crosby, 1887. **R.,** **87,** 1393.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1393.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1886, by Maj. Heuer (**R.** unfav.), **87,** 1393.

S-585 COURTABLEAU BAYOU, LA.

APPROPRIATIONS.

1880,	$7,500,	**80,** 1160.
1881,	7,500,	**81,** 1294.
1884,	4,000,	**84,** 1279.
1886,	5,000,	**86,** 1264.
1888,	5,000,	**88,** 1256.
1890,	2,200,	**90,** 1749.
1894,	5,000,	**95,** 1762.
1896,	2,500,	**96,** 1503.
1899,	20,000,	**99,** 1847.
Total,	58,700	

COMMERCE.

Benefit from work done, **83,** 1124.
Tonnage, 1890, 36,000 t.; 1893, 15,000 t.; 1896, 2,000 t., **02,** 322.

CONTRACTS.

Plant, old and unserviceable, sold by auction in 1893, **93,** 1823.
1895. F. Ottendorfer, hire of steamboat, $45.50 per day, **95,** 1762.
1899. J. E. Crusel, removing raft, $17,500, and constr. log boom, $585, **99,** 1848.
1901. John J. Keegan, removing obstr., $1,800, **01,** 1898.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 145; **81,** 195; **82,** 191; **83,** 210; **84,** 213; **85,** 220; **86,** 218; **87,** 184; **88,** 170; **89,** 198; **90,** 179; **91,** 225; **92,** 219; **93,** 244; **94,** 225; **95,** 251; **96,** 219; **97,** 283; **98,** 274; **99,** 326; **00,** 371; **01,** 389; **02,** 322; **03,** 334; **08,** 431; **10,** 529; **11,** 566; **12,** 687.

In charge:
Maj. C. W. Howell, 1879–81. **R.,** **80,** 1160, 1169; **81,** 1293.
Maj. A. Stickney, 1881–84. **R.,** **82,** 1380; **83,** 1121; **84,** 1277.
Capt. T. Turtle, 1884–85. **R.,** **85,** 1403, 1405.
Maj. W. H. Heuer, 1885–87. **R.,** **85,** 1403; **86** 1263; **87,** 1375.
Capt. W. L. Fisk, 1888–91. **R.,** **88,** 1254; **89,** 1491; **90,** 1747.
Maj. J. B. Quinn, 1891–99. **R.,** **91,** 1826; **92,** 1500; **93,** 1821; **94,** 1365; **95,** 1760; **96,** 1501; **97,** 1762; **98,** 1474; **99,** 1847.
Maj. H. M. Adams, 1900. **R.,** **00,** 2259.
Lt. E. M. Adams, 1901. **R.,** **01,** 1898.
Lt. Col. H. M. Adams, 1902–03. **R.,** **02,** 1340; **03,** 1295.
Col. E. H. Ruffner, **08,** 421.
Lt. Col. L. H. Beach, 1910–11. **10,** 489; **11,** 526.
Maj. H. Burgess, 1911. **11,** 526; **12,** 645.
Lt. Col. L. H. Beach, 1912–. **12,** 645.

Assistants:
H. C. Collins. **R.,** **80,** 1170; **81,** 1294; **83,** 1122; **84,** 1278; **85,** 1404.
Lt. O. T. Crosby. **R.,** **87,** 1376.
Capt. R. R. Ralston, **11,** 526.
1st Lt. R. P. Howell, jr., **11,** 526; (Capt.) **12,** 645.

OPERATIONS.

1881-82. Closure of run-out, Bayou Big Fordoche, by brush, timber, and clay dam, built by hired labor; also choking other run-out bayous by felled trees, **82,** 1381
1882-83. Closure of run-out, Bayou Little Fordoche, with dam, built by hired labor; d. of water on Little Devil Bar increased 3′, **83,** 210, 1123.
1884-85. Constr. of quarter boat and flatboat with pile driver attached, **85,** 1403.
1885-86. Dams at Little and Big Fordoche rebuilt by hired labor. **86,** 1263.
1886-87. Dams in progress at outlets of Bayou English, and repairs made to other dams, **87,** 1375.
1887-88. Repairs to old dams in the Big and Little Fordoche, and new dam begun in Bayou English, **88,** 1255
1889-90. Broken dams in Bayous Manizelle, English, and Fordoche repaired with sheet piling, **90,** 1749.
1890-91. Repairs to plant, **91,** 1827.
1891-92. Repairs to dams at Cane, Manizelle, and Big Fordoche Bayous, **92,** 1501.
1895-96. Several bayous closed and efforts made to clear obstructing raft of logs from the stream, **96,** 1502.
1899-00. Log boom constructed and raft removed, **00,** 2259.
1900-01. Obstr. removed from chan., **01,** 1898.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 1170; **81,** 1295; **93,** 1821.
Little Devil Bar, at the entrance to the bayou, an obstr. to navigation, **95,** 1762.
In 1896 chan. obstr. and traffic completely blocked by a raft of logs that came in from the Atchafalaya, **96,** 1502; **97,** 1762.

PROJECTS.

By Maj. Howell, 1880, to imp. l.-w. navigation, Port Barre to Atchafalaya, by removal of obstr., closing run-out bayous, and constr. of a needle dam and lock 4 m. above Port Barre; est., $40,000, **80,** 1160.
In 1883 Maj. Stickney increased the previous est. by $38,500, to provide for masonry lock walls instead of timber constr. previously proposed, **83,** 1122, 1124; **85,** 1403.
In 1884 Capt. Turtle proposed that all other work be held in abeyance until the bayous on the s. side of Bayou Courtableau were closed: est., $16,000, **85,** 1404, 1406; **86,** 219.
By Maj. Quinn, 1894, repair of dams across several bayous and, if funds permitted, closing of several small bayous, **95,** 1762.
By Maj. Quinn, 1899, to place a floating log boom across the mouth of the bayou to prevent the entrance of drift from the Atchafalaya, and to remove the raft so as to restore navigation, **99,** 1847.

SURVEYS.

Ex. au. act Mar. 3, 1879, **80,** 145, 1169; **R.** by Maj. Howell, 1880, **79,** 112; **80,** 1169.
Sur. by H. C. Collins, 1880, **81,** 1293.
Pre. ex., to gain 12′, au. act Mar. 2, 1907; **R.,** Col. Ruffner, July 13, 1907 (unfav.).[1] **08,** 431.
Pre. ex. and sur. au. act Mar. 3, 1909 (**Rs.** to come), **10,** 529; **11,** 566; **12,** 687.

[1] H. D. 478, 60th, 1st.

S-592 COCODRIE BAYOU, LA.

ENGINEERS.

Chief of Engineers. R., 91, 229; **10,** 529.
In charge:
Capt. W. L. Fisk. **R., 91,** 1849.
Lt. Col. L. H. Beach, **10,** 489.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt Fisk (**R.** unfav.), **91,** 1849.
Ex. au. act Mar. 3, 1909; made, 1909, by DO. (**R.** unfav.),[1] **10,** 529.

S-617 GRAND LAKE, LA.

ENGINEERS.

Chief of Engineers. R., 80, 146; **83,** 212.
In charge. Maj. A. Stickney. **R., 83,** 1131.
Assistant. H. C. Collins. **R., 83,** 1131.

PHYSICAL CHARACTERISTICS.

Grand Lake Bayou described, **83,** 1132.

PLANS.

No imp. should be attempted until route for entering the upper end of the lake be decided on, **83,** 1131.

SURVEYS.

Au. act June 14, 1880, **80,** 146; made by Maj. Stickney, 1883 (see Plans), **83,** 1131.

S-642 TECHE BAYOU, LA.

Part.	Title.	Period.	Appropriations.
a	Teche Bayou, La	1829–1912	$402,200
b	Teche Bayou—Canal to Grand Lake	1880–1887	25,000
	Total		427,200

Part (a), S-642 Teche Bayou, La.[2]

APPROPRIATIONS.

1829,	$200 (sur.), act Mar. 2.
1870	500 (sur.), **70,** 347.
	17,500, **70,** 61.
1880,	6,000, **80,** 1159.
1881,	20,000, **81,** 1286.
1884,	6,500, **84,** 1273.
1890,	5,000, **91,** 1828.
1894,	6,000, **95,** 1764.
1896,	10,000, **96,** 1504.
1899,	10,000, **99,** 1849.
1902,	7,500, **02,** 1341.
1905,	7,500, **05,** 1455.
1907,	130,000, **07,** 1429.
1908,	500, **08,** 1481.
1909,	5,000, **09,** 1467.
1910,	50,000, **10,** 1611.
1911,	60,000, **11,** 1752.
1912,	60,000, **12,** 1967.
Total,	402,200 (incl. $462.08 misc., and less $5,022.48 reverted to Treas., $397,639.60, **12,** 1967).

COMMERCE.

Important, **72,** 556, 568.
Large amount of C. to be benefited, **80,** 1168; **84,** 1273; **86,** 1249; **87,** 1373.
Small C. requirement of the bayou above St. Martinville, **86,** 1250.
Description of, St. Martinville to Port Barre, **95,** 1789; **97,** 1785.
Much injured by shoaling of the bayou, **93,** 1825.
Rates reduced by general imp., **95,** 1764.
Est. value, 1896, about $4,250,000, **96,** 1504. Jan. 1 to Dec. 31, 1899, C. 272,975 t., **00,** 2260.
Bayou an important C. stream of s. La. Sugar, rice, and cotton plantations along banks, **03,** 1296.
Increasing; 450,542 t., 1903, **04,** 1902; 1911, 810,45, t.; valued at $7,685,321, **12,** 1970.
Since opening of Plaquemine Lock, boat line estab. between Teche points and New Orleans; rates considerably less than by rail, **11,** 540.

CONTRACTS.

1880. G. A. Meyer, removal of obstr., **81,** 1285. Unsatisfactory character of work done, **85,** 1397.
1895. H. Camors, furnishing dr., $79 per day, **95,** 1765.
1896. J. V. Higbee, hire of dr. $45.25 per day, **97,** 1765.
1899. J. H. Gardner, furnishing snagging plant; 196 days, at $36.70 per day, **00,** 2261.
1903. J. H. Gardner Constr. Co., operating dr. and snag boat, $79.75 per day of 16 hours, **03,** 1297.
1908. C. M. Guess, jr., furn. and operating dr. for dr. chan., $75 per day, **08,** 1481.
1911. Acme Lumber Co., piles for Keystone Lock (prices given), **11,** 1752. Avery Planting & Imp. Co., sand and gravel (prices given); Fritz Jahnke (Inc.), Lehigh Portland cement (quantities and prices given), **12,** 1967. J. W. Sederquist, steel for Keystone Lock, $0.0164 lb.; J. & J. B. Milholland Co., steel, valves, cast-iron capstans, 22,500 lbs. steel, 39,500 lbs. cast iron, etc.; Robinson Lumber, Veneer & Box. Co. (Ltd.), timber for lock gates (prices given); J. W. Thompson, sand and gravel for Keystone Lock (quantities and prices given), **12,** 1968. Eskald & Alexander, st. for Keystone Lock, $2.63 t.; Loodice Grange, for rent of dwelling at Keystone Lock, $3 per mo.; J. J.

[1] H. D. 345, 61st, 2d.
[2] Sur.—**R.,** Aug. 22, 1829; est., $30,000. (H. D. 482, 55th, 2d.)

Burdin, hire of sternwheel towboat, $15 per day; Cumberland Telephone & Telegraph Co., rent of telephone, Keystone Lock, $4.75 mo.; Loodice Grange, rent, 2-room dwelling, Keystone Lock, $3 per mo., **12,** 1969.

1912. S. M. Crites, lease of towboat with barge, $15 per day, **12,** 1969.

ENGINEERS.

Chief of Engineers. **R., 70,** 61, 347; **71,** 65; **72,** 61; **80,** 144, 145; **81,** 194; **82,** 190; **83,** 209; **84,** 213; **85,** 217; **86,** 215; **87,** 183; **89,** 202; **91,** 226, 230; **92,** 220; **93,** 245; **94,** 226; **95,** 252, 260; **96,** 220; **97,** 284, 292; **98,** 274; **99,** 327; **00,** 372; **01,** 391; **02,** 323; **03,** 334; **04,** 352; **05,** 364; **06,** 391; **07,** 407; **08,** 429; **09,** 449; **10,** 500, 529; **11,** 537, 566; **12,** 655, 686.

In charge:

Capt. C. W. Howell, 1870–81; **70,** 61; **71,** 64; **72,** 60. **R., 70,** 347, 351; **71,** 516; **72,** 556, 568; (Maj.) **80,** 1159, 1166; **81,** 1285.

Maj. A. Stickney, 1881–84. **R., 82,** 1378; **83,** 1111; **84,** 1272.

Capt. T. Turtle, 1884–85; **85,** 1397.

Maj. W. H. Heuer, 1885–87. **R., 85,** 1397; **86,** 1245, 1248; **87,** 1370.

Capt. W. L. Fisk, 1888–92. **R., 88,** 1253; **89,** 1515, 1532; **91,** 1852.

Maj. J. B. Quinn, 1891–99. **R., 91,** 1828; **92,** 1503; **93,** 1824; **94,** 1368; **95,** 1763, 1788; **96,** 1503; **97,** 1764, 1783; **98,** 1475; **99,** 1848.

Maj. H. M. Adams, 1900, and 1902–04. **Rs., 00,** 2260; (Lt. Col.) **02,** 1341; **03,** 1295; **04,** 1901.

1st Lt. E. M. Adams, 1901. **R., 01,** 1899.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1454; **06,** 1309.

Col. E. H. Ruffner, 1907–08. **R., 07,** 1428; **08,** 1480.

Lt. Col. L. H. Beach, 1909–12. **R., 09,** 1466; **10,** 1610; **12,** 1966.

Maj. H. Burgess, 1911. **R., 11,** 1751.

Assistants:

W. D. Duke, **70,** 347, 350.

D. M. Kingsbury, **72,** 557, 568.

H. C. Collins. **R., 80,** 1166; **83,** 1113; **84,** 1274.

Lt. O. T. Crosby. **R., 86,** 1251; **87,** 1371; **89,** 1518.

P. H. Thomson. **R., 91,** 1853.

J. L. Brownlee. **R., 97,** 1785.

ESTIMATES. (See Plans and Projects.)

By Capt. Howell, removal of obstr., $18,472, **70,** 350.

LEGAL PROCEEDINGS.

Citizen's League of St. Martinville, La., had land, required for lock and dam purposes and for canal feeder, sur., and made arrangements to have said land trans. to U. S., **07,** 1428. Abstract of title forwarded to Atty. Genl. for opinion as to validity, **08,** 1480. Land deeded to U. S.; deeds approved and recorded, **09,** 1466.

U. S. is to be secured against claims for damages due to overflow from lock and dam, and draining of Spanish Lake. Bonds presented by parish of St. Martin, town of St. Martinville, and village of Breaux Bridge, for $10,000. Comptroller of Treas., Judge Advocate General and Engineer Dept. decide personal bonds fulfill sufficient guarantee of U. S. against damages, **09,** 1466; **10,** 1610.

OBSTRUCTIONS. (See Physical characteristics.)

OPERATIONS.

1869–70. Work deferred on account of unhealthfulness of the season, **70,** 61.

1870–71. All obstr. removed, mouth to New Iberia, **71,** 65, 516.

1871–72. Completion of work; navigation imp. from St. Martinville to the Atchafalaya R., 75 m. List of obstr. removed, **72,** 61, 556.

1880–81. Obstr. removed by contract between St. Martinville and Leons Br., **81,** 1286.

1882–83. Sur. of bayou from Charenton Canal to Port Barre, **83,** 209.

1883–84. Completion of maps and preparation of plans for imp., **84,** 1272.

1884–85. Wreck and 435 snags and logs removed, with hired labor, from bayou between New Iberia and St. Martinville, **85,** 1398.

1885–86. Removal of obstr., with hired labor, to 19 m. below head of bayou, **86,** 1247.

1886–87. Removal of obstr. to headwaters of bayou, **87,** 1370.

1891–92. 350 snags and stumps, 144 piles, and 66 fallen trees cleared from chan., **92,** 1503.

1894–95. About 98,000 c. y. dr., and 300 obstr. removed, **95,** 1763.

1896–97. About 64,500 c. y. dr., and 1,665 obstr. removed, **97,** 1764.

1899–00. 2,571 obstr. removed, **00,** 2260.

1902–03. Total of 56,513 c. y. dr., and 2 wrecks, 50 logs, and 434 snags removed from chan., **03,** 1296.

1906–07. No work done beyond location of site of lock near St. Martinville and site of dam across head of Bayou Vermilion, **07,** 1428.

1907–08. 34,425 c. y. dr. under contract, **08,** 1480.

1909–10. Borings for lock and dam made, and plans and specifications for concrete lock, timber crib dam, concrete abutment, and lockkeeper's dwelling prepared, **10,** 1610.

1910–11. Sheet-pile cofferdam built around site of lock; cableway erected; employees' quarters built, and 15,886 c. y. excavated from lock pit; 1,700 c. y. excavated from site of abutment by wheelbarrows; 44,402 c.. y. dr. from shoal places in Bayou Teche (mainten.). All work done by hired labor, **11,** 1751.

1911–12. Work by hired labor on lock at Keystone continued; 5,700 c. y. removed from lock pit, 2.000 c. y. from lower approach, and 4,775 c. y. from site of dam; driving of piles for lock foundation completed; installation of mixing plant completed; lockkeeper's dwelling nearly completed; banks cleared of trees, **12,** 1966.

PHYSICAL CHARACTERISITCS.

Description of obstr., **70,** 348.

Description of bayou, **80,** 1167; **83,** 1114; **86,** 1249; **89,** 1516; **91,** 1853; **93,** 1824; **95,** 1789.

Current observations and discharge, **86,** 1251, 1254.

Chan. dimensions, **97,** 1764.

Shoals form from the material emerging from drainage ditches, **93,** 1824; **97,** 1784.

Bayou flows out of Bayou Courtabaleau at Port Barre, flows into Atchafalaya R., is navigable from that R. to St. Martinville at all seasons; from the latter place to Port Barre, about 55 m. navigable for only 6 months in year, **95,** 1789.

Shoaling, **01,** 1899; **06,** 1310.

Yellow fever, La., 1907, **07,** 1428.

Variation of w. l. bet. h. and l. w., 12′, **08,** 429.

Max. draft; 3′, **08,** 429.

Borings for lock and dam show foundations consist of mud and clay, **10,** 1610.

PLANS. (See Projects.)

By Maj. Stickney, 1883, carrying l.-w. d. of 5′ to within 4 m. of Port Barre, by clearing bayou of obstr. and by dr., and constr. of 2 locks and dams; est., $135,625, **83,** 1112, 1116; **86,** 1246.

Locks to be 50′ x 300′ and 8′ lift; lower lock to be placed about 5 m. below St. Martinville; upper lock, 2 m. below Breaux Br., **84,** 1274; **85,** 1398.

In 1886 Lt. Crosby est. cost of single movable dam, with lock, 14 m. below St. Martinville, at about $175,000, **86,** 1250, 1257; **87,** 1370.

Maj. Heuer recom. no app. be made for constr. of lock and dam until capacity of "present" imp. be tested, **85,** 1399; **86,** 1250; **87,** 1371.

In 1889 Capt. Fisk reported bayou unworthy of slack-water imp., **89,** 1515.

In 1891 Col. Comstock reported bayou, St. Martinville to Port Barre, unworthy of imp., **91,** 1852.

PRIVATE (STATE) WORK.

La. app. $30,000 to remove overhanging trees and projecting logs; work in progress, **70,** 350.

See Legal proceedings.

PROJECTS. (See Plans.)

By Capt. Howell, 1870, removing wrecks, snags, trees, and other obstr. in Bayou Teche, **70,** 349; **72,** 556.

By Maj. Howell, 1880, imp. of Bayou Teche, New Iberia to Leonville, by removal of obstr., and constr. of 3 movable dams; est., $56,690, **80,** 1159, 1166, 1169; **82,** 1378.

Maj. Heuer advised that no app. for lock and dam be made till the capacity of imp. had been tested, **85,** 1399; **86,** 1230; **87,** 1371.

In 1897 Maj. Quinn est. $245,086 to imp. bayou bet. St. Martinville and Port Barre, **97,** 1785.

By Maj. Quinn, 1899, subproj., for removal of obstr. from bayou, under contract, **99,** 1848.

Act Mar. 2, 1907, modified "present" proj. so as to obtain 6′ navigation to Arnaudville, by dr., removal of snags, etc., and constr. of lock; est., $111,000,[1] **07,** 408.

Increase in est. for lock and dam constr., $25,000; also recom. dike constr. on Bayou Fusilier, $5,000; drainage canal to Spanish Lake, and regulating gates, $18,000; raising lake level by constr. 2 small levees, $12,000; dr. below lock at Keystone, $30,000, and $10,000 for contingent expenses; total increase of $100,000 over former est., **10,** 501. Revised est. gives cost of lock and dam constr. at $10,000 addl., reducing 1910 est. by $15,000, **11,** 538.

SURVEYS.

By Capt. Howell, 1870, **70,** 61, 347, 351.

Au. act Mar. 3, 1879, **80,** 145; made by Maj. Howell, 1879, **80,** 1166.

Charenton Canal to Port Barre, by Maj. Stickney, 1882, **83,** 1113; **85,** 1397.

Charenton Canal to mouth, by Lt. Crosby, 1885, **85,** 1398.

Ex., with view of putting in locks and dams, au. act Aug. 11, 1888; made, 1889, by Capt. Fisk (**R.** unfav.; see Plans), **89,** 1515, 1518, 1532.

Ex., St. Martinville to Port Barre, au. act Aug. 17, 1894; made, 1895, by Maj. Quinn (**R.** fav. to partial imp.), **95,** 1788.

Sur. of the same division au. act June 3, 1896; made by Maj. Quinn, 1897 (**R.** fav.; see Projects), **97,** 1783.

Act Mar. 3, 1905, au. resur. of bayou, contemplating securing a l.-w. chan. of 6′, St. Martinville to source of bayou, about 50 m., **05,** 1454. **R.** by Lt. Col. Sears, Dec. 26, 1905[1] (unfav.), **06,** 392.

Supple. **R.** by BERH., Feb. 7, 1905, requested by R. and H. Com., reviewing **R.** of Maj. Quinn et al., 1897, etc. In opinion of Board it is not advisable to undertake any further imp. than contemplated by present proj. (see Projects, 1907).[2]

Supple. **R.** by BERH., Dec. 27, 1906, requested by R. and H. Com. Board recom. expend. of $110,000 by constr. of lock and dam, extending navigation to Arnaudville. All necessary lands and feeders to be ceded free to U. S.[3]

Pre. ex. and sur. au. act Mar. 3, 1909, with view to securing increased d. (**R.** to com.), **10,** 529; **11,** 566; **12,** 686.

Maps.[1] **89,** 1522.

Part (b), S-642 Teche Bayou, La. (Canal connecting with Grand Lake at Charenton, La.)

APPROPRIATION.

1881, $25,000, **81,** 1288.

COMMERCE.

Amount to be benefited by imp., **80,** 1189.

Plantations on bayou not directly benefited, **85,** 1400; **86,** 1260.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 145; **81,** 194; **82,** 190; **83,** 209; **84,** 212; **85,** 218; **86,** 216; **87,** 184.

In charge:

Maj. C. W. Howell, 1879–81. **R.,** **80,** 1187; **81,** 1287.

Maj. A. Stickney, 1881–84. **R.,** **82,** 1378; **83,** 1116; **84,** 1275.

Capt. T. Turtle, 1884–85. **R.,** **85,** 215.

Maj. W. H. Heuer, 1885–87. **R.,** **85,** 1399; **86,** 1259; **87,** 1374.

Capt. W. L. Fisk, 1888. **R.,** **88,** 1253.

Assistant. H. C. Collins. **R.,** **80,** 1188; **83,** 1118; **84,** 1275.

LEGISLATION.

State legislation ceding jurisdiction of land to U. S., **82,** 1379.

PLANS. (See Projects.)

By Maj. Stickney, 1882, open canal 100′ w. at bottom and without lock; est., by contract, $130, 350; by hired labor, $85,000.

For canal 50′ at bottom, with lock. Est., by contract, $138,600; by hired labor, $123,125, **83,** 1117, 1119; **84,** 1275. Not deemed advisable by the Chief of Engineers to expend available funds for constr. of the plant required to perform the work by hired labor, **84,** 1275.

In 1888 Capt. Fisk stated that a slack-water navigation would only benefit that portion of the Teche country above the lock, **88,** 1253.

PRIVATE AND CORPORATE WORK.

Right of way given by the Charenton Canal Co., **82,** 1379; **83,** 1116.

PROJECTS. (See Plans.)

By Maj. Howell, 1880, canal connecting Bayou Teche at Charenton with Grand Lake, 50′ x 6,594′ at bottom, 5′ to 6′ d. at ordinary l. w., provided with a lock with double gates. Est. cost, $75,000, **80,** 1189; **86,** 1260. Modified, 1885, for canal 100′ w. at bottom and without locks, **84,** 1275; **85,** 1399.

Recom. by Maj. Heuer that no work be done until $75,000 be app., **86,** 1260; **87,** 1374.

SURVEYS.

Au. act June 28, 1879, **80,** 145; made by Maj. Howell, **80,** 1187.

Sur. for location of canal, 1882, **83,** 209.

S-647 FUSILIER BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 146; **81,** 197; **82,** 194.

In charge. Maj. A. Stickney, 1881. **R.,** **82,** 1419.

Assistant. H. C. Collins. **R.,** **82,** 1419.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1419.

PLANS.

Bayou Fusilier, except for the imp. of Bayou Teche, useless to navigation, **82,** 1419.

SURVEYS.

Au. act June 14, 1880, **80,** 146; ex. made under direction of Maj. Howell, 1881, **82,** 194, 1419.

[1] H. D. 527, 59th, 1st. [2] R. and H. C. Doc. 39, 61st, 2d. [3] R. and H. C. Doc. 6, 59th, 2d.

S-680 CARLIN BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R., 91,** 229.
In charge. Maj. J. B. Quinn. **R., 91,** 1838.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1838.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Quinn (**R.** unfav.), **91,** 1838.

S-696 VERMILION BAYOU, RIVER, AND PASSES, LA.

APPROPRIATIONS.

1880,	$5,000,	**80,** 1158.
1881,	4,900,	**81,** 1282.
1892,	7,500,	**93,** 1827.
1894,	5,000,	**95,** 1767.
1896,	1,000,	**96,** 1506.
1899,	2,500,	**99,** 1850.
1902,	*9,000,	**02,** 1343.
1903,	[1] 200,	**04,** 1908.
1905,	*1,000,	**05,** 1464.
1907,	*7,000,	**07,** 1438.
1909,	*2,500,	**09,** 1478.
1910,	3,000,	**10,** 1621.
1910,	[1] 10,000,	**10,** 1621.
1912	*3,000 *500	**12,** 1980.
Total,	62,100	(less $1,800 trans. to all't for imp. Bayou Plaquemine Brule, La., $60,300, **12,** 1980).

COMMERCE.

Increase of C. due to imp., **83,** 1106.
Prospective benefit of imp., **87,** 1401.
In 1894–95, for the first time in years, a steamer began to ply on the bayou to the great advantage of shippers, **95,** 1767.
1899, the C., 7,650 t., **00,** 2262; 1901, 31,385 t., **02,** 324; 1911, 29,151 t., **12,** 673.
Lower rates at Abbeville than to intermediate points, on account of being located on navigable waters, **06,** 400.

CONTRACTS.

1881. G. A. Meyer, clearing 22 m. of R., $4,750, **81,** 1281. J. Maguire, constr. a brush dam and clearing 27½ m. of R., **82,** 1373.
1892. V. Von Schoeler, furnishing snag boat, $74.85 per day; furnishing and driving guide piles, $9.25 each, **93,** 1827.
1895. E. Wise, hire of snag boat, $65 per day, **95,** 1767.
1899. V. Von Schoeler, furnishing snag boat 70 days, at $42.25 per day of 8 hours, **00,** 2263.
1907. M. A. Sweeney Shipyard & Foundry Co., constr. of combined dr. and snag boat, $37.400, **08,** 1500; supple. contract for $1,750, **09,** 478.
1910. Drackett & Terrebonne, repairs and alterations to U. S. dr. *Delatour*, $4,771.80 (see Calcasieu R., La.), **11,** 1756, 1763.

ENGINEERS.

Chief of Engineers. **R., 80,** 143, 145; **81,** 192; **82,** 189; **83,** 207; **87,** 188; **91,** 230; **93,** 246; **94,** 227; **95,** 253; **96,** 220; **97,** 285; **98,** 275; **99,** 328; **00,** 373; **01,** 391; **02,** 323; **03,** 339; **04,** 356; **05,** 370; **06,** 399; **07,** 416; **08,** 442; **09,** 460, 469; **10,** 516; **11,** 553; **12,** 671.

In charge:

Maj. C. W. Howell, 1879–81. **R., 80,** 1157, 1164; **81,** 1281.
Maj. Stickney, 1881–83. **R., 82,** 1373; **83,** 1106.
Maj. W. H. Heuer, 1887. **R., 87,** 1398.
Capt. W. L. Fisk. **R., 91,** 1855.
Maj. J. B. Quinn, 1893–99. **R., 93,** 1826; **94,** 1370; **95,** 1766; **96,** 1505; **97,** 1766; **98,** 1477; **99,** 1850.
Maj. H. M. Adams, 1900, 1902, and 1904. **R., 00,** 2262; (Lt. Col.) **02,** 1342; **04,** 1908.
Lt. E. M. Adams, 1901. **R., 01,** 1900.
Capt. C. S. Bromwell, 1903. **R., 03,** 1306.
Capt. J. F. McIndoe, 1905–08. **R., 05,** 1463; **06,** 1316; **07,** 1437; (Maj.) **08,** 1499.
Lt. Col. L. H. Beach, 1909–10, and 1912–. **R., 09,** 1477; **10,** 1620; **12,** 1980.
Maj. H. Burgess, 1911. **R., 11,** 1763.

Assistants:

W. H. Hoffman. **R., 80,** 1165.
Lt. O. T. Crosby. **R., 87,** 1398.
P. H. Thomson. **R., 91,** 1856.

OPERATIONS.

1881–82. 22 m. of R. below the RR. br. cleared of obstr. by contract, **82,** 1373.
1882–83. 27½ m. of R. cleared and a brush dike 650′ long built by contract, **83,** 1106.
1892–93. Over 3,000 obstr. removed, **93,** 1827.
1893–94. 50 guide piles driven, **94,** 1371.
1894–95. About 450 obstr. removed, **95,** 1766.
1895–96. About 900 obstr. removed, **96,** 1506.
1899–00. Stream cleared of snags and over, hanging trees from Abbeville, La., to the Southern Pacific RR. br., **00,** 2262.
1902–03. About 20 m. of bayou cleared of obstr., **03,** 1306.
1903–04. Work completed by removal of 520 overhanging trees and 553 obstr., such as snags, logs, etc., **04,** 1908.
1906–07. 31 snags removed and 175 overhanging trees cut, **07,** 1437.
1907–08. 11 snags and fallen trees and 1 coal boat removed, **08,** 1499.
1909–10. From mouth to RR. br. removed 4,695 snags and trees, 2 old ferry approaches, 1 sunken barge, 44 old bridge piles, and dr. 10,862 c. y.; 15,905 c. y. dr. from bar at mouth, **10,** 1620.
1910–11. 3 piles and 1 snag removed, **11,** 1763.
1911–12. 2,551 obstr. removed, **12,** 1980.

PLANS. (See Projects.)

Maj. Heuer, 1886, est. cost of imp. from Abbeville to Louisiana & Texas RR. br., by removal of snags, etc., at $5,000, but does not consider locality worthy of imp., **87,** 1398.

PROJECTS. (See Plans.)

By Maj. Howell, 1879, imp. of the R. to a l.-w. d. of 5′ from RR. br. above Vermilion to mouth in Vermilion B., by removal of trees, logs, and snags; est., $9,900, **80,** 1157, 1165, 1166. Imp. not considered permanent, **80,** 1165; **83,** 1107; **87,** 1398.
By Capt. Fisk, 1891, removing snags, overhanging trees, and logs in the bayou, and driving guide piles in the B. to mark chans.; est., $25,000, **91,** 1856, **93,** 1826.

* Allotment.
[1] Trans. from all't for imp. Mermentau R. and tributaries.

By Maj. Quinn, 1894–95, clearing the stream above Abbeville as far as available funds would permit, about 30 m., **95,** 1766.

By Maj. Quinn, 1899, clearing the stream of snags and overhanging trees, from Abbeville, La., to the Southern Pacific RR. br., **99,** 1850.

Act July 12, 1902, au. mainten. by removal of obstr. (snags, logs, etc.), mouth to Southern Pacific RR. br., **03,** 1306.

Act Apr. 11, 1907, au. $5,000 for constr. of combined dr. and snag boat, **08,** 1499.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 112; **80,** 145; made by Maj. Howell, 1879, **80,** 1164.

Ex., Abbeville to RR. br., au. act Aug. 5, 1886; made, 1886, by Maj. Heuer, **87,** 1398.

Ex., 1891, by Capt. Fisk, **91,** 1855.

Pre. ex. and sur. au. act Mar. 2, 1907, to Lafayette, with view to obtaining 6′. **R.** by Maj. McIndoe Jan. 21, and Lt. Willing Aug. 10, 1908; est., $22,660,[1] **09,** 469.

S-696 (a) INLAND WATERWAY, DONALDSONVILLE, LA., TO RIO GRANDE, TEX.

(Via Vermilion Bay, La., etc.)

Part.	Title.	Period.	Appropriations.
b	Donaldsonville to Rio Grande	1873–1879	.....
c	Franklin to Mermentau R.	1907–1912	$301.792
d	Mermentau R. to Sabine R.	1910–1912	200,000
	Total	.....	501,792

Part (b), S-696 Donaldsonville, La., to the Rio Grande River, Tex. (Canal.)

COMMERCE.

Important, **75,** 877, 880–883, 894.

ENGINEERS.

Chief of Engineers. R., 73, 66; **75,** 79; **79,** 112.

In charge. Capt. C. W. Howell, 1873–75, **73,** 66; **75,** 79; **79,** 111. **R., 75,** 875.

Assistants:
J. A. Hayward. **R., 75,** 883.
H. C. Ripley, **75,** 889.
J. C. Polhemus. **R., 75,** 895, 897.
Lt. H. M. Adams. **R., 75,** 893.

ESTIMATES. (See Plans.)

By Capt. Howell, 1875, inland navigation, Donaldsonville to the Rio Grande: For sec. 1, chan. from Donaldsonville to Vermilion B., $1,653,705; for sec. 2, Vermilion B. to Sabine Lake, $1,587,889, and js. at mouth of Sabine R., $90,828; Sabine Lake to Galveston B., $1,018,250; sec. 3, Galveston B. to Brazos R., $212,144; sec. 4, lock at Rio Grande, $28,110; Indianola to Madre Lagoon, $3,258,288; Madre Lagoon to Rio Grande, $190,256, **75,** 880–883, 896–901; total, $8,039,461, **75,** 882.

PHYSICAL CHARACTERISTICS.

General description, **75,** 876–900.
High and low water range, **75,** 883.

PLANS. (See Estimates.)

By Capt. Howell, 1875, inland navigation from Donaldsonville to the Rio Grande, as follows: Sec. 1, from Donaldsonville to Vermilion B. by slack water via Bayou Lafourche to Napoleonville; thence by a canal in a direct line to Lake Verret; thence to Flat Lake; from Flat Lake via the Little Atchafalaya R. and Bayou Teche to Franklin; thence to Cote Blanche B. and via the latter and Vermilion B. to Schooner Bayou; est., $1,653,705, **75,** 879, 880, 883, 884. Sec. 2, Vermilion B. to Galveston B. Canal; from Schooner Bayou to White Lake; thence via canal to Turtle Lake, Alligator Lake, and Lake Collicon; thence via Bayou Collicon to Grand Lake, Bayou Lacassine to Lake Lacassine; Bayou Misère to Lake Misère; thence via canal to Willow Lake; via Bayou Bois Connie to Calcasieu Lake; Kelso Bayou to Black Lake (Sabine Lake); thence by small chain of lakes and Mud Bayou to East Bay Bayou (Galveston B.); est., $2.696,967, **75,** 880–882, 889–896. Sec. 3, Galveston B. to Brazos R. by increasing the existing 3′ navigation to 6′ by cuts through reefs in West Galveston B. and in Oyster B.; thence through ridge separating Oyster B. and Brazos R., to Brazos R.; est., $212,144, **75,** 881, 898. Sec. 4, Brazos R. to Rio Grande by canal from Brazos R. across marshy prairies and through small freshwater lakes to San Bernard R.; thence through Cedar Lake; thence direct to Cany Creek; thence via Cany Creek to Matagorda B., and via the latter to Indianola H. From Indianola to the Rio Grande a 6′ tide-water canal, 80′ w. at the top, following along the coast line, recom. as the only feasible plan; est., $3,476,644, **75,** 882. General discussion of routes: Sec. 1, lock proj. in Bayou Lafourche impracticable, **75,** 878, 887. Dam and inclined plane impracticable, **75,** 879. Route via Bayou Teche with a cut to Bayou Cypremort, and dr. this bayou to Vermilion B.; est., $1,258,538, not recom., **75,** 880. Sec. 4, cuts through lagoons from Indianola H. to Rio Grande not permanent; est., $1,902,978, **75,** 882.

PRIVATE (STATE AND CORPORATE) WORK.

Canal excavated by the Brazos Canal Co., connecting West Galveston B. with the Brazos R., **75,** 898. Chan. excavated by the State from Espiritu Santo B. to San Antonio B., thence to Mesquite B., **75,** 898. Pass dr. between Aransas and Corpus Christi Bs., **75,** 899.

SURVEYS.

By Capt. Howell, 1872, **73,** 66; **75,** 79, 876, 883, 889, 890, 893, 895, 897.

By Capt. Howell, 1879, **79,** 112.

[1] H. D. 1218, 60th, 2d.

Part (c), S-696 Franklin to Mermentau, La. (Inland waterway.)

APPROPRIATIONS.

1907, $89,292, **07,** 1437.
1908, 100,000, **08,** 1499.
1909, 100,000, **09,** 1468.
1910, 12,500, **10,** 1612.

Total, 301,792 (incl. misc., $301,818.15, **12,** 1971).

COMMERCE.

Canal system necessary for safety of C. of smaller streams, **10,** 503.
Effect of imp. on C., **11,** 541.
Description of; no RR. adjacent; waterway has cheapened transportation by small boats and barges, **12,** 659.
In 1911, 216 t., **12,** 659.

CONTRACTS.

1908. John Anderson, dr., 7¾¢ c. y., **09,** 1468.
1912. Eskald & Alexander, lock gates, $37,000; supple. (same contractor), Mar. 2, 1912, creosoting timber, $1,644, **12,** 1971. T. Cheney Lawless, hire of floating plant, $70 per month; and launch, $5 per day, **12,** 1972.

ENGINEERS.

Chief of Engineers. R., 07, 415, 451; **08,** 441; **09,** 451; **10,** 503; **11,** 541; **12,** 658.

In charge:
Capt. J. F. McIndoe, 1907–08. **R., 07,** 1437; (Maj.) **08,** 1498.
Lt. Col. L. H. Beach, 1909–10. **R., 09,** 1467; **10,** 1612.
Maj. H. Burgess, 1911. **R., 11,** 1753.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1971.

LEGAL PROCEEDINGS.

Deeds covering entire right of way submitted to Atty. Gen. for approval, **09,** 1468; **12,** 1973.

LEGISLATION.

In May, 1908, La. granted au. for donation of lands under control of school boards and Drainage Commission, **08,** 1498.

OPERATIONS.

1908-09. 96,606.22 c. y. removed up to June 17, 1909, when dr. plant was destroyed by fire, **09,** 1468; **10,** 1612.
1909-10. 337,896.53 c. y. excavated, **10,** 1612.
1910-11. Canal between Schooner Bayou and White Lake completed; navigable for boats drawing less than 3′, White Lake to Mermentau R.; 26,198.48 c. y. removed, **11,** 1753.
1911-12. Portion of waterway between Grand Lake and Vermilion B. completed Sept. 30, 1911; dr. through bars in lakes forming part of route between Grand Lake and Vermilion B. and partial constr. of tidal lock in Schooner Bayou, **12,** 659.

PHYSICAL CHARACTERISTICS.

Country peculiarly adapted to estab. of canal system, due to existence of large number of lakes and streams and low elevation of land, **10,** 503; **12,** 658.
Details, **11,** 541, 542; **12,** 658, 659.

PROJECT.

For chan. 5′ x 40′, Bayou Teche, near Franklin, La., to Cote Blanche and Vermilion Bs., by dr. canal and existing waterways, thence up Schooner Bayou, thence by dr. canal to White Lake, across White Lake, by dr. canal to Grand Lake and across to Lake Misere, w. of Mermentau R.; est., $289,292, and $20,000 an. mainten.,[1] **07,** 415; **08,** 441. Acts 1909, 1911, au. Sec. of War to make such changes in location of chan. as might be desirable; rights of way to be free to U. S., **12,** 659.
War Dept. decided that cost of br. for Southern Pacific Ry. at Bayou Yokely be borne by U. S., **08,** 1498.
Act July 25, 1912, au. Sec. of War to purchase Hanson Canal; cost not to exceed $65,000, **12,** 659.

SURVEYS.

Ex. and sur. au. acts 1873 and 1905, **12,** 658.
5 routes for chan. between Bayou Teche and Vermilion B. ex., **07,** 1437.
Pre. ex., with plan and est., of inland waterway, Rio Grande R., Tex., to Miss. R. at Donaldsonville, La., au. Mar. 3, 1905. **R.,** Maj. Jadwin, 1906; est., $289,292, and $20,000 an. mainten., for section from Mermentau R. to Miss. R. through Bayou Plaquemine,[1] **07,** 451.
Of part of route west of Vermilion B. completed, and sur. to Franklin on Bayou Teche continued to Nov., 1907; maps of route w. of Vermilion B. furnished property owners, **08,** 1498.
For location of route n. of Cote Blanche and Vermilion Bs., **12,** 659.
Between Calcasieu and Sabine Rs., **12,** 1973.
Maps. **12,** 658.

Part (d), S-696 Mermentau River to Sabine River, La. and Tex. (Waterway.)

APPROPRIATIONS.

1910, $100,000, **10,** 1612.
1912, 100,000, **12,** 1973.

Total, 200,000 ($200,000.40, **12,** 1973).

ENGINEERS.

Chief of Engineers. R., 10, 505; **11,** 542; **12,** 660.
In charge. Lt. Col. L. H. Beach. **R., 10,** 1612, **11,** 1754; **12,** 1973.

LEGAL PROCEEDINGS.

Deeds conveying entire right of way, free of cost to U. S., sent to Atty. Gen. for approval, **12,** 1973.

OPERATIONS.

1911-12. No work done pending approval of necessary deeds for right of way by Atty. Gen. Specifications for dr. prepared and approv., **12,** 1973.

PRIVATE WORK.

Route selected involves expend. of $27,000 more than for another route line, but difference provided voluntarily by local interests, **12,** 660.

PROJECT.

Act June 25, 1910, au. waterway from Mermentau to Sabine Rs. (in continuation of waterway from Franklin to Mermentau R., under constr.), 5′ x 40′ m. l. w., with appropriate side slopes; est., $390,000, and $20,000 an. mainten. Right of way to be furnished free,[1] **10,** 505; app. can be used under au. of Chief of Engineers and Sec. of War for any modification of plan, **12,** 660.

SURVEYS.

See **75,** 879; **08,** 1498; **09,** 1467.
Two surveys, incidental to right of way for waterway between Calcasieu and Sabine Rs., made, **11,** 1754.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 660.

[1] H. D. 640, 59th, 2d.

S-707 PETIT ANSE (Ance) BAYOU, LA.

COMMERCE.

A salt company the only firm concerned, **84,** 1369.

ENGINEERS.

Chief of Engineers. R., 84, 227.

In charge. Capt. A. M. Miller. **R., 84,** 1369.
Assistant. P. C. Montgomery. **R., 84,** 1369.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Capt. Miller, 1882 (**R.** unfav.), **84,** 1369.

S-712 TIGRE BAYOU, LA.

COMMERCE.

None, **04,** 1966.

ENGINEERS.

Chief of Engineers. R., 04, 366, 1965.
Boards. BERH. **R., 04,** 1966.
In charge. Lt. Col. H. M. Adams, 1904. **R., 04,** 1966.
Assistant. J. I. Conklin. **R., 04,** 1967.

PHYSICAL CHARACTERISTICS.

Private parties have dug canals, **04,** 1968.

SURVEYS.

Pre. ex. au. act June 13, 1902. **R.** by Lt. Col. H. M. Adams, Sept. 20, 1902[1] (unfav.), **04,** 1965.

S-745 MERMENTAU (Mermenton) RIVER AND TRIBUTARIES, LA.

APPROPRIATIONS.

1892,	$7,500.00,	**93,** 1829.
1894,	5,000.00,	**95,** 1769.
1896,	5,000.00,	**96,** 1508.
1899,	6,115.25,	**99,** 1851.
1902,	*2,500.00,	**02,** 1344.
1905,	*2,000.00,	**05,** 1466.
1907,	*18,000.00,	**07,** 1439.
1909,	*1,500.00,	**09,** 1480.
1910,	*2,000.00,	**10,** 1622.
1912,	*500.00,	**12,** 1982.
Total,	[2] 50,115.25	(less trans., $37,915.25, **12,** 1982).

COMMERCE.

May be important, **91,** 1862.
From Jan. 1 to Dec. 31, 1899, 2,866 t., **00,** 2264.
Shipments and receipts for 9 years previous to 1901, **01,** 393.
Secy. State RR. Com. states Mermentau has lower rates than intermediate points because of imp., **06,** 401.
Statement of shipments and receipts for 10 years previous, **12,** 675; 1902, 50,000± t.; 1905, 43,000± t.; 1908, 45,000± t.; 1911, 23,000 t., **12,** 675.

CONTRACTS.

1892. Harvey & Erlinger, furnishing SS. for snagging, $98 per day, **93,** 1829.
1897. C. Clarke, operation of U. S. dr., $32 per day; brush-dam constr., $1.03 l. f. ($7,969), **98,** 1479.
1899. C. Clarke & Co., furnishing dr. boat and crew, $122 per day of 16 hours, **00,** 2265.
1903. John Short, repairs to brush dams, **03,** 1308.
1906. J. B. Streater, removal of snags, logs, etc., $47 per day of 8 hours, **07,** 1439.
1908. M. A. Sweeney Shipyard & Foundry Co., constr. one wooden hull hydraulic dr. and snag boat, $37,400; supple. agreement modifying orig. contract, **09,** 1480.
1910. Drackett & Terrebonne, repairs and alterations to dr. *Delatour* (see Mouth and passes of Calcasieu R., La.), **11,** 1765.

ENGINEERS.

Chief of Engineers. R., 91, 230; **93,** 246; **94,** 227; **95,** 254; **96,** 221; **97,** 285; **98,** 275; **99,** 329; **00,** 374; **01,** 392; **02,** 324; **03,** 340; **04,** 357; **05,** 371; **06,** 401, 411; **07,** 416; **08,** 443; **09,** 462; **10,** 518; **11,** 555; **12,** 673, 688.

In charge:
Capt. W. L. Fisk, 1891. **R., 91,** 1858.
Maj. J. B. Quinn, 1891–99. **R., 91,** 1862; **93,** 1828; **94,** 1372; **95,** 1768; **96,** 1507; **97,** 1767; **98,** 1478; **99,** 1851.
Maj. H. M. Adams, 1900. **R., 00,** 2264.
Lt. E. M. Adams, 1901. **R., 01,** 1901.
Lt. Col. H. M. Adams, 1902. **R., 02,** 1343.
Capt. Chas. S. Bromwell, 1903. **R., 03,** 1308.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1909.
Capt. J. F. McIndoe, 1905–08. **R., 05,** 1465; **06,** 1317; **07,** 1439; (Maj.) **08,** 1501.
Lt. Col. L. H. Beach, 1909–10. **R., 09,** 1479; **10,** 1622.
Maj. H. Burgess, 1911. **R., 11,** 1764.
Lt. Col. L. H. Beach, 1912–. **R., 12,** 1982.

Assistant. P. H. Thompson. **R., 91,** 1859, 1863.

OPERATIONS.

1892–93. Over 500 obstr. removed, **93,** 1828.
1897–98. Nearly 27,000 c. y. dr.; upper dam, 5′ x 2,500′, and lower dam, 3,000′ l., completed, **98,** 1478.
1899–00. 39,484 c. y. dr., **00,** 2264.
1902–03. Upper dam repaired, **03,** 1308.
1906–07. 345 snags and other obstr. removed, **07,** 1439.

PHYSICAL CHARACTERISTICS.

Description of, incl. its 5 tributaries (bayous), stream is 254 m. l., **91,** 1859; **10,** 518.
Ex. shows brush dams damaged by storms and settlement; do not effectively confine current to dr. chan., **01,** 1902.
Increased consumption of water for rice irrigation permitted inflow of salt water, causing lower dam to be destroyed by teredo, **03,** 1308.

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* Allotment.
[1] H. D. 192, 58th, 2d.
[2] Trans. to all't for imp. chan., B., and passes, Bayou Vermilion, 1903 and 1910, $10,200. Trans. to all't for imp. Bayou Plaquemine Brule, La., 1911, $2,000.

In s. La.; formed by junction of Bayou Nezpique and Bayou des Cannes, 2 m. above town of Mermentau; flows sw. for 70 m. to Gulf, after passing through Lake Arthur, Grand Lake, Upper Mud Lake, and Lower Mud Lake. Bayou Queue de Tortue joins it from e. 5 m. above head of Lake Arthur and Bayou Lacassine, and Bayou Lacassine flowing into Grand Lake from w. Bayou Plaquemine Brule is trib. to Bayou des Cannes, joining it from e. 3 m. above mouth Mermentau 250′–1,000′ w. and has l.-w. d. of 10′±. Trib., crooked and much obstructed, though formerly considerable C. on them, **12,** 674.

PLANS. (See Projects.)

By Maj. Quinn, 1891, clearing obstr., Viterboville to the mouth, and building brush dam at Lower Mud Lake; est., $23,615. One j. only considered necessary at the mouth to give 13′ of water over the bar; est., $781,210, **91,** 1863.

PRIVATE WORK.

Act Cong. Jan. 10, 1903, au. Rice Irrigation & Imp. Assn., State of La., to construct at own expense locks and dams near mouth of R., plans and specifications to be approved by Sec. of War (plans, etc., au. Mar. 12, 1903), **03,** 641.

PROJECTS. (See Plans.)

By Maj. Quinn, 1892, snag removal, etc., Mermentau and Bayou Nezpique, and brush dam Lower Mud Lake to deepen chan. by scow; est., $23,615.25, **92,** 1862; **12,** 674.

By Maj. Quinn, 1897, applying available money to building brush dams in Mud Lake to help secure chan. 6′ x 50′, and to dr. to secure immediate results, **97,** 1767.

By Maj. Adams, 1899, for redr. chan., **00,** 2264.

Proj. au. Apr. 5, 1907, provides $10,000 be applied to constr. of combined dr. and snag boat (see Homochitto R.), **08,** 1501.

SURVEYS.

Ex. under direction of Capt. Fisk, 1890 (**R.** fav. to sur.), **91,** 1858.

Sur. made, 1891, by Maj. Quinn, **91,** 1862.

Minor surs. made, 1899, **99,** 1852.

Pre. ex., from headwaters at junction with Bayous des Cannes and Nezpique, to a point in Gulf of Mexico beyond bar at mouth, for permanent chan. of at least 20′, au. act Mar. 3, 1905. **R.,** Maj. McIndoe, July 25, 1905[1] (unfav.), **06,** 411.

See Bayou Queue de Tortue.

Pre. ex. and sur. au. act Feb. 27, 1911, for lock and dam, and for maintaining level of Grand Lake and inland waterway of La. (**R.** to come), **12,** 688.

S-756 QUEUE DE TORTUE BAYOU, LA.

APPROPRIATIONS.

1912, $25,000, **12,** 1990.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 529; **12,** 686.

In charge. Lt. Col. L. H. Beach, 1910–. **R.,** **12,** 1990.

PROJECT.

Act July 25, 1912, au. clearing stream, mouth to Southern Pacific Ry. br., by removing snags, logs, fallen and overhanging trees; also to make a number of cut-offs across such points as are so short as to interfere with safe navigation,[1] **12,** 686.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Lt. Col. Beach, July 13 and Nov. 26, 1909; est., $25,000,[1] **10,** 529.

Maps.[1]

S-760 PLAQUEMINE BRULE BAYOU, LA.

APPROPRIATIONS.

1910,	$5,000,	**10,** 1623.
1912,	[3] 3,800,	**12,** 1984.
1912,	4,000,	**12,** 1984.
Total,	12,800	

ENGINEERS.

Chief of Engineers. **R.,** **08,** 449; **10,** 518; **11,** 557; **12,** 676.

In charge:

Maj. J. F. McIndoe, **08,** 431.

Lt. Col. L. H. Beach, 1910, 1912. **R.,** **10,** 1623; **12,** 1983.

Maj. H. Burgess, 1911. **R.,** **11,** 1766.

OPERATIONS.

1910–11. 10 snags removed by U. S. plant, **11,** 1766.

1911–12. Snags and obstr. removed, **12,** 1983.

PROJECTS.

Act June 25, 1910, au. removal of snags, logs, and other obstr., to provide a clear chan. of 6′ x 60′, beginning at mouth of bayou and extending upstream to near the town of Crowley, 29 m.; est., $10,000, with $250 an. mainten.,[4] **10,** 518.

SURVEY.

Pre. ex. au. act Mar. 2, 1907. **R.** by Capt. McIndoe, 1907 and 1908; est., $10,000,[4] **08,** 449.

S-793 CALCASIEU PASS, LAKE, AND RIVER, LA.

APPROPRIATIONS.

1872,	[5] $15,000,	**73,** 65.
1881,	[6] 3,000,	**81,** 1301.
1881,	[5] 12,000,	**81,** 1305.
1882,	[6] 7,000,	**82,** 1386.
1882,	[5] 3,000,	**82,** 1388.
1884,	[6] 6,500,	**84,** 1282.
1888,	10,000,	**88,** 1257.
1890,	75,000,	**90,** 1751.
1892,	100,000,	**92,** 1506.
1894,	90,000,	**95,** 1773.
1896,	80,000,	**96,** 1511.
1899,	35,000,	**99,** 1854.
1902,	75,000,	**02,** 1345.
1905,	100,000,	**05,** 1467.
1907,	*25,000,	**07,** 1441.
1909,	*8,000,	**09,** 1469.
1910,	5,000,	**10,** 1614.
Total,	649,500	(incl. sales, etc., $649,426.40, **12,** 1974).

[1] H. D. 178, 59th, 1st.
[2] H. D. 609, 61st, 2d.
[3] Trans. from Mermentau R. and Bayou Vermilion.
[4] H. D. 789, 60th, 1st.
[5] Calcasieu Pass.
[6] Calcasieu River.
* Allotment.

COMMERCE.

Description of, **71,** 68, 558; **74,** 721.

Extent to which further imp. would benefit C., **89,** 1528.

RR. rates reduced, **08,** 446; **12,** 664.

From 1901 to 1909 a steady increase; in 1910, decrease to some extent, **11,** 545.

1911, 404,800 t., **12,** 1975.

CONTRACTS.

1881. G. C. Fobes & Co., dr., $10,444, **82,** 1387.

1894. C. Clarke & Co., capping j. with st., $4.59 l. t. ($55,080), **95,** 1773.

1896. J. Winches, j. extension; brush mattresses, $1.20 s. y.; riprap st., $2.95 t.; and granite capping, $4.60 t. ($22,510), **96,** 1511. C. Clarke & Co., w. j. extension; brush mattresses, 91¢ s. y.; riprap st., $2.80 t.; and granite capping, $4.50 t. ($62,530), **97,** 1770.

1898. C. Clarke & Co., operating U. S. dr., $29 per day, **98,** 1481.

1899. Christie & Lowe, extending w. j.; mattress, 80¢ s. y.; riprap st., $2.20 t. ($33,900), **00,** 2267.

1902. John Short, repairs to and extension of e. j., **03,** 1310, 1311. Bowers Southern Dredging Co., dr., 20¢ c. y. for removal of 50,000 c. y.; agreement to repair j. and additional dr., 17½¢ c. y., to extend chan., **03,** 1310.

1906. Bowers Southern Dredging Co., dr., 9.9¢ c. y.; piles in place, $17.60 each. Charles Clarke & Co., riprap st., $2.94 t., **06,** 1319.

1908. M. A. Sweeney Shipyard & Foundry Co. constr. of combined dr. and snag boat; price, $37,400, **08,** 1503.

1908. M. A. Sweeney Engine & Foundry Co., changes in constr. of combined dr. and snag boat; price, $1,750, **09,** 1469. Change in position of boilers, smokestack, bulkheads, etc., $662.45, **10,** 1614.

1910. Drackett & Terrebonne, repair and alteration of U.S. dr. *Delatour*, $4,771.80, **11,** 1756.

ENGINEERS.

Chief of Engineers. R., 71, 68; **72,** 61; **73,** 65; **74,** 73; **80,** 146; **81,** 196, 1302; **82,** 192; **83,** 211, 212; **84,** 215; **85,** 221, 222; **86,** 220; **87,** 185; **88,** 171; **89,** 199, 202; **90,** 180; **91,** 226; **92,** 220; **93,** 247; **94,** 228; **95,** 255; **96,** 222; **97,** 286; **98,** 276; **99,** 330; **00,** 375; **01,** 394; **02,** 325; **03,** 341; **04,** 358; **05,** 372; **06,** 402, 411; **07,** 419; **08,** 445; **09,** 452; **10,** 505; **11,** 543; **12,** 661.

In charge:

Capt. C. W. Howell, 1871–82; **71,** 67; **72,** 60; **73,** 63; **74,** 72. **R., 71,** 557; **73,** 634; **74,** 721; **81,** 1300, 1301, 1304.

Maj. A. Stickney, 1881–84. **R., 82,** 1385, 1386; **83,** 1127, 1129; **84,** 1281, 1282.

Capt. T. Turtle, 1884–85. **85,** 1409, 1414.

Maj. W. H. Heuer, 1885–87. **R., 85,** 1409, 1414; **86,** 1276, 1277; **87,** 1378, 1402.

Capt. W. L. Fisk, 1888–91. **R., 88,** 1256; **89,** 1492, 1527; **90,** 1750.

Maj. J. B. Quinn, 1890–99. **R., 91,** 1829; **92,** 1504; **93,** 1830; **94,** 1373; **95,** 1770; **96,** 1509; **97,** 1768; **98,** 1480; **99,** 1853.

Maj. H. M. Adams, 1900. **R., 00,** 2266.

Lt. E. M. Adams, 1901. **R., 01,** 1903.

Lt. Col. H. M. Adams, 1902. **R., 02,** 1345.

Capt. Chas. S. Bromwell, 1903. **R., 03,** 1309.

Lt. Col. H. M. Adams, 1904. **04,** 1910.

Capt. J. F. McIndoe, 1905–08. **R., 05,** 1466; **06,** 1318; **07,** 1440; (Maj.) **08,** 1502.

Lt. Col. L. H. Beach, 1909–10. **R., 09,** 1468; **10,** 1613.

Maj. H. Burgess, 1911. **R., 11,** 1755.

Lt. Col. L. H. Beach, 1912–. **R., 12,** 1974.

Assistants:

A. C. Bell. **R., 81,** 1302.

W. S. Davis. **R., 83,** 1127.

Lt. O. T. Crosby. **R., 87,** 1379.

T. L. Raymond. **R., 87,** 1403.

OPERATIONS.

1870–71. Sur., **71,** 557.

1872–73. Chan. 60′ x 2,962′ dr., **73,** 65, 634.

1873–74. Chan. completed to a w. of 6.5′ x 60′, d. w. in Calcasieu Pass to Calcasieu Lake, **74,** 73, 721.

1881–82. Dr., **82,** 1387.

1886–87. Partial constr. of pile revet. for chan. over bar. Excavating of a chan. 6′ x 100′ begun in 1887 through bar at mouth of R.; 13,408 l. f. revet. wall built, **87,** 1379.

1887–88. 50,085 c. y. dr. by hired labor from bar at mouth of Calcasieu R., **88,** 1257.

1888–89. 27,074 c. y. dr. by hired labor, **89,** 1493.

1892–93. 1,104 l. f. j. on e. side of chan. completed, and constr. of 10,000′ of revet. on n. side of chan. nearly completed, **93,** 1831.

1893–94. Revet. completed, 144,634 c. y. dr., and about 5,000 l. f. e. j. built, **94,** 1374, 1375.

1894–95. E. j. completed to 7,347 l. f., 196,509 c. y. dr., and 6,652 l. f. of e. j. capped, **95,** 1772.

1895–96. In connection with preceding year, 6,552 l. f. e. j. capped, and extension of e. j. in progress, **96,** 1510, 1511.

1896–97. In connection with preceding year, e. j. extended 500 l. f., and 2,200 l. f. w. j. constr., **97,** 1769.

1897–98. 16,118 c. y. dr. and revet. repaired, **98,** 1480.

1899–00. 7,777 s. y. mattress and 13,066 t. st. placed in w. j., completing the extension, **00,** 2266.

1901–02. Shell reef in Calcasieu Lake chan. partially removed, **02,** 1345.

1902–03. Redr. chan. extended 2,770′, making total distance redr. 8′ x 60′ x 5,770′, **03,** 1310.

1904–05. E. j. repaired and extended 600′; work completed, **05,** 1466.

1905–06. 132,071 c. y. removed, **06,** 1318.

1906–07. Dr. completed; total of 352,779 c. y. removed, producing chan. 7′ x 100′ x 34,000′; 54 pile clusters placed to mark chan.; 18,763 t. riprap st. placed, completing rebuilding of old revet., **07,** 1440.

1910–11. 100,937 c. y. dr. by U. S. dr. *Delatour*, restoring chan. to former d. of 8′, **11,** 1755.

1911–12. Tender for U. S. dr. *Delatour* purchased, **12,** 1974.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 68, 557.

Refilling of the previously dr. chan., **85,** 1414; **86,** 1277; **87,** 1380.

Storms damaging works, **94,** 1374.

Effects of e. j., **94,** 1375; **95,** 1772.

Depths, **97,** 1769.

Rises sw. La. and flows sw. to Gulf of Mexico. About 22 m. from Gulf it debouches into Calcasieu Lake. The connection between the lake and the Gulf, 7 m. long, is known as Calcasieu Pass, **12,** 661.

D. over bar at mouth of pass, 7′; at head of pass, 8′; max. draft from Gulf of Mexico to Lake Charles, 6′ at l. w., the variation being 2′, **12,** 664.

PLANS. (See Projects.)

By Maj. Heuer, chan. 12′ d. by dr. and protecting js. across bar; est., $600,000, **87,** 1403.

Est., $307,681, to repair and complete js.; $10,000 for chan. revets., and $10,000 an. to maintain dr. chan., **01,** 1903.

PROJECTS.

By Capt. Howell, 1871, imp. bar at head of pass by dr. a chan. 5′ x 80′ x 1½ m.; est., $15,000, and, if extra dr. boat necessary, $25,000 to be added to est., **71,** 558; **72,** 61; **82,** 1387; **86,** 1277. This work accomplished in 1873–74, **74,** 73, 721.

In 1881 the previously dr. chan. having closed, it was proposed to reopen it 8′ x 70′ at l. w.; est., $15,000, **81,** 1304; **86,** 1277.

By Maj. Howell, 1881, for imp. of R. above the town of Lake Charles to Philips Bluff by cleaning chan. of snags, logs, etc., to a navigable w. and d.,

and dr. bar at foot of Calcasieu Lake; est., $25,080, **81,** 196, 1302.

In 1886, the chan. having again partly refilled, it was proposed to redr. 6′ x 100′, protecting it by a pile-and-plank revet. on each side, **87,** 1379.

By Maj. Heuer, 1887, for 12′ d. through the bar obstr. the passage from the pass to the d. w. of the Gulf, with 2 converging js. of brush mattress and riprap granite; est., $600,000, **87,** 1403, 1404.

Act July 13, 1892, added the imp. of the bars at the head and foot of Calcasieu Lake, to gain 8′; revet. of chans.; est., $150,000, **91,** 1829.

By Maj. Quinn, 1894–95, dr. chans. through bar at lake head, capping the e. j. with st., and for dr. chan. 12′ d. and as wide as funds would permit, from the 12′ contour inside to the same contour outside, **95,** 1772.

Proj. submitted, 1899–1900, for extending the w. j. 1,000′, **00,** 2266.

By Col. H. M. Adams, 1902, expend. $10,000 on redr. chan. through Lake Calcasieu to 8′, and $65,000 in repairing and extending e. j., **02,** 1345; approv. July 3, 1902, **03,** 342.

By Capt. McIndoe, 1906, redr. chans. s. of the old revet. at the inner pass, and at the mouth of the R., to 7′; for rebuilding old revet. at inner pass, and for marking chan. through Calcasieu Lake with pile clusters; approv. Jan. 17, 1906, **06,** 1318.

SURVEYS.

Ex. by Capt. Howell, **71,** 557.

Au. act June 14, 1880, **80,** 146. Ex. made by Maj. Howell, 1880, **81,** 1301.

Ex. of lower reach of R., **83,** 1127.

Ex. of bars at mouth of R. and pass au. act Aug. 5, 1886; made by Maj. Heuer, **87,** 1402.

Ex. au. act Aug. 5, 1886; made, 1888, by Capt. Fisk, **89,** 1527.

Made by Lt. Adams, 1901, to ascertain condition of revetments and chan. d. in lake; d. of from 4½′ to 6½′; shell reef had formed, **01,** 1903.

Ex. by Capt. McIndoe; 8′ chan. of 1903 had shoaled to 4′; chan. revetments had almost entirely disappeared, **05,** 373.

Pre. ex. and sur. of Calcasieu Lake and R., mouth of Calcasieu Pass to head of navigation in Calcasieu R., au. act Mar. 3, 1905;[1] made by Maj. McIndoe (**R.** unfav.), **06,** 411.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 663.

Maps. **94,** 1374; **95,** 1772; **97,** 1770; **99,** 1854; **00,** 2268.

S-799 BLACK BAYOU, LA. (Between Calcasieu Lake and Sabine Lake.)

ENGINEERS.

Chief of Engineers. **R.,** **91,** 230.
In charge. Capt. W. L. Fisk. **R.,** **91,** 1851.

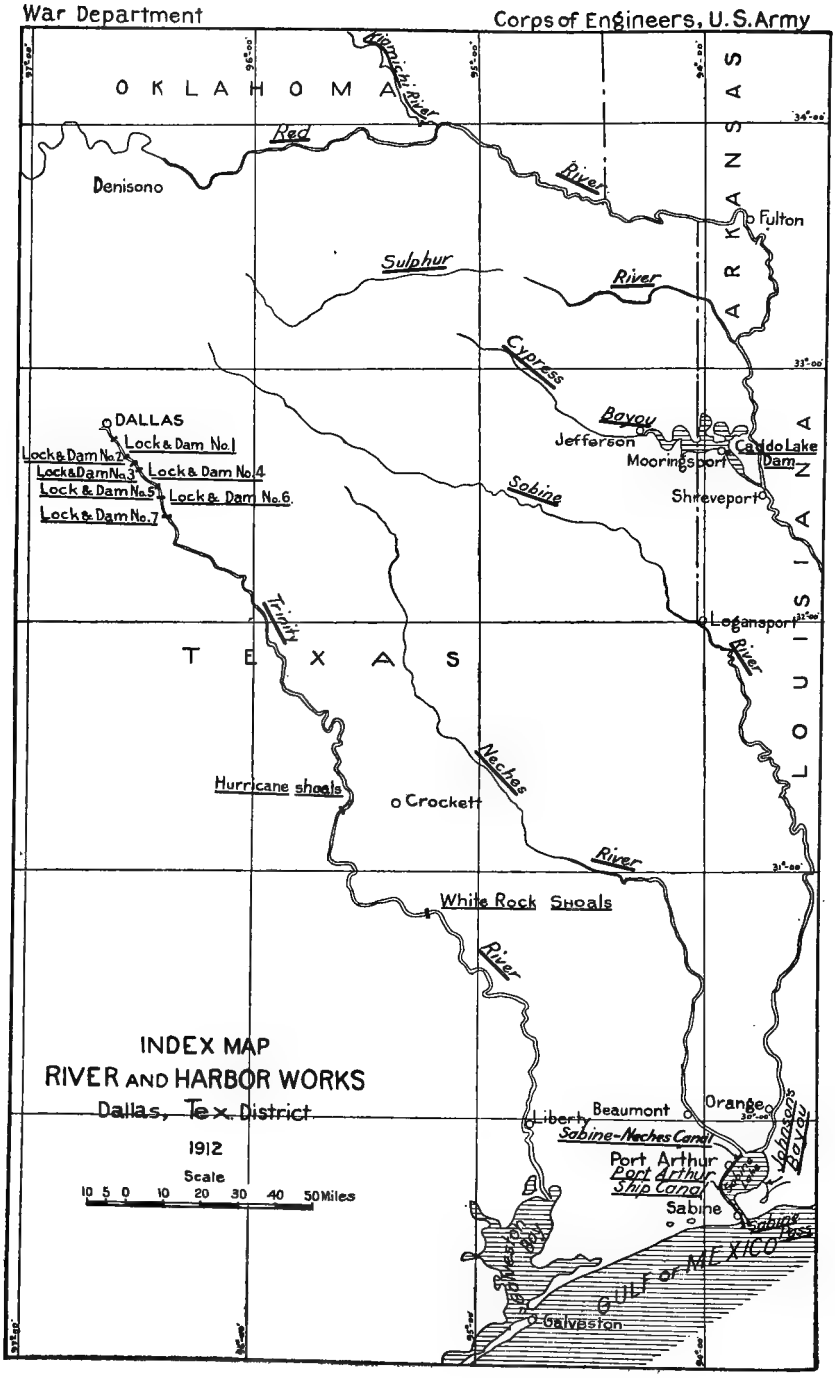
SURVEY.

Ex. of Black Bayou for connection between Calcasieu Lake and Sabine Lake, au. act Sept. 19, 1890; made, 1890, by Capt. Fisk (**R.** unfav.), **91,** 1851.

[1] H. D. 724, 59th, 1st.

RIVER AND HARBOR WORKS—GULF OF MEXICO.

T.—DALLAS, TEX., DISTRICT.


War Department
Corps of Engineers, U.S.Army
OKLAHOMA
ARKANSAS
LOUISIANA
TEXAS
Kiamichi River
Red River
Denisono
Fulton
Sulphur River
Cypress Bayou
Jefferson
Mooringsport
Caddo Lake Dam
Shreveport
Sabine River
DALLAS
Lock & Dam No. 1
Lock & Dam No. 2
Lock & Dam No. 3
Lock & Dam No. 4
Lock & Dam No. 5
Lock & Dam No. 6
Lock & Dam No. 7
Trinity River
Logansport
Neches River
Hurricane shoals
Crockett
White Rock Shoals
INDEX MAP
RIVER AND HARBOR WORKS
Dallas, Tex. District
1912
Scale
10 5 0 10 20 30 40 50 Miles
Liberty
Beaumont
Orange
Sabine-Neches Canal
Port Arthur
Port Arthur Ship Canal
Johnson's Bayou
Sabine
Sabine Pass
Galveston Bay
GULF OF MEXICO
Galveston

T.—DALLAS, TEX., DISTRICT.

In charge of U. S. Engineer Office,
Federal Bldg., Dallas, Tex.

T 1 Gulf of Mexico.
T 2 Sabine Pass, La. and Tex.[1] **(1)**
T 3 Sabine Lake, La. and Tex. (2)
T 4 Johnsons Bayou, La. (3)
T 5 Sabine R., La. and Tex. (3)
T 6 Neches R., Tex. (3)
T 7 Sabine and Neches Canal, Tex. (3, 5, 6)
T 8 Port Arthur Ship Canal, Tex. (2)
T 9 Sabine Pass H., Tex. (2)
T 10 Trinity R., Tex. (tributary to Galveston B., Tex. See Dist. U.)

The upper reaches of the Red R., from Fulton, Ark., are geographically included in T District, as follows:

T 11 Red R., La., Tex. and Okla. (See Dist. X.)
T 12 Little R., Ark. and Okla. (11)
T 13 Kiamichi R., Okla. (11)
T 14 Blue R., Okla. (11)
T 15 Washita R., Okla. (11)
T 16 Sulphur R., Tex. and Ark. (11)
T 17 Twelvemile Bayou, La. (11)
T 18 Caddo Lake, Tex. and La. (17)
T 19 Cypress Bayou, Tex. and La. (18)

T-3 SABINE LAKE, LA. AND TEX.

Part.	Title.	Period.	Appropriations.
a	Sabine Lake including channel to mouths of Sabine and Neches Rivers.	1893–1912	$546,500
b	Sabine-Neches Canal	1911–1912	235,000
	Total		781,500

Part (a), T-3 Sabine Lake including Channel from Port Arthur Canal to mouths of Sabine and Neches Rivers, Tex.

APPROPRIATIONS.

1899, $10,000, **99,** 1856.
1902, 125,000, **02,** 1348.
1906, 411,500, **06,** 1321.

Total, 546,500 (incl. misc., $546,571.10, **12,** 2033).

COMMERCE.

Description of. Resources of the country tributary to the Sabine and Neches Rs. very great, **93,** 1852; **95,** 1791.

From Jan. 1. to Dec. 31, 1899, C. 141,122 t., **00,** 2272.

Importance of oil industry, **04,** 1936.

[1] The following list includes all the waterways, important and less important, tributary to the Sabine waters:

T 2 (a) Sabine Pass, La. and Tex. (1)
(b) Sabine Lake, La. and Tex. (a)
(c) Johnsons Bayou, La. (b)
(d) Three Bayou, La. (b)
(e) Sabine R., La. and Tex. (b)
(f) Black Bayou, La. (e)
(g) Vinton Canal, La. (e)
(h) Bayou Conway, La. (e)
(i) Caney Cr., La. (e)
(j) Brush Cr., La. (e)
(k) Cypress Cr., La. (e)
(l) Hoosier Cr., La. (k)
(m) Ridge Cr., La. (e)
(n) Trout Cr., La. (e)
(o) Bayou L'Anacoco, La. (e)
(p) Cypress Cr., La. (o)
(q) Bayou Zourie, La. (o)
(r) Bayou Castor, La. (o)
(s) Bayou Liberty, La. (r)
(t) Prairie Cr., La. (o)
T 2 (u) Pocoson Cr., La. (o)
(v) Mill Cr., La. (e)
(w) Damrell Cr., La. (e)
(x) Ten Mile Cr., La. (e)
(y) Pearl Cr., La. (e)
(z) Sandy Cr., La. (e)
(aa) Bayou Toreau, La. (e)
(bb) Selfs Bayou, La. (aa)
(cc) Walker Bayou, La. (aa)
(dd) Bayou Sally, La. (aa)
(ee) Black Haw Cr., La. (e)
(ff) Franks Bayou, La. (e)
(gg) Bayou Lonnan, La. (e)
(hh) Bayou San Miguel, La. (e)
(ii) Bayou San Patrice, La. (e)
(jj) Bear Cr., La. (e)
(kk) Cow Bayou, La. (e)
(ll) Bayou Clement, La. (e)
(mm) Bayou Grand Cane, La. (e)

Remarks on rice growing, and benefit of prospective imp., **04,** 1936.

CONTRACTS.

1899. C. Clarke & Co., dr. boat and crew, 77 days, at $110.60 per day of 16 hours, **00,** 2273.

1906. Bowers Southern Dredging Co., dr., 8¢ c. y., and revet. work, $9.20 l. f., **06,** 1321.

1908. Bowers Southern Dredging Co., dr., 12¢ c. y., **08,** 1547.

1911. The South Texas Telephone Co., leasing telephone with exchange service, $3 per mo., **12,** 2033.

ENGINEERS.

Chief of Engineers. **R., 93,** 251; **95,** 260; **97,** 292; **99,** 333; **00,** 378, 384; **01,** 396; **02,** 328; **03,** 344; **04,** 361, 365; **05,** 375; **06,** 404; **07,** 421; **08,** 475; **09,** 498; **10,** 560; **11,** 600, 621; **12,** 726, 752.

Boards:

Convened, New Orleans, La., Apr. 20 and July 10, and at Sabine Lake, Apr. 21, 1899, by S. O. No. 14, dated Mar. 16, 1899, to make reex. of the proposed chan. through Sabine Lake, Tex. **R., 00,** 2304. (Maj. J. B. Quinn, Capts. C. S. Riché and C. A. F. Flagler.)

BERH. **R., 04,** 1939, 1949.

In charge:

Maj. J. B. Quinn, 1893–99. **R., 93,** 1850; **95,** 1790; **97,** 1789; **99,** 1856.

Maj. H. M. Adams, 1900, 1902, and 1904. **R., 00,** 2272, 2302; (Lt. Col.) **02,** 1347; **04,** 1914, 1930.

Lt. E. M. Adams, 1901. **R., 01,** 1907.

Capt. C. S. Bromwell, 1903–04. **R., 03,** 1314; **04,** 1944, 1953.

Capt. J. F. McIndoe, 1905–07. **R., 05,** 1469; **06,** 1319; **07,** 1443.

Capt. W. P. Wooten, 1908. **R., 08,** 1546.

Capt. A. E. Waldron, 1909–10. **R., 09,** 1526; **10,** 1669.

Capt. T. H. Jackson, 1911–. **R., 11,** 1815; (Maj.) **12,** 2032.

Assistants:

J. L. Brownlee. **R., 93,** 1852.

A. H. Weber. **R., 04,** 1933.

LEGAL PROCEEDINGS.

Land owners offer to donate right of way for inland route, **06,** 1320.

OPERATIONS.

1899-00. 85,064 c. y. dr., **00,** 2272.

1905-06. 750,169 c. y. dr., and 2,412′ timber revet. built at mouth of Taylors Bayou, **06,** 1320.

1906-07. 2,440,634 c. y. dr. and chan. marked with 21 pile clusters, **07,** 1443.

1907-08. 1,114,085 c. y. dr.; canal connecting mouths of Rs. with Taylors Bayou completed, **08,** 1546.

1908-09. Office building constr. and other minor work done, **09,** 1526.

1909-10. Obstr. removed from chan., **10,** 1669.

1910-12. Sunken obstr. removed, **11,** 1815; **12,** 2033.

PHYSICAL CHARACTERISTICS.

Description of Sabine Lake. The lake, 18 m. l., and with d. in 1892 ranging from 4′ to 7′, part of the water route from the d. w. of Sabine and Neches Rs. to Sabine Pass on the Gulf of Mexico, **93,** 1851; **95,** 1790; **97,** 1789.

Shoaling, outer end of Sabine R. Chan., **00,** 378.

Description of, **04,** 1934.

PROJECTS.

In 1897 Maj. Quinn est. $20,000 to $4,117,800 to obtain chans. of various dimensions, **97,** 1789.

Act. Mar. 3, 1899, app. $10,000 to imp. mouths of Sabine and Neches Rs., a portion of the money to pay for a reex. for chan. through Sabine Lake, **00,** 378.

Proj., 1899–1900, provided for dr. chan. 60′ x 8′ d. w. in the Neches R. to d. w. in Sabine Lake, **00,** 2272.

BE., 1899, est. $300,000 to imp. mouths of the Sabine and Neches Rs., with an. app. for mainten., **00,** 2305.

Lt. Col. Adams est., 1902, it would require $4,000 an. mainten., **02,** 1347.

Act June 13, 1902, au. proj. based on est. of Maj. Quinn, 1897, for chan. 8′ d. through Sabine Lake, or d. if funds should be furnished by private interests for additional d.; est., $150,000,[1] **02,** 328.

By Capt. Bromwell, 1903, est. varying from $382,000 to $530,000 for 9′ chans., varying in w., location, and means of protection. Chan. 100′ w. to Sabine Pass, with rock revet., at est. cost of $464,000 recom., or if connection can be made with Port Arthur Canal through Taylors Bayou without assuming obligations to maintain such canal, then that route at est. cost of $415,000 recom., **04,** 1946; **05,** 1469; also est. for various routes varying from $400,000 to $747,000, and $30,000 an. mainten.,[2] **04,** 1953.

Act Mar. 3, 1905, au. proj. for connecting mouths of Sabine and Neches Rs. with Taylors Bayou, or a point in Sabine Lake, near mouth of bayou, a chan. 9′ d. at or near w. shore of lake. In discretion of Sec. of War chan. may be constr. through land near lake and provided that right of way be furnished free, **05,** 375.

Act Mar. 2, 1907, au. extension of chan. at s. end with d. of 9′ to junction with Port Arthur Canal, and w. canal in front of Port Arthur, in discretion of Sec. of War, **07,** 423.

SURVEYS.

Ex. au. act July 13, 1892; made, 1892, by Maj. Quinn (**R.** fav. to partial imp.), **93,** 1850. Another au. act Aug. 17, 1894; made by the same officer, 1895 (**R.** fav.), **95,** 1790.

Sur. au. act June 3, 1896; made by Maj. Quinn, 1897 (see Projects), **97,** 1789, **02,** 328.

Sur. of mouths of Sabine and Neches Rs., and a reex., with **R.** thereon, of the proposed chan. through Sabine Lake, au. act Mar. 3, 1899; made, 1899, by BE. (see Projects), **00,** 2304.

Pre. ex. and sur. au. act June 13, 1902, for ship chan. from Beaumont, on the Neches R., and Orange, on the Sabine R., to Sabine Lake, thence along w. shore of said lake to Sabine Pass, Tex., incl. connection between said chan. and the Port Arthur Canal, with view to excavating chan. of ds. of 9′, 12′, 18′, and 25′. **R.,** Lt. Col. Adams, on pre. ex., Oct. 21, 1902, and on sur. by Capt. Bromwell, Dec. 12, 1903, and Feb. 13, 1904; ests. from $382,000 to $747,000; the one at $536,500 and $30,000 an. mainten. preferred.[2] **04,** 365–66, 1927.

Of proposed route, **05,** 1469.

Pre. ex. and sur. au. act Mar. 3, 1909, from mouths of Sabine and Neches Rs. to mouth of Taylors Bayou, and incl. Sabine R. from Orange to said canal and Neches R. from Beaumont to said canal. **R.** by Capt. Waldron, Sept. 18, 1909, and Mar. 5, 1910[3] (unfav.), **10,** 577.

Of Sabine Pass and Port Arthur Ship Canal, incl. Taylors Bayou, and turning basin at Port Arthur, au. act Mar. 3, 1909. **R.** by Capt. Waldron; est., $2,000,000, provided right of way to turning basin be furnished free to U. S.,[4] **10,** 577.

R. by BERH., Jan. 18, 1909; requested by Commerce Com. to further examine Sabine and Neches Canal, Tex. Board is of opinion that work already provided above Port Arthur is sufficient for present and prospective C.[5]

Reex. of chan. from Orange and Beaumont, on Sabine and Neches Rs., to Port Arthur Ship Chan., Tex., au. act June 25, 1910. **R.** by special board, Sept. 25, 1910; est., $1,143,000, of which amount local interests propose to contribute one-half ($571,500), with $50,000 an. mainten.,[6] **11,** 621.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 729.

Maps.[3 4]

[1] H. D. 299, 54th, 2d.
[2] H. D. 634, 58th, 2d.
[3] H. D. 836, 61st, 2d.
[4] H. D. 773, 61st, 2d.
[5] R. and H. Com., 50, 61st, 2d.
[6] H. D. 1290, 61st, 3d.

Part (b), T-3 Sabine-Neches Canal, Including Sabine River to Orange and Neches River to Beaumont, Tex.

APPROPRIATIONS.

1911, $200,000, **11,** 1818.
1912, 35,000, **12,** 2037.

Total, 235,000 (total available, incl. $571,500 contributed by private interests, $806,500, **12,** 2037).

CONTRACTS.

1912. Bowers Southern Dredging Co., dr. 7,291,000 c. y., 7.29¢ c. y., and clearing 30 acres, at $50 acre, **12,** 2037.

ENGINEERS.

Chief of Engineers. **R., 11,** 602; **12,** 729.
In charge. Capt. T. H. Jackson, 1911–. **R., 11,** 1817; **12,** 2035.

OPERATIONS.

1911-12. 310,572 c. y. dr., **12,** 2036.

PRIVATE WORK.

Beaumont navigation interests deposited $428,000 in accordance with act Feb. 27, 1911, **11,** 1818.
Orange Co. navigation interests deposited $143,500; bind themselves to maintain chan. in sec. "b," **12,** 731.

PROJECTS.

Act Feb. 27, 1911, au. imp. Sabine-Neches Canal, Tex., from Port Arthur Ship Canal to mouth of Sabine R., the Neches R. up to Beaumont, Tex., and Sabine R. to Orange, to 25′, bottom w. in Sabine-Neches Canal 80′ and bottom w. in open Rs. 150′, etc.; total cost, $1.143,000; local interests to contribute one-half ($571,500) and maintain chan., free of cost to U. S., for 3 years, and to provide for operation and mainten. of guard lock therein,[1] **11,** 602.
Act July 25, 1912, extends proj. to incl. cutting off of bends and w. of chan., **12,** 2036.
Map. **12,** 2036.

T-4 JOHNSONS BAYOU, LA.

APPROPRIATIONS.

1899, $2,500, **99,** 1855.
1907, 2,500, **07,** 1442.
1911, 2,000, **11,** 1814.
1912, 2,500, **12,** 2032.

Total, [2] 9,500, **12,** 2032.

COMMERCE.

Amounted to 3,163 t., 1899, **00,** 2268.
1908, 5,000± t.; 1911, 2,300± t., **12,** 725.

CONTRACTS.

1899. C. Clarke & Co., dr., 19¢ c. y. ($2,090), **00,** 2269.

ENGINEERS.

Chief of Engineers. **R., 99,** 332; **00,** 377; **01,** 395; **02,** 326; **03,** 343; **04,** 360; **05,** 374; **07,** 421; **08,** 474; **09,** 497; **10,** 559; **11,** 599; **12,** 724.

In charge:
Maj. J. B. Quinn, 1897–99. **R., 99,** 1855.
Maj. H. M. Adams, 1900–02. **R., 00,** 2268; (Lt. Col.) **01,** 1905; **02,** 1346.
Capt. Chas. S. Bromwell, 1902–04. **R., 03,** 1311.
Lt. Col. H. M. Adams, 1904. **R., 04,** 1913.
Capt. J. F. McIndoe, 1904–07. **R., 05,** 1468; **07,** 1442.
Capt. W. P. Wooten, 1907–08. **R., 08,** 1545.
Capt. A. E. Waldron, 1908–11. **R., 09,** 1525; **10,** 1667.
Capt. T. H. Jackson, 1911–. **R., 11,** 1813; (Maj.) **12,** 2031.

OPERATIONS.

1899-00. 11,762 c. y. dr., completing proj., **00,** 2268.
1909-10. Dr. to maintain chan. of 6½′ average d. by U. S. dr.; erected beacon to mark its location, **10,** 1667.
1910-11. 40,613 c. y. dr., **11,** 1814.

PHYSICAL DATA.

Stream in extreme sw. portion of La., runs nw. to Sabine L.; 25± m. l. Proj. portion at mouth only, **12,** 724.

PROJECTS.

By Maj. Quinn, 1899, 6′ chan. from the 6′ d. in Sabine L. to 6′ d. in the bayou, of such w. as funds would permit, **99,** 1855.

SURVEYS.

Pre. ex. made, 1897, in connection with a sur. of Sabine L., by Maj. Quinn. (**R.** fav.), **97,** 1789; **99,** 1855.
Ex., 1908; and B. found unworthy of imp., **08,** 1545; on 2d ex., 1908, recom. that bar in chan. be dr.; au., **09,** 1525.

T-5 SABINE RIVER, LA. AND TEX.[3]

APPROPRIATIONS.

1872, [4] $2,700, **73,** 684.
1878, 10,000, **78,** 84.
1879, 6,000, **79,** 108.
1880, 5,000, **80,** 1195.
1881, 7,000, **81,** 1323.
1882, 4,000, **82,** 1424.
1892, 5,000, **92,** 1511.
1894, 5,000, **95,** 1779.
1896, 2,000, **96,** 1517.
1899, 2,000, **99,** 1857.

Total, 48,700

COMMERCE.

Important, **71,** 540, 543; **73,** 680.
Description of; mostly lumber, and increasing, **96,** 1516.
From Jan. 1 to Dec. 31, 1899, C. 407,373 t., **00,** 2274.
Mostly floating of logs, **04,** 1961.

CONTRACTS.

1878. Brott & Norris, dr., 17¢ c. y.; annulled, **79,** 904.
1879. S. N. Kimball, dr., 22½¢ c. y., **79,** 904.
1880. F. A. Hyatt, cut-off excavation, **80,** 1194.

[1] H. D. 1290, 61st, 3d
[2] $238.65 reverted to Treas.
[3] Sur.—**R.** Feb. 15, 1853; est., $159,750. (H. D. 482, 55th, 2d.)
[4] Allotment for sur.

1889. Sabine Tram Co., pile and brush dam constr., $3,647, **90,** 1752.
1893. Lyles & Allardyce, hire of snag boat, $64.70 per day, **93,** 1837.
1895. Same firm, hire of snag boat, $54.60, **95,** 1780.
1899. V. Von Schoeler, snagging plant and crew, 36 days, at $69.50 per day of 8 hours (oral agreement), **00,** 2274.

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 62; **71,** 67; **72,** 62; **73,** 66; **78,** 84; **79,** 108; **80,** 146, 150; **81,** 198; **82,** 195; **83,** 200; **84,** 208; **85,** 224; **86,** 222; **87,** 186; **89,** 200; **90,** 180; **91,** 228, 230; **92,** 222, 223; **93,** 249, 251; **94,** 231; **95,** 258; **96,** 224; **97,** 289; **98,** 279; **99,** 333; **00,** 379; **01,** 397; **02,** 329; **03,** 345; **04,** 362, 366; **05,** 376; **08,** 486; **12,** 752.

Boards. BERH. considers stream not worthy of further imp., **04,** 1958.

In charge:

Capt. C. W. Howell, 1870–80. **R., 71,** 540; **73,** 680; **78,** 610; **79,** 904.
Maj. S. M. Mansfield, 1880–82. **R., 80,** 1193, 1199; **81,** 1321.
Maj. W. H. Heuer, 1882–84, 1885–87. **R., 82,** 1422; **83,** 1055; **85,** 1425; **86,** 1287; **87,** 1383.
Capt. T. Turtle, 1884–85. **R., 84,** 1255.
Capt. W. L. Fisk, 1888–91. **R., 88,** 1259; **89,** 1494; **90,** 1752.
Maj. J. B. Quinn, 1891–99. **R., 91,** 1835; **92,** 1510, 1513; **93,** 1835, 1848; **94,** 1379; **95,** 1778; **96,** 1515; **97,** 1773; **98,** 1485; **99,** 1857.
Maj. H. M. Adams, 1900, 1902, and 1904. **R., 00,** 2274; (Lt. Col.) **02,** 1348; **04,** 1915, 1957.
Lt. E. M. Adams, 1901. **R., 01,** 1908.
Capt. C. S. Bromwell, 1903. **R., 03,** 1315.
Capt. J. F. McIndoe, 1905. **R., 05,** 1471.
Capt. W. P. Wooten. **R., 08,** 474.
Maj. T. H. Jackson. **R., 12,** 724.

Assistants:

G. Dyes. **R., 71,** 542.
F. P. Leavenworth. **R., 73,** 681.
J. S. Polhemus. **R., 80,** 1195.
P. H. Thomson. **R., 93,** 1849.
A. H. Weber. **R., 04,** 1959.

ESTIMATES. (See Plans and Projects.)

By Capt. Howell, purchase of dr. in connection with Trinity R., $42,600, **71,** 541; **78,** 611.
By G. Dyes, converging js., $1,800; shell embankments and piling, $10,252.40, **71,** 543.

LEGISLATION.

1856. $51,455 app. by Texas for imp. of R., **73,** 683.

OPERATIONS.

1879-80. 42,567 c. y. dr. from cut through bar, **80,** 1194.
1880-81. Cut-off at Dead Bend completed and one at head of Narrows begun, **81,** 1322.
1881-82. Cut-off at the Narrows completed, **82,** 1423.
1882-83. Chan. 6′ x 100′ redr. for 5,600′, **83,** 1056.
1889-90. Constr. of pile and brush dams begun under contract, **90,** 1752.
1890-91. Pile and brush dam constr. in progress under contract, **91,** 1835.
1891-92. Proj. completed, **92,** 1511.
1892-93. 1,325 obstr. removed, **94,** 1380.
1895-96. Nearly 2,000 obstr. removed, **96,** 1516.
1899-00. 955 misc. obstr. removed, **00,** 2274.
1900-01. 41 snags and logs and 174 trees removed, **01,** 1908.

PHYSICAL CHARACTERISTICS.

General description, **71,** 540, 542; **73,** 682, 683.
Description of, between Sudduths Bluff, Tex., and Logansport, La., **93,** 1848.
Tendency of obstr. to re-form, **96,** 1516.
Waterway made up of a series of pools and crossings, or shoals, impossible to navigate at l. w. Loose and stranded logs form serious obstr., **04,** 1960.

PLANS. (See Estimates and Projects.)

By Capt. Howell, purchase of a dr. to operate both at Trinity and Sabine Rs., **71,** 541.
By G. Dyes, (1) converging js. to concentrate discharge of water; (2) shell embankment and piling to close the cut-off and the West Pass, **71,** 543.
Capt. Fisk reports, 1888, that further imp. are inadvisable, as the existing chan. meets the requirements of C., **88,** 1260.
By Maj. Quinn, 1891, removal of snags and similar obstr. between Sabine Lake and Sudduths Bluff; est., $10,000, **92,** 1514.

PRIVATE (STATE AND CORPORATE) WORK.

1853. Company formed for imp. of the navigation of the R., **73,** 683.
(See Legislation.)

PROJECTS. (See Estimates and Plans.)

By Capt. Howell, 1873, dr. chan. across bar at mouth of R. to 5′, and removing snags and obstr. from R. above; est., $56,000; est., orig., $31,033, **73,** 681; **79,** 904, 905; **80,** 1195.
By Maj. Mansfield, 1880, excavation of cut-off from the main R. into the Narrows, 5′ x 40′ x 320′; formation of 2 other cut-offs of 100′ each; removal of snags, logs, and similar obstr., and constr. of pile and brush obstr. across old chan.; est., $17,500, **80,** 1199. R. not considered susceptible of permanent imp., **86,** 222; **92,** 1510.
By Maj. Quinn, 1892, removing snags and other obstr. between Sabine Lake and Sudduths Bluff; est., $10,000. In 1893, est. $2,000 an. mainten., **93,** 1836.
By Maj. Quinn, 1895, to dr. chan. across bar at R. mouth. (See Sabine Pass, Tex.)
Subproj., 1897, to clear R. of obstr. from Morgans Bluff to head of the Narrows, **99,** 1857.
Subproj., 1899, to remove most dangerous obstr. between Morgans Bluff and Sudduths Bluff, **99,** 1857; **00,** 2274.

SURVEYS.

By G. Dyes, 1871. **R., 71,** 542.
By F. P. Leavenworth, 1872–73. **R., 73,** 681.
Resur. au. act Mar. 3, 1879; made, 1880, by Maj. Mansfield, **80,** 1195.
Of Narrows of Sabine R., **80,** 1199.
Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Quinn, **92,** 1513.
Ex. of the R. from Sudduths Bluff, Tex., to Logansport, La., au. act July 13, 1892; made, 1892, by Maj. Quinn (**R.** unfav.), **93,** 1848.
General ex. of the work, **97,** 1773.
Ex., mouth to Logansport, La., au. act June 13, 1902. **R.** by Lt. Col. Adams[1] (unfav.), **04,** 1956.
Ex., mouth to Logansport, La., and Belzora, Tex., au. act Mar. 2, 1907. **R.** by Capt. Wooten, Dec. 11, 1907[2] (unfav.), **08,** 486.
Pre. ex. and sur. au. act June 25, 1910, as far as practicable above Orange, **12,** 752.

[1] H. D. 177, 58th, 2d.

[2] H. D. 490, 60th, 1st.

T-6 NECHES RIVER, TEX. (Including survey of Angelina River, Tex.)

APPROPRIATIONS.

1878,	$8,000, **78,** 84.
1879,	5,000, **79,** 109.
1880,	5,000, **80,** 1202.
1881,	3,000, **81,** 1325.
1882,	5,000, **82,** 1425.
1884,	7,000, **84,** 1257.
Total,	33,000

COMMERCE.

Does not warrant heavy expend. for imp., **74,** 748.
Obstr. to navigation, **74,** 748, 752.
Description of, large, **93,** 1854.
Decreasing in 1895–96 on account of obstr. in the stream, **96,** 1518.

CONTRACTS.

1878. Brott & Norris, dr., 17¢ c. y. Contract annulled, **79,** 907.
1879. S. N. Kimball, dr., 22¼¢ c. y., **79,** 909.
1881. Neyland & Henderson, removal of obstr., **81,** 1324.

ENGINEERS.

Chief of Engineers. R., 72, 62; **74,** 74; **78,** 84; **79,** 109; **80,** 147, 150; **81,** 198; **82,** 195; **83,** 200; **84,** 208; **85,** 225; **86,** 222; **87,** 186; **89,** 200; **90,** 181; **91,** 228; **92,** 222; **93,** 250, 251; **94,** 232; **95,** 259; **96,** 225; **97,** 290; **08,** 486.

In charge:
Capt. C. W. Howell, 1872–79. **72,** 62. **R., 74,** 742; **78,** 611; **79,** 905.
Maj. S. M. Mansfield, 1880–81. **R., 80,** 1201; **81,** 1324.
Capt. C. E. L. B. Davis, 1881–82. **R., 81,** 1324.
Maj. W. H. Heuer, 1882–84. **R., 82,** 1425; **83,** 1057.
Capt. T. Turtle, 1884–85. **R., 84,** 1256.
Maj. W. H. Heuer, 1885–87. **R., 85,** 1426; **86,** 1288; **87,** 1384.
Capt. W. L. Fisk, 1888–91. **R., 88,** 1260; **89,** 1495; **90,** 1753.
Maj. J. B. Quinn, 1891–97. **R., 91,** 1836; **92,** 1511; **93,** 1837, 1853; **94,** 1381; **95,** 1781; **96,** 1518; **97,** 1775.
Capt. W. P. Wooten, **08,** 474.

Assistants:
Lt. H. M. Adams, 1873. **R., 74,** 743.
A. De Man, 1873. **R., 74,** 745.
J. S. Polhemus. **R., 80,** 1202.
P. H. Thomson. **R., 93,** 1854.

OPERATIONS.

1881–82. R. imp. between Yellow Bluff and Bevilport, by removal of snags, logs, and similar obstr., **82,** 1425.
1888–89. 55,842 c. y. dr. by hired labor, **89,** 1495.
1895–96. 74,885 c. y. dr., **96,** 1518.

PHYSICAL CHARACTERISTICS.

General, **74,** 747, 748, 751, et seq., **80,** 1203.
Bar at mouth, **74,** 743, 753.
Description of, from mouth to Shooks Bluff, **93,** 1853.

PLANS.

By Lt. Adams, dr. chan. to a w. of 80′ and d. of 5′, **74,** 743.
By A. De Man, removing snags and overhanging willows which obstr. the navigation of the Angelina R., **74,** 748. Dr. the chan. through middle ground, and constr. of js. 9,300′ and 2,200′ l. at the mouth of the Neches R., **74,** 754.

PRIVATE (STATE AND CORPORATE) WORK.

Imp. of the Angelina R. (trib. to Neches) has been attempted by Texas, but the attempts resulted in a failure, owing to the incompetency of the contractors, **74,** 749.

PROJECTS.

By Capt. Howell, 1878, dr. chan. 5′ x 40′ at m. l. w. across the bar at the mouth of the Neches R.; est. $26,318, **78,** 84; **79,** 909; **80,** 1202.
By Maj. Mansfield, 1880, removing snags, trees, and similar obstr. from Yellow Bluff to Bevilport, 7 m.; est., $15,000, **80,** 1204.
Total est. for projs. of 1878–80, $41,318, **87,** 1384.
By Maj. Quinn, 1895, expend. available funds in dr. chan. about 100′ w. and 6′ d. from d. w. in Neches R. to d. w. in Sabine Lake, **95,** 1781.

SURVEYS.

By A. De Man, 1872–73. **R., 74,** 745.
Ex. by Capt. Howell, 1878, **79,** 905.
Resur. from mouth to Bevilport au. act Mar. 3, 1879; made, 1880, by Maj. Mansfield, **80,** 1202.
Ex. from its mouth to Shooks Bluff au. act July 13, 1892; made, 1892, by Maj. Quinn, **93,** 1853 (**R.** fav.).
Pre. ex. with plan and est. of cost of imp. au. act Mar. 2, 1907. **R.,** Capt. Wooten, 1907 and 1908; est., $15,000,[1] **08,** 486.

T-8 PORT ARTHUR CANAL, TEX. (Operating and care.)

APPROPRIATIONS.[2]

1907,	$30,000.00
1907,	18,989.08
1908,	22,353.81
1909,	15,000.00
1909,	15,000.00
1909,	25,664.76
1910,	126,125.89
1911,	40,216.29
1911,	9,519.70
1911,	6,200.00
Total,	[3] 309,069.53

COMMERCE.

In 1911, 1,880,017 t., mostly corn, paint, iron, steel, tin plate, lard, etc., **12,** 2040.

CONTRACTS.

1907. Spence & Parrish, wooden revet., $15.11 l. f., **07,** 1446.
1909. John Jacobson, dr., 10½¢ c. y., **09,** 1529.
1911. Bowers Southern Dredging Co., dr. 175,000 c. y., in turning basin at head of ship canal, 10.4¢ c. y.; Ellicott Machine Co., constr. and delivering one complete wooden hull, 15″ pipe-line dr., $84,520, **12,** 2039.

[1] H. D. 870, 60th, 1st.
[2] Allotments from permanent indefinite app. for operation and care of canals and other works of navigation, as per sec. 4, act July 5, 1884, amended and reenacted by sec. 6, act Mar. 3, 1909.
[3] Furnished by T. District office.

1912. J. B. Griffith, lease of tug *Captain Nelson*, fully equipped and services of crew of 2 men, $375 per month, **12,** 2039.

ENGINEERS.

Chief of Engineers. **R., 07,** 424; **08,** 476; **09,** 500; **10,** 563; **11,** 604; **12,** 734.

In charge:
Capt. J. F. McIndoe, 1907. **R., 07,** 1445.
Capt. W. P. Wooten, 1908. **R., 08,** 1548.
Capt. A. E. Waldron, 1909–10. **R., 09,** 1529; **10,** 1671.
Capt. T. H. Jackson, 1911–. **R., 11,** 1818; **12,** 2037.

LEGAL PROCEEDINGS.

Port Arthur Canal and appurtenances trans. to U. S. by owners, 1906, and jurisdiction ceded by State of Texas, 1907, **07,** 424.

OPERATIONS.

1906-07. Dr. of canal company bought by U.S., **07,** 1446.
1907-08. 100,567 c. y. dr. by contract, and 38,605 by U. S. plant, **08,** 1548.
1908-09. 13,900 l. f. shoals dr., **09,** 1529.
1909-10. 11,500 l. f. chan. dr., and 293,596 c. y. dr. from turning and lumber basins, **10,** 1671.
1910-11. Dr. shoal places in canal to 26′ or 27′ for 9,200′, and redr. entire length of lumber basin at Port Arthur docks, 2,500′, **11,** 1818.
1911-12. U. S. dr. shoal places in canal to d. of 26′ and 27′, removing 113,115 c. y. silt; 89,135 c. y. in turning basin at head of Port Arthur Ship Canal dr. by contract, **12,** 2039. 24,000 c. y. dr. from turning basin by contract; wooden hull, 15″ pipe line dr. named *Orange*, delivered, **12,** 2038.

PHYSICAL CHARACTERISTICS.

Condition of canal upon acceptance by U. S., **07,** 425.
Considerable shoaling in turning basin at Port Arthur docks, **11,** 605.

PROJECTS.

Subproj. approv. Aug. 8, 1910, au. dr. about 175,000 c. y. from turning basin at head of Port Arthur Canal to secure 26′; also provides for constr. of a 15″ hydraulic pipe-line dr. at a cost of about $75,000, **11,** 1818.

SURVEYS.

Of break between canal and Sabine Lake, **07,** 1445.
Of canal, **07,** 1446.

T-9 SABINE PASS HARBOR, TEX.[1]

APPROPRIATIONS.

1852,	$5,000, act Aug. 30 (sur.).
1872,	†*2,000, **73,** 685 (sur.).
1875,	20,000, **76,** 77, 589.
1876,	[2] 38,000, **76,** 77, 592; **77,** 468.
1878,	30,000, **78,** 83.
1879,	25,000, **79,** 108.
1880,	50,000, **80,** 1164.
1881,	150,000, **81,** 1318.
1882,	150,000, **82,** 1422.
1884,	200,000, **84,** 1250.
1886,	198,750, **86,** 1281.
1888,	250,000, **88,** 1263.
1890,	300,000, **90,** 1757.
1892,	350,000, **92,** 1509.
1894,	[3] 275,000, **95,** 1776.
1896,	75,000, **96,** 1514.
1897,	480,000, **97,** 1771.
1898,	400,000, **98,** 1483.
1899,	150,000, **99,** 1860.
1899,	264,000, **99,** 1860.
1900,	36,000, **00,** 2278.
1902,	185,000, **02,** 1351.
1905,	150,000, **05,** 1473.
1907,	160,000, **07,** 1448.
1908,	190,000, **08,** 1551.
1909,	*200,000, **09,** 1532.
1909,	10,000, **09,** 1532.
1910,	150,000, **10,** 1674.
1911,	150,000, **11,** 1821.
1912,	433,800, **12,** 2042.
Total,	[4] 5,076,550 (less $17,491.59 returned to Treas., and incl. $3,345.13 recd. from sales, etc., $5,062,403.54, **12,** 2042).

COMMERCE.

Unimportant, Blue Buck Point, **73,** 676.
Important, **75,** 948.
Description of. Almost wholly shipments of pine lumber to domestic and foreign ports, **96,** 1514.
Operations by 2 railroads in progress, 1896–79, with a view to making the pass a great grain exporting and importing port, **96,** 1514.
C. concerned in imp., 1899, valued at from $3,000,000 to $5,000,000, **99,** 1860; **00,** 2277.
Rail rates lowered on account of imp., **08,** 1550.
Imp. have marked effect in controlling rates, **09,** 503.
Diagram showing relation of freight tonnage value, and apps., **11,** 1822.
1911, 2,443,962 t., **12,** 2043.
"There were moved on this waterway during the calendar year 1911 2,443,962 short tons of miscellaneous freight, consisting of principally crude petroleum and its refined products, sulphur, cotton, lumber, rice, and general merchandise, valued at $49,864,181.

" *Comparative statement of shipments and receipts.*

	Short tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	87,632	38,746	.....
1898	238,400	150,768	.....
1899	326,982	88,582	.....
Calendar year—			
1899	326,494	.....	488
1900	217,489	.....	109,005
1901	150,087	.....	67,402
1902	689,688	539,601	.....
1903	1,315,248	625,560	.....
1904	1,792,371	477,123	.....
1905	1,779,954	.....	12,417
1906	1,904,389	124,435	.....
1907	1,848,159	.....	56,230
1908	1,802,307	.....	45,852
1909	2,185,786	383,479	.....
1910	2,304,113	118,327	.....
1911	2,443,962	139,849	.....

* Allotment.
† May include $1,000 for sur. of Blue (Blo) Buck Point Pass, **73,** 676.
[1] Sur.—**R.,** Feb. 15, 1853. (H. D. 482, 55th, 2d.)
[2] To be applied to the imp. of Sabine Pass B. and R., Blue Buck Pt. Bar, and Neches R., **76,** 592; applied to Sabine Pass alone, **76,** 592; **77,** 468.
[3] See Projects, 1895.
[4] $16,297.03 of this, part of app. of 1897 to buy a dr., not being required, returned to Treas., **00,** 2279.

"The improvement at Sabine Pass has caused a reduction in the local freight rates as stated in previous annual reports, but the freight rates to Port Arthur and Sabine, Tex., consist of the through rate to Beaumont plus a certain differential, which is applied by the State railway commission to all seaports." **12,** 737.

CONTRACTS.

1875. Curtis, Fobes & Co., dr., 12½¢ c. y., **76,** 591. Annulled, **77,** 75, 468.

1882. F. A. Hyatt & Co., j. constr., $2.25 and $3.90 c. y., **83,** 1050.

1884. Louisiana Jetty & Lightering Co., st., $3.70 t., **85,** 1420.

1888. Louisiana Jetty & Lightering Co., j. constr., **89,** 1497.

1891. C. Clarke & Co., j. constr., **92,** 1507.

1892. T. L. Smith, j. extension: mattresses, 95¢ s. y.; riprap st., $3.15 t. ($224,975). C. Clarke & Co., dr., 13½¢ c. y. ($32,400), **93,** 1834.

1894. F. A. Hyatt & Co., j. extension: brush mattresses, 80¢ s. y.; hearting st., $2.50; riprap st., $2.85; and granite capping st., $4.55 l. t. ($115,250). R. Moore Dredging Co., dr., 9¢ c. y. ($103,500), **95,** 1777.

1897. Christie & Lowe, j. extension: brush mattresses, 68¢ s. y.; riprap st., $1.67; and capping st., $3.80 t.; dr., 10¢ c. y. ($792,800), **97,** 1772.

1898. National Dredging Co., dr., 13¢ c. y. ($17,550), **98,** 1484.

1899. R. Moore Dredging Co., dr., 9.5¢ c. y. ($85,500). Townsend & Downey, dr. boat with two 10-inch pumps, $87,900, **99,** 1861; **00,** 2278.

1903. John Short, repairs to and extension of e. j., $100,000, **03,** 1318.

1904. Higgins Oil & Fuel Co. (2 contracts), fuel oil, 75¢ bbl., **05,** 1474.

1905. Higgins Oil & Fuel Co., fuel oil, 70¢ bbl.; C. Clarke & Co., repair of e. j., st., $2.29 t. in place, **05,** 1474. Sun Co., fuel oil, 70¢ bbl., **06,** 1324.

1906. Higgins Oil & Fuel Co., fuel oil, 72½¢ bbl., **06,** 1324. Higgins Oil & Fuel Co., fuel oil, 90¢ bbl., **07,** 1449.

1907. Higgins Oil & Fuel Co., fuel oil, $1.12 bbl., **07,** 1449.

1908. Sun Pipe Line Co., fuel oil, 97¢ bbl.; Higgins Oil & Fuel Co., fuel oil, $1.25 bbl., **08,** 1551. Higgins Oil & Fuel Co., fuel oil, $1.05 bbl.; C. Clarke & Co., repairing and rebuilding e. j., st., $2.59½ t., **08,** 1552.

1910. D. M. Picton & Co., j. work, $135,156, **10,** 1674.

1911. T. S. Reed, trustee for Gulf National Bank, repairing js., st., $2.87½ t. in place (about 27,100 t.), **12,** 2041–42.

ENGINEERS.

Chief of Engineers. **R., 72,** 62; **73,** 66; **75,** 80; **76,** 77; **77,** 75; **78,** 83; **79,** 108; **80,** 145; **81,** 197, 199; **82,** 194, 195; **83,** 199; **84,** 207, 216; **85,** 223; **86,** 221; **87,** 187; **88,** 172; **89,** 200; **90,** 181; **91,** 227; **92,** 221; **93,** 248; **94,** 230; **95,** 257; **96,** 223; **97,** 288; **98,** 278; **99,** 335; **00,** 380; **01,** 398, 401, 402; **02,** 330; **03,** 346; **04,** 363; **05,** 377; **06,** 407; **07,** 425; **08,** 477; **09,** 501; **10,** 564, 577; **11,** 605; **12,** 735.

Boards:

Convened, New York, Mar. 11, 1882, to report upon proj. by Maj. Heuer for imp. of Sabine Pass. **R., 82,** 1438. (Cols. Tower and Newton and Lt. Col. Abbot.)

Convened, New York, Dec. 1, 1884, to report on proj. by Capt. Turtle for imp. of Sabine Pass. **R., 85,** 1420. (Col. Duane and Lt. Cols. Abbot and Comstock.)

Convened, New Orleans, La., Feb. 11, 1891, by S. O. No. 89, to report upon imp. of Sabine Pass. **R., 91,** 1834. (Col. Comstock, Maj. Quinn, and Capt. Black.)

In charge:

Lt. Henry L. Smith, 1853. **R., 75,** 945.

Capt. C. W. Howell, 1872–81; **73,** 66. **R., 73,** 676, 684; **75,** 944; **76,** 589; **77,** 468; **78,** 609; **79,** 902; (Maj.) **80,** 1162.

Capt. C. E. L. B. Davis, 1881–82. **R., 81,** 1317.

Capt. W. H. Heuer, 1882–84, 1885–87. **R., 82,** 1422, 1426, 1427, 1428; **83,** 1048; (Maj.) **85,** 1415; **86,** 1278, 1284; **87,** 1385.

Capt. T. Turtle, 1884–85. **R., 84,** 1250.

Capt. W. L. Fisk, 1888–91. **R., 88,** 1261; **89,** 1496; **90,** 1753.

Maj. J. B. Quinn, 1891–99. **R., 91,** 1831; **92,** 1506; **93,** 1832; **94,** 1376; **95,** 1774; **96,** 1512; **97,** 1771; **98,** 1482; **99,** 1858.

Maj. H. M. Adams, 1900–02 and 1904. **R., 00,** 2276; **01,** 1916, 1918–19; (Lt. Col.) **02,** 1349; **04,** 1916.

Lt. E. M. Adams, 1901. **R., 01,** 1910.

Capt. C. S. Bromwell, 1903. **R., 03,** 1317.

Capt. J. F. McIndoe, 1905–07. **R., 05,** 1472; **06,** 1322; **07,** 1447.

Capt. W. P. Wooten, 1908. **R., 08,** 1549.

Capt. A. E. Waldron, 1909–10. **R., 09,** 1530; **10,** 1672.

Capt. T. H. Jackson, 1911–. **R., 11,** 1820; (Maj.) **12,** 2040.

Assistants:

Lt. H. M. Adams. **R., 73,** 676, 684.

T. L. Raymond. **R., 83,** 1051; **84,** 1251; **85,** 1416, 1423; **86,** 1282, 1286; **87,** 1388.

A. C. Bell. **R., 89,** 1499; **90,** 1757.

Lt. P. S. Bond. **R., 02,** 1352.

F. F. Axtell. **R., 04,** 1919; **05,** 1475.

OPERATIONS.

1875–76. 23,294 c. y. dr., **76,** 77, 591.

1876–77. 10,450 c. y. dr., **77,** 468.

1877–78. Dr. by U. S. dr. *Essayons*, **78,** 609.

1878–79. Dr. by U. S. dr. *Essayons;* also repairs, **79,** 903.

1880–81. 12′ chan. dr. through Blue Buck Bar, **81,** 1318.

1882–83. 10,600 l. f. of brush and st. j. built, **83,** 1048.

1883–84. 5,474 l. f. brush and st. j. added to that already built, **84,** 1250.

1884–85. Work on e. j. commenced under 1884 contract, **85,** 1421.

1885–86. E. j. foundation extended 990′ and top work 350′; w. j. raised above high tide for 5,710′, **86,** 1279.

1886–87. Foundation course of e. j. extended to 14,000′ from shore line, **87,** 1386–1388.

1887–88. 6,993 c. y. brush mattress and 5,767 t. st. placed in e. j., **88,** 1262.

1888–89. E. j. foundation extended 2,300′, **89,** 1497.

1889–90. 7,458 c. y. of brush, 18,876 c. y. sandst. and granite riprap, and 9,378 t. of sandst. placed in j., **90,** 1755.

1890–92. J. constr. in progress under contract, **91,** 1832; **92,** 1508.

1892–93. About 6,000 t. capping st., 32,000 t. riprap, and 42,000 s. y. brush mattresses placed in js.; 159,376 c. y. dr., **93,** 1833.

1893–94. 198,401 c. y. dr. from chan.; 39,000 t. riprap st., and 23,333 s. y. mattresses placed in w. j., **94,** 1377.

1894–95. 155,669 c. y. dr.; 6,433 t. riprap st., and 13,294 s. y. brush matresses placed in e. j., **95,** 1775.

1895–96. Dr. and e. j. extension in progress, **96,** 1513; 73,334 c. y. dr. from R. mouth, **96,** 1514.

1897–98. 299,799 c. y. dr.; e. j. extended 4,100′, and w. j. completed for 3,000′, **98,** 1482, 1483.

1898–99. 404,063 c. y. dr., **99,** 1859.

1899–00. E. j. extended 300′, w. j. extended 3,425′; 1,414 c. y. dr. from main ship chan., and constr. of dr. in progress, **00,** 2276, 2277.

1900–01. 19,925 c. y. riprap and 2,470 c. y. capping st. placed in js.; 211,885 c. y. dr. opposite Sabine from between js., **01,** 1910. New dr. *Sabine* received, **01,** 1911.

1901–02. 603,563 c. y. dr. under contract; 317,695 c. y. dr. by U. S. plant, partly paid for from funds advanced by Kansas City Southern RR. Co., **02,** 1350.

1902–03. 138,274 c. y. dr. under contract, and 357,670 c. y. by U. S. plant, **03,** 1317.

1903–04. 254,280 c. y. dr., **04,** 1916. 28,143 t. st. placed in e. j., **04,** 1917.

1904–05. 422,175 c. y. dr. by U. S. plant, and 7,926 t. st. placed in js., **05,** 1472.

1905-06. 452,205 c. y. dr. by U. S. plant, **06,** 1322. 39,506 t. st. placed in e. j., raising 6,033 l. f. to 4′ above l. t., **06,** 1323.

1906-07. 490,293 c. y. dr. by U. S. plant, **07,** 1447. Performance of dr. *Sabine* from completion up to date, **07,** 426.

1907-08. 496,665 c. y. dr., **08,** 1549. 62,901 t. st. placed in e. j., **08,** 1550.

1908-09. 381,225 c. y. dr. by U. S. plant, **09,** 1530. 55,991 c. y. riprap st. placed along j., **09,** 1531.

1909-10. 437,132 c. y. dr., 455 granite blocks trans. from w. to e. js., and 9,150 t. st. and 710 c. y. concrete placed in w. j., **10,** 1672–73.

1910-11. 507,487 c. y. dr. by U. S. plant for mainten.; repair work on js. completed, **11,** 1821.

1911-12. 137,475 c. y. dr.; 6,979 t. st. placed on w. j. and 18,121 t. on e. j., **12,** 2041.

PHYSICAL CHARACTERISTICS.

General, **73,** 684; **75,** 945–947.

Tides, **86,** 1280.

Perforation of rock used in js. by marine animal, **87,** 1387.

Settlement of js., **94,** 1377.

85,000 acres of pasture lands reclaimed by work of imp., **96,** 1514.

D. of chan. through js., **97,** 1771.

Great storm destroyed, 1899, 2 brush mats on the w. j., **99,** 1859.

Triangulation system of Sabine Pass, **04,** 1920, and description and elevations of bench marks, **04,** 1923.

PLANS.

By Lt. Smith, 1853, dr. 9′ chan., etc., $7,000, **75,** 945.

By Capt. Heuer, 1882, d.-w. chan. from Sabine Pass to Orange and Beaumont by dr. chan. considered useless with the present demands of C., **82,** 1426.

By Maj. Stickney, water route connecting Calcasieu R. with Sabine Pass considered unworthy of imp., **84,** 1285.

PROJECTS.

By Capt. Howell, dr. chan. about 2½ m. l., 12′ x 150′; est., $105,026, **75,** 947. For dr. chan. 4½ m., 20′ x 150′; est., $390,317, **75,** 947; **77,** 75; **78,** 609. Dr. operations in force, 1875 to 1881, during which interval about $160,000 expended, **81,** 198.

In 1882 Capt. Heuer proposed 2 high brush and st. js., curving from either bank at mouth of Sabine Pass, parallel with each other and at a distance of 2,000′ apart; the w. j. to be 18,120′ l., and e. j. 19,800′ l.; also for possible excavation of chan. between js. 20′ x 100′ at bottom; this chan. to extend from j. entrance to 18′ chan. inside the bar; est., $3,177,606, **82,** 1436, 1437; **83,** 1054.

The BE. of 1882 favored high js. without the shore openings proposed by Capt. Heuer, **82,** 1439; **91,** 1831.

In 1891 the board (Col. Comstock, Maj. Quinn, and Capt. Black) proposed elevation of the e. j. to 2′ above m. h. w. for the first 16,600′, and the w. j. to m. h. w. level for the first 4,000′, thence to the end of the j. 2′ above m. h. w., **91,** 1835.

By Maj. Quinn, 1895, dr. bar at mouth of the R. with U. S. dr.; est., about $4,000, **96,** 1514.

By Maj. Quinn, 1896, constr. 5,300 l. f. e. j. and 6,600 l. f. w. j.; est., $985,000; and enlarging and maintaining dr. chan. with U. S. plant; est., $65,000. Act 1896 limited the cost of completing the proj. to $1,050,000, **98,** 1482.

By Maj. Quinn, 1897, expend. $100,000 to purchase a dr. and $30,000 to operate same during fiscal year 1898; modified, 1898, making available for immediate use $15,000 of the $30,000 app. for dr., **98,** 1482; **00,** 2277.

By Maj. Quinn, 1897, subproj. for expend. $350,000, as follows: Dr. chan., $30,000; extending e. j., $282,000; and capping w. j., $38,000, **00,** 2276.

By Maj. Quinn, 1898, subproj. for expend. $400,000, as follows: Completing e. j., $171,040.28, and extending w. j., $228,951.72; modified, 1898, to permit $30,000 to be used for dr., **99,** 1859; **00,** 2276.

Subproj., 1898–99, expend. $264,000 to extend w. j.; modified, 1899, reducing allotment for w. j. by 34,000 t. of riprap st. and adding this amount to the e. j.; again modified, 1900, to permit sufficient st. being used to complete e. j., the remainder to be placed on w. j., **99,** 1859; **00,** 2276.

By Maj. Quinn, 1899, straightening, w., and otherwise imp. main chan. by removing such parts of the oyster flats as funds available ($150,000) would permit between a point 1,000′ n. of the U. S. life-saving station and a point opposite the U. S. lighthouse, **99,** 1859; **00,** 2277.

Maj. Quinn est., 1899, $150,000 for enlarging the main ship chan. at Sabine Pass, Tex., **99,** 1862.

By Maj. Adams, 1900, expend. $36,000 to complete imp. at Sabine Pass under existing continuing contract, **00,** 2277.

By Maj. Adams, 1900, plan for w. and d. chan. from about 1,000′ n. of life-saving station to entrance of Port Arthur Canal; est., $25,000,[1] **01,** 1918; **02,** 330.

By Lt. Adams, 1901, est. for completing js., incl. repairing damage by storm, $1,116,573, **01,** 1911; **02,** 1350.

Maj. Adams est., 1901, $100,000 to repair damage done by storm of Sept.,[2] 1900, **01,** 1919; **02,** 331.

Est., 1907, $1,016,573 to complete proj., incl building up of low portions of js. to 4′ above l. w., additional contract dr., and mainten., **07,** 426.

Act July 25, 1912, au. proj. for repair and building up of js. to provide chan. of 25′ d., dr. Port Arthur Canal 26′ x 150′, dr. new turning basin 26′ x600′ x 1,700′; est., $2,000,000, with $290,000 first year mainten., and $190,000 an. for mainten. thereafter, subject to right of way being furnished free to U. S.,[3] **12,** 737.

SURVEYS.

By Lt. Smith, 1853. **R., 75,** 945.

By Lt. Adams, 1872. **R., 73,** 684. Of Blne (Bl.) Buck Point Pass. **R., 73,** 676.

By Capt. Howell, 1875. **R., 75,** 945.

For a d.-w. connection from Sabine Pass to Orange and Beaumont au. act Mar. 3, 1881; made, 1882, by Capt. Heuer, **82,** 1426.

To connect Calcasieu R. with Sabine Pass au. act Aug. 2, 1882; made, 1882, by Maj. Stickney; **R.** as unworthy of imp., **84,** 1285.

Sur. and ex. of work, **85,** 1416; **86,** 1286.

Sur. of the pass made, 1888 and 1889, by Capt. Fisk, **89,** 1499; **90,** 1756, 1759.

Ex. au. act June 6, 1900. **R.** by Maj. Adams,[1] **01,** 1915.

From Gulf of Mexico to Sabine Lake; also for h. lines, **04,** 1917.

Of j. chan. and h., **06,** 1323; **07,** 1448.

Pre. ex. and sur. au. act Mar. 3, 1909, of Sabine Pass and Port Arthur Ship Canal, Tex., to and incl. Taylors Bayou and turning basin at Port Arthur. etc. **R.** by Capt. Waldron, 1909 and 1910; est., $2,000,000, provided right of way for turning basin, $10,000, be furnished free to U. S.,[3] **10,** 577.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 738.

Maps.[3] **83,** 1054; **85,** 1416; **86,** 1282; **89,** 1498; **90,** 1759; **92,** Atlas, 77; **93,** 1832; **94,** 1378; **95,** 1776; **96,** 1514; **97,** 1772; **99,** 1860; **00,** 2278; **04,** 1920; **12,** 2040.

[1] H. D. 70, 56th, 2d. [2] H. D. 152, 56th, 2d. [3] H. D. 773, 61st, 2d.

T-10 TRINITY RIVER, TEX.[1]

Part.	Title.	Period.	Appropriations.
a	Trinity R., Tex., mouth of	1852–1912	$102,453.36
b	Trinity R., Tex., above mouth	1899–1912	1,682,287.00
c	Trinity R., Tex., operating and care, locks and dams	1909–1912	20,565.56
	Total		1,805,305.92

Part (a), T-10 Trinity River, Tex. (Mouth of.) †

APPROPRIATIONS.

1852, [2] $3,000.00, act Aug. 30 (sur.).
1872, [3] 3,500.00, **73,** 691 (sur.).
1878, 10,000.00, **78,** 84.
1879, 2,500.00, **79,** 110.
1880, 4,000.00, **80,** 1239.
1881, 10,000.00, **81,** 1342.
1882, 8,000.00, **82,** 1458.
1888, 12,500.00, **88,** 1286.
1890, 10,000.00, **90,** 1804.
1892, 10,000.00, **92,** 1542.
1894, 5,000.00, **95,** 1814.
1896, 5,000.00, **96,** 1546.
1899, 7,000.00, **99,** 1966 (sur.).
1902, *62.97, **06,** 1341.
1905, *3,800.00, **06,** 1341.
1907, [4] *1,000.00, **07,** 1466; **08,** 461; **10,** 1644.
1909, *3,590.39, **10,** 1644.
1910, [5] 1,500.00, **10,** 1644.
1911, 2,000.00, **11,** 1789.

Total, 102,453.36 (less $10,500 for surs., 1872 and 1899, and $1,341.97 trans. to Clear Creek and Dickinson Bayou, and incl. misc., $90,626.57, **12,** 2008).

COMMERCE.

Important, **71,** 67, 539; **73,** 686, 690.
Description of, **96,** 1553; **00,** 2363.
1911, 1,293 t., **12,** 702.

CONTRACTS.

1878. Brott & Norris, dr., 17¢. cy., **79,** 907.
1879. S. N. Kimball, dr., 22½¢ c. y., **79,** 909
1881. G. L. Long, dr. and snag removal, **81,** 1341.
1884. J. S. Atkinson, sheet-pile revet., $3 l. f., and dr., 15¢ c. y., **85,** 1456.
1889. B. F. Hutches, j. constr., $2.73 l. f., **90,** 1805.
1891. J. J. Atkinson, timber j. constr., $2.90 l. f., **91,** 1921.
1894. C. & R. P. Clarke, dr., 32½¢ c. y. ($3,250), **94,** 1403.

ENGINEERS.

Chief of Engineers. R., 70, 32, 62; **71,** 67; **72,** 62; **73,** 66; **78,** 84; **79,** 110, 112; **80,** 148; **81,** 200; **82,** 197; **83,** 202; **84,** 217; **85,** 227; **86,** 224; **87,** 189; **88,** 174; **89,** 204; **90,** 184; **91,** 233, 235, 1936; **92,** 226; **93,** 255; **94,** 235; **95,** 264; **96,** 229, 231; **97,** 296; **98,** 285; **99,** 341; **00,** 388, 394; **01,** 405, 411, 1972; **02,** 336; **03,** 354, 355; **04,** 372, 375, 2021; **05,** 387; **06,** 419, 430; **07,** 438; **08,** 460; **09,** 481; **10,** 542; **11,** 580; **12,** 702.

Boards. BE. **R., 04,** 2021–26.

In charge:
Capt. C. W. Howell, 1869–79. **R., 71,** 537, 538; **73,** 685; **78,** 612; **79,** 918.
Maj. S. M. Mansfield, 1880–81. **R., 80,** 1238, 1239
Capt. C. E. L. B. Davis, 1881–82. **R., 81,** 1340
Maj. S. M. Mansfield, 1882–86. **R., 82,** 1457; **83,** 1082; **84,** 1304; **85,** 1455; **86,** 1323.
Maj. O. H. Ernst, 1886–90. **R., 87,** 1421; **88,** 1285; **89,** 1557.
Maj. C. J. Allen, 1890–92. **R., 90,** 1802; **91,** 1918, 1936; **92,** 1540.
Maj. A. M. Miller, 1893–97. **R., 93,** 1880; **94,** 1401; **95,** 1813; **96,** 1546, 1551; **97,** 1805.
Maj. J. B. Quinn, 1898. **R., 98,** 1508.
Capt. C. S. Riché, 1899–02. **R., 99,** 1965; **00,** 2329, 2348, 2356; **01,** 1938, 1971; **02,** 1382; **03,** 1338–40.
Capt. Edgar Jadwin, 1904–06. **R., 04,** 1993, 2001; **05,** 1500, 1504; **06,** 1339.
Capt. J. C. Oakes, 1907–09. **R., 07,** 1466; **08,** 1524; **09,** 1503.
Maj. G. P. Howell, 1910–11. **R., 10,** 1643; **11,** 1788.
Maj. E. I. Brown, 1912–. **R., 12,** 2008.

Assistants:
Lt. H. M. Adams. **R., 73,** 686.
G. Dyes. **R., 71,** 538.
J. S. Bird. **R., 73,** 687.
W. L. Webb. **R., 80,** 1240.
E. M. Hartrick. **R., 90,** 1805.
G. Bagnall. **R., 91,** 1921; **92,** 1542.
D. Allen. **R., 94,** 1403.
F. Oppikofer. **R., 96,** 1554; **00,** 2360.
D. A. Watt. **R., 04,** 1997.

OBSTRUCTIONS.

14 brs., 1895, more or less obstructive, **96,** 1551, 1554; **00,** 2360.

OPERATIONS.

1879–80. 22,000 c. y. dr. from bar at mouth, **80,** 1239.
1880–81. 25,000 c. y. dr. from bar at mouth. **81,** 1341.
1881–82. 2,900 c. y. sand dr.; 58 snags and trees and 1 wreck removed, **82,** 1458.
1884–85. 2,775 l. f. of revet. built and 23,275 c. y. dr., **85,** 1456.
1889–90. 3,269 l. f. of j. built under contract, **90,** 1803.
1890–91. 1,360 l. f. of revet. built, and repairs made to existing works, **91,** 1919.
1891–92. Repairs to existing works completed, **92,** 1542.
1893–94. W. j. extended about 1,200 l. f., completing it; 6,626 c. y. dr., **94,** 1402.
1897–98. Log jam at R. mouth removed, **98,** 1508.
1899–00. Log jams removed from the Middle Pass, and Brown Pass of the R., **00,** 2329.
1902–03. Snag boat and quarterboat constr.; preliminary design of Lock No. 1 submitted; dr. *Gen. H. M. Robert* removed all snags, 700′ of bulkhead, and dr. 3,100′ to 8′ x 75′, **03,** 1338, 1339.

* Allotment.
† See U-12 on p. 735.
[1] Sur.—**R.,** Jan. 30, 1853. Est., $31,808. (H. R. D. 482, 55th, 2d.)
[2] Specific app.
[3] Allotment from app. for sur. and ex.
[4] $341.97 trans. to Clear Creek, Tex., **08,** 461.
[5] $1,000 trans. to Dickinson Bayou, **11,** 580.

1903-04. Snags and overhanging trees removed over 49.7 m. of sec. 1; profiles, data, and lock and dam plans prepared for consideration of BE. in accordance with provisions of act June 13, 1902; drifts, snags, and leaning trees removed over 28 m. between mouth and sec. 1, and plans made for constr. of lock, **04,** 1993–98, 2001.

1904-05. Contour maps and borings made for sites of Locks 1, 4, and 6, and plans completed for Lock and Dam No. 1, sec. 1; snagging continued until Mar., 1905, mouth to sec. 1, when work was stopped owing to act Mar. 3, 1905, diverting funds from this sec. to sec. 1; dr. *Gen. H. M. Robert* removed 58,077 c. y. from mouth; snag boat *Gen. S. M. Mansfield* removed log jam of 1,477 logs and snags from Middle Pass, **05,** 1500, 1504.

1905-06. 163 snags removed, **06,** 1339.

1907-08. 23,989 c. y. removed from Browns Pass by dr. *Gen. H. M. Robert*, **08,** 1524.

1909-10. Derrick barge removed 2,759 c. y., and dr. *Capt. C. W. Howell* removed 8,400 c. y.; snag boat *Guadaloupe* removed log jam at Browns Pass, **10,** 1643.

1910-11. Log boom to keep drift out of pass constr. at cost of $500, **11,** 1788.

PHYSICAL CHARACTERISTICS.

Described, **71,** 538, 539; **73,** 686, 687, 688; **87,** 1421; **89,** 1557; **90,** 1802.

Description of, between Magnolia and Dallas. 206¾ m. l., forming the boundary line of several counties. Obstr. in 1895 by snags, etc., **96,** 1552.

Slight shoaling of imp. part, **96,** 1546.

Description of, Dallas to mouth, **00,** 2350.

Hurricane, Sept. 8, 1900, a benefit to the mouth of this R., in that it swept away the accumulation of logs and drift which in recent years caused the mouth to be blockaded after every rise, **01,** 1938.

A chan. 6′ x 80′ dr. a distance of 1,800′, **12,** 702

PLANS. (See Projects.)

By G. Dyes, 1871, imp. of mouth; recom. for Pass A a chan. 4½′ x 150′ through inner and outer bars, protected by a pile break'r; est., $15,942, **71,** 539. Modified by Capt. Howell, **71,** 537.

Imp. by locks and dams disapproved, 1873, by Capt. Howell and Lt. Adams, recom. only imp. below Liberty, the removal of snags and excavating a chan. 6′ x 80′ x 12,500′; est., $22,581, **73,** 687.

PRIVATE WORK.

Under arrangements between interested parties, dr. *Thos. H. Ball*, owned by city of Houston, Tex., worked for one week redr. chan. into Browns Pass, **12,** 2008.

PROJECTS. (See Plans.)

By Capt. Howell, 1871 and 1873, imp. of Trinity R., securing a 5′ chan. from mouth up to Liberty, by constr. of pile break'r at the mouth, removal of snags, and dr.; est., $46,000, **71,** 537; **73,** 685; **80,** 1238. Increased, 1887, to $59,500, **87,** 1422. Work not considered permanent, **79,** 919.

In 1889 Maj. Ernst proposed constr. of 2 parallel sheet-pile js., each 7,600′ l. and 275′ apart, to concentrate R. flow across the bar; also low, submerged dams across the 2 principal passes, to prevent their enlargement; est., $55,000, making orig. est. of proj., as revised, $89,500, **89,** 1558; **92,** 1541.

By Maj. Miller, 1893–94, expend. app. of 1892 to obtain immediate benefit by extending the w. j. about 1,200 l. f. to meet the 5′ contour of the B., and to connect the inner and outer 5′ contours by chan. 5′ x 100′, **94,** 1402.

In 1895 Maj. Miller est. $125,000 to remove obstr., etc., and $1,600,000 to constr. locks and dams, **96,** 1552, 1553, 1554.

Capt. Riché est., 1899–1900, $4,000,000 and $4,550,000 for a 4′ and 6′ chan., and $280,000 an. mainten., **00,** 2353.

In future, work on the mouth of this stream to be conducted by dr. and snagging, in connection with proj. of 1899 for imp. of "Brazos River, Velasco to Richmond; West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams," of which Trinity R. is a part, **01,** 1939.

Of June 13, 1902, for open R. work, and lock and dam constr. in sec. 1 (provisional),[1] **02,** 336.

Of June 13, 1902, after consideration by BE., was pronounced unfeasible and inadvisable; act Apr. 28, 1904 (Public, No. 216), amending act June 13, 1902, provides that Sec. of War be au. to expend so much as may be necessary of the funds app. under first act, in the constr. of one lock and dam on the R. between the mouth and sec. 1, **04,** 373.

Application of available funds further directed by act Mar. 3, 1905, which provided for their diversion from lock and dam constr. below sec. 1, to constr. of Locks and Dams Nos. 1, 4, and 6 in sec. 1; this act also au. Sec. of War, in his discretion, to constr. Locks and Dams Nos. 2, 3, and 5 instead of No. 4, provided that no funds be expended unless $66,000 be donated by citizens of Dallas for constr. of dams at Old R. and Parsons Slough, **05,** 388.

SURVEYS.

At mouth of R. au., 1870, **70,** 32, 62; **71,** 538; made by G. Dyes, 1871, **71,** 67, 537.

From mouth to Magnolia au., 1872, **72,** 62; made by J. S. Bird, 1873, **73,** 687.

Resur. au. act Mar. 3, 1879, from its mouth to the br. of the Great Northern RR., **79,** 112; made, 1880, by Maj. Mansfield, **80,** 1239.

Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Allen (**R.** unfav.), **91,** 1936.

Sur. from Magnolia to Dallas au. act Aug. 17 1894; made, 1895, by Maj. Miller (**R.** unfav.; see Projects), **96,** 1551.

Sur. of Trinity R., Tex., mouth to Dallas, with view to procuring navigable d. at l. w. of 4′, 5′, and 6′, resp., au. act Mar. 3, 1899; made, 1899, by Capt. Riché (**R.** fav.; see Projects), **00,** 2350, 2356.

Au. act June 6, 1900; made, 1900, by Capt. Riché, ex. of Trinity R. between Dallas and Fort Worth (**R.** unfav.),[2] **01,** 411.

As au. act June 13, 1902, for consideration of BE.; borings for locks, water supply, and topography developed in sec. 1, **04,** 1993–1996.

Part (b), T-10 Trinity River, Tex. (Above mouth.)[3]

APPROPRIATIONS.

1899,	[4] $7,000	
1902,	125,000,	**02,** 336, 1379.
1903,	250,000,	**03,** 354.
1906,	111,000,	**06,** 1355.
1907	75,287	**07,** 1487.
	75,000	
1908,	90,000,	**08,** 482.
1909	$125,000	**09,** 1538.
	75,000	
1910	184,000	**10,** 1683.
	85,000	
1911,	40,000,	**11,** 1832.
1912,	440,000,	**12,** 2047.
Total,	[5] 1,682,287	

[1] H. D. 409, 56th, 1st.

[2] H. D. 83, 56th, 2d.

[3] Up to Aug. 4, 1905, the work of imp. of the mouth and above the mouth of Trinity R. is indexed under one head. After 1905, the imp. of the mouth (which has been app. for and imp. under allotments for imp. "Brazos River, Velasco to Richmond and the mouths of adjacent streams") has been separated from the imp. above the mouth, and is included in another district.

[4] Sur., Dallas to Fort Worth.

[5] Does not include $66,000 received from citizens of Dallas, Tex.

COMMERCE.

Prevailing freight rates high; in one instance Texas RR. Com. made a reduction of 17¢ 100 lbs., **10,** 1682.

No effect on rates produced. No C. expected until R. is canalized, **12,** 740, 2046.

"The expenditures made in cleaning the river have resulted in no increased depth, but the removal of snags and drifts has made the stream safer to navigate at medium and high stages. There is no navigation above Liberty other than the rafting of logs.

"Owing to the fact that the river is not yet navigable to Dallas, the only place at which it can come into active competition with the railroads, no effect on freight rates has been produced." **12,** 740.

CONTRACTS.

1906. D. C. McCord, constr. Lock and Dam No. 1 and dam at Parsons Slough, $135,792.18, **06,** 1355.

1908. Hubbard Building & Realty Co., constr. Lock and Dam No. 6, $144,113.95; Ball-Carden Co., constr. Lock and Dam No. 2, $125,482.36; Lock and Dam No. 4, $126,338.91, **08,** 1558, 1559.

1910. J. G. White & Co. (Inc.), completion of Lock No. 6, $85,000, **10,** 1684.

1911. C. W. Fisher, lease of warehouse, 50¢ per mo.; J. J. Patterson, lease of strip of land, $100 in one payment, **11,** 1834. L. M. Graham, lease of strip of land, $50 in one payment, **11,** 1835. Southwestern States Portland Cement Co., Portland cement, $2.12 bbl.; Risley Bros. & Co., st., unit prices given, **12,** 2051. National Iron & Steel Co., steel (unit prices given), **12,** 2051–52. Penn Bridge Co., iron and steel (unit prices given); Vinson & Graham, st. (unit prices given), **12,** 2052.

1912. List of leases for strips of land for narrow-gauge ry., **12,** 2048.

ENGINEERS.

Chief of Engineers. R., 06, 430; **07,** 454; **08,** 481; **09,** 506; **10,** 569; **11,** 611; **12,** 739.

Boards. BE. convened by S. O. No. 25, reported May 27, 1911, on lock and dam at Hurricane Shoal, **11,** 612, 1829.

In charge:

Capt. W. P. Wooten, 1906–08. **R., 06,** 1353; **07,** 1486; **08,** 1555.

Capt. A. E. Waldron, 1909–10. **R., 09,** 1536; **10,** 1679.

Capt. T. H. Jackson, 1911–. **R., 11,** 1827; (Maj.) **12,** 2043.

LEGAL PROCEEDINGS.

Deeds for the necessary land at sites for lock and dam at White Rock Shoals, and Lock and Dam No. 7, furnished by Dallas Chamber of Commerce and approv. by Atty. Gen., **12,** 2045.

OPERATIONS.

1905–06. Snagging continued by U. S. SS. *Holland*, **06,** 1353, 1354.

1906–07. Lock and Dam No. 1: Cofferdam, excavation for land wall, foundation piles, and lock tender's dwelling completed; concrete work being placed. Locks and Dams Nos. 2 and 4: Plans and specifications prepared. Lock and Dam No. 6: Excavation for land wall partly completed, land cleared, and cofferdam constr.; snagging and obstr. removal continued, **07,** 1486.

1907–08. Lock and Dam No. 1: Lock completed except lower gates and excavation for permanent dam and abutment. Locks and Dams Nos. 2 and 4: Land for sites secured and contract let for constr., but commencement of work retarded by prolonged h. w. Lock and Dam No. 6: Excavation for land wall and cofferdam constr. continued; sur. of site made, and plans prepared for lock and dam at Hurricane Shoals; snagging and obstr. removal continued over 180 m. of R., **08,** 1555.

1908–09. Lock and Dam No. 1 completed, and plant removed to site of dam at Parsons Slough; work continued on excavation and cofferdam at Lock and Dam No. 2; work on Lock and Dam No. 4 held up pending contractor obtaining right of way for tramway; at Lock and Dam No. 6, land wall completed, and R. wall and excavation for abutment about 70% completed; title to land for lock and dam at Hurricane Shoals not obtained; will be procured by condemnation proceedings; snagging and obstr. removal continued, **09,** 1536–38.

1909–10. Dam at Parsons Slough completed; little progress made on Locks and Dams Nos. 2 and 4; contractor suspended operations on Lock and Dam No. 6 and contract annulled Oct. 22, 1909, title to site obtained for lock and dam at Hurricane Shoals; snagging and obstr. removal continued; **10,** 1679.

1910–11. U. S. commenced completion of Locks and Dams Nos. 2, 4, and 6, the contracts having been abandoned by the contractors. Work accomplished by U. S. given. Lock and Dam No. 6 completed, **11,** 1827–30. Snagging work prosecuted, **11,** 1830.

1911–12. Work on completion of Locks and Dams Nos. 2 and 4 continued. Work accomplished given, **12,** 2043–44. Plant assembled for constr. of lock and dam at Hurricane Shoals, 3 houses built and derrick erected, **12,** 2044. Plant being shipped from Lock and Dam No. 2 to White Rock Shoal for constr. of lock and dam, **12,** 2045. Plant being shipped from Lock and Dam No. 4 to site of proposed Lock and Dam No. 7, **12,** 2045. Snagging operations continued; quantities given, **12,** 2046.

PHYSICAL CHARACTERISTICS.

Flow of water small; discussion as to best method of furthering imp., whether by continuous imp. from tide water or at isolated sections, **10,** 1681.

Problem in future should be caring for flood waters, and protection of large area of rich bottom lands subject to overflow during floods, **12,** 2047.

PRIVATE WORK.

Citizens of Dallas contributed $66,000 for building dams at Old R. and Parsons Slough, **06,** 430.

PROJECTS.

The $340,000 app. for constr. of Locks and Dams No. 4, in sec. 1, and at Hurricane Shoals, insufficient, and Capt. Waldron recom. that $170,000 add'l be app., **09,** 506, 1537.

Capt. Jackson recom. revision of proj. based on complete sur. of R., and that snagging "for the present" be limited to below Liberty, **11,** 1830–31.

BE. recom. mixed type for dam for Hurricane Shoals, **12,** 2045.

Completion of proj. to exceed est. by 100%, **12,** 2046.

SURVEYS.

Sur. and borings made for Locks and Dams Nos. 1, 2, and 6, **06,** 1353.

Ex. at site of lock and dam at White Rock Shoals; sur. of proposed site for Lock and Dam No. 7, **11,** 1829.

For RR. connecting Beaumont and Great Northern RR. with site of lock and dam at White Rock Shoals, **12,** 2045.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 740.

Part (c), T-10 Trinity River, Tex., Locks and Dams on. (Operating and care.)

APPROPRIATIONS.[1]

1909,	$3,518.71,	**09,** 1542.
1910,	7,423.22,	**10,** 1687.
1911,	5,671.65,	**11,** 1836.
1912,	3,951.98,	**12,** 2053.
Total,	20,565.56	

CONTRACTS.

1910. The Southwestern Telegraph & Telephone Co., leasing telephone equipment, $7 per mo., **11,** 1836.

1911. The Southwestern Telegraph & Telephone Co., leasing telephone lines (prices given), **12,** 2054.

ENGINEERS.

Chief of Engineers. **R., 09,** 507; **10,** 572; **11,** 616; **12,** 745.

In charge:

Capt. A. E. Waldron, 1909–10. **R., 09,** 1541; **10,** 1687.

Capt. T. H. Jackson, 1911–. **R., 11,** 1835; (Maj.) **12,** 2053.

OPERATIONS.

1909. Lock and Dam No. 1 placed under the app. for operating and care, on Mar. 1, 1909; after first few operations a defect developed at lower gates which allowed considerable leakage; repair of defect commenced; telephone line constr., **09,** 1541.

1909-10. Small maneuvering boat constr.; 2 U. S. boats locked through, **10,** 1687.

1910-11. Lock and Dam No. 1, mainten.; no lockages, **11,** 1835. Dam at Parsons Slough placed under proj. Jan. 16, 1911, and structures repainted. Lock and Dam No. 6 placed under proj. Apr. 8, 1911, and operations confined to mainten.; no lockages. Telephone line constr. from Lock and Dam No. 1 to Nos. 2, 4, and 6, **11** 1836.

1911-12. Mainten. work at Lock and Dam No. 1, dam at Parsons Slough, and Lock and Dam No. 6; no lockages, **12,** 2053.

T-11 RED RIVER, LA., TEX., AND OKLA.

(See p. 795.)

T-12 LITTLE RIVER, ARK.

COMMERCE.

Important, **79,** 991.

Description of (unimportant), **84,** 1407, 1408; **93,** 2087; **95,** 1967.

ENGINEERS.

Chief of Engineers. **R., 78,** 88; **79,** 118; **84,** 232; **87,** 210; **93,** 271; **95,** 279.

In charge:

Maj. W. H. H. Benyaurd, 1878. **R., 79,** 990.

Capt. J. H. Handbury. **R., 84,** 1406.

Capt. H. S. Taber. **R., 87,** 1545.

Capt. J. H. Willard, 1893–95. **R., 93,** 2087; **95,** 1965.

Assistant. J. Ewens. **R., 93,** 2088.

PHYSICAL CHARACTERISTICS.

General; obstr., **79,** 990.

Proximity of lead mines, **79,** 991.

Description of, **84,** 1407; **93,** 2087, 2089; **95,** 1966.

Enters the Red R. about 3 m. above Fulton. White Cliff is about 48 m. above the entrance; in the R. below this point shoals were numerous in 1893, **95,** 1967.

Table showing the variation in the rise and fall of Red R. below mouth of Little R., and the consequent difficulty of entering the latter, **93,** 2088.

PLANS.

By Maj. Benyaurd, removing obstr., snags, logs, etc.; est., $12,000, **79,** 991.

SURVEYS.

Ex. by Maj. Benyaurd, 1878–79. **R., 79,** 990.

Ex. au. acts Aug. 2, 1882, and Aug. 5, 1886 (**R.** unfav.), **84,** 1406; **87,** 1545.

Ex. au. act July 13, 1892; made, 1893, by Capt. Willard (**R.** unfav.), **93,** 2087. Another from Fulton to White Cliff au. act Aug. 17, 1894; **R.** by Capt. Willard, 1895 (unfav.), **95,** 1965.

T-13 KIAMICHI RIVER, OKLA.

ENGINEERS.

Chief of Engineers. **R., 10,** 577.

In charge. Capt. A. E. Waldron, **10,** 559.

SURVEY.

Pre. ex. of R. to a point opposite Talihina, au. act Mar. 3, 1909. **R.,** Capt. Waldron, Sept. 24, 1909 (unfav.),[2] **10,** 577.

T-15 WASHITA RIVER, OKLA.

ENGINEERS.

Chief of Engineers. **R., 10,** 577.

In charge. Capt. A. E. Waldron, **10,** 559.

SURVEY.

Pre. ex. of Washita R., Okla., up to Mountain View, au. act Mar. 3, 1909. **R.** by Capt. Waldron, Oct. 14, 1909[3] (unfav.), **10,** 577.

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[1] Expend. under the permanent indefinite app., act July 5, 1884, as amended and reenacted by sec. 6, act Mar. 3, 1909, for operation and care of canals, etc.

[2] H. D. 212, 61st, 2d. [3] H. D. 209, 61st, 2d.

T-16 SULPHUR RIVER, TEX. AND ARK.

APPROPRIATIONS.

1894, [1] $2,488.99, **07,** 1491.
1907, 36,000.00, **07,** 1491.
1910, 7,500.00, **10,** 1692.

Total, 45,988.99

COMMERCE.

Description of; fairly important, **93,** 2083.
Practically none, 1904, **04,** 2086.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **93,** 271; **04,** 398; **06,** 434; **07,** 457; **08,** 485; **09,** 510; **10,** 576; **11,** 621, 622; **12,** 751.

Boards. BERH. concurs in Capt. Porter's opinion that imp. is not advisable, **04,** 2087.

In charge:
Capt. A. M. Miller. **R., 84,** 1345.
Capt. J. H. Willard, 1893. **R., 93,** 2083.
Capt. C. L. Potter, 1904. **R., 04,** 2085.
Capt. W. P. Wooten, 1907–08. **R., 07,** 1491; **08,** 1562.
Capt. A. E. Waldron, 1908–11. **R., 09,** 1545; **10,** 1692.
Capt. T. H. Jackson, 1911–. **R., 11,** 1840; (Maj.) **12,** 2059.

Assistants:
P. C. Montgomery. **R., 84,** 1346.
J. Ewens. **R., 93,** 2084.

OPERATIONS.

1907–12. Quarterboat constr., and snags and other obstr. removed, **08,** 1562; **09,** 1545; **10,** 1692; **11,** 1840; **12,** 2059.

PHYSICAL CHARACTERISTICS.

Description of; enters Red R. about 107½ m. above Shreveport, La., **93,** 2083.

PROJECTS.

Act Mar. 2, 1907, au. imp. of 150 m. of R. above Red R. by dr. and operations of snag boat; est., $36,000, **07,** 457.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Miller (**R.** unfav.), **84,** 1345.
Ex. of R., mouth to Sulphur Station, au. act July 13, 1892; made, 1893, by Capt. Willard (**R.** fav. to removal of snags), **93,** 2083.
Pre. ex., from mouth to Sulphur Station, au. act June 13, 1902. **R.** by Capt. Potter, July 18, 1902[2] (unfav.), **04,** 398, 2084.
Pre. ex. au. act Mar. 3, 1905. **R.** by Capt. Wooten, Dec. 5, 1905, and May 11, 1906. Plan of imp. in connection with Red R. by extension of snagging to include Sulphur R., presented,[3] **06,** 434.
Pre. ex. of chan. connecting Red and Sulphur Rs., by way of Texarkana, au. act June 25, 1910. **R.** by Capt. Waldron, Nov. 22, 1910,[4] **11,** 622.

T-18(a) JEFFERSON, TEX., AND SHREVEPORT, LA. (Waterway.)

APPROPRIATIONS.

1910, $100,000, **10,** 1690.

COMMERCE. (See Physical data.)

1911, 14,250 t.; a large percentage due to development of Caddo oil fields, **12,** 2056.

CONTRACTS.

1912. H. B. Thompson Co., dam, $81,005.52; unit prices given, **12,** 2056.

ENGINEERS.

Chief of Engineers. **R., 08,** 486; **10,** 573, 577; **11,** 618; **12,** 747, 752.

In charge:
Capt. W. P. Wooten, **08,** 474.
Capt. A. E. Waldron, 1910–11. **R., 10,** 1690.
Capt. T. H. Jackson, 1911–. **R., 11,** 1837; **12,** 2055.

PHYSICAL CHARACTERISTICS.

Description of, **10,** 574.
Waterway from Jefferson, at head of navigation of Cypress Bayou, to foot of Caddo Lake; after leaving Caddo L. waterway passes through Big and Little Willow Passes, and spreads out into Soda L. From thence the stream passes over falls into Twelvemile Bayou, and thence into Red R. Falls eating their way upstream; would finally destroy navigation Jefferson to Mooringsport, **12,** 747.

Construction of dam will cut off navigation to Shreveport, La., but it would preserve w. level and hence navigable chan. in Cypress Bayou and Caddo Lake between Jefferson, Tex., and Mooringsport, La., **11,** 1838.

PROJECTS. (See Cypress Bayou, La.)

1905, it was proposed to dr. chan. Red R. to foot of Caddo L., giving 6′ 8 months an., and to put l. and dam at foot of lake, the l. and d. to preserve part existing, preventing its drainage by the dr. chan. below, **12,** 747.
Act June 25, 1910, au. constr. dam at foot of Caddo L. 3,116′ long, giving upper pool surface elevation of 187′, so as to admit of a lock when necessary; est., $100,000,[5] **10,** 1690.

SURVEYS.

(See Cypress Bayou for sur. of 1905.)
Act Mar. 2, 1907, au. ex. for dam. **R.,** Capt. Wooten, July 27 and Nov. 2, 1907; est., $100,000,[6] **08,** 486.
Act Mar. 3, 1909, au. ex. for lock in proposed dam. **R.,** Capt. Waldron, Nov. 3, 1909, concurring in Capt. Wooten's recom. of 1907 for dam without lock,[5] **10,** 577.
Act Feb. 27, 1911, au. ex. and sur. for lock in proposed dam at Caddo Lake, and chan. from said dam to Red R. by way of Big Pass, Little Pass, Soda Lake, Twelvemile Bayou, and Cross Bayou (**R.** unfav.), **12,** 752.

Maps.[5]

[1] Allotted from app. for Red R.
[2] H. D. 231, 58th, 2d.
[3] H. D. 870, 59th, 1st.
[4] H. D. 12, 62d, 1st.
[5] H. D. 220, 60th, 1st.
[6] H. D. 680, 61st, 2d.

T-19 CYPRESS BAYOU, LA. AND TEX.

APPROPRIATIONS.[1]

1886,	$18,000,	**86,** 1348.
1890,	10,000,	**91,** 2022.
1892,	2,000,	**92,** 1671.
1894,	10,000,	**95,** 1886.
1896,	5,000,	**96,** 1591.
1907,	10,000,	**07,** 1489.
1909,	*6,000,	**09,** 1543.
1910,	5,000,	**10,** 1689.
1911,	2,500,	**11,** 1837.
1912,	5,000,	**12,** 2055.
Total,	73,500	(incl. misc. ($27), $94,000 carried under Part (a), X-28 and $5,000 allotted from app. for Red R., act Aug. 11, 1888, and $1,701.33 act June 13, 1892, $174,228.33, **12,** 2055).

COMMERCE.

Description of, **93,** 2071; **97,** 1899. Limited, **93,** 2068, 2071.

1901, none, **01,** 2033.

Small gasoline boat operated with slight tonnage, **03,** 1373.

1910, increase in C. due to opening of oil wells, **10,** 573.

ENGINEERS.

Chief of Engineers. R., 80, 151; **81,** 212; **82,** 209; **83,** 218; **84,** 223; **85,** 233, 244; **86,** 229; **87,** 194, 203; **88,** 177; **89,** 208; **90,** 186; **91,** 248; **92,** 240; **93,** 271; **95,** 269; **96,** 234; **97,** 301; **98,** 292; **99,** 350; **00,** 401; **01,** 414; **02,** 346; **03,** 365; **04,** 386, 398; **05,** 402; **06,** 431, 434; **07,** 455; **08,** 483; **09,** 507; **10,** 572, 577; **11,** 617; **12,** 745.

Boards. BERH. reviews Capt. Potter's **R.** and concurs in his opinion on inadvisability of constr. dam and digging ditch into Red R., **04,** 2080.

In charge:

Maj. W. H. H. Benyaurd, 1874–83. **R., 80,** 1280; **81,** 1428; **82,** 1561.

Maj. A. M. Miller, 1883–85. **R., 83,** 1161; **84,** 1332.

Capt. E. Bergland, 1885–86. **R., 85,** 1493, 1552; **86,** 1347.

Capt. J. H. Willard, 1886–99. **R., 87,** 1453, 1494; **88,** 1343; **89,** 1595; **90,** 1826, 1914; **91,** 2021; **92,** 1668; **93,** 2065; **95,** 1885; (Maj.) **96,** 1589; **97,** 1896; **98,** 1589; **99,** 1992.

Maj. T. L. Casey, 1900–01. **R., 00,** 2502; **01,** 2033.

Capt. C. L. Potter, 1901–03. **R., 02,** 1409; **04,** 2076.

Capt. C. S. Bromwell, 1903–04. **R., 03,** 1372.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2037.

Capt. J. F. McIndoe, **04,** 399.

Capt. G. M. Hoffman, 1904–05. **R., 05,** 1527.

Capt. W. P. Wooten, 1905–08. **R., 06,** 1356; **07,** 1489; **08,** 1559.

Capt. A. E. Waldron, 1908–11. **R., 09,** 1543; **10,** 1688.

Capt. T. H. Jackson, 1911–. **R., 11,** 1837; **12,** 2054.

Assistants:

F. S. Burrowes. **R., 85,** 1553.

H. M. Marshall. **R., 93,** 2074.

R. Elfiein. **R., 98,** 1590.

OPERATIONS.

1879–80. 2,102 stumps and snags removed from chan., 326 trees cut down, **80,** 1280.

1884–85. 335 trees cut, 60 snags removed, 315′ sand bars washed out, **85,** 1493.

1886–87. Rebuilding dr. boat, **87,** 1453.

1887–88. 102,704 c. y. earth, etc., and 2,150 logs and snags removed from chan., 825 l. f. brush dams built, and 560 trees removed from banks, **88,** 1344.

1889–90. 26,359 c. y. dr. from chan., 4,200 trees cut, 210 stumps and trees removed from chan., **90,** 1827.

1898–99. About 8,800 snags and other obstr. removed from bayou, and 50,000 s. y. willows and brush cut, **99,** 1993.

1906–07. Obstr. removed between Jefferson and Mooringsport, **07,** 1489.

1907–12. Obstr. removed, **08,** 1559; **09,** 1543; **10,** 1688; **11,** 1837; **12,** 2054.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 1917; **93,** 2066; **98,** 1590.

Elevation of water surfaces, **93,** 2075, 2076.

Sediment, **93,** 2081.

High-water marks, **93,** 2082.

Discharge observations, **93,** 2082.

Low stage in Red R. prevented entrance therefrom of plant for imp. the bayou in 1897–98, **98,** 1590.

PLANS. (See Projects.)

By Maj. Howell, 1874, dam across the lake at Albany Pt. and excavation of cut through to Red R.; est., $372,580, **80,** 1281; **87,** 1454, 1494.

PROJECTS. (See Plans.)

History of proj. and plans for imp., **90,** 1914.

By Capt. Howell, 1872, removal of obstr. and clearance of a chan.; est., $50,000, **73,** 622. Completed in 1880, **80,** 1280; **86,** 229.

By Capt. Bergland, 1885, straightening and marking chan., cutting stumps, and reopening cuts by dr.; est., $18,000, **85,** 1494; **87,** 194.

Capt. Willard, 1893, est. $375,000 to imp. the lakes and bayou by lock and dam system, **93,** 2068.

Congress app., 1894, for dr. and removing obstr. and straightening chan. between Jefferson, Tex., and Shreveport, La., on recom. of Capt. Willard in his **R.** of 1893, **95,** 1886; **97,** 1897.

SURVEYS.

Act July 5, 1884, au. sur. of Cypress Bayou and lakes between Jefferson, Tex., and Shreveport, La.; made, 1885, by Capt. Bergland, **85,** 1552.

Ex. au. act Aug. 5, 1886; made by Capt. Willard, **87,** 1494.

Sur. to ascertain whether the navigation of the bayou and connecting lakes could be materially and permanently imp. by a system of locks and dams, and if fav. the cost thereof, au. act Sept. 19, 1890; made by Capt. Willard. Final **R.** (unfav.) submitted in 1893, **93,** 2065. Tabulated results of tertiary triangulation, **93,** 2077; precise levels, **93,** 2078; bench marks, **93,** 2079.

Pre. ex. to ascertain navigability of dam and ditch into Red R., au. act June 13, 1902. **R.** by Capt. Potter, July 18, 1902[2] (not worthy of further imp.), **04,** 398, 2075.

Sur. of Cypress Bayou and chans. connecting Shreveport, La., with Jefferson, Tex., incl. ex. of falls near Little Pass, au. act Mar. 3, 1905, **05,** 1527. **R.** by Capt. Wooten, Dec. 23, 1905[3] (unfav.), **06,** 434.

Pre. ex. for constr. of dam at Caddo Lake, au. act Mar. 2, 1907. **R.** by Capt. Wooten, July 27, and Nov. 2, 1907; est., $100,000,[4] **08,** 486.

Sur. for constr. of lock in proposed dam at Caddo Lake, au. act Mar. 3, 1909. **R.** by Capt. Waldron, Nov. 3, 1909;[5] concurs in Capt. Wooten's recom. of 1907 for dam without lock, **10,** 577.

Maps.[4] **93,** 2068, 2080.

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* Allotment.

[1] App. 1872–9 listed in X 28.

[2] H. D. 115, 58th, 2d.

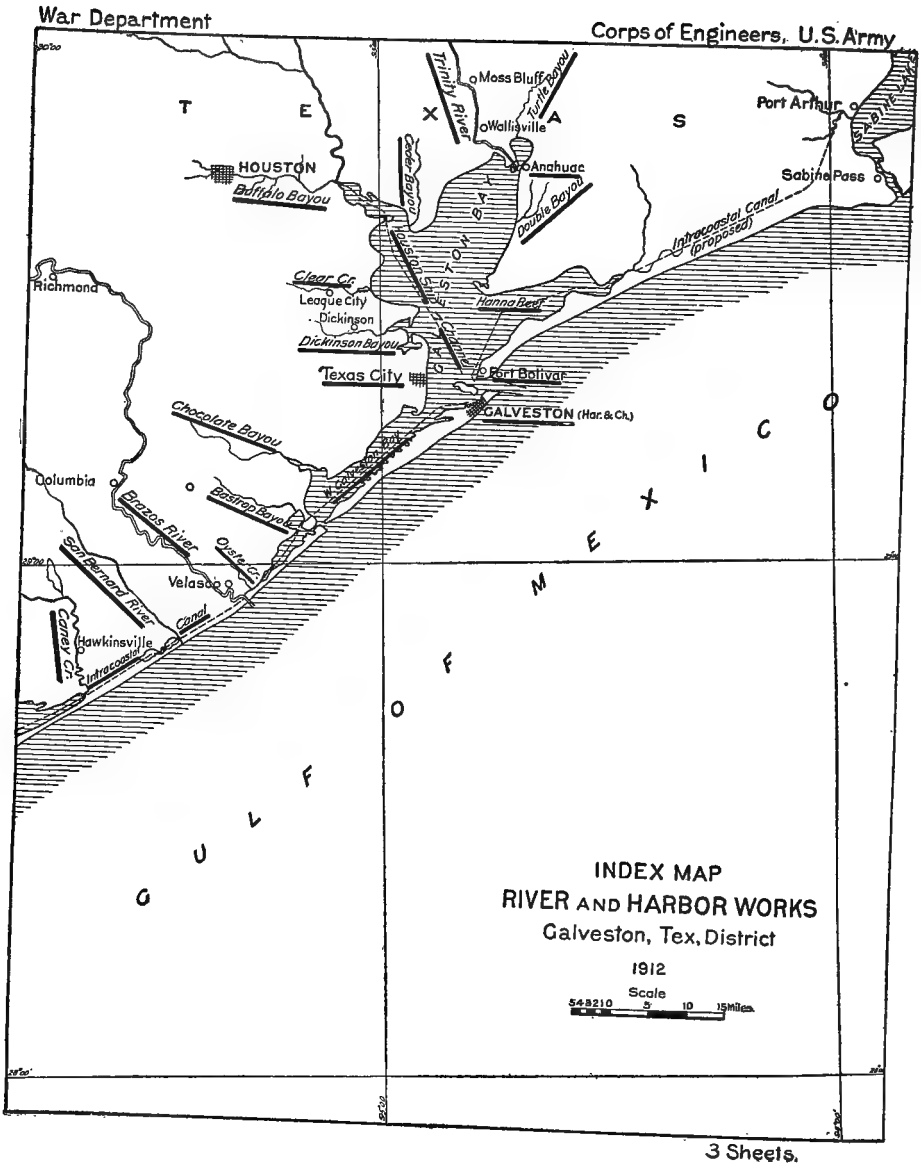
[3] H. D. 785, 59th, 1st.

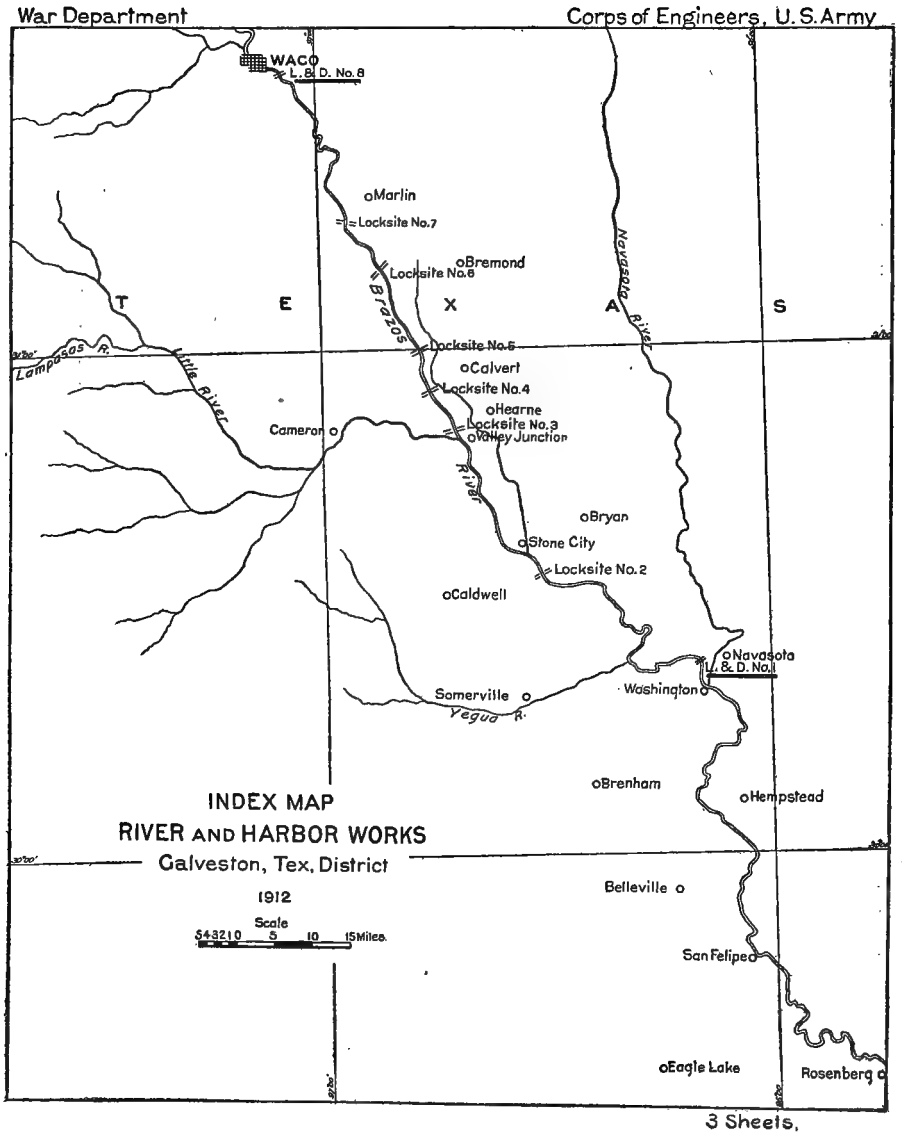
[4] H. D. 220, 60th, 1st.

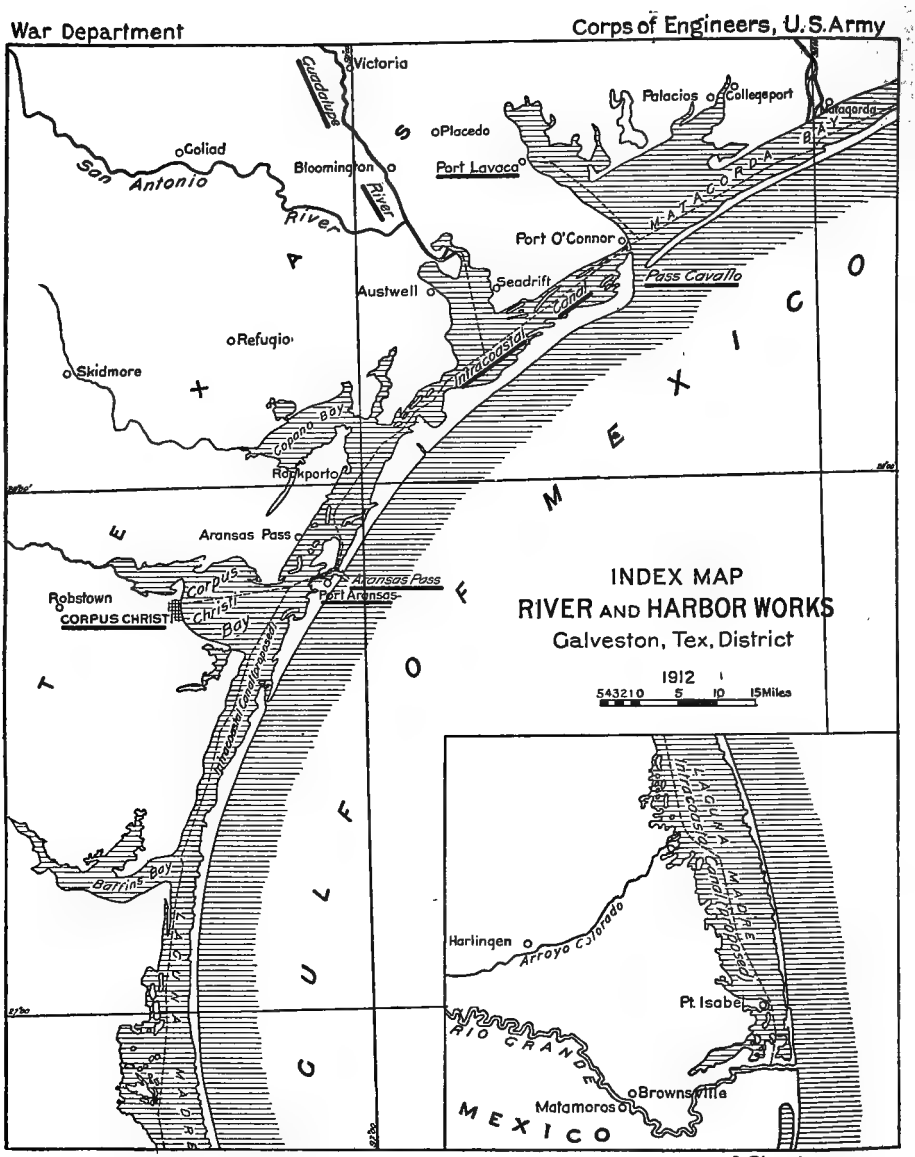
[5] H. D. 680, 61st, 2d.

RIVER AND HARBOR WORKS—GULF OF MEXICO.

U.—GALVESTON, TEX., DISTRICT.


War Department
Corps of Engineers, U.S. Army
T E X A S
HOUSTON
Buffalo Bayou
Trinity River
Moss Bluff
Turtle Bayou
Wallisville
Anahuac
Double Bayou
Port Arthur
Sabine Pass
Intracoastal Canal (proposed)
Cedar Bayou
GALVESTON BAY
Clear Cr.
League City
Dickinson
Dickinson Bayou
Hanna Beef
Texas City
Port Bolivar
GALVESTON (Har. & Ch.)
Richmond
Chocolate Bayou
Columbia
Brazos River
Bastrop Bayou
Oyster Cr.
Velasco
San Bernard River
Carey Cr.
Hawkinsville
Intracoastal Canal
G U L F O F M E X I C O
INDEX MAP
RIVER AND HARBOR WORKS
Galveston, Tex. District
1912
Scale
5 4 3 2 1 0 5 10 15 Miles
3 Sheets.


War Department
Corps of Engineers, U. S. Army
WACO
L. & D. No. 8
Marlin
Locksite No. 7
Bremond
Locksite No. 6
Brazos
T
E
X
A
S
Navasota River
Lampasas R.
Little River
Locksite No. 5
Calvert
Locksite No. 4
Hearne
Locksite No. 3
Valley Junction
Cameron
River
Bryan
Stone City
Locksite No. 2
Caldwell
Navasota
L. & D. No. 1
Washington
Somerville
Yegua R.
Brenham
Hempstead
INDEX MAP
RIVER AND HARBOR WORKS
Galveston, Tex. District
1912
Scale
5 4 3 2 1 0 5 10 15 Miles.
Belleville
San Felipe
Eagle Lake
Rosenberg
3 Sheets.


War Department
Corps of Engineers, U.S.Army
INDEX MAP
RIVER AND HARBOR WORKS
Galveston, Tex, District
1912
5 4 3 2 1 0 5 10 15 Miles
Victoria
Guadalupe
Placedo
Palacios
Collegeport
Matagorda
Coliad
San Antonio
River
Bloomington
Port Lavaca
MATAGORDA BAY
Port O'Connor
Pass Cavallo
Austwell
Seadrift
Intracoastal Canal
Refugio
Skidmore
Copano Bay
Rockport
Aransas Pass
Corpus Christi Bay
Robstown
CORPUS CHRIST
Aransas Pass
Port Aransas
Intracoastal Canal (proposed)
Barrins Bay
LAGUNA MADRE
TEXAS
GULF OF MEXICO
Harlingen
Arroyo Colorado
Pt. Isabel
RIO GRANDE
Brownsville
Matamoros
MEXICO
3 Sheets.

U.—GALVESTON, TEX., DISTRICT.

In charge of U. S. Engineer Office,
Trust Company Bldg., Galveston, Tex.

U 1 Gulf of Mexico.
U 2 Texas Waterways.
U 3 Port Bolivar Chan., Tex. (1)
U 4 Port Bolivar, Tex. (3) (5)
U 5 Galveston B., Tex. (3) (1)
U 6 East Galveston B., Tex. (5)
U 7 East Galveston B. to Port Arthur (inland waterway), Tex. (6) (2)
U 8 East B. Bayou, Tex. (6)
U 9 Double Bayou, Tex. (5)
U 10 Anahuac H., Tex. (5)
U 11 Turtle Bayou, Tex. (5)
U 12 Trinity R., Tex. (5)
(Mouth only in U engineer district. See T Dist., p. 725, for data concerning river.)
U 13 Old (Trinity) R., Tex. (12)
U 14 Cedar Bayou, Tex. (5)
U 15 San Jacinto R., Tex. (5)
U 16 Buffalo Bayou, Tex. (5)
U 17 Old (Jacinto) R., Tex. (16)
U 18 Greens Bayou, Tex. (16)
U 19 Hunting Bayou, Tex. (16)
U 20 White Oak Bayou, Tex. (16)
U 21 Houston H., Tex. (16)
U 22 Brays Bayou, Tex. (16)
U 23 Simms Bayou, Tex. (16)
U 24 Vinces Bayou, Tex. (16)
U 25 Morgan Canal, Tex. (26) (5)
U 26 Houston Ship Chan., Tex. (25) (5) (3) (30)
U 27 Clear Cr., Tex. (5)
U 28 Dickinson Bayou, Tex. (5)
U 29 Texas City H., Tex. (5)
U 30 Galveston H., Tex. (1) (5) (3)
U 31 Highland Bayou, Tex. (5) (30)
U 32 Greens Bayou, Tex. (5)
U 33 West Galveston B., Tex. (5)
U 34 Chocolate Bayou, Tex. (33)
U 35 San Luis Pass, Tex. (1) (33)
U 36 Bastrop Bayou, Tex. (33)
U 37 Austin Bayou, Tex. (36)
U 38 West Galveston B. to Rio Grande R., Tex. (inland waterway). (33) (47) (2)
U 39 Oyster Cr., Tex. (38)
U 40 Brazos R., Tex. (1)
U 41 Navasota R., Tex. (40)
U 42 Little Brazos R., Tex. (40)
U 43 Bosque R., Tex. (40)
U 44 Little R., Tex. (40)
U 45 San Bernard R., Tex. (1)
U 46 Caney Cr., Tex. (38) (47)
U 47 Matagorda B., Tex. (1)
U 48 Colorado R., Tex. (47)
U 49 Concho R., Tex. (48)
U 50 San Saba R., Tex. (48)
U 51 Llano R., Tex. (48
U 52 Pedernales R., Tex. (48)
U 53 Tres Palacios B., Tex. (47)
U 54 Pilkington Bayou, Tex. (53)
U 55 Tres Palacios R., Tex. (53)
U 56 Lavaca R., Tex. (47)
U 57 Navidad R., Tex. (56)
U 58 Pass Cavallo, Tex. (1) (47)
U 59 Powderhorn Bayou, Tex. (47)
U 60 San Antonio B., Tex. (47)
U 61 Guadalupe R., Tex. (60)
U 62 San Marcos R., Tex. (61)
U 63 Comal R., Tex. (61)
U 64 San Antonio R., Tex. (61)
U 65 Copano B., Tex. (70) (38)
U 66 Aransas R., Tex. (65)
U 67 Aransas B., H., and Pass, Tex. (1) (68)
U 68 Corpus Christi B., Tex. (67) (38) (70)
U 69 Nueces R., Tex. (68)
U 70 Laguna Madre, Tex. (38) (68) (1) (72)
U 71 Baffins B., Tex. (70)
U 72 Brazos Santiago Pass, Tex., (70) (1)
U 73 Arroyo Colorado, Tex. (70)
U 74 Rio Grande R., Tex. and Mexico. (1)
U 75 Devils R., Tex. (74)
U 76 Pecos R., Tex. and N. Mex. (74)

U-2 (a) TEXAS WATERWAYS. (Removing hyacinths.)

[See p. 572]

U-2 (b) SABINE, GALVESTON, PASS CAVALLO, VELASCO, BRAZOS SANTIAGO, AND CORPUS CHRISTI HARBORS, AND SABINE, BRAZOS, AND TRINITY RIVERS.

APPROPRIATION.

1852 (surs.), $5,000, act Aug. 30.
1889 (sur.) 2,000, act Mar. 2, for deep-water harbor on n. w. coast.

Total, 7,000

U-3 GALVESTON TO PORT BOLIVAR, TEX. (Channel.)

APPROPRIATIONS.

1907, $50,000, **07,** 1460.
1909, 50,000, **09,** 1496.
1910, 91,080, **10,** 1638.
1911, 25,000, **11,** 1783.
1912, 25,000, **12,** 2001.

Total, 241,080 (incl. sales, $241,080.35, **12,** 2001).

COMMERCE.

Chan. used for tugs and barges in transfer of freight cars to and from Galveston, **07,** 434.

Lumbermen save 35¢ per M ft. b. m. in handling charges over Galveston, **12,** 696.

1908, 50,000 t.; 1909, 82,000 t.; 1910, 180,000± t.; 1911, 232,000 t., mainly lumber for export, **12,** 696.

CONTRACTS.

1907. John Jacobson, dr., 9¼¢ c. y., **07,** 1461.

1910. John Jacobson, dr., 11.90¢ c. y.; **10,** 1638. North American Dredging Co., dr., 777,000 c. y., 10¾¢ c. y., **11,** 1783.

ENGINEERS.

Chief of Engineers. R., 07, 433; **08,** 455; **09,** 474; **10,** 535; **11,** 573; **12,** 695.

In charge:

Capt. John C. Oakes, 1907–09. **R., 07,** 1460; **08,** 1515; **09,** 1495.

Maj. G. P. Howell, 1910–11. **R., 10,** 1637; **11,** 1782.

Maj. E. I. Brown, 1912–. **R., 12,** 2000.

OPERATIONS.

1907-08. 247,998 c. y. dr.; work 40% completed, **08,** 1515.

1908-09. 269,929 c. y. dr.; sunken dr. boat removed from chan. and 2 beacons erected, **09,** 1495.

1909-10. 373,369 c. y. dr.; dr. *Gen. C. B. Comstock* removed shoals to 24¾′, 89,046 c. y., **10,** 1637.

1910-11. 255,551 c. y. dr. by contract; 127,618 c. y. dr. by U. S. dr. *Col. A. M. Miller* in removing shoals, **11,** 1782.

1911-12. 755,275 c. y. dr. by contract; 32,002 c. y. dr. by U. S. dr. *Gen. C. B. Comstock* in removing shoals, **12,** 2001.

PHYSICAL CHARACTERISTICS.

Chan. (1908) 23′–26′ x 150′ x 2,130′, **08,** 1515.

Shoaling (1910) to 20′, **10,** 1637.

Ruling d. (1912) 25.6′ in entrance chan. and 21′ in turning-basin, **12,** 2001.

Port Bolivar Chan. is at end of Bolivar Peninsula, about 4 m. n. of Galveston. Before imp., no chan. or H., **12,** 695.

PRIVATE WORK.

The Gulf & Interstate RR. Co. built a slip and wharf, **09,** 1495.

PROJECTS.

Act Mar. 2, 1907, au. chan. 25′ x 150′, with increased w. at wharf, from Galveston H. to Port Bolivar,[1] **07,** 433.

Act June 25, 1910, enlarged proj. by increasing dimensions of chan. to 30′ x 200′, with turning-basin 1,000′ sq.; est., $91,080,[2] **10,** 535; done, 1912, **12,** 696.

SURVEY.

Ex. au. act Mar. 3, 1905, for chan. 25′–30′ x 300′, resp., to d. w.; made by Capt. Jadwin. **R.,** Mar. 24, 1906[1] (imp. as proposed not deemed advisable), **06,** 429.

Maps.[2]

U-4 PORT BOLIVAR, TEX.

ENGINEERS.

Chief of Engineers. R., 06, 429.
Boards. BERH. (See Survey, 1905.)
In charge. Capt. Edgar Jadwin, **06,** 411.

PHYSICAL CHARACTERISTICS.

Port Bolivar at w. end of Bolivar Pt., on e. side of entrance to Galveston B.[1]

SURVEY.

Pre. ex. au. act Mar. 3, 1905, with view to chan. 25′–30′ x 300′, resp., to d. w. **R.** by Capt. Jadwin, Mar. 24, 1906 (fav.); BERH.[1] (unfav.), **06,** 429.

U-5 (a) GALVESTON BAY TRIBUTARIES—(West Galveston Bay Channel, Turtle Bayou, Trinity River, Anahuac Channel, Oyster Creek, Cedar, Chocolate, and Bastrop Bayous), Tex. (Including mouths of adjacent streams.)

The following information is taken bodily from **R.** Chief of Engineers, 1912, p. 699:

"This project has embraced the improvement of the following localities: West Galveston Bay, the Galveston and Brazos Canal, Hanna Reef (East Bay Bayou), Double Bayou, Anahuac Channel, mouth of Trinity River, Turtle Bayou, Cedar Bayou, Clear Creek, Dickinson Bayou, Chocolate Bayou, Bastrop Bayou, Oyster Creek (q. v.). (Annual Report Chief of Engineers, 1900, p. 2438 et seq.)

"Prior to March 3, 1899, the improvement of West Galveston Bay and the Galveston and Brazos Canal, Double Bayou, mouth of Trinity River, and Cedar Bayou was independent. The river and harbor act of that date made an appropriation for the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams. The mouth of Trinity River and Cedar Bayou were transferred to this work, and Anahuac Channel was added by the act of March

[1] H. D. 719, 59th, 1st.

[2] H. D. 328, 61st, 2d (map).

3, 1905. Chocolate and Bastrop Bayous were added by the act of March 2, 1907, and Turtle Bayou and Oyster Creek by the act of June 25, 1910. As adjacent streams Hanna Reef (East Bay Bayou), Clear Creek, and Dickinson Bayou have been improved. Double Bayou has not been specially named in the act since 1905 and is now under improvement as an adjacent stream.

"The Brazos River between Velasco and Richmond, which was included in the improvement for a time, is now covered by a separate appropriation.

"As the West Galveston Bay Channel and Galveston and Brazos River Canal have been included in the 'Inland waterway on the coast of Texas,' and appropriated for under that heading, allotments for these works under this appropriation have ceased.

"The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of the streams and bayous from deep water in the bay to deep water in the bayous.

"The improvement is intended to develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

"The estimated cost of the modified project has been given in previous reports as $248,646.34, but, as works originally embraced in this project have been transferred to other appropriations and new works have been added for which no estimate of cost have been made, there is no estimated cost for the entire project. All the channels called for have been completed, but maintenance is regularly required.

"The amount *expended* on these improvements under present project to June 30, 1912, has been as follows (for appropriations, etc., see each work named below):

Channel across Hanna Reef (E. Bastrop Bayou) (q. v.)	$3,299.67
Double Bayou (q. v.)	19,261.09
Anahuac Channel (q. v.)	15,556.10
Mouth of Trinity River (see Trinity R., Tex. dist.)	12,726.57
Turtle Bayou (q. v.)	8,899.97
Cedar Bayou (q. v.)	17,707.10
Clear Creek	27,480.16
Dickinson Bayou	20,724.35
Bastrop Bayou	17,730.29
Chocolate Bayou	12,143.89
Oyster Creek	6,942.24
Dredge Gen. H. M. Robert	67,992.51
Dredge Capt. C. W. Howell	15,000.00
Total	245,463.94

"Of this amount $83,646.23 was applied to maintenance of improvement, and $116.43 has been derived from miscellaneous sources, such as sales, etc.

"By authority of river and harbor act of March 3, 1899, a pipe-line hydraulic dredge was constructed for the improvement of these streams at a cost of $67,992.51. This dredge (*Gen. H. M. Robert*) was burned April 18, 1909, and the dredging has since been carried on by the dredge *Capt. C. W. Howell*. The latter, however, was lost at sea September 14, 1911, and there is now no plant available for light-draft work.

"More and larger boats, especially power boats with schooner hulls, have been built to utilize the improvement. Most of the points reached are settlements not on railroads, and the improvements are of great importance to their commercial life.

"The effect of these improvements has been generally to decrease freight rates to all points reached by the channels improved." **12,** 699.

U-7 GALVESTON BAY TO SABINE LAKE, TEX.

APPROPRIATION.

1872, $3,000 (all'd), **73,** 680.

COMMERCE.

Future, would not be unimportant, **73,** 677.

ENGINEERS.

Chief of Engineers. **R., 72,** 62; **73,** 66.
In charge. Maj. C. W. Howell, 1872. **R., 73,** 677.

Assistants:
Lt. H. M. Adams, 1873. **R., 73,** 677.
J. S. Polhemus, 1873. **R., 73,** 678.

LEGISLATION.

Subsidy of $7,500 per m. granted by county of Galveston to the Texas & Mississippi Canal & Navigation Co. to aid them in the constr. of the canal, **73,** 677.

PHYSICAL CHARACTERISTICS.

Character of country along the line of proposed canal, **73,** 679.

PLANS.

By J. S. Polhemus, canal, Galveston B. to Sabine Lake, 6′ x 50′; est., $645,236, **73,** 680.

SURVEYS.

Sur., ship canal, under direction of Lt. Adams, by J. S. Polhemus. **R., 73,** 677, 678.

U-8 EAST BAY BAYOU, TEX. (Including channel across Hannas Reef.)

APPROPRIATIONS.

1902,	*$681.91,	**06,** 1341.
1909,	[1] *1,794.11,	**09,** 1502; **10,** 540, 1642.
1910,	*[2] 823.65,	**10,** 1642.
Total,	3,299.67	

COMMERCE.

An. C. value $5,000, **00,** 2380, 2383; 1911, 2,406 t., **12,** 701.

ENGINEERS.

Chief of Engineers. **R., 00,** 394; **03,** 355; **06,** 418; **07,** 437; **08,** 459; **09,** 479; **10,** 540; **11,** 578; **12,** 700.

* Allotment.
[1] $2,000 less $205.89 trans. to Bastrop Bayou, Tex., **1910,** 540.
[2] $2,000 less $1,176.35 trans. to Dickinson Bayou, Tex., **1911,** 578.

In charge:
Capt. C. S. Riché, 1899–1903. **R., 00,** 2379, 2381; **03,** 1339.
Capt. Edgar Jadwin, 1906. **R., 06,** 1341.
Capt. John C. Oakes, 1907–09. **R., 07,** 1465; **08,** 1522; **09,** 1501.
Maj. G. P. Howell, 1910–11. **R., 10,** 1642; **11,** 1786.
Maj. E. I. Brown, 1912–. **R., 12,** 2005.

Assistant. S. M. Wilcox. **R., 00,** 2383.

OPERATIONS.

1902–03. Chan. across reef connecting lower Galveston B., East B., and East B. Bayou was dr. to 7′ x 45′–60′ and 900′ l., **03,** 1339.

1908–09. Derrick barge No. 1 dr. chan. across the shell reef, removing 5,773 c. y.; beacon erected to mark chan., **09,** 1501.

1909–10. Chan. across reef completed, total of 6,692 c. y. being removed; beacon estab. at n. end of pass, **10,** 1642.

1910–11. 7,616 c. y. dr., **11,** 1786.

PHYSICAL CHARACTERISTICS.

East B. Bayou empties into Galveston East B. about 30 m. ne. of Galveston, Tex.; one of the adjacent streams referred to in the app. of Mar. 3, 1899, for imp. "Brazos R. between Velasco and Richmond, W. Galveston B. Chan., Double Bayou, and the mouth of adjacent streams," **00,** 2380.
Description of, **00,** 2383.
Ruling d., 1912, 5.5′, **12,** 2005.

PROJECTS.

Capt. Riché est., 1900, $10,000 to make the imp. as a part of an inland light-draft navigation system, **00,** 2382.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2380, 2381.

U-9 DOUBLE BAYOU, TEX.

APPROPRIATIONS.

1902,	*$6,952.65,	**06,** 1341.
1907,	*[1] 4,000.00,	**07,** 1465; **08,** 460, 1523.
1909,	*[2] 5,000.00,	**09,** 1502; **10,** 541, 1643.
1910,	*[3] 5,000.00,	**10,** 1643.
1911,	*5,000.00,	**11,** 1787.
Total,	25,952.65	(less $1,691.56 trans., $24,261.09, **12,** 2006).

COMMERCE.

1911, 6,007 t., **12,** 701, 2006.

ENGINEERS.

Chief of Engineers. **R., 91,** 235; **98,** 287; **01,** 408; **02,** 337; **03,** 354; **04,** 373; **05,** 390; **06,** 418; **07,** 437; **08,** 459; **09,** 479; **10,** 540; **11,** 578; **12,** 701.

In charge:
Maj. C. J. Allen. **R., 91,** 1933.
Maj. J. B. Quinn, 1898. **R., 98,** 1512.
Lt. C. S. Riché, 1898–1903. **R., 98,** 1512; **01,** 1950; **02,** 1379; **03,** 1339.
Capt. Edgar Jadwin, 1904–06. **R., 04,** 1999; **05,** 1502; **06,** 1339.
Capt. John C. Oakes, 1907–09. **R., 07,** 1465; **08,** 1522; **09,** 1502.
Maj. G. P. Howell, 1910–11. **R., 10,** 1642; **11,** 1787.
Maj. E. I. Brown, 1912–. **R., 12,** 2006.

Assistants:
Lt. C. W. Langfitt. **R., 91,** 1935.
E. M. Hartrick. **R., 98,** 1514.

OPERATIONS.

1902–03. Dr. *Gen. H. M. Robert* removed 13,305 c. y.; operations suspended Oct. 9, 1902, on account of heavy clay, **03,** 1339.

1904–05. 80,480 c. y. removed by dr. *Gen. H. M. Robert*, **05,** 1502.

1905–06. 71,008 c. y. removed by dr. *Gen. H. M. Robert* (this work was paid for by private parties), **06,** 1339.

1907–08. 54,994 c. y. removed by dr. *Gen. H. M. Robert*, **08,** 1523.

1908–09. 63,917 c. y. removed by dr. *Capt. C. W. Howell*, **09,** 1502.

1910–11. 40,816 c. y. dr. by U. S. dr. *Capt. C. W. Howell*, redr. chan., making 6′ x 60′ x 7,100′, **11,** 1787.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 1935; **98,** 1513.
At 1898 the most recent sur. had shown that nearly 2,200′ intervened between 6′ d. in Galveston B. and the same d. in the bayou, **98,** 1513.
Chan. d., June, 1912, 2.7′, **12,** 701.

PLAN.

In 1890 Maj. Allen did not consider the bayou worthy of imp., **91,** 1934.

PRIVATE WORK. (See Operations, 1905–6.)

PROJECTS.

In 1898 Lt. Riché est. $20,000 or $80,000, depending upon the plan adopted, to open a chan. through bar at the bayou mouth, **98,** 1514.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Allen, **91,** 1933.
Cong. resolution, 1898, called for submission of est. for opening a chan. through the bar at the mouth of the bayou. **R.,** 1898, by Lt. Riché (see Projects), **98,** 1512.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 701.

* Allotment.
[1] $403.50 trans. to Clear Creek, Tex., **08,** 460.
[2] $266.94 trans. to Bastrop Bayou, Tex., **10,** 541.
[3] $1,021.12 trans. to Chocolate Bayou, Tex., **11,** 579

U-10 ANAHUAC CHANNEL, TEX.

APPROPRIATIONS.

1905, *[1] $6,100, **06,** 1341.
1907, *[1] 6,000, **07,** 1466.
1909, *[1] 4,000, **09,** 1502.
1910, *[1] 5,000, **10,** 1643.
1911, *[1] 3,000, **11,** 1788.

Total, [2] 24,100 ($17,741.95 (see footnote [2] below), **12,** 2007).

COMMERCE.

Chan. used by U. S. mail boat, and as there is no RR. communication with adjacent country, all produce and supplies pass through the chan., **08,** 460.
Description of, **11,** 579; **12,** 702.
Traffic, 1911, 26,385 t., **12,** 702.

CONTRACTS.

1912. Dr. *Thos. H. Ball,* borrowed from city of Houston, Tex., the U. S. to pay only operating expenses, **12,** 2007.

ENGINEERS.

Chief of Engineers. Rs., 05, 390; **06,** 418; **07,** 438; **08,** 460; **09,** 480; **10,** 541; **11,** 579; **12,** 701.

In charge:
Capt. Edgar Jadwin, 1905–06. **Rs., 05,** 1502; **06,** 1339.
Capt. John C. Oakes, 1907–09. **Rs., 07,** 1465; **08,** 1523; **09,** 1502.
Maj. G. P. Howell, 1910–11. **Rs., 10,** 1643; **11,** 1788.
Maj. E. I. Brown, 1912–. **R., 12,** 2007.

OPERATIONS.

1904–05. Dr. *Gen. H. M. Robert* removed 119,401 c. y. material; snag boat *Gen. S. M. Mansfield* removed 212 large snags from entrance to Browns Pass, **05,** 1502.
1905–06. 24,555 c. y. material removed by *Gen. H. M. Robert;* 16 snags removed, **06,** 1339.
1907–08. 162,028 c. y. material removed, **08,** 1523.
1909–10. 35,717 c. y. removed by dr. *Capt. C. W. Howell,* **10,** 1643.
1911–12. Chan. redr., 6′–8′ x 50′ x 6,600′, removing 45,200 c. y., at 3.4¢ c. y.; material placed 25′ away from edge of chan., **12,** 2007.

PHYSICAL CHARACTERISTICS.

Description of, **11,** 579, 1788; **12,** 701, 2007.
Continuous shoaling expected; material soft, **12,** 2007.

PRIVATE WORK.

Dr. *Gen. H. M. Robert* removed from slip at Anahuac, Tex., 5,828 c. y.; paid for from funds deposited by private parties, **07,** 438.
(See also Contracts.)

PROJECTS.

Act Mar. 3, 1905, included Anahuac Chan. under the imp. of Brazos R., Velasco to Richmond, and mouths of adjacent streams, with a proj. imp. of a chan. 6′, Trinity B. to Anahuac Chan., thence to Browns Pass.; est., $5,550, **05,** 390.

U-11 TURTLE BAYOU, TEX.

APPROPRIATIONS.

1910, *$10,000, **10,** 1644.

COMMERCE.

Charcoal, wood, and farm products, valued at $12,500, transported down the bayou during 1900, **00,** 2346.
1911, 3,962 t., **12,** 703.

ENGINEERS.

Chief of Engineers. Rs., 00, 394; **06,** 417; **07,** 436; **08,** 458; **09,** 478; **10,** 543; **11,** 580; **12,** 702.

In charge:
Capt. C. S. Riché, 1899–1900. **R., 00,** 2342, 2345.
Maj. G. P. Howell, 1910–11. **Rs., 10,** 1644; **11,** 1789.
Maj. E. I. Brown, 1912–. **R., 12,** 2009.
Assistant. F. Oppikofer. **R., 00,** 2346.

OPERATIONS.

1910–11. U. S. dr. Capt. C. W. Howell dr. chan. 5′ x 50′ x 15,895′, removing 79,125 c. y., **11,** 1789.

PHYSICAL CHARACTERISTICS.

Turtle Bayou empties into Turtle B., the head of Trinity B. (part of Galveston Upper B.) and is one of the adjacent streams referred to in the app. Mar. 3, 1899, for imp. "Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams," **00,** 2343.
Description of, **00,** 2343.

PROJECTS.

Capt. Riché est., 1900, $10,000 to make the imp., **00,** 2345.
This work added to proj. for imp. of West Galveston B. Chan., and the mouths of adjacent streams, etc., Tex., by act June 25, 1910; proposed to secure and maintain a 5′ chan. in the entrance to bayou; est., $10,000, **10,** 543.

SURVEYS.

Ex. and sur. of Turtle Bayou au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2343, 2345.

U-12 TRINITY RIVER, TEX.[3]

U-13 OLD (Trinity) RIVER, TEX.

ENGINEERS.

Chief of Engineers. R., 12, 724.
In charge. Maj. G. P. Howell, **12,** 688.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, of Old (Trinity) R., Tex., in Chambers Co., with view to securing increased d. (**R.** to come), **12,** 724.

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* Allotment.
[1] From app. for misc. streams, etc., consolidated; i. e., W. Galveston Bay Chan., Trinity R., Cedar Bayou, etc., at various times.
[2] $451.21 of this trans. to Trinity R., Tex., **10,** 542. $1,307.81 of this trans. to Dickinson Bayou, Tex., **11,** 580. $4,599.03 of this trans. to Clear Creek, Tex., **11,** 580.
[3] For data, see p. 725.

U-14 CEDAR BAYOU, TEX.

APPROPRIATIONS.

1890, $18,150, **91,** 1923.
1892, 14,000, **92,** 1545.
1902, 5,000, **02,** 1384.
1905, * 2,100, **06,** 1341.
1907, *[1] 5,000, **07,** 1467; **08,** 461.
1909, *[2] 5,000, **09,** 1504; **10,** 544.
1910, [3] 3,500, **10,** 544, 1645.

Total, 52,750 (less $2,892.90 trans., $49,857.10, **12,** 2010).

COMMERCE.

Important, **75,** 943, 944.
Transportation, **87,** 1436.
In 1906, 48,000 sacks of rice came out of this bayou, **07,** 439.
1911, 21,000 t., **12,** 703.

CONTRACTS.

1891. A. M. Shannon & Co., dr., 24¢ c. y.; brush mattress in place, $6 cord; st. in place, $2.50 c. y., **92,** 1545.

ENGINEERS.

Chief of Engineers. Rs., 75, 80; **87,** 193; **89,** 207; **90,** 186; **91,** 233; **92,** 227; **93,** 256; **94,** 236; **95,** 264; **02,** 338; **03,** 356; **04,** 375; **05,** 391; **06,** 419; **07,** 439; **08,** 461; **09,** 481; **10,** 543; **11,** 581; **12,** 703.

In charge:
Capt. C. W. Howell, 1975. **75,** 79. **R., 75,** 941.
Maj. O. H. Ernst, 1887–90. **Rs., 87,** 1435; **90,** 1815.
Maj. C. J. Allen, 1888–92. **Rs., 90,** 1816; **91,** 1922; **92,** 1543.
Maj. A. M. Miller, 1893–95. **Rs., 93,** 1883; **94,** 1405; **95,** 1815.
Capt. C. S. Riché, 1902–03. **Rs., 02,** 1383; **03,** 1341.
Capt. Edgar Jadwin, 1904–06. **Rs., 04,** 2001; **05,** 1505; **06,** 1339.
Capt. John C. Oakes, 1907–09. **Rs., 07,** 1467; **08,** 1525; **09,** 1504.
Maj. G. P. Howell, 1910–11. **Rs., 10,** 1644; **11,** 1790.
Maj. E. I. Brown, 1912–. **R., 12,** 2010.

Assistant. R. B. Talfor, **75,** 929. **Rs., 90,** 1817; **92,** 1546; **93,** 1884; **94,** 1407.

OPERATIONS.

1891-92. 10,350 c. y. dr.; 833 cords of brush mattress and 2,278 c. y. st. in place, **92,** 1545.

1892-93. S. j. extended 517 l. f. and n. j. 325 l. f., **93,** 1884.

1893-94. 21,000 c. y. dr., **94,** 1406.

1904-05. Dr. *Gen. H. M. Robert* removed 119,851 c. y. in excavating chan. 8′ x 80′ between js. and across Cloppers Bar; js. were repaired by depositing 308 t. riprap, **05,** 1505.

1907-08. Dr. *Gen. H. M. Robert* dr. 7′ chan. from d. w. in San Jacinto B. through Cloppers Bar to and inside js., removing 98,974 c. y.; snag boat *C. W. Howell,* equipped with clam-shell bucket, removed 1,734 c. y. from Cedar Bayou Gap, **08,** 1525.

1908-09. Dr. *Capt. C. W. Howell* removed 9,375 c. y., **09,** 1504.

1910-11. 8,922 c. y. dr. from chan 7′ x 80′ x 2,650′ by dr. *Capt. C. W. Howell,* **11,** 1790.

PHYSICAL CHARACTERISTICS.

Description of, **75,** 942; bayou discharges into nw. cor. Galveston Upper B., 3½ m. below mouth San Jacinto R., and 28½ m. from Galveston, Tex., **12,** 703.
Deterioration of chan. from natural causes, **87,** 1436.
Ruling d., June, 1911, 4.5′, **11,** 581, 1790; June, 1912, 4.3′, **12,** 2010.

PLANS. (See Projects.)

By Capt. Howell, 1874, chan. 5′ x 100′ across the bar; est., $5,750, **75,** 942.
Maj. Ernst, 1887, est. $48,875 cost of chan. excavation, **87,** 1436.

PROJECTS. (See Plans.)

By Maj. Allen, 1889, chan. through the bar at the mouth of the bayou, dr. and revet.; 5′ chan., $18,150 to $20,735; 6′ chan., $24,035 to $51,700, **90,** 1817, 1818.
By Maj. Allen, 1889, dr. chan. 5′ x 100′ m. l. w.; protection of the chan. thus formed with brush and st. walls or revet., with occasional dr. to maintain the chan. d.; est., $32,500, **91,** 1923; **92,** 1544.
In 1892–93 Maj. Miller est. cost of the existing proj. should be increased by $6,500, **93,** 1883.
Act June 2, 1902, au. mainten. of imp., provided that the dr. built for use in this locality should be available for this work, **02,** 338.

SURVEYS.

By R. B. Talfor, of bar in Galveston B. near mouth of the San Jacinto R., 1874, **75,** 80.
Ex. au. act Aug. 5, 1886; made, 1887, by Maj. Ernst, **87,** 1435.
Sur. for removal of bar at mouth au. act Aug. 11, 1888; made, 1889, by Maj. Allen, **90,** 1816.

U-26 GALVESTON SHIP CHANNEL AND BUFFALO BAYOU, TEX.

Part.	Title.	Period.	Appropriations.
a	Galveston B. Ship Chan	1871–1900	$859,016.85
b	Buffalo Bayou	1880–1900	228,750.00
c	Houston Ship Chan	1898–1912	2,500,000.00
d	Morgan Canal—Operating and care	1896–1910	9,560.00
	Total		3,597,326.85

* Allotment.
[1] $214.48 trans. to Clear Creek, Tex., **08,** 461.
[2] $218.53 trans. to Bastrop Bayou, Tex., **10,** 544.
[3] $2,390.97 trans. to Clear Creek, Tex., **11,** 582. $68.92 trans. to Dickinson Bayou, **11,** 582.

Part (a), U-26 Galveston Bay—Ship Channel, Tex.

APPROPRIATIONS.[1]

1872,	[2] $10,000.00,	**73,** 634.
1874,	[2] 10,000.00,	**74,** 74.
1875,	[2] 10,200.00,	**75,** 79.
1875,	[3] 25,000.00,	**75,** 79.
1876,	[3] 72,000.00,	**76,** 77.
1876,	10,000.00 (sur.),	**77,** 75.
1878,	[4] 75,000.00,	**78,** 83.
1879,	[4 5] 80,000.00,	**79,** 110.
1880,	50,000.00,	**80,** 1238.
1881,	50,000.00,	**81,** 1334.
1882,	94,500.00,	**82,** 1457.
1888,	100,000.00,	**88,** 1281.
1890,	40,000.00,	**91,** 1909.
1890,	[6] 92,316.85,	act Sept. 19.
1892,	40,000.00,	**92,** 1539.
1894,	50,000.00,	**95,** 1808.
1896,	50,000.00,	**96,** 1544.
Total,	859,016.85	

COMMERCE.

Important, **71,** 535; **73,** 65, 635; **75,** 873–875; **76,** 587, 588.

Tolls for passing ship chan. at Morgans Pt., **77,** 461.

Necessity of chan. less than formerly and not called for by interests of C. **83,** 202, 1082.

Description of. Probable benefits of imp. to, apparently to be greater than expend., **96,** 1543.

CONTRACTS.

1875. E. W. Cave, dr., 17 to 25¢ c. y., **75,** 872; **76,** 585, 586.

1878. G. C. Fobes & Co., dr., 15⅞¢ c. y., **79,** 110, 915, 918.

1881. J. E. Slaughter, dr., 13.7¢ c. y., **81,** 1333.

1888. G. C. Fobes, dr., 11.3¢ c. y., **88,** 1282. G. C. Fobes, dr., 12¼¢ c. y., **89,** 1551.

1893. R. Moore Dredging Co., dr., 24½¢ c. y. ($56,350), **93,** 1875.

1894. C. & R. P. Clarke, dr., 12½¢ c. y. ($18,750), **95,** 1808.

ENGINEERS.

Chief of Engineers. R., 71, 66; **73,** 65; **74,** 73; **75,** 79; **76,** 76; **77,** 74, 456; **78,** 83; **79,** 110; **80,** 147; **81,** 200, 1334; **82,** 196; **83,** 202, 1080; **84,** 217; **85,** 226; **86,** 224; **87,** 189; **88,** 173; **89,** 203; **90,** 183; **91,** 232; **92,** 225; **93,** 253; **94,** 234; **95,** 262; **96,** 227; **97,** 294; **98,** 283; **99,** 340; **00,** 386.

Boards:

Convened, Sept. 1, 1877, New York City, to consider location of proposed ship chan. through Galveston B. Recom. a line from Red-Fish Bar to the head of Bolivar Chan. as the most advantageous, **77,** 467; **78,** 608. (Col. Tower, Lt. Cols. Wright and Newton, and Capt. Howell.)

Convened, S. O. No. 9, C. of E., 1883. **R., 83,** 1078. B. reported it improbable that a chan. of the proposed d. would be permanent through the Morgan Cut, **83,** 1081, 1082. (Maj. Mansfield; Capts. Damrell and Heuer.)

Convened, Galveston, Tex., Dec. 4, 1890, by S. O. No. 66, to **R.** upon value of chan. constr. by the Buffalo Bayou Ship Channel Co. in Galveston B. **R., 91,** 1910. (Col. Comstock, Maj. Allen, and Lt. Langfitt.)

In charge:

Capt. C. W. Howell, 1871–80. **R., 71,** 533; **73,** 634; **74,** 740; **75,** 870, 872, 874; **76,** 585; **77,** 455, 458, 459; **78,** 607; **79,** 912; (Maj.) **80,** 146.

Maj. S. M. Mansfield, 1880–86. **R., 80,** 1236; **81,** 1332; **82,** 1456; **83,** 1075; **84,** 1303; **85,** 1454; **86,** 1322.

Maj. O. H. Ernst, 1886–90. **R., 87,** 1417; **88,** 1279; **89,** 1548.

Maj. C. J. Allen, 1890–92. **R., 90,** 1797; **91,** 1906; **92,** 1536.

Maj. A. M. Miller, 1893–97. **R., 93,** 1872; **94,** 1396; **95,** 1806; **96,** 1542; **97,** 1803.

Maj. J. B. Quinn, 1898. **R., 98,** 1505.

Capt. C. S. Riché, 1899–. **R., 99,** 1961; **00,** 2325.

Assistants:

Lt. H. M. Adams, **71,** 66. **R., 71,** 534.

W. D. Duke, **71,** 535.

Capt. C. E. L. B. Davis, **79.** 106. **R., 79,** 916; **80,** 1236.

Lt. J. B. Quinn, **75,** 78. **R., 75,** 875.

J. C. Forsby, **76,** 586.

A. Cross, **76,** 586.

A. G. Blanchard, **76,** 586.

J. A. Hayward. **R., 77,** 459.

H. C. Ripley. **R., 77,** 462.

E. M. Hartrick. **R., 88,** 1282; **89,** 1551; **90,** 1800.

G. Bagnall. **R., 91,** 1909; **92,** 1539.

D. Allen. **R., 93,** 1875; **94,** 1398; **95,** 1808.

ESTIMATES. (See Plans and Projects.)

By Lt. Adams, 1870, Galveston B.: 1st, $3,443,113; 2d, $940,315; 3d, $382,017, **71,** 536.

By Capt. Howell, 1875, completion of a 9′ chan. through Red Fish Bar. $10,200; 10′, 12′, or 15′ chan., Bolivar Chan. to Morgans Pt., $283,479, $651,562, or $1,260,062, **75,** 873; **76,** 77.

By Lt. Quinn, 1875, removal of obstr. in San Jacinto R., $6,000, **75,** 875.

By J. A. Hayward, 1877, 12′ ship chan., 100′, 200′ base, 3 routes: 1st, $402,620, $744,779; 2d, $342,014, $660,653; 3d, $160,994, $434,879, **77,** 460, 463.

By H. C. Ripley, 1877, 12′ chan., Red Fish Bar to Bolivar Chan., 100′ w., $146,856; 150′ w., $216,096; 200′ w., $285,331, **77,** 463.

LEGISLATION.

Proviso attached to act of Mar. 3, 1879, relating to Bayou Ship Channel Co., **79,** 214.

Subsequent action relating thereto, **81,** 1334; **82,** 1457; **84,** 394.

OPERATIONS.[7]

1872–73. Completion of chan., 7′ x 70′ x 1.500′, through Red Fish Bar, by U. S. dr., **73,** 65, 635.

1874–75. Chan., 7.5′–10′ x 60′ x 2,982′, **75,** 79, 870.

1875–76. Removal of total of 104,920 c. y.; chan., 14½′ x 61.000′ on Red Fish Bar. Work on chan. between mouth of San Jacinto R. and Bolivar Chan. in progress, **76,** 76, 585, 586.

1878–79. Dr. in chan. between Red Fish Bar and Bolivar Chan., **79,** 917; 510,379 c. y. dr. from chan. in Lower Galveston B, **80,** 1236.

1881–82. 160,440 c. y. dr. from chan., **82,** 1456.

1882–83. 801,789 c. y. dr. from chan., **83,** 202, 1075. Work done not permanent, **83,** 1078, 1080.

1886–87. Sur. of chan.; preparations for resumption of dr., **87,** 1419, 1421.

1887–88. 200,000 c. y. dr. from ship chan., **88,** 1284.

1888–89. 1,618,220 c. y. dr. from ship chan., **89,** 1549.

1889–90. 19.829 c. y. dr. **90,** 1798.

1891–92. Mainten. and repair of beacons and triangulation stations, **92,** 1539.

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[1] Total app., 1824 to 1875, $45,000. (H. D. 120, 44th, 1st.)
[2] Red-Fish Bar Chan.
[3] Chan. between San Jacinto R. and Bolivar Chan.
[4] Chan. between Red-Fish Bar and Bolivar Chan.
[5] See proviso, **79,** 214.
[6] Paying Buffalo Bayou Ship Chan. Co. for Morgan Cut and Canal.
[7] History of operations since 1873, **79,** 912.

1892-93. W. bank of canal revet. for 1,959 l. f., **93,** 1873.

1893-94. Beacons repaired, fence erected about U. S. reservation, 153,376 c. y. dr., **94,** 1396, 1397.

1894-95. 299,332 c. y. dr., **95,** 1867.

1895-96. 122,513 c. y. dr. and 10 beacons rebuilt, **96,** 1543.

PHYSICAL CHARACTERISTICS.

Description, **71,** 534, 536; **76,** 586; **77,** 459, 461; **93,** 1872.

Obstr. in San Jacinto R., **75,** 874, 875.

Current observations, **77,** 464, 465.

Table of tides, **75,** 874, 875.

Shoaling, **93,** 1875; **95,** 1807; **96,** 1543; **97,** 1803.

PLANS. (See Estimates and Projects.)

By Lt. Adams, 1870, 3 routes: (1) chan, 12′ x 150′, through Galveston B. and Buffalo Bayou to Houston; (2) chan., 6′ x 150′ m. l. w. across the Red Fish and Cloppers Bars; (3) chan., 6′ x 100′, across Red Fish and Cloppers Bars. Each of the plans to include the removal of obstr., shore protection by sheet piling between Harrisburg and Houston. Third plan recom. by Lt. Adams, **71,** 536.

By J. A. Hayward, ship chan. through Galveston B.: (1) 12′ chan. from San Jacinto R. to Bolivar Chan.; (2) San Jacinto R. to Red Fish Bar and Bolivar Chan.; (3) Morgans Pt. to Bolivar Chan., with retaining wall, **77,** 459, 461, 463.

By Lt. Quinn, 1875, removal of Southern obstr., consisting of flats and scows in the San Jacinto R., **75,** 875.

PRIVATE (PRIVATE AND CORPORATE) WORK.

Valuable imp. made below Harrisburg by the Houston Direct Navigation Co. Expend. should be reimbursed and chan. tolls estab., **71,** 533, 535, 536; **71,** 461.

Contractor and private parties continued work on chan., 1875, after the expend. of app.; removed 4,832 c. y., **76,** 586.

Proviso attached to act of Mar. 3, 1879, requiring the Bayou Ship Channel Co. to surrender their rights before application of app. of 1880, **79,** 214.

Action relating thereto and subsequent compliance of the co., **81,** 1334, 1338; **82,** 1457.

PROJECTS.[1] (See Estimates and Plans.)

By Lt. Adams, chan., 6′ x 100′, across Red Fish and Cloppers Bars, $62,805. Approv. by Capt. Howell, increasing est. to $125,000, **71,** 533, 535, 536. Revised by Capt. Howell to chan. 150′ x 10′; and, again, to chan. 9′ d. through Red Fish Bar alone, **74,** 740; **75,** 79, 870, 872.

By J. A. Hayward, chan., 12′ d., mouth of San Jacinto R. to Bolivar Chan., **75,** 79. Recom. by Capt. Howell, changing the upper terminus to Morgans Pt., **75,** 873. Concurred in by the Chief of Engineers, **76,** 76; **77,** 456, 459, 588.

By Capt. Howell, 12′ chan. from Red Fish Bar to Bolivar Chan., **77,** 466. Approv. by BE., **77,** 467.

By Capt. Howell, 1878, chan., 12′ x 100′, from Red Fish Bar to Morgans Pt., **78,** 83, 607; **79,** 110.

In 1883 the BE. reported that the chan. could not be made permanent at any reasonable cost, **83,** 1081.

Recom. by Chief of Engineers that available funds be reserved pending action of Cong., **83,** 1082; **84,** 217.

US. bought Morgan Cut and Canal, 5.43 m. l., for $92,316.85, **12,** 697.

By Maj. Miller, 1892, after acquisition by U. S. of the Morgan Cut and Canal, formerly owned by the Buffalo Bayou Ship Channel Co., for maintaining a chan. at least 12′ x 100′ from Bolivar Chan. to outer end of Morgan Cut and Canal, the chan. to be suitably marked by beacons, **93,** 1872.

By Maj. Miller, 1893, for expending available funds to dr. at Red Fish Bar and in Morgan Cut chan. having a d. of 9½′ below m. l. t., and w. at bottom of about 100′; to revet. about 1,900 l. f. of w. bank of the Morgan Canal, and to slope both banks to prevent erosion, **93,** 1873.

SURVEYS.

By Lt. H. M. Adams, **71,** 66, 533, 534.

By Lt. H. M. Adams, to Dollar Pt., **71,** 66.

By Lt. Quinn, ex. of San Jacinto R., **75,** 874.

By J. A. Hayward and H. C. Ripley, **77,** 75, 458, 459, 462.

Resur. of chan. made, 1889, by Maj. Ernst, **89,** 1549.

Sur. along the line of the ship chan. made, 1897. (See Galveston, Tex., Channel from, to Houston.)

Maps. **90,** 1800; **91,** 1911.

Part (b), U-26 Buffalo Bayou, Tex.

APPROPRIATIONS.

1881,	$25,000,	**81,** 1343.
1882,	50,000,	**82,** 1459.
1884,	25,000,	**84,** 1306.
1886,	18,750,	**86,** 1326.
1888,	25,000,	**88,** 1288.
1890,	25,000,	**90,** 1809.
1892,	25,000,	**92,** 1551.
1894,	15,000,	**95,** 1818.
1896,	20,000,	**96,** 1549.
Total,	228,750	

COMMERCE.

Important, **81,** 1346; **84,** 1307; **93,** 1886; **96,** 1549.

Cotton shipments, **90,** 1808.

CONTRACTS.

1881. G. L. Long, dr., 21¢ c. y.; removal of trees, $190 per m., **82,** 1459.

1882. J. J. Atkinson, dr., 26¢ c. y.; removal of trees and stumps, and revet. of banks, **83,** 1084.

1884. R. Moore, dr., 23¢ c. y.; removal of snags, $2.70 each, **85,** 1458.

1887. J. J. Atkinson, dr. and removal of obstr., **87,** 1424.

1888. J. J. Atkinson, dr. and r. removal $24,192, **89,** 1561.

1891. J. J. Atkinson, dr. and removal of trees and logs, $21,110, **91,** 1927.

1893. L. Meggett, dr., 31¢ c. y.; removal of obstr., 6¼ and 7½¢ c. f., and $14.85 per hour ($25,000), **93,** 1888.

1894. R. Moore Dredging Co., dr., 30¢ c. y.; removal of obstr., 5 and 6¢ c. f., and $13.50 per hour ($9,840), **95,** 1818.

ENGINEERS.

Chief of Engineers. R., 80, 150; **81,** 201, 204; **82,** 198; **83,** 203; **84,** 218; **85,** 227; **86,** 225; **87,** 190; **88,** 174; **89,** 205; **90,** 185; **91,** 234; **92,** 227; **93,** 256; **94,** 237; **95,** 265; **96,** 229; **97,** 296; **98,** 286; **99,** 340; **00,** 386.

In charge:

Maj. S. M. Mansfield, 1880–86. **R., 81,** 1342, 1344; **82,** 1458; **83,** 1083; **84,** 1305; **85,** 1457; **86,** 1325.

Maj. O. H. Ernst, 1886–90. **R., 87,** 1423; **88,** 1286; **89,** 1559.

Maj. C. J. Allen, 1890–92. **R., 90,** 1807; **91,** 1924; **92,** 1548.

Maj. A. M. Miller, 1893–97. **R., 93,** 1886; **94,** 1409; **95,** 1816; **96,** 1547; **97,** 1806.

[1] Proj. of 1871–77 proposed formation of a dr. chan. 12′ x 100′ m. l. w., head of Bolivar to the U. S. cut through Red Fish Bar, thence to the cut through Morgans Pt. Est., $446,326.42. **78,** 608; **79,** 918; **80,** 1237; **87,** 1418. Imp. not considered permanent, **79,** 918; **83,** 1074.

Maj. J. B. Quinn, 1898. **R., 98,** 1510.
Capt. C. S. Riché, 1899–. **R., 99,** 1977; **00,** 2330.

Assistants:
B. F. Taylor. **R., 81,** 1344; **84,** 1306.
R. B. Talfor. **R., 88,** 1288; **89,** 1561; **91,** 1928; **92,** 1551; **93,** 1889; **94,** 1411; **96,** 1549.

OPERATIONS.

1881–82. 24,895 c. y. dr. and trees removed from 11¾ m. of R. bank, **82,** 1459.
1882–83. 162,780 c. y. dr., 971 trees removed, and 1,247,810 sq. f. of bank cleared, **83,** 1084.
1883–84. 64,943 c. y. dr. and 379 trees removed, **84,** 1305.
1884–85. 78,600 c. y. dr. and 277 snags removed, **85,** 1457.
1885–86. 13,500 c. y. dr. and 26 stumps removed, **86,** 1326.
1887–88. 56,677 c. y. dr. and 2,852 c. f. logs removed from the bayou, **88,** 1287.
1888–89. 48,104 c. y. dr. and 1,795 c. f. sunken logs removed, **89,** 1560.
1889–90. 6,651 c. y. dr. and 1,062 c. f. logs and stumps removed, **90,** 1808.
1890–91. 26,200 c. y. dr.; 2,900 c. y. material dug from the banks; 2,900 c. f. logs removed from the chan. and 13,348 c. f. trees from the banks, **91,** 1925.
1891–92. Removing stumps and logs and excavating from projecting points, **92,** 1551.
1892–93. 23,358 c. y. dr. and about 1,200 obstr. removed, **93,** 1887.
1893–94. 27,980 c. y. dr. and over 100 obstr. removed, **94,** 1410.
1895–96. 36,474 c. y. dr., about 750 obstr. removed, and 20,500 c. f. trees felled, **96,** 1548.

PHYSICAL CHARACTERISTICS.

Description of bayou, **81,** 1345; **87,** 1423; **90,** 1807.
Shoaling, **96,** 1549.

PLANS.

By Maj. Mansfield, 1880, chan. between Simms and White Oak Bayous, 12′ x 150′; est., $1,125,341, **81,** 1344, 1346.

PRIVATE (CORPORATE) WORK.

Charter of the Buffalo Bayou Ship Canal Co. **87,** 1425.

PROJECTS.

By Maj. Mansfield, 1880, chan. 12′ x 100′ between Simms Bayou and mouth of White Oak Bayou at Houston; revet. of bank, removal of trees, and dr; est., $385,299, **81,** 1343, 1344, 1346; **91,** 1925; **92,** 1550.
Permanent imp. not expected, **87,** 190.
By Maj. Miller, 1892, expend. app. of that year in dr. bars to 10′ m. l. w., in easing sharpness of points, and in removal of obstr., **93,** 1887.
In 1896 Maj. Miller recom. combining this work with that on Galveston B. Ship Chan., **96,** 1548.

SURVEYS.

Au. act June 14, 1880, **80,** 150; made by Maj. Mansfield, 1880, **81,** 1344.

Part (c), U-26 Houston Ship Channel[1] (Galveston Ship Channel and Buffalo Bayou), Tex.

APPROPRIATIONS.

1899,	$300,000,	**99,** 1964.
1902,	300,000,	**02,** 1375.
1903,	500,000,	**03,** 1335.
1904,	200,000,	**04,** 1987.
1905,	200,000,	**05,** 1493.
1906,	200,000,	**06,** 1337.
1907,	200,000,	**07,** 1463.
1908,	145,000,	**08,** 1519.
1909,	155,000,	**09,** 1499.
1910,	300,000,	**10,** 1640.

Total, 2,500,000 (incl. sales, $2,500,352.69, **12** 2004).

COMMERCE.

Description of, **98,** 1519.
Large and important. Board of 1897 **R.** probably $600,000 an. would be saved in rates by an imp. chan., **98,** 1519.
Marked fav. influence of imp. on rates, **06,** 416.
Effect on rates unknown, and difficult to determine, because of RR. rate differential in favor of Houston au. by the RR. Com. of Texas, **07,** 435; **12,** 698.
1900–1, 155,000 t. ±; 1902–3, 109,700 t. ±; 1906, 132,000 t.; 1909, 1,215,000 t.; 1911, 1,400,000 t.; bulk. cotton, **12,** 698. 2005.
"The total length of the improved channel is 57 miles, 50 miles to the turning basin and 7 miles farther to Houston.
"The amount and value of the commerce transported is as follows:

Year.	Short tons.	Value.
Calendar year—		
1911	1,354,897	$34,721,530
1910	1,371,650	39,155,357
1909	1,214,904	36,097,560
1908	602,734	28,318,621
1907	452,463	24,466,730
Calendar year—		
1906	132,108	No value.
1905	104,907	$12,544,323
Fiscal year—		
1904–5	106,135	17,225,993
1903–4	111,840	18,350,133
1902–3	109,704	15,812,632
1901–2	141,130	21,038,677
1900–1901	154,459	19,630,640

"The bulk of the tonnage is cotton, amounting last calendar year to 97,247 short tons, valued at $23,338,280, which is carried on barges to Galveston and there loaded on vessels.
"The effect of this project on freight rates is unknown and is indeterminate because of a railroad rate differential in favor of Houston, authorized by the railroad commission of the State of Texas." **12,** 698.

CONTRACTS.

1900. C. Clarke & Co., dr., 6.98¢ c. y.; dike constr., 11½¢ l. f. ($342,330), **00,** 2328.
1903. Bowers Southern Dredging Co., dr., Div. 1, 8.8¢ c. y., and Div. 2, 14¢ c. y., **03,** 1336.
1906. August Nelson, dr., 19.9¢ c. y., **06,** 1337.
1908. Kingsford Foundry & Machine Works, furnishing 4 boilers, $8,600, **08,** 1520. John Jacobson, dr. 650,000 c. y., 13.45¢ c. y., **09,** 1500.
1909. American Creosote Works (Inc.), creosoted piles and lumber, prices listed, **10,** 1641.
1912. L. T. Gaylord, dr., prices given, **12,** 2002.

ENGINEERS.

Chief of Engineers. R., 98, 284, 286; **99,** 340; **00,** 386; **01,** 404; **02,** 334; **03,** 351; **04,** 370 **05,** 385; **06,** 415; **07,** 434; **08,** 455; **09,** 475; **10,** 536; **11,** 574; **12,** 696.

[1] Name changed to "Houston Ship Channel, Tex." by act June 25, 1910, **10,** 536.

Boards:
Convened, S. O. No. 7, Feb. 12, 1897, at Houston, Tex., July 26, 1897, to make ex. and **R.** called for by act Feb. 1, 1897. **R., 98,** 1515. (Col. H. M. Robert, Maj. A. M. Miller, and Capt. McC. Derby.)
BERH. submits **R.,** Dec. 15, 1904, recom. modification of projs. (see Projects), **05,** 386, 1495.

In charge:
Maj. J. B. Quinn, 1897–98. **R., 98,** 1515.
Capt. C. S. Riché, 1899–1903. **R., 99,** 1964; **00,** 2327; **01,** 1933; **02,** 1374; **03,** 1334.
Capt. Edgar Jadwin, 1903–07. **R., 04,** 1985; **05,** 1492; **06,** 1335.
Capt. John C. Oakes, 1907–10. **R., 07,** 1461; **08,** 1516; **09,** 1496.
Maj. G. P. Howell, 1910–11. **R., 10,** 1638; **11,** 1784.
Maj. E. I. Brown, 1912–. **R., 12,** 2002.

Assistants:
Lt. M. L. Walker, **01,** 402; **02,** 332.
R. B. Talfor. **R., 01,** 1935; **04,** 1988.
E. M. Hartrick. **R., 04,** 1990.
Capt. G. M. Hoffman, **04,** 366.
F. C. Stanton. **R., 05,** 1494.

LEGAL PROCEEDINGS.

Deeds secured for rights of way, **06,** 1336, 1337; **07,** 1462; **08,** 1517; **12,** 2004.

LEGISLATION.

Act June 13, 1902, provides that amounts app. and au. shall be expended in developing chan. in Divs. 1 and 2 to uniform d., and that not more than ½ shall be expended upon Div. 2, **02,** 335.

OPERATIONS.

1899–1900. Old beacons renovated, new ones constr., and location of same in progress, **00,** 2327.
1900–01. Div. No. 1: 324,687 c. y. dr.; work commenced on temporary pile and brush dikes, **01,** 1933–35.
1901–02. Div. No. 1: 2,772,741 c. y. dr.; dike work completed, **02,** 1374.
1902–03. Div. No. 1: 1,220,583 c. y. dr. Div. No. 2: 73,455 c. y. dr., **03,** 1334.
1903–04. Div. No. 1: 3,991,581 c. y. dr. Div. No. 2: 1,153,178 c. y. dr., **04,** 1986, 89, 91.
1904–05. Div. No. 1: 1,566,042 c. y. dr. Div. No. 2: 1,150,721 c. y. dr., 703 snags removed and surs. made. Div. No. 3: 857 snags removed and surs. made, **05,** 1492, 94.
1905–06. Div. No. 2: 865,485 c. y. dr. Div No. 3: 166,800 c. y. dr. by U. S. drs.; 13,683 c. y. rehandled due to break in sluiceway. Dr. *Gen. H. M. Robert* repaired and imp., used for snagging and also dr. 7,270 c. y. from Div. 2 and 14,673 c. y. from Div. 3, **06,** 1336.
1906–07. 1,503,226 c. y. dr. from Divs. 2 and 3, **07,** 1461, 62. Operation of drs., **07,** 1480.
1907–08. 1,950,241 c. y. dr., derrick barge constr. for snagging and 101 trees and 107 snags removed from bayou, **08,** 1516–18. Details of dr. and snagging operations, **08,** 1538.
1908–09. 3,987,209 c. y. dr., 1,342 trees and 1,157 snags removed, **09,** 1496. Consolidated report of dr. and snagging operations, **09,** 1522.
1909–10. 119,669 c. y. dr.; repairs to dike; 1,602′ sheet-pile bulkhead completed and 8,926′ partly completed; snagging in Div. 3; dump scows repaired, **10,** 1638.
1910–11, Repairs to dike, 11,448 l. f. completed. Portion of dike carried away by storm recovered and used to build 3 spur dikes, **11,** 1784.
1911–12. Dr. from Div. 2 (bayou), Morgan Pt. to Harrisburg, 38,648 c. y., **12,** 2003.

PHYSICAL CHARACTERISTICS.

Description of route: 58¾ m. l., naturally divided into 2 parts; the first through the open waters of Galveston B. and Morgan Canal, and the second through San Jacinto B. and **R.** of same name to Lynchburg, and thence up Buffalo Bayou to Houston, **98,** 1517; chan. begins at d. w. in Bolivar Roads, G. H., extends across G. B. and through San Jacinto B. and R. and Buffalo Bayou to Houston—50 m. is of ship chan. proper to turning-basin, last 7 m. is a light-draft chan. to Houston. Entire chan. is tidal, **12,** 696.
Changes in dr. chan. due to shoaling and scouring, **04,** 1986; **05,** 1492, 98; **06,** 1335, 36; **07,** 1461, 62; **08,** 1517, 18; **09,** 1496, 97; **10,** 1638–40; **11,** 1784.
Variation of water surface, **06,** 416.
Severe flood in 1907, **07,** 1462; flood rises equal 12′ or more, **12,** 698.
Uncreosoted timber in dike damaged by storm in 1909, **10,** 1639.
Dike damaged by storm in 1911, **11,** 1784.
Silting in various sections, **12,** 2003.

PRIVATE WORK.

In 1909 city of Houston d. and w. turning-basin at foot of Main St. and built 500′ of bulkhead on s. side of bayou, **09,** 1498.
Harris County Houston Ship Channel Navigation District, a local organization, undertakes to bear ½ of est. cost of $2,500,000 for completing imp., **10,** 537; bonds issued and $300,000 deposited to order of Sec. of War.
City of Houston dr. (1910) 2 slips n. side turning-basin, **10,** 1639.
Shoals near Houston removed by city (1911), **11,** 1785.

PROJECTS.

By BE., 1897, 17½′ chan., 80′ w., with side slopes about 1 on 2, from d. w. in Galveston H., Galveston B., and Morgans Cut (Div. 1); for constr. pile and brush dike from Morgans Cut to Red Fish Bar, and for surs., superintendence, and contingencies that might be necessary, $25,000 being reserved for administration, surs., and mainten. above Div. 1 (through San Jacinto B. to Houston, Tex.); est., $4,000,000, and $100,000 an. mainten., **98,** 1518; **00,** 2327.
Act Feb. 20, 1900, repealed items app. in act Mar. 3, 1899, relating to imp. of Galveston Ship Chan. and Buffalo Bayou, Tex. The following amendment was substituted: *Provided,* That all sums heretofore app. and available for the work on Galveston Ship Chan. and Buffalo Bayou are hereby made available for said [that of 1897] proj.: *Provided further,* That all of said sums of money not necessary for administration, surs., and mainten. be used in imp. Div. No. 1 of said sur., **00,** 387.
BERH. recom., 1904, modification of proj. as follows: Terminate imp. at point near head of Long Reach, provide cut-offs at 3 points with least radius of 2,500′, ease all other bends to same minimum radius, provide turning-basin near head of Long Reach with w. of 600′; 26,000′ revet.; one hydraulic dr.; est. cost of completing proj., in addition to funds available, $3,550,000,[1] **05,** 1495; 50% done, 1912. **12,** 698.
Act June 25, 1910, an. constr., to limit of $2,500,000, and requiring Harris County Houston Ship Canal Navigation District to furnish $1,250,000 (see PRIVATE WORK) in portion, the U. S. app. not to be expend. otherwise; also, proj. to be completed with the foregoing sum, **12,** 698.
Change of route of chan. from Morgan Pt. to Texas City Chan. recom. by Maj. Howell, **11,** 1785.

SURVEYS.

Act Feb. 1, 1897, called for ex. and sur., with est. for chan. not less than 25′ x 100′ from j. mouths at Galveston, through existing ship chan., and up Buffalo Bayou to Houston; and for H. at the latter place of same d., but 500′ w. Made by board in 1897 (see Projects), **98,** 1515.
1912, resur. begun preparatory to dr. under new proj., **12,** 698.

[1] R. and H. Com. 35, 61st, 2d.

Part (d), U-26 Morgan Canal, Tex. (Operating and Care.)

APPROPRIATIONS.[1]

1896,	$240
1897,	360
1898,	360
1899,	360
1900,	360
1901,	5,000
1902,	360
1903,	360
1904,	360
1905,	360
1906,	360
1907,	360
1908,	360
1909,	360
Total,	9,560

CONTRACTS.

1902. Moore & Sieber, repairing bulkhead; constr. bulkhead, $6.05 l. f.; removing old bulkhead, $1.33⅓ l. f.; erecting fence posts, 30¢ each, and gate posts, 40¢ each, **02,** 1377, 1378.

ENGINEERS.

Chief of Engineers. R., 97, 298; **98,** 284; **99;** 341; **00,** 388; **01,** 405; **02,** 336; **03,** 353; **04,** 372, **05,** 387; **06,** 417; **07,** 436; **08,** 458; **09,** 477; **10,** 539.

In charge:

Maj. A. M. Miller, 1897. **R., 97,** 1808.
Maj. J. B. Quinn, 1898. **R., 98,** 1507.
Capt. C. S. Riché, 1899–1903. **R., 99,** 1965; **00,** 2328; **01,** 1937; **02,** 1377; **03,** 1337.
Capt. Edgar Jadwin, 1904–06. **R., 04,** 1992; **05,** 1499; **06,** 1338.
Capt. John C. Oakes, 1907–09. **R., 07,** 1464; **08,** 1521; **09,** 1501.
Maj. G. P. Howell, 1910–. **R., 10,** 1641.

OPERATIONS.

1901–02. Repairs of damage to canal bulkhead by storm completed, fence built on boundary line, and work on new bulkhead and removal of old bulkhead completed, **02,** 1377.

1904–05. Bulkhead and boundary fence damaged by fire in 1904 repaired by Bowers Southern Dredging Co., **05,** 1499.

U-27 CLEAR CREEK, TEX.

APPROPRIATIONS.

1902,	*$2.30, **06,** 1341.
1907,	*10,487.86, **08,** 1526; **12,** 2011.
1909,	*5,599.03, **09,** 1504; **12,** 2011.
1910,	11,390.97, **10,** 1645; **11,** 582, 1791; **12,** 2011.
Total,	27,480.16, **12,** 2011.

COMMERCE.

Farm products shipped to Galveston, with return shipments of groceries and general merchandise, **00,** 2387.
1911, 11,257 t., **11,** 704.

ENGINEERS.

Chief of Engineers. R., 00, 395; **06,** 417; **07,** 439; **08,** 461; **09,** 482; **10,** 544; **11,** 582; **12,** 703.

In charge:

Capt. C. S. Riché, 1899–1900. **R., 00,** 2385, 2388.
Capt. Edgar Jadwin, 1906. **R., 06,** 1341.
Capt. John C. Oakes, 1907–09. **R., 07,** 1467; **08,** 1525; **09,** 1504.
Maj. G. P. Howell, 1910–11. **R., 10,** 1645; **11,** 1790.
Maj. E. I. Brown, 1912–. **R., 12,** 2011.

Assistant. S. M. Wilcox. **R., 00,** 2389.

OBSTRUCTIONS.

Creek crossed by the Columbia Tap; Gulf, Colorado & Santa Fe; Galveston, Houston & Henderson; and the Galveston, La Porte & Houston RR.; the latter, near the mouth, is the only road having a drawspan in its br., **00,** 2390.
Stream navigable to Friendswood, 20 m., except that same is obstr. at 10 and 14 m. from mouth by brs.; brs. modified to provide 24′ openings, **09,** 483.

OPERATIONS.

1907–08. 80,083 c. y. removed by dr. *Capt. C. W. Howell,* **08,** 1525.

1908–09. 3 permanent beacons erected to mark chan., **09,** 1504.

1909–10. Derrick barge No. 2 removed 1,275 snags between Davis Br. and Friendswood Br., **10,** 1645.

1910–11. 127,231 c. y. dr. by U. S. dr. *Capt. C. W. Howell,* **11,** 1791.

PHYSICAL CHARACTERISTICS.

Clear Creek empties into Galveston Upper B., and is one of the adjacent streams referred to in the app. Mar. 3, 1899, for imp. "Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams," **00,** 2386.
Description of, **00,** 2386.
Ruling d., June 25, 1912, 5.3′ across Clear Lake and 4.1′ entrance chan. in Galveston B., **12,** 2011.

PRIVATE WORK.

41,000 c. y. removed by Suderman & Dolson under contract with private parties, in excavation of 6′ chan. from 6′ contour in Galveston B. to d. w. in the creek, **08,** 1526; **12,** 703.

PROJECTS.

Capt. Riché est., 1900, $10,000 to make the imp. as a part of an inland light-draft navigation system, **00,** 2388.
Proposed excavation of a chan. 5′ x 17,000′ across bar and through the lake; est., $8,000, **07,** 440.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2386, 2388.
At mouth of creek; bench marks estab.; cost, $139.39, **10,** 1645.

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* Allotment.
[1] Expend. under permanent indefinite app. acts of July 5, 1884, and Mar. 3, 1909, operating and keeping in repair canals and other public works.

U-28 DICKINSON BAYOU, TEX.

APPROPRIATIONS.

1907, *$7,000.00, **07,** 1468.
1909, *[1] 4,000.00, **09,** 1505; **10,** 545.
[2] 987.78 } **09,** 484.
[3] 51.87 }
1910, 5,000.00, **10,** 1646.
1910, [4] 3,699.83, **11,** 523.

Total, 20,739.48 (less $18.71 trans. to Bastrop Bayou, and incl. receipts from sales, $20,810.23, **12,** 2012).

COMMERCE.

Practically none; all products shipped by rail to local and n. markets, **00,** 2400.
Tonnage, 1911, 4,783 t., **12,** 704.

ENGINEERS.

Chief of Engineers. R., 00, 395; **06,** 417; **07,** 440; **08,** 462; **09,** 483; **10,** 545; **11,** 582; **12,** 704.

In charge:
Capt. C. S. Riché, 1899–1900. **R., 00,** 2396, 2399.
Capt. John C. Oakes, 1907–09. **R., 07,** 1468; **08,** 1526; **09,** 1505.
Maj. G. P. Howell, 1910–11. **R., 10,** 1645; **11,** 1791.
Maj. E. I. Brown, 1912–. **R., 12,** 2012.

Assistant. S. M. Wilcox. **R., 00,** 2400.

OBSTRUCTIONS.

Bayou crossed by 2 Galveston County brs., the Galveston, Houston & Henderson RR., and the Galveston, Houston & Northern Ry., the latter being the only one with a drawspan, **00,** 2400.

OPERATIONS.

1907-08. 47,811 c. y. dr. from bar in chan., **08,** 1526.
1908-09. 127,247 c. y. dr., completing chan. from 6′ to 6½′ x 60′; 5 permanent beacons erected as chan. marks, **09,** 1505.
1910-11. 85,067 c. y. dr. over 19,500′, making chan. 6′ x 50′, by U. S. dr., **11,** 1791.

PHYSICAL CHARACTERISTICS.

Dickinson Bayou or R. empties into Galveston Lower B. about 20 m. nw. from Galveston, Tex., and is one of the adjacent streams referred to in the app. Mar. 3, 1899, for imp. "Brazos R. between Velasco and Richmond, W. Galveston B. Chan., Double Bayou, and the mouths of adjacent streams," **00,** 2397.
Description of, **00,** 2397.
Stream navigable 10 m. from mouth for tugs and schooners; upon removal of county and railway brs. same class of vessels could navigate to a point 25 m. from mouth, **10,** 545.
Ruling d., 1912, 4.2′, **12,** 2012.

PROJECTS.

Capt. Riché est., 1900, $7,500 to make the imp. as a part of an inland light-draft navigation system, **00,** 2399.
To excavate a chan. across the bar from 5′ in B. to 5′ in bayou; est., $7,000, **07,** 440.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2397, 2399.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 704.

U-29 (a) GALVESTON HARBOR TO TEXAS CITY, TEX. (Channel.)

APPROPRIATIONS.

1899, $250,000, **99,** 1962.
1907, 60,000, **07,** 1459.
1909, 50,000, **09,** 1494.
1910, 100,000, **10,** 1636.
1911, 50,000, **11,** 1780.
1912, 100,000, **12,** 1999.

Total, 610,000 (incl. sales, $610,002.40, **12,** 1999).

COMMERCE.

Beneficial effect of imp. on rates, due to estab. of new line of SS. from New York City to Texas City, **09,** 474; **10,** 535; which broke previous rate agreement; rate reduced 51¼%, volume of business increased over 300%; in 1911–12 rates made higher, **12,** 694.
Rates advanced again, **11,** 572.
1904, 36,000 t. ±; 1907, 78,000 t. ±; 1911, 450,000 t. ±, **12,** 694.

CONTRACTS.

1899. Drake & Stratton Co., dr., $250,000, **00,** 2327.
1907. John Jacobson, dr., $1.74 l. f., **07,** 1459.
1909. Bowers Southern Dredging Co., dr. 34,000 l. f. of chan., $1.77 l. f., **10,** 1636.
1910. L. T. Gaylord, dr. 1,153,500 c. y., 9.3¢ c. y.; L. T. Gaylord, dr. 12,000 l. f. of chan., $2.33 l. f., **11,** 1781.
1911. Bowers Southern Dredging Co., dr. 5,000 l. f. of chan., 9¢ c. y., **12,** 1999.

ENGINEERS.

Chief of Engineers. R., 99, 339; **00,** 386; **01,** 403; **02,** 334; **03,** 351; **04,** 369; **05,** 384; **06,** 415; **07,** 433; **08,** 453; **09,** 473; **10,** 534; **11,** 571; **12,** 693.

In charge:
Capt. C. S. Riché, 1899–1903. **R., 99,** 1962; **00,** 2326; **01,** 1930; **02,** 1372; **03,** 1331.
Capt. Edgar Jadwin, 1903–07. **R., 04,** 1983; **05,** 1489; **06,** 1334.
Capt. John C. Oakes, 1907–10. **R., 07,** 1459; **08,** 1514; **09,** 1494.
Maj. G. P. Howell, 1910–11. **R., 10,** 1636; **11,** 1780.
Maj. E. I. Brown, 1912–. **R., 12,** 1998.

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* Allotment.
[1] $18.71 trans. to Bastrop Bayou, Tex., **10,** 545.
[2] Trans. from Chocolate Bayou.
[3] Trans. from Clear Creek.
[4] Trans. from—

Cedar Bayou	$68.92
Chocolate Bayou	146.75
Hanna Reef	1,176.35
Mouth of Trinity R	1,000.00
Anahuac Chan	1,307.81
	3,699.83

Assistants:
E. M. Hartrick. **R., 99,** 1963; **01,** 1931; **02,** 1373; **03,** 1333; **04,** 1985; **05,** 1491.
Lt. M. L. Walker, **01,** 402; **02,** 332.
Capt. G. M. Hoffman, **04,** 366.

LEGISLATION.

Act June 13, 1902, modifies terms of payment for work under contract, **02,** 1372.

OPERATIONS.

1900-01. 815,060 c. y. dr., **01,** 1931–32.
1901-02. 967,100 c. y. dr., **02,** 1373.
1902-03. 16 sections of 1,000′ each of chan. completed, involving 1,105,330 c. y.; 20,000′ of chan. completed at end of fiscal year, **03,** 1332–33.
1903-04. 15 sections dr. to prescribed cross section; cleaning up other sections, **04,** 1984–85.
1904-05. Chan. completed, **05,** 1490.
1907-08. 1,101,147 c. y. dr., **08,** 1514.
1908-09. 273,284 c. y. dr., **09,** 1494.
1909-10. Chan. redr. to 25′ x 100′ x 34,000′; 1,636 l. f., which shoaled after dr., redr., **10,** 1636.
1910-11. Chan. extended 687′ along wharves, 27′ x 200′; chan. w. to 200′ to Sta. 5; redr. Sta. 5 to 10, 27′ x 100′–110′, removing 1,109,318 c. y.; chan. redr. Sta. 10 to 22 to 27′ x 100′, **11,** 1780.
1911-12. 225,176 c. y. refill dr. in mainten. of chan., **12,** 1998. 15% of 30′ proj. done, **12,** 694.

PHYSICAL CHARACTERISTICS.

Contractor's dr. driven ashore by hurricane of Sept. 8, 1900, **01,** 1931–32.
Effect of hurricane of 1900 on chan., **01,** 1932.
Material washed back into chan. by storm, 1901, **02,** 1373.
Shoaling in completed chan., made by U. S. and private firms, requiring repeated dr., **03,** 1333; **06,** 1334; **07,** 1459; **09,** 474; **10,** 1636; **11,** 1780.
Ruling d., **12,** 1998.
Texas City is on mainland, 8 m. nw. of Galveston.

PRIVATE (CORPORATE) WORK.

Texas City Terminal Co., 1895–96, dr. a chan. 16′ d., **99,** 339.
Texas City Transport Co., 1906, dr. 698,222 c. y., restoring chan. to full w. of 23′–25′ x 100′ d., **06,** 1334.
Texas City Co., up to 1912, expend. over $300,000 in maintain. chan., **12,** 694.

PROJECTS.

By Capt. Riché, 1899, chan. 25′ x 100′ n. of Pelican Isld. from Galveston H. to Texas City, Tex.; est., $500,000, **99,** 1962; to extent of $250,000 au., **12,** 693.
Act June 25, 1910, enlarged proj. by app. $100,000 for mainten. and dr. as recom. in **R.**[1] (see Galveston H. surs.), which contemplates extending chan. to connect with new slip of Texas City Terminal Co., making chan. dimensions 30′ x 200′; est., $410,000, **10,** 534; modification of st. dike (part of proj.)—H. R. and H. Com. Doc. 1, 66th Cong., 1st sess.
Act July 25, 1912, au. continuing imp. and mainten. by dr. within limits recom., i. e., 30′ x 200′, **12,** 694.

SURVEYS.

Ex. with plan and est. of cost, for chan. 26′ x 200′, au. act Mar. 2, 1907; made by Maj. Jadwin and Capt. Oakes. **Rs.,** June 8 and Sept. 7, 1907; est., $40,000,[2] **08,** 474.
Maps.[1 2] **06,** 1334.

U-30 GALVESTON, TEX.

NOTE.—Galveston, Tex., is on an island on the Texas coast, facing the Gulf of Mexico. *Behind* this island lies Galveston Bay. A channel leads from a pass between Galveston and Port Bolivar back through Galveston Bay to Houston, Tex., called the Houston Ship Channel. Improvements have been made at various points around this bay—at Double Bayou, Anahuac, Turtle Bayou, Trinity R. (mouth), San Jacinto R., Cedar Bayou, Clear Creek, Dickinson Bayou, Texas City. (See all of these for data.)
There is a project for connecting Galveston Bay with Sabine Lake on the ne., following the coast line.
There is also a project to connect Galveston Bay in the other or w. direction with Brazos R.
There are also channels connecting Galveston with Port Bolivar and with Texas City (q. v.).

Part.	Title.	Period.	Appropriations.
a	Galveston H.	1867–1912	$11,533,000
b	Galveston Chan.	1900–1912	1,520,000
c	Galveston (sea wall)	1904–1912	750,000
	Total		13,803,000

Part (a), U-30 Galveston Harbor, Tex.[3]

APPROPRIATIONS.[4]

1870,	$25,000,	**70,** 61; **71,** 517.
1871,	20,000,	**71,** 65, 517.
1872,	31,000,	**72,** 555.
1874,	60,000,	**74,** 73, 722.
1875,	150,000,	**75,** 79.
1876,	142,000,	**76,** 581.
1878,	125,000,	**78,** 82, 607.
1879,	100,000,	**79,** 110.
1880,	175,000,	**80,** 1207.
1881,	$250,000,	**81,** 1328.
1882,	400,000,	**82,** 1446.
1886,	300,000,	**86,** 1293.
1888,	500,000,	**88,** 1269.
1890,	500,000,	**90,** 1770.
1891,	600,000,	**91,** 1875.
1892,	450,000,	**92,** 1527.
1893,	1,000,000,	**93,** 1864.
1894,	600,000,	**95,** 1800.
1895	1,160,000,	**95,** 1800.
	200,000,	**95,** 1800.

[1] H. D. 328, 61st, 2d (incl. maps).
[2] H. D. 402, 60th, 1st.
[3] Ex.—**R.** (fav.) Sept. 30, 1853. (H. D. 482, 55th, 2d.)
[4] Statement of total app., **78,** 82; **79,** 912. Retention of app. delays work in 1876 and 1877, **77,** 73. Method of making app. not conducive to economy, **77,** 73, 447.

1896	$300,000, **96,** 1528.
	840,000, **96,** 1528.
	[1] 50,000, **96,** 1528.
1897,	500,000, **97,** 1796.
1899,	50,000, **99,** 1955.
1902,	350,000, **02,** 1357.
1903,	300,000, **03,** 1323.
1904,	100,000, **04,** 1975.
1905,	200,000, **05,** 1481.
1906,	250,000, **06,** 1329.
1907,	300,000, **07,** 1455.
1908,	630,000, **08,** 1509.
1909,	70,000, **09,** 1490.
1909,	*200,000, **09,** 1490.
1910,	350,000, **10,** 1632.
1910,	*25,000, **10,** 1632.
1911,	155,000, **11,** 1775.
1912,	75,000, **12,** 1992.
Total,	11,533,000 (less $150,000 trans. to Galveston Chan. and incl. receipts from sales, etc., $11,418,678.74, **12,** 1993).

COMMERCE.

Value of imp. as obtained in 1885, **85,** 1451.

Draft of vessels passing outer bar, **85,** 1451.

Of great value, and rapidly increasing, because of works of imp., **96,** 1527.

Not interrupted by damage to imp. caused by hurricane of Sept. 8, 1900, **01,** 1923.

Est. in 1909 that value of imp. to the country is more than double the amount of $10,000,000 per an. est. in 1902, **09,** 471.

For 1911, 3,700,000 t., **12,** 690.

Rates reduced materially, **12,** 690.

"It is difficult to state what the effect of the project has been upon freight rates. The rates on foreign shipments are much less than they were 10 years ago. Cotton, the chief article of export, of which 2,979,063 bales were exported in the past year, now has an average rate to Liverpool and Hamburg of 40 cents per 100 pounds and to Bremen 42 cents. Ten years ago the rate was 45 to 55 cents.

"The deep water to the wharves and consequent elimination of lighterage charges, the increased size of the vessels employed, the presence of the tramp steamer that prevents the regular lines from keeping up the rates, and the increased production in the Southwest have all had their effect. For the effect upon coastwise rates, attention is invited to the remarks under that head on the 'Improvement of the Texas City Channel.'

"All the commerce for Galveston Channel, Texas City Channel, and Port Bolivar Channel comes in through this channel. In addition, the commerce for the Houston Ship Channel, bound in and out from the Gulf, uses this channel. The total volume of this commerce is approximately 3,793,273 short tons, valued at $427,016,385. For details of this tonnage and of the effect of the improvement on freight rates, attention is invited to the reports on the above channels." **12,** 690.

CONTRACTS.[2]

1871-77. Morris & Cumings, constr. and delivery (within 100 working days) of a dr., $25,000, **71,** 517, 523. J. H. Lynch, delivery of 2 dump scows, $5,600, **71,** 517. Sufficient data obtained, 1875, to offer work by contract, **75,** 867. Recom., 1876, that work be not done by contract, **76,** 580; renewed, 1877, **77,** 448.

1881. T. K. Thompson, cordage; Shannon & Hyatt, brush; Gulf, Colorado & Santa Fe RR., st., **81,** 1327.

1882. Hitchcock & Byrnes, st.; A. M. Shannon, brush; H. Marwitz & Co. and A. Flake & Co., cordage; Burnett & Ross, cane; I. Heffron, handling st., **82,** 1442, 1443; **83,** 1060, 1061, 1070.

1887. A. M. Shannon & Co., raising height of old s. j., **87,** 1416.

1888. A. M. Shannon & Co., riprap j. constr., $402,475, **89,** 1538.

1890. O'Conner, Laing & Smoot, constr. of railway, incl. trestle, and furnishing sandst., riprap, and granite blocks in place, $3,469,710, **91,** 1879.

1893. T. S. Marvel & Co., twin-screw propeller, $28,500, **93,** 1864.

1894. Bucyrus Steam Shovel & Dredge Co., self-propelling suction dr., $86,000, **95,** 1801.

1895. J. W. Byrnes, constr. coal wharf, $6,000, **96,** 1528.

1902. Isaac Heffron, riprap, $1.77 t., **03,** 1322–24.

1903. J. M. O'Rourke & Co., repairing js. (prices listed), **03,** 1322–24.

1905. Charles Clarke & Co., repairing js. (prices listed), **06,** 1329.

1907. Charles Clarke & Co., repairing and extending js. (prices listed); T. H. Phillips, furn. cement, 4,200 bbls., $2.20 bbl., 7½¢ allowed for return of sacks; W. G. Tabb, sand, 2,200 c. y., $1.75 c. y.; Isaac Heffron, 4,400 c. y. broken st., $2.20 c. y., and 1,000 t. riprap, $1.55 t., **08,** 1510.

DEFENSE.

Partial destruction of batteries on Pelican Spit, 1867, by erosive action of sea, **68,** 505, 509; protection necessary to prevent, **68,** 505, 509, 511, 517; obstr. placed in H. by South, 1863, **68,** 508.

DOCUMENTS. (Not published in reports.)

Capt. G. B. McClellan's **R.** Ex. Doc. 1853 and 1854, ii, 560; **68,** 504, 507.

ENGINEERS.

Chief of Engineers. R., 67, 38; **68,** 55; **70,** 61; **71,** 65; **72,** 60; **73,** 65; **74,** 73; **75,** 79; **76,** 75; **77,** 73; **78,** 82; **79,** 109; **80,** 147; **81,** 199; **82,** 196; **83,** 201; **84,** 216; **85,** 226; **86,** 223, 1294; **87,** 189; **88,** 172; **89,** 203; **90,** 182; **91,** 231; **92,** 224; **93,** 252; **94,** 233; **95,** 261; **96,** 226; **97,** 292; **98,** 282; **99,** 338; **00,** 384; **01,** 402, 412; **02,** 332, 343; **03,** 348; **04,** 366; **05,** 381; **06,** 411; **07,** 429, 451; **08,** 449; **09,** 469; **10,** 529; **11,** 566; **12,** 688.

Instructions of, concerning sur., 1867, **68,** 498.

Boards:

1864. To consider the practicability and probable cost of increasing d. in Galveston B. and entrance, by plan submitted by Capt. Howell. (See Projects.) B. considered that 2 prs. from Fort and Bolivar Pts. would imp. the outer and, incidentally, the inner bar, **74,** 737. Future extension of prs., aided by harrowing, probably necessary. In view of the novelty of the plan proposed, the B. recom. a trial of the plan at inner end of Fort Pt.; if successful, then a trial in most exposed position. Gabions should have covers and bottoms, **74,** 738. The auxiliary works within the B. to be delayed until practicability of plan has been demonstrated; revised est. of cost, **74,** 739.

(Lt. Cols. Wright, Tower, and Newton and Capt. Howell.)

Capt. Howell, not fully concurring, submitted that he was more confident than the other members of the B. in the adequacy of constr., and considered his est. adequate, **74,** 739.

Reconvened Jan. 7, 1875, to consider Capt. Howell's report in relation to progress and continuation of work. B. considered that the results obtained by experience of 1874 not decisive, but that the full tests recom. in 1874 be carried out. A trial to be made with a single row of gabions (in connection with the method of 2 rows) in each tier, **75,** 869.

Reconvened Dec. 28, 1875, to reconsider the question of imp. and modification, if any, of plan adopted, **76,** 581. Review of the conclusions of 1874, **76,** 582. B. concluded that the 2 js. recom., 1874, would produce an important increase in the d. over outer bar, and recom. that the first part constr. be from Fort Pt. toward the main chan.; that gabions be not definitely adopted for main works until more extended test, **76,** 583; that the

* Allotted.

[1] For dr. bar.

[2] Tables showing kind and amount of st. used in js., and other items of expense, **93,** 1866; **94,** 1393; **95,** 1803; **96,** 1537; **97,** 1799, 1800; **98,** 1495–96.

chan. caused by the storm of Sept., 1874, across isld. should be closed; that the gabions be placed on mats, previously sunk, **76,** 584.

Convened Aug. 9, 1879, to consider the imp. of the entrance to Galveston H. **R., 80,** 1266. B. recom. no more gabions be made, but that the 600 on hand be strengthened and used as a further trial of their value. They also suggested a trial of the Dutch system of j. constr. by use of alternate layers of mattress and st., **80,** 1270, 1271.

Reconvened June, 1880. **R., 80,** 1221. The B. recom. use of broad foundation mattress covered with brush and st. or concrete blocks, **80,** 1227, 1230. Observations by B. on mattress constr., **82,** 1452.

(Cols. Tower and Newton and Lt. Col. Gillmore.)

Convened Jan., 1886. **R., 86,** 1297. B. recom. building up and completing the s. j. to crest of outer bar; building a n. j. to crest of outer bar; extending both js. to the 30′ curve in the Gulf; such dr. from time to time, in aid of tidal scour, as the rate of app. given might afford, **86,** 1292.

(Col. Duane and Lt. Cols. Abbot and Comstock.)

Convened, Philadelphia, Dec. 11, 1889, by S. O. No. 29, to ex. and **R.** upon the most eligible location for a d.-w. H. on the nw. coast of the Gulf of Mexico. **R., 90,** 1781.

(Lt. Cols. Robert, Gillespie, and Smith.)

Appointed to make ex. of effect of storm of Sept. 8, 1900, on js. and main ship chan. and to **R.** upon their condition and cost of necessary repair. B. submitted **R.** Nov. 23, 1900,[1] with est. of $1,500,000 for repairs (Col. H. M. Robert, Maj. H. M. Adams, Capt. C. S. Riché, Capt. Edgar Jadwin), **01,** 412, 2018.

In charge:

Maj. M. D. McAlester. **R., 67,** 363; **68,** 497.

Capt. C. W. Howell, 1871–80. **R., 71,** 516; **72,** 554; **74,** 721; **75,** 846; **76,** 564; **77,** 446; **78,** 603; **79,** 909; **80,** 146.

Maj. S. M. Mansfield, 1880–86. **R., 80,** 1204, 1231; **81,** 1326; **82,** 1441; **83,** 1059; **84,** 1295; **85,** 1449; **86,** 1291, 1311, 1315.

Maj. O. H. Ernst, 1886–90. **R., 87,** 1415; **88,** 1265; **89,** 1535.

Maj. C. J. Allen, 1890–92. **R., 90,** 1767; **91,** 1871; **92,** 1523.

Maj. A. M. Miller, 1893–97. **R., 93,** 1861; **94,** 1389; **95,** 1797; **96,** 1523; **97,** 1793.

Maj. J. B. Quinn, 1898. **R., 98,** 1491.

Capt. C. S. Riché, 1899–1903. **R., 99,** 1953; **00,** 2308; **01,** 1921; **02,** 1356, 1393; **03,** 1321.

Capt. Edgar Jadwin, 1903–07. **R., 04,** 1973; **05,** 1479; **06,** 1327.

Capt. J. C. Oakes, 1907–10. **R., 07,** 1453; **08,** 1507; **09,** 1487.

Maj. G. P. Howell, 1910–11. **R., 10,** 1630; **11,** 1773.

Maj. E. I. Brown, 1912–. **R., 12,** 1991.

Assistants:

Lt. W. S. Stanton, **67,** 363. **R., 68,** 504.

Lt. H. M. Adams, **71,** 520. **R., 74,** 722.

Lt. J. B. Quinn. **R., 75,** 846.

Lt. C. E. L. B. Davis. **R., 76,** 576; **77,** 449; **78,** 603; **80,** 1208, 1232.

H. C. Ripley. **R., 74,** 726; **75,** 868; **76,** 577; **77,** 452; **78,** 604, 606; **80,** 1210, 1219, 1231; **82,** 1447; **83,** 1073; **84,** 1300; **88,** 1272; **89,** 1542.

R. B. Talfor, W. Thompson, J. C. Buchanan, R. Scott, **76,** 580.

W. H. Burke. **R., 81,** 1328.

W. A. Hinkle. **R., 82,** 1450; **83,** 1071; **84,** 1299.

Lt. G. A. Zinn. **R., 88,** 1270.

Lt. W. C. Langfitt. **R., 89,** 1538; **90,** 1770; **91,** 1879; **92,** 1527.

G. Bagnall. **R., 90,** 1779; **91,** 1896.

E. M. Hartrick. **R., 91,** 1890; **92,** 1529; **93,** 1865; **94,** 1391; **95,** 1801; **96,** 1536; **97,** 1798; **98,** 1494; **99,** 1956; **00,** 2311; **01,** 1925–30; **02,** 1368, 1401; **03,** 1325; **04,** 1976; **05,** 1482.

Lt. W. V. Judson. **R., 95,** 1801; **96,** 1529.

L. C. Sabin. **R., 98,** 1497; **00,** 2312.

F. Oppokofer. **R., 98,** 1505.

Lt. M. L. Walker, **01,** 402; **02,** 332.

Capt. G. M. Hoffman, **04,** 366.

ESTIMATES. (See also Plans and Projects.)

By Maj. McAlester, 1868, plan of closing San Luis Pass, $330,000, **68,** 501, 517. Dr. chan. 12′ x 80′, $10,952, **68,** 503, 517. System of js., composed of concrete blocks, intersecting Bolivar Chan. from shoals of Pelican Isld. and Spit, $1,300,000, **68,** 515.

By Capt. Howell, 1873, impr. the H. with js. and training walls, consisting of cement-covered gabions (see Projects), $1,259,446. Part recom. by BE., 1874, $1,224,000, **74,** 734, 740; **78,** 82; **79,** 912.

By BE., 1874, $1,759,401, **74,** 740; **79,** 912. Comparison by Capt. Howell of est. of 1873 and of that of the BE., 1874, with results of cost as determined by experience of 1874 and 1875, **75,** 865.

Revised est. by Capt. Howell, 1875, $559,740, **75,** 866; **77,** 74; **78,** 82. Effect of changes in method and proj. on ests., **77,** 447.

Cost of completion of existing proj., $682,446, **79,** 110, 912.

LEGISLATION.

Draft of an act to facilitate execution and to protect certain public works of imp., **71,** 522.

OPERATIONS.

1870. Proposals for dr. rejected; ineffectual attempts to hire or purchase a dr.; au. given to build, **71,** 517. Temporary character of relief from dr., **71,** 521.

1871–72. Suspended because d. on outer bar is as great as d. on inner; dr. transferred to other works, **72,** 60, 554.

1873–74. Confined to care of property, **74,** 724.

1874–75. Work began under proj. of Capt. Howell, Sept., 1874; fav. results obtained, **75,** 79, 864. Unexpected results, **75,** 847, 858. Difficulty in obtaining material for gabions, **75,** 846. Method of conducting work; changes recom., **75,** 849, 858. Necessity of cross js. to check abrasion, **75,** 853. Cost per l. f. of j., gabions in 2 rows, $16.04, **75,** 848. Gabions in 1 row, $5.21, **75,** 863.

1875–76. General progress, **76,** 564, 577. Storm, disastrous effects of (Sept. 14, 1875), **76,** 75, 566, 570, 579, 583. Changes in details of gabions, **76,** 574. Work already done has given 16½′ over inner bar, **76,** 580. Cost per l. f. of j., $6.12, **76,** 570.

1876–77. Suspended from July to Sept., 1876, by retention of apps., **77,** 73, 446, 449. General progress during year, **77,** 449, 453. Ds. obtained over inner bar, 15¾′ to 16¾′, **77,** 452. Placing mats under gabions increases cost of single gabion, but obviates necessity of several rows, **77,** 447. Cost per l. f. gabionade on scow ready for position, $8.92, **77,** 447, 451.

1877–78. Work discontinued Nov., 1877, to June 12, 1878 from lack of app.; repairs to break'r at Fort Pt.; extension of gabionade at Bolivar Pt., **78,** 603, 605. D. of w. obtained by work done, **78,** 604.

1878–79. Gabionade extends 7,332′; has maintained 20′ over outer bar, **79,** 109, 910. Résumé of past operations, **79,** 910.

1879–80. 2,278 l. f. added to Bolivar Gabionade, **80,** 1208. Placing of gabions discontinued and mats loaded with concrete blocks substituted, **80,** 1209, 1227. Description of gabion constr., **80,** 1232.

1880–81. Extension of s. j. with brush and cane mattress ballasted with concrete and st., **81,** 1326, 1328, 1329; **82,** 1441.

1881–82. 111,393 c. y. brush mattress and st. ballast placed in s. j., **82,** 1442, 1445. Cost of j. per c. y., $2.88, **83,** 1066.

1882–83. 107,555 c. y. of brush mattress and st. ballast placed in s. j., **83,** 1060, 1066, 1071. Cost of j. per c. y., $2.83, **83,** 1066.

1883–84. 38,204 c. y. of brush mattress and st. ballast placed in s. j., **84,** 1296, 1299. Cost per c. y., $3.17, **84,** 1296; **85,** 1450; **86,** 1305.

1886–87. Preparations for resumption of work on s. j., **87,** 1416.

1887–88. 4,550 l. f. of the old s. j. built up to 5′ above m. l. w. under contract; 90,125 c. y. riprap st. blocks and clay used, **88,** 1266, 1272.

1888–89. 464 l. f. of shore branch of j. built; j. extended seaward 900′, and 200′ additional partly

[1] H. D. 134, 56th, 2d.

finished; 2,175 l. f. of trestle and RR. built, **89,** 1536.

1889-90. S. j. extended 2,800′ and partly completed for an additional 1,200′; r. work completed upon 8,559 l. f. of shore branch; RR. trestle extended 428′ beyond incomplete r. work, **90,** 1768, 1774.

1890-91. 10,969 c. y. of riprap and 4,320 c. y. block st. placed in s. j., **91,** 1891. R. work extended 350′ and trestle and track 240′, **91,** 1872.

1891-92. 100,400 t. riprap and 50,617 t. granite blocks used in extension of s. j. 7,523′, **92,** 1530.

1892-93. S. j. extended to total l. of about 32,829′; n., 3,600′, **93,** 1863.

1893-94. N. j. extended to total l. of about 16,000′, **94,** 1390.

1894-95. N. j. extended to a total l. of 22,500′; 11,000′ of trestle on s. j. repaired, and 12,600′ in course of constr.; portion of s. j. with clay core raised; 68,071 c. y. dr., **95,** 1798, 1799.

1895-96. S. j. completed to total distance of 33,100′; n. j., to 25,110′. 213,596 c. y. dr. by contract, and 419,748 c. y. by U. S. dr. Coal wharf built at Fort Pt., **96,** 1525, 1526.

1896-97. S. j. completed to total l. of 34,800′, with an apron 803′ l. at its outer end; n. j., to 24,700′. 806,646 c. y. dr. by US. dr., **97,** 1794, 1795.

1897-98. N. j. extended to total l. of 25,907′, with 307′ of riprap apron; 562,976 c. y. dr. by U. S. dr., **98,** 1492.

1898-99. 500,702 c. y. dr., **99,** 1954.

1899-00. 661,038 c. y. dr., **00,** 2308.

1900-01. 442,822 c. y. dr. by U. S. dr.; emergency dr. by hired plant after hurricane of Sept. 8, 1900, while U. S. dr. was stranded; repairs to dr. at beginning of fiscal year and emergency repairs after hurricane, **01,** 1922, 1926.

1901-02. 181,485 c. y. dr.; dr. repaired and oil-burning apparatus installed, **02,** 1356, 1368.

1902-03. Repairs to s. j., 27,763 t. riprap placed; 386,459 c. y. dr., **03,** 1322, 1325.

1903-04. Repairs to s. j., using 34,069 t. riprap; repairs to n. j., using 45,992 t. riprap; 674,491 c. y. dr.; dr. overhauled and repaired, **04,** 1974, 1976.

1904-05. Repairs to s. j., using 10,168 t. riprap; repairs to n. j., using 59,025 t. riprap; 1,091,640 c. y. dr. by U. S. drs.; dr. *Comstock* overhauled and repaired, **05,** 1480, 1482, 1484.

1905-06. 40,519 t. riprap placed in s. j.; 1,303,865 c. y. dr., **06,** 1327, 1328.

1906-07. 10,946 t. riprap placed in s. j.; repairs to shore branch; 1,104,407 c. y. dr.; dr. *Comstock* repaired, **07,** 1454. Operation of dr., **07,** 1477.

1907-08. 2,734 t. riprap and 1,553 c. y. concrete placed in repairs to s. j.; 23,398 t. riprap placed in extension of s. j.; 3,207 t. riprap placed in repairs to n. j.; 492,532 c. y. dr.; dr. repaired, **08,** 1508. Constr. of new dr. commenced, **08,** 1145, 1508. Operation of dr., **08,** 1538.

1908-09. 3,168 t. riprap and 128 c. y. concrete placed in repairs to s. j.; 51,313 t. riprap placed in extension to s. j.; 6,739 t. riprap placed in repairs to n. j.; storehouse built at Fort Pt.; 3,210,333 c. y. dr. by U. S. drs., **09,** 1488, 1489. New dr. *Galveston* completed, **09,** 1154, 1488. Operation of dr., **09,** 1516.

1909-10. 1,738 t. riprap placed in s. j. repairs; 1,680 t. riprap placed in n. j. repairs; 2,973,614 c. y. dr.; drs. repaired, **10,** 1630, 1631. Operation of drs., **10,** 1659.

1910-11. 4,480′ s. j. repaired; 1,759,789 c. y. dr.; dr. repaired, **11,** 1774. Operation of dr., **11,** 1805.

1911-12. Repairs made to s. j., **12,** 1991.

PHYSICAL CHARACTERISTICS.

Of Galveston H., **68,** 507; **71,** 518; **74,** 723, 729; **75,** 846.

Pelican Spit, **68,** 504; **74,** 723, 729. Movement of, since 1851, **68,** 504, 508, 571. Cause of, **74,** 723, 730, 731.

Harbor, **68,** 501, 507.

Character of bottom, **74,** 729.

Rise and fall of tides, **68,** 502; **74,** 732; **86,** 1300. Physical changes, **86,** 1303.

Velocity of currents, **68,** 570; **74,** 728.

Presence of littoral currents, **71,** 519, 520; **74,** 723, 724, 728. Uncertainty of, **74,** 736, 738.

Table of velocity and direction of wind, 1874 and 1875, **75,** 862.

Elevation of water during gale of Sept., 1875, **76,** 578.

Teredo navalis, action of, on piles, **68,** 512; **86,** 1312, 1314, 1316. Cement protects gabions against, **76,** 570.

Peculiar formation at Fort Pt., **77,** 449.

Description of Galveston B., **86,** 1297.

Description of Galveston Bar, **86,** 1298.

Area of cross sections at Bolivar Bar, **80,** 1213.

Wind diagrams and observations, **80,** 1220; **86,** 1299.

Tidal observations, **88,** 1270, 1276; **89,** 1536, 1538, 1542; **90,** 1770, 1773; **95,** 1801; **96,** 1529; **98,** 1493, 1505.

Effect of storms upon ht. of tide, **88,** 1274.

Description of the passes and harbors on nw. coast of the Gulf of Mexico, **90,** 1783.

Discussion of the relative advantages for the location of a d.-w. H. or outer H. off Padre Isld., mouth of Brazos R., Cedar Bayou, Corpus Christi Pass, Brazos Santiago entrance, San Luis Pass, Pass Cavallo, Sabine Pass, Aransas Pass, and Galveston entrance, **90,** 1783, 1788.

D. increasing as an effect of the works of imp., **93,** 1863; **97,** 1796.

Structure-damaging storms, **96,** 1526; **97,** 1796; **98,** 1493.

Subsidence of js., **96,** 1535; **97,** 1801.

Hurricane of Sept. 8, 1900, damaged js. and caused shoaling of chan.; other property destroyed; dr. stranded, **01,** 1923, 1929, 2018.

Reduction of scouring effect in chan. due to lowering of js., **01,** 1924–29.

H. w. due to storms, **02,** 1371.

Depositing of sand in Galveston Chan. reduced by closing gaps in js., **03,** 1322.

Changes in ds. as shown by sur. of 1904, **04,** 1979.

Damages to js. by storm in 1909, **10,** 1630, 1631.

Chan. from d. w. in the Gulf to wharves has least d. of 33′; general increase in d. for past 3½ years (1912), 7′, **12,** 1992.

Orig. embraced anchorage area of over 1,960 acres—1,500 a., 20′+; 1,300 a., 24′+; 460 a., 30′+. Entrance was obstr. by 2 bars, inner and outer, requiring lighterage. At 1912, area, 258,500± a., 20′–40′, 79,000 a. ± being chan. ocean bar to anchorage. Galveston to S. W. Pass, Miss. R., 410 m. ± e.; to Aransas Pass, 188 m. w.; to Brazos R., 50 m. w., **12,** 688.

No mainten. dr. required for 12 mos. up to 1912, **12,** 690.

PLANS. (See Estimates and Projects.)

Of Maj. McAlester, 1868, closing San Luis Pass with a dam, thereby increasing the H. reservoir 36 sq. m., and depending on scouring effect of ebb tides, **68,** 501, 516. Results not proportionate to cost, also action uncertain, hence objected to, **68,** 502. For a system of js. intersecting Bolivar Chan. from the shoals of Pelican Isld. and Spit; j. formed of concrete blocks, laid without cement, **68,** 512. Objections to, enormous cost, defective action of, insecurity of, danger to water front of city, **68,** 500. Of pile j. commenced by city of Galveston, 1869 (see Private work.)

PRIVATE (CITY) WORK.

Pile j. commenced by city, 1869, at Fort Pt. and (intended to d. inner bar) "now about 1 m. l.," **74,** 723; **75,** 858; **79,** 910. Partially swept away by storm of Sept., 1875, **76,** 566. $100,000 app. in 1883 by city to continue work, **83,** 1063, 1068; **84,** 1296.

Chan. in front of wharves dr. (1901) by Galveston Wharf Co., with dr. hired from U. S., **02,** 1356, 1369.

PROJECTS. (See Contracts; Estimates, and Plans.)

By Maj. McAlester, 1868, inner bar, dr. a chan. 12′ x 80′, **68,** 503, 517; **71,** 517. Unable to profitably contract; au. given to build a dr., **71,** 517. Temporary character of relief given, **71,** 521. Proj. for dr. not worthy of consideration, **74,** 732.

By Capt. Howell, 1871, entrance to B. and H. to admit vessels drawing 18′, **71,** 518. Break'r along the crest of Galveston Bar, and js. to extend

the head of Galveston Isld. to "Middle Ground Breakers," **71,** 520. Break'r to consist of concrete blocks on grillage foundation; js. similar to, but of lighter constr., **71,** 521. Proj. abandoned on account of the absence of hitherto supposed littoral currents, **74,** 736.

From 1870 to 1872, incl., $76,000 app., expend. in building and operating a dr. on the inner bar and in strengthening the Fort Pt. j., **71,** 517; **72,** 554; **74,** 724.

Capt. Howell, 1873–74, proposed the removal of the inner bar between Fort Pt. and Pelican Spit, and d. the chan. over the outer bar to 18'; proposed to effect the first by continuing the city dike to the edge of Bolivar Chan., and thereby secure sufficient contraction to scour the desired chan. The second was to be done by prolonging the first dike seaward and by the constr. of a parallel dike from Bolivar Pt. In place of st. it was proposed to use gabions covered with hydraulic cement and filled with sand, **74,** 732, 736; **80,** 1221.

Considered by BE., 1874–75; changes recom., using single row of gabions placed on mats, **75,** 849, 869.

From 1874 to 1879, incl., $577,000 app. under this proj., resulting in a 20' chan. over the inner bar, **80,** 147.

In 1879 BE. recom. no more gabions be made; that those on hand be strengthened and used for further experiment; also that trial be made of the Dutch system of js. composed of alternate layers of mattress and st., **79,** 910; **80,** 1270.

In 1880, BE. further recom. use of broad foundation mattress covered with brush and st. or concrete blocks, **80,** 1227, 1230. Sketches of js. as proposed, **80,** 1228. Est., incl. app. of 1880, $1,825,813, **81,** 1328. Least d. proposed over outer bar, **84,** 217; **85,** 1450; **86,** 1297.

The B. of 1886 recom. building up and completing s. j. to the crest of the outer bar, building a n. j. to crest of bar, and extending both js. to the 30' curve in the Gulf; dr. from time to time, in aid of tidal scour, as the rate of app. given might afford, **86,** 1292.

Interval between outer ends of js. to be 7,000', **86,** 1308. D. to be obtained, **86,** 223, 1309, 1311. General plan of constr., **86,** 1310. Est., $7,000,000, in addition to $1,478,000 app. previous to 1886, or an aggregate of $8,478,000, **86,** 1311; **87,** 1416.

Maj. Miller est., 1896, $250,000 additional to complete existing proj., to cover dr., not considered in orig. est., **96,** 1527.

The dept., 1897, au. outer ends of the js. should be built up for 500' each, making their total l. as follows: S. j., 35,300'; n., 25,700'; the first to have an apron 300' l., and the second 307' l., **97,** 1794.

Hurricane, Sept. 8, 1900, damaged js.; est. by BE. for repair, $1,500,000, **01,** 2018. Completed, 1906; cost, $1,200,000, **12,** 689.

Act June 13, 1902, au. modification of plan for s. j. to conform to protection work proposed by city of Galveston, **02,** 333, 1357.

Modification, in 1907, au. by Sec. of War d. of 30' by repairing and extending js. and by dr., incl. constr. of new dr. (see Surveys), **07,** 430, 451.

For mainten. by dr. and repair of js., see Galveston Chan.

Proj. called completed, 1912, **12,** 689. (See Physical data.) 1912, one SS. line ceased using bar pilots, **12,** 689.

SURVEYS.

By U. S. Coast Sur., began June, 1867, **67,** 38, 363; **68,** 498, 505. Completed Apr., 1868, **68,** 55, 499. Changes determined by comparison of surs., 1843, 1853, 1868, **68,** 508.

Sur. of 1870, **70,** 520. Of 1872 and 1873, method of making, **74,** 726. Results of, and comparison with earlier, **74,** 723. Borings, method of making, by water jet, **74,** 724. Specimens of bottom obtained, **74,** 725.

Surs. of 1875–76, **76,** 577.

Resur. of inner and outer bar; comparison of existing and past condition, **78,** 606.

Of inner and outer bars, **79,** 911.

Previous to 1880, **80,** 1266.

Resur. of H. entrance; made, 1888, by Maj. Ernst, **88,** 1267, 1277; 1889, **89,** 1536, 1546; 1890, by Maj. Allen, **90,** 1768, 1777.

Description of Galveston base line, **00,** 2312.

Ex. and sur. au. act June 6, 1900, **02,** 343; made by Capt. Riché. **R.,** 1900 and 1901; est., $2,250,000,[1] the essential feature being a dike from mainland near Texas City to Pelican Spit. Opinion of Lt. Col. Adams, Div. E., concurred in by Chief of Engrs., that imp. proposed is of importance to local interests rather than to general C. and its undertaking by U. S. not warranted, **02,** 343, 1392.

Resur. of Galveston B. to determine effect of hurricane of Sept. 8, 1900. Sur. of Galveston Chan. with view to imp. Sur. around Pelican Isld. and Flat, for inner H. and a dike between Texas City and Pelican Spit. Surs. of bars, **01,** 1923, 1928–29.

Permanent bench marks estab., **01,** 1930.

Rectangular condition of sur. marks, etc., **02,** 1358.

Resur. of Galveston B. in progress (1903), **03,** 1323.

Sur. of H., 1904, **04,** 1979.

Resur. of Galveston B.; chart completed, **06,** 1329.

Ex. au. act Mar. 3, 1905, for uniform d. of 30', **06,** 430; made by Capt. Jadwin; **R.,** July 13, 1906: est., $600,000, in addition to sum required to complete js., for dr., incl. constr. of a new dr.,[2] **07,** 451.

R. by B.E.R.H., Jan. 16, 1907, requested by R. and H. Com. to ascertain whether it would not be preferable to extending js. than to use app. for a new dr. Board is of opinion it would be necessary to operate add'l dr. even if js. are extended.[3]

Ex. and sur. of Galveston B. and H. au. act May 27, 1908. **R.,** Dec. 30, 1908, by Capt. Oakes; est., $5,063,204, incl. amount required for completion of Galveston Chan. under existing proj.,[4] **10,** 559.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 689.

Maps:[4]
78, 606; **80,** 1206; **82,** 1444; **83,** 1074; **84,** 1300; **88,** 1278; **89,** 1536; **90,** 1772, 1776; **91,** 1875, 1889; **92,** Atlas, 79, 80, 81; **93,** 1864; **94,** 1390; **95,** 1804; **96,** 1540; **97,** 1802; **98,** 1496; **99,** 1960; **01,** 1930; **02,** 1371; **04,** 1978; **05,** 1482; **06,** 1328; **07,** 1454; **08,** 1510; **09,** 1490; **10,** 1632; **12,** 1992.

Entrance, **87,** 1416.

Minor surs. (see each an. **R.**).

Resur. of the B. commenced in 1897–98, **98,** 1493, 1497.

Photographs, **09,** 1490.

Part (b), U-30 Galveston Channel, Tex.

APPROPRIATIONS.

1902,	$100,000,	**02,** 334, 1371.
1903,	200,000,	**03,** 1329.
1904,	*20,000,	**05,** 1485.
1905,	175,000,	**05,** 384, 1485.
1906,	[5] 50,000,	**06,** 1333.
1907,	200,000,	**07,** 1457.
1909,	$200,000,	**09,** 1492.
1910,	250,000,	**10,** 1634.
1911	125,000 / [5] 100,000	**11,** 571, 1776.
1912,	100,000,	**12,** 1995.
Total,	1,520,000 (incl. sales, $1,521,975.57, **12,** 1995).	

*Allotment.
[1] H. D. 91, 57th, 1st.
[2] H. D. 340, 59th, 2d.
[3] R. and H. Com., 11, 59th, 2d.
[4] H. D. 328, 61st, 2d.
[5] Diverted from app. for Galveston H.

COMMERCE.

Existing chan. inadequate to accommodate rapidly increasing business of port, **01,** 1962, 1965.

Unit value of general merchandise discussed, **05,** 1487.

C. increasing, **08,** 453.

Reduction in rates, **10,** 533.

This port stands second of all ports in U. S. in value of foreign exports, **11,** 570; $35,000,000, 1895; $218,448,144, 1912; N. Y., 1907–8, $700,000,000±; 1911–2, $773,000,000±; Galveston, 1907–8, $162,000,000±; 1911–2, $220,000,000±; New Orleans, 1907–8, $160,000,000±; 1911–2, $173,000,000±. **12,** 692.

Total collected at customhouse for port, 1911, $810,172.08, **12,** 1995.

Diagram showing tonnage, value, and app., **12,** 1995.

For C. in t., see Galveston H.

"The maximum draft that can be carried at mean low water June 30, 1912, from deep water in the Gulf, is 32½ feet as far as Forty-sixth Street.

"The commercial statistics for the port are as follows:

Calendar year.	Domestic exports.	Foreign imports.	Coastwise.	Total value.
1911	$215,178,301	$10,280,249	$146,297,574	$371,756,124
1910	206,678,617	4,741,396	166,720,049	378,140,062
1909	182,406,762	4,125,330	137,298,352	323,830,444
1908	202,152,984	5,516,822	218,388,000	426,057,806
1907	236,277,727	7,621,761	203,768,556	447,668,044
1906	170,759,269	3,772,090	349,486,007	524,017,366
1905	140,113,700	3,034,973	971,925,155	515,073,828

"The business has increased from a yearly foreign export business in fiscal year 1895 of about $35,000,000 to $218,448,144 in the fiscal year ending June 30, 1912. This port stands second in the value of foreign exports of all the ports in the United States, as the following table shows:

Ports.	1907–8	1908–9	1909–10	1910–11
New York	$701,062,913	$607,239,481	$651,986,356	$772,552,449
Galveston	161,352,201	189,464,335	173,178,992	220,504,917
New Orleans	159,455,773	144,981,625	140,376,560	172,835,293
Philadelphia	109,261,436	84,286,440	73,266,343	69,956,380
Boston	96,051,068	76,157,558	70,516,789	71,534,082
Baltimore	89,988,505	77,550,658	77,381,507	85,120,843
Savannah, Ga	61,695,330	50,900,156	63,428,155	72,076,045

"It is difficult to state what the effect of the project has been upon freight rates. The rate on foreign shipments are much less now than they were 10 years ago. Cotton, the chief article of export, of which 2,735,303 bales were exported in the past year, now has an average rate to Liverpool and Hamburg of 40 cents per 100 pounds, and to Bremen 42 cents. Ten years ago the rate was 45 to 55 cents.

"The deep water to the wharves and consequent elimination of lighterage charges, the increased size of the vessels employed, the presence of the tramp steamer that prevents the regular lines from keeping up the rates, and the increased production in the Southwest have all had their effect. For the effect upon coastwise rates, attention is invited to the remarks under that head on the "Improvement of the Texas City Channel." 11 12, 1692.

For effect of works on coastwise traffic, see Texas City Chan.

CONTRACTS.

1902. Moore & Sieber, constr. pile and brush dike, prices listed, **03,** 1328–29.

1903. Bowers Southern Dredging Co., dr., 8.3¢ c. y., **03,** 1328–29.

1904. Geo. V. Cresson Co., cutter engine, etc., for dr., $5,900, **04,** 1981.

1905. Bowers Southern Dredging Co., suction dr., $102,500, **05,** 1486.

1911. L. T. Gaylord, dr. 4,200,000 c. y., 6.7¢ c. y., **11,** 1777.

ENGINEERS.

Chief of Engineers. **R., 01,** 411; **02,** 334; **03,** 350; **04,** 368; **05,** 383; **06,** 413; **07,** 431, 451; **08,** 452; **09,** 471; **10,** 531; **11,** 568; **12,** 690.

In charge:

Capt. C. S. Riché, 1900–03. **R., 01,** 1960, 1967; **02,** 1371; **03,** 1328.

Capt. Edgar Jadwin, 1903–07. **R., 04,** 1979; **05,** 1485; **06,** 1330.

Capt. John C. Oakes, 1907–10. **R., 07,** 1456; **08,** 1511; **09,** 1491.

Maj. G. P. Howell, 1910–11. **R., 10,** 1633; **11,** 1775.

Maj. E. I. Brown, 1912–. **R., 12,** 1993.

Assistants:

Lt. M. L. Walker, **01,** 402; **02,** 332.

E. M. Hartrick. **R., 01,** 1969; **03,** 1329; **04,** 1981; **05,** 1489.

Capt. G. M. Hoffman, **04,** 366.

OPERATIONS.

1902-03. 60,000 c. y. dr. by contract; constr. of pile and brush dike commenced; 270,608 c. y. dr. by U. S. drs., **03,** 1328–30.

1903-04. 1,993.143 c. y. dr. by contract and 243,564 c. y. by U. S. plant; cutter head and engine installed on dr. *Gen. H. M. Robert,* **04,** 1979–81.

1904-05. 343,977 c. y. dr. by contract and 565,138 c. y. by U. S. plant; pile and brush dike reinforced, **05,** 1485, 1489.

1905-06. U. S. dr. *Col. Miller* completed; 551,257 c. y. dr.; dike connected with Pelican Isld. and low places reinforced; 249,099 c. y. excavated by U. S. dr. *Gen. H. M. Robert* and deposited behind dike; cedar cuttings planted on dike, **06,** 1330.

1906-07. 1,138,318 c. y. dr., **07,** 1456. Operation of drs., **07,** 1480.

1907-08. 2,018,309 c. y. dr., **08,** 1511. Operation of drs., **08,** 1540.

1908-09. 864,947 c. y. dr., **09,** 1491. Repairs to dr. *Gen. H. M. Robert,* **09,** 1492. Operation of drs., **09,** 1517.

1909-10. 2,323.742 c. y. dr. by U. S. drs.; dr. *Miller* repaired, **10,** 1633. Operation of drs., **10,** 1660.

1910-11. 1,145,983 c. y. dr. by U. S. dr. *Miller,* incl. 5,000 c. y. fill in bulkhead for U. S. Life Saving

Station; repairs to pile and brush dike, 704 l. f. partly completed, **11,** 1776. Consolidated report of operations of dr. *Miller*, **11,** 1807.

1911-12. 7,050,971 c. y. dr. in new work and in mainten.; a basin in front of Federal quarantine station excavated and its bulkhead filled; dr. completed, **12,** 1993. Repairs to w. end of pile and brush dike completed, **12,** 1994. Chan. completed to full proj. d., **12,** 692.

PHYSICAL CHARACTERISTICS.

Description of, **01,** 1961.

Shoaling and scouring of dr. chan., **04,** 1980; **05,** 1485; **06,** 1330; **09,** 1492; **10,** 1633; **11,** 1776; **12,** 1993.

Chan. 5 m. l., draft 32½′, as far as 46th St., passing along wharf front of city and connecting same with js. entrance chan., **12,** 690; **12,** 692

PRIVATE WORK.

In 1906 wharf company dr. 76,377 c. y. from along wharves, **06.** 1330.

In 1907 wharf company dr. 65,260 c. y., and Southern Pacific Co. dr. 102,379 c. y., **07,** 1456.

In 1908 wharf company dr. 24,895 c. y., **08,** 1511.

In 1909 wharf company dr. 24, 872 c. y., **09,** 1492.

PROJECTS.

By Capt. Riché, 1900, provides for 30′ x 1, 100′ chan., 50′ distant from H. line on either side; est., $1,585,000 (see surs.), **01,** 1960.

Act June 13, 1902, au. 30′ chan. from outer end of inner bar to 51st St., of such w. as shall best subserve interests of C. (see Surveys, 1900), **02,** 334.

Modified by act Mar. 2, 1907, providing for extension of chan. from 51st St. to 56th St.; est., $129,310, **07,** 432.

Act June 25, 1910, modified proj. by providing, in the discretion of the Sec. of War, for extension of chan. to 57th St., with w. of 1,000′ between 51st St. and 57th St.; as recom. in **Rs.**[1] (see Galveston H. surs.), **10,** 532.

Adopted proj. (1909) contemplates chan. 30′ x 1,200′ from inner bar to 51st St. and 700′ w. from 51st St. to 56th St., **09,** 472; to 57th St., **12,** 691.

SURVEYS.

Ex. and sur., of Galveston B., Tex., with view to w., d., and extending chan. from Gulf of Mexico to a point opposite 51st St., Galveston, au. act June 6, 1900; made by Capt. Riché. **Rs.,** Nov. 15 and Dec. 21, 1900; est., $1,585,000, or $1,500,000 if entire work done under one contract; $25,000 an. mainten.,[2] **01,** 411, 1959–60, 1967.

Ex. au. act Mar. 3, 1905, with view to enlargement and extension farther west, **06,** 430; made by Maj. Jadwin. **R.,** Feb. 13, 1907, presents plan for extending chan. from 51st St. to 57th St., Cong, docs., etc., relating to exs., surs., plans, etc., **12;** 691, with w. of 700′; est., $129,310,[3] **07,** 451.

Maps.[2 3] **05,** 1486; **06,** 1332; **07,** 1458; **08,** 1512. **12,** 1995.

Part (c), U-30 Galveston, Tex. (Sea wall, etc.)

APPROPRIATIONS.

1904,	$591,046. 25,	**04,** 2011.
1906,	158,953. 75,	**06,** 1351.
Total,	750,000. 00 ($750,001.50, incl. sales,	**12,** 2030).

COMMERCE.

Importance of, **03,** 1353, 1355, 1358.

Protection works needed to increase confidence of investors and induce installation of additional freight-handling facilities, **03,** 1352–54.

CONTRACTS.

1904. J. M. O'Rourke & Co., sea wall, prices given, **05,** 1516.

1905. Isaac Heffron, riprap revet., prices given, **05,** 1516.

1906. North American Dredging Co., filling, soiling, and sodding, 22.99¢ c. y. in place, **06,** 1351.

1908. North American Dredging Co. (supple.), retaining wall, 9,000 t. riprap, prices given, **08,** 1538.

1909. J. C. Underwood, constr. concrete sidewalk, brick pavement and concrete curbing; amounts and prices given, **10,** 1658.

1910. J. C. Underwood, supple., for using bituminous fill in brick pavement, **10,** 1658.

ENGINEERS.

Chief of Engineers. **R., 03,** 349; **04,** 381; **05,** 398; **06,** 428; **07,** 450; **08,** 473; **09,** 496; **10,** 557; **11,** 597; **12,** 723.

Boards. BE. appointed under act June 13, 1902, to make ex. and prepare plans and est. for protection of port of Galveston, and U. S. property on Galveston Isld., from storms, by break'ter or other means. **R.,** Dec. 19, 1902, recom. constr. sea wall and embankment along Gulf front of city, from 39th St. to 45th St., thence w. along front of Fort Crockett Reservation, and raising of grades to conform to similar imps. undertaken by local au. Cost of sec. from 39th to 45th Sts. est. at $340,000, to be borne by local au. Cost of work along U. S. Reservation est. at $410,000 (Lt. Col, Adams, Maj. Derby, and Capt. Judson), **03,** 349. 1348.

In charge:

Capt. C. S. Riché, 1903. **R., 03,** 1348.

Capt. Edgar Jadwin, 1903–07. **R., 04,** 2011; **05,** 1515; **06,** 1350.

Capt. John C. Oakes, 1907–10. **R., 07,** 1476; **08,** 1537; **09,** 1515.

Maj. G. P. Howell, 1910–11. **R., 10,** 1657; **11,** 1805.

Maj. E. I. Brown, 1912–. **R., 12,** 2030.

LEGAL PROCEEDINGS.

Title perfected to land deeded to U. S. between 39th and 45th Sts., **06,** 1350.

OPERATIONS.

1904-05. Work on sea wall commenced, 2,058′ completed, **05,** 1515.

1905-06. 2,029′ sea wall completed, 7,786 t. riprap apron placed in front of wall, 8,638 t. riprap placed to complete revet. 1,245′ l. at w. boundary of Fort Crockett Reservation, **06,** 1350.

1906-07. 995,691 c. y. sand filling deposited on reservation, **07,** 1477.

1907-08. 469,444 c. y. filling placed, of which 8,187 c. y. were top soil and sod; 5,031 l. f. riprap retaining wall built along n. side of reservation, **08,** 1537.

1908-09. 251,587 c. y. filling placed, of which 36,769 c. y. were top soil and sod; 300 l. f. riprap wall built, **09,** 1515.

1909-10. Minor repairs to sea wall, fill and retaining wall, concrete walks, brick pavement; concrete curbing constr. in rear of sea wall, **10,** 1658.

1910-11. Minor repairs, **11,** 1805.

1911-12. Minor repairs to sea wall, fill and retaining wall, **12,** 2030.

PHYSICAL CHARACTERISTICS.

Description of, along Gulf front of city, **06,** 1350.

[1] H. D. 328, 61st, 2d. [2] H. D. 264, 56th, 2d. [3] H. D. 768, 59th, 2d.

PRIVATE WORK.

Description of plans for sea wall, and grade raising, undertaken by local au., **03,** 1349, 1352.

PROJECTS.

Act Apr. 28, 1904, app. $410,000 for protection works along front of Fort Crockett Reservation; also app. $181,046.25 for extension of above works from 39th to 45th Sts., conditional on conveyance in fee simple to U. S. of land lying between 39th and 45th Sts. and south of Avenue A in city of Galveston (see Boards), **04,** 381; act June 30, 1906, au. completion (see Appropriations), **12,** 723.

Extract from specifications for sea wall, with drawings and photographs, **05,** 3024.

Tests of cement mixed with sand, clay, and loam, **05,** 3027.

SURVEYS.

Maps. **05,** 3028 (constr. details and photographs).

Part (d), U-30 Galveston Island, Tex. (East end.)

ENGINEERS.

Chief of Engineers. **Rs., 95,** 266; **96,** 231; **97,** 208.

In charge. Maj. A. M. Miller, 1895–97. **Rs., 96,** 1558; **97,** 1813.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 1558.

Erosion caused by violent storms, and consequent littoral movement of almost impalpable sand, **96,** 1558.

Effect of s. j. after extension at Galveston such as to almost if not quite prevent erosion at that point, **97,** 1813.

PROJECTS.

In 1895 Maj. Miller est. that to prevent erosion would cost $90,000 or $115,000 by 2 plans, **96,** 1558. (See Physical data.)

SURVEYS.

Sur. of the e. end to determine the causes of its erosion and to obtain est. for its prevention, au. act Aug. 17, 1894; made, 1895, by Maj. Miller (see Projects), **96,** 1558. Further determinations and est. called for act June 3, 1896; **R.** (unfav.) by Maj. Miller, 1896, **97,** 1813.

U-31 HIGHLAND BAYOU, TEX.

COMMERCE.

None, and none looked for, **00,** 2414.

ENGINEERS.

Chief of Engineers. **R., 00,** 395.

In charge. Capt. C. S. Riché, 1899–1900. **R., 00,** 2410, 2412.

Assistant. S. M. Wilcox. **R., 00,** 2413.

OBSTRUCTIONS.

Bayou crossed by RR., wagon, and foot brs.; so narrow at Hitchcock that any sort of structure is considered sufficient, **00,** 2414.

PHYSICAL CHARACTERISTICS.

Highland Bayou empties into Galveston B., Tex., about 9 m. w. of Galveston; one of the adjacent streams referred to in the app. Mar. 3, 1899, for imp. "Brazos R." between Velasco and Richmond, West Galveston B. Chan., Double Bayou, and the mouths of adjacent streams, **00,** 2411.

Description of, **00,** 2413.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; ex. made, 1899, by Capt. Riché (**R.** fav.); sur. made, 1899, by Capt. Riché (**R.** unfav.), **00,** 2413.

U-33 WEST GALVESTON BAY, TEX.

APPROPRIATIONS.

1892,	$15,000,	**93,** 1878.
1894,	5,000,	**95,** 1810.
1896,	5,000,	**96,** 1545.
1905,	*10,000,	**06,** 1341.
1907,	59,500,	**08,** 1529.
1908,	92,029,	**08,** 1529.
1909,	*32,000,	**09,** 1507.
Total,	218,529	

COMMERCE.

5,434[1] vessels used waters of Galveston B., **10,** 1649.

CONTRACTS.

1892. B. T. Masterson, dr., 30¢ c. y. ($11,500), **93,** 1878.

1894. C. & R. P. Clarke, dr., 60¢ c. y. ($9,000), **95,** 1811.

1910. Bowers Southern Dredging Co., dr. 275,000 c. y., 14¼¢ c. y., **10,** 1649.

ENGINEERS.

Chief of Engineers. **R., 92,** 228; **93,** 254; **94,** 235; **95,** 263; **96,** 228; **97,** 295; **98,** 284; **99,** 342; **00,** 389; **01,** 406; **02,** 338; **03,** 356; **04,** 375; **05,** 392; **06,** 420; **07,** 441; **08,** 465; **09,** 487; **10,** 548.

In charge:

Maj. C. J. Allen, 1890. **R., 92,** 1563, 1566.

Maj. A. M. Miller, 1893–97. **R., 93,** 1877; **94,** 1399; **95,** 1809; **96,** 1544; **97,** 1804.

Maj. J. B. Quinn, 1898. **R., 98,** 1507.

Capt. C. S. Riché, 1899. **R., 99,** 1963; **00,** 2331.

Capt. C. S. Riché, 1901–03. **R., 01,** 1939; **02,** 1384; **03,** 1342.

Capt. Edgar Jadwin, 1904–06. **R., 04,** 2002; **05,** 1505; **06,** 1339.

Capt. J. C. Oakes, 1907–09. **R., 07,** 1469; **08,** 1528; **09,** 1507.

Maj. G. P. Howell, 1910–. **R., 10,** 1648.

Assistants:

R. B. Talfor. **R., 92,** 1565.

G. Bagnall. **R., 92,** 1569.

D. Allen. **R., 93,** 1879; **94,** 1400; **95,** 1811.

E. M. Hartrick. **R., 04,** 2003.

LEGISLATION.

This chan. forms part of the "Inland Waterway" and an app. has been made for it under that head; "hereafter" this work will be reported under "Inland Waterway on the Coast of Texas," **07,** 441.

OPERATIONS.

1892–93. 2,928 c. y. dr., **93,** 1878.

1893–94. 5,399 c. y. dr., **94,** 1399.

* Allotment.

[1] This may represent trips rather than actual vessels.

1894-95. 14 beacons erected and 10,847 c. y. dr., **95,** 1810, 1812.
1895-96. 6,333 c. y. dr., **96,** 1544.
1900-03. No work done—chan. deeper than connecting water of Galveston and Brazos Canal,[1] **01,** 1940; **02,** 1383; **03,** 1342.
1903-04. U. S. dr. *Pigmy* fitted up with snagging outfit; repairs made to dr. *Gen. H. M. Robert* and launch *Col. Riché*, **04,** 2002.
1904-05. Snag boat *Gen. S. M. Mansfield* prepared for dr.; 6 piles and 21 iron pipes removed from chan.; 7 iron tripods and 3 signal beacons erected, **05,** 1505.
1905-06. Dr. and snag boat *Gen. S. M. Mansfield* dr. 3′ chan. at all places where less than 3′ was found, removing 33,653 c. y.; 16 beacons erected as chan. marks, **06,** 1339.
1906-07. Dr. *Gen. S. M. Mansfield* removed 23,001 c. y.; 13 beacons erected as chan. marks, **07,** 1469.
1908-09. Dr. *Gen. H. M. Robert* removed 123,986 c. y. up to Apr. 17, 1909, at which time she was destroyed by fire; U. S. derrick barge No. 1 dr. a chan. under drawbr., removed piling obstr. and dr. *Gen. H. M. Robert*, and erected beacons as chan. marks, **09,** 1507.
1909-10. 204,964 c. y. removed under contract, and dr. *Capt. Howell* removed 180,347 c. y., **10,** 1648.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1563.
West B., extending from Galveston B. to the w. end of Oyster B., lies between Galveston Isld. and the mainland, **93,** 1877.

PRIVATE (STATE) WORK.

In 1859 Texas had dr. chan. through B. with d. of 5′, which was filled up again by a storm in 1875, **93,** 1877.

PROJECTS.

By Maj. Allen, 1891, straightening chan. and removing points bordering them, to dr. least w. of 200′ and d. of 3½′ bet. RR. brs. to San Luis Pass in B., and 100′ w. and 3′ d. along Christmas Pt. in Oyster B., chan. to be marked by beacons; est., $29,000, **92,** 1568, 1569; **93,** 1877.
By Maj. Miller, 1892, application of app. of 1892 to obtaining part of the foregoing plan, **93,** 1877.
General proj. of 1902, for Brazos R., Velasco to Richmond, etc., provided for purchase of West Galveston B. and Brazos Canal at a cost of $30,000 (see "Inland Waterway," Dist. U.), **03,** 1342.
The West Galveston B. Chan. included in the "Inland Waterway on the Coast of Texas" and allotments for this work from app. for "Brazos R., Velasco to Richmond," etc., proj. of 1899, have ceased; about four-fifths of proj. work has been completed, **08,** 458.
Of Mar. 2, 1907, provides for a navigable inland chan. of 5′ along coast of Texas, utilizing lagoons lying bet. the islds. and the mainland, of which proj. West Galveston B. and the Galveston and Brazos Canal are parts; these two items previously considered independently are now improved under a joint app.,[2] **08,** 465.

SURVEYS.

Au. act Sept. 19, 1890; made, 1891, by Maj. Allen, **92,** 1566.
Au. act Mar. 3, 1905, from Aransas Pass to West Galveston B. Chan. at Brazos R. (as a part of the proposed inland waterway from the Rio Grande R., Tex., to a connection with the Mississippi R. at Donaldsville, La.), **06,** 430.

U-34 CHOCOLATE BAYOU, TEX.

APPROPRIATIONS.

1907,	[3] *$9,000.00,	**07,** 1469.
1909,	[4] *4,000.00,	**09,** 1506.
1910,	*4,853.25,	**10,** 1647; **11,** 1792.
1911,	*3,500.00,	**12,** 2013.
Total,	21,353.25 (less amounts trans., $15,626.29, **12,** 2013).	

COMMERCE.

About 10,000 t. produce, etc., carried an. to and from Galveston, **00,** 2405.
1911, 7,515 t., **12,** 705.

ENGINEERS.

Chief of Engineers. R., 00, 395; **06,** 417; **07,** 441; **08,** 463; **09,** 485; **10,** 546; **11,** 583; **12,** 704.

In charge:
Capt. C. S. Riché, 1899–1900. **R., 00,** 2403, 2406.
Capt. John C. Oakes, 1907–09. **R., 07,** 1468; **08,** 1528; **09,** 1506.
Maj. G. P. Howell, 1910–11. **R., 10,** 1646; **11,** 1792.
Maj. E. I. Brown, 1912–. **R., 12,** 2012.

Assistant. S. M. Wilcox. **R., 00,** 2407.

OPERATIONS.

1908-09. Dr. *Capt. C. W. Howell* removed 98,904 c. y. of material, completing 5½′ chan. from 5′ contour in Galveston B. to Chocolate Bayou, **09,** 1506.
1910-11. 46,968 c. y. dr., **11,** 1792.
1911-12. 227 snags and 377 overhanging trees removed, **12,** 2012.

PHYSICAL CHARACTERISTICS.

Chocotale Bayou empties into Chocolate B., which latter merges with Galveston B. about 12 m. n. of San Luis Pass, one of the adjacent streams referred to in the app. of Mar. 3, 1899, for imp- "Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams," **00,** 2404.
Description of Bayou, **00,** 2407.
Max. draft June 30, 1911, 3.6′, **11,** 583.
Chan. navigable for 15 m. beyond Liverpool, and navigation could be extended farther were it not for the overhanging trees along the banks and snags, **12,** 705.

PROJECTS.

Capt. Riché est., 1900, it would cost $15,000 to make the imp. component part of a light-draft inland navigation system, **00,** 2406.
To excavate a chan. across the bar, from 5′ in B. to 5′ in bayou; est., $9,000, **07,** 441; au. act Mar. 2, 1907, **07,** 436.

SURVEY.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects). **00,** 2404, 2406.
Of bayou, **10,** 1646.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 705.

* Allotment.
[1] H. D. 447, 56th, 1st, 1900, 2418–25.
[2] H. D. 640, 59th, 2d.
[3] $1,500 and $987.78 trans. to Clear Creek and Dickinson Bayou, Tex., resp., **08,** 463; **09,** 485.
[4] $1,100 and $2,139.18 trans. to Bastrop Bayou and Trinity R., Tex., resp., **10,** 547.

U-36 BASTROP BAYOU, TEX.

APPROPRIATIONS.

1907, *$9,920.22, **08,** 1527.
1909, *7,810.07, **10,** 1646.
1910, [1]*1,000.00, **10,** 1646.

Total, 18,730.29

COMMERCE.

None, and none looked for, **00,** 2418.
Chan. used but little, **10,** 546.
Description of, **11,** 584.

ENGINEERS.

Chief of Engineers. R., 00, 395; **07,** 436, 440; **08,** 458, 462; **09,** 478, 484; **10,** 539, 545; **11,** 584; **12,** 705.

In charge:
Capt. C. S. Riché, **1899–00. R., 00,** 2414, 2416.
Capt. John C. Oakes, 1907–09. **R., 07,** 1465, 1468; **08,** 1522, 1527; **09,** 1501, 1505.
Maj. G. P. Howell, 1910–11. **R., 10,** 1642, 1646; **11,** 1793.
Maj. E. I. Brown, 1912–. **R., 12,** 2013.

Assistant. S. M. Wilcox. **R., 00,** 2417.

OPERATIONS.

1906–07. 65,510 c. y. dr., **07,** 1468.
1907–08. 16,645 c. y. dr., **08,** 1527.
1909–10. 154,196 c. y. dr., **10,** 1646.

PHYSICAL CHARACTERISTICS.

Bastrop Bayou empties into Bastrop B., part of W. Galveston B.; one of the adjacent streams referred to in the app. Mar. 3, 1899, for imp. "Brazos R. between Velasco and Richmond, W. Galveston B. Chan., Double Bayou, and the mouths of adjacent streams," **00,** 2415.
Description of, **00,** 2417; **11,** 584; **12,** 705.
Max. draft, 1912, over shoalest part, 2.6′ m. l. t., **12,** 705.

PROJECTS.

Act Mar. 3, 1905, consolidated this work with West Galveston B. Chan., etc. (q. v.), **07,** 436.

PRIVATE WORK.

Chan. dr. through Shell Reef at mouth of bayou paid for by parties interested, **07,** 440.

SURVEYS.

Ex. and sur. au. by act Mar. 3, 1899; ex. made, 1899, by Capt. Riché (**R.** fav.); sur. made, 1899, by Capt. Riché (**R.** unfav.), **00,** 2415, 2416.

U-38 INLAND WATERWAY, COAST OF TEXAS.—West Galveston Bay to Rio Grande River.

Part.	Title.	Period.	Appropriations.
a	General data and dredging plant	1907–1912	$165,000.00
b	Brazos River and Galveston Bay	1879–1897	.....
c	Galveston and Brazos Canal	1902–1912	67,307.66
d	Galveston and Brazos Canal—operating and care	1904–1912	4,397.67
e	Brazos River and Matagorda Bay	1910–1912	262,000.00
f	Aransas Pass to Pass Cavallo	1907–1912	105,850.00
g	Rio Grande River to Donaldsonville, La.	1906–1907	.....
	Total	.....	604,555.33

Part (a), U-38 General Data and Dredging Plant.

NOTE.—The following reference to this proj. is taken bodily from An. R. Chief of Engineers, **12,** 706:

"The river and harbor act of March 2, 1907, appropriated $133,829, and authorized the Secretary of War to enter into contract for materials and work to the extent of $300,000, all of which has since been appropriated.

"In addition, $192,000 has been appropriated for maintenance.

"This project embraces the improvement of the following localities: West Galveston Bay and Brazos River Canal; channel from Aransas Pass to Pass Cavallo, including the Guadalupe River to Victoria; Turtle Cove Channel from Aransas Pass to Corpus Christi, Tex.

"The river and harbor act of June 25, 1910, appropriated $200,000 toward the construction of the section of the waterway between Brazos River and Matagorda Bay, in accordance with the report printed in Rivers and Harbors Committee Document No. 3, Sixty-first Congress, second session. The estimated cost of the entire section, 5 feet depth and 40 feet width, is $400,000. With the completion of this section the entire waterway between Galveston and Corpus Christi, a distance of 200 miles, will be opened up.

"The object of the improvement is to obtain and maintain a navigable channel depth of 5 feet in a canal along the coast of Texas, utilizing the lagoons lying between the islands and the mainland. The improvement will develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

"The amount expended under this appropriation to June 30, 1912, has been as follows (see each work named below for total of appropriations):

West Galveston Bay and Brazos River Canal (q. v.)	$175,419.93
Channel between Brazos River and Matagorda Bay (q. v.)	77,880.88
Aransas Pass to Pass Cavallo (q. v.)	72,597.54
Guadalupe River (q. v.)	182,495.60
Turtle Cove Channel (q. v.)	126,723.57
Total	635,117.52

* Allotment. [1] Entire allotment trans. to Chocolate Bayou in 1911.

"The projected channels have been obtained, except the river channel from Victoria to the mouth of the Guadalupe River and the channel between Brazos River and Matagorda Bay.

"More and larger boats with auxiliary gas engines have been built to utilize the improvement. Most of the points to be reached are settlements which railways can not afford to develop, and the improvements are of great importance to their commercial life.

"The effect of the project on freight rates is shown by one instance—from Galveston to the plantations on the lower end of the Guadalupe. The rate by rail to the nearest point and by boat to the river landing is 63½ cents per 100 pounds on general merchandise; the all-water route rate is 35 cents. The combined cotton rate is $2.90 per bale and the all-water rate $1 per bale." **12,** 707.

APPROPRIATIONS.[1]

1899,	$65,000,	**99,** 1970.
1902,	50,000,	**02,** 1380.
1905,	50,000,	**05,** 1503.
Total,	165,000	

COMMERCE.

Varied and valuable; is important an., **06,** 417; **12,** 700.

CONTRACTS.

1901. Moore & Sieber, hull for dr., $10,930; Morris Machine Works, centrifugal pump and engines, $8,338, and propelling engines, etc., $5,025; Wheeler Condensing & Engineering Co., condenser, $2,498; Thos. P. Benton & Son, electric-light plant, $1,050; New Jersey Foundry & Machine Co., distilling plant, $1,090, and jet and feed pumps, etc., $1,600; Henry Vogt Machine Co., boilers, $3,945; Memphis Machine Works, refrigerating plant, $1,295, **01,** 1951. Arthur Fritsch, steam-spud lift, suction frame and fittings, etc., $5,293.50; Crane Co., piping, valves, and fittings, $1,760, **02,** 1381.

ENGINEERS.

Chief of Engineers. **R., 99,** 343; **00,** 391; **01,** 408; **02,** 337; **03,** 354; **04,** 373; **05,** 389.

In charge:
Capt. C. S. Riché, 1899–1903. **R., 99,** 1970; **00,** 2334; **01,** 1950; **02,** 1379; **03,** 1339.
Capt. Edgar Jadwin, 1904–05. **R., 04,** 1999; **05,** 1503.

Assistants:
Lt. M. L. Walker, **02,** 332.
E. M. Hartrick. **R., 02,** 1381; **04,** 2000.
Capt. G. M. Hoffman, **04,** 366; **05,** 361.
J. H. Masculine. **R., 05,** 1503.

LEGAL PROCEEDINGS.

Galveston and Brazos Canal purchased by U. S. and paid for, **03,** 355, 1342.

OPERATIONS.

1900-01. Preparations in progress for beginning work, **01,** 408.

1901-02. Dr. practically completed except for furnishing, wiring, etc., **02,** 1379.

1902-03. 13,304.82 c. y. dr. from Double Bayou; chan. across Hannas Reef dr. to 7′, 45′ to 60′ w.; snags, etc., removed from Trinity R.; dr. *Gen. H. M. Robert* completed and put in commission Aug. 6, 1902, **03,** 1339.

1903-04. Log jam in chan. between Brazos R. and Oyster Creek removed, and a boom constr.; 2,200 c. y. dr. by U. S.; bulkhead constr. across a break in canal bank; floating plant repaired, **04,** 1999.

1904-05. 80,480 c. y. dr. from Double Bayou; 131,639 c. y. dr. and 212 snags and part of old bulkhead removed from Anahuac Chan.; 3,236′ Galveston and Brazos Canal cleared of grass and logs and 8,000 c. y. silt and clay removed; repairs made to floating plant, **05,** 1502.

PROJECTS. (See Appropriations.)

The proj., 1899, to obtain and maintain a navigable chan. 4′ to 6′ d. across the bars at the mouths of most of the streams and bayous along the Texas coast, with a dr. and snagging plant owned and operated by the U. S., **99,** 344.

Recom., 1906, that further app. be dependent on U. S. being relieved of mainten. of br. across Galveston and Brazos Canal, **06,** 421, 424.

Act 1905 included gaining 6′ chan., Trinity B. to Anahuac Chan. and thence to mouth of Browns Pass; cost, $5,500, **05,** 390.

SURVEY.

Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 408; **02,** 337.

Part (b), U-38 Brazos River and Galveston Bay, Tex. (Channel between.)[2]

COMMERCE.

Description of, **97,** 1812, 1813.

The route ex., 1896, a regulator of freight rates between certain Brazos R. points and Galveston, **97,** 1810.

ENGINEERS.

Chief of Engineers. **R., 81,** 204; **97,** 298.

In charge:
Maj. S. M. Mansfield, 1881. **R., 81,** 1376.
Maj. A. M. Miller, 1897. **R., 97,** 1809.

Assistants:
W. L. Webb. **R., 81,** 1376.
Lt. W. V. Judson. **R., 97,** 1811.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1377; **97,** 1810.

Part of the route ex., 1896, runs through a canal of the Galveston & Brazos Navigation Co., which company, under its charter from Texas, collects toll from passing craft, **97,** 1810.

PLANS.

By Maj. Mansfield, 1880, canal about 38 m. l., 4′ x 80′; est., $70,353, **81,** 1376, 1379.

SURVEYS.

Au. act Mar. 3, 1879, **81,** 204.

Ex. au. act June 3, 1896; made, 1896, by Maj. Miller (**R.** unfav.), **97,** 1809.

[1] The funds available at the end of the fiscal year 1899 for imp. Brazos R., Tex., chan. in West Galveston B., and Trinity R., Tex., to be used in dr. and snagging at those points in connection with the app. of 1899, **99,** 1970.

[2] Sur.—**R.,** Apr. 1, 1854; est., $44,000. (H. D. 482, 55th, 2d.)

Part (c), U-38 Galveston and Brazos Canal, Tex.

APPROPRIATIONS.

1902, *$39,307.66 } **07,** 1470.
1905, *28,000.00 }

Total, 67,307.66

COMMERCE.

12,361 t. carried through canal, **11,** 587.

No appreciable effect on rates; apparently only fishing and produce craft; 4,903 boats drawn through br. across W. Galveston B., 1912, **12,** 708.

ENGINEERS.

Chief of Engineers. R., 02, 337; **03,** 355; **04,** 374; **05,** 390; **06,** 420; **07,** 442; **08,** 465; **09,** 487; **10,** 549; **11,** 587; **12,** 708.

In charge:

Capt. C. S. Riché, 1903. **R., 03,** 1342.

Capt. Edgar Jadwin, 1904–06. **R., 04,** 1999; **05,** 1502; **06,** 1340.

Capt. John C. Oakes, 1907–09. **R., 07,** 1470; **08,** 1529; **09,** 1507.

Maj. G. P. Howell, 1910–11. **R., 10,** 1648; **11,** 1794.

Maj. E. I. Brown, 1912–. **12,** 2015.

OPERATIONS.

1902–03. Canal purchased at cost of $30,000, **03,** 1342.

1903–04. Log jam removed, and a boom constr. across mouth to prevent recurrence of jam; dr. *Pigmy* removed 2,200 c. y. of material and constr. a bulkhead across break in canal bank, **04,** 1999.

1904–05. 3,236′ of canal cleared of grass, logs, etc., and about 8,000 c. y. silt and clay removed, **05,** 1502.

1905–06. 138,658 c. y. removed by U. S. drs., eaving the canal with a ruling d. of 3′, **06,** 1340.

1906–07. 20,017 c. y. removed by U. S. drs. in mainten. work, and 8,448 c. y. removed by dr. *Capt. C. W. Howell* in the excavation of a 5′ chan., **07,** 1470.

1907–08. Dr. *Capt. C. W. Howell* removed 165,406 c. y., **08,** 1528.

1908–09. Dr. *Capt. C. W. Howell* removed 255,483 c. y.; canal practically completed in accordance with proj. of 1907, **09,** 1507.

1909–10. 12 piling, 162 snags, and 226 c. y. mud removed by derrick barge No. 1, **10,** 1648.

PHYSICAL CHARACTERISTICS.

Depths in canal, **12,** 2015.

At 1912, chan. 36 m. l.—21 m. in W. Galveston B. and 15 m. thence to Brazos R., **12,** 708.

PRIVATE WORK.

Canal orig. dr. by Galveston & Brazos Navig. Co. Orig. cut was 10 m. (1851–1853), 6′ x 100′. SS. 145′–175′ l. and from 28′–30′ w. used canal, carrying 550–1,200 bales of cotton, **12,** 708.

PROJECTS.

Act June 13, 1902, included $30,000 for purchase of canal; badly obstr. by snags, silt, etc., **02,** 337.

Of Mar. 2, 1907, for "Inland Waterway on the Coast of Texas" au. 5′ inland waterway, and combines the imp. of West Galveston B. Chan. and Galveston and Brazos R. Canal; chan. to be 40′ w.; est., $151,529, and $20,000 an. mainten., **07,** 442, 443; **08,** 465.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1905; made, 1906, for inland waterway from the Rio Grande R., Tex., to the Mississippi R. at Donaldsonville, La.,[1] **07,** 451.

Maps.[1]

Part (d), U-38 Galveston and Brazos Canal, Tex. (Operating and care.)

APPROPRIATIONS.[2]

1905,	$334.23,	**05,** 1506.
1906,	1,002.36,	**06,** 1342.
1907,	599.53,	**07,** 1471.
1908,	1,981.55,	**08,** 1533.
1909,	120.00,	**09,** 1511.
1910,	130.00,	**10,** 1653.
1911,	120.00,	**11,** 1799.
1912,	110.00,	**12,** 2019.

Total, 4,397.67

ENGINEERS.

Chief of Engineers. R., 05, 392; **06,** 421; **07,** 443; **08,** 469; **09,** 491; **10,** 553; **11,** 592; **12,** 712.

In charge:

Capt. Edgar Jadwin, 1905–06. **R., 05,** 1506; **06,** 1342.

Capt. John C. Oakes, 1907–09. **R., 07,** 1471; **08,** 1533; **09,** 1511.

Maj. G. P. Howell, 1910–11. **R., 10,** 1653; **11,** 1799.

Maj. E. I. Brown, 1912–. **R., 12,** 2019.

OPERATIONS.

1904–05. Watchmen were placed at canal during year for operating drawbr. and tending log boom at mouth, **05,** 1506.

1906–07. Materials purchased and piles driven for new pivot br., **07,** 1471.

1907–08. New drawbr. built by U. S. at cost of $1,776.55, and turned over to county of Brazoria in Sept., 1907, to be operated and maintained by them in accordance with agreement; watchmen stationed at canal to operate temporary pontoon br. and care for log boom at entrance, **07,** 1471; **08,** 1533.

1908–12. Boom tender stationed at mouth of canal, **09,** 1511; **10,** 1653; **11,** 1799; **12,** 2019.

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* Allotment.

[1] H. D. 640, 59th, 2d.

[2] Expend. under the permanent-indefinite app. acts July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

Part (e), U-38 Brazos River and Matagorda Bay. (Channel between.)[1]

APPROPRIATIONS.

1910, $200,000, **10,** 1649.
1912, 62,000, **12,** 2016.

Total, 262,000

CONTRACTS.

John Jacobson, dr. 2,166,800 c. y., 8.74¢ and 10½¢ c. y., **11,** 1796.

ENGINEERS.

Chief of Engineers. **R., 10,** 550; **11,** 588; **12,** 709.

In charge:
Maj. G. P. Howell, 1910–11. **R., 10,** 1649; **11,** 1795.
Maj. Earl I. Brown, 1912–. **R., 12,** 2016.

OPERATIONS.

1910–11. 3,250 c. y. dr., **11,** 1796.
1911–12. 535,596 c. y. dr., **12,** 2016.

PHYSICAL CHARACTERISTICS.

Land along route of this waterway marshy with numerous shallow bayous, lakes, and ponds; elevations along line do not exceed 5′ above m. l. t.; total l. 32 m., 24½ m. of which are overland, **10,** 550.

PROJECTS.

Act June 25, 1910, contemplates chan. 5′ x 40′; cost, $400,000, with $15,000 an. mainten.,[2] **10,** 550.

Act July 25, 1912, au. $50,000 for continuing work by dr., and $12,000 for constr. of highway brs. at points where waterway would intersect existing county roads, **12,** 709.

Part (f), U-38 Aransas Pass to Pass Cavallo, Tex.

APPROPRIATIONS.

1907. $25,500, **07,** 1472; **08,** 1530.
1908, 40,350, **08,** 1530.
1909, *40,000, **09,** 1508.

Total, 105,850 ($105,851.45, incl. sales, **12,** 2017).

COMMERCE.

Imp. has had no effect on rates, **10,** 551; **11,** 589; **12,** 710. Traffic, 1911, 1,497 t., **12,** 710.

CONTRACTS.

1907. Bowers Southern Dredging Co., dr., 18.8¢ c. y., p. m., **08,** 1531.

ENGINEERS.

Chief of Engineers. **R., 07,** 444; **08,** 466; **09,** 488; **10,** 550; **11,** 589; **12,** 710.

In charge:
Capt. J. C. Oakes, 1907–09. **R., 07,** 1472; **08,** 1530; **09,** 1508.
Maj. G. P. Howell, 1910–11. **R., 10,** 1650; **11,** 1796.
Maj. E. I. Brown, 1912–. **R., 12,** 2017.

OPERATIONS.

1907–08. 18,022 c. y. excavated to prescribed cross section and 12,889.5 c. y. from 1′ below; 10,800 l. f. actually dr., **08,** 1530.

1908–09. 138,031.8 c. y. excavated to prescribed cross section and 88,603.1 c. y. from 1′ below, over distance of 56,975 l. f.; 25 beacons erected along line of cut, **09,** 1508.

1909–10. 28,716 c. y. redr. from shoal across Mesquit B. to 6′ for 12,100′; sunken barge removed, **10,** 1650.

1910–11. U. S. dr. *Capt. C. W. Howell* dr. through shoals bet. m. 41 and m. 30, a distance of 44,250 l. f., removing 101,652 c. y., **11,** 1796, 1797.

1911–12. U. S. dr. *Capt. C. W. Howell* dr. through shoals bet. m. 30 and m. 0, distance of 8,000 l. f., removing 22,400 c. y., and obtaining 5′ x 40′, **12,** 2017.

PHYSICAL CHARACTERISTICS.[3]

PRIVATE WORK.

This chan. orig. developed by Texas and private interests; old U. S. mail route, Indianola to Corpus Christi, **07,** 444.

PROJECTS.

Au. act Mar. 2, 1907, 5′ x 40′ chan., Aransas Pass to Matagorda B.; 63 m.; est., $65,850,[3] **08,** 466.

Act July 25, 1912, au. Sec. of War to change route of chan. to pass by town of Port O'Connor, Tex., and to expend available funds for this work, **12,** 710.

SURVEYS.

Pre. ex.[4]
Maps.[4]

Part (g), U-38 Rio Grande River, Tex., to Mississippi River at Donaldsonville, La.

ENGINEERS.

Chief of Engineers. **R., 06,** 430; **07,** 451.

BOARDS.

BERH, on Jan. 8, 1907, gave rehearing on **R.** on inland waterway, Corpus Christi and the Miss. R. (unfav. to any larger expend. "at the present time"). **R.,** Cong. Doc. 8, 59, 2d.

In charge. Maj. Edgar Jadwin, **06,** 411; **07,** 429.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905, of inland waterway from Rio Grande R., Tex., to Mississippi R. at Donaldsonville, La., **06,** 430. **R.** by Maj. Jadwin, Dec. 14, 1906.—Aransas Pass to Pass Cavallo, cost $65,850, with $10,000 an. mainten.; Brazos R. to Galveston, cost $141,528.80, with $20,000 an. mainten.; Mermentau R. to Mississippi R. through Bayou Plaquemine, cost $289,292, with $20,000 an. mainten.,[3] **07,** 451.

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* Allotment.
[1] Waterway to Aransas Bay—Ex. **R.** (unfav.), Apr. 18, 1853. H. D. 482, 55th, 2d.
[2] H. D. Com. 3, 61st, 2d. [3] H. D. 640, 59th, 2d. [4] H. D. 336, 59th, 2d.

U-39 OYSTER CREEK, TEX.

APPROPRIATIONS.

1910, [1] * $10,000, **10,** 1647.

COMMERCE.

Farm products, **00,** 2424.

ENGINEERS.

Chief of Engineers. **R., 00,** 396; **10,** 547; **11,** 584; **12,** 705.

In charge:
Capt. C. S. Riché, 1899–1900. **R., 00,** 2418, 2421.
Maj. G. P. Howell, 1910–11. **R., 10,** 1647; **11,** 1793.
Maj. E. I. Brown, 1912–. **R., 12,** 2014.

Assistant. S. M. Wilcox. **R., 00,** 2423.

OPERATIONS.

1910–11. 61,843 c. y. dr., making a new chan. from mouth of creek in the Galveston-Brazos R. Canal for 10,670′, cutting off one bend and forming chan. 5′ x 40′, **11,** 1793.

PHYSICAL CHARACTERISTICS.

Oyster Creek at one time emptied into the Gulf of Mexico, about 2 m. ne. of Brazos R. entrance; now empties into the Galveston and Brazos Canal, the orig. entrance having been closed by a barge sunk across the creek below the canal. Creek one of the adjacent streams referred to in the app. of Mar. 3, 1899, for imp. "Brazos R. between Velasco and Richmond, West Galveston B. Chan., Double Bayou, and the mouths of adjacent streams," **00,** 2419.

Description of, **00,** 2423.

June, 1911, ruling d. in dr. chan. was 4.4′, and above end of said chan. 3.7′, **11,** 1793.

June 29, 1912, ruling d. in dr. chan. was 1.5′, **12,** 2014.

PROJECTS.

Capt. Riché est., 1900, $65,000 and the purchase of the Galveston and Brazos Canal at an additional cost of $50,000, to make the imp. as a part of an inland light-draft navigation system, **00,** 2422.

Act June 25, 1910, added this work to the proj. for imp. of West Galveston B. Chan. and other works; it is proposed to secure a 5′ chan. in the creek by the aid of U. S. plant, **10,** 547.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2419, 2423.

U-40 BRAZOS RIVER, TEX.[2]

Part.	Title.	Period.	Appropriations.
a	Brazos R.	1874–1906	$168,750
b	Brazos R.—Mouth	1899–1912	432,500
c	Brazos R.—Velasco to Washington	1904–1912	225,000
d	Brazos R.—Washington to Richmond	1900–1904	150,000
e	Brazos R.—Washington to Waco	1904–1912	700,000
	Total		1,676,250

See also Inland waterways connecting and Brazos R. district map.

Part (a), U-40 Brazos River, Tex. (Including mouth.)

APPROPRIATIONS.

1880,	[3] $40,000,	**80,** 1244.
1881,	[3] 40,000,	**81,** 1350.
1882,	[3] 50,000,	**82,** 1462.
1884,	[3] 10,000,	**84,** 1310.
1886,	[3] 18,750,	**86,** 1328.
1896,	5,000,	**97,** 1808.
1896,	[3] 5,000,	**97,** 1816 (sur.).
Total,	168,750	

COMMERCE.

Description of, **75,** 936; **81,** 1350; **93,** 1895; **95,** 1838, 1839.

Large and important, Velasco to Richmond, **95,** 1838.

Relating to works of Brazos River Channel & Dock Co., **97,** 1831.

Board, 1896, of opinion that mainten. of R. mouth H. was of sufficient public interest to justify the US. completing works of Brazos River Channel & Dock Co., provided company would dedicate to the public one m. of R. front lands at mouth; also of opinion that enhanced value of property of the company, which would arise from the U. S. taking charge of the H. works, would be sufficient compensation for their transfer to the U. S., **97,** 1826.

Between Velasco and Richmond about 15,435 t. an., **99,** 344.

Letters from parties interested in imp. mouth to city of Waco, **01,** 1982.

CONTRACTS.[4]

1881. Kanters & Son, j. constr. **81,** 1347. G. L. Long, j. constr., **82,** 1461.
1882. R. Moore, j. constr., **83,** 1087.
1884. F. A. Brock, **85,** 1461.

DEFENSE.

Adaptability as a naval station, **79,** 938.
Recom. concerning, by Maj. Howell, **79,** 944, 945.

* Allotment.
[1] $1,978.88 trans. to Chocolate Bayou, **11,** 585.
[2] Velasco H., Tex.—Ex.—**R.** (fav.), Sept. 30, 1853. (H. D. 482, 55th, 2d.)
[3] For mouth of Brazos R.
[4] Cost of works of the Brazos River Channel & Dock Co., **97,** 1822.

ENGINEERS.

Chief of Engineers. **R., 75,** 79; **78,** 85; **79,** 111, 112; **80,** 148; **81,** 201, 1351; **82,** 198; **83,** 203; **84,** 218; **85,** 228; **86,** 225; **87,** 191; **88,** 175, 1293; **89,** 205; **91,** 235; **93,** 257; **95,** 266; **96,** 230; **97,** 297, 298; **98,** 287; **99,** 344; **00,** 392; **01,** 409, 411; **02,** 339; **03,** 357; **04,** 376; **05,** 392; **06,** 422.

Boards:

Permanent B. on R. and H. imp. **R., 81,** 1352. (See Projects.)

Convened, New York, Nov. 11, 1887, to report upon imp. of mouth of the Brazos R. **R., 88,** 1299. (Cols. Casey and Abbot, Lt. Col. McFarland, and Maj. King.)

BE., under instructions from Sec. of War, Dec. 2, 1896, convened, Velasco, Tex., and in Washington, D. C., to ascertain character and value of imp. made at R. mouth by Brazos River Channel & Dock Co. **R.** (see Commerce), **97,** 1815. (Col. H. M. Robert; Civil Engineer R. Moore, St. Louis, Mo., and Stehman Forney, US. Coast and Geodetic Sur.)

In charge:

Maj. C. W. Howell, 1874–80, **75,** 79; **78,** 82; **79,** 111. **R., 75,** 929, 937; **79,** 938; **80,** 146.

Maj. S. M. Mansfield, 1880–86. **R., 80,** 1242; **81,** 1347; **82,** 1460; **83,** 1087; **84,** 1309; **85,** 1460; **86,** 1327.

Maj. O. H. Ernst, 1886–89. **R., 87,** 1427; **88,** 1291, 1294; **89,** 1563.

Maj. A. M. Miller, 1893–97. **R., 93,** 1893; **95,** 1833, 1838; **97,** 1808, 1815.

Maj. J. B. Quinn, 1898. **R., 98,** 1511.

Capt. C. S. Riché, 1899–1903. **R., 99,** 1970; **00,** 2335; **01,** 1951, 1975, 2009, 2011; **02,** 1385; **03,** 1342.

Capt. E. Jadwin, 1904–06. **R., 04,** 2003; **05,** 1507; **06,** 1344.

Assistants:

R. B. Talfor, **75,** 929; **79,** 938. **R., 75,** 929.
H. C. Ripley, **79,** 938. **R., 79,** 939.
J. M. Picton, **82,** 1462.
H. C. Ripley. **R., 87,** 1428.
Lt. W. C. Langfitt. **R., 93,** 1896.
S. W. Campbell. **R., 95,** 1835.
S. M. Wilcox. **R., 95,** 1840.
Lt. M. L. Walker, **02,** 332.
Capt. G. W. Hoffman, **04,** 366.

LEGISLATION.

Texas, under a general law, sanctioned organization of the Brazos River Channel & Dock Co., with au. to extend its works for imp. of the R. mouth as far inland as might be necessary to obtain security from storms, etc., **93,** 1893; **97,** 1818.

Congress, 1888, au. company to construct, own, and operate js. and other similar works at the R. mouth, and to charge and collect tolls therefor, subject to regulation, provided work should be satisfactorily done in a defined period; right reserved to purchase works, **97,** 1819.

OBSTRUCTIONS.

Bridges obstr. navigation, **75,** 936.

List of RR. and other brs. without draws between Waco and Richmond, **95,** 1833.

OPERATIONS.

1880–81. Partial constr. of 742½ l. f. of n. chan. j., **81,** 1348.

1881–82. Work on n. j. in progress, **82,** 1461.

1882–83. Work in progress on n. and s. js., **83,** 1088.

1884–85. Work in progress on n. j., **85,** 1461. N. j. partly completed throughout 2,433 l. f. S. j. foundation course laid for 700′, **86,** 1327.

1904–05. Dr. at various places by snag boat *Capt. C. W. Howell*, **05,** 1507.

1905–06. 25,953 c. y. dr. by snag boat, exhausting the balance available for imp. of this section under old proj. of 1896, **06,** 422, 1344. [For subsequent details of imp. of Brazos R., Tex., Velasco to Richmond, see parts (b), and (c).

PHYSICAL CHARACTERISTICS.

Description of, **75,** 930, 931, 932, 933, 937, 940, 941, 943, 944; **88,** 1294; **93,** 1894; **95,** 1833; **97,** 1817.

List of obstr., **75,** 930, 931, 934.

Current observations, **75,** 932, 937; **79,** 942; **97,** 1837.

Table of distances, **75,** 933.

"Littoral currents," **75,** 937, 940; **97,** 1839.

Table of gauge readings, **79,** 941.

Slight tides in R., **81,** 1349, 1353.

One of the principal Rs. of Texas, about 800 m. l., flowing through its central and agricultural portion into Gulf of Mexico without intervention of a B., having a bar at the mouth, the position of which was considered, 1897, to be as variable as the d. of the chan. through it, **97,** 1817. Richmond, 102 m. from the mouth, up to which place in 1892 navigation was obstr. by snags, etc., **93,** 1896. Between Waco and Richmond, 328 m., navigation obstr., 1895, by ledges, shoals, and RR. and other brs. without draws, **95,** 1833. From Velasco to Richmond, 89 m., R. tortuous, banks varying in height from 9′ to 47′, and obstr. by shoals, snags, and fall of 1½′ at Bolivar Landing, **95,** 1838.

Effect of works of imp., **97,** 1821.

Tidal observations at mouth, **97,** 1836, 1839.

Surface slope observations, **97,** 1837.

Changes in the R. banks and in the Gulf shore line, **97,** 1838.

Mouth to city of Waco obstr. by shoals; locks and dams necessary; description of, **01,** 2011.

PLANS.

By Maj. Howell, 1879, for H. of refuge and naval station; w. and d. chan.; est., $12,052 to $1,762,575, **79,** 944, 945. For a basin 30′ x 500′ x 1,000′; est., $157,407, **79,** 944, 945.

PRIVATE (STATE AND CORPORATE) WORK.

Texas expended, 1857–58, $60,000 in an imp. of the R., mouth to Washington, 255 m., **75,** 934. Imp. insufficient, **75,** 934.

Imp. of mouth carried on from 1888–96 by the Brazos River Channel & Dock Co., during which time 2 straight and parallel js. built, placed 560′ apart, center to center, the e. one being 4,708′ and the w. 5,018′ l.; wing dams built from these at intervals, and out from the banks for about 5 m. upstream to Velasco, **93,** 1893; **97,** 1820, 1821. History of the company, **97,** 1818.

PROJECTS.

By Maj. Howell, 1872, imp. of chan. over the bar at mouth of R. by means of 2 converging pile js., each five-eighths m. l. and 400′ apart at their outer ends; est., $286,484, **75,** 938, 941; **80,** 1243.

Work not considered susceptible of permanent completion, **80,** 1244.

By Maj. Mansfield, 1880, parallel js. of brush, st., and concrete; direction to be chosen so as to fix the chan. in its natural position. Approx. l. of n. j., 3,600′; of s. j., 4,350′; est., $522,890.44, **81,** 1349. Recom. by BE., **81,** 1355. Concurred in by Chief of Engineers, and approv. by Sec. of War, **81,** 1352.

In 1887 the $140,833 expend. had not resulted in any useful effect upon the bar; the plan for imp. to receive further consideration, **87,** 191.

In 1887, upon consideration of Maj. Ernst's report on the results of the sur. of that year, the BE. recom. no further works of imp. be at "present" attempted, **88,** 1300.

By Maj. Miller, 1895, removing obstr. from R. bet. Velasco and Richmond; est., $10,000, and an an. expend. of $2,500 for mainten., **95,** 1839.

History of proj. for d. entrance to R., **97,** 1818.

See Commerce.

SURVEYS.

Of Brazos R. below Waco, incl. bar at its mouth, by R. B. Talfor, 1874, **75,** 80, 929.

Of R. from a point 8 m. above its mouth to outer bar, by H. C. Ripley, 1878, **78,** 85; **79,** 111, 112. **R., 79,** 939.

Of mouth of Brazos R., made, 1887, by Maj. Ernst, **88,** 1294.

Ex., mouth to Richmond, au. act July 13, 1892; made, 1892, by Maj. Miller (**R.** fav. to limited imp.), **93,** 1893.

Ex., Waco down to Richmond, au. act Aug. 20, 1894 (**R.** unfav.); the same act also au. sur. from,

Velasco up to Richmond. Both were made, 1895, by Maj. Miller (see Projects), **95,** 1833, 1838.

Investigation of the character, value, etc., of the imp. made at the mouth by the Brazos River Channel & Dock Co., au. act June 3, 1896; made, 1896–97, by BE., **97,** 1815. Surs. made under direction of this board by the Coast and Geodetic Sur., which detailed to that work H. L. Marindin. **R., 97,** 1836. Report of Civil Engineer Corthell, representing the company, **97,** 1840.

Ex. and sur. au. act June 6, 1900, with view to procuring 4′, 5′, and 6′ made; **Rs.** by Capt. Riché, Aug. 29, 1900, Dec. 22, 1900, and Jan. 30, 1901, submitted with est. of $5,950,000 for imp. by locks and dams, and $225,000 an. for mainten.; and est. of $3,725,000 for imp. by open chan. work and locks and dams combined, and $145,000 an. for mainten.,[1] **01,** 411, 1975, 2004, 2009.

Maps: **95,** 1844.

Sketch of mouth, **75,** 936.

List of maps relating to imp. of R. mouth (not printed), **97,** 1834.

Part (b), U-40 Brazos River, Tex. (Mouth of.)

APPROPRIATIONS.[2]

1899,	$85,000,	**99,** 1969.
1902,	50,000,	**02,** 1386.
1905,	50,000,	**05,** 395.
1906,	87,500,	**06,** 1348.
1907,	35,000,	**07,** 1474.
1911,	100,000,	**11,** 1800.
1912,	25,000,	**12,** 2020.
Total,	[3] 432,500	

COMMERCE.

Description of, **05,** 395; **06,** 424, 1348; **11,** 593.

Very little C. during year, **08,** 469.

Only vessels using chan. are fishing schooners, **10,** 554.

Some effect on ocean freight rates on competing lines to Galveston, **12,** 714.

During 1911, 3,063 t., valued at $759,678, **12,** 714.

CONTRACTS.

1899. C. Clarke & Co., st., $2.69 and $3.59 t.; logs in place, 20¢ l. f. ($68,105), **00,** 2333.

1903. Moore & Sieber, repairing js. and constr. cribs and spurs, $3.14 t. for small riprap, $3.95 for large riprap, and 35¢ l. f. for logs placed in cribs and spurs covering all necessary fastenings and brush, **03,** 1345.

1905. Charles Clarke & Co., repairing js., $3.12 t. for small riprap and $3.73 t. for large riprap, **06,** 1348.

1907. Charles Clarke & Co., j. work, 9,000 t. riprap, at $3.58 t. in place in js., **08,** 1535.

1911. Bowers Southern Dredging Co., dr. 600,000 c. y., 15¢ c. y., **12,** 2020.

1912. Charles Clarke & Co., repairing ne. j.; prices listed, **12,** 2020.

ENGINEERS.

Chief of Engineers. **R., 99,** 343, 346; **00,** 390, 396; **01,** 407; **02,** 340; **03,** 358; **04,** 377; **05,** 394; **06,** 424; **07,** 446; **08,** 469; **09,** 492, 497; **10,** 553; **11,** 592; **12,** 713, 724.

Boards:

Special, convened to ex. effect of storm of Sept. 8, 1900, on js. in Brazos R.; est. cost of completion of existing proj. increased $175,000 (amount of damage), **01,** 412, 2022. (Col. H. M. Robert, Maj. H. M. Adams, Capt. C. S. Riché,[4] and Capt. Edgar Jadwin.)

In charge:

Capt. C. S. Riché, 1899–1903. **R., 99,** 1969; **00,** 2332, 2426; **01,** 1940; **02,** 1386; **03,** 1344.

Col. H. M. Robert. **R., 99,** 1977.

Capt. Edgar Jadwin, 1904–06. **R., 04,** 2005; **05,** 1510; **06,** 1348.

Capt. J. C. Oakes, 1907–09. **R., 07,** 1474; **08,** 1534; **09,** 1511.

Maj. G. P. Howell, 1910–11. **R., 10,** 1654; **11,** 1799.

Maj. E. I. Brown, 1912–. **R., 12,** 2019.

Assistants:

S. W. Campbell. **R., 00,** 2334; **01,** 1943; **04,** 2007.

E. M. Hartrick. **R., 00,** 2433.

R. B. Talfor. **R., 00,** 2435; **01,** 1943.

Lt. M. L. Walker, **01,** 402.

LEGAL PROCEEDINGS.

The Brazos River Channel & Dock Co., Apr. 25, 1899, transferred to the U. S. js. and auxiliary works, also a release of rights and privileges conferred upon t by its charter or by act of Aug. 9, 1898, **99,** 1969.

By act of June 3, 1896, it would seem that it was unlawful for the Senate to require the ex. called for Jan. 28, 1899, **99,** 1977.

OPERATIONS.

1899–00. Constr. of ne. and sw. js. in progress, **00,** 2332.

1900–01. Work on js. continued until hurricane of Sept. 8, 1900, **01,** 1941.

1903–04. 75,107 l. f. of logs, and 2,890.85 t. of riprap placed in building and fill of 119 cribs on the east bank from station O of ne. j. up to the Galveston-Brazos Canal; 24,970 l. f. of logs, and 406.10 t. of riprap used in building 15 spurs along the right bank of the R. in the big bend above lighthouse; 2,746.51 t. riprap used in repairing shore end of ne. j. and in filling some of the worst gaps between station 12 and stations 40 and 41, **04,** 2007.

1905–06. 3,878.44 t. small riprap and 12,119.28 t. large riprap delivered and placed between stations 11 and 13, 16 and 24, and 27 and 44, ne. j., partially completing its repairs, **06,** 424, 1348.

1906–07. 3,887.03 t. of small riprap placed; 7,191.42 t. large riprap delivered and placed between stations 10 and 47, ne. j., and station 38+85 and station 50 sw. j.; repairs made to spur dikes in Big Bend above lighthouse; crib dikes on n. bank between j. and entrance to Brazos Canal repaired, **07,** 1474.

1907–08. 11,255.02 t. large and small riprap delivered and placed, 9,140.56 t. distributed over sw. j. and 2,114.46 t. over ne. j., and the crib dike running on n. bank to the entrance of Brazos Canal; repairs to js. are practically completed, **08,** 1534.

1911–12. 618,361 c. y. dr.; 2,323 t. riprap placed in repairing ne. j., **12,** 2019.

PHYSICAL CHARACTERISTICS. (See Surveys.)

Effects of storm of Sept. 8, 1900, on js., **01,** 1942.

Depths over bar and below js. at different dates determined by Coast and Geodetic Sur., etc., **05,** 394.

Range of tide, 1.77′, **06,** 425.

Description of, **07,** 446.

Minimum d. on bar, 17′ at m. l. w., **08,** 469.

Erosion of R. at right bank with tendency to break through Jupiter Cut; action for prevention imperative, **09,** 1511.

Depth on bar beyond js. 18′ at m. l. w., and outer end of js. to the wharf, 13′, **11,** 593.

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[1] H. D. 283 and 450, 56th, 2d.

[2] The unexpended balance of app., act of Aug. 5, 1886, amounting to $16,651.57 (see Brazos River), reallotted Mar. 3, 1899, **00,** 2332.

[3] This amount, with the $163,750, under the head of Brazos R., Tex., app. for mouth of Brazos R. between 1880 and 1896, makes $596,250 the total of app. as given in an. report for 1912.

[4] H. D. 133, 56th, 2d.

PROJECTS.

By Col. Robert, 1899, for putting the existing js. in the mouth of the creek in a fair condition to protect a dr. while working in the chan.; also for beginning to construct spur dikes to narrow the chan. between the js., and for dr. a chan. to a d. of 18′ m. l. t., and 150′ w.; est., $250,000, **99,** 1978; **00,** 2332.

Capt. Riché est., 1900, it would cost (1) $1,265,000 to extend the js. ½ m.; (2) $200,000 to dr. and to build a system of spur dikes to contract the chan. to 440′ between js., with $30,000 annually for mainten.; (3) $1,300,000 for a 20′ chan., 150′ w., by j. extension, spur dikes, and dr., with $30,000 an. for mainten., or $375,000 for dr. alone, with $40,000 an. for mainten., **00,** 2428.

$175,000 added to proj. est. (See Board of Engineers.)

By act June 13, 1902, for reinforcing shore end n. j. to render unlikely any flanking, and filling gaps in j., **03,** 359.

BERH. recom., 1909, existing proj. should be confined to maintaining js., **09,** 492.

SURVEYS.

Sur. and est. for imp. the mouth of Brazos R. near Velasco, Tex., with all information for continuing the work done by the Brazos River Channel & Dock Co., or otherwise, with probable cost, ordered, Jan. 28, 1899, by a resolution of the Senate of the United States; data from the report of the BE., 1896, submitted, 1899, by Col. Robert (see Legal proceedings; Projects), **99,** 1977.

Ex. and sur. of mouth of Brazos R., Tex., with est. of cost of (1) extending the js. ½ m.; (2) of the d. and w. of chan. to be obtained by such extension; (3) and cost of obtaining a 20′ chan., 150′ wide, ordered by act of Mar. 3, 1899; made, 1900, under direction of Capt. Riché (see Projects), **00,** 2426.

Descriptions of soundings, triangulations, levels, and cross sections, **00,** 2436.

Special est. of storm effect of 1900 on js. (See Boards of Engineers.)

Pre. ex. of the mouth to determine what further imp., if any, should be made thereon, ordered by act of Mar. 2, 1907; unfav. **R.** made by Capt. Oakes, 1908,[1] **09,** 497.

An ex. of the js. was made to ascertain the amount of damage caused by the storm of July 21, 1909; the js. were not breached but suffered the loss of many cap blocks due to heavy seas and drift; est. to place js. in condition they were before storm, $100,000, **10,** 1654.

A sur. of Big Bend of the Brazos R. was made, with an est. of imp. to prevent the threatened cut-off at Jupiters Cut, **10,** 1654.

R. by BERH. Feb. 4, 1910, req. by R. and H. Com. to determine if any further imp. is necessary. Board is of opinion none is required.[2]

Ex. with view to preventing a cut-off at Jupiters Cut, ordered by act June 25, 1910; made and **R.** dated Sept. 7, 1910, submitted by Maj. Howell (unfav.),[3] **12,** 724.

Maps.[1] **08,** 1534; **09,** 1512.

Cong. docs., etc., relating to exs., surs., plans, etc. **02,** 340; **03,** 358; **05,** 394; **06,** 425; **07,** 447; **11,** 592.

Part (c), U-40 Brazos River, Tex. (Velasco to Old Washington.)

APPROPRIATIONS.

1905,	$25,000, **05,** 1508.
1907,	75,000, **07,** 1485.
1909,	*25,000, **09,** 1535.
	[4] 15,000, **09,** 1535.
1910,	45,000, **10,** 1677.
1911,	25,000, **11,** 1826.
1912,	15,000, **12,** 2022.
Total,	225,000

COMMERCE.

No C. on this portion of the R., **05,** 394.

Leading articles are sugar, molasses, oil, wood, and provisions, **08,** 481.

Considerable increase in; RR. rates Galveston to Brazoria 35¢ 100 lbs., water rates 20¢ 100 lbs., but agreement between Brazoria and RR. prevents town from availing itself of lower rate, **10,** 1677.

No C. can develop until stream is canalized, **11,** 1826.

CONTRACTS.

1905. Sabine Tram Co., long leaf yellow pine lumber, 5″ x 8″ x 24′, $15 per M f. b. m., 3″ x 12″ x 16′, $15.50 per M f. b. m., **05,** 1508.

1908. Thos. Benson, lease of room, $2.50 per month, **09,** 1535.

1909. T. L. Smith, lease of room, $2.50 per month, **09,** 1535. M. A. Sweeney Shipyard & Foundry Co., furnishing and delivering complete snag boat, $28,490, **10,** 1678.

ENGINEERS.

Chief of Engineers. **R., 05,** 393; **06,** 422; **07,** 453; **08,** 481; **09,** 505; **10,** 568; **11,** 610; **12,** 715.

In charge:

Capt. Edgar Jadwin, 1905–06. **R., 05,** 1507; **06,** 1344.

Capt. W. P. Wooten, 1907–08. **R., 07,** 1485; **08,** 1554.

Capt. A. E. Waldron, 1909–10. **R., 09,** 1534; **10,** 1677.

Capt. T. H. Jackson, 1911–. **R., 11,** 1825.

Maj. E. I. Brown, 1912–. **R., 12,** 2021.

Assistants.

Chas. Schuster. **R., 05,** 1509; **06,** 1345.

Capt. G. M. Hoffman, **05,** 381.

OPERATIONS.

1904–05. Snag boat *Capt. C. W. Howell* fitted with dr. bucket; preliminary snagging of entire reach from Old Washington to Richmond; two-thirds of js. between Hemstead and Richmond constr.; orange-peel bucket trans. to hoister *Navasota;* l. of pile and brush dike completed, r. blasted, and clay blasted and removed, **05,** 1507–09.

1905–06. 11 pile and brush js. and 3,100′ of r. js. constr.; 121,214 c. y. dr.; total cost of work from commencement given, **06,** 1344.

1906–07. 450 l. f. r. j. partly completed; 448 snags and other obstr. removed; new hull placed on snag boat *Navasota,* and plant repaired; 3 drifts removed from near the St. Louis, Brownsville & Mexico RR., **07,** 1485.

1907–08. 1,500′ of brush and pile j. completed, and 928′ partly completed; 7,219 snags and other obstr. and 1 side jam removed; 80% of proj. completed, **08,** 1554.

1908–09. 6,886′ brush and pile j. completed, 810′ of which was new j. and 6,076′ replacing portions of old js.; obstr. removed; repairs to snag boat commenced, **09,** 1534.

1909–10. Snagging operations continued over 32 m. of R., and 2,455 l. f. of shoals dr., **10,** 1677.

1910–11. Snag boat *Waco* completed, accepted and commenced snagging; operations detailed, **11,** 1825.

1911–12. Snags and obstr. removed from R.; 8,558 c. y. sand dr.; work on raising wrecked snag boat *Navasota* in progress, **12,** 2022.

* Allotment.
[1] H. D. 1087, 60th, 2d.
[2] R. and H. Com. 28, 61st, 2d.
[3] H. D. 280, 62d, 2d.
[4] Trans. from Galveston district on account of snag boat *Capt. C. W. Howell.*

PHYSICAL CHARACTERISTICS.

R. subject to big floods and caving banks, **05,** 1508.

Low water references from daily gauge readings by U. S. Geol. Sur. at Richmond, **06,** 1344.

List of shoals in Brazos R., **06,** 1345–1347.

This section of R. navigable for light draft boats for about 8 months in the year; a d. of 4′ for 8 months in the year has been obtained, **07,** 453.

Tidal influence extends to m. 35; R. has small flow, not sufficient to give good navigable d., **11,** 1825, 1826.

U. S. snag boat *Navasota* sank; machinery being removed; new hull to be built, **12,** 2021.

PROJECTS.

Act Mar. 3, 1905, au. continuing imp. by open chan. work and dike constr., and increased area of proj. to cover R. between Velasco and Washington,[1] **05,** 393.

SURVEYS.

Reconnoissance made, 1904, by Capt. Jadwin revealed existence of more shoals than given by sur. of 1901; number of shoals and l. of same given, **05,** 1509.

Of 16 js., for purpose of observing effect on chans., **09,** 1534.

Bet. mouth and Waco,[1] **01,** 411, 1975, 2004, 2009. (See Brazos R., bet. mouth and Waco.)

Part (d), U-40 Brazos River, Tex. (Richmond to Old Washington.)[2]

APPROPRIATIONS.

1902, $150,000, **02,** 1385.

COMMERCE.

Letters regarding benefits of proposed imp. from interested parties, **01,** 1982.

CONTRACTS.

1904. The Charles Barnes Co., engines ($3,350) and boilers ($3,120) for snag boat, **04,** 2004.

ENGINEERS.

Chief of Engineers. **R., 01,** 411; **02,** 339; **03,** 357; **04,** 377.

In charge:

Capt. C. S. Riché, 1901–03. **R., 01,** 1974, 2004, 2011; **02,** 1385; **03,** 1343.

Capt. Edgar Jadwin, 1904. **R., 04,** 2004.

Assistants:

F. Oppikofer. **R., 01,** 2006.

S. Campbell. **R., 01,** 2014.

Lt. M. L. Walker, **02,** 332.

D. A. Watt. **R., 04,** 2005.

Capt. G. M. Hoffman, **04,** 366.

OPERATIONS.

1902–03. Plant under constr. at Old Washington nearly ready; force organized; hull of snag boat, pile-driver boat, office boat, mess boat, and 1 material barge completed and launched, **03,** 1343.

1903–04. Some r. removed; about 3,000 snags taken from bed, and 34,400 snags and trees cut up on the banks; stern-wheel steam launch completed; hull of self-propelling snag boat launched; surs. commenced for constr. of dikes, **04,** 377, 2005.

PHYSICAL CHARACTERISTICS.

R. obstr. by shoals and rapids, **01,** 2011.

PROJECTS.

Act June 13, 1902, au. proj. for imp. this section of R. by removing snags, etc., and constr. training walls and spur dikes, **02,** 339;[1] est., $200,000, **03,** 357.

SURVEYS.

Ex. and sur. au. act June 6, 1900, mouth to Waco, with view to providing 4′, 5′, and 6′; **Rs.** by Capt. Riché, Aug. 29, Dec. 22, 1900, and Jan. 30, 1901. Est. for imp.: By locks and dams, $5,950,000, and $225,000 an. for mainten.; by open chan. work and locks and dams combined, $3,725,000, and $145,000 an. for mainten.,[3] **01,** 411, 1975, 2004, 2009.

For constr. of dikes, **04,** 377.

Part (e), U-40 Brazos River, Tex. (Old Washington to Waco.)

APPROPRIATIONS.

1905,	$75,000,	**05,** 392.
1907,	75,000,	**07,** 1484.
1908,	100,000,	**08,** 1553.
1909,	*75,000,	**09,** 1534.
1909,	50,000,	**09,** 1534.
1910,	75,000,	**10,** 1676.
1911,	50,000,	**11,** 1824.
1912,	200,000,	**12,** 2025.
Total,	700,000	

COMMERCE.

Freight on roads heavy and rates high; no C. of account yet developed, **07,** 452, 1484.

Imp. of this portion as well as that below Old Washington would cause reduction in rates throughout contiguous country, **09,** 504.

CONTRACTS.

1910. Grainger & Co., furnishing and delivering iron and steel at Herrington, Tex., $23,172; unit prices listed, **10,** 1676.

1911. Independent Bridge Co., lock valves, 2 sets steel lock gates and operating gear; unit prices listed, **12,** 2025.

1912. Chas. Sigler, constr. RR. from Downs, Tex., to site of Lock and Dam No. 8, unit prices listed, **12,** 2025.

ENGINEERS.

Chief of Engineers. **R., 05,** 392; **06,** 422, 429; **07,** 452; **08,** 479; **09,** 503; **10,** 567; **11,** 608; **12,** 716.

In charge:

Capt. Edgar Jadwin, 1905–06. **R., 06,** 1343.

Capt. W. P. Wooten, 1907–08. **R., 07,** 1483; **08,** 1552.

Capt. A. E. Waldron, 1909–10. **R., 09,** 1533; **10,** 1675.

Capt. T. H. Jackson, 1911–. **R., 11,** 1823.

Maj. E. I. Brown, 1912–. **R., 12,** 2022.

Assistant. Capt. G. W. Hoffman, **05,** 381.

LEGAL PROCEEDINGS.

Land for 1 lock at Hidalgo Falls deeded to U. S. and jurisdiction ceded by State of Texas, **06,** 1343.

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* Allotment.

[1] H. D. 283, 56th, 2d.

[2] After 1904 continued under Brazos R., Velasco to Old Washington.

[3] H. D. 283 and 450, 56th, 2d.

OPERATIONS.

1905-06. Preparations in progress for commencing work at lock, Hidalgo Falls, **06,** 1343.

1906-07. Excavation made for land wall at Lock and Dam No. 1, Hidalgo Falls, and 90% of concrete placed; filling behind wall partly completed and upper guide crib completed except paving; constr. of locktender's dwelling at cost of $3,038.37 completed, but building was completely destroyed by fire, **07,** 1483, 1484. Quantities and cost of material given, **07,** 1484.

1907-08. Concrete in land wall, Lock No. 1, Hidalgo Falls, filling behind wall, excavation for foundation of R. wall and floor, driving round and sheet piles for foundation of R. wall and floor, and placing concrete in lower portion of R. wall completed during year, **08,** 1552. Principal items of work given, **08,** 1553.

1908-09. Constr. of R. wall and floor of lock, filling in and paving behind land wall, constr. upper and lower cribs, placing bank protection above lock, and repairing plant completed during year, **09,** 1533. Work about 55% completed, **09,** 504. Principal items of work given, **09,** 1533.

1909-10. Abutment completed and foundation piles driven for dam at lock and dam, Hidalgo Falls; work suspended Apr. 1, 1910, pending arrival of iron and steel; principal items of work given, **10,** 1675. Work about 60% completed, **10,** 568.

1910-11. Iron and steel for lock and dam at Hidalgo Falls delivered; constr. work suspended Nov. 15, 1910; condition of work stated; work commenced on plans for Lock and Dam No. 8, **11,** 1823.

1911-12. Work continued on weir and drift chute, locktender's dwelling constr., and sur. made of lock site at Lock and Dam No. 1; work about 90% completed, **12,** 2022. Work on constr. of locktender's dwelling, ry. spur 2.8 m. l., assembling of plant, purchasing of material, cofferdam constr. and driving of foundation piles begun; about 25% completed, **12,** 2022.

PHYSICAL CHARACTERISTICS.

From Hidalgo Falls to Waco the profile of R. is an alternating series of steep and gentle slopes, rendering it susceptible of effective imp. by a combination of locks and dams with open chan. work bet., **07,** 452.

Damage by flood of May, 1908, described, **08,** 1553.

Gauge readings of 5′ or more, number of periods and duration at Waco, July 1, 1905, to June 30, 1911, **11,** 1824.

PROJECTS.

Provided for conditionally by act of Mar. 3, 1905, to determine whether navigation can be secured at reasonable cost by any method other than by locks and dams, and if not the least number of locks and dams that will furnish such navigation, and to secure navigation by open chan. work or by not to exceed 9 locks and dams, **05,** 392.

Expend. of funds app. in 1905 ($75,000) au. for constr. of land wall of 1 lock at Hidalgo Falls, **06,** 421.

Act June 25, 1910, au. constr. of Lock and Dam No. 8, about 7 m. below Waco, **10,** 567.

Reference to proj. au. by Congress, proposed work during ensuing year, and sites most fav. for future work,[1] **11,** 1824.

Act July 25, 1912, app. $200,000 for Lock and Dam No. 8 and 2 addl. locks, **12,** 717.

SURVEYS.

Ex. with view to determining whether 4 to 6 months navigation could be secured at reasonable cost by any method other than by locks and dams; **R.** July 11, 1905, by Capt. Jadwin; plan presented; est., $2,915,000, with $100,000 an. mainten. (not considered advisable to undertake imp. at "present" time),[2] **06,** 429.

Sur. made to show exact extent of damage by excessive flood of May, 1908, **08,** 1553.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to selection of sites for addl. locks and dams bet. Old Washington and Waco, made and approx. locations of 7 addl. locks and dams selected, as shown in profile on sheet printed in H. D.; **Rs.** by Capt. Waldron, June 5, 1909, and Dec. 3, 1910,[1] **12,** 723, 724.

Maps.[1]

U-45 SAN BERNARD RIVER, TEX.

COMMERCE.

Farm products the principal articles of C., **00,** 2445.

ENGINEERS.

Chief of Engineers. **R.,** **00,** 396.

In charge. Capt. C. S. Riché, 1899–1900. **R.,** **00,** 2438, 2440.

Assistant. S. M. Wilcox. **R.,** **00,** 2447.

PHYSICAL CHARACTERISTICS.

San Bernard R. empties into the Gulf of Mexico about 10 m. sw. of Brazos R. entrance, **00,** 2439.

Description of, **00,** 2445.

PROJECTS.

Capt. Riché est., 1899, $270,000 to make the imp. as a component part of an inland light-draft navigation system, **00,** 2441.

SURVEY.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects) **00,** 2439, 2440.

Maps. **00,** 2444.

U-46 CANEY CREEK, TEX.

COMMERCE.

Small, and no increase expected, **89,** 1581.

Farm products the principal articles of C., **00,** 2457.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 207; **00,** 397.

In charge:

Maj. O. H. Ernst, 1888–89. **R.,** **89,** 1580.

Capt. C. S. Riché, 1899–. **R.,** **00,** 2453, 2455.

Assistants:

R. B. Talfor. **R.,** **89,** 1581.

S. M. Wilcox. **R.,** **00,** 2457.

PHYSICAL CHARACTERISTICS.

Caney Creek at one time emptied into the Gulf of Mexico; now empties into Matagorda B., **00,** 2454.

Description of, **00,** 2457.

PROJECTS.

Capt. Riché est., 1900, $20,000 to make the imp. as a part of an inland light-draft navigation system, **00,** 2456.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Ernst (**R.** unfav.), **89,** 1580.

Ex. and sur. au. act Mar. 3, 1899; made, 1899–1900, by Capt. Riché (**R.** fav.; see Projects), **00,** 2454, 2455.

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[1] H. D. 95, 62d, 1st.

[2] H. D. 705, 59th, 1st.

U-47 MATAGORDA BAY, TEX.

ENGINEERS.
Chief of Engineers. **R., 06,** 429.
In charge. Capt. Edgar Jadwin, **06,** 411.

SURVEY.
Pre. ex. au. act Mar. 3, 1905, for chan. to Matagorda. **R.,** Capt. Jadwin, Aug. 9, 1905[1] (unfav.), **06,** 429.

U-47(a) ALLIGATOR HEAD HARBOR, MATAGORDA BAY, TEX.

COMMERCE.
Unimportant, **00,** 2464.

ENGINEERS.
Chief of Engineers. **R., 00,** 397.
In charge. Capt. C. S. Riché, 1899–1900. **R., 00,** 2462.
Assistant. E. M. Hartrick. **R., 00,** 2465.

PHYSICAL CHARACTERISTICS.
Description of; Alligator Head on mainland at the foot or w. end of Matagorda B., **00,** 2463.

SURVEY.
Ex. for plans and est. for removal of bars and furnishing inlet for ocean-going vessels, au. act Mar. 3, 1899; made, 1899, by Capt. Riché (**R.** unfav.), **00,** 2463.

U-48 COLORADO RIVER, TEX.[2]

APPROPRIATION.
1852, $20,000, act Aug. 30.

COMMERCE.
Too small to be benefited by R. imp., **95,** 1823; **00,** 2459.

ENGINEERS.
Chief of Engineers. **R., 66,** 7; **91,** 235; **95,** 266; **99,** 346; **00,** 397; **09,** 497; **12,** 724.

In charge:
Maj. C. J. Allen. **R., 91,** 1939.
Maj. A. M. Miller, 1895. **R., 95,** 1821.
Capt. C. S. Riché, 1900–. **R., 00,** 2458, 2461.
Capt. J. C. Oakes, 1909. **09,** 469.
Lt. Col. L. H. Beach, 1909. **09,** 469.
Maj. E. I. Brown, 1912. **12,** 688.

Assistants:
S. M. Wilcox. **R., 95,** 1824.
E. M. Hartrick. **R., 00,** 2460.

PHYSICAL CHARACTERISTICS.
Description of, between mouth and Wharton; raft, sand bars, sharp bends, and snags, **95,** 1822.

Great raft in R., **91,** 1939, **00,** 2460. "Raft" situated about 12 m. from mouth of R.; really a succession of rafts covering 15 to 20 m. of R., **00,** 2462.

SURVEYS.
Ex. for removal of raft at the mouth au. act Sept. 19, 1890; made, 1891, by Maj. Allen (**R.** unfav.), **91,** 1939.
Ex. from mouth to Wharton, Tex., au. act Aug. 17, 1894; made by Maj. Miller (**R.** unfav.), **95,** 1821.
Ex. mouth to great raft, au. act Mar. 3, 1899; made, 1899, by Capt. Riché (**R.** unfav.), **00,** 2459.
Ex. for 10′ canal, 100′ w., around the raft in Colorado R., in Matagorda County, Tex., au. act Mar. 3, 1899; made, 1899, by Capt. Riché (**R.** unfav.), **00,** 2461.
Ex. and sur. au. act Mar. 2, 1907, to obtain navigable chan. from mouth as far up as practicable; made, 1909[3] (**R.** unfav.), **09,** 497.
Ex. and sur. au. act Feb. 27, 1911, to gain imp. by locks and dams (**R.** to come), **12,** 724.

U-53(a) MATAGORDA BAY TO PALACIOS, TEX. (Channel.)

ENGINEERS.
Chief of Engineers. **R., 08,** 473.
In charge. Capt. J. C. Oakes, **08,** 449.

SURVEY.
Pre. ex. au. act Mar. 2, 1907, of chan. from Palacios through Tres Palacios B. to Matagorda B., Tex. **R.,** Capt. Oakes, Aug. 7, 1907[4] (unfav.), **08,** 474.
R. by BERH., Sept. 12, 1910, reviewing above **R.** Board is still of opinion it would not be advisable to imp.[5]

U-54 PILKINGTON BAYOU, TEX.

ENGINEERS.
Chief of Engineers. **R., 11,** 598.
In charge. Maj. G. P. Howell, **11,** 566.

SURVEY.
Pre. ex. au. act June 25, 1910. **R.,** by Maj. Howell, Aug. 26, 1910[6] (unfav.), **11,** 598.

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[1] H. D. 154, 59th, 1st.
[2] Ex.—**R.** (fav.), Apr. 27, 1853. (H. D. 482, 55th, 2d.)
[3] H. D. 1211, 60th, 2d.
[4] H. D. 448, 60th, 1st.
[5] R. and H. Com. 53, 61st, 3d.
[6] H. D. 10, 62d, 1st.

U-55 TRES PALACIOS RIVER, TEX.

ENGINEERS.
Chief of Engineers. **R., 12,** 724.
In charge. Maj. G. P. Howell, **12,** 688.

SURVEY.
Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 724.

U-56(a) MATAGORDA BAY TO LAVACA BAY, TEX. (Channel between.)

COMMERCE.
Chief industry is shipping of fish and oysters; prospects are that rice will become leading agricultural product, **04,** 2016.

ENGINEERS.
Chief of Engineers. **R., 04,** 382.
Boards. BERH. concurs in DO. **R.** on inadvisability of imp., **04,** 2018.
In charge. Capt. C. S. Riché, 1904. **R., 04,** 2015.

SURVEY.
Pre. ex. for chan. 9′ x 100′, au. act June 13, 1902. **R.,** Capt. Riché, June 17, 1903[1] (unfav.), **04,** 382, 2015.

U-56(b) PASS CAVALLO TO PORT LAVACA, TEX. (Channel.)

APPROPRIATIONS.
1910, $10,000, **10,** 1654.

COMMERCE.
In 1911, 734 t., **12,** 718.
Imp. has had no effect on rates, **12,** 718.

CONTRACTS.
1910. Bowers Southern Dredging Co., dr. through Sands Pt. and Gallinipper Reefs, 24.7¢ c. y., **11,** 1800.

ENGINEERS.
Chief of Engineers. **R., 08,** 474; **09,** 497; **10,** 554; **11,** 593; **12,** 718.

In charge:
Capt. J. C. Oakes, 1908–10. **R., 10,** 1654.
Maj. G. P. Howell, 1911. **R., 11,** 1800.
Maj. E. I. Brown, 1912–. **R., 12,** 2026.

OPERATIONS.
1910-11. 36,200 c. y. dr., making chan. 7′ x 80′; proj. completed, **11,** 1800.

PHYSICAL CHARACTERISTICS.
Max. draft, 1912, at m. l. w., 7′, **12,** 718.
Variation of water surface about 1′, **12,** 718.

PROJECTS.
Act June 25, 1910, au. chan. 7′ x 80′ to Port Lavaca; est., $10,000, and $2,500 an. mainten.,[2] **10,** 554.

SURVEYS.
Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Capt. Oakes, Mar. 20 and May 28, 1908; est., $10,000,[1] **08,** 474; **09,** 497.
Maps.[2]

U-58(a) PASS CAVALLO HARBOR AND INLET.[3]

APPROPRIATIONS.

1876,	$20,000,	**77,** 75.
1878,	25,000,	**78,** 84.
1879,	25,000,	**79,** 111.
1880,	50,000,	**80** 1245.
1881,	60,000,	**81,** 1358.
1882,	60,000,	**83,** 1090.
1884,	50,000	**84,** 1312.
1886,	37,500,	**86,** 1330.
Total,	327,500	

COMMERCE.
Imp. of H. not warranted, **71,** 532.
4 vessels wrecked in storm of 1854, **71,** 531.

CONTRACTS.
1880. R. Kanters & Son, j. constr., **81,** 1356.
1881. G. L. Long, j. constr., **82,** 1463.
1882. A. M. Shannon & Co., j. constr., **83,** 1089.
1884. A. M. Shannon, j. constr., **85,** 1463.

DEFENSE.
Fort Esperanza on Matagorda Isld., **71,** 531.

ENGINEERS.
Chief of Engineers. **R., 70,** 31, 62; **71,** 66; **73,** 66; **74,** 74; **77,** 75; **78,** 84; **79,** 111; **80,** 148; **81,** 202, 204; **82,** 199, 201; **83,** 204; **84,** 219; **85,** 228; **86,** 225; **87,** 191; **88,** 175; **89,** 205.

Boards:
Constituted, S. O. No. 63, C. of E., 1879, to **R.** upon imp. of Pass Cavallo Inlet into Matagorda B. Ordered to convene at New York July 1, 1879, **79,** 928. **R., 80,** 1256–1260. (Cols. Tower and Newton and Lt. Col. Gilmore.)
Convened, New York, Nov. 11, 1887, to ex. and **R.** upon the advisability of continuing further imp. at Pass Cavallo. **R., 88,** 1299. (Cols. Casey and Abbot, Lt. Col. McFarland, and Maj. King.)

In charge:
Lt. G. B. McClellan, 1853. **R.** (extract), **71,** 532.
Capt. C. W. Howell, 1870–80. **R., 71,** 526; **74,** 760; **77,** 469; **78,** 613; **79,** 921; **80,** 146. Recom. that expend. of the app. of 1876 be suspended until further action of U. S.; approv., **77,** 469, 471.

[1] H. D. 180, 58th, 2d.
[2] H. D. 1082, 60th, 2d.
[3] Sur.—**R.,** Apr. 18, 1853; est., $11,739. (H. D. 482, 55th, 2d).

Maj. S. M. Mansfield, 1880–86. **R., 80,** 1244, 1256; **81,** 1356; **82,** 1463, 1493; **83,** 1089; **84,** 1310; **85,** 1462; **86,** 1328.
Maj. O. H. Ernst, 1886–89. **R., 87,** 1429; **88,** 1301, 1302; **89,** 1564.

Assistants:
Lt. E. A. Woodruff. **R., 71,** 531.
H. C. Ripley. **R., 74,** 760; **79,** 924.
Capt. C. E. L. B. Davis. **R., 79,** 923.
A. Cross. **R., 79,** 925.
J. M. Picton. **R., 82,** 1494.
H. C. Ripley. **R., 82,** 1465.

OPERATIONS.

1880–81. Partial constr. of 958 l. f. of j. on s. side of chan., **81,** 1357.
1881–82. Work in progress over 1,325 l. f. of j., **82,** 1463, 1466.
1882–83. Foundation course extended seaward 2,250′, **83,** 1089.
1883–84. Foundation course extended 1,723′ seaward, making a total extension of 5,253 l. f., **84,** 1311.
1884–85. 7,158 c. y. of mattress and 1,861 t. of st. placed in the j. to increase its height, **85,** 1463.
1885–86. 4,027,636 c. y. of mattress and 1,131 t. of st. placed in the work, **86,** 1329.

PHYSICAL CHARACTERISTICS.

General, **71,** 531, 532; **74,** 761, 762, 764, 765; **79,** 924, 927; **80,** 1257.

PLANS.

By Capt. Howell, sheet piling, $36,000, **77,** 470.
By A. Cross, js. to guard against abrasion, $45,800, **79,** 926.
By Maj. Mansfield, 1881, dr. chan. 3′ x 100′ across the bar in Matagorda B. in front of inlet to St. Marys Bayou; est., $10,000, **82,** 1494.

PROJECTS.

By Capt. Howell, 1874, gabionades to close Elizabeth and Decrow Chans., to confine current to the main chan., scouring to deepen it.; est., $715,325, **74,** 763, 764; **77,** 469.
The BE., 1879, recom. extending j. from the head of Matagorda Isld. in a se. direction, and the constr. of groins and transverse js. for shore protection, to obtain a 12′ chan. across the bar, and to protect the head of Matagorda Isld.; est., $1,039,280, **80,** 1258–1260; **86,** 1329; **87,** 1430.
In 1887, in view of the failure to accomplish the desired result, the BE. recom. no further work be undertaken, **88,** 1300.

SURVEYS.

By Lt. Woodruff, 1870. **R., 71,** 531.
By H. C. Ripley, 1873. **R., 74,** 760.
By A. Cross, 1878, under the direction of Capt. Davis. **R., 79,** 925. Comparison of surs. of 1873 and 1878, **79,** 924.
Near mouth of St. Marys Bayou, au. act Mar. 3, 1879, **81,** 203; made by Maj. Mansfield, 1881, **82,** 1493.
Comparison of surs., **82,** 1467.
Of Pass Cavallo, made, 1887, by Maj. Ernst, **88,** 1302.
Maps. Of Cavallo Pass, **80,** 1258; **85,** 1462.

U-58 (b) PASS CAVALLO TO PORT O'CONNOR, TEX. (Channel.)

ENGINEERS.

Chief of Engineers. R., 08, 474; **09,** 497.
In charge. Capt. J. C. Oakes, **08,** 449; **09,** 497.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Capt. Oakes, Apr. 7, 1908, on subject of estab. a H.[1] (unfav.), **08,** 474; **09,** 497.

U-61 GUADALUPE RIVER, TEX.

APPROPRIATIONS.

1907,	$38,829,	**07,** 1473.
1908,	21,871,	**08,** 1531.
1909,	50,000,	**09,** 1509.
1909,	*32,000,	**09,** 1509.
1910,	50,000,	**10,** 1651.
1912,	40,000,	**12,** 2018.

Total, 232,700 (incl. misc., $232,720.55, **12,** 2018).

COMMERCE.

Unimportant, **75,** 926, 927.
Description of, **95,** 1827.
Sugar cane, etc., will be moved over section below Victoria, recently opened, **10,** 551.
1911, 6,000± t., **12,** 2018.
Imp. has had no effect on rates. **12,** 711.

CONTRACTS.

1907. Bowers Southern Dredging Co., dr., 18.8¢ c. y., **09,** 1509.
1908. Kingsford Foundry & Machine Works, 2 fuel oil tanks, 2 fresh water tanks and 4 brass deck screw plates; amount, $895, **08,** 1532.

ENGINEERS.

Chief of Engineers. R., 75, 79; **89,** 207; **95,** 266; **04,** 381; **06,** 430; **07,** 443, 444, 451; **08,** 467; **09,** 489; **10,** 551; **11,** 589; **12,** 710, 724.

Boards. BERH. reviewed, July 29, 1903, **R.** of Capt. Riché, and concurred on undesirability of imp.,[2] **04,** 2013.

In charge:
Capt. C. W. Howell, **75,** 79. **R., 75,** 924.
Maj. O. H. Ernst, 1888. **R., 89,** 1577.
Maj. A. M. Miller, 1895. **R., 95,** 1826.
Capt. C. S. Riché, 1904. **R., 04,** 2012.
Capt. Edgar Jadwin, 1906–07. **06,** 411; **07,** 429.
Capt. J. C. Oakes, 1907–09. **R., 07,** 1473; **08,** 1531; **09,** 1509.
Maj. G. P. Howell, 1910–11. **R., 10,** 1650; **11,** 1797.
Maj. E. I. Brown, 1912–. **R., 12,** 2017.

Assistants:
L. M. Lynch, **75,** 924. **R., 75,** 925.
R. B. Talfor. **R., 89,** 1579.
S. M. Wilcox. **R., 95,** 1828.
Capt. J. C. Oakes, **07,** 429.

LEGISLATION.

Texas offered a bonus of 8 sections of land for every m. of R. cleared, **75,** 927.

OPERATIONS.

1907–08. Combined dr. and snag boat completed, and snagging and dr. begun at close of year, **08,** 1531.

*Allotment. [1] H. D. 1217, 60th, 2d. [2] H. D. 187, 58th, 2d.

1908-09. 145,983 c. y. dr. under contract and 53,065 c. y. by U. S. dr. and snag boat *Guadalupe;* 5,388 snags removed, **09,** 1509.

1909-10. 43,142 c. y. dr. under contract, completing chan. into mouth of R.; 9,300 c. y. dr. and 1,500 snags and 2,300 trees removed by U. S. dr. and snag boat *Guadalupe;* 19,000 snags and trees removed by U. S. derrick barges Nos. 1 and 2; 4,150 c. y. dr. by derrick barge No. 1; beacons erected to mark chan., **10,** 1651.

1910-11. 12,946 snags and overhanging trees removed, and 50,575 c. y. dr. by U. S. derrick barges Nos. 1 and 2, **11,** 1797.

1911-12. 29,449 snags and overhanging trees removed by U. S. snag boat *Guadalupe* and derrick barges Nos. 1 and 2; 112,883 c. y. dr. by U. S. dr. *Capt. C. W. Howell,* **12,** 2017–18.

PHYSICAL CHARACTERISTICS.

Description of, **75,** 925–928; **89,** 1579.
Elevations, **75,** 925.
Obstr., **75,** 926.

Description of, mouth to Cuero: About 62 m. l., with a fall of 6′ bet. Cuero and Victoria; contains about 10 shoals with many overhanging trees and other obstr.; soft bar at mouth; crossed by 5 brs., **95,** 1826.

Bay section: Chan. connects mouth of Guadalupe R. with chan. from Aransas Pass to Pass Cavallo, **08,** 467.

Work accomplished has been very beneficial, **12,** 711.

R. enters San Antonio B. 16 m. from the inland waterway on the coast of Texas. Its w. varies from 90′ at m., increasing to 140′ 52 m. above mouth; d. varies from less than 3′ over shoals to 20′ at bends. R. formerly navigable to Victoria (52 m.), but owing to rafts navigation in recent years abandoned, **12,** 711.

PLANS.

By Capt. Howell, 1875, removal of 3 rafts; est., $7,194, **75,** 927, 928, 929.

PROJECTS.

Bay section: Navigable waterway 5′ x 40′; est., $30,000. River section to Victoria, Tex.: Removal of snags, rafts, etc., and dr. of shoals to 5′; est., $62,700 (Mar. 2, 1907, for inland waterway (q. v.) coast of Texas; total app., $133,829), **07,** 443.

SURVEYS.

Ex. by L. M. Lynch of R. below Gonzales, **75,** 79, 924.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Ernst (**R.** unfav.), **89,** 1577.

Ex. mouth to Cuero, Tex., au. act Aug. 17, 1894; made, 1894, by Maj. Miller (**R.** unfav.), **95,** 1826.

Pre. ex., San Antonio B. to and above Victoria, au. act June 13, 1902. **R.,** Capt. Riché, May 28, 1903 (unfav.),[1] **04,** 381, 2012.

Sur. and est. of cost of waterway, Aransas Pass to and up Guadalupe R. to Victoria, and from Victoria to Cuero, au. act Mar. 3, 1905. **R.,** Maj. Jadwin, June 14, 1906. Several plans presented, but only 1, that for imp. from Aransas Pass to Matagorda B. (est., $73,800, with $10,000 an. mainten.), recom.,[2] **06,** 430; **07,** 451.

Pre. ex. and sur. au. Feb. 27, 1911, for Guadalupe R., Tex., to Victoria, for imp. by locks and dams (**R.** to come), **12,** 724.

Maps.[2]

U-64 SAN ANTONIO RIVER, TEX.

APPROPRIATION.

$1,500, Aug. 30, 1852 (sur.).

SURVEY.

R. Aug. 31, 1853; est. $19,300. (H. D. 482, 55th, 2d.)

U-67 ARANSAS PASS, TEX.

NOTE.—Aransas Pass leads from Gulf of Mexico to B. behind the front coast into which Nueces R. flows. Corpus Christi is near the mouth of the latter stream and is on the back B. To the n. is a more or less open back coast chan., leading in the direction of Pass Cavallo. To the s. this chan. leads into Laguna Madre.

Part.	Title.	Period.	Appropriations.
a	Aransas B., H., and Pass	1870–1912	$2,278,750
b	Aransas B.—Deep-water H. at Harbor Isld	1910–1912	375,000
	Total		2,653,750

Part (a), U-67 Aransas Bay, Harbor, and Pass, Tex.[3]

APPROPRIATIONS.

1879,	$35,000,	**79,** 111.
1880,	65,000,	**80,** 1247.
1881,	80,000,	**81,** 1359.
1882,	100,000,	**82,** 1471.
1884,	100,000,	**84,** 1316.
1886,	101,250,	**86,** 1333.
1888,	100,000,	**88,** 1308.
1897,	[4] 5,000,	act June 4, 1897.
1899,	60,000,	**99,** 1972.
1902,	250,000,	**02,** 1387.
1905,	$100,000,	**05,** 1512.
1906,	100,000,	**06,** 1349.
1907,	200,000,	**07,** 1476.
1908,	200,000,	**08,** 1536.
1909,	100,000 / 90,000	**09,** 1513.
1910,	217,500 / 350,000	**10,** 1656.
1911,	25,000,	**11,** 1802.
Total,	2,278,750	($2,278,769.90, incl. sales, **12,** 2028).

[1] H. D. 187, 58th, 2d.
[2] H. D. 336, 59th, 2d.
[3] Ex.—**R.** (unfav.), Apr. 18, 1853. (H. D. 482, 55th, 2d.)
[4] For Board to ascertain character and value of imp. of Aransas Pass Harbor Co.

COMMERCE.

Important, **71,** 531; **79,** 933, 936.
Trade of Corpus Christi, **89,** 1567.
Description of, **98,** 1531, 1549.
See Projects.
No permanent imp. in rates, **10,** 556.
Traffic, 1911, 8,880 t. State of Texas expected to effect rate reduction, **12,** 720.

CONTRACTS.

1881. F. Brunner, brush, $3.35 cord; **82,** 1469; C. M. Holdin, st., **82,** 1469.
1882. A. M. Shannon & Co., brush, $2.60; st., $5.60 c. y., **83,** 1092.
1884. A. M. Shannon & Co., brush, $2.60; st., $4.40 c. y., **85,** 1466.
1887. A. M. Shannon & Co., riprap, $2.95 c. y., **88,** 1308.
1888. Charles Clarke & Co., riprap, $2.99 c. y., **89,** 1565.
1899. C. Clarke & Co., dr., 45¢ and 80¢ c. y. ($53,750), **00,** 2337.
1900. Charles Clarke & Co., dr., 45¢ and 80¢ c. y.; contract terminated by supple. articles of agreement, **01,** 1953. Charles Clarke & Co., repairing n. or curved j., about 24,500 t. st., $3.25 t.; Judge Adv. Gen. decided contract illegal; it was not approv., **01,** 1953.
1901. Charles Clarke & Co., repairing j.: Riprap in place, $3.30 t.; large blocks in place, $3.95 t., **02,** 1387.
1903. H. C. Ripley, j. constr.: Small riprap, $3.75 t.; large riprap, $4.25 and $4.60 t.; large blocks, $5.10 t., **03,** 1346. Moore & Sieber, removing part of old US. j., $46,000, **03,** 1346.
1905. Charles Clarke & Co., j. work: Small riprap, $3.46; large riprap, $3.89; large blocks, $4.48 t., **06,** 1349.
1908. David M. Picton, j. constr.: 80,000 t. riprap, at $3.50 t.; 23,000 t. crest st., at $4.37 t.; 10,000 l. f. trestle and track, at $6.35 l. f.; 12,000 l. f. trans. wharves, at $2.10 l. f., **08,** 1536.
1909. David M. Picton & Co., j. constr.: 82,500 t. riprap, at $3.08 t.; 18,500 t. crest st., at $4.09 t.; 2,700 l. f. trestle, at $7.50 l. f.; repairs to n. j., 15,000 t. riprap, at $2.81 t.; 1,000 t. cap blocks, at $3.93 t.; s. j. across isld., 5,700 t. riprap, at $2.70 t.; 1,700 l. f. trestle, at $4.30 l. f., **09,** 1514.
1910. David M. Picton & Co., st. work on n. and s. js., quantities and unit prices given, **11,** 1803.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 62; **71,** 66; **78,** 85; **79,** 111, 112; **80,** 149; **81,** 202; **82,** 199; **83,** 204; **84,** 219; **85,** 229; **86,** 226; **87,** 191; **88,** 175; **89,** 205; **90,** 185; **91,** 235; **98,** 289; **99,** 344, 345; **00,** 392; **01,** 409; **02,** 341; **03,** 359; **04,** 379; **05,** 395; **06,** 425; **07,** 447; **08,** 470; **09,** 493; **10,** 555; **11,** 594; **12,** 718.

Boards:
Ordered to convene, New York, July 1, 1879, **79,** 928; by S. O. No. 63, O. C. of E., 1879 (see Projects), **80,** 1254.
Convened, New York, July 19, 1887, to report upon imp. of Aransas Pass. **R., 88,** 1318. (Cols. Casey, Abbot, and Craighill; Lt. Cols. Houston and McFarland, and Maj. King.)
Convened, S. O. 145, dated A. G. O., June 23, 1897, at city of Aransas Pass, Tex., on July 20, 1897, and at Tarpon and Corpus Christi, Tex., on other dates, to ascertain the character and value of imp. made at the pass by the Aransas Pass Harbor Co. **R., 98,** 1527. (Col. H. M. Robert, Maj. Wm. T. Rossell, Capt. John Biddle.)
Constituted by S. O. No. 145, dated June 23, 1897, convened, New York City, Oct. 7, 1898, by S. O. No. 24, dated Oct. 1, 1898 (see Surveys). **R., 99,** 1974. (Col. H. M. Robert and Maj. W. T. Rossell.)

In charge:
Maj. C. W. Howell, 1871–79. **R., 71,** 526; **79,** 928.
Maj. S. M. Mansfield, 1880–86. **R., 80,** 1245; **81,** 1358; **82,** 1469; **83,** 1091; **84,** 1312; **85,** 1464; **86,** 1330.
Maj. O. H. Ernst, 1886–90. **R., 87,** 1431; **88,** 1307, 1312; **89,** 1564.
Maj. C. J. Allen, 1890–91. **R., 90,** 1810; **91,** 1942.
Maj. J. B. Quinn, 1898. **R., 98,** 1527.
Capt. C. S. Riché, 1899–1903. **R., 99,** 1972, 1973; **00,** 2336; **01,** 1952; **02,** 1386; **03,** 1345.
Capt. Edgar Jadwin, 1904–06. **R., 04,** 2007, **05,** 1510; **06,** 1348.
Capt. John C. Oakes, 1907–09. **R., 07,** 1475; **08,** 1535; **09,** 1512.
Maj. G. P. Howell, 1910–11. **R., 10,** 1655; **11,** 1801.
Maj. E. I. Brown, 1912–. **R., 12,** 2027.

Assistants:
Lt. E. A. Woodruff; **71,** 66. **R., 71,** 526.
H. C. Collins, **R., 79,** 934.
H. S. Douglas and W. H. Hoffman; **79,** 934.
T. S. Sedgwick. **R., 80,** 1247.
W. L. Webb. **R., 82,** 1472.
J. E. Savage. **R., 88,** 1308.
G. Bagnall. **R., 89,** 1566.
R. B. Talfor. **R., 00,** 2337; **01,** 1954.
F. Oppikofer. **R., 02,** 1388; **04,** 2009.
S. M. Wilcox. **R., 05,** 1512.

ESTIMATES. (See also Plans and Projects.)

By Lt. Woodruff, for cost of 1st plan, $31,794.48; 2d, $49,500; 3d, $688,355.25; 4th, $99,000; 5th, $31,293.90, **71,** 529, 530.
By Maj. Howell, for cost of 1st plan, $60,405; 2d, $126,440; 3d, $11,748; 4th, $2,000; 5th, $30,555.50; 6th, $31,123.40; 7th, $167,222.10; 8th, $198,888.75; **79,** 932, 933.

LEGAL PROCEEDINGS.

About 168 acres on Mustang Isld. and about 100 acres on St. Josephs Isld. deeded to the U. S. for military reservation under au. Congress, **08,** 1535.

LEGISLATION.

Charter of the Aransas Pass Harbor Co., **98,** 1553. Acts of Congress under which the company operated, **98,** 1554, 1556.
Aransas Pass Harbor Co., 1899, released and surrendered all rights and privileges granted to it in Aransas H. by Congress; also the js. in said H., **99,** 1972.

OPERATIONS.

1879–80. Preliminary work in progress, **80,** 1246.
1880–81. Work done with hired labor and open-market purchases; constructing groin js. for protecting Mustang Isld. and the s. chan. j., **81,** 202, 1361.
1881–82. Constr. js. with hired labor, **82,** 1469; successful work done, **82,** 199, 1470, 1474.
1882–83. Extending s. j., 1,200 l. f., with 15,476 c. y. brush and 3,474 t. of st., **83,** 1092.
1883–84. Extending j. to 3,900′; 10,686 c. y. brush and 2,940 c. y. st. used; chan. 10½′ d. m. l. w. over bar, **84,** 219, 1314.
1884–85. Extending j. seaward, and raising height with 23,017 c. y. of brush mattress and 4,626 t. of st.; building superstr. with hired labor, over work previously completed; chan. 11′ m. l. w. obtained over bar, **85,** 1466.
1885–86. With hired labor, repairs made to outer end of s. j., and trees planted on St. Josephs Isld., **86,** 1332.
1886–87. Protective work in progress, **87,** 1432.
1887–88. Protective work continued; 27,825 c. y. riprap laid protecting 1,895 l. f. of bank; 414,982 s. f. of slope covered; 480 l. f. of spur dike built, **88,** 1311.
1888–89. 15,988 c. y. riprap placed in protective work, covering 278,531 s. f. of slope; 205 l. f. of spur built, **89,** 1565.
1889–90. Repairs to revet. at head of Mustang Isld., **90,** 1811.
1901–02. 11,534.76 t. riprap and 10,737.11 t. blocks placed, completing 1,300′ of j., **02,** 1387.
1903–04. 20,843.71 t. small riprap, 14,460.52 t. large riprap, and 809.31 t. large blocks placed in j.; part of old U. S. j. removed, **04,** 2009.
1904–05. 10,751.33 t. st. placed in j., **05,** 1511, 1513.
1905–06. 50,332.26 t. st. placed in n. j., **06,** 1348.
1906–07. Rock lump removed from chan., **07,** 1475.

1907-08. Trans. wharf and 3,181′ trestle and track built, **08,** 1535.

1908-09. Trestle and track extended 253′, 55,080.16 t. riprap and 5,303.35 t. crest st. placed in n. j.; 514′ trans. wharf and 3,862′ trestle built, and 45,155.35 t. riprap and 4,707 t. crest st. placed in s. j., **09,** 1513.

1909-10. 31,289 t. riprap placed in repairs to n. j.; trestle and track on s. j. extended 2,638′, and 88,164 t. riprap and 8,969 t. crest st. placed in j.; 1,414′ trestle and track built and 6,410 t. riprap placed in constr. of 1,000′ spur to s. j., **10,** 1655.

1910-11. 20,684.70 t. riprap placed in n. j. for 1,375′, j. rebuilt to 5′ above m. l. w. and crest blocks replaced; 15,997.40 t. riprap placed in s. j. for 765′, j. built to 5′ above m. l. w., and 2,870.85 t. crest st. placed, **11,** 1801. U. S. snag boat *Guadalupe* removed 650′ of outer end of Nelson Jetty, **11,** 1802.

1911-12. U. S. dr. *Gen. C. B. Comstock* removed 381,302 c. y. from chan., at operating cost of 8.352¢ c. y. and total cost of 13.974¢ c. y.; U. S. snag boat *Guadalupe* dynamited 1,070 l. f. of outer end of Mansfield Jetty, sinking the rock to from 25′ to 30′ below water surface, and afterwards drove piling for mooring posts, **12,** 2027.

PHYSICAL CHARACTERISTICS.

General, **71,** 527 et seq.; **79,** 929, 934 et seq.; **80,** 1254; **81,** 1360; **98,** 1529.

Rate of movement of bar, **87,** 1431.

Tidal basin and volume of tidal prism at Aransas Pass; d., surface, w., and areas of cross sections, **88,** 1316.

Description of, Aransas B., **91,** 1942.

Table showing variations of d., w., and cross sections of the pass, **98,** 1530.

Table indicating that since the building of the j. the position of the chan. apparently more constant and the w. across bar lessened, **98,** 1540.

Old U. S. js. found, 1901, not to be obstr. to scour. See acts of Congress, etc., **01,** 1952.

Current measurements, **04,** 2007.

Details of, **10,** 555; **11,** 594, 1801, 1802; **12,** 718, 719, 2027.

Last sur. showed chan. 20′ x 340′ w. end of js. to near Station C, thence chan. 20′ and 250′ to 300′ w. of Station C, and 20′ x 250′ w. for remainder of imp., **12,** 720.

PLANS. (See Estimates, Private work, and Projects.)

By Lt. Woodruff: (1) For groins of pile work, normal to shore line; (2) for a system of riprap js.; (3) for canal from mouth of Turtle Cove to Corpus Christi B. 4 m. l., 10′ x 150′; (4) for system of riprap, building triangular prisms of palm, palmetto, or mangrovef rom Turtle Cove to Gulf coast line; (5) for revet. or j. on n. side of entrance to the canal 10′ x 1,400′, **71,** 529, 530.

By Maj. Howell: (1) For deepening chan. across outer bar of Aransas Pass; (2) protection of head of Mustang Island; (3) closing Corpus Christi Pass by a dam; (4) prevention of drifting of sand off from the lower portions of the pass; (5) dr. chan. in Aransas Pass to 10′ x 100′; (7) and (8) d. other chans. than the one already in use; **79,** 930, 931.

PRIVATE (PRIVATE AND CORPORATE) WORK.

Work by private enterprise, 1869, for imp. of chan., by extension of js., to cut off secondary chan., and to aid in d. main chan., **71,** 528; **79,** 930, 937.

Chan. bet. Corpus Christi and Aransas Pass d., **79,** 930.

$10,000 subscribed by local interests in 1883 to carry on the work, **84,** 1313; **87,** 1432.

Projs. of the Aransas Pass Harbor Co. to secure 20′, but Board of 1897 found about 9′ only, **98,** 1537, 1540, 1544.

Projs. for imp., and work done at the pass by other than the Aransas Pass Harbor Co., **98,** 1534. History of the latter company, **98,** 1535. Its plan of imp., **98,** 1536. Work done by it, which consisted of the constr. of 2 js. (see engineers' plan, **98,** 1559), and certain auxiliary work in the chan., **98,** 1537; contracts, **98,** 1561–67. Condition of works when examined by Board of 1897, **98,** 1539; effects of, **98,** 1540; cost of, **98,** 1541.

PROJECTS. (See Estimates, Plans, and Private work.)

By Maj. Howell: (1) Deepening chan. over the bar at entrance to Aransas Pass with fascines to contract the current and increase its scouring effect; est. cost, $60,405; (2) protecting end of Mustang Isld. from erosion with matting of fascines ballasted with st.; est., $126,440, **79,** 930, 931, 932.

By BE., 1879, forming and maintaining 12′ chan. m. l. w. over bar by extending the n. j. from the end of St. Josephs Isld., and the s. j. from end of Mustang Isld., and the constr. of groins in conjunction with beach protection for the head of Mustang Isld. to and beyond Turtle Cove; est., js., groins, etc., $759,185; imp. of the interior chan. from pass up to Rockport and Corpus Christi to be by dr.; est. (by Maj. Howell), $441,537.75, **80,** 1245, 1254; **81,** 1363; **85,** 1465; **86,** 1330 (by Cols. Tower and Newton and Lt. Col. Gillmore); **80,** 1271. In 1887, the work designed and partly executed having partly failed to obtain the desired result at the pass, Maj. Ernst proposed to abandon as much of the s. j. as curved n., and by an easy change in direction to the s. to lead the j. by the shortest line to d. w., the n. j. to be placed parallel to the outer end of the s. j. To protect Mustang Isld. it was proposed to riprap its slope from h. w. mark to bottom of the chan. The works proposed were expected to secure a chan. at least 20′ d. Est. of revised proj., $2,052,543.72, **87,** 1432.

Congress having, in 1890, granted to the Aransas Pass Harbor Co. right to imp. navigation of the pass, further operations on the part of the U. S. suspended, **90,** 1811.

1898, the Board of 1897 of opinion that the works of the Aransas Pass Harbor Co. for the imp. of the pass were of no value to U. S., **98,** 1544; and showed that if the U. S. should take up and complete the works for the imp. of the pass the securities of the company would be practically as valuable as if the imp. had been effected by the company, **98,** 1545.

Under provision act Mar. 3, 1899, Aransas Pass Harbor Co., Mar. 27, 1899, gave up all rights, incl. j. built at pass entrance, **01,** 409.

By BE., 1897, to constr. 2 parallel js., also to remove a part of the old U. S. j. and to dr. to obtain a 20′ chan. 150′ w. at bottom; est., $1,525,000, **99,** 1975.

By Capt. Riché, 1900, to expend $40,772.35, remainder of app. of 1888, to complete part of n. j., **00,** 2336.

By Capt. Riché, repairing n. or curved j. from inner end of existing j. as far out as available funds, about $75,000, would permit, **01,** 1952.

Act June 13, 1902, app. $250,000 for completion of n. j. according to plans of Aransas Pass Harbor Co., strengthening j. and removing when necessary old j. or other obstr. to scour, **02,** 341. On completion of this work the chan. grew steadily worse. Finally the chan. was on n. side of j. instead of s., reverse design of Aransas Pass Harbor Co., **12,** 719.

Modified, 1907, in accordance with plans of BE. to provide for s. j. parallel to the general direction of existing j., and extension shoreward of Haupt Jetty, and later the extension of both js.; est., incl. $100,000 for dr., $1,288,699.50,[1] **07,** 448.

Changed in accordance with plans of Maj. Howell to incl. repairs to n. j., dr. to 20′, and removing obstr. from chan. at est. of $277,500, and omitting 1,750′ extension of js.; total est., revised proj., $1,157,500,[2] **10,** 556, 558.

Approv. proj. 99% done, **12,** 720.

SURVEYS.

By Lt. Woodruff, 1870. **R., 71,** 526, 528.

By H. C. Collins, 1878. **R., 79,** 928, 934.

Minor sur., **80,** 1258, 1264; **82,** 1470; **83,** 1092; **85,** 1466; **00,** 2336.

Sur., 1882, by H. C. Ripley and W. L. Webb, **82,** 1470.

Made, 1887, by Maj. Ernst, **88,** 1312.

Ex. of Aransas B., au. act Sept. 19, 1890; made, 1891, by Maj. Allen (**R.** unfav. to removing Half-Moon Reef), **91,** 1942.

[1] R. and H. Com. D. 5, 59th, 2d.

[2] H. D. 639, 61st, 2d.

Sundry civil act June 3, 1898, provided for a BE. to ascertain the character and value of the imp. made at the pass by the H. company. **R.**, 1897, **98**, 1527.

Plans, specifications, and est. for imp. the H., and especially plans and est. for removing sand bar at pass, and d. of chan. across the bar, to at least 20′ and w. of at least 150′ at bottom, to furnish an inlet for vessels from the Gulf of Mexico, the **R.** to be rendered to say whether the work should be undertaken, called for by joint resol., May 28, 1898. Board of 1897 **R.** fav., **99**, 1974.

Borings taken over old U. S. pier, **01**, 1954.

Description and location of stations, **01**, 1955, 1957.

Of chan., **02**, 1388.

From gorge to 36′ contour in Gulf, cross sections of pass taken and current measurements made, maps accompanying, **04**, 2008.

Of the pass, and borings over site of old j., **05**, 1511.

Maps of latest sur. of the pass with **R.**, **06**, 1349.

R. by BERH., Dec. 6, 1906, requested by R. and H. Com. Board is of opinion Aransas Pass is worthy of great consideration, and that a d. w. port is justified by the C. interests involved. No est. cost given.[5]

Au. act Mar. 3, 1909, made, 1909; **R.**, Maj. Howell,[1] **10**, 558, 1655.

Of pass, made June, 1911; **R.**, Maj. Howell, **11**, 1802.

Of pass, made June, 1912; **R.**, Maj. Brown, **12**, 2027.

Ex. and sur., au. act June 25, 1910; made, 1910, under direction of special BERH.,[2] **11**, 598.

Maps:[1]

Map of the coast of Texas and maps on enlarged scale of Corpus Christi and Aransas Bs. and their connections, followed by plans of dam and j., **79**, 934; **85**, 1466; **00**, 2340.

Location of js., **87**, 1432.

Miscellaneous, **02**, 1388; **04**, 2008; **05**, 1512; **06**, 1348; **08**, 1536; **09**, 1514; **10**, 1656; **11**, 1802.

Part (b), U-67 Aransas Pass, Tex. (Deep-Water Harbor at Harbor Island).

APPROPRIATIONS.

1911, $125,000, **11**, 1803.
1912, 250,000, **12**, 2029.

Total, 375,000 ($375,000.30, incl. sales, **12**, 2529.)

COMMERCE. (See Aransas Pass, Tex.)

Proj. has had no effect on rates, **12**, 721.

CONTRACTS.

1911. David M. Picton & Co., st. dike, unit prices given; Bowers Southern Dredging Co., dr., 11¢ c. y., **12**, 2029.

ENGINEERS.

Chief of Engineers. **R.**, **11**, 596; **12**, 721.

In charge:
Maj. G. P. Howell, 1911. **R.**, **11**, 1803.
Maj. E. I. Brown, 1912–. **R.**, **12**, 2028.

LEGISLATION.

In fulfillment of conditions in proj. act of 1911, Texas prohibited terminal monopoly at this H., and deeds of land required for dike vested in U. S., **11**, 596; **12**, 721.

OPERATIONS.

1910-11. Sur. made for location of st. dike on St. Joseph Isld. and specifications for constr. and necessary dr. prepared, **11**, 1803.

1911-12. 10,000 l. f. st. dike 24′ w. at bottom and 14′ w. at top, with crest 8′ above m. l. w., constr. on St. Joseph Isld.; 641,082 c. y. dr. within cross-section, and 71,387 c. y. from next foot below prescribed area, **12**, 2028, 2029.

PHYSICAL CHARACTERISTICS.

A d. of 20′ having been gained through Aransas Pass, needful to estab. d. w. H. for shipping at Harbor Isld., opp. entrance chan. through pass, **12**, 721.

D. over part of H. excavated, 20′, June 30, 1912, **12**, 721.

PROJECTS.

Proj. (see Legislation above) provides for roadstead 20′ x 1,200′ x 3,000′ bet. Harbor and St. Josephs Islds., and for chan. 20′ x 400′ x 5,420′ leading from n. end of roadstead, and for st. dike 10,000′ l. on St. Joseph Isld., connecting with n. j.; est., $375,000, with $25,000 an. for mainten.,[2] **11**, 596; **12**, 721.

SURVEYS.

Ex. and sur. au. act June 25, 1910; made, 1910 (see Projects), **11**, 598, 599.[2]

U-67 (c) ARANSAS PASS HARBOR TO ROCKPORT, TEX.

ENGINEERS.

Chief of Engineers. **R.**, **10**, 559.
In charge. Capt. J. C. Oakes, 1910. **10**, 559.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to d. and w. chan.; **Rs.** by Capt. Oakes, 1909 and 1910 unfav.,[3] **10**, 559.

R. by BERH., Oct. 3, 1910, requested by R. and H. Com. reviewing above **R.** D. at Murrays Reef no shallower than at other places. Board is opinion not advisable to undertake work.[4]

Maps.[3]

U-67 (d) ARANSAS BAY, ST. CHARLES BAY, TEX.

ENGINEERS.

Chief of Engineers. **R.**, **91**, 235; **04**, 382, 2019.

Boards. BERH. **R.**, **04**, 2020.

In charge:
Maj. C. J. Allen, 1890–91. **R.**, **91**, 1942.
Capt. Edgar Jadwin, 1904. **R.**, **04**, 2019.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, under direction of Maj. Allen (**R.** unfav.), **91**, 1942.

Pre. ex. au. act June 13, 1902, view to removal of reefs which now obstr. navigation. **R.** by Capt. Riché, May 28, 1903[6] (unfav.), **04**, 2019. BERH. concurs in views of local officer, **04**, 2020.

[1] H. D. 639, 61st, 2d.
[2] H. D. 1094, 61st, 3d.
[3] H. D. 734, 61st, 2d.
[4] R. and H. Com. 54, 61st, 3d.
[5] R. and H. Com. D. 43, 61st, 2d.
[6] H. D. 77, 58th, 2d.

U-68 (a) CORPUS CHRISTI, TEX.[1]

U-68 (b) ARANSAS PASS TO CORPUS CHRISTI, TEX. (Including Turtle Cove Channel.)

APPROPRIATIONS.[2]

1907,	$10,000.00,	**07,** 1473.
1908,	90,750.00,	**08,** 1532.
1909,	4,278.35,	**12,** 2019.
	21,681.82,	**12,** 2019.
1910,	157,900.00,	**10,** 552, 557, 1657.
Total,	284,610.17	($284,626.57, incl. sales, etc., **12,** 2019, 2030).

COMMERCE.

No effect on rates, **10,** 552, 1653.

Same as through Aransas Pass; rates on general merchandise 20% less than RR. rates, and on cotton reduced 13¢ 100 pounds, **11,** 597; **12,** 712, 722.

Traffic, 1911, 8,880 t., **12,** 2030.

CONTRACTS.

1908. Bowers Southern Dredging Co., dr., 14¢ c. y., p. m., **08,** 1533.

1910. Bowers Southern Dredging Co., redr., $1.20, 3,400 l. f. of chan., **10,** 1652. Bowers Southern Dredging Co., dr., 1,000,000 c. y., 13.74¢ c. y., **11,** 1804.

ENGINEERS.

Chief of Engineers. R., 06, 430; **07,** 445; **08,** 468; **09,** 490; **10,** 552, 557; **11,** 591, 596; **12,** 712, 722.

In charge:

Capt. J. C. Oakes, 1907–09. **R., 07,** 1473; **08,** 1532; **09,** 1510.

Maj. G. P. Howell, 1910–11. **R., 10,** 1652, 1657; **11,** 1798, 1804.

Maj. E. I. Brown, 1912–. **R., 12,** 2019, 2029.

OPERATIONS.

1908–09. 791,031 c. y. removed from prescribed cross section and 132,037 c. y. from 1′ below, resulting in completed chan. 8½′ to 9′ d. and 75′ w. on bottom for 31,400′, from 9′ of water in Aransas Pass to 8′ in Corpus Christi B.; 7 iron beacons erected on s. side of chan., **09,** 1510.

1910–11. 214,998 c. y. dr. from cross section and 51,651 c. y. from 1′ below, producing 12′ for 16,200′, **11,** 1804. Turtle Cove Chan. dr. to 9½′, **11,** 1798.

1911–12. 663,070 c. y. dr. from prescribed area; 142,250 c. y. from foot below, for 40,200 l. f., **12,** 2029.

PHYSICAL CHARACTERISTICS.

Turtle Cove a natural depression bet. Harbor and Mustang Islds., connecting at high tide Aransas and Corpus Christi Bs., about 1½′ x 2,000′ x 14,000′ m. l. w., **07,** 445.

PROJECTS.

Proj. au. act 1907, chan. 8½′ x 75′, Turtle Cove Chan.; est., $123,750, **07,** 445.

Extended by act June 25, 1910, to obtain 12′ chan. bet. Aransas Pass and Corpus Christi,[3] **10,** 552, 557.

SURVEYS.

Sur. and est. au. act Mar. 3, 1905, route Aransas Pass via Turtle Cove, to Corpus Christi, **06,** 430. **R.**[4] by Capt. Jadwin, May 22, 1906; est., $123,750, **07,** 451.

Ex. and sur. au. act Mar. 3, 1909; made, 1909, by Capt. Oakes,[3] **10,** 552, 1652.

U-72 (a) BRAZOS SANTIAGO HARBOR, TEX.[5]

APPROPRIATIONS.

1878,	$6,000,	**78,** 111.
1880,	25,000,	**80,** 1273.
1881,	75,000,	**81,** 1367.
1882,	60,000,	**82,** 1477.
1884,	25,000,	**84,** 1318.
1886,	37,500,	**86,** 1335.
1888,	25,000,	**88,** 1320.
Total,[6]	253,500	

COMMERCE.

Important, **71,** 544. Obstr. to C., **79,** 111.

Light and decreasing, **93,** 1891; **95,** 1831.

Without water communication the locality at Brazos Santiago, off Pt. Isabel, never to prosper; business is falling off, 1900, and the country gradually being deserted; **00,** 2470.

Since imp., boats drawing 8′ and 8½′ can proceed direct to wharf at Isabel, Tex., eliminating the lighterage method theretofore necessary, **05,** 398.

Large fav. effect of imp. on RR. rates; table showing rates on different classes of freight, **06,** 427, 428.

CONTRACTS.

1878. New Orleans Wrecking Co., removal of wreck, **79,** 920.

1881. G. L. Long, j. constr., **82,** 1476.

1883. R. Moore, j. constr., **84,** 1317.

1884. R. Moore, j. constr., **85,** 1469.

1904. Bowers Southern Dredging Co., dr., 19½¢ c. y., **05,** 1514.

ENGINEERS.

Chief of Engineers. R., 70, 32, 62; **71,** 67; **79,** 111; **80,** 149; **81,** 203, 204; **82,** 200; **83,** 205; **84,** 220; **85,** 229; **86,** 226; **87,** 192; **88,** 176; **89,** 206; **90,** 185; **91,** 234; **92,** 227; **93,** 257; **94,** 239; **95,** 265, 266; **99,** 346; **00,** 393, 397; **01,** 410; **02,** 342; **03,** 360; **04,** 380; **05,** 397; **06,** 427; **07,** 449; **08,** 472; **09,** 495; **10,** 559; **11,** 598; **12,** 724.

Boards. R. and H. imp. **R., 82,** 1489. (See Projects.)

In charge:

Capt. McClellan, 1853. **R.** (extract), **71,** 545.

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[1] Sur.—**R.** Apr. 18, 1853; est., $11,739. (H. D. 482, 55th, 2d.)

[2] 1909 { $10,000, **09,** 1510. / 23,000 (allotment), **09,** 1510.

[3] H. D. 678, 61st, 2d.

[4] H. D. 338, 59th, 2d.

[5] Sur.—**R.** Apr. 18, 1853. (H. D. 482, 55th, 2d.)

[6] The balance of $57,476 returned to the Treas., 1895, reallotted, 1900; **00,** 2340.

Maj. C. W. Howell, 1870–80. **R., 71,** 544; **79,** 919; **80,** 146.
Maj. S. M. Mansfield, 1880–86. **R., 80,** 1272; **81,** 1365; **82,** 1475, 1480; **83,** 1094; **84,** 1316; **85,** 1468; **86,** 1334.
Maj. O. H. Ernst, 1886–91. **R., 87,** 1433; **88,** 1320; **89,** 1568; **90,** 1813.
Maj. C. J. Allen, 1891–92. **R., 91,** 1930; **92,** 1553.
Maj. A. M. Miller, 1893–95. **R., 93,** 1890; **94,** 1413; **95,** 1819, 1830.
Capt. C. S. Riché, 1900–1903. **R., 00,** 2340, 2469; **01,** 1958; **02,** 1390; **03,** 1346.
Capt. Edgar Jadwin, 1904–06. **R., 04,** 2010; **05,** 1513; **06,** 1350.
Capt. John C. Oakes, 1907–09. **R., 07,** 1476; **08,** 1536; **09,** 1514.
Maj. G. P. Howell, 1910–11. **10,** 529; **11,** 566.
Maj. E. I. Brown, 1912–. **12,** 688.

Assistants:
Lt. H. M. Adams, **71,** 67. **R., 71,** 544.
H. S. Douglass. **R., 79,** 920.
H. C. Ripley. **R., 81,** 1367; **82,** 1477, 1482.
J. C. Wright. **R., 83,** 1095.
Lt. W. L. Fisk. **R., 84,** 1318.
Lt. G. A. Zinn. **R., 88,** 1327.
E. M. Hartrick. **R., 00,** 2471.
Lt. M. L. Walker, **02,** 332.
Capt. G. M. Hoffman, **04,** 366.

OPERATIONS.

1868. Closing of Pass of Boca Chica in order to increase amount of water flowing through Brazos Pass, **71,** 545.
1878–79. Wreck of bark *Rène des Mers* removed from H., **79,** 920.
1881–82. Constr. of s. j. commenced and 495 l. f. partly completed, **82,** 1476.
1882–83. Work in progress over 2,300 l. f. of s. j. Delay from yellow fever. **83,** 1095.
1883–84. Work in progress on s. j., **84,** 1317.
1884–85. Work in progress on s. j.; total l. of 3,500′, **85,** 1468; **86,** 1334.
1886–87. Sur. of H. in progress, **87,** 1433.
1904–05. 257,171 c. y. removed, producing chan. 70′ x 10′ inside the bar across Laguna Madre to the RR. wharf at Isabel, Tex., 1,200′, and a turning basin 10′ x 300′ x 400′; work completed, **05,** 397, 1513.

PHYSICAL CHARACTERISTICS.

General, **71,** 544, 545.
Description of pass, **81,** 1368; **82,** 1489.
Gradual filling of H., **81,** 1369.
Small rise of tides, **82,** 1490.
Dimensions of H. as shown by sur. from 1867 to 1887; stability of sand bottom, **88,** 1326.
Brazos Santiago, the pass or chan. of communication bet. the Gulf of Mexico and Laguna Madre; affords the only navigable approach to Pt. Isabel, the port of the frontier town of Brownsville, on the Rio Grande, **00,** 2469.
Navigable d., 7′ 6″ m. l. w. over bar, **01,** 1958.
Shoaling to less than 6′ m. l. w., **07,** 449.

PLANS. (See Projects.)

By Lt. Adams, a j., foundation to be constr. by covering bottom with a layer of gunny sacks filled with hydraulic concrete, above the foundation the j. to be built of blocks of hydraulic concrete, the j. to concentrate the whole action of outward current upon one part of the bar. Est., $775,000. **71,** 67, 545, 546.

PROJECT. (See Plan.)

By Maj. Howell, removal of wreck, **79,** 919.
By Maj. Mansfield, 1881, d. chan. across the bar and the mainten. of suitable H. inside the pass, with 2 parallel js. at mouth of R. extended to the 12′ curve, and a dam from Pt. Isabel to Brazos Santiago closing the lagoon, the s. j. to be 3,630′ and the n. j. 2,940′ l. Est., $678,084.50. **81,** 1367, 1372; **82,** 1478, 1481, 1489, 1490; **86,** 1334.
Approved by BE., 1881, so fas as the application of available funds to constr. of s. j. would permit, **82,** 1490; **86,** 1335; **87,** 1433.
In 1888, the works theretofore constr. having practically disappeared, Maj. Ernst est. cost of reconstr. of both js. at $1,130,000, **88,** 1321.
Total of expend. under app. at the date of rendering the above est. $188,590, making the revised est. from the annulment of the work $1,318,590, **91,** 1931; **92,** 1554.
Proj., 1900, to hire a dr. plant to dr. chan. over bar to give temporary relief to the locality, **00,** 2340.
By Capt. C. S. Riché, 1900, to use the balance, $57,476, remaining in Treas., to dr. chan. over the bar, which had shoaled; bids for hire of plant rejected as excessive, but new sur. showed renewal of d. of 8′, all that was necessary, **01,** 410, 1958.

SURVEYS.

By Lt. Adams. **R., 71,** 544.
From Brazos Santiago to Pt. Isabel, au. act Mar. 3, 1881; made by Maj. Mansfield, 1882, **82,** 1477.
Of H. and bar, made, 1887, by Maj. Ernst, **88,** 1322.
Ex. of bar and H. au. act Aug. 17, 1894, **R.** by Maj. Miller, 1894 (unfav.), **95,** 1830.
Ex. of H. at Brazos Santiago, off Pt. Isabel, Tex., with view to removing bars and to furnishing inlet to permit ocean-going vessels to enter H., au. act Mar. 3, 1899; made, 1899, by Capt. Riché (**R.** unfav.) **00,** 2469.
Of bar, from 30′ contour in the Gulf to the gorge bet. Brazos and Padre Islds., incl. 6′ curve in Laguna Madre, made, 1900, by Capt. Riché, **01,** 1958.
Pre. ex. and sur. au. act Mar. 3, 1909 (**R.** to come), **10,** 559; **11,** 598; **12,** 724.
Maps. **82,** 1478; **84,** 1318; **05,** 1514.

U-73 ARROYO COLORADO, TEX.

ENGINEERS.

Chief of Engineers. **R., 09,** 497.

In charge. Capt. John C. Oakes, **09,** 469.

SURVEYS.

Au. act Mar. 2, 1907, to obtain chan. 8′ or less. Harlingen to d. w. at Pt. Isabel; made, 1908, by Capt. Oakes, **R.** unfav.,[1] **09,** 497.

[1] H. D. 1216, 60th, 2d.

U-74 RIO GRANDE RIVER, TEX., MEX., AND N. MEX.

Part.	Title.	Period.	Appropriations.
a	Rio Grande, Ft. Brown	1869–1887	$21,735
b	Rio Grande, N. Mex	1888–1889	
	Total		21,735

Part (a), U-74 Rio Grande River, Fort Brown, Tex.

APPROPRIATIONS.

1876, $10,000, **77,** 76.
1879, 7,000, act Mar. 3, **80,** 1274.
1882, 1,000, **82,** 1491.
1890, 3,375, act Aug. 30.

Total, 21,735

ENGINEERS.

Chief of Engineers. R., 77, 75; **78,** 85; **80,** 149; **81,** 203; **82,** 201; **83,** 205; **84,** 220; **85,** 230; **86,** 227; **87,** 192.

In charge:
Lt. Haupt, 1869; **77,** 474.
Capt. J. F. Gregory, 1876–78; **77,** 75. **R., 77,** 473; **78,** 619.
Capt. W. R. Livermore, 1880; **80,** 149.
Maj. C. W. Howell, 1880; **80,** 146.
Maj. S. M. Mansfield, 1880–86. **R., 80,** 1273; **81,** 1374; **82,** 1491; **83,** 1097; **84,** 1320; **85,** 1470; **86,** 1336.
Maj. O. H. Ernst, 1886–87. **R., 87,** 1434.

Assistants:
S. W. Brooks. **78,** 620.
H. C. Ripley. **R., 81,** 1375.

OPERATIONS.

Previous to 1876 a costly work of sheet piling and timber was built by the Quartermaster's Dept., scarcely a trace remaining, **77,** 474.

1876–77. Pile j. 200′ l. constr., the tops of the piles about 5′ below the level of flood water; j. ballasted with mattresses of brush covered with bricks, **77,** 475; **78,** 621.

1877–78. Pile j. extended 130′, of which 40′ was sheet piling, **78,** 620.

1879–80. Completion of bank protection by use of brush mats, **80,** 150, 1274.

1880–81. Repairs, **81,** 1374.

PHYSICAL CHARACTERISTICS.

Erosive character of the floods of the Rio Grande, **77,** 473, 474; **78,** 85.
Dangers arising from floods, **77,** 474; **78,** 621.

PRIVATE AND CORPORATE WORK.

1871. Pile j. constr. by private parties, **77,** 474.
1878. J. of live-willow piles constr. by the Levee Co., of Brownsville; expense about $3,000, **78,** 621.

PROJECTS.

By Capt. Gregory, pile j. 150′ l., at an angle of 9° with the shore, to deflect the current from the bank; also for a wing at the lower end to prevent erosion behind the work, **77,** 475. For expend. of the balance of the app. of 1876 in repairs, extension, etc.; approv., **78,** 620. For the extension of the j. 400′ for the further protection of the R. banks, est., $14,400, **78,** 621; **82,** 201.

After an expend. of $16,769 it was decided in 1882 to abandon further efforts to control the action of the R., **82,** 201; **86,** 227; **87,** 1434.

SURVEYS.

By Lt. Haupt, 1869, **77,** 474.
By Capt. Gregory, **77,** 474. Comparison of the sur. of 1869 and 1876, **77,** 474.

Part (b), U-74 Rio Grande River, N. Mex.

ENGINEERS.

Chief of Engineers. R., 89, 1571.

In charge. Maj. O. H. Ernst, 1888. **R., 89,** 1571.

Assistant. G. Bagnall. **R., 89,** 1572.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1571.

SURVEYS.

Ex., Embudo to El Paso, au. act Aug. 11, 1888; made, 1889, by Maj. Ernst (**R.** unfav., expense too great), **89,** 1571.

RIVER AND HARBOR WORKS.

MISSISSIPPI RIVER SYSTEM.

United States waterways tributary to the Gulf of Mexico include, of course, the Mississippi itself, with its tributaries. This system is so extensive, however, that it is arranged under the title of this section, namely, "Mississippi River System."

Matter concerning the Mississippi itself, irrespective of its tributaries, is collected at one place, under the special designation of "HH—Mississippi River." See page 1067.

The first group of tributaries, at the mouth, are so immediately connected with contiguous waterways flowing into the Gulf of Mexico that they are embraced under the designation "S—New Orleans, La., District." See page 679.

The district of the Mississippi system immediately above District S is District V, and the districts which follow are lettered from W to Z, and from AA to KK, respectively.

The groups are arranged in sections as follows:

Lower Mississippi River System (S (see paragraph 3 above), V, W, X, Y, Z).
Ohio River System (AA, BB, CC, DD, EE, FF).
Missouri River System (GG).
Mississippi River (HH).
Upper Mississippi River System (II, JJ, KK).

MAPS. See page 1097.

RIVER AND HARBOR WORKS—LOWER MISSISSIPPI RIVER SYSTEM.

V.—NEW ORLEANS, LA., DISTRICT.

(4th M. R. C.)

In charge of Mississippi River Commission,
New Orleans, La.

This district includes the shores or banks of the Mississippi River from the head of the Passes (13 miles from the Gulf), to Warrenton, Miss., 7½ miles below Vicksburg, Miss., a total length of 452.8 miles by river.

See page 1067 for data.

RIVER AND HARBOR WORKS—LOWER MISSISSIPPI RIVER SYSTEM.

W.—VICKSBURG, MISS., DISTRICT.

(3d M. R. C.)

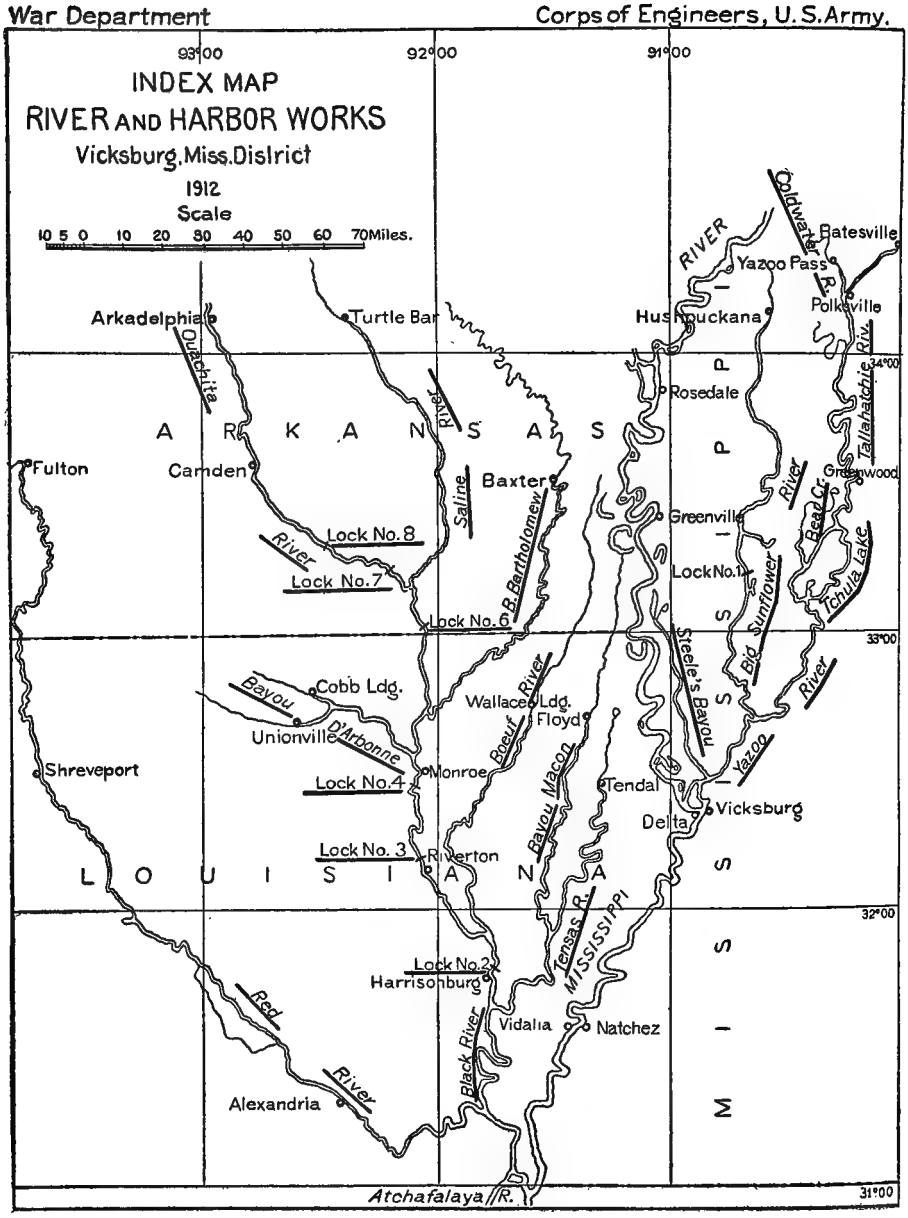
In charge of Mississippi River Commission,
Vicksburg, Miss.

This district includes the banks of the Mississippi River from Warrenton, Miss., to White River, Ark. (214 miles).

See page 1067 for data.

RIVER AND HARBOR WORKS—LOWER MISSISSIPPI RIVER SYSTEM.

X.—VICKSBURG, MISS., DISTRICT.


War Department
Corps of Engineers, U.S.Army.
INDEX MAP
RIVER AND HARBOR WORKS
Vicksburg, Miss. District
1912
Scale
10 5 0 10 20 30 40 50 60 70 Miles.
93°00
92°00
91°00
34°00
33°00
32°00
31°00
ARKANSAS
LOUISIANA
MISSISSIPPI
Arkadelphia
Turtle Bar
Hushpuckana
Batesville
Yazoo Pass
Polkeville
Rosedale
Greenwood
Greenville
Fulton
Camden
Baxter
Lock No. 8
Lock No. 7
Lock No. 6
Lock No. 1
Cobb Ldg.
Unionville
Wallace Ldg.
Floyd
Shreveport
Monroe
Lock No. 4
Tendal
Delta
Vicksburg
Lock No. 3
Riverton
Lock No. 2
Harrisonburg
Vidalia
Natchez
Alexandria
Ouachita
River
Saline
B. Bartholomew
Bayou
D'Arbonne
Boeuf
Bayou Macon
Tensas R.
MISSISSIPPI
Black River
Red
River
Atchafalaya R.
Steele's Bayou
Big Sunflower
River
Yazoo
River
Coldwater R.
Tallahatchie Riv.
Bear Cr.
Tchula Lake

X.—VICKSBURG, MISS., DISTRICT.

In charge of U. S. Engineer Office,
Vicksburg, Miss.

NOTE.—This district includes tributaries of the Mississippi River, on the east side, from below Vicksburg, Miss., to vicinity of Memphis, Tenn., and on west side, from the 31st parallel to below Arkansas River, Ark.

X 1 Mississippi R.
X 2 Bayou Pierre, Miss. (1)
X 3 Big Black R., Miss. (1)
X 4 Yazoo R., Miss. (1)
X 5 Tchula Lake, Miss. (4)
X 6 Horse Shoe Lake, Miss. (5)
X 7 Old R., Miss. (5)
X 8 Yalobusha R., Miss. (4)
X 9 Loosacoona R., Miss. (8)
X 10 Tallahatchie R., Miss. (4)
X 11 Coldwater R., Miss. (10)
X 12 Yazoo Pass, Miss. (11)
X 13 Cassidy Bayou, Miss. (11)
X 14 Bear Creek, Miss. (4)
X 15 Big Sunflower R., Miss. (4)
X 16 Dawson Lake, Miss. (15)
X 17 Quiver R., Miss. (15)
X 18 Hushpuckana Bayou, Miss. (15)
X 19 Bogue Phallah, Miss. (15)
X 20 Choctaw Bayou, Miss. (15)
X 21 Little Sunflower R., Miss. (4)
X 22 Rolling Fork Bayou, Miss. (21)
X 23 Deer Cr., Miss. (22)
X 24 Little Deer Cr., Miss. (4)
X 25 Steele Bayou, Miss. (4)
X 26 Washington Bayou, Miss. (25)
X 27 Lake Washington, Miss. (26)
List returns next to west bank of Miss. R. below Vicksburg, Miss.
X 28 Red R., below Fulton, Ark. and La. (1)
X 29 Black R., La. (28)
X 30 Tensas R., La. (29)
X 31 Choctaw Bayou, La. (30)
X 32 Mill Bayou, La. (30)
X 33 Bayou Macon, Ark. and La. (30)
X 34 Ouachita R., La. (29)
X 35 Boeuf R., Ark. and La. (34)
X 36 Bayou Bonne Idee, La. (35)
X 37 Bayou Bartholomew, La. and Ark. (34)
X 38 Saline R., Ark. (34)
X 39 Little Missouri R., Ark. (34)
X 40 Bayou D'Arbonne, La. (34)
X 41 Bayou Cornie, Ark. and La. (40)
X 42 Little R., La. (29)
X 43 Bayou Castor, La. (42)
X 44 Dugdemona R., La. (42)
X 45 Saline R., La. (28)
X 46 Loggy Bayou, La. (28)
X 47 Lake Bisteneau, La. (28)
X 48 Lake Dorcheat, La. (28)
X 49 Bayou Pierre, La. (28)
X 50 Cane R., La. (28)

X-2 PIERRE BAYOU, MISS.

APPROPRIATION.
1886, $5,000, **87,** 1383.

COMMERCE.
None, **87,** 1383.

ENGINEERS.
Chief of Engineers. R., 85, 226; **87,** 185; **10,** 599.

In charge:
Capt. T. Turtle, 1885. **R., 85,** 1439.
Maj. W. H. Heuer, 1885. **R., 85,** 1440; **87,** 1382.
Capt. C. S. Smith, **10,** 578.

OPERATIONS.
1886-87. Obstr. from mouth to a point 16 m. above removed, **87,** 1382.

PHYSICAL CHARACTERISTICS.
Bayou described, **85,** 1444; **87,** 1382.

PROJECTS.
By Maj. Heuer, for removing logs, snags, and trees to a point 16 m. above mouth; est., $20,000, **85,** 1444. Proj. completed in 1886, **87,** 1382.

SURVEYS.
Ex. au. act July 5, 1884; made by Maj. Heuer, **85,** 1440.
Pre. ex. au. Mar. 3, 1909, from mouth to Por, Gibson. **R.** by Capt. Smith, Aug. 6 and Sept. 23t 1909 (unfav.),[1] **10,** 599.

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[1] H. D. 701, 61st, 2d.

X-3 BIG BLACK RIVER, MISS.

APPROPRIATIONS.

1884, $5,000, **85,** 1525.
1886, 5,000, **86,** 1365.
1892, 5,000, **92,** 1622.

Total, 15,000

COMMERCE.

Small, **93,** 2023. Practically none, present or prospective, 1902, **04,** 2073.

ENGINEERS.

Chief of Engineers. R., 81, 213; **82,** 210; **85,** 241; **86,** 236; **87,** 198; **88,** 181; **89,** 212; **90,** 191; **91,** 242; **92,** 234; **93,** 264; **94,** 244: **95,** 273; **04,** 397, 2072; **12,** 781.

Boards. BERH. **R., 04,** 2075.

In charge:
Maj. W. H. H. Benyaurd, 1881–82. **R., 82,** 1565.
Capt. E. Bergland, 1884–86. **R., 85,** 1524; **86,** 1365.
Capt. J. H. Willard, 1886–95. **R., 87,** 1465; **88,** 1356; **89,** 1608; **90,** 1890; **91,** 1993; **92,** 1622; **93,** 2022; **94,** 1482; **95,** 1926.
Capt. Chas. L. Potter, **04,** 2072.
Lt. Col. H. M. Adams, 1904. **R., 04,** 2074.
Maj. J. A. Woodruff, 1912. **R., 12,** 752.

Assistants:
W. S. Davis. **R., 82,** 1566.
W. Porterfield. **R., 85,** 1525.

LEGISLATION.

Act of legislature of Miss. to remove br. obstr. navigation, **88,** 1357.

OBSTRUCTIONS.

Br. without draws obstr. navigation, **82,** 1566; **85,** 241, 1524; **86,** 236.
No further work to be done till the State should remove obstr. br., **87,** 1466.
Permanent iron swing br., erected 1892–93 in place of fixed wooden br. at Baldwins Ferry, as approved by Sec. of War, **93,** 2023.

OPERATIONS.

1884–85. Obstr. removed from mouth to 75 m. above, **85,** 1524, 1527.
1890–91. 101 snags and logs, jams, and 2 drifts cleared from the chan.; 1 brush wing dam built, and 13,403 leaning trees cleared from banks, **91,** 1994.
1894–95. Old wreck removed, some st. blasted from chan., 1,059 s. y. brush and willows cut, and nearly 100,000 obstr. destroyed, **95,** 1929.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1567; **95,** 1927; **04,** 2072.
Height of freshets increased by drift jams cast into R. by private parties, **04,** 2073.

PROJECTS.

By Maj. Benyaurd, 1881, removing logs, snags, and similar obstr. from R. bet. mouth and Coxs Ferry, 130 m.; est., $32,000, **82,** 1566, 1570; **87,** 1466. After partial completion of the proj. under the app. of 1884, the app. of 1886 made conditional upon the removal of certain br. over the R. In 1888, in view of the fact that the mainten. of the br. regarded as of greater practical benefit and importance than imp. of R., Capt. Willard recom. that no further app. be made, **88,** 1356.
Works not permanent, **95,** 1929.

SURVEYS.

Ex. au. act June 14, 1880; made by Maj. Benyaurd, 1881, **82,** 1565.
Ex. by Capt. Willard made, 1894, **95,** 1927.
Pre. ex. mouth to Illinois Central RR. br. au. act June 13, 1902; made, 1902, by Capt. Potter (**R.,** unfav.),[1] **04,** 2072.
Pre. ex. and sur., mouth to town of West, au. by Congress, **12,** 781.
List of Cong. docs., etc., relative to exs., surs., plans, etc., **04,** 2073.

X-4 YAZOO RIVER, MISS.

APPROPRIATIONS.

1873, $40,000, **73,** 56, 485.
1875, 12,000, **75,** 63, 522.
1876, 15,000, **76,** 78, 596.
1878, 25,000, **78,** 86, 628.
1879, 15,000, **79,** 115, 967.
1880, 12,000, **80,** 1310.
1881, 6,000, **81,** 1408.
1882, 8,000, **82,** 1548.
1884, 10,000, **84,** 1334.
1886, 15,000, **86,** 1358.
1888, 32,000, **88,** 1360.
1890, 25,000, **91,** 1999.
1892, 20,000, **92,** 1643.
1894, 20,000, **95,** 1931.
1896, 20,000, **96,** 1616.
1899, 20,000, **99,** 2012.
1902, 21,000, **02,** 1429.
1905, [2]90,000, **05,** 1556.
1907, [3]36,000, **07,** 1512.
1909, 10,000, **09,** 1569.
1910, [4]16,000, **10,** 1722.
1912, 7,000, **12,** 2085.

Total, 475,000 (less trans. of $18,721.49, $456,278.51, **12,** 2085).

COMMERCE.

Traffic upon the R., **83,** 1144.
After sur. of 1896, removal of bar at Yazoo City not recom., as such removal would probably impair navigation above and below it, **97,** 306.
Average C. for past 10 years, 193,841 t.; value, $5,052,000, **00,** 408.
List of SS. engaged in navigation of R. during 1902, **02,** 1431.
For past 15 years (at 1905) bet. 102,098 and 544,503 t., **05,** 411.
Rates on cotton by boat about 50% less than by rail; cotton seed is about 33⅓% less, live stock about one-third of RR. rates, and meal about 50% less, **06,** 445.
On Yazoo R., its tributaries and Vicksburg H., an. average 321,594 t.; **12,** 771.

CONTRACTS.

1873. New Orleans Wrecking & Salvage Co., removal of 11 wrecks, **74,** 62, 364.
1906. E. J. Howard, constr. and delivery of steel snag boat, $42,483, **06,** 1379.

[1] H. D. 207, 58th, 2d.
[2] $5,000 trans. to Tallahatchie and Coldwater R.; $7,000 trans. to Big Sunflower R.
[3] $1,500 trans. to Tallahatchie and Coldwater R.
[4] $1,221.49 trans. to Tallahatchie and Coldwater R.; $4,000 trans. to Big Sunflower R.

ENGINEERS.

Chief of Engineers. **R., 72,** 56; **73,** 56; **74,** 62; **75,** 69; **76,** 77; **77,** 76; **78,** 86; **79,** 115; **80,** 153; **81,** 208; **82,** 205; **83,** 214; **84,** 223, 227; **85,** 237, 243; **86,** 233; **87,** 198; **88,** 181; **89,** 213; **90,** 191; **91,** 243; **92,** 235; **93,** 264; **94,** 245; **95,** 274; **96,** 239; **97,** 305; **98,** 296; **99,** 355; **00,** 407; **01,** 420; **02,** 351; **03,** 373; **04,** 394; **05,** 409; **06,** 443; **07,** 469; **08,** 499; **09,** 526; **10,** 592; **11,** 638; **12,** 771.

In charge:

Lt. Col. W. F. Raynolds, 1872; **72,** 56.

Col. J. H. Simpson, 1873; **73,** 53.

Capt. W. H. H. Benyaurd, 1873–83; **73,** 53. **R., 73,** 485; **74,** 364; **75,** 522; **76,** 594; **77,** 480; **78,** 626; **79,** 967; (Maj.) **80,** 1310; **81,** 1407; **82,** 1547.

Maj. A. M. Miller, 1883–85. **R., 83,** 1143; **84,** 1333, 1355.

Capt. E. Bergland, 1885–86. **R., 85,** 1507, 1537; **86,** 1357.

Capt. J. H. Willard, 1886–99. **R., 87,** 1467; **88,** 1359; **89,** 1609; **90,** 1892; **91,** 1996; **92,** 1624; **93,** 2024; **94,** 1483; **95,** 1929; (Maj.) **96,** 1613; **97,** 1922; **98,** 1619; **99,** 2009.

Maj. T. L. Casey, 1900–01. **R., 00,** 2519; **01,** 2048.

Capt. C. L. Potter, 1902. **R., 02,** 1429.

Capt. C. S. Bromwell, 1903. **R., 03,** 1396.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2061.

Capt. G. M. Hoffman, 1905–07. **R., 05,** 1554; **06,** 1376; **07,** 1508.

Capt. C. S. Smith, 1908–10. **R., 08,** 1579; **09,** 1566; **10,** 1719.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1867; (Maj.) **12,** 2081.

Assistants:

J. D. McKown. **R., 73,** 484.

J. Burney. **R., 74,** 365.

J. Straszer. **R., 76,** 594; **78,** 627.

T. M. Farrell. **R., 84,** 1356.

P. R. Starr. **R., 85,** 1508.

T. C. Thomas. **R., 04,** 2069.

ESTIMATES.

By Capt. Benyaurd, 1874, imp. of R. (covering a period of 4 years) by constr. of snag boats and removal of snags, $120,000, **74,** 365; **75,** 522; **76,** 596; **77,** 480.

By J. Burney, 1874, constr. and operation of boats, **74,** 365; **76,** 596.

OBSTRUCTIONS.[1] (See Operations.)

OPERATIONS.[1]

1873-74. 9 wrecks removed by contract, **74,** 62.

1875-76. Removal of obstr. by U. S. snag boat belonging to Ouachita R., **76,** 78, 594.

1877-78. Removal of obstr. by U. S. snag boat belonging to Ouachita R., **78,** 86, 626.

1878-79. Constr. of snag boat in progress to be used on several Rs. jointly, **79,** 967.

1879-80. Wrecks of 2 SS. removed, also, logs, snags, and similar obstr., **80,** 1310.

1880-81. 250 snags and 2,194 trees removed and cut, **81,** 1407.

1881-82. 607 snags and wreck of SS. removed and 172 trees cut down, **82,** 1547.

1882-83. 545 snags removed and destroyed and 485 trees cut down, **83,** 1144.

1884-85. 894 snags and stumps and 1 SS. wreck removed from chan.; also 1,773 trees cut and 6 jams removed, **85,** 1507.

1886-87. Summary of operations, **87,** 1467.

1887-88. 415 snags and stumps removed from the chan.; 203 trees and shore snags removed from the banks, and 150 l. f. of wing dam built, **88,** 1359.

1888-89. Extensive repairs to snag boat *Meigs:* 494 snags removed from the chan., and 1,675 trees and shore snags removed from the banks, **89,** 1610.

1889-90. 730 logs and snags and 6 wrecks removed from the chan., and 94 shore snags and trees cleared from banks, **90,** 1893.

1890-91. 403 snags and 10 log jams removed from the chan., and 633 leaning trees cleared from the banks, **91,** 1997.

1891-92. 750 snags, 55 shore snags, and 2 wrecks removed, **92,** 1626.

1892-93. 150 l. f. brush wing dam built, several wrecks removed, 920 s. y. brush and willows cut, and about 15,000 snags and other obstr. removed, **93,** 2026.

1893-94. Wreck removed, 225 l. f. brush dam built, 785 s. y. brush and willows cut, and over 27,000 snags, etc., removed, **94,** 1485.

1894-95. Care and repair of plant, **95,** 1930.

1896-97. Portions of wrecks removed, 2,294 s. y. brush and willows cut, and about 116,700 obstr. removed, **97,** 1923.

1897-98. Several wrecks removed, 4,925 s. y. brush and willows cut, and nearly 30,000 snags and other obstr. removed, **98,** 1620.

1898-99. About 69,600 snags and other obstr. and 2,800 s. y. willows and brush removed from chan., **99,** 2011.

1899-00. 1,100 snags and other obstr. and parts of 2 wrecks removed from chan. **00,** 2520.

1900-01. 4,187 snags and logs cut and pulled, trees felled, topped, girdled, and cut; 2 wrecks removed, **01,** 2048.

1901-02. 5,160 snags, etc., cut and pulled; trees girdled, felled, etc., **02,** 1429.

1902-03. 2,344 snags and logs, etc., pulled, cut, and destroyed; 1,899 trees felled, cut, etc., **03,** 1396.

1903-04. 3,058 snags and logs removed, and 1,719 trees felled, etc., **04,** 2062.

1904-05. 1,720 snags and logs removed, 225 l. f. wing dams built, and 1,980 trees felled and cut up, **05,** 1554.

1905-06. 1,486 snags, etc., pulled, destroyed, and cut, and 1,485 trees felled and cut, **06,** 1376.

1906-07. 1,490 snags, etc., removed, and 6,174 trees cut and felled, **07,** 1508.

1907-08. Brush wing dam built at head of Honey Isld., 3 wrecks removed, 2,937 snags and stumps pulled and cut, 10,796 trees felled and cut, 450 s. y. willows and brush cut. The new steel snag boat *Ben Humphreys* delivered at Vicksburg May 30, 1908, **08,** 1579.

1908-09. 3,017 snags, etc., destroyed and removed, 2 wing dams built, 5 wrecks removed, 6,820 c. y. dr., 2,787 trees felled and cut up, and 20,950 c. y. brush and willows cut, **09,** 1566.

1909-10. 7,800 c. y. dr. from chan. at McCormick Bar, 1,350 c. y. through bar below Greenwood, 1 wing dam built, jams, snags, stumps, etc., removed, and trees cut, destroyed, etc., **10,** 1719.

1910-11. 888 snags, etc., removed, 4,370 trees felled and cut, and 7,747 s. y. willows and brush cut, **11,** 1868.

1911-12. About 2,000 snags, etc., removed, trees cut and felled; wreck removed, cost of which was paid for by owners, **12,** 2082.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2025; **94,** 1485; **96,** 1614; **97,** 1922; **98,** 1619.

Description of, in the vicinity of bar at Yazoo City. Bar evidently formed by gravel brought down from adjacent hills by Town Bayou. **96,** 1615.

Floods, and sliding and caving banks, render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation, **05,** 411.

PROJECTS.

By Capt. Benyaurd, 1874; imp. of the R. by constr. of snag boat and removal of wrecks, snags, logs, and similar obstr., **74,** 365.

From 1873 to 1886, $158,000 app., **75,** 522; **76,** 596; **77,** 480; **78,** 626; **87,** 1470.

Maj. Casey recom. grouping together of Yazoo R. and tributary streams, in order to prosecute work more economically, **01,** 2049; consolidated by act June 13, 1902, **02,** 1429.

[1] List of obstr., **73,** 483; **74,** 365.

SURVEYS.

For removal of wrecks and obstr., 1872, **72,** 56.

Of Yazoo Pass with a view to connecting the pass with the Mississippi R. au. act Aug. 2, 1882; made, 1883, by Maj. Miller (**R.** unfav.), **84,** 1355.

Sur. from the Louisville, New Orleans & Texas RR. br. to its mouth au. act Sept. 19, 1890; made, 1891, by Capt. Willard, **91,** 1998; **92,** 1626.

Act of 1894 and of 1896 au. removal of bar at Yazoo City. Chief of Engineers au. sur., which commenced in 1896 by Maj. Willard, **96,** 1615.

Maps. **91,** 1997.

X-5 TCHULA LAKE, MISS.

APPROPRIATIONS.

1881,	$3,000,	**81,** 1414.
1882,	2,500,	**82,** 1552.
1884,	1,500,	**84,** 1335.
1886,	2,000,	**86,** 1361.
1888,	3,000,	**88,** 1362.
1890,	3,000,	**90,** 1897.
1892,	3,000,	**92,** 1647.
1894,	3,000,	**95,** 1944.
1902,	*4,000,	**02,** 1429–30.
1905,	*4,000,	**05,** 1556.
1907,	*4,000,	**07,** 1512.
1909,	*5,000,	**09,** 1569.
Total,	38,000 (less $1,113.27 trans. to Tallahatchie and Coldwater R., $36,886.73, **12,** 2085).	

COMMERCE.

Limited and not increasing. Water rates lower than RR. rates, **12,** 778.

ENGINEERS.

Chief of Engineers. **R., 79,** 118; **80,** 158; **81,** 210; **82,** 207; **83,** 215; **84,** 224; **85,** 238; **86,** 234; **87,** 199; **88,** 181; **89,** 213; **90,** 192; **91,** 244; **92,** 236; **93,** 266; **94,** 247; **95,** 275; **02,** 351, 353; **03,** 373, 374, 375; **04,** 395, 396; **05,** 409; **06,** 443; **07,** 469, 472; **08,** 498, 502; **09,** 526, 530; **10,** 595; **11,** 642; **12,** 778.

In charge:

Maj. W. H. H. Benyaurd, 1879–82. **R., 80,** 1350; **81,** 1414; **82,** 1552.

Maj. A. M. Miller, 1882–84. **R., 83,** 1150; **84,** 1335.

Capt. E. Bergland, 1884–87. **R., 85,** 1514; **86,** 1360.

Capt. J. H. Willard, 1887–95. **R., 87,** 1471; **88,** 1361; **89,** 1612; **90,** 1896; **91,** 2001; **92,** 1645; **93,** 2038; **94,** 1506; **95,** 1942.

Maj. T. L. Casey, 1900–01, **02,** 343.

Capt. C. L. Potter, 1901–03. **R., 02,** 1429.

Capt. C. S. Bromwell, 1903–04. **R., 03,** 1396.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2064.

Capt. J. F. McIndoe, 1904, **05,** 399.

Capt. G. M. Hoffman, 1904–07. **R., 05,** 1555; **06,** 1378; **07,** 1511.

Capt. C. S. Smith, 1907–11. **R., 08,** 1582; **09,** 1568; **10,** 1721.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1870, 1872, 1874; (Maj.) **12,** 2084.

Assistants:

H. C. Wilson. **R., 82,** 1553.

W. S. Davis. **R., 83,** 1151; **85,** 1515.

T. C. Thomas. **R., 03,** 1404; **04,** 2071.

H. M. Marshall. **R., 05,** 1560.

OPERATIONS.

1881–82. 12,551 trees cut down and deadened and 686 snags removed, **82,** 1552.

1882–83. 19,785 trees cut, girdled, and topped; 3,348 snags and logs cut, **83,** 1150.

1884–85. 946 trees cut, topped, and girdled, and 111 snags removed, **85,** 1515.

1886–87. 4,180 trees, snags, and stumps, and 1 wreck removed, **87,** 1472.

1888–89. 104 snags removed from chan.; 1,320 trees and 125 s. y. brush cleared from banks, **89,** 1612.

1890–91. 70 snags and 3 log jams removed from chan., and 884 trees and 660 s. y. of brush cleared from banks, **91,** 2001.

1891–92. 340 snags removed from chan., and 1,624 trees girdled, 1,833 leaning trees cut; 2,743 logs and shore snags removed, and 56,735 s. y. brush cut, **92,** 1646.

1894–95. Wrecks removed; 3,236 s. y. brush and willows cut; nearly 72,000 snags, etc., removed, **95,** 1944.

1902–03. Removing snags, leaning trees, etc., **03,** 1397, 1404.

1904–05. Clearing chan. of log jams, snags, etc., **05,** 1555.

1905–06. Clearing chan. of snags, overhanging trees, etc., **06,** 1378.

1906–12. Snagging, etc., **07,** 1511; **09,** 1569; **10,** 1722; **12,** 2084.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 1943.

Condition of works and d. of w., **04,** 2067.

PROJECTS.

By Maj. Benyaurd, 1879, imp. of Tchula Lake from Honey Isld., to its junction with the Yazoo, 80 m., by removal of logs, snags, and similar obstr.; est., $10,000, **80,** 1351.

Imp. not considered permanent, **86,** 234.

SURVEY.

Au. act Mar. 3, 1879; made, 1879, by Maj. Benyaurd, **79,** 118; **80,** 1350.

X-6 ROEBUCK (Horseshoe) LAKE, MISS.

COMMERCE.

Small, **84,** 1358.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **08,** 504.

In charge:

Capt. A. M. Miller. **R., 84,** 1357.

Capt. G. M. Hoffman, **08,** 486.

Assistant. W. S. Davis. **R., 84,** 1358.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1358, 1359.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Miller (**R.** unfav.), **84,** 1357.

Pre. ex., of Roebuck Lake from its mouth to the RR. br. at Itta Bena, au. act Mar. 2, 1907. **R.,** Capt. Hoffman, Oct. 8, 1907[1] (unfav.), **08,** 504.

* Allotment.

[1] H. D. 811, 60th, 1st.

X-8 YALOBUSHA (Yallabusha) RIVER, MISS.

APPROPRIATIONS.

1881, $3,500, **81,** 1414.
1882, 3,500, **82,** 1555.
1884, 2,000, **84,** 1337.
1886, 2,000, **86,** 1363.

Total, 11,000

COMMERCE.

Cotton production, **83,** 1153.
Description of; unimportant, **95,** 1983, 1984.
To assure navigation would require system of slackwater imp., which would be out of all proportion to C. to be developed, **04,** 2093.

ENGINEERS.

Chief of Engineers. R., 80, 158; **81,** 210; **82,** 207; **83,** 216; **84,** 225, 226; **85,** 240; **86,** 235; **87,** 199; **95,** 279; **04,** 398; **12,** 781.

In charge:
Maj. W. H. H. Benyaurd, 1879–83. **R., 80,** 1348; **81,** 1414; **82,** 1554.
Maj. A. M. Miller, 1883–85. **R., 83,** 1152; **84,** 1337, 1342.
Capt. E. Bergland, 1885–87. **R., 85,** 1519; **86,** 1363.
Capt. J. H. Willard, 1887–95. **R., 87,** 1473; **88,** 1362; **95,** 1979.
Capt. C. L. Potter, 1904. **R., 04,** 2091.
Maj. J. A. Woodruff, **12,** 752.

Assistants.
N. M. Rees. **R., 80,** 1349.
W. S. Davis. **R., 84,** 1342; **85,** 1520.

OPERATIONS.

1881–82. 540 logs and snags removed and 694 trees destroyed, **82,** 1554.
1882–83. 3,956 trees, logs, and snags removed, **83,** 1153.
1884–85. 2,557 trees cut and girdled and 4,299 snags and logs removed, **85,** 1520.
1886–87. 2,329 snags, logs, and stumps removed and 12,425 trees cut, **87,** 1474.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 1348, 1349; **95,** 1979.

PROJECTS.

By Maj. Benyaurd, 1879, imp. from Grenada to its mouth, 63 m., by removal of snags, sunken logs, leaning timber, etc., est., $7,000, **80,** 1350; **87,** 1473.
Additional expend. required to maintain imp., **87,** 1473.

SURVEYS.

Ex. au. act Mar. 3, 1879, **79,** 118; made, 1879, by Maj. Benyaurd, **80,** 1348.
Ex. above Grenada au. act Aug. 2, 1882; made, 1883, by Maj. Miller (**R.** unfav.), **84,** 1342.
Ex. au. act Aug. 17, 1894; made by Capt. Willard, 1895 (**R.** unfav.), **95,** 1979.
Pre. ex. au. act June 13, 1902, Grenada to mouth. **R.** by Capt. Potter, July 18, 1902[1] (unfav.), **04,** 398, 2091. BERH. **R.** unfav., **04,** 2094.
Pre. ex. au. act Mar. 3, 1909, to the town of Derma. **R.** by Capt. Woodruff, Mar. 29, 1911[2] (unfav.), **12,** 781.

X-9 LOOSACOONA RIVER, MISS.

ENGINEERS.

Chief of Engineers. R., 84, 226.
In charge. Capt. A. M. Miller. **R., 84,** 1344.
Assistant. W. S. Davis. **R., 84,** 1344.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Miller (**R.** unfav.), **84,** 1344.

X-10 TALLAHATCHIE AND COLDWATER RIVERS, MISS.

Part.	Title.	Period.	Appropriation.
a	Tallahatchie R., Miss.	1878–1904	$65,500.00
b	Coldwater R., Miss.	1878–1897	11,000.00
c	Tallahatchie and Coldwater Rs., Miss.	1905–1912	49,406.35
d	Tallahatchie R. from mouth of Coldwater R. to Batesville	1906–1912	9,972.43
	Total		135,878.78

Part (a), X-10 Tallahatchie River, Miss.

APPROPRIATIONS.

1879, $6,000, **79,** 116.
1880, 9,000, **80,** 1319.
1881, 3,000, **81,** 1412.
1882, 3,000, **82,** 1551.
1884, 3,000, **84,** 1336.
1886, 3,500, **86,** 1362.
1888, 5,000, **88,** 1364.
1890, $5,000, **90,** 1899.
1892, 5,000, **92,** 1650.
1894, 4,000, **95,** 1947.
1896, 4,000, **96,** 1629.
1899, 5,000, **99,** 2021.
1902, *10,000, **02,** 1432.

Total, 65,500

* Allotment. [1] H. D. 201, 58th, 2d. [2] H. D. 263, 62d, 2d.

COMMERCE.

Important, **79,** 985.
C. of R., **83,** 1148.
Average C. for the last 10 years, 49,411 t. an.; value, $1,489,000, **00,** 411.

ENGINEERS.

Chief of Engineers. R., 78, 88; **79,** 116, 118; **80,** 155; **81,** 209; **82,** 206; **83,** 215; **84,** 224; **85,** 239; **86,** 234; **87,** 200; **88,** 182; **89,** 213; **90,** 192; **91,** 244; **92,** 236; **93,** 266; **94,** 247; **95,** 276; **96,** 241; **97,** 308; **98,** 299; **99,** 358; **00,** 410; **01,** 422; **02,** 352; **03,** 373; **04,** 394, 398.

Boards. BERH. **R., 04,** 2090.

In charge:
Capt. W. H. H. Benyaurd, 1879–83. **R., 79,** 971, 985; (Maj.) **80,** 1319; **81,** 1411; **82,** 1550.
Maj. A. M. Miller, 1883–85. **R., 83,** 1148; **84,** 1335.
Capt. E. Bergland, 1885–87. **R., 85,** 1517; **86,** 1361.
Capt. J. H. Willard, 1887–99. **R., 87,** 1474; **88,** 1363; **89,** 1613; **90,** 1897; **91,** 2003, **92,** 1648; **93,** 2041; **94,** 1508; **95,** 1945; (Maj.) **96,** 1626; **97,** 1932; **98,** 1637; **99,** 2020.
Maj. T. L. Casey, 1900–01. **R., 00,** 2534; **01,** 2067.
Capt. C. L. Potter, 1902. **R., 02,** 1432.
Capt. C. S. Bromwell, 1903. **R., 03,** 1396.
Lt. Col. H. M. Adams, 1904. **R., 04,** 2062, 2090.

Assistants:
J. M. Searles, **79,** 982.
J. J. Barry. **R., 80,** 1320.

OPERATIONS.

1879-80. 25,381 trees cut down and girdled, **80,** 1319.

1880-81. 27 snags and logs removed and 31,538 trees cut and deadened, **81,** 1412.

1881-82. 457 snags and logs removed from chan., **82,** 1551.

1882-83. 405 snags pulled, 6,740 s. y. brush cut and 2,167 trees and logs cut, deadened, and removed from R. bed, **83,** 1148.

1884-85. 857 snags and stumps pulled, 2 side jams removed, and 557 trees cut and girdled, **85,** 1517.

1886-87. 1,107 logs, snags, and trees removed and 2,727 leaning trees cut, **87,** 1475.

1888-89. 265 snags and logs removed from chan., **89,** 1614.

1889-90. 424 snags and logs and 3 wrecks removed from chan., and 12,920 trees and 435 s. y. brush cleared from banks, **90,** 1899.

1890-91. 302 snags and 53 logs removed from chan., and 417 shore snags, 2,902 trees, and 95 s. y. of brush cleared from banks, **91,** 2004.

1891-92. 398 snags and 2 wrecks removed from chan., **92,** 1650.

1892-93. Wreck removed; 1,440 s. y. brush and willows cut; and over 15,000 snags and other obstr. removed, **93,** 2044.

1893-94. Wreck removed; 150 s. y. brush and willows cut; about 3,400 snags and other obstr. removed, **94,** 1510.

1895-96. Several wrecks removed; over 1,600 s. y. brush and willows cut, and about 64,000 snags etc., removed, **96,** 1627, 1628.

1896-97. Part of wreck removed; 2,744 s. y. brush and willows cut; about 114,000 snags and other obstr. removed, **97,** 1933.

1897-98. A few obstr. removed, **98,** 1637.

1899-00. About 6,300 snags and other obstr., 1,100 s. y. willows and brush, and 2 wrecks removed from chan., **00,** 2535.

1900-01. 3,647 snags, logs and other obstr. removed from R. and 810 s. y. willows cut from banks, **01,** 2068.

1901-02. 5,046 snags and other obstr. removed from R. and 250 s. y. willows cut from banks, **02,** 1432.

1902-03. 3,894 snags and other obstr. removed from R. and 3,275 s. y. brush cut from banks, **03,** 1396.

1903-04. 1,072 snags and other obstr. removed from R. and 30 s. y. brush cut from banks, **04,** 2062.

PHYSICAL CHARACTERISTICS.

Described, **79,** 985; **93,** 2043; **94,** 1509; **96,** 1627, 1628; **97,** 1932; **98,** 1637.
Description of, above mouth of the Coldwater, **93,** 2042.
Caving and sliding banks, and shifting and scouring of chan. bring new obstr. into chan., **93,** 2044; **03,** 375.

PROJECTS.

By Maj. Benyaurd, 1879, imp. of l.-w. navigation from junction with Coldwater R. to mouth, 165 m.; by removal of snags, trees, and wreck of steamer; est. cost, $40,000, **79,** 116, 971, 985; **87,** 200, 1474. Imp. not considered permanent, **88,** 1363.
By Capt. Willard, 1892, expend. no part of app. of that year on R. above mouth of the Coldwater; Sec. of War sanctioned applying app. to R. below Coldwater, **93,** 2043.
Proj. of 1879 modified, 1899, by Maj. Willard, to permit expend. $10,000 in one working season to put the Tallahatchie bet. the Yazoo and Coldwater Rs. in fairly good navigable condition, and about $2,500 yearly for mainten. for some time to come, **99,** 2021.
Act June 13, 1902, au. continuing imp. and mainten. of work done along lines of former projs., **03,** 374.

SURVEYS.

Ex. by J. M. Searles, 1878–79, **78,** 88; **79,** 118, 982.
Pre. ex. au. act June 13, 1902, mouth of Coldwater R. to Batesville. **R.** by Capt. Potter[1] (unfav.), **04,** 398, 2088. BERH. concurs, **04,** 2090.

Part (b), X-10 Coldwater River, Miss.

APPROPRIATIONS.

1879,	$7,000,	**79,** 116.
1880,	4,000,	**80,** 1321.
Total,	11,000	

COMMERCE.

Fertility of country tributary to R., **79,** 985.
Description of; unimportant, **93,** 2100; **97,** 1943.

ENGINEERS.

Chief of Engineers. R., 78, 88; **79,** 116, 118; **80,** 155; **81,** 209; **82,** 206; **83,** 215; **84,** 225; **85,** 240; **93,** 272; **97,** 310.

In charge:
Capt. W. H. H. Benyaurd, 1878–83, **78,** 88; **79,** 112, 117. **R., 79,** 970, 984; (Maj.) **80,** 1321; **81,** 1413; **82,** 1551.
Maj. A. M. Miller, 1883–85. **R., 83,** 1149; **84,** 1336.
Capt. E. Bergland, 1885. **R., 85,** 1518.
Capt. J. H. Willard, 1893–97. **R., 93,** 2099; **97,** 1943.

Assistants:
J. M. Searles, **79,** 982.
J. Barry. **R., 80,** 1321.
J. H. Burney. **R., 80,** 1322.

[1] H. D. 190, 58th, 2d.

OPERATIONS.

1879-80. 2,777 trees cut and girdled, **80,** 1321.
1880-81. 3,553 logs, snags, and stumps removed and trees cut down, **81,** 1413.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 984, 985; **93,** 2099; **97,** 1944.

PROJECTS.

By Capt. Benyaurd, 1879, removing obstr. with hired labor, U. S. flatboat; est., $25,000, **79,** 116, 970, 985.

SURVEYS.

Ex. ordered and in progress, **78,** 88.
Ex. completed by J. M. Searles, **79,** 118, 982.
Ex. Coldwater and Tallahatchie Rs. made, 1880, by Maj. Benyaurd, **80,** 1322.
Ex. au. act July 13, 1892; made, 1893, by Capt. Willard (**R.** unfav.), **93,** 2099.
Ex. au. act June 3, 1896; made, 1896, by Maj. Willard (**R.** unfav.), **97,** 1943.

Part (c), X-10 Tallahatchie and Coldwater Rivers, Miss.

APPROPRIATIONS.

1905,	*$5,000.00,	**05,** 1556.
1907,	[1] 5,000.00	**07,** 1509.
	*5,000.00	
1909,	*10,000.00,	**09,** 1569.
1909,	[1] 1,500.00,	**09,** 1569.
1910,	*5,000.00,	**10,** 1722.
1911,	*8,544.02,	**11,** 640, 1872.
	[2] 140.84,	**11,** 640.
	[1] 1,221.49,	**11,** 640.
1912,	*8,000.00,	**12,** 2085.
Total,	49,406.35	

COMMERCE.

Of little importance and decreasing, **12,** 774.

ENGINEERS.

Chief of Engineers. R., 05, 409; **06,** 443; **07,** 470; **08,** 499; **09,** 527; **10,** 592; **11,** 639; **12,** 773.

In charge:
Capt. G. M. Hoffman, 1905–07. **R., 05,** 1555; **06,** 1377; **07,** 1509.
Capt. C. S. Smith, 1908–10. **R., 08,** 1580; **09,** 1567; **10,** 1720.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1868; (Maj.) **12,** 2082.

Assistant. H. M. Marshall. **R., 05,** 1560.

OPERATIONS.

1904-05. 270 snags and other obstr. removed from Tallahatchie R., **05,** 1555.
1905-06. 472 snags and other obstr. removed from Tallahatchie R.; 2,290 snags and 1 wreck removed from Coldwater R., and 23,000 s. y. willows cut from banks, **06,** 1377–78.
1906-07. 11,466 snags and other obstr., 90,000 s. y. brush cut and 2 wrecks removed from both Rs., **07,** 1509.
1907-08. 14,992 snags and other obstr. removed and 64,158 s. y. brush cut, **08,** 1580.
1908-09. 12,679 snags and other obstr. removed **09,** 1567.
1909-10. 17,348 snags and other obstr. removed and 39,875 s. y. of brush cut, **10,** 1720.
1910-11. 90 obstr. removed from Tallahatchie R. bet. mouth and Archula Landing; 4,348 snags, etc., removed from Coldwater R. upstream from Marks and downstream to Glendora on Tallahatchie R., **11,** 1868.
1911-12. 10,830 snags and other obstr. removed, **12,** 2083.

Part (d), X-10 Tallahatchie River from mouth of Coldwater River to Batesville, Miss.

APPROPRIATIONS.

1907,	$4,000.00,	**07,** 1510.
1909,	5,000.00,	**09,** 529.
	[2] 972.43,	**11,** 640.
Total,	9,972.43	

ENGINEERS.

Chief of Engineers. R., 06, 446; **07,** 470; **08,** 500; **09,** 528; **10,** 593; **11,** 640; **12,** 774.

In charge:
Capt. G. M. Hoffman, 1906–07. **R., 07,** 1510.
Capt. C. S. Smith, 1908–10. **R., 08,** 1581; **09,** 1567; **10,** 1720.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1868; **12,** 2082.

OPERATIONS.

1906-07. 2,575 snags and other obstr. removed and 25,950 s. y. brush cut, **07,** 1510.
1907-08. 8,288 snags and other obstr. removed and 33,200 s. y. brush cut, **08,** 1581.
1909-10. 58 logs and stumps removed, **10,** 1720.
1910-11. 2,707 snags and other obstr. removed, **11,** 1868.
1911-12. Repairs to floating plant, **12,** 2083.

PROJECTS.

Act Mar. 2, 1907, au. $4,000 in resuming work in accordance with plan,[3] **07,** 1510.

SURVEYS.

Pre. ex. of Tallahatchie R., mouth of Coldwater R. to Batesville, au. act Mar, 3, 1905. **R.** by Capt. Hoffman, Nov. 9, 1905; est., $2,000 per an., for series of years, and eventually not more than $1,000 per an.,[3] **06,** 446.

* App.
[1] Trans. from Yazoo R. app.
[2] Trans. from Tchula Lake app.
[3] H. D. 147, 59th, 1st.

X-13 CASSIDY (Cassidy's) BAYOU, MISS.

COMMERCE.

Small, **85,** 1534, 1537.
Description of; unimportant, **93,** 2096.

ENGINEERS.

Chief of Engineers. **R., 85,** 243; **87,** 203; **93,** 272; **10,** 599.

In charge:
Capt. E. Bergland. **R., 85,** 1534.
Capt. J. H. Willard, 1887–93. **R., 87,** 1497; **93,** 2095.
Capt. Clarke S. Smith, 1910. **R., 10,** 578.

Assistant. F. S. Burrows. **R., 85,** 1535.

LEGISLATION.

Act of Mississippi, 1886, incorporated the Cassidy Bayou Dam & Lock Co., having right to imp. and navigate the stream for 30 years, **93,** 2097.

PHYSICAL CHARACTERISTICS.

Bayou described, **85,** 1535; **93,** 2096.

PLANS.

Capt. Bergland reported the removal of snags and similar obstr., 44 m. of bayou, mouth to Hopsons Bayou, would cost $8,800, **85,** 1534, 1537.
In 1887 Capt. Willard recom. expend. $5,000 to clear the bayou from snags to 50 m. above the mouth, **87,** 1497.

PROJECTS.

Snag removal advised, if the charter of the dam company should be revoked, **93,** 2096.

SURVEYS.

Ex. au. acts July 5, 1884, and Aug. 5, 1886; made by Capt. Bergland (**R.** unfav.), 1885, **85,** 1534, and Capt. Willard in 1886, **87,** 1497.
Ex. au. act July 13, 1892; made, 1893, by Capt. Willard (**R.** unfav.), **93,** 2095.
Pre. ex. mouth to Belen, Miss., au. act Mar. 3, 1909, made; **R.** by Capt. Smith, Aug. 19, 1909 (unfav.),[1] **10,** 599.

X-14 BEAR CREEK (branch of the Yazoo River), MISS.

APPROPRIATIONS.

1910,	*$3,000.00,	**10,** 597, 1722.
1911,	*1,540.66,	**11,** 1872.
Total,	4,540.66	

COMMERCE.

Description of; unimportant, **95,** 1991; **11,** 644.
About 5,350 bales of cotton an. and some lumber, **10,** 597; **11,** 666.

ENGINEERS.

Chief of Engineers. **R., 81,** 213; **82,** 210; **95,** 280; **08,** 504; **10,** 597; **11,** 644; **12,** 780.

In charge:
Maj. W. H. H. Benyaurd, 1882. **R., 82,** 1563.
Capt. J. H. Willard, 1895. **R., 95,** 1990.
Capt. C. S. Smith, 1910. **R., 10,** 1719.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1871; (Maj.) **12,** 2084.

Assistant. W. S. Davis. **R., 82,** 1563.

OPERATIONS.

1910–11. Snags and other obstr. removed, summary given, **11,** 1871.
1911–12. Snags and other obstr. removed, **12,** 2084.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1563; **95,** 1990; **11,** 644.
Creek a succession of small lakes and creeks about 80 m. l.; runs dry during l. w., lakes becoming stagnant pools, **95,** 1990; **10,** 597.

PLANS.

By Maj. Benyaurd, 1881, clearing out obstr. from about 44 m. of the creek and connecting lakes at an est. of $6,000, **82,** 1563, 1565.

PROJECTS.

By Capt. Smith, 1908, plan for imp.; est., $3,000,[2] **08,** 504.
Act June 25, 1910, au. cutting out undergrowth which obstr. navigation; est. $3,000; $2,500 to be app. 3 years later for mainten.; **10,** 597; addl. sum of $1,540 req., **11,** 644.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1881, by Maj. Benyaurd (see Plans), **82,** 1563.
Ex. au. act Aug. 17, 1894; made, 1895, by Capt. Willard (**R.** unfav.), **95,** 1990.
Ex. au. act Mar. 2, 1907; made, 1907, by Capt. Hoffman,[2] **08,** 504.

X-15 BIG SUNFLOWER RIVER, MISS.[3]

APPROPRIATIONS.

1879,	$20,000.00,	**79,** 116.
1880,	8,000.00,	**80,** 1318.
1881,	4,000.00,	**81,** 1411.
1882,	5,000.00,	**82,** 1549.
1884,	5,000.00,	**84,** 1335.
1886,	5,000.00,	**86,** 1359.
1888,	5,000.00,	**88,** 1367.
1890,	5,000.00,	**90,** 1903.
1892,	5,000.00,	**92,** 1656.
1894,	5,000.00,	**95,** 1951.
1896,	5,000.00,	**96,** 1632.
1899,	$5,000.00,	**99,** 2024.
1902,	*20,000.00,	**02,** 1434.
1905,	*6,000.00,	**05,** 1556.
1907,	100,000.00,	**07,** 1512.
1910,	[2] 7,000.00,	**10,** 1722.
	*10,000.00,	**10,** 1722.
1911,	[4] 4,000.00,	**12,** 2085.
1911,	*865.51,	**11,** 1872.
1912,	75,000.00,	**12,** 2085.
Total,	307,365.51 (plus receipts from sales, $93.82, **12,** 2085).	

* Allotment.
[1] H. D. 324, 61st, 2d.
[2] H. D. 908, 60th, 1st.
[3] This work app. for in 1902, combined with Yazoo and Tallahatchie Rs. and Tchula Lake.
[4] Trans. from allotment for Yazoo R.

COMMERCE.

Advantages resulting from imp., **85,** 1511.

Reduction in rates consequent upon imp., **89,** 1617; **91,** 245.

Description of; not unimportant, **93,** 1639, 2051.

Average C., 1900, for "last 11 years 32,258 t. an.," value, $970,000, **00,** 412.

50% reduction in rates, **02,** 353.

Eng. imp. commended by com. interests as great relief, **11,** 641, 1868.

1911, 92,000±t., **12,** 776.

CONTRACTS.

1907. O. A. Gibson, constr. levee to close chutes, 27¢ c. y., **08,** 1583.

1909. Morrison Bros., levee extension of the Little Sunflower Dike in Sharkey Co., 25.45¢ c. y., **10,** 1720.

ENGINEERS.

Chief of Engineers. **R.,** **78,** 88; **79,** 116, 117; **80,** 155; **81,** 208; **82,** 206; **83,** 214; **84,** 224; **85,** 238; **86,** 234; **87,** 200; **88,** 183; **89,** 214; **90,** 193; **91,** 245; **92,** 238; **93,** 268; **94,** 248; **95,** 277, 280; **96,** 242, 243; **97,** 308; **98,** 300; **99,** 359; **00,** 411; **01,** 424; **02,** 353; **03,** 373; **04,** 394; **05,** 409; **06,** 443; **07,** 469; **08,** 501; **09,** 529; **10,** 594; **11,** 641; **12,** 775.

In charge:

Capt. W. H. H. Benyaurd, 1878–82, **78,** 88; **79,** 112, 117. **R.,** **79,** 970, 983; (Maj.) **80,** 1316; **81,** 1408, **82,** 1548.

Maj. A. M. Miller, 1882–85. **R.,** **83,** 1145; **84,** 1334.

Capt. E. Bergland, 1885–86. **R.,** **85,** 1511; **86,** 1359.

Capt. J. H. Willard, 1886–99. **R.,** 87, 1477; **88,** 1365; **89,** 1617; **90,** 1901; **91,** 2007; **92,** 1654; **93,** 2047; **94,** 1513; **95,** 1949; (Maj.) **96,** 1630, 1638; **97,** 1935; **98,** 1639; **99,** 2022.

Maj. T. L. Casey, 1900–01. **R.,** **00,** 2537; **01,** 2070.

Capt. Chas. L. Potter, 1902. **R.,** **02,** 1433.

Capt. Chas. S. Bromwell, 1903. **R.,** **03,** 1397.

Lt. Col. H. M. Adams, 1904. **R.,** **04,** 2061.

Capt. G. M. Hoffman, 1905–07. **R.,** **05,** 1555; **06,** 1378; **07,** 1510.

Capt. Clarke S. Smith, 1908–10. **R.,** **08,** 1581; **09,** 1567; **10,** 1720.

Capt. J. A. Woodruff, 1911–. **R.,** **11,** 1868; (Maj.) **12,** 2083.

Assistants:

J. M. Searles, **79,** 982. **R.,** **80,** 1316.

J. J. Barry. **R.,** **81,** 1409; **82,** 1549; **83,** 1146.

C. W. Phifer. **R.,** **85,** 1512.

H. M. Marshall. **R.,** **96,** 1644; **05,** 1560.

T. C. Thomas, **03,** 1401; **04,** 2068.

OBSTRUCTIONS. (See Physical characteristics below.)

OPERATIONS.

1879-80. 10 wing dams built by hired labor at Oliphant Bar; removal of snags and logs, **80,** 155, 1316.

1880-81. 472 snags and logs removed and 7,000 trees cut down; wing dams built at Callao and Vick's Landing, **81,** 1408.

1881-82. 20,245 trees cut down, 186 logs removed, 775 l. f. wing dams built at Callao, Shell Ridge, and Vick's Landing, **82,** 1548.

1882-83. 20,433 trees cut down, 3,109 logs and snags and 600 brush piles removed, **83,** 1145.

1884-85. 2,524 l. f. wing dams built at Oliphant, Callao, Woodburn, Johnsonville, and Hollywood; 400 logs and snags removed, **85,** 1511, 1513.

1886-87. 46 snags, stumps, and logs removed, and 1,115 l. f. of wing dams built, **87,** 1478.

1887-88. 117 snags and 164 c. y. earth removed from chan.; 5,151 l. f. wing dams built; 319 trees and 8,260 s. y. willows cleared from banks, **88,** 1366.

1888-89. 140 logs and snags removed from chan., and 619 trees cleared from banks, **89,** 1617.

1889-90. 813 l. f. of wing dams built; 15 snags removed from chan. and 5 trees from banks; 375 l. f. of brush wing dams built, **90,** 1902.

1890-91. 645 snags and 2 wrecks removed from chan., and 320 trees cleared from banks; 375 l. f. of brush wing dams built, **91,** 2008.

1891-92. 50 snags and logs removed from chan., and 23 trees cut from banks, **92,** 1655.

1892-93. Part of wreck removed; 1,065 s. y. brush and willows cut; and about 17,800 snags and other obstr. removed, **93,** 2050.

1895-96. One old dam repaired; 23 wing dams, amounting to 1,810 l. f., built; 5,463 s. y. brush and willows cut; and nearly 25,000 snags, etc., removed, **96,** 1632.

1897-98. 32 wing dams, amounting to 2,817 l. f., built; 3,305 s. y. brush and willows cut; and 61,600 snags, etc., removed, **98,** 1640.

1898-99. At Hollywood Bar a wing dam was built to cause scour; an old dam repaired, **99,** 2022.

1899-00. 20 wing dams built and 14 old dams repaired; 10,069 snags and other obstr. and 35,700 s. y. willows and brush removed from chan., **00,** 2538, 2539.

1900-01. Snag boat *Columbia* removed 39 snags, 1 stump, and 8 shore snags, **01,** 2070.

1902-03. 2,745 l. f. wing dam built, and 431 snags, stumps, and logs removed, **03,** 1397.

1903-04. 3,665 l. f. wing dam constr., 3 old dams repaired and strengthened, and logging and snagging continued, **04,** 2063.

1904-05. 15 wing dams built (total of 5,700′), 21 old dams repaired and strengthened, and 2,630 snags and logs removed, **05,** 1555.

1905-06. 3 wing dams built (total of 1,530 l. f.), 12 dams repaired; over 45,000 leaning trees felled and cut up; over 9,000 snags, logs, and stumps removed; about 2,000 trees girdled; 100 sq. yds. willows and brush cut, etc., **06,** 1378.

1906-07. 5 jams broken up and destroyed; over 900 snags, stumps, and logs removed; 11,924 leaning trees cut; 2,060 trees girdled, and 8,293 sq. yds. willows and brush cut, **07,** 1510.

1907-08. 80 l. f. wing dam built at Eastland Shoals; over 4,000 snags, stumps, and logs removed; 1 jam broken up and destroyed; over 24,000 leaning trees felled and cut up; over 3,000 trees girdled; 1,000 s. y. willows and brush cut, and 4 wrecks removed, **08,** 1582.

1908-09. Repairing wing dams, removing snags, logs, and trees, cutting willows and brush, and constr. 5 levees, **09,** 1568.

1909-10. Levee extension of Little Sunflower Dike completed; embankment constr.; chan. d. at Oliphant Bar by snag boat *Ben Humphreys;* wing dams built and repaired; snagging, etc., continued, **10,** 1720, 1721.

1910-11. Work of the U. S. snag boats and derrick boats in dr. cuts, building dikes and wing dams, and removing obstr., **11,** 1868, 1869, 1870.

1911-12. Snagging and constr. and repair of wing dams, 9,200 c. y., bucket measurement, dr. from 3 cuts in lower 66 m. of R., **12,** 776, 2083, 2084.

PHYSICAL CHARACTERISTICS.

Described (navigable for boats of light draft 6 months in year); **79,** 983; **85,** 1511; **93,** 2049; **96,** 1631, 1639; **98,** 1639; **12,** 775, 776.

Obstr., **79,** 983, 984.

Great beneficial changes since 1878. Gain in depth. **96,** 1641.

Water escaping through crevasses along the Mississippi front during a flood said to have brought in large quantities of drift, etc., **97,** 1935.

Operations (q. v) show something of character of stream.

PRIVATE WORK.

Dikes built by SS. men. Improperly placed, **09,** 1568.

PROJECTS.

By Maj. Benyaurd, 1879, imp. R. to 3′ to 3½′ by removal of obstr. from lower part of R., and imp. of Oliphant Bar and Mussel Shoals by wing dams; est., $66,000, **79,** 116, 970; **86,** 234; **88,** 1365; modified, 1899, by Maj. Willard to permit expend. $20,000 in one or two seasons of l. w. to complete imp., and $3,000 an. mainten., **99,** 2023.

Removal of obstr. bet. mouth of Hushpuckena R. (about 30 m. below Clarksdale) and Baird; below

Baird the imp. of the R. by constr. of contraction works, to obtain navigable d. of 3′; est. for necessary closing dams below Baird, $75,000, and about $10,000 per year for 5 years for open R. work, and $5,000 per year thereafter,[1] **07,** 471.

Act July 25, 1912, au. constr. of lock and dam at foot of Hollywood Bar, 74 m. above mouth of R.; est., $300,000; open chan. work and dr. below mouth of Hushpuckena R.; est., $50,000,[2] **12,** 776.

SURVEYS.

Ex. au. and in progress, **78,** 88; completed by J. M. Searles, **79,** 117, 982.

Oliphant Bar and Mussel Shoal, **80,** 1316.

Line of precise levels run from Friars Pt., on the Mississippi, to Clarksdale, to check base lines of probable sur. for locks and dams, **95,** 1951.

Ex. with view to imp. R. to Clarksdale with locks and dams au. act Aug. 17, 1894; made, 1896, by Maj. Willard (**R.** fav. to limited imp.), **96,** 1638; **99,** 362.

Pre. ex. and plan and est. of cost of imp., with view to obtaining continuous navigation from mouth to RR. br. at Clarksdale,[1] **06,** 446.

For purpose of locating levees to close chutes in lower R., made, 1907, **08,** 1582.

Pre. ex. and sur. from near Baird to mouth of Hushpuckena R. au. by R. and H. act Mar. 2, 1907 (**R.** unfav.), **08,** 504; **09,** 532; **12,** 776.

Made, 1909, from mouth of Big Sunflower R. to head of Mabin Isld., showing dikes built and d. of water, **09,** 1568.

Cong. docs., etc., relative to surs., exs., plans, etc., **03,** 376; **04,** 397; **07,** 472; **08,** 503; **12,** 775, 776.

X-17 QUIVER RIVER, MISS.

ENGINEERS.

Chief of Engineers. **R.,** **12,** 781.
In charge. Maj. J. A. Woodruff, **12,** 752.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 781.

X-19 BOGUE (Phalia) PHALIAH, MISS.

COMMERCE.

Description of. Unimportant. **89,** 1629; **95,** 1990.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 217; **95,** 280; **10,** 599.
In charge. Capt. J. H. Willard, 1889–95. **R.,** **89,** 1628; **95,** 1988.
Assistant. H. M. Marshall. **R.,** **89,** 1628.

PHYSICAL CHARACTERISTICS.

Description of. Very crooked stream, tributary to the Big Sunflower, obstr. by logs, jams, etc., **89,** 1629; **95,** 1988.

SURVEYS.

Ex., especially of the Narrows, au. act Aug. 11, 1888; made by Capt. Willard in 1889 (**R.** unfav.), **89,** 1628. Another ex. au. act Aug. 17, 1894; made by Capt. Willard, 1895 (**R.** unfav.), **95,** 1988.

Pre. ex. au. act Mar. 3, 1909, from mouth to the Forks of the Bogue; BE. review unfav..[3] **10,** 599.

X-23 DEER CREEK, MISS.

COMMERCE.

Important, **85,** 1539.

ENGINEERS.

Chief of Engineers. **R.,** **85,** 244.
In charge. Capt. E. Bergland. **R.,** **85,** 1538.
Assistant. F. S. Burrows. **R.,** **85,** 1540.

OBSTRUCTIONS.

RR. and highway brs. without draws, **85,** 1539, 1543.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 1538, 1540.

PLANS.

In 1884 stream worthy of imp. if artificial obstr. were removed; creek could be cleared of logs and similar obstr.; est., $13,563, **85,** 1539, 1544.

SURVEY. (See Plans.)

Ex. au. act July 5, 1884; made by Capt. Bergland, **85,** 1538.

X-25 STEELE AND WASHINGTON BAYOUS, AND LAKE WASHINGTON, MISS.

APPROPRIATIONS.

1884,	$2,500.00,	**85,** 1523.
1886,	2,500.00,	**86,** 1364.
1888,	2,500.00,	**88,** 1365.
1890,	2,500.00,	**90,** 1901.
1892,	2,500.00,	**92,** 1653.
1910,	*5,000.00,	**10,** 1722.
1911,	*1,549.81,	**11,** 1872.
1912,	*2,500.00,	**12,** 2085.
Total,	21,549.81	

COMMERCE.

Cotton production, **84,** 1360, 1362.
Decreasing, **93,** 2047.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 227; **85,** 241; **86,** 235; **87,** 200; **88,** 182; **89,** 214; **90,** 193; **91,** 244; **92,** 237; **93,** 267; **94,** 248; **95,** 276; **08,** 504; **10,** 596; **11,** 642; **12,** 778.

* Allotment.
[1] H. D. 667, 59th, 1st.
[2] H. D. 1251, 60th, 2d, and House R. and H. Com. D. 2, 62d, 2d. [3] H. D. 329, 61st, 2d.

In charge:
Maj. A. M. Miller, 1882–85. **R., 84,** 1360.
Capt. E. Bergland, 1885–87. **R., 85,** 1522; **86,** 1363.
Capt. J. H. Willard, 1887–96. **R., 87,** 1476; **88,** 1364; **89,** 1615; **90,** 1900; **91,** 2005; **92,** 1651; **93,** 2045; **94,** 1511; **95,** 1948.
Capt. C. S. Smith, 1908–11. **R., 08,** 486; **10,** 1719.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1870; (Maj.) **12,** 2084.

Assistant. P. C. Montgomery. **R., 84,** 1361.

OPERATIONS.

1884–85. 2,993 trees, snags, and logs cut and removed, **85,** 1523.
1886–87. Removal of obstr. from 40 m. of chan., **87,** 1477.
1888–89. 111 snags removed from chan., and 480 trees and 44,950 s. y. brush cleared from banks, **89,** 1616.
1889–90. 7 snags removed from chan., and 142 trees cleared from banks, **90,** 1900.
1890–91. 87 snags, 42 log jams, and 38 leaning trees cleared and removed, **91,** 2006.
1891–92. 28 snags, 157 logs, 1,599 trees, and 11,800 s. y. of brush removed from R. and banks, **92,** 1652.
1910–11. Obstr. removed from R. and banks, **11,** 1870.
1911–12. Snags removed, trees cut, etc., from R. and shore, **12,** 2084.

PHYSICAL CHARACTERISTICS.

Description, **84,** 1360.

PROJECTS.

By Maj. Miller, 1883, imp. of bayou from mouth to Swan Lake by removal of obstr. at l. w., giving a 7-months navigable chan.; est., $14,960, **84,** 1362.
Act June 25, 1910, au. removal of snags, logs, stumps, etc.; est., $15,000, **10,** 596.

SURVEY.

Ex. au. act Aug. 2, 1882; made, 1883, by Maj. Miller, **84,** 1360.
Pre. ex. au. act Mar. 2, 1907, mouth of Steele Bayou to Glen Allan. **R.** by Capt. Smith, 1907 and 1908; est., $15,000,[1] **08,** 504.

X-28 RED RIVER, LA., TEX., AND ARK.[2]

Part.	Title.	Period.	Appropriations.
a	Red R.	1828–1879[3]	$1,274,877.50
b	Red R., mouth	1880–1882[4]	.....
c	Red R., except mouth, including above Fulton, Ark	1880–1892	728,500.00
d	Red R., near mouth to Fulton	1892–1912	960,000.00
e	Red R., above Fulton, Ark	1892–1912	406,500.00
f	Red R., Shreveport to Fulton	1887	.....
	Total	.....	3,369,877.50

Part (a), X-28 Red River, Ark., La., and Tex.

APPROPRIATIONS.[5]

Removal of raft:
1828, $25,000.00, act May 23.
1831, 187.50 (sur.), act Mar. 2.
1832, 20,000.00, act July 3.
1834, 50,000.00, act June 28.
1835, 50,000.00, act Mar. 3.
1836, 40,800.00, act July 2.
1836, [6]30,000.00, act July 2.
1837, 65,000.00, act Mar. 3.
1838, 70,000.00, act Apr. 20.
1841, 75,000.00, act Sept. 4.
1845, 240.00, act Mar. 3.
1847, [7]7,150.00, act Mar. 2.
1852, 100,000.00, act Aug. 30.
1872, 150,000.00, act June 10.
1873, 30,000.00, **73,** 64, 620, 630.
1874, 50,000.00, **74,** 72, 704.
1875, 20,000.00, **75,** 69, 527.

Removing raft and closing Tones Bayou:
1876, $35,000.00, **76,** 78, 599; **77,** 77.
1878, 30,000.00, **78,** 87, 630.
1879, 15,000.00, **79,** 113, 954.

Closing Tones Bayou:
1872, [8]$20,000.00, **73,** 623, 630.

Removing snags and other obstr.:
1878, $25,000.00, **78,** 87, 634.
1879, 22,500.00, **79,** 114, 961.

Imp. mouth:
1878, $150,000.00, **78,** 87, 632; **79,** 961.
1879, 40,000.00, **79,** 114, 961.

Imp. of upper R. above raft:
1879, $10,000.00, **79,** 114.

Imp. of Cypress Bayou:
1872, $10,000.00, **73,** 620, 623; **74,** 706.
1873, 50,000.00, **73,** 64, 623; **74,** 720.
1876, 13,000.00, **76,** 78, 600; **77,** 77, 490.
1878, 15,000.00, **78,** 87, 634.
1879, 6,000.00, **79,** 113, 959.

Total, 1,274,877.50

COMMERCE.

Important, **73,** 623, 651, 664, 667.

[1] H. D. 904, 60th, 1st.
[2] Red River, Ark. and La. (See also Clear Lake, Black Bayou, Red Bayou, Black Lake, and Kelley Bayou.) Sur.—**R.,** June 1, 1841, est., $75,000. Jan. 18, 1855, est. indefinite. (H. D. 482, 55th, 2d.)
[3] Includes app. for imp. mouth (1878–9) and Cypress Bayou (1872–9).
[4] See Miss. R., lower part, for imp. of mouth.
[5] Statements of app., **74,** 704; **77,** 481, 489; **78,** 630, 633; **79,** 954, 959.
[6] Building and operating boat.
[7] To supply deficiency.
[8] In addition, $4,500 allotted 1877, probably from the general app. for R., **79,** 954.

CONTRACTS.

History of early contracts, **73,** 644.
1872. Eager Elleeman & Co., dam to close Tones Bayou, **73,** 628.

ENGINEERS.

Chief of Engineers:
Reports—
Removal of raft, **66,** 7; **71,** 67; **72,** 61; **73,** 64; **74,** 72; **75,** 69; **76,** 78; **77,** 77; **78,** 86; **79,** 112.
Closing Tones Bayou, **73,** 64; **74,** 72; **75,** 70; **77;** 77; **78,** 86; **79,** 112.
Removing snags and obstr., **78,** 87; **79,** 114.
Imp. mouth, **78,** 87; **79,** 113.
Imp. upper R., **79,** 114.
Imp. Cypress Bayou, **70,** 31, 62; **71,** 66; **72,** 61; **73,** 64; **74,** 73; **75,** 69; **76,** 78; **77,** 77; **78,** 87; **79,** 113.

In charge:
Capt. C. W. Howell, 1870-74. Reports—
Removal of raft, **72,** 568; **73,** 613; **74,** 702; **75,** 524, 902.
Closing Tones Bayou, **73,** 623, 635, 671; **74,** 704; **75,** 530.
Imp. of Cypress Bayou, **71,** 66; **72,** 568; **73,** 620, 668; **74,** 706; **75,** 528.
Imp. falls at Alexandria, **75,** 522, 902.

Capt. W. H. H. Benyaurd, 1874–79. Reports—
Removal of raft, **75,** 526; **76,** 596; **77,** 480; **78,** 629; **79,** 951.
Closing Tones Bayou, **77,** 483; **78,** 629; **79,** 951.
Removing snags and other obstr., **78,** 634; **79,** 961.
Imp. mouth., **78,** 636; **79,** 959.
Imp. of R. above raft, **79,** 964, 986.
Imp. of Cypress Bayou, **75,** 528; **76,** 599; **77,** 488; **78,** 633; **79,** 957.

Assistants:
Lt. E. A. Woodruff. **R.,** **72,** 569, 572; **73,** 613, 635, 668. Death, **74,** 702.
G. Woodruff, **74,** 703.
Lt. J. B. Quinn. **R.,** **75,** 524.
J. Burney. **R.,** **77,** 483; **78,** 631; **79,** 955.
W. C. Melvin. **R.,** **79,** 954.
J. Straszer, **79,** 962.
G. R. Wilson. **R.,** **79,** 993.
F. W. Gee. **R.,** **74,** 706.
H. A. Leavitt. **R.,** **74,** 716.
H. C. Ripley. **R.,** **75,** 906.

ESTIMATES. (See Plans and Projects.)

By Capt. Johnston, 1874, removal of raft, $156,000, **73,** 646.
By Lt. Woodruff, 1872, $259,014, **72,** 572; **74,** 704; **76,** 598; **77,** 482. Reason for cost exceeding est., **76,** 599.
By Capt. Benyaurd, 1879, completion, $122,500, **79,** 954.
By Lt. Woodruff, closing Tones Bayou, 1873, $42,916, **73,** 675; **74,** 706; **75,** 526. By Capt. Howell, 1874, $20,000, **74,** 73, 705.
By Capt. Benyaurd, 1878, removing snags and other obstr., $175,000, **78,** 634, 635.
By Capt. Benyaurd, 1878, mouth, $300,000, **78,** 87, 636.
By Capt. Benyaurd, 1879, R. above raft, $67,836, **79,** 989.
By Lt. Woodruff, 1872, Cypress Bayou; dam at lower end of Soda Lake, $70,000, **73,** 670.
By Capt. Howell, 1874, 3′ d., Shreveport to Jefferson, $372,580, **74,** 73, 710, 715, 720; **75,** 69, 529.
By Capt. Benyaurd, 1878, completion of proj., $20,000, **78,** 633.
By Capt. Howell, 1875, falls at Alexandria, l. w. canal; if locks be provided with common gates, $82,611; if Fouracre's and Girard's gates, $83,605, **75,** 904; or dam at foot of falls, with lock and navigable sluice, $97,653, **75,** 904.
By H. C. Ripley, 1875, straight cut through upper falls, 5′ x 100′, $75,256, **75,** 908; or wing dams, aided by cut through lower falls, $60,907, **75,** 909.
By Capt. Howell, 1875, shore protection in front of Alexandria, $18,400, **75,** 906.
By Capt. Benyaurd, 1879, snag boat, $60,000, **79,** 961.

OPERATIONS.

History of, previous to 1866, **73,** 644, 664.
1872-73. Purchase of wrecking boat, and removal of raft by hired labor, **73,** 64, 613. Successful use of nitroglycerine in removal of raft, **73,** 618; **74,** 703. Closing Tones Bayou by l. w. dam, destruction of same by high water, **73,** 628; reclosing of, by drift, **73,** 630; **74,** 704; 43,839 c. y. dr. from Cypress Bayou, **73,** 64, 622.
1873-74. Navigable chan. through raft opened for entire l., Nov., 1873. Completion of drift dam closing Tones Bayou, **74,** 72, 703, 705. Dr. continued in Cypress Bayou, chan. w. and d. by removal of 53,700 c. y., **74,** 796, 708.
1874-75. Removing parts of raft and w. chan. Premature explosion of nitroglycerine, **75,** 523, 526. Dr. chan. on Cypress Bayou continued, **75,** 69, 528, 529.
1875-76. W. chan. through raft. Present condition of. **76,** 78, 597. Continuation of dr. in Cypress Bayou, **76,** 600.
1876-77. W. chan. through raft, **77,** 77, 481. Closing Tones Bayou by brush dam, **77,** 77, 483, 487.
1877-78. W. chan. through raft and keeping R. free from obstr., **78,** 86, 629. Repairing and raising dam at Tones Bayou, **78,** 86, 630. Building new dr. at Cypress Bayou, **78,** 87, 633.
1878-79. Removing parts of old raft, **79,** 112, 951. Changes produced by work at, **79,** 113, 952, 955. Dr. at mouth of R. for temporary imp., **79,** 113, 959. Removing snags and wrecks from R., **79,** 114, 961, 962. Repairing and raising dam at Tones Bayou, **79,** 953. W. chans. at Cypress Bayou, **79,** 113, 958.

PHYSICAL CHARACTERISTICS.

Floods on Red R., **69,** 343, 351; **73,** 642; **75,** 578, 616, 662, 663; **76,** 616.
Description of raft, **72,** 569; **73,** 616, 640, 664, 666; **76,** 598; **79,** 955.
Ancient discharge of R. probably through Atchafalaya R., **73,** 640.
Injurious action of cut-offs, **73,** 645.
Geological notes, **73,** 651.
Characteristics of Tones Bayou, **73,** 672; **77,** 484.
Characteristics of Cypress Bayou, **74,** 706, 709; **73,** 621, 650, 669.
Characteristics at falls of Alexandria, **75,** 902.
Characteristics of R. above raft, **79,** 986.

PLANS. (See Estimates; Mississippi River—Levees; and Projects.)

History of early plans, **72,** 569; **73,** 644. Discussion of plans, **73,** 647.
By Capt. Johnson, 1854, R. at raft, passage around raft through Dooleys Bayou, Shift and Soda Lakes, and Twelve-mile Bayou, **72,** 569.
Lt. Woodruff, 1872, reported plan inadequate, **72,** 569.
By W. C. Melvin, 1875, reservoirs to restrain floods and assist l. w. discharge, **75,** 616, 673.
By G. W. R. Bayley, Louisiana levee commission, 1875, levees with a gradual closure of side outlets, **75,** 621.
For imp. of passage at falls of Alexandria by detour through bayous, rapids, and Jean de Jean, **75,** 903. Considered impracticable, **75,** 904, 907. By excavated chan. through r., **75,** 903, 905. Results considered uncertain, **75,** 903. By use of wing dams, to obtain uniform slope from head to foot of falls, **75,** 904, 908. Considered objectionable from velocity of current produced and obstr. formed to R. floods, **75,** 904.
By Capt. Howell, canal to be used at l. w. only, to give d. not less than 5′ over Upper Falls, and extending from head to foot of rapids, locks to be 60′ x 200′; cost, by use of common gates at locks, $82,611; or by use of Fouracre's and Girard's shutters, $83,605, **75,** 904; or an imp. by dam at foot of falls with lock and navigable sluice; cost, $97,653, **75,** 904.
For imp. R., 1879, at the raft by a detour through Tones Bayou, Bayous Pierre and Winsey, and Lakes Bayou Pierre and Cannasanier; R. route considered preferable, **79,** 991, 992, 996.
For imp. Cypress Bayou, 1879, by removal of stumps and snags, and use of dams with or without

locks, **72,** 573; **73,** 669. Various plans considered, **74,** 710, 711, 714.

By Capt. Benyaurd, 1878, imp. mouth of R. by a dam closing mouth of old R. bet. the head of Atchafalaya R. and Turnbull Isld., **78,** 87, 636. More careful surs. indicate plan would not probably be satisfactory, **79,** 960.

PRIVATE AND CORPORATE WORK.

Imp. of Cypress Bayou by city of Jefferson, **73,** 622; **79,** 957. Dr. furnished the U.S. by city of Jefferson, **73,** 64, 620.

Bayou Pierre R. and Bayou Winsey Navigation Co., for imp. R. in vicinity of raft, **73,** 625; **79,** 996.

$3,000 contributed by New Orleans citizens and others for repair of break, Tones Bayou, **78,** 630.

PROJECTS. (See Estimates and Plans.)

History of early proj., **72,** 569; **73,** 644. Discussion of proj., **73,** 647.

By Lt. Woodruff, 1872, removing obstr. at raft by cutting a chan. through, **72,** 569; **73,** 613. Methods used, **73,** 614.

By Capt. Howell, 1872, imp. R. by gradually closing Tones Bayou by a l. w. dam, **73,** 624, 627, 628, 674, 675; **77,** 483, 484; **79,** 953.

By Capt. Howell, 1872, Tones Bayou, dr. and removing obstr. from Jefferson to Caddo Lake and the constr. of dams at foot of Soda Lake, **72,** 61; **73,** 622; **74,** 714; **75,** 69, 529.

By Capt. Howell, 1875, to protect city front from erosion at Alexandria with st. revet., **75,** 906.

By Capt. Benyaurd, 1878, removal of snags and obstr. from R. by use of snag boat and hired labor, **78,** 634.

SURVEYS.

History of early sur., **73,** 646.

Ex. of raft, **71,** 67.

Ex. of Cypress Bayou, **71,** 66; **72,** 568, 572; **73,** 635, 668.

Raft, Cypress Bayou, and Tones Bayou, **73,** 635, 638.

Falls at Alexandria, **75,** 79, 902, 906.

Cypress Bayou, **74,** 707, 716.

R. above raft, Tones Bayou, and falls at Alexandria, **78,** 88, 89; **79,** 986.

Tones Bayou, Bayous Pierre and Winsey, and Lake Pierre, **79,** 114, 991.

Maps. Tones Bayou, **77,** 486.

Part (b), X-28 Red River, La. (Mouth.)

ENGINEERS.

Chief of Engineers. **R., 80,** 151; **81,** 205; **82,** 203.

Boards. Convened Apr., 1880, to consider plan for permanent imp. of the mouth of the R. **R., 80,** 1284 (Cols. Tower and Newton and Maj. Abbot.)

In charge. Maj. W. H. H. Benyaurd, 1878–82. **R., 80,** 1282, 1288; **81,** 1389; **82,** 1511, 1515. Trans. to Mississippi River Commission June 30, 1882, **82,** 1512.

Assistants:
E. Flood. **R., 81,** 1390.
M. Rees. **R., 81,** 1391.
F. S. Burrowes. **R., 82,** 1522.
H. St. L. Coppee. **R., 82,** 1531.

OPERATIONS.

1879–80. 57,800 c. y. removed by dr. from bars at mouth, **80,** 1282.

1880–81. 38,574 c. y. dr. from inner bar, **81,** 1389, 1390.

1881–82. Dr. operations continued, **82,** 1511. Work trans. to Mississippi River Commission, **82,** 1512.

PHYSICAL CHARACTERISTICS.

Description of the junction of the Red R. with the Mississippi R., **80,** 1289; **81,** 1391; **82,** 1524. Separation of the two Rs. in 1847, **80,** 1292, 1295.

Unity of the Red and Atchafalaya Rs., **80,** 1289, 1293, 1295.

Direction of currents at mouth of Red R., **81,** 1391.

Discharge of Red R., **81,** 1394, 1399.

Discharge of Atchafalaya R., **81,** 1394, 1399.

PLANS. (See Projects.)

By Maj. Benyaurd, rectification of the Red and Atchafalaya Rs. at their junction with the Mississippi R., **80,** 1288–1299. Considered by BE. of 1880, **80,** 1284–1288.

PROJECTS. (See Plans.)

BE. 1880, recom. continuation of dr. at mouth of the Red R. as a temporary imp., **80,** 1288.

SURVEYS.

1880, **81,** 1391.

1882, **82,** 1513, 1519, 1531.

Mouth of Grand Bayou, au. act Mar. 3, 1881; made under direction of Maj. Benyaurd, 1881, **82,** 1515.

Part (c), X-28 Red River, La., and Ark. (Except at mouth but including above Fulton, Ark.)

APPROPRIATIONS.

Removing raft and closing Tones Bayou:
1880, $25,000, **80,** 1280.
1881, 10,000, **81,** 1403.

Removing snags and other obstr.:
1880, 60,000, **80,** 1304.
1881, 10,000, **81,** 1404.

Imp. of R. above raft:
1880, 10,000, **80,** 1305.

Red R., La.:
1882, 75,000, **82,** 205.
1884, 75,000, **84,** 1323.
1886, 75,000, **86,** 1342.
1888, 65,000, **88,** 1342.
1890, 100,000, **90,** 1849.
1892, 145,000, **92,** 1597.

Red R. above Fulton:
1886, 7,000, **87,** 1502.
1888, 3,000, **88,** 1376.
1890, 2,000, **90,** 1927.
1892, 3,500, **92,** 1601.

Sur., Fulton to Atchafalaya:
1888, $35,000, **88,** 177.
1890, 28,000, **90,** 1927.

Total, 728,500

COMMERCE.

Objections to closing Tones Bayou, **82,** 1541.

Information relating to number of wrecks on R., **87,** 1444.

Benefits to be derived from completion of imp. on the R. above Fulton, **89,** 1640.

Steamers engaged in navigation, **92,** 1598.

CONTRACTS.

1881. Allen & Blaisdell, iron-hull snag boat, $44,650, **81,** 1405. Gervin & Bietry, earthern dam,

closing Tones Bayou, **81,** 1403; **82,** 1539. Action relating to destruction of dam in process of constr. under this contract, **82,** 1540; **85,** 1473.

1882. E. P. Doherty, r. removal at the falls near Alexandria, $3.45 c. y., **83,** 1136.

1891. Martin & Hunt, closing outlets, $4,930, **92,** 1591.

ENCROACHMENTS.

Injury to R. by acts of lumbermen, **80,** 1278; **82,** 1538.

Malicious destruction of dam closing Tones Bayou, **82,** 1540; **85,** 231, 1473; **86,** 1340.

Action of State enjoining work near Alexandria, **84,** 1329.

ENGINEERS.

Chief of Engineers:

Upper Red R. **R., 80,** 152, 158; **81,** 207; **82,** 205.

Removing raft and closing Tones Bayou. **R., 80,** 150; **81,** 206; **82,** 203.

Removing obstr. **R., 80,** 152; **81,** 207; **82,** 204.

Imp. Red R., La. **R., 83,** 213; **84,** 221; **85,** 230; **86,** 227; **87,** 193, 203; **88,** 176, 184; **89,** 207, 217; **90,** 186, 195; **91,** 236, 237; **92,** 229, 230.

In charge:

Upper Red R.:

Maj. W. H. H. Benyaurd, 1879–82. **R., 80,** 1304; **81,** 1406; **82,** 1545.

Maj. A. M. Miller, 1882–83. **R., 83,** 1143.

Removing raft and closing Tones Bayou:

Maj. W. H. H. Benyaurd, 1874–82. **R., 80,** 1277; **81,** 1402; **82,** 1538.

Maj. A. M. Miller, 1882–83. **R., 83,** 1138.

Removing obstr.:

Maj. W. H. H. Benyaurd, 1878–82. **R., 80,** 1302; **81,** 1404; **82,** 1543.

Maj. A. M. Miller, 1882–83. **R., 83,** 1142.

Imp. Red R., La.:

Maj. A. M. Miller, 1882–84. **R., 83,** 1143; **84,** 1321.

Capt. E. Bergland, 1884–86. **R., 85,** 1471; **86,** 1337.

Capt. J. H. Willard, 1886–87. **R., 87,** 1439 1490.

Red R. above Fulton, Ark.:

Capt. H. S. Taber, 1884–90. **R., 85,** 1623, 1671; **87,** 1502; **88,** 1375; **89,** 1639; **90,** 1925.

Capt. J. H. Willard, 1886–92. **R., 88,** 1331; **89,** 1584; **90,** 1819, 1833; **91,** 1946, 1961; **92,** 1573, 1600.

Assistants:

E. F. White. **R., 81,** 1405; **82,** 1544; **84,** 1324; **85,** 1480.

J. T. Dorey. **R., 84,** 1325; **85,** 1482.

J. W. Beamen. **R., 84,** 1327; **85,** 1483.

M. A. Orlopp. **R., 85,** 1618.

H. Vance. **R., 87,** 1447; **88,** 1339.

J. Ewens. **R., 91,** 1953; **92,** 1592.

H. M. Marshall. **R., 92,** 1595.

LEGAL PROCEEDINGS.

Action, Louisiana, enjoining work at Alexandria, **84,** 1329; **85,** 1486.

OPERATIONS.[1]

1879-80. On upper Red R., 1,210 snags, 2,229 logs, and 753 trees removed; **80,** 1304. Removal of log jams in vicinity of raft, **80,** 1278. Progress on dam closing Tones Bayou, **80,** 1278. Above Alexandria, 1,380 snags, 495 trees, and 2 wrecks removed, **80,** 1302.

1880-81. On upper R., 460 snags, 1,526 logs and stumps, and 190 trees removed, **81,** 1406. Removal of log jams at the raft, **81,** 1402. Bet. mouth of Ouachita R. and 25 m. below Shreveport, 665 snags and 1,216 trees and stumps removed, **81,** 1404.

1881-82. R. cleaned at the raft, **82,** 1538. At Tones Bayou, partial completion of dam closing bayou; subsequent destruction of dam, **82,** 1339. 1,214 snags and stumps removed from R. below Alexandria, **82,** 1544.

1882-83. In the R. above Shreveport, 1,904 snags and stumps, 5,793 trees, 117 jams, and 110 logs were removed, **83,** 1136, 1137. Below Shreveport, 336 snags, 3,627 trees, and 3 jams were removed, **83,** 1136.

1883-84. On upper R., 309 snags, 95 jams, 512 trees, 5,144 stumps and shore snags removed; below Shreveport, 1,621 snags, 347 trees, 841 stumps, 2 wrecks, and 10 drift piles removed, **84,** 1322, 1325. In vicinity of Alexandria, 2,051 c. y. of r. removed, **84,** 1322, 1328.

1884-85. 40,529 snags, stumps, and trees removed; 27 jams removed at the raft, **85,** 1474, 1475, 1480, 1482. Constr. and subsequent destruction of dam, closing side outlet at Sale & Murphy's canal, **85,** 1476. Progress of r. removal near Alexandria, **85,** 1477, 1483. Partial constr. of work at Alexandria for protection of H., **85,** 1478, 1485.

1885-86. Completion of contract for r. removal at falls near Alexandria, and constr. of dam at lower falls, **86,** 1340. Progress of work at Alexandria H., **86,** 1341.

1886-87. Removal of obstr. by snag boats from Garland, Ark., to mouth of the Atchafalaya R., **87,** 1440. Constr. of snag boat for R. above Fulton, **87,** 1502.

1887-88. 798 snags and 10 drift piles removed from the R. above Fulton, **88,** 1375. 4,400 snags and stumps, 110 log jams, and 2 wrecks removed at and below Shreveport, **88,** 1333–1335.

1888-89. 2,900 logs, snags, and stumps, and 160 log jams removed from the R., and 7,000 trees cut from the banks at and below Fulton, below Shreveport, and at Cypress and Dorcheat Bayous, **89,** 1585–1587. 764 snags removed above Fulton, **89,** 1640.

1889-90. 48,959 c. y. earth and 4,400 snags removed from the chan.; 16,850 trees cut from the banks, and 231,710 s. y. brush and willows cut at Alexandria, and at Cypress and Dorcheat Bayous, **90,** 1827, 1828.

1890-91. 6,038 snags cleared from the chan., 134 jams removed, 10,022 leaning trees cut; 2 wrecks removed; 109,200 s. y. of brush cleared from the banks, **91,** 1949, 1950. 956 snags and 111 leaning trees removed above Fulton, **91,** 1961, 1962.

1891-92. 7,981 c. y. material dr.; 5 wrecks and 11,899 snags removed from the chan., and 8,846 trees and 107,325 s. y. of brush cleared from the banks, **92,** 1580, 1582. Sale & Murphy outlets closed by dam constr. under contract, **92,** 1592.

PHYSICAL CHARACTERISTICS.

Vicinity of Falls of Alexandria, **80,** 1347.

Above Fulton, Ark., **85,** 1618–1627.

River slopes, **87,** 1449.

Description; lakes and bayous, Shreveport, La., to Fulton, Ark., with their obstr. **87,** 1490.

PLANS. (See Projects.)

Résumé of plans for imp. of R. at falls near Alexandria, **80,** 1343–1345.

Plans proposed by Maj. Howell, 1875, for passage of falls, **75,** 902; **80,** 1345, 1347.

PROJECTS. (See Plans.)

1828 to 1852, incl., $533,137.50 app. for removal of the raft.

In 1872, under a renewal of app., the "present" proj. for removal of the raft, and the closing of Tones Bayou by a dam adopted, **72,** 569; **73,** 624, 628, 674; **85,** 1472.

In 1875 proposed to protect city front at Alexandria from erosion by means of st. revet., **75,** 906.

In 1878, imp. below Fulton, Ark., by the removal of snags and other obstr., inaugurated, **78,** 634.

In 1879, imp. of the falls near Alexandria undertaken, to furnish chan. 4½ x 75″, **80,** 1348.

In 1882, proposed to close certain outlets above Shreveport, **82,** 1546; **85,** 1477.

In 1884, imp. above Fulton, Ark., by removal of snags and similar obstr. undertaken, **85,** 1618, 1622. Amount app. 1872 to 1886, incl., $809,000, **87,** 1451; **92,** 1574.

[1] History of operations prior to 1886, **85,** 1472; **86,** 1338.

SURVEYS.

Falls near Alexandria, La., au. act June 18, 1878; made by Maj. Benyaurd, 1879, **80,** 1342.

Mouth to Fulton au. act Aug. 2, 1882, **84,** 227. Progress by Capt. Willard, **87,** 1446.

Fulton, Ark., by Capt. Taber, **85,** 1617, 1623.

Ex. au. Aug. 5, 1886, of connections with Clear Lake, Black Bayou, Red Bayou, Black Lake, and Keely Bayon—Shreveport, La., to Fulton, Ark. Unfav. R. by Capt. Willard, **87,** 1490.

Red R., Fulton, Ark., to the Atchafalaya R., au. act Aug. 5, 1886. By Capt. Willard, **88,** 177, 1337; **89,** 1591; **90,** 1830, 1838.

Maps:
Shreveport to Natchitoches, **82,** 1542; **85,** 1490.
Vicinity of Tones Bayou, **82,** 1542; **85,** 1490.
90, 1840, 1870; **91,** 1955; **92,** Atlas, 82.

Part (d), X-28 Red River, its Tributaries and Outlets, La., Ark., and Indian Territory, Fulton to head of Atchafalaya.

APPROPRIATIONS.[1]

1894,	[2]$150,000,	**95,** 1850.
1896,	100,000,	**96,** 1567.
1899,	150,000,	**99,** 1986.
1902,	100,000,	**02,** 1407.
1905,	100,000,	**05,** 1522.
1907,	150,000,	**07,** 1495.
1909,	65,000,	**09,** 1552.
1910,	75,000,	**10,** 1698.
1911,	20,000,	**11,** 1844.
1912,	50,000,	**12,** 2064.
Total,	960,000	

COMMERCE.

Description of, Sulphur R., **96,** 1582; **98,** 1583.

An. average C. for 11 years to 1900, 104,397 t.; value $5,295,000, **00,** 400.

Decline in navigation, **09,** 513.

Initial trip of SS. *City of Shreveport*, **10,** 1697.

Average t. for 18 years, 301,314 t.; value, $10,589,460, **11,** 624.

CONTRACTS.

1892. J. Dordan and M. Hunt, levee constr., 126,000 c. y., 14½¢ c. y.; S. D. Moody & Co., 58,551 c. y., 17.9¢ c. y.; J. N. Ogden, 91,008 c. y., 15½¢ c. y., **93,** 1913.

1893. Martin & Hunt, levee constr., 21,000 c. y., 22.8¢ c. y., **94,** 1426.

1894. J. Scott & Sons, levee constr., 261,455 c. y., 14.39¢ c. y., **95,** 1856.

1895. W. J. Bently, levee constr., 284,326 c. y., 13.89¢ c. y.; M. Hunt, 70,393 c. y., 13½¢ c. y., **96,** 1576. New Orleans & Northeastern RR. Co., elevator dr., $9,500, **96,** 1572.

1898. J. Thomas, constr. Choctaw Levee, 66,445 c. y., 9⅓¢ c. y.; W. J. Bently & Co., constr. levee on Red R. at and above Hervey Canal, 14.8¢ c. y. ($38,461.72), **99,** 1988.

1899. W. J. Bently & Co., constr. Scotts Slough Levee, 251,511 c. y., 21.84¢ c. y., **00,** 2486.

1911. Dubuque Boat & Boiler Works, constr. steel hull hydraulic dr., $97,592, **11,** 1845.

ENGINEERS.

Chief of Engineers. **R., 93,** 258; **94,** 238; **95,** 267; **96,** 232; **97,** 299; **98,** 289; **99,** 347; **00,** 398, 414; **06,** 434; **07,** 458; **08,** 486, 504; **09,** 511; **10,** 578; **11,** 622; **12,** 752.

In charge:

Capt. J. H. Willard, 1886–99. **R., 93,** 1901; **94,** 1415; **95,** 1848; (Maj.) **96,** 1565; **97,** 1877; **98,** 1575; **99,** 1979.

Maj. T. L. Casey, 1900–. **R., 00,** 2480, 2569.

Capt. G. M. Hoffman, 1906–07. **R., 06,** 1359; **07,** 1493.

Capt. C. S. Smith, 1907–11. **R., 08,** 1563; **09,** 1547; **10,** 1695.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1841; (Maj.) **12,** 2061.

Assistants:

H. M. Marshall. **R., 93,** 1925; **94,** 1439; **95,** 1860; **96,** 1584; **00,** 2489.

J. J. Hoopes. **R., 00,** 2491.

LEGISLATION.

3 levee districts along the R. created by acts of legislature of Louisiana, **98,** 1581; **99,** 1983.

OPERATIONS.

1892-93. About 16,000 snags and other obstr. removed; 227 l. f. wing dams built; 8,000 s. y. brush and willows cut; several wrecks removed; 324,323 c. y. levees built, **93,** 1907, 1908, 1915, 1916.

About 4,000 snags, etc., removed from Little R., and 3,875 s. y. willows, etc., cut.

10,242 c. y. r. excavated at Alexandria and used to constr. dike there and repair another, **93,** 1919, 1920.

1893-94. About 25,500 snags, etc., removed; 285 l. f. wing dams built, several wrecks removed; 17,350 s. y. brush and willows cut, **94,** 1424, 1425. 79,000 c. y. levees built, **94,** 1425.

3,483 c. y. r. excavated at Alexandria and used to raise and strengthen dikes there, **94,** 1425.

Over 10,000 snags, etc., removed from bet. Shreveport and Jefferson, and 1,300 s. y. willows, etc., cut, **94,** 1430.

1894-95. About 32,000 snags, etc., removed; 200 s. y. brush and willows cut; and 2,915 l. f. wing dams built. Several wrecks removed, **95,** 1854, 1855. 261,455 c. y. levees built, **95,** 1856.

1895-96. About 9,000 snags, etc., removed; 205 l. f. pile dike built, **96,** 1572. 354,719 c. y. levees built, **96,** 1575, 1576.

Over 5,000 snags, etc., removed from Sulphur R., **96,** 1582.

1896-97. About 110,000 snags, etc., removed; over 3,500 s. y. brush, etc., cut; 4,731 l. f. pile and brush dams built and several wrecks removed, **97,** 1881, 1883, 1884.

4,951 c. y. r. excavated at Alexandria and part of it deposited in banks in that vicinity, **97,** 1885.

About 7,000 snags, etc., removed from Sulphur R., **97,** 1889.

1897-98. About 12,000 snags, etc., removed; 350 s. y. brush, etc., cut; 3,719 l. f. brush dams built and 500 s. y. brush mattresses laid, **98,** 1578, 1579.

8,089 c. y. r. excavated at Alexandria and some of it deposited in banks in that vicinity, **98,** 1580.

1898-99. Boats repaired and about 9,000 snags and other obstr. removed from R.; 66,445 c. y. Choctaw Bayou levee built; and 247,400 c. y. of levee built at and above Hervey Canal in Red R., **99,** 1980, 1981.

1899-00. About 5,000 obstr. removed from R.; Scotts Slough levee built; Choctaw Bayou levee repaired, and in cooperation with the State of Louisiana closed the Tones Bayou outlet, Little R., at Scopini Cut-off, **00,** 2480, 2483.

1905-06. Obstr. removed from R. and banks, **06,** 1360.

1906-07. Obstr. removed, and 4 dikes built at Rattling Slough, La., **07,** 1494.

1907-08. Obstr. removed, and repairs made to dikes at Alexandria, La., **08,** 1564.

1908-09. Obstr. removed, plans prepared for constr. suction dr., closing Spirit Lake outlet, and building Chalk Level levee in Bossier Parish, La., **09,** 1547.

1909-10. Obstr. removed, **10,** 1697.

1910-11. Obstr. removed, **11,** 1843.

1911-12. Removing obstr., **12,** 2061.

[1] For allotments of app., see the end of each an. R.

[2] $5,000 for imp. of Sulphur R.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 1901, 1909; **94,** 1420, 1430; **95,** 1850; **96,** 1569, 1580; **97,** 1878, 1882; **98,** 1576.

Banks of R. for hundreds of m. covered with a heavy growth of timber, caving and sliding continually. Quantity of drift during high stages enormous, jams, acres in extent, forming in a few hours. **93,** 1904; **94,** 1419; **95,** 1851. In 1897 Maj. Willard remarked that the drift, the shifting and changing chan. uncovering snags, etc., and the caving and sliding banks, would necessitate snagging for many years, or until the banks had been cleared for some distance back, the banks fixed, and the floods restrained by a substantial system of levees, **97,** 1885.

Comparison of early and existing conditions, **93,** 1909; **94,** 1431.

Floods and flood discharge, **93,** 1911, 1912; **94,** 1422, 1426; **96,** 1569; **97,** 1880; **98,** 1579.

Description of, Little R. from Scopini Cut-off to Knox Point, **93,** 1911; **95,** 1855. Imp. by its own natural movement, **95,** 1855; **96,** 1574.

Descent of l. w. line, continuation of, **94,** 1431; **95,** 1878; **96,** 1574.

Discharge. At Shreveport, **93,** 1923; Scopini Cut-off, **93,** 1923. Tabulated results of discharge measurements made near Shreveport in 1891, **93,** 1976. Discharge observations, **93,** 1984; **94,** 1433; **95,** 1871.

Sediment, **93,** 1977; **94,** 1449.

High-water marks, **93,** 1978; **94,** 1426.

Elevation of zeros of water gauges, **93,** 1984.

Low-water marks, **94,** 1441; **95,** 1852, 1861; water surfaces at various points during, **95,** 1867.

Comparison of l. w. slope from upper falls to Alexandria, **94,** 1447.

Comparison of high waters of 1892–94, **94,** 1451.

Borings in bed of R., summary of, **95,** 1872.

Description of, Sulphur R., **96,** 1581.

Description of Choctaw Bayou levee and the levee districts along the Red R., **99,** 1981, 1983.

Description of Red R. physics (maps), and Scotts Slough Levee and others, **00,** 2489, 2491.

Water gauges, **06,** 436; **08,** 488; **09,** 512; **10,** 579; **11,** 623; **12,** 755.

PRIVATE WORK.

"Canals" built by private parties. Description of, **93,** 1909.

Constr. of levees jointly by U. S., riparian States, and parishes. Work performed by U. S. very small in comparison with that performed by the other agencies (see Projects), **93,** 1914, 1915; **94,** 1434; **95,** 1851, 1856, 1858, 1878; **96,** 1569, 1575, 1577; **97,** 1885; **98,** 1580, 1582.

Surs. made by State engineers for levee lines, **97,** 1887.

Levees built by State and local levee boards since 1892, **98,** 1580.

Louisiana built, 1898–99, 79,304 c. y. of the Choctaw Bayou Levee, **99,** 1981, 1985.

Louisiana in cooperation with the U. S., 1899, closed the Tones Bayou Outlet, Little R., at Scopini Cut-off, **00,** 2483.

PROJECTS.

Principles to be followed to save whatever has been done for imp. of the R., and to prevent its closure, **93,** 1905.

By Capt. Willard, 1892, snagging in Little R. and dr. of points where bottom was of resisting clay, using therefor $20,000 of app. of 1890 as provided thereby, **93,** 1911. In 1893 recom. that dr. be suspended or modified, app., **93,** 1912.

In 1893 Capt. Willard est. $30,000 to constr. 2,500 l. f. revet. in front of Alexandria, **93,** 1920; $25,000 for constr. of sills and revet. to close Tones Bayou, **93,** 1913; and that the est. of protecting Shreveport H. water front would be not less than $50,000, **93,** 1921.

By Capt. Willard, 1893–94, removal of obstr. from Cypress Bayou and the lakes bet. Shreveport, La., and Jefferson, Tex., using therefor $5,000 from the app. of 1892 as provided thereby, **94,** 1430.

In 1894 Capt. Willard recom. that serious imp. of navigation be commenced at an early date, **94,** 1430.

By Capt. Willard, 1895–96, removal of obstr. from Sulphur R., using therefor $5,000 of the app. of 1894 as provided thereby, **96,** 1581.

In 1896 Capt. Willard recom. united action be taken by the U. S., the States interested, and the local levee boards to prevent cut-offs, and for proper care and protection of levees during periods of high water, **96,** 1578.

Levee system at 1896. Description of and condition, **96,** 1579.

Levee work, est. amount done and to be done, **97,** 1890. Allotments for (see Appropriations, allotments of app.).

In 1895–96 Capt. Willard est. $300,000 or a little more, to close the gap in the Caddo levee system, **96,** 1580, 1581; **97,** 1890.

Under acts of 1892–94 a plan for the imp. of the R. au. to include constr. of a substantial system of levees to restrain the greatest floods, either alone or in partnership with the riparian States, to confine the R. to the adopted chan., thereby imp. and giving ease and safety to navigation. Begun in 1892 by an endeavor to put the levees built or enlarged up to a grade of about 3′ above the highest flood of record. **98,** 1580.

Purchase of elevator dr. at reduced price, **96,** 1572.

Maj. Casey est., 1900, $11,300 to make the imp., **00,** 2576.

Plan au. Mar. 1, 1907, for repairing and strengthening dikes at Alexandria, La., **07,** 459.

SURVEYS.

Miscellaneous surs. Shreveport Reach, **93,** 1921. For levees, **95,** 1856; **97,** 1887 (see Private work). Resur. of Alexandria Reach, **96,** 1575.

Sur. of the R. au. act 1886, **93,** 1921; **94,** 1439; **95,** 1860, 1879; **96,** 1583. Reconnoissance to test and reset gauges, make local surs., and take discharge observations, **95,** 1860. Base-measuring apparatus, details of, **93,** 1924. Triangulation, details of, **93,** 1935. Hypsometry, **93,** 1944. Description and elevations of precise bench marks, **93,** 1951; of R. section reference points, **93,** 1957; of permanent reference points, **93,** 1972. Topography, details of, **93,** 1974. Hydrography, details of, **93,** 1974.

Ex. and sur. of Alexandria H., with est. of imp., if any, au. act Mar. 3, 1899; made by Maj. Casey, 1900 (**R.** fav.) (see Projects), division engineer's **R.** unfav., **00,** 2570.

Ex. of Boyce Landing, La., au. by act Mar. 2, 1907. **R.** by Capt. Hoffman, Oct. 29, 1907[1] (unfav.), **08,** 504.

List of surs. from Fulton, Ark., to Atchafalaya R., La., from 1887 to 1910, incl., **11,** 625.

Ex. and sur. au. act Mar. 3, 1909 (**R.** to come), **12,** 781.

Maps. (Photographs, plates, etc.), **93,** 1908, 1920, 1926, 1954, 1984, 1990; **94,** 1440; **95,** 1880; **00,** 2489; **09,** 1550; **10,** 1698; **11,** 1844.

[1] H. D. 219, 60th, 1st.

Part (e), X-28 Red River, above Fulton, Ark., including some work "above Shreveport."

APPROPRIATIONS. (See Appr., p. 795, 797.)

1894,	$3,500,	**95,** 1884.
1896,	3,000,	**96,** 1588.
1902,	*10,000,	**02,** 1407.
1905,	*100,000,	**05,** 1522.
1907,	100,000,	**07,** 1490.
1909,	40,000,	**09,** 1544.
1910,	50,000,	**10,** 1691.
1911,	25,000,	**11,** 1839.
1912,	75,000,	**12,** 2058.
Total,	406,500	

COMMERCE.

Limited, **93,** 2001; **95,** 1883; **96,** 1587.
C. of upper Red R. entirely local, **00,** 2569.
Reduction in rates due to proj., **05,** 401.
Proj. expected to reduce rates, **07,** 457.

CONTRACTS.

1903. Hunter & Fry, building 4 dikes, $20,362, **03,** 1365 (terminated Sept. 10, 1903, owing to impracticability of resuming work, **04,** 2031).

1906. M. A. Sweeney Shipyard & Foundry Co., constr. 1 snag boat, $21,840, **06,** 1357.

ENGINEERS.

Chief of Engineers. R., 93, 260; **94,** 240; **95,** 268; **96,** 234; **97,** 300; **98,** 291; **99,** 349, 362; **00,** 401, 414; **01,** 412, 425; **02,** 343; **03,** 361; **04,** 382, 398; **05,** 399; **06,** 432; **07,** 456; **08,** 484; **09,** 509, 548; **10,** 574; **11,** 599, 622; **12,** 748, 752.

Boards. BERH. concurs in opinion of Capt. Potter that imp. bet. Fulton, Ark., and Denison, Tex., not deemed advisable. **R.,** 1903, **04,** 2083. (See Surveys), **09,** 548.

In charge:

Capt. J. H. Willard, 1886–1900. **R., 93,** 1999; **94,** 1452; **95,** 1881; (Maj.) **96,** 1587; **97,** 1895; **98,** 1588; **99,** 1991; **00,** 2565.
Maj. T. L. Casey, 1901. **R., 01,** 2025, 2074.
Capt. C. L. Potter, 1901–03. **R., 02,** 1405; **04,** 2081.
Capt. C. S. Bromwell, 1903–04. **R., 03,** 1363.
Lt. Col. H. M. Adams, 1904. **R., 04,** 2030.
Capt. J. F. McIndoe, **04,** 399.
Capt. G. M. Hoffman, 1904–05. **R., 05,** 1519.
Capt. W. P. Wooten, 1905–08. **R., 06,** 1356; **07,** 1490; **08,** 1560.
Capt. A. E. Waldron, 1908–11. **R., 09,** 1543; **10,** 1690.
Capt. T. H. Jackson, 1911–. **R., 11,** 1839; (Maj.) **12,** 2057.

Assistants:

W. H. Polk. **R., 01,** 2080; **05,** 1526.
L. L. Griffith. **R., 03,** 1368.
H. M. Marshall. **R., 04,** 2035; **05,** 1525.

OPERATIONS.

1892–93. About 1,200 snags and other obstr. removed, **93,** 2001.

1894–95. About 4,000 snags, etc., removed, **95,** 1883.

1897–98. Over 500 snags, etc., removed, **98,** 1588.

1898–99. About 100 snags and other obstr. removed, **99,** 1991.

1900–01. About 24,000 obstr. removed from R., and repairs made to snag boat *Howell*, **01,** 2027.

1901–02. About 69,500 obstr. removed from R., **02,** 1406.

1902–03. About 5,000 obstr. removed from R., and work on constr. of dikes for imp. of chan. at Shreveport in progress, **03,** 1369.

1903–04. 12,297 obstr. removed from lower R., and 1,929 obstr. above Fulton, Ark. Shore end of 3 dikes were built at Shreveport, La., by hired labor, **04,** 2030.

1904–05. 44,998 obstr. removed from lower R. and 14,920 from above Fulton, Ark. Work on dikes at Shreveport, La., completed, and repairs made to snag boat *Howell*, **05,** 1521.

1905–11. Obstr. removed from R. and banks, **06,** 1357; **07,** 1490; **08,** 1561; **09,** 1544; **10,** 1690; **11,** 1839.

1911–12. Obstr. removed on Red R.; also on Kiamichi R., **12,** 2057.

PHYSICAL CHARACTERISTICS. (See Red River, below Fulton.)

Description of, **93,** 2000; **95,** 1882; **01,** 2074.
Scouring, **93,** 2001.
Oscillations on this part of the R. so rapid that boats frequently make but one trip on a rise, and have to regulate traffic by the quantity and duration of the rainfall, **98,** 1588.
Details, Kiamichi R. to Blue R., **00,** 2566.
Statement of gauge readings, **02,** 345; **04,** 384; **05,** 1525.
Floods producing high stages, **03,** 1365; **04,** 2032.
Formation of bar at Shreveport, La., **04,** 2031.

PRIVATE WORK.

By direction of Capt. Willard, the Texarkana & Fort Smith Ry. made an effort to open a chan. through the bar at its br. n. of Texarkana, **95,** 1883.
Levees built by State and local levee boards, **01,** 2027; **03,** 1370.

PROJECTS.

By Maj. Willard, combination of work under this head with that for the R. below Fulton, snagging operations for the latter work not to cease at Fulton, but be carried up above until app. therefor should be exhausted, **96,** 1588; **97,** 1895.
Act of Mar. 3, 1899, providing for continuing operations under the general title "Improving Red River," **99,** 1991.
Constr. of dike to imp. chan. at Shreveport, La., approv. by Sec. of War, Oct. 2, 1902, **03,** 1365.
Act Mar. 3, 1905, au. $15,000 for imp. of chan. at Alexandria, La., **06,** 1522.
Act July 25, 1912, au. continuing existing proj. with addition of dr. on bars, and closure of certain chutes behind islds., **12,** 749.

SURVEYS.

Ex., mouth of Kiamichi R. to Blue R., au. act Mar. 3, 1899; made, 1899, by Maj. Willard (**R.** unfav.), **00,** 2565.
Ex. for imp. navigation bet. Shreveport, La., and Denison, Tex., au. act June 6, 1900. **R.** by Maj. Casey, Sept. 20, 1900[1] (not worth yof imp. by U. S.), **01,** 425, 2073, etc.
Statement of sur., exs., and other documents from 1872 to 1902, incl., **03,** 364.
Ex. for imp. navigation bet. Fulton, Ark., and Denison, Tex., au. by act June 13, 1902. **R.** by Capt. Potter, July 18, 1902[2] (not worthy of imp.), **04,** 398, 2081.
Ex. au. act Mar. 2, 1907, bet. Fulton, Ark., and mouth of Washita R., made by a BE. **R.,** May 27, Dec. 30, 1907, and Mar. 27, 1909. Est., $160,000 for first 2 years, and $50,000 an. mainten.,[3] **09,** 548.
Pre. ex. of chan. connecting Red and Sulphur Rs., au. by act June 25, 1910. **R.** by Capt. Waldron, Nov. 22, 1910,[4] **11,** 622.
Pre. ex. and sur. au. act June 25, 1910, mouth of Washita R. to mouth of Big Washita R., Tex. and Okla. (**R.** to come), **12,** 752.

* Allotment. [1] H. D. 84, 56th, 2d. [2] H. D. 200, 58th, 2d. [3] H. D. 71, 61st, 1st. [4] H. D. 12, 62d, 1st.

X-29 BLACK AND OUACHITA RIVERS, LA. AND ARK.

Part.	Title.	Period.	Appropriations.
a	Black and Ouachita Rs.	1870–1912	$2,906,869
b	Ouachita R. above Camden	1909–1912	20,000
	Total		2,926,869

Part (a), X-29 Ouachita and Black Rivers, Ark. and La.

APPROPRIATIONS.

1871, [1]$25,000, **71,** 59, 334; **72,** 53.
1871, [1]26,000, **71,** 59, 335; **72,** 54.
1872, [1]60,000, **72,** 53; **73,** 464.
1872, [1]40,000, **72,** 54; **73,** 464.
1873, [1]60,000, **73,** 56, 484.
1876, [1]12,000, **76,** 77; **77,** 76.
1878, [1]10,000, **78,** 86.
1879, [1]10,000, **79,** 115, 966.
1880, [1]8,000, **80,** 1307.
1881, [1]12,000, **81,** 1417.
1882, 12,000, **82,** 1557.
1884, 15,000, **84,** 1330.
1886, 17,500, **86,** 1352.
1888, { 20,000, **88,** 1348.
{ 19,000, **88,** 178.
1890, 15,000, **90,** 1876.
1892, 40,000, **92,** 1605.
1894, 50,000, **95,** 1911.
1896, 70,000, **96,** 1599.
1898, 110,000, **99,** 1996.
1902, 111,500, **02,** 1411.
1903, 250,000, **03,** 1375.
1905, { 80,000 } **05,** 1531.
{ 12,000 }
1906, 91,954, **06,** 1367.
1907, 200,780, **07,** 1499.
1908, 225,000, **08,** 1571.
1909, 176,135, **09,** 1558.
1909, *160,000, **09,** 1558.
1910, 521,000, **10,** 1708.
1911, 292,000, **11,** 1856.
1912, { 115,000 } **12,** 2071.
{ 50,000 }

Total, 2,906,869 (incl. misc., $2,909,362.25, **12,** 2071).

COMMERCE.

Demands of C. do not justify costly imp., **72,** 369, 371; **74,** 355, 357, 363; **81,** 1421.
C. of R. and list of SS. engaged, **91,** 1973; **92,** 1606.
Description of; in 1895 was probably such as would warrant constr. of lock and dam system, **95,** 1900.
List of SS., **01,** 416, 2037.
Formation of Monroe Ry. & Nav. Co. due to au. proj. for locks and dams, **03,** 1376.
Effect on rates, **05,** 404; **12,** 759.

CONTRACTS.

1873. F. G. Gaylord, timber for locks at Buffalo Shoals, Jacks Isld., and Rock R., **73,** 465, 485; abandoned, **74,** 349.
1875. Material sold on account of abandonment of proj., **75,** 521.
1904. Chicago Engineering & Construction Co., constr. Locks and Dams Nos. 4 and 6 (prices given), **05,** 1531–32.
1905. Chicago Engineering & Construction Co., supple., **05,** 1531; **06,** 1367. Ed. J. Howard, constr. and delivery of steel snag boat, $42,483, **06,** 1367. (Contract with Chicago Engineering & Construction Co. terminated by agreement on Oct. 20, 1908, and their plant, materials, buildings, etc., trans. to US., **09,** 1555.)
1908. Midland Bridge Co., building Lock No. 2, to cost $296,694.50 (unit prices given), **09,** 1556, 1558. Glencoe Lime & Cement Co., 5,000 bbls. Portland cement, $2.34 bbl. in wood, or $2 bbl. in sacks, and 10¢ for each sack not returned, **09,** 1559.
1909. H. E. Talbot Co., for partial constr. of Lock No. 6 (prices given), **10,** 1709. United Kansas Portland Cement Co., 14,000 bbls. Portland cement (prices given), **10,** 1710.
1910. H. E. Talbot Co., supple., constr. of Lock No. 6 (prices given), **11,** 1857.
1911. Penn Bridge Co., 307,000 lbs. structural metal for Locks and Dams Nos. 4 and 8 (prices given), and erecting about 232,000 lbs. structural metal in gates of Lock No. 8, at 1.74¢ per lb., **11,** 1857.
1912. Zeb Ward, 5,000 t. riprap, $2.20 t.; Blaw Steel Centering Co., 384,516 lbs. structural metal and special winches (prices given); Lawrence D. Weaning, erecting 248,000 lbs. structural metal, 1.5¢ lb., and 2,700′ b. m., lumber, $15 per M; United Kansas Portland Cement Co., 3,000 bbls. Portland cement, $1.83 bbl., and 10¢ for each empty sack not returned, **12,** 2072.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 66; **71,** 59; **72,** 53, 54; **73,** 55; **74,** 61; **75,** 68; **76,** 77; **77,** 76; **78,** 86; **79,** 115; **80,** 152; **81,** 211; **82,** 208; **83,** 217; **84,** 221, 227; **85,** 235; **86,** 230; **87,** 195; **88,** 178; **89,** 209, 217; **90,** 188; **91,** 238, 239; **92,** 231; **93,** 261, 272; **94,** 241; **95,** 269; **96,** 235; **97,** 302; **98,** 293, 302; **99,** 350; **00,** 402, 414; **01,** 415, 425; **02,** 346, 354; **03,** 366; **04,** 387; **05,** 403; **06,** 437; **07,** 461; **08,** 489; **09,** 515; **10,** 582, **11,** 626; **12,** 756.

Boards. Revision of proj. of Lt. Col. W. F. Raynolds, 1873 (no proceedings given), **74,** 352.

In charge:
Lt. Col. W. F. Raynolds. **R., 71,** 334, **72,** 345, 346, 367.
Col. J. H. Simpson. **R., 73,** 464.
Capt. W. H. H. Benyaurd, 1873–83. **R., 73,** 484; **74,** 348, 352; **75,** 521; **76,** 592; **77,** 477; **78,** 623; **79,** 965; (Maj.) **80,** 1305, 1307; **81,** 1416; **82,** 1556.
Maj. A. M. Miller, 1883–85. **R., 83,** 1155; **84,** 1329, 1351, 1363, 1381, 1383, 1386.
Capt. E. Bergland, 1885–86. **R., 85,** 1497; **86,** 1351.
Capt. J. H. Willard, 1887–99. **R., 87,** 1455, 1487, 1495; **88,** 1346; **89,** 1596, 1631; **90,** 1871, 1878; **91,** 1964, 1975; **92,** 1602; **93,** 2002, 2091; **94,** 1455; **95,** 1887; (Maj.) **96,** 1591; **97,** 1904; **98,** 1594; **99,** 1994.
Maj. T. L. Casey, 1900–01. **R., 00,** 2503, 2544; **01,** 2034, 2091.
Capt. C. L. Potter, 1902. **R., 02,** 1410, 1435.
Capt. C. S. Bromwell, 1903. **R., 03,** 1373.
Lt. Col. H. M. Adams, 1904. **R., 04,** 2039.
Capt. J. F. McIndoe, **05,** 399.
Capt. G. M. Hoffman, 1905–07. **R., 05,** 1528; **06,** 1362; **07,** 1497.
Capt. C. S. Smith, 1908–10. **R., 08,** 1567; **09,** 1554; **10,** 1700.
Capt. James A. Woodruff, 1911–. **R., 11,** 1845; (Maj.) **12,** 2065.

* Allotment.

[1] Ouachita R.

Assistants:
J. Straszer. **R., 71,** 338; **74,** 350; **76,** 593; **77** 477; **78,** 624.
C. Smith. **R., 72,** 368.
C. W. Durham. **R., 74,** 357.
W. C. Melvin. **R., 80,** 1307; **81,** 1418.
E. F. White. **R., 81,** 1417; **82,** 1557; **83,** 1157; **84,** 1382.
P. C. Montgomery. **R., 84,** 1353.
F. S. Burrowes. **R., 84,** 1383.
T. C. Thomas. **R., 95,** 1903; **98,** 1604; **00,** 2549; **05,** 1536.
H. M. Marshall. **R., 00,** 2547; **01,** 2040, 2091; **02,** 1414, 1437; **03,** 1377; **04,** 2042; **05,** 1536.
A. M. Todd. **R., 11,** 1851.

ESTIMATES. (See Projects.)

By Lt. Col. Raynolds, 1871, temporary imp. by removal of snags and obstr., Arkadelphia to mouth, $98,300, **71,** 335, 337, 344.

By Lt. Col. Raynolds, 1872, permanent imp., Camden to Trinity, by locks and dams, i. e., 2 timber locks and dams in Arkansas and 3 in Louisiana, $1,163,083.75, **72,** 53, 55, 346, 348, 367, 374; **77,** 479. If of masonry, $2,194,916.35, **72,** 348, 367, 370; **74,** 352.

By Capt. Benyaurd, 1873, revising previous est. If for 7 locks and dams of timber, $2,644,768; of st., $4,952,976, **74,** 354. For 8 locks and dams of timber, $2,626,252; of st., $5,162,319, **74,** 354. For 10 locks and dams of timber, $2,995,566; of st., $6,079,233, **74,** 354.

LEGAL PROCEEDINGS.

Condemnation proceedings to acquire land needed for mound at Lock and Dam No. 8, **08,** 1570.

Acquisition of land for Locks and Dams Nos. 3 and 7, **12,** 2070.

OPERATIONS.

1871-72. Removal of 16,277 trees and 393 snags, **71,** 334; **72,** 53, 55, 345, 347.

1872-73. 14,121 trees, 131 snags, 6 drift piles, and 1 stump removed, **73,** 55, 465, 491.

1873-74. 10,074 trees and 153 snags removed, **74,** 62, 349, 350.

1874-75. 87 trees, 118 snags, and 2 drift piles; also one-half of the wreck of the *Lolawanna* removed, **75,** 521.

1875-76. 835 trees and 653 snags removed, **76,** 77, 593.

1876-77. Removal of obstr. and constr. of wing dams at Spoon Camp, Buffalo Shoals, **77,** 76, 477.

1877-78. Removal of snags and obstr. and constr. of wing dams, **78,** 86, 623.

1878-79. Removal of snags and obstr., **79,** 965.

1879-80. 400 snags removed from chan. below Monroe, **80,** 1305.

1880-81. 456 snags and 4,159 trees removed from chan. and banks of upper Ouachita; dam at Catahoula Shoals rebuilt, **81,** 1416.

1881-82. 241 snags and logs removed and 6,210 trees cut down, **82,** 1556.

1882-83. 780 logs and snags destroyed; 900 trees, shore snags, and stumps removed; wreck of SS. *Little Bob B.* removed, **83,** 1155.

1884-85. 677 snags pulled; 2,652 trees, stumps, and logs removed from chan., **85,** 1499.

1886-87. 465 snags and stumps removed and 267 trees cut, **87,** 1456.

1889-90. 2,970 snags, stumps, and logs removed from chan., and 8,580 trees cut and girdled on the banks bet. Camden and mouth, **90,** 1872. 3,130 snags and 11 c. y. r. removed from chan.; 66 c. y. st. and 100 l. f. brush wing dams built; 39,800 trees girdled and cut, and 138,563 s. y. brush and willows cut from banks above Camden, **90,** 1878.

1890-91. 1,470 snags cleared from chan.; 34,548 trees and stumps removed from banks; 10,035 trees girdled; 6,767 s. y. willows and brush cut, and 250 l. f. of brush dams built bet. Camden and mouth, **91,** 1965, 1966. 1,467 snags and 29 c. y. r. removed from chan.; 783 trees and 4,304 s. y. of brush cleared from banks, and 800 l. f. of brush dams built above Camden, **91,** 1976.

1891-92. 2,562 snags cleared from chan., and 11,368 shore snags removed from banks; 77,342 trees cut; 24,543 trees girdled, and 675 s. y. of brush and willows cut, **92,** 1604.

1892-93. About 37,000 snags and other obstr. removed; 1,325 s. y. willows and brush cut, and several wrecks removed, **93,** 2005.

1893-94. About 2,000 snags, etc., removed; 29,026 c. y. dr. at Catahoula Shoals, and about half deposited along right bank, **94,** 1459.

1894-95. About 2,000 snags, etc., removed, **95,** 1890; 53,492 c. y. dr. at Catahoula Shoals, and deposited in dike above mouth of Little Creek and along right shore, and portion of a wreck removed, **95,** 1891.

1895-96. Nearly 1,000 snags, etc., removed; several wrecks removed, **96,** 1594.

1896-97. About 13,000 snags, etc., removed; dam at Catahoula Shoals repaired; 6,697 s. y. willows, etc., cut, **97,** 1905, 1906.

1897-98. Dam at Catahoula Shoals repaired; 3 brush wing dams built; wreck removed; 31,993 s. y. brush, etc., removed, and over 28,000 snags, etc., removed, **98,** 1595.

1898-99. Boats repaired, and 45 obstr. removed, **99,** 1994.

1899-00. About 16,000 snags and other obstr., and 5 wrecks removed from chan., **00,** 2504.

1900-03. Snagging, **01,** 2034; **02,** 1410; **03,** 1373.

1903-04. Snagging; completing borings, surs., etc., at sites of locks and dams, **04,** 2039.

1904-05. Constr. of Locks and Dams Nos. 4 and 6 commenced, **05,** 1529.

1905-06. Snagging; constr. of locks and dams in progress, **06,** 1362–65.

1906-07. Snagging; constr. of Locks and Dams Nos. 4 and 6 in progress; plans and specifications prepared for Locks and Dams Nos. 2 and 8, **07,** 1497–98.

1907-08. Snagging; new snag boat completed; constr. of Locks and Dams Nos. 4 and 6 in progress; test borings and surs. made at sites of Nos. 2 and 8; constr. of Lock No. 8 by hired labor and purchase of material commenced, **08,** 1567–70.

1908-09. Snagging and dr.; completion of Lock No. 4 by hired labor commenced; work commenced under contract for constr. of Lock No. 2; constr. of Lock No. 8 by hired labor continued, **09,** 1555.

1909-10. Snagging; work continued at Locks Nos. 4 and 8 by hired labor, and at Nos. 2 and 6 under contract, **10,** 1700–08.

1910-11. Snagging; work continued at Locks and Dams Nos. 4 and 8 by hired labor and at Locks Nos. 2 and 6 under contracts; surs. and borings made with view to acquiring sites for Locks and Dams Nos. 3 and 7, **11,** 1845.

1911-12. Snagging; wreck removed; work at Locks and Dams Nos. 4 and 8 continued by hired labor, at Lock and Dam No. 6 partly by contract and partly by hired labor, and at Lock No. 2 by contract, **12,** 757–58, 2065–69.

PHYSICAL CHARACTERISTICS.

In general, **71,** 368; **74,** 358.
Slope of R., **72,** 368; **74,** 352.
Discharge of R., **72,** 370.
Description of the Ouachita; table of distances, falls, etc., **89,** 1633.
Description of, **93,** 2004; **94,** 1461; **95,** 1889, 1896; **96,** 1593, 1595; **97,** 1904, 1906; **98,** 1594; **00,** 2547.
Description of, above Camden, Ark., **93,** 2091.
Oscillations of the R. rapid, **93,** 2005, 2092.
High stages of the R., **93,** 2004.
Gauge readings, 1892–93, at Arkadelphia and Camden, **93,** 2093.
Discharge measurements, **93,** 2095; **94,** 1465; **97,** 1909; **98,** 1611; **00,** 2549.
Table of elevations in f. above Coast Survey, mean Gulf level of h. w. of 1882, and lowest water of record on the R., and also average fall per mile, **94,** 1465.
Tributaries, description of, and fall at h. and l. w. bet. them and Ouachita R., **95,** 1897.
Imp. at Catahoula Shoals, giving evidence of permanency, **96,** 1594.
Development of levees on the right bank of the Mississippi R. made it probable in 1896 that the extreme h.-w. marks of earlier years would not be

reached again in the upper R., and if system should be extended to mouth of Red R. the Ouachita would probably be able to carry the waters of its basin without danger to the people on its banks, **96,** 1597.

Unhealthy conditions giving great difficulty in making surs., **96,** 1598; **98,** 1599.

Condition of works and d. of w., **02,** 347; **12,** 758.

For data on stream discharge, borings, etc., see final report on sur. au. act Aug. 17, 1894, **02,** 1445–1570.

Abnormally h. w. 1905–08; interferes with work, **08,** 490.

PLANS. (See Estimates and Projects.)

C. W. Durham, 1874, imp. to 4′ by removal of snags, with w. and d. of by dr. and r. excavation, **74,** 362.

Maj. Miller, 1883, proposed protecting banks, vicinity Monroe, La., est., $10,000, **84,** 1383.

PRIVATE WORK.

Levees, work on, performed by State engineers, **96,** 1598.

PROJECTS. (See Estimates and Plans.)

Lt. Col. Raynolds, 1871, temporary imp. Arkadelphia to mouth by removal of snags and dr. on worst bars; est., $98,300, **71,** 337.

Lt. Col. Raynolds, 1872, permanent imp., Camden to Trinity, 297 m., by locks and dams, and to d. of not less than 4′. Locks of wood, dams of timber and st., 2 locks and dams in Arkansas, $464,233, and 3 locks and dams in Louisiana, $697,850, **72,** 53, 54, 346, 348, 370, 374; **73,** 484.

Revised by BE., 1873 (no facts given), **74,** 352.

Capt. Benyaurd, 1874, recom. abandonment of above proj. as being too costly when compared with the C. to be benefitted, **74,** 357.

Proj. abandoned, 1875, **75,** 521; **77,** 479; **79,** 966.

Capt. Benyaurd, 1877, imp. at special points by means of wing dams, **77,** 76, 477; **78,** 623.

Character of imp. carried on, 1880, viz, the removal of logs, snags, and similar obstr., would not permanently imp. the R. or permit giving a definite est., **80,** 1306; **84,** 1386; **86,** 231.

Act 1884, Black R., Ark. and La., placed under the same head as the Ouachita, **86,** 1351.

Amount expend. on proj. to June 30, 1888, incl. cost of snag boat and outfit, $193,912, **88,** 1348.

By Capt. Willard, 1887, imp. Ouachita, Camden up to Arkadelphia, 76 m., by cutting leaning timber, removing snags, and building brush dams at the shoals; est., $9,000, **89,** 1598.

By Capt. Willard, 1892, applying app. of that year to repair of plant, surs. and work at Catahoula Shoals, and general imp., snagging, etc., bet. Camden, Ark., and mouth of Black R., **93,** 2003.

Lock and dam navigation of R., history of projs., **94,** 1460.

By Capt. Willard, 1894, application of $30,000 of the app. of 1894 for commencement of sur. of R. au. act 1894, and for completion of sur. at a further est. of $120,000, **95,** 1892.

Discussion of form of dams applicable to needs of the R., **95,** 1897. Table of approx. locations for 5 movable dams, to include tributaries, **95,** 1899. Early est. of cost of lock and dam system, **95,** 1901. In 1895, Capt. Willard made a pre. est. of $2,000,000 for 5 dams, **95,** 1902.

Levees, revival of interest in, **96,** 1598.

Maj. Casey est., 1900, $275,000 each for constr. of 13 locks and dams, or $3,575,000 for entire system, **00,** 2546.

Proj. au., 1902 (see Surveys), contemplates constr. of 9 locks and movable dams to provide navigable d. of 6½′, mouth of Black R., La., to 10 m. above Camden, Ark. (360 m.), at est. cost of $1,998,576; completion of maps of sur., etc., and continuance of snagging for mainten. of past work at an. cost of about $20,000, **03,** 366. Est. of cost increased to $2,038,888, **05,** 403, and later to $2,109,980, **07,** 461. Change in location of Lock and Dam No. 2 eliminates Lock and Dam No. 1 from proj.; approx. $270,000 saved by change, but cost elsewhere increased, **08,** 490, 1569. Est. cost of Locks and Dams Nos. 4 and 6 increased $439,000, **09,** 1556.

Detailed est. cost of Lock and Dam No. 3, $670,000, **11,** 1854, and of Lock and Dam No. 7, $634,000, **11,** 1855.

SURVEYS.

Au. July, 1870, **70,** 31, 66.

From Arkadelphia to mouth, 1870, **71,** 334, 335.

For more definite location of locks and dams bet. Camden and Trinity, 1873, **73,** 485; **74,** 62, 349, 352.

Special sur. of Catahoula Shoals, 1878, **79,** 115.

Ex. of Catahoula Shoals and vicinity, 1879, **80,** 1307.

Ex. of Ouachita R. from Camden to Arkadelphia au. act Aug. 2, 1882; made, 1883, by Maj. Miller (**R.** unfav.), **84,** 1351.

Ex. au. for cut-offs, act Aug. 2, 1882; made 1882, by Capt. Miller (**R.,** unfav.), **84,** 1363.

Ex. of Hs. of Monroe and Trenton, La., on Ouachita R., with view to prevent caving of banks, au. act Aug. 2, 1882; made, 1883, by Maj. Miller, **84,** 1381.

Plan and est. for continuing imp. of Ouachita R. from mouth to Camden, Ark., au. act Aug. 2, 1882; made, 1882, by Maj. Miller, **84,** 1386.

Reex. with view to slack water, Camden to mouth, au. act Aug. 5, 1886; made by Capt. Willard (**R.** unfav.), **87,** 1487.

Ex. above Camden au. act Aug. 5, 1886; made by Capt. Willard (**R.** unfav.), **87,** 1495.

Ex. for permanent imp. of Ouachita R., mouth to head of navigation., au. act Aug. 11, 1888; made, 1889, by Capt. Willard (**R.** unfav.), **89,** 1631.

Ex. above Camden, Ark., au. act July 13, 1892; made, 1893, by Capt. Willard (**R.** unfav.), **93,** 2091.

Precise level run bet. Vidalia and Monroe, La., **94,** 1459.

Surs. for lock and dam navigation. History, **94,** 1460. Comparison of, with sur. au. act 1894, **98,** 1598.

Act Aug. 17, 1894, au. submission of plans and est. for imp. by locks and dams, to be completed with an allotment from app. for that year. Capt. Willard **R.** it would be impracticable to make a thorough sur. with the whole app., and submitted proj. for a thorough sur. (see Projects), under which work commenced 1894, **95,** 1891, 1892. Procuration of precise levels, reconnoissances, **95,** 1892, 1895. Discrepancies in levels determined at early dates, **95,** 1894. Field and office work, **96,** 1595; **97,** 1907; **98,** 1595. Details of methods, etc.: Traverse lines, **98,** 1606; hypsometry, **98,** 1607; topography, hydrography, gauges, **98,** 1610; discharge, **98,** 1611; sediment, profiles, **98,** 1612. Surs. continued, 1899, under many difficulties, **99,** 1994. Pre. **R.** made, 1900, by Maj. Casey (see Projects), **00,** 2545.

Surs. continued, **01,** 2035.

Pre. ex. au. act June 6, 1900, front of Camden, Ark., on Ouachita R., with view to imp. said H. and grading and protecting R. bank in front of city. **R.** by Maj. Casey, Aug. 7, 1900[1] (imp. in manner indicated in act not advisable), **01,** 425, 2090–94.

Final **R.** on sur. au. act Aug. 18, 1894, by Capt. Potter, Feb. 22, 1902. Plan of imp. contemplates locks and dams to provide navigable d. of 6½′, mouth to a point above Camden, Ark. (360 m.); est., $1,998,576[2] (see Projects), **02,** 354, 1435, 1570.

Surs. made for Locks and Dams Nos. 3 and 7, **11,** 1851–52.

Maps. **91,** 1966, 1969; **08,** 1568; **11,** 1846, 1848, 1850.

[1] H. D. 96, 56th, 2d.

[2] H. D. 448, 57th, 1st.

Part (b), X-29 Ouachita River above Camden to Arkadelphia, Ark.

APPROPRIATIONS.[1]

1910,	$10,000,	**10,** 1711.
1911,	7,500,	**11,** 1859.
1912,	2,500,	**12,** 2074.
Total,	20,000	

COMMERCE.

Chiefly floating saw logs to mills. Other C. small; declined in recent years, **10,** 585.

ENGINEERS.

Chief of Engineers. R., 10, 585; **11,** 629; **12,** 760, 781.

In charge:
Capt. C. S. Smith, 1910. **R., 10,** 1710.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1858; (Maj.) **12,** 2073.

OPERATIONS.

1910-11. Derrick boat built and snagging operations commenced, **11,** 1858–59.
1911-12. Snagging, **12,** 2073–74.

PROJECTS.

Act June 25, 1910, au. removal of snags and other obstr. accumulated since 1890; est., $10,000, and $2,500 an. mainten., **10,** 585. Revised est., $17,500, **11,** 629.

SURVEYS.

Ex. au. act Mar. 3, 1909. **R.** by Capt. Smith on which proj. based **10,** 585. R. from Camden to Arkadelphia worthy of imp. to extent of removing snags, etc., **10,** 1711. **Rs.,**[2] July 29 and Sept. 23, 1909, on pre. ex., Camden to Arkadelphia, Ark., together with **R.,** June 15, 1911, on sur. with view to location of site for proposed storage reservoir on this stretch of R., au. act Mar. 3, 1909, submitted by DO. Constr. of reservoir not recom. An. app. of $2,500 recom. for mainten., **12,** 781.

X-30 TENSAS RIVER AND BAYOU MACON, LA.

Part.	Title.	Period.	Appropriation.
a	Macon Bayou, La	1881–1887	
b	Tensas River and Bayou Macon, La	1881–1912	$72,500
	Total		72,500

Part (a), X-30 Macon (Maçon) Bayou, La.

COMMERCE.

Important, **81,** 1463.

ENGINEERS.

Chief of Engineers. R., 81, 213; **85,** 236; **86,** 232; **87,** 197.

In charge:
Maj. W. H. H. Benyaurd. **R., 81,** 1462.
Capt. E. Bergland, 1885–86. **R., 85,** 1504; **86,** 1355.
Capt. J. H. Willard, 1887. **R., 87,** 1463.

Assistant. F. S. Burrows. **R., 81,** 1463.

PHYSICAL CHARACTERISTICS.

Described, **81,** 1463.

OPERATIONS.

1886-87. Obstr. removed from Floyds to junction of bayou with Tensas R., **87,** 1464.

PLANS. (See Project.)

By Maj. Benyaurd, 1880, clearing the bayou of logs and similar obstr. from its head to junction with Tensas R.; est., $17,000, **81,** 1463.

PROJECTS. (See Plans.)

Act July 5, 1884, imp. of Bayou Macon united with Tensas R., La., by the adoption of Maj. Benyaurd's plan of 1880, **84,** 400; **85,** 1504.

SURVEYS.

Ex. au. act June 14, 1880; made by Maj. Benyaurd, 1880, **81,** 1462.

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[1] App. of 1871, 1872, and 1888, $94,000, incl. under Ouachita and Black Rs., Ark. and La.
[2] H. D. 588, 62d, 2d.

Part (b) X-30 Tensas River and Bayou Macon, La.

APPROPRIATIONS.

1881,	[1] $3,000, **81,** 1423.
1884,	[2] 4,000, **84,** 1332.
1886,	4,000, **86,** 1356.
1888,	5,000, **88,** 1356.
1890,	5,000, **90,** 1889.
1892,	5,000, **92,** 1619.
1894,	5,000, **95,** 1925.
1896,	5,000, **96,** 1612.
1899,	4,000, **99,** 2008.
1902,	*4,000, **04,** 2047.
1905,	[3] *8,700, **06,** 1541.
1907	*5,000, **07,** 1505.
	[4] * 800, **07,** 1504.
1909,	*5,000, **09,** 1562.
1910,	*6,000, **10,** 1713.
1912,	*3,000, **12,** 2078.
Total,	72,500

COMMERCE.

Description of Bayou Macon; unimportant, **95,** 1977.

Average C. for "last" 11 years, 14,106 t. an.; value, $564,500, **00,** 406.

Navigable stages frequently not coincident with needs of transportation, **04,** 391.

1911, 9,956 t., **12,** 2079.

CONTRACTS.

1884. Wooton & Brondway, removal of obstr., $125 per m., **85,** 1504.

ENGINEERS.

Chief of Engineers. R., 81, 212, 213; **82,** 209; **83,** 218; **84,** 223; **85,** 236; **86,** 232; **87,** 197; **88,** 180; **89,** 211; **90,** 190; **91,** 241; **92,** 233; **93,** 263; **94,** 244; **95,** 273; **96,** 238; **97,** 304; **98,** 295; **99,** 354; **00,** 406; **01,** 419; **02,** 347; **03,** 368; **04,** 389; **05,** 405; **06,** 439; **07,** 463; **08,** 492; **09,** 519; **10,** 586; **11,** 633; **12,** 766.

In charge:

Maj. W. H. Benyaurd, 1880–82. **R., 81,** 1422, 1457; **82,** 1559.

Capt. A. M. Miller, 1882–84. **R., 83,** 1160; **84,** 1331.

Capt. E. Bergland, 1884–87. **R., 85,** 1504; **86,** 1355.

Capt. J. H. Willard, 1887–99. **R., 87,** 1463; **88,** 1354; **89,** 1605; **90,** 1888; **91,** 1989; **92,** 1617; **93,** 2018; **94,** 1479; **95,** 1923, 1974; (Maj.) **96,** 1611; **97,** 1920; **98,** 1616; **99,** 2006.

Maj. T. L. Casey, 1900–01. **R., 00,** 2517; **01,** 2046.

Capt. Chas. L. Potter, 1902. **R., 02,** 1418.

Capt. Chas. S. Bromwell, 1903. **R., 03,** 1379.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2043.

Capt. G. M. Hoffman, 1905–07. **R., 05,** 1538; **06,** 1368; **07,** 1503.

Capt. Clarke S. Smith, 1908–10. **R., 08,** 1573; **09,** 1560; **10,** 1711.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1862; (Maj.) **12,** 2077.

Assistants:

H. C. Wilson. **R., 81,** 1458.

H. M. Marshall. **R., 03,** 1383; **04,** 2049; **05,** 1542.

OPERATIONS.

1881–82. 695 snags and 697 leaning trees removed, **82,** 1557.

1884–85. 1,193 logs and snags removed from Tensas R. by contract, **85,** 1504.

1886–87. Obstr. in Bayou Macon removed from Floyd's to junction with Tensas R., **87,** 1464.

1887–88. 330 snags removed from the chan., and 392 shore snags and leaning trees cleared from the banks, **88,** 1355.

1888–89. 1,939 snags and logs removed from the chan., and 5,480 trees from the banks, **89,** 1605.

1891–92. 875 snags, 1,512 stumps, and 1,450 shore snags removed, and 2,398 trees and logs cleared from the banks, **92,** 1619.

1892–93. Over 50,000 s. y. brush and willows cut; and over 159,000 snags and other obstr. destroyed, **93,** 2021.

1893–94. 375 s. y. brush, etc., and about 2,000 obstr. removed, **94,** 1481.

1894–95. 10,930 s. y. brush, etc., and over 10,000 obstr. destroyed. Over 16,000 obstr. destroyed in Bayou Macon, **95,** 1925.

1895–96. Wreck removed and also a few obstr., **96,** 1612.

1897–98. 2,242 s. y. brush and willows cut, and about 1,800 obstr. destroyed, **98,** 1617.

1898–99. About 9,000 snags and other obstr. and 35,000 s. y. willows and brush removed from Bayou Macon, **99,** 2007.

1901–02. 10,550 snags, stumps, etc., removed, 38,639 s. y. willows and brush cut, 8 c. y. mud lumps removed, and 1 wreck removed, **02,** 1417.

1903–04. 5,120 snags, trees, logs, etc., removed or destroyed, 21,553 s. y. willows and brush cut, and 47 c. y. earth removed, **04,** 2045.

1905–06. 3,483 snags, logs, and stumps cut, 10 jams broken up and destroyed, 6,109 trees cut, 876 trees girdled, and 22,670 s. y. willows and brush cut, **06,** 1369.

1906–07. 2,260 snags, stumps, and logs removed or destroyed, 13,739 trees felled, 5,342 trees girdled, 9,044 s. y. willows and brush cut, 2 wrecks removed, and jam broken up, **07,** 1504.

1907–08. 2,173 snags, logs, and trees removed and destroyed; quarterboat sank, **08,** 1574.

1908–09. 12,207 snags and logs removed or destroyed, 8 jams broken up, 10 mud lumps destroyed, and 1,520 trees cut, **09,** 1520.

1909–10. 1,845 snags, 1,122 logs, and 789 trees removed or destroyed, and 7,900 s. y. willows and brush cut, **10,** 1712.

1910–11. 7,647 snags, 1,148 logs, 10 trees removed, 3,070 trees felled, cut, and topped, 13 jams broken up and destroyed, 4,895 s. y. willows and brush cut, and wreck of old br. removed, **11,** 1862.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1458; **93,** 2019; **94,** 1480; **95,** 1925; **96,** 1612; **97,** 1920; **98,** 1617.

Drift brought down by floods, caving and sliding banks, and rapid growth of timber, etc., adding obstr. each year, **97,** 1921.

Description of, above Floyd. This place about 98 m. from the mouth, **95,** 1974. Part ex., 1895, narrow and shallow, and so filled with snags and other obstr. as to be unnavigable at any stage, **95,** 1978.

PROJECTS.

By Maj. Benyaurd, 1880, removal of snags, logs, and similar obstr. from the mouth to Dallas, 180 m.; est., $23,000, **81,** 1457, 1461. Also removal of the same class of obstr. in Bayou Macon, Floyd to its mouth, about 130 m.; est., $17,000, **88,** 1355; **92,** 1617.

By act July 5, 1884, imp. Bayou Macon was united with that of Tensas R., **84,** 400; **85,** 1504.

Movement to reclaim abandoned plantations along R. causes demand for imp. (as orig.) up to Dallas, **01,** 2046.

Capt. Bromwell, 1903, est. $2,500 an. to maintain chan., **03,** 1379.

*Allotment.

[1] For Tensas R. only.

[2] By act July 5, 1884, imp. of Bayou Macon, La., was united with that of the Tensas R., **84,** 400; **85,** 1504.

[3] Incl. $3,700 trans. from Boeuf R., **06,** 1540.

[4] Trans. from Bayous D'Arbonne and Corney and Boeuf R., **07,** 1504.

App. for Bayou Bartholomew, Boeuf R., Tensas R. and Bayou Macon, and Bayous D'Arbonne and Corney combined, by act 1902, **03,** 368.

SURVEYS.

Au. act June 14, 1880; made by Maj. Benyaurd, 1880, **81,** 1457.

Ex. of Bayou Macon above Floyd, Ark., au. act Aug. 17, 1894; made, 1895, by Capt. Willard (**R.** unfav.), **95,** 1974.

Of Ouachita and Black Rs. and several tributaries, incl. Tensas R. and Bayou Macon, au. act Aug. 18, 1894; completed, 1902, by Capt. Potter,[1] **602,** 1435.

X-30(c) ROUNDAWAY AND VIDAL BAYOUS, LA.

APPROPRIATIONS.

1888,	$1,000,	**89,** 1607.
1890,	1,000,	act Sept. 19.
Total,	2,000	

COMMERCE.

Small, **84,** 1348; **87,** 1498.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **87,** 203; **88,** 180; **89,** 212; **91,** 242; **92,** 234.

In charge:

Capt. A. M. Miller. **R., 84,** 1347.

Capt. J. H. Willard, 1887–92. **R., 87,** 1497; **89,** 1606; **91,** 1992; **92,** 1620.

Assistant. T. M. Farrell. **R., 84,** 1348.

OPERATIONS.

1888–89. 162 snags removed from the chan.; 714 trees and 149 s. y. brush cut from the banks, **89,** 1607.

1891–92. 146 snags and logs cleared from the chan.; 956 leaning trees cut from the banks, and 240 s. y. of willow brush removed, **92,** 1621.

PROJECTS.

By Capt. Willard, 1887, removing snags and leaning trees from the canal and that part of Bayou Vidal that would remain open from Lake Palmyra to the line of levee to be built by State au. n. of the lake; est., $1,000. Increased in 1889, for further removal of obstr. to $3,000, **89,** 1606, 1607.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Miller (**R.** unfav.), **84,** 1347.

Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Willard (**R.** unfav.), **87,** 1497.

X-35 BŒUF RIVER, ARK. AND LA.

APPROPRIATIONS.

1881,	$5,000.00,	**81,** 1423.
1882,	5,000.00,	**82,** 1560.
1884,	5,000.00,	**84,** 1331.
1886,	5,000.00,	**86,** 1354.
1888,	6,000.00,	**88,** 1354.
1890,	5,000.00,	**90,** 1887.
1892,	10,000.00,	**92,** 1616.
1894,	8,000.00,	**95,** 1922.
1896,	6,000.00,	**96,** 1608.
1899,	6,000.00,	**99,** 2005.
1902,	[2]* 3,500.00,	**02,** 1417.
1905,	*[3] 900.00,	**05,** 1540.
1907,	*5,000.00,	**07,** 1503.
1909,	*4,000.00,	**09,** 1562.
1910,	[4] 3,769.22,	**10,** 1713.
1912,	*3,000.00,	**12,** 2078.
Total,	81,169.22	($81,196.97, incl. receipts from sales, **12,** 2078).

COMMERCE.

Important, **81,** 1427; **85,** 1546.

Details, **95,** 1971, 1972; **96,** 1609; **11,** 633.

Average an. C. for "last" 11 years, 6,856 t., valued at $297,000, **00,** 406. Average to 1911, $223,000, **12,** 765.

Traffic, 1911, 6,362 t., **12,** 2,079.

CONTRACTS.

1885. Emmick & Feith, removal of obstr., $75 per m., **85,** 1503.

1888. A. Hefner, earth filling, 22¢ c. y., **88,** 1353.

ENGINEERS.

Chief of Engineers. **R., 80,** 158; **81,** 213; **82,** 209; **83,** 218; **84,** 222; **85,** 235, 244; **86,** 231; **87,** 196; **88,** 179; **89,** 211; **90,** 190; **91,** 241; **92,** 233; **93,** 263; **94,** 243; **95,** 272, 279; **96,** 237; **97,** 303; **98,** 294; **99,** 353; **00,** 405; **01,** 418; **02,** 348; **03,** 368; **04,** 389; **05,** 405; **06,** 439; **07,** 463; **08,** 493; **09,** 520; **10,** 586; **11,** 632; **12,** 764.

In charge:

Maj. W. H. H. Benyaurd, 1880–82. **R., 81,** 1423.

Capt. A. M. Miller, 1882–84. **R., 82,** 1560; **83,** 1161; **84,** 1331.

Capt. E. Bergland, 1884–86. **R., 85,** 1502; **86,** 1354.

Capt. J. H. Willard, 1886–99. **R., 87,** 1461; **88,** 1353; **89,** 1603; **90,** 1885; **91,** 1985; **92,** 1614; **93,** 2015; **94,** 1475; **95,** 1920, 1969; (Maj.) **96,** 1605; **97,** 1917; **98,** 1614; **99,** 2002.

Maj. T. L. Casey, 1900–01. **R., 00,** 2515; **01,** 2044.

Capt. Chas. L. Potter, 1902. **R., 02,** 1416, 1436.

Capt. Chas. S. Bromwell, 1903. **R., 03,** 1379.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2043.

Capt. G. M. Hoffman, 1905–07. **R., 05,** 1538; **06,** 1368; **07,** 1501.

Capt. Clarke S. Smith, 1908–10. **R., 08,** 1573; **09,** 1560; **10,** 1711.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1861; (Maj.) **12,** 2077.

Assistants:

H. St. L. Coppée. **R., 81,** 1424.

C. Quinn. **R., 85,** 1546.

J. Ewens. **R., 91,** 1986.

T. C. Thomas. **R., 96,** 1608.

H. M. Marshall. **R., 02,** 1437–1570; **03,** 1383; **04,** 2050; **05,** 1543.

OPERATIONS.

1881–82. By hired labor, 3,264 logs, trees, and stumps removed, and 3 brush heaps destroyed, **82,** 1560.

1882–83. By hired labor, 2,663 logs and trees and 3 brush heaps removed, **83,** 1161.

1884–85. By contract, 1,679 logs, snags, and trees, and 35 brush heaps removed, **85,** 1503.

1887–88. Closure of outlet No. 1 completed, **88,** 1353.

1888–89. Closure of outlets Nos. 2 and 3 completed by deposit of 14,860 c. y. of earth; 3,000 snags

* Allotment.

[1] H. D. 448, 57th, 1st.

[2] $1,500 trans. to Tensas R. and Bayou Macon, **11,** 1863.

[3] $4,100 trans. to Tensas R. and Bayou Macon, **12,** 2078.

[4] Trans. from Bayou Bartholomew, **12,** 2078.

removed from chan., and 7,440 trees and 3,770 s. y. brush cleared from the banks, **89,** 1603.

1889-90. 130 snags removed from the chan., and 314 trees and shore snags cleared from the banks, **90,** 1886.

1891-92. 40,416 snags, logs, and stumps cleared from the chan.; 11,156 shore snags removed; 66,557 leaning trees removed or girdled; 20,060 s. y. brush and willows cut; wreck removed, **92,** 1616.

1893-94. 23,000 snags and other obstr. removed and 2,050 s. y. brush and willows cut, **94,** 1478.

1894-95. 1,830 l. f. brush dams built; 48,021 s. y. brush and willows cut, and about 12,000 snags, etc., removed, **95,** 1922.

1895-96. 13,414 s. y. brush, etc., cut; over 20,000 snags, etc., removed. Proj. for h.-w. navigation completed, **96,** 1607.

1896-97. A few obstr. removed, **97,** 1919.

1898-99. About 4,600 snags and other obstr. and 21,996 s. y. willows and brush removed from chan. and banks of the R., **99,** 2003.

1900-01. Mainten. work commenced by removal of logs, snags, etc., on May 6, 1901, at Pt. Jefferson and carried downstream for a distance of 65 m., **01,** 2044.

1901-02. Mainten. work continued by removal of logs, snags, etc., **02,** 1417.

1902-03. 36 logs and other obstr. removed; new hull built for quarterboat, **03,** 1384.

1903-04. Mainten. work continued at a cost of $3,383.11, **04,** 2044.

1904-05. Mainten. work continued over 9 m. of R., **05,** 1539.

1905-06. Quarterboat No. 7 completed; mainten. work continued from Pt. Jefferson to mouth, **06,** 1369.

1907-08. Six m. of R. worked over and obstr. removed, **08,** 1574.

1908-09. Mainten. work continued by removal of obstr. over entire R., **09,** 1560.

1909-10. Mainten. work continued over 139 m. of R., **10,** 1712.

1911-12. Snags and other obstr. removed, **12,** 2077.

PHYSICAL CHARACTERISTICS.

R. described, **81,** 1425; **93,** 2016; **94,** 1477; **95,** 1922, 1969; **96,** 1608.

R. rises in s. Arkansas and enters the Ouachita in Louisiana. Part ex., 1895, consists of a succession of pools and shoals, dry or nearly so at the lowest stages, and almost impassable because of snags and other obstr., **95,** 1973.

Chan. d. increasing below mouths of outlets near Pt. Jefferson, **96,** 1607; cross sections at, **96,** 1610.

Table showing l.-w. d. over the upper shoals and bars, **96,** 1608.

Discharge operation, etc., in technical detail, **02** 1445.

Navigation more difficult each year, **07,** 465.

Details of, **12,** 765.

PRIVATE WORK.

By Louisiana before 1840, **02,** 348.

PROJECTS.

By Maj. Benyaurd, 1880, imp. Wallace to the mouth, 280 m., by removal of obstr.; est., $20,020, **81,** 1424, 1428.

By Capt. Bergland, 1884, closing 3 outlets of Bœuf R. near Pt. Jefferson; est., $8,500, **85,** 235, 1503, 1546.

In 1892, $26,000 est. complete closure of the 3 outlets, for continuing the removal of obstr., and sur. of Bœuf R., **92,** 1616.

In 1893, Capt. Willard est. $30,000 to close the 3 outlets near Pt. Jefferson destroyed by levee breaks of 1890, **93,** 2017; **96,** 1607.

In 1896, Maj. Willard est. $2,500 yearly to maintain imp. made by completed proj. of that year, **96,** 1607.

By Maj. Willard, 1896, to defer expend. app. of 1896 until sufficient money should be on hand to close outlets near Pt. Jefferson, **97,** 1917.

Maj. Willard est., 1899, $30,000 to close the outlets, and $2,500 for mainten., **99,** 2004.

This work considered as separate proj. up to 1902. Act June 13, 1902, consolidated this R. with tributaries of the Ouachita R., incl. Bayou Bartholomew, Bœuf R., Tensas R., Bayou Macon, and Bayous D'Arbonne and Corney, La. and Ark. Mainten. proj. continued, **03,** 368.

By Capt. Hoffman, 1907, recom. outlet of Bœuf R. at Pt. Jefferson be closed (a revival of proj. of 1893), aiding in draining Bayou Lafourche basin, to permit development of 220,800 acres adjacent, **07,** 1503; **10,** 1712.

The existing proj. (1912) mainten. from the mouth to Wallace Landing; an. cost, about $5,000, **12,** 764.

SURVEYS.

Au. act June 14, 1880, **80,** 158; made by Maj. Benyaurd, 1880, **81,** 1423.

Of outlets of Bœuf R., au. act July 5, 1884; made by Capt. Bergland, 1884, **85,** 1545.

The 3 outlets near Pt. Jefferson and the old connecting levees bet. them. ex., 1893, by Capt. Willard, **93,** 2016.

Ex. of the R. in Arkansas above Wallace Landing au. act Aug. 17, 1894; **R.,** 1895, by Capt. Willard (**R.** unfav.), **95,** 1969.

Reconnoissance made, 1896, by Maj. Willard, **96,** 1607.

Au. act Aug. 18, 1894. Final **R.** Feb. 22, 1902, by Capt. Potter on sur. of Ouachita and Black Rs. (and tributaries incl. Bœuf R.). Plans of imp. contemplate a system of locks and movable dams; est., $1,998,576,[1] **02,** 354. Bench marks, reference lines, etc., in detail, **02,** 1445.

Cong. docs., etc., relating to exs., surs., plans, etc., **02,** 1436; **03,** 370; **04,** 391; **07,** 1502; **10,** 529; **12,** 764.

X-37 BARTHOLOMEW BAYOU, ARK. AND LA.[2]

APPROPRIATIONS.

1881,	$8,000,	**81,** 1422.
1882,	5,000,	**82,** 1559.
1884,	5,000,	**84,** 1331.
1886,	5,000,	**86,** 1353.
1888,	5,000,	**88,** 1352.
1890,	5,000,	**90,** 1884.
1892,	5,000,	**92,** 1613.
1894,	5,000,	**95,** 1919.
1896,	4,000,	**96,** 1604.
1899,	$5,000,	**99,** 2001.
1902,	*5,000,	**02,** 1415.
1905,	*5,000,	**05,** 1540.
1907,	*5,000,	**07,** 1502.
1909,	*4,000,	**09,** 1562.
1910,	[3] * 5,000,	**10,** 1713.
1912,	*3,000,	**12,** 2078.
Total,	79,000	

* Allotment.

[1] H. D. 448, 57th, 1st.

[2] Bayou Bartholomew, Bœuf R., Tensas R., and Bayou Macon; and Bayous D'Arbonne and Corney, La. and Ark., consolidated by R. and H. act, June 13, 1902, **02,** 1415; **12,** 762.

[3] $1,000 trans. to Bayous D'Arbonne and Corney, and $1,269.22 to Bœuf R., **12,** 2078.

COMMERCE.

Importance of imp. to, **72,** 383.
Reduction of insurance due to imp., **83,** 1159.
Cotton trade of the bayou, and reduction in rates thereon, **90,** 1884; **91,** 1983.
Average for 18 years, 12,500 t.; value, $317,900, **08,** 493.
Rates reduced about 50%; largely diverted to railroads on account of low stages of R. for 6 months of year, **10,** 586; **12,** 764.
1911, 400 t., **12,** 2078.

CONTRACTS.

1884. Emmick & Feith, removal of obstr., $75 per m., **85,** 1501.

ENGINEERS.

Chief of Engineers. R., 71, 59; **72,** 55; **78,** 88; **79,** 118; **80,** 158; **81,** 211, 213; **82,** 208; **83,** 217; **84,** 222; **85,** 235; **86,** 231; **87,** 196; **88,** 179; **89,** 210; **90,** 189; **91,** 240; **92,** 232; **93,** 262; **94,** 242; **95,** 271; **96,** 236; **97,** 303; **98,** 294; **99,** 352; **00,** 404; **01,** 417; **02,** 347; **03,** 368; **04,** 389; **05,** 405; **06,** 439; **07,** 463; **08,** 492; **09,** 519; **10,** 586; **11,** 631; **12,** 763.

In charge:
Lt. Col. W. F. Raynolds, 1872. **R., 72,** 390.
Maj. W. H. H. Benyaurd, 1879–82. **R., 79,** 997; **81,** 1422, 1453; **82,** 1558.
Maj. A. M. Miller, 1882–84. **R., 83,** 1158; **84,** 1330.
Capt. E. Bergland, 1884–86. **R., 85,** 1501, 1548; **86,** 1353.
Capt. J. H. Willard, 1886–99. **R., 87,** 1459; **88,** 1351; **89,** 1601; **90,** 1882; **91,** 1982; **92,** 1610; **93,** 2012; **94,** 1471; **95,** 1917; (Maj.) **96,** 1601; **97,** 1914; **98,** 1613; **99,** 2000.
Maj. T. L. Casey, 1900–01. **R., 00,** 2513; **01,** 2042.
Capt. Chas. L. Potter, 1902. **R., 02,** 1415.
Capt. Chas. S. Bromwell, 1903. **R., 03,** 1379.
Lt. Col. H. M. Adams, 1904. **R., 04,** 2043.
Capt. G. M. Hoffman, 1905–07. **R., 05,** 1538; **06,** 1368; **07,** 1501.
Capt. Clarke S. Smith, 1908–10. **R., 08,** 1573; **09,** 1560; **10,** 1711.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1861; (Maj.) **12,** 2076.

Assistants:
A. H. Blaisdell. **R., 72,** 383.
M. L. Lum. **R., 79,** 997.
R. M. Spicer. **R., 83,** 1159.
C. Quinn. **R., 85,** 1549.
H. M. Marshall. **R., 03,** 1383; **04,** 2049; **05,** 1542.

LEGAL PROCEEDINGS.

App. by State for imp. declared unconstitutional, **72,** 385; **79,** 1002.

OPERATIONS.

1881–82. Removal by hired labor of 9,954 trees and logs, 5 drift piles, and 1 wreck, **82,** 1558.
1882–83. Removal by hired labor of 4,341 trees, logs, and stumps, **83,** 1159.
1884–85. Removal by contract of 5,837 stumps, logs, and snags, 2 wrecks, 123 brush piles, and 697 leaning trees; clearing 66⅔ m. of the bayou, **85,** 1502.
1886–87. 5,289 trees, logs, and snags removed, **87,** 1460.
1887–88. 3,460 logs and snags removed from chan., 3,126 trees, and 8,653 s. y. brush cut from banks, **88,** 1351.
1889–90. 10,500 snags and 3 wrecks removed from chan.; 49,650 trees, 6,500 shore snags, and 9,325 s. y. brush cut from the banks, **90,** 1883.
1890–91. 1,670 snags removed from chan., 10,852 stumps and logs removed from chan. and banks, and 44,600 trees girdled and removed, **91,** 1984.
1891–92. 3,470 snags and stumps removed; 10,105 shore snags and logs and 41,054 trees cleared from the banks, **92,** 1612.
1893–94. About 10,000 obstr. removed, over 8,000 s. y. brush and willows cut, and several wrecks removed, **94,** 1474.
1894–95. About 1,500 obstr. removed, **95,** 1919.
1895–96. About 12,700 snags and other obstr., and 18,809 s. y. brush and willows removed, **97,** 1915.
1897–98. Over 1,500 snags and other obstr., 1,094 s. y. brush and willows, and 450 cords drift removed, **98,** 1613.
1898–99. Boat repaired and a few obstr. removed from chan., **99,** 2000.
1899–00. About 13,700 snags and other obstr. removed from chan. and 56,000 s. y. willows and brush cut from banks, **00,** 2514.
1902–09. Snags, stumps, and logs removed, and leaning trees cut, **03,** 1380; **04,** 2044; **05,** 1539; **06,** 1370; **07,** 1502; **08,** 1573; **09,** 1560.
1910–12. Snags and other obstr. removed, summary given, **11,** 1861; **12,** 2076.

PHYSICAL CHARACTERISTICS.

Described, **72,** 384; **79,** 998, 999; **94,** 1473; **95,** 1919; **96,** 1603; **97,** 1914.
Considerable imp. in d. of bars below Lind Grove, La., noted, **94,** 1474.
Drift, caving, and sliding banks, and rapid growth of vegetation constantly adding new obstr., becoming greater in quantity and more difficult to move each year, **98,** 1613.

PLANS.

By A. H. Blaisdell, removal of obstr., $34,716, **72,** 383, 385, 386.
By M. L. Lum, removal of obstr., $23,005, **79,** 1003.
Capt. Bergland, 1885, est. $20,000 as cost of removal of obstr. for navigation 7 months in the year, **85,** 1549.

PRIVATE (STATE) WORK. (See Legal proceedings.)

Imp. of R. by Louisiana in cutting trees and removing snags, **72,** 385; **79,** 1002.
Early imp. by State, **79,** 1000.

PROJECTS.

By Maj. Benyaurd, 1880, imp. of bayou, Baxter Station to mouth, 213 m., by removal of trees, logs, and snags; est., $26,862, **81,** 1455.
No permanent imp. feasible, **85,** 235.
Condensed history of work, **96,** 1601.
In 1897 Maj. Willard est. $2,500 per year to maintain unobstr. navigation at stages when steamboats could run, **97,** 1917; **02,** 1615.

SURVEYS.

Au. act Mar. 3, 1871, **71,** 59; made under direction of Lt. Col. Raynolds, by A. H. Blaisdell, C. E. **R., 72,** 383.
Au. act June 18, 1878, **79,** 118; made under direction of Maj. Benyaurd, by M. L. Lum. **R., 79,** 997.
Preceding ex. and sur., **81,** 1454.
Ex., 1884, **85,** 1501.
Ex., head of navigation to Lincoln Co. line, au. act July 5, 1884; made, 1885, by Capt. Bergland (**R.** unfav.), **85,** 1549.
Sur. of the bayou in connection with Ouachita R., **96,** 1604.
List of Cong. docs., etc., containing ex., sur., etc., **12,** 763.

X-38 SALINE RIVER, ARK.

APPROPRIATIONS.

1880, $7,500, **80,** 1326.
1881, 5,000, **81,** 1515.
1882, 4,000, **82,** 1586.
1884, 5,000, **85,** 1599.
1910, 5,400, **10,** 1749.
1912 { 3,000 *500 } **12,** 2075.

Total, 30,400 (less $208.33 repaid to Treas., $30,191.67, **12,** 2075).

COMMERCE.

Benefit of proposed imp., **79,** 1006.
C. influenced by imp., **80,** 1326.
C. does not justify further app., **84,** 1404; **86,** 1388; **87,** 1506, 1546.
Description of; small, **93,** 2122.

ENGINEERS.

Chief of Engineers. R., 78, 88; **79,** 118; **80,** 156; **81,** 218; **82,** 216; **83,** 224; **84,** 231; **85,** 250; **86,** 243; **87,** 204, 210; **93,** 279; **10,** 616; **11,** 630; **12,** 761.

In charge:
Capt. W. H. H. Benyaurd, 1878–81; **78,** 88. **R., 79,** 1003; (Maj.) **80,** 1325; **81,** 1435.
Capt. T. H. Handbury, 1881–84. **R., 81,** 1515; **82,** 1585; **83,** 1174.
Maj. M. B. Adams, 1884–85. **R., 84,** 1404.
Capt. H. S. Taber, 1885–93. **R., 85,** 1598; **86,** 1387; **87,** 1505, 1546; **93,** 2122.
Capt. C. L. Potter, 1902. **R., 02,** 1436.
Maj. M. L. Walker, 1910–11. **R., 10,** 1748.
Capt. C. S. Smith, **11,** 622.
Capt. J. A. Woodruff, 1911–. **R., 11,** 1860; (Maj.) **12,** 2074.

Assistants:
Z. Harrison. **R., 79,** 1004.
E. C. Wiley. **R., 85,** 1599.
H. M. Marshall. **R., 02,** 1437.

OBSTRUCTIONS.

Complaints of jams in R., due to drift; removed, **12,** 2075.

OPERATIONS.

1880–81. Removal of logs and snags, **81,** 1435.
1881–82. 466 snags, 1,300 logs, and 5,633 trees removed, **82,** 1585.
1882–83. 3,772 trees, 554 snags, a dam, a raft, and drift-piles removed, **83,** 1174.
1884–85. 1,200 snags, 3,985 trees, and 1,463 logs removed from chan., **85,** 1598.
1910–11. Trees cut and logs and snags removed, **11,** 1860.
1911–12. Removing obstr., **12,** 2075.

PHYSICAL CHARACTERISTICS.

General, **79,** 1004; **93,** 2123.
List of shoals, **79,** 1005.
Description of the adjacent country, **79,** 1005.
Obstr., snags, and leaning trees, **79,** 1005; **93,** 2123.

PLAN.

By Z. Harrison, removing snags and leaning trees with a snag boat; est., $30,151, **79,** 1006.

PRIVATE WORK.

Leaning trees and the more dangerous snags removed by private contractors, **79,** 1005.

PROJECTS.

By Maj. Benyaurd, 1879, removing snags, logs, trees, and similar obstr.; est., $30,151, **79,** 1006; **80,** 1325.
Further app. not recom., **86,** 1388; **87,** 1547.
Act June 25, 1910, au. removing snags, logs, trees etc.; est., $5,400, **10,** 1749.

SURVEYS.

By Z. Harrison, ex., 1878–79 (see Plan). **R., 79,** 1004.
Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Taber, 87, 1546. Capt. Taber **R.** further sur. or imp. as unnecessary, **87,** 1546.
Ex. au. act July 13, 1892; **R.** submitted by Capt. Taber, 1893 (D. E.'s **R.** fav. to snag removal, but C. of E.'s **R.** unfav.), **93,** 2122.
Au. act Aug. 18, 1894, included in sur. of Ouachita and Black Rs. and tributaries. **R.** by Capt. Potter, Feb. 22, 1902,[1] **02,** 1436.
Pre. ex., with plan and est. of cost, for imp. of R. from mouth, n. to Turtle Bar, au. act Mar. 2, 1907. **R.** by Capt. Connor, 1907 and 1908; est., $5,400,[2] **09,** 547.

X-39 LITTLE MISSOURI RIVER, ARK.

APPROPRIATIONS.

1871, $10,000, **71,** 350.
1872, 10,000, **72,** 53.

Total, 20,000

COMMERCE.

Cotton products tributary to R., **71,** 346, 348, 349.
Difficulties of transportation and high tariffs, **71,** 349.
Duration of season of navigation, **71,** 348.
RR. connections, **73,** 464.

ENGINEERS.

Chief of Engineers. R., 70, 31, 66; **71,** 59; **72,** 53; **73,** 55.

In charge:
Lt. Col. W. F. Raynolds, 1870–73. **R., 71,** 346, 349; **72,** 344.
Col. J. H. Simpson, 1873. **R., 73,** 461.

Assistant. J. Straszer. **R., 71,** 349; **73,** 462.

OPERATIONS.

1870–71. Removal of obstr. in progress, **71,** 350.
1871–72. Most serious obstr. removed, by means of a snag boat, from junction with the Ouachita to mouth of Antoine Creek, **72,** 53, 344.
1872–73. Removal of 453 snags, 647 snags cut off below l. w., and 9,496 drift trees removed; 153 bowlders removed from rapids; completion of proj., **73,** 55, 462, 463.

PHYSICAL CHARACTERISTICS.

Descriptions, **71,** 346–349; **73,** 463.
List of obstr., **71,** 347.

PROJECTS.

By Lt. Col. Raynolds, removal of obstr. and imp. of chan.; est., $23,000, **71,** 346, 348.

SURVEY.

By J. Straszer, 1870, **70,** 66; **71,** 59, 347.

* Allotment. [1] H. D. 448, 57th, 1st. [2] H. D. 1212, 60th, 1st.

X-40 D'ARBONNE AND CORNEY (Cornay or Cornie River) BAYOUS, LA.

APPROPRIATIONS.

1884,	[1] $5,000,	**85,** 1506.
1886,	[1] 2,000,	**86,** 1357.
1888,	[1] 2,000,	**88,** 1350.
1890,	[1] 2,000,	**90,** 1880.
1892,	4,000,	**92,** 1609.
1894,	3,000,	**95,** 1916.
1902,	*2,500,	**03,** 1381.
1905,	[2] * 1,600,	**05,** 1540.
1907,	*2,000,	**07,** 1505.
1909,	*2,000,	**09,** 1562.
1910,	*2,500,	**10,** 1713.
1911,	[3] * 1,000,	**11,** 635, 1863.
1912,	*3,000,	**12,** 768, 2078.
Total,	32,600,	**12,** 768, 2078.

COMMERCE.

Navigation stages frequently not coincident with needs of transportation, **04,** 391.

The average tonnage (cotton, cotton seed, etc., and return freights of plantation supplies), 1903 to 1911, about 16,160 t., **12,** 768.

CONTRACT.

1885. Emmick & Feith, removing obstr., $197.50 per m., **85,** 1506.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **85,** 236; **86,** 232; **87,** 195, 203; **88,** 178; **89,** 209; **90,** 189; **91,** 240; **92,** 1609; **93,** 261; **94,** 242; **95,** 271; **02,** 347, 350, 354, 1435; **03,** 368; **04,** 389; **05,** 405; **06,** 439; **07,** 463; **08,** 492; **09,** 519; **10,** 586; **11,** 634; **12,** 767.

In charge:

Capt. A. M. Miller, 1884. **R., 84,** 1372, 1376.

Capt. E. Bergland, 1884–86. **R., 85,** 1505; **86,** 1356.

Capt. J. H. Willard, 1886–95. **R., 87,** 1458, 1489; **88,** 1349; **89,** 1599; **90,** 1879; **91,** 1980; **92,** 1609; **93,** 2009; **94,** 1468; **95,** 1914.

Capt. Chas. S. Bromwell, 1903. **R., 03,** 1379.

Lt. Col. H. M. Adams, 1904. **R., 04,** 2043.

Capt. G. M. Hoffman, 1905–07. **R., 05,** 1538; **06,** 1368; **07,** 1501.

Capt. Clarke S. Smith, 1908–10. **R., 08,** 1573; **09,** 1560; **10,** 1711.

Capt. J. A. Woodruff, 1911–. **R., 11,** 1862; (Maj.) **12,** 2077.

Assistants:

T. M. Farrell. **R., 84,** 1372.

F. S. Burrows. **R., 84,** 1376.

J. R. Vaughan. **R., 95,** 1915.

H. M. Marshall. **R., 02,** 1437; **03,** 1384; **04,** 2049; **05,** 1543.

OBSTRUCTIONS.

Underwriters concerned notified and ordered to remove a wreck, **95,** 1916.

OPERATIONS.

1884–85. Obstr. removed from 23 m. of chan., **85,** 1506.

1886–87. Obstr. removed from 17 m., **87,** 1458.

1887–88. 3,036 leaning trees and shore snags cut, 243 logs removed from the chan., and 12,880 s. y. brush and willows cut, **88,** 1350.

1888–89. 1,185 snags removed from chan., 3,540 trees cut and topped, and 3,746 s. y. brush cleared from banks, **89,** 1599.

1889–90. 600 logs and snags removed from the chan., 11,600 trees cut and topped on the banks, and 425 s. y. brush cut, **90,** 1880.

1890–91. 53 snags cleared from the chan.; 565 shore snags and logs cut; 562 trees cleared from the banks, **91,** 1981.

1891–92. 2,138 snags and stumps cleared; 4,200 shore snags and logs removed; 12,450 s. y. brush and willows cut; 7 wrecks removed, **92,** 1609.

1893–94. Wrecks removed and about 10,000 snags and other obstr. removed from Bayou Corney. About 9,000 snags, etc., removed from other parts, and 3,725 s. y. brush and willows cut, **94,** 1470.

1902–03. 2,267 snags, logs, etc., removed, 7 jams broken up, and 4,889 s. y. willows and brush cut, **03,** 1380.

1904–05. 549 snags, logs, stumps, and trees removed or destroyed, 6,484 s. y. willows and brush cut, **05,** 1539.

1906–07. 1,166 snags, stumps, and logs removed or destroyed, 640 trees felled, 85 fallen trees cut up, and 5,525 s. y. willows and brush cut, **07,** 1505.

1907–08. 2,772 snags, logs, and stumps removed or destroyed, 2 jams broken up and destroyed, 677 trees felled and cut up, 8 trees girdled, 22,340 s. y. willows and brush cut, and 1 wreck removed, **08,** 1575.

1910–11. 4,801 snags and other obstr. removed, and 2,200 sq. yds. willows and brush cut from head to mouth of bayou, **11,** 1862.

1911–12. 1,016 snags and other obstr. removed, and 2,755 sq. yds. willows and brush cut, **12,** 2077.

PHYSICAL CHARACTERISTICS.

Description of bayou, **84,** 1372, 1377; **95,** 1915.

Corney R., **87,** 1489.

Bayou D'Arbonne is a combination of branches, flows se. and enters Ouachita R. 6 m. above Monroe, La. It is 37.7 m. long. Bayou Corney is a small creek, flows se. from Claiborne Parish, La. It is 76 m. l. Little D'Arbonne, the south branch, is about 56 m. l., **12,** 767.

PROJECTS.

By Maj. Miller, 1883, removing logs, snags, and similar obstr. from the bayou mouth to Stein Bluff, 42 m.; est., $15,000, **84,** 1376; **85,** 1506.

Capt. Willard, 1893, est. $6,000 to complete the work, the act of 1892 having extended the imp. above Stein Bluff to head of navigation at Cobb Landing, **93,** 2010. Act of 1894 au. $1,000 should be spent removing obstr. from Little D'Arbonne, **12,** 767.

Capt. Bromwell est., 1903, it would cost $1,000 an. to maintain chan., **03,** 1379.

App. for Bayou Bartholomew, Bœuf R., Tensas R., and Bayou Macon and Bayous D'Arbonne and Corney combined, act 1902, **03,** 368.

Existing proj., 1912, for mainten. below Cobb Landing; est., $2,000 an., **12,** 767.

SURVEYS.

Au. act Aug. 2, 1882; made by Maj. Miller, **84,** 1372, 1376, 1380.

Ex. (Corney R.) au. act Aug. 5, 1886; made, 1887, by Capt. Willard (**R.** unfav.), **87,** 1489.

Ex. of the bayou and its branches made, 1895, by Capt. Willard, **95,** 1915.

Of Ouachita and Black Rs. and several tributaries, incl. Bayou D'Arbonne, au. act Aug. 18, 1894; made, 1902, by Capt. Potter,[4] **02,** 1435.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 767.

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* Allotment.

[1] D'Arbonne Bayou.

[2] $400 of this amount trans. to Tensas R. and Bayou Macon, 1906.

[3] Trans. from allotment for Bayou Bartholomew for removing obstr. in the Little D'Arbonne Branch.

[4] H. D. 448, 57th, 1st.

X-42 LITTLE RIVER, LA.

APPROPRIATION.

1888, $2,500, **89,** 1601.

COMMERCE.

Description of, not large, **95,** 1987.

ENGINEERS.

Chief of Engineers. **R., 87,** 203; **88,** 179; **89,** 210; **90,** 189; **95,** 279.
In charge. Capt. J. H. Willard, 1887–95. **R., 87,** 1498; **89,** 1600; **90,** 1881; **95,** 1984.
Assistant. W. Decker. **R., 95,** 1983.

OPERATIONS.

1887–89. 2,645 logs and snags removed from the chan., and 4,300 trees and stumps removed from the banks, **89,** 1601.
1889–90. 120 snags removed from the chan. and 515 trees from the banks, completing the proj., **90,** 1881, 1882.

PHYSICAL CHARACTERISTICS.

Description, **87,** 1498; **95,** 1985.
Formed by Bayous Castor and Dugdemona, and reaches Ouachita R. through Catahoula Prairie, which becomes a lake in h. w. A tributary of Black R., **95,** 1985.

PROJECTS.

By Capt. Willard, 1887, clearing obstr. from Catahoula Lake to Trinity, 25± m.; est., $2,500, **87,** 1499; **89,** 1600. Completed in 1890, **90,** 1881.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Willard, **87,** 1498.
Ex. au. act Aug. 17, 1894; made by Capt. Willard, 1895 (**R.** fav. to removal of snags), **95,** 1984.

X-43 CASTOR BAYOU, LA.

COMMERCE.

Description of, **95,** 1965.

ENGINEERS.

Chief of Engineers. **R., 91,** 249; **95,** 279.
In charge. Capt. J. H. Willard, 1891–95. **R., 91,** 2028; **95,** 1962.
Assistant. R. S. Buck. **R., 91,** 2029.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2029; **95,** 1963, 1964.

Chief function of the stream to drain the neighboring country, **95,** 1963, 1964.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Willard (**R.** unfav.), **91,** 2028.
Ex. au. act Aug. 17, 1894; **R.** (unfav.) submitted by Capt. Willard, 1895, **95,** 1962.

X-44 DUGDEMONA RIVER OR BAYOU, LA.

COMMERCE.

Description of: Unimportant, **95,** 1961, 1962.

ENGINEERS.

Chief of Engineers. **R., 87,** 203; **95,** 279.
In charge. Capt. J. H. Willard, 1887–95. **R., 87,** 1489; **95,** 1961.

PHYSICAL CHARACTERISTICS.

Description of: A tortuous creek uniting with Bayou Castor to form Little R., **95,** 1962.

PLANS.

Capt. Willard, 1887, reported that any imp. would be unadvisable and not a public necessity, **87,** 1489.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Willard (see Plans), **87,** 1489.
Ex. au. act Aug. 17, 1894; **R.** made by Capt. Willard, 1895 (unfav.), **95,** 1961.

X-46 LOGGY BAYOU, LAKE BISTENAU, AND LAKE DORCHEAT, LA.

APPROPRIATION.

1884, $5,000, **85,** 1497.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **85,** 233; **86,** 230; **87,** 195.

In charge:
Capt. A. M. Miller. **R., 84,** 1363.
Capt. E. Bergland, 1884–86. **R., 85,** 1496; **86,** 1350.
Capt. J. H. Willard, 1886–87. **R., 87,** 1454.

Assistant. P. C. Montgomery. **R., 84,** 1363.

OPERATIONS.

1884–85. Removal of obstr. from Murrells Pt., on the Dorcheat, to the mouth of Loggy Bayou, **85,** 1496.

PROJECTS.

From the ex. made in 1882 it was est. that the cost of removing obstr. to increase the season of navigation 2 months would cost $19,338, **84,** 1366; **85,** 1496.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Capt. Miller (**R.** unfav.; see Projects), **84,** 1363.

X-48 DORCHEAT BAYOU, LA.

ENGINEERS.

Chief of Engineers. **R., 89,** 217.
In charge. Capt. J. H. Willard. **R., 89,** 1630.
Assistant. H. M. Marshall. **R., 89,** 1630.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1630.

SURVEY.

Ex. au. act Aug. 11, 1881; made, 1889, by Capt. Willard (**R.** unfav.), **89,** 1630.

X-49 PIERRE BAYOU, LA.

APPROPRIATION.

1884, $8,600, **85,** 232 (sur.).
Act July 5, 1886, provided for completing sur., **86,** 229, 459.

ENGINEERS.

Chief of Engineers. **R., 83,** 213; **84,** 221. 227; **85,** 232; **86,** 229; **87,** 194; **88,** 171.

In charge:
Capt. A. M. Miller, 1883. **R., 83,** 1139.
Capt. E. Bergland, 1885–86. **R., 85,** 1487; **86,** 1343.
Capt. J. H. Willard, 1886–87. **R., 87,** 1453
Capt. W. L. Fisk, 1888. **R., 88,** 1258.

Assistants:
J. Birney. **R., 83,** 1139.
H. Vance. **R., 85,** 1491.

OPERATIONS.

1887-88. 84 snags and 65 logs and trees removed from chan., **88,** 1258.

PHYSICAL CHARACTERISTICS.

Description of, bayou, **85,** 1478, 1491; **86,** 1343; **88,** 1259.
Description of raft, **85,** 1488.

PLANS.

History of previous plans, **85,** 1489.
By Capt. Miller, 1883, for removing raft from Bayou Pierre; est., $100,000, **83,** 1139.

PROJECTS.

By Maj. Heuer, for imp. bayou to a point 16 m. above its mouth by removing logs, snags, and trees; est., $20,000, **85,** 1444. Proj. completed in 1886, **87,** 1382.

SURVEYS.

Ex. by Capt. Miller, 1883, **83,** 1139.
Sur. au. act July 5, 1884; made by Capt. Bergland, **85,** 1487; **86,** 1343; **87,** 1453.
Maps. Red R. in vicinity of Bayou Pierre, **85,** 1490.

X-50 CANE RIVER, LA.

APPROPRIATIONS.

1884,	$2,500,	**85,** 1496.
1909,	*2,000,	**09,** 1554.
Total,	4,500,	**09,** 1554.

ENGINEERS.

Chief of Engineers. **R., 84,** 227; **85,** 233; **86,** 230; **87,** 194; **91,** 249, 2022; **09,** 514; **10,** 581.

In charge:
Capt. A. M. Miller, 1882–85. **R., 84,** 1366.
Capt. E. Bergland, 1885–86. **R., 85,** 1495; **86,** 1349.
Capt. J. H. Willard, 1886–91. **R., 87,** 1452; **91,** 2022.
Capt. Clarke S. Smith, 1909–10. **R., 09,** 1553; **10,** 1699.

Assistant. P. C. Montgomery. **R., 84,** 1367.

OPERATIONS.

1884-85. 2,504 shore and chan. snags removed, 4,517 trees and stumps cut, and 1,250 c. y. r. blasted, **85,** 1495.

1908-09. 9,054 snags, stumps, logs, trees, and other obstr. removed, placing stream in navigable condition; no further work contemplated, as stream is not considered worthy of continuous imp., **09,** 1553.

PHYSICAL CHARACTERISTICS.

Described, **84,** 1367.

PROJECTS.

By Capt. Miller, 1882, removing obstr., head to mouth, to allow navigation 6 months in the year. Est., $7,665, **84,** 1368; **87,** 1452.
Section 5, act Mar. 3, 1905, declared this R. to be not a navigable water of the U. S.; section repealed, act June 26, 1906, **09,** 514.

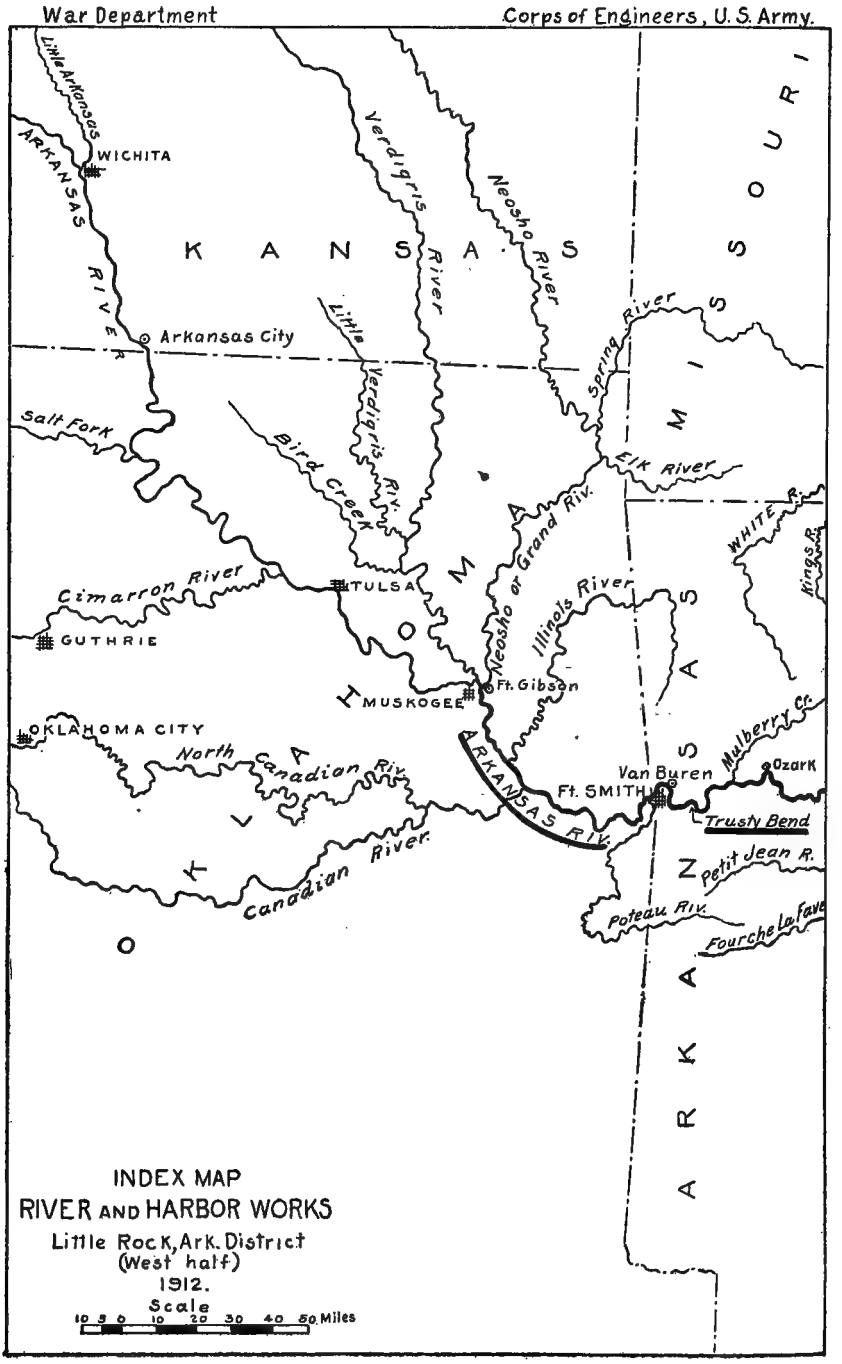
SURVEYS.

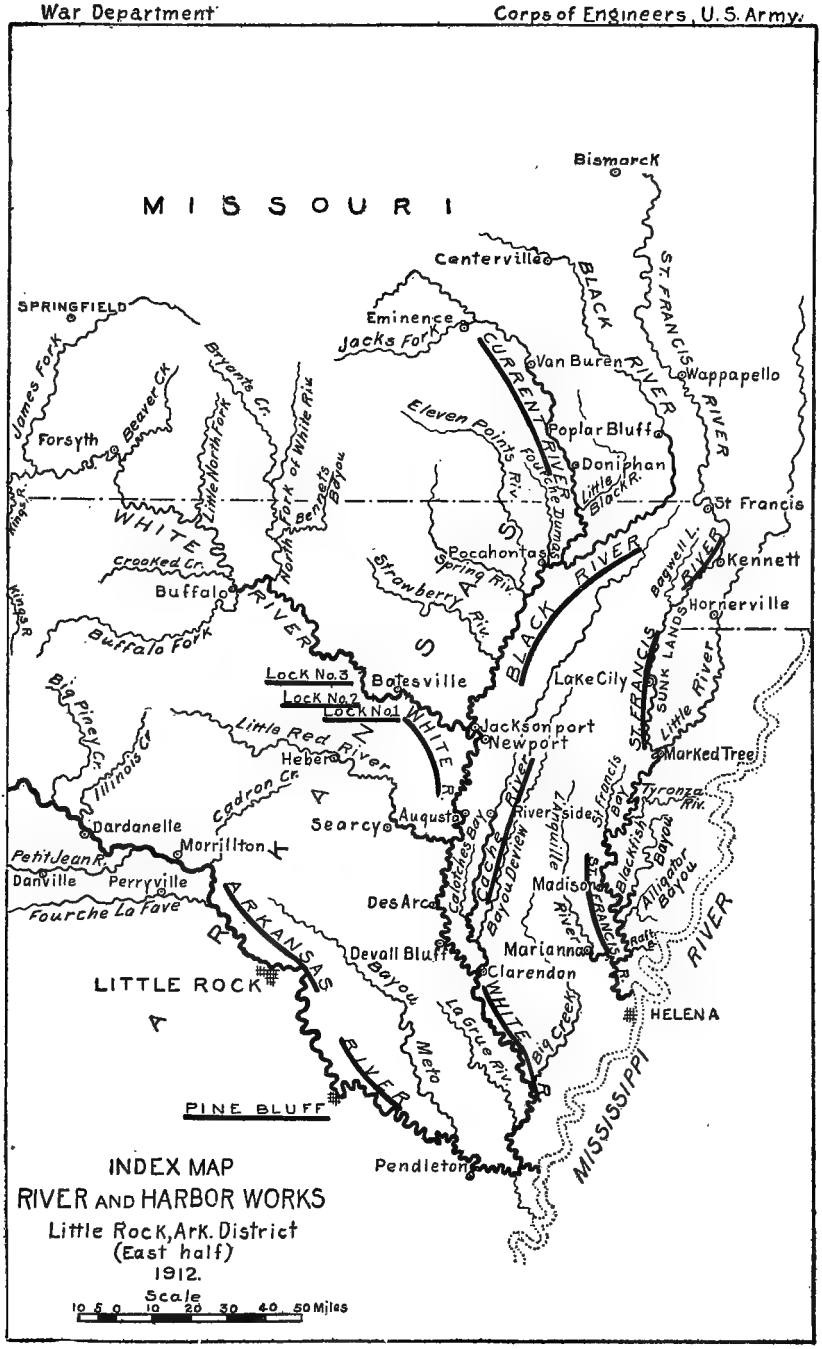
Ex. au. act Aug. 2, 1882; made, 1883, by Capt. Miller, **84,** 1366.
Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Willard (**R.** unfav. to slack-water imp.), **91,** 2022.

* Allotment.

RIVER AND HARBOR WORKS—LOWER MISSISSIPPI RIVER SYSTEM.

Y.—LITTLE ROCK, ARK., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
Little Arkansas
WICHITA
ARKANSAS RIVER
Verdigris River
Neosho River
KANSAS
MISSOURI
Little Verdigris Riv.
Arkansas City
Spring River
Salt Fork
Bird Creek
Elk River
WHITE R.
Kings R.
Cimarron River
TULSA
Neosho or Grand Riv.
Illinois River
GUTHRIE
Ft. Gibson
MUSKOGEE
OKLAHOMA CITY
North Canadian Riv.
ARKANSAS RIV.
Mulberry Cr.
Ozark
Van Buren
Ft. SMITH
Trusty Bend
Petit Jean R.
Canadian River
Poteau Riv.
Fourche La Fave
INDEX MAP
RIVER AND HARBOR WORKS
Little Rock, Ark. District
(West half)
1912.
Scale
10 5 0 10 20 30 40 50 Miles


War Department
Corps of Engineers, U. S. Army.
MISSOURI
Bismarck
Centerville
BLACK RIVER
ST. FRANCIS RIVER
SPRINGFIELD
Eminence
Jacks Fork
CURRENT RIVER
Van Buren
Wappapello
James Fork
Beaver Ck
Bryants Cr.
Forsyth
Little North Fork
North Fork of White Riv.
Eleven Points Riv.
Poplar Bluff
Doniphan
Little Black R.
Kings R.
WHITE RIVER
Bennets Bayou
St Francis
Pocahontas
Spring Riv.
Strawberry Riv.
Crooked Cr.
Buffalo
Kennett
Bagwell L.
Hornerville
Buffalo Fork
Lock No. 3
Lock No. 2
Lock No. 1
Batesville
Lake City
SUNK LANDS
Little River
Big Piney Cr.
Little Red River
Jacksonport
Newport
Marked Tree
Illinois Cr.
Heber
Cadron Cr.
Tyronza Riv.
Dardanelle
Searcy
Augusta
Riverside
St. Francis Bay
Blackfish Bayou
Petit Jean R.
Morrillton
Danville
Perryville
Fourche La Fave
Des Arc
Calotches Bay
Cache River
Bayou Deview
L'Anguille River
Madison
Alligator Bayou
Rafle
ARKANSAS RIVER
Devall Bluff
Marianna
Clarendon
LITTLE ROCK
Bayou Meto
La Grue Riv.
Big Creek
HELENA
PINE BLUFF
Pendleton
MISSISSIPPI RIVER
INDEX MAP
RIVER AND HARBOR WORKS
Little Rock, Ark. District
(East half)
1912.
Scale
10 5 0 10 20 30 40 50 Miles

Y.—LITTLE ROCK, ARK., DISTRICT.

In charge of U. S. Engineer Office,
Bankers' Trust Bldg., Little Rock, Ark.

This district is on the WEST side of the Mississippi River, and extends along its bank from below Arkansas to almost opposite Cairo, Ill.

Y 1 Mississippi R. (See HH, p. 1067.)
Y 2 Arkansas R., Ark., Okla., and Kans. (1)
Y 3 Bayou Meto, Ark. (2)
Y 4 Cadron Cr., Ark. (2)
Y 5 Illinois Cr., Ark. (2)
Y 6 Big Piney Cr., Ark. (2)
Y 7 Mulberry Cr., Ark. (2)
Y 8 Illinois R., Okla. and Ark. (2)
Y 9 Neosho (Grand) R., Okla. and Kans. (2)
Y 10 Elk R., Okla. and Mo. (9)
Y 11 Spring R., Okla., Kans., and Mo. (9)
Y 12 Verdigris R., Okla. and Kans. (2)
Y 13 Little Verdigris R., Okla. and Kans. (12)
Y 14 Bird Cr., Okla. (12)
Y 15 Little Arkansas R., Kans. (2)
Y 16 Salt Fork, Okla. (2)
Y 17 Cimarron R., Okla. (2)
Y 18 Canadian R., Okla. (2)
Y 19 North Fork, Okla. (18)
Y 20 Poteau R., Okla. and Ark. (2)
Y 21 Petit Jean R., Ark. (2)
Y 22 Fourche La Fave, Ark. (2)
List now leaves Arkansas R.; moves upstream of Miss. R. to—
Y 23 White R., Ark. and Mo. (1)
Y 24 Big Cr., Ark. (23)
Y 25 Cache R., Ark. (23)
Y 26 Bayou Deview, Ark. (25)
Y 27 Culotches B., Ark. (25)
Y 28 Black R., Ark. and Mo. (23)
Y 29 Current R., Ark. and Mo. (28)
Y 30 Little Black R., Ark. and Mo. (29)
Y 31 Jacks Fork, Mo. (29)
Y 32 Fourche Dumas, Ark. and Mo. (28)
Y 33 Spring R., Ark. and Mo. (28)
Y 34 Eleven Points R., Ark. and Mo. (33)
Y 35 Strawberry R., Ark. (28)
Y 36 North Fork, Ark. and Mo. (23)
Y 37 Bennets Bayou, Ark. and Mo. (36)
Y 38 Bryants Cr., Mo. (36)
Y 39 Little North Fork, Ark. and Mo. (23)
Y 40 Beaver Cr., Mo. (23)
Y 41 James Fork, Mo. (23)
Y 42 Kings R., Ark. and Mo. (23)
Y 43 Crooked Cr., Ark. (23)
Y 44 Buffalo Fork, Ark. (23)
Y 45 Little Red R., Ark. (23)
Y 46 La Grue R., Ark. (23)
List now leaves White R. (23); moves upstream of Miss. R. to—
Y 47 St. Francis R., Ark. (1)
Y 48 Raft Bayou, Ark. (47)
Y 49 Alligator Bayou, Ark. (47)
Y 50 Blackfish Bayou, Ark. (47)
Y 51 Tyronza R., Ark. (47)
Y 52 Little R., Ark. and Mo. (47)
Y 53 Bagwell Lake, Ark. (47)
Y 54 St. Francis B., Ark. (47)
Y 55 L'Anguille R., Ark. (47)

Y-2 ARKANSAS RIVER, ARK., OKLA., AND KANS.

Part.	Title.	Period.	Part.	Title.	Period.
a	Arkansas R., summary of commerce, phy. char., and project		g	Arkansas R., removing obstructions	1880–1901
b	Appropriations	1832–1912	h	Arkansas R., Pine Bluff	1880–1912
c	List of special points, mouth to headwaters		i	Arkansas R., Little Rock to mouth	1885–1887
d	Arkansas R	1877–1887	j	Arkansas R., Ft. Smith	1885–1887
e	do	1888–1900	k	Arkansas R., Crawford Co	1912
f	do	1901–1912			

Part (a), Y-2. General Data—Arkansas River, Ark., Okla., and Kans.

COMMERCE.

Traffic, 1900, 75,000± t.; 1905, 86,000± t.; 1911, 81,000 t., **12,** 785.

No apparent effect by R. on traffic rates. R. not taken into consideration by railway commission of contiguous State, in fixing rail rates, which fact applies also to *all rivers in Ark.*, **12,** 785.

PHYSICAL CHARACTERISTICS.

Rises in central Colorado and empties into Miss. R. at se. cor. of Arkansas. 1,460 m. l.—350 in Colo., 400 in Kans., 340 in Okla., and 370 in Ark. Orig. condition, obstruc. by shifting sand bars and numerous snags in the lower reaches, and by gravel and rock shoals, and snags in upper reaches. Navigation during l. w. impossible, **12,** 785.

PROJECT.

The general proj. covers navigable portion—from mouth to mouth of Neosho (Grand R.), 461 m., **12,** 785.

Part (b), Y-2 Arkansas River—Appropriations.[1]

GENERAL IMPROVEMENTS.

1832,	$14,962.00, **08,** 1590.	
1835,	40,000.00, **08,** 1590.	
1837,	25,000.00, **08,** 1590.	
1838,	38,884.34, **08,** 1590.	
1842–44,	80,000.00 (estimate), **08,** 1590.	
1852,	39,730.53, **08,** 1590.	
1866–78,	344,831.59, **77,** 80; **78,** 92; **08,** 1590.	
1886,	54,000.00, **87,** 1510.	
1888,	150,000.00, **88,** 1385.	
1890,	180,000.00, **90,** 1939.	
1892,	250,000.00, **92,** 1680.	
1904,	*501.41, **05,** 1567. *20,000.00, **04,** 2099.	
1905,	35,000.00, **05,** 1567.	
1907,	35,000.00, **07,** 1519.	
1909,	35,000.00, **09,** 1578.	
1912,	30,000.00, **12,** 2091.	
		$1,372,909.87

FORT SMITH, ARK.

1876,	[2]$10,000.00, **77,** 80.	
1878,	[3]10,000.00, **78,** 82.	
1884,	5,000.00, **85,** 1563.	
1886,	13,000.00, **87,** 205.	
		$38,000.00

FORT SMITH TO WICHITA, KANS.

1879,	$20,000.00, **79,** 125.	
1880,	15,000.00, **80,** 1467.	
1881,	24,000.00, **81,** 1510.	
1882,	20,000.00, **82,** 1169.	
		$79,000.00

OBSTRUCTION REMOVAL—SNAG BOAT.
(See also Gen. imp.)

[4]1879,	$30,000.00, **08,** 1590.	
[4]1880,	35,000.00, **08,** 1590.	
[4]1881,	25,000.00, **81,** 1501.	
[4]1882,	35,000.00, **82,** 1574.	
1884,	36,000.00, **84,** 228.	
1886,	19,875.00, **86,** 1373.	
1888,	25,000.00, **88,** 1380.	
1890,	20,000.00, **90,** 1931.	
1892,	20,000.00, **92,** 1675.	
1894,	20,000.00, **95,** 1998.	
1896,	20,000.00, **96,** 1651.	
1899,	20,000.00, **99,** 2032.	
		$305,875.00

PINE BLUFF, ARK. (See Gen. imp., Pine Bluff, etc.)

1880,	$25,000.00, **80,** 1467.	
1881,	23,000.00, **81,** 1503.	
1882,	20,000.00, **82,** 1576.	
1884,	55,500.00, **84,** 229.	
1886,	8,000.00, **86,** 1376.	
1907,	74,200.00, **12,** 1883.	
1908,	*17,957.00, **11,** 1883.	
1909,	97,200.00, **09,** 1584.	
1912,	*25,000.00, **12,** 2091.	
		$345,857.00

LITTLE ROCK TO MOUTH.

1884,	$19,000.00, **85,** 1603.	
		$19,000.00

GENERAL IMPROVEMENTS, OBSTRUCTIONS REMOVED—SNAG BOATS.

1894,	$250,000.00, **95,** 2011.	
1896,	100,000.00, **96,** 1666.	
1899,	100,000.00, **99,** 2034.	
1902,	110,000.00, **02,** 1574.	
		$560,000.00

RED FORK.

1900,	*$10,000.00, **01,** 2104.	
1905,	30,000.00, **05,** 1567.	
		$40,000.00

GENERAL IMPROVEMENTS, INCLUDING PINE BLUFF.

1910,	$51,000.00, **10,** 1731.	
		$51,000.00

DREDGE PLANT.

1910,	$375,000.00, **10,** 1733.	
		$375,000.00

GENERAL IMPROVEMENTS, PINE BLUFF—DREDGE PLANT.

1911,	$62,500.00, **11,** 1881.	
		$62,500.00

VICINITY OF CRAWFORD CO. LEVEE.

1912,	$30,000.00, **12,** 2093.	
		$30,000.00
	Grand total	[5] $3,279,141.87

* Allotment.

[1] The titles of app. and of parts under which history of imp. is gathered, do not agree because of the ever shifting restrictions of the app. acts. For the same reason, the classification of app. in the above table can not be made precise. The references given above constitute official au. for the interpretation of the classification.

[2], [3] See p. 1090.

[4] Probably included in Table 8, p. 1091.

[5] $114.57 (sales, etc.) addl. makes $3,279,256.44 given, **11,** 1883; **12,** 2091, 2093, 2094. See also footnotes 2, 3, 4.

Part (c), Y-2 Arkansas River—Special Points, Mouth to Headwaters.

Miss. R., Ark.
Red Fork, Ark.
Pine Bluff, Ark.
Little Rock, Ark.
Dardanelle, Ark.
Ozark, Ark.
Crawford Co., Ark.
Van Buren, Ark.
Ft. Smith, Ark.
Webbers Falls, Okla.
Grand (Neosho) R., Okla.
Ft. Gibson, Okla.
Tulsa, Okla.
Wichita, Kans.
Hutchinson, Kans.
Great Bend, Kans.
Hamburg, Kans.
Dodge City, Kans.

Part (d), Y-2 Arkansas River.

APPROPRIATIONS. [See part (b).]

COMMERCE.

Important, **78,** 658; **79,** 126.

DEFENSE.

Forts Gibson, Ind. T., and Smith, Ark., in vicinity, **77,** 501; **78,** 658; **79,** 1081, 1082.

ENGINEERS.

Chief of Engineers. R., 77, 80; **78,** 92, 93; **79,** 125, 126, 127; **80,** 168; **81,** 215; **82,** 213; **83,** 221; **84,** 229, 232; **85,** 245, 251; **86,** 244; **87,** 205, 1522.

Boards. Convened, New York, Mar., 1887, to consider imp. of Arkansas R. **R., 87,** 1523, 1527. (Cols. Casey and Abbot, Lt. Cols. Comstock and McFarland.)

In charge:
Maj. Charles R. Suter, 1877–78. **R., 77,** 501; **78,** 658; **79,** 1081, 1085; **80,** 1466; **81,** 1660.
Capt. T. H. Handbury, 1881–83. **R., 81,** 1508; **82,** 1576; **83,** 1168.
Maj. M. B. Adams, 1883–84. **R., 84,** 1397, 1399, 1405.
Capt. H. S. Taber, 1884–87. **R., 85,** 1561, 1611; **86,** 1391; **87,** 1510, 1519, 1520.

Assistants:
Capt. D. W. Wellman, **78,** 658. **R., 78,** 659.
J. H. Curtis, **78,** 658.
J. D. McKown, **79,** 1085. **R., 79,** 1086.

OBSTRUCTIONS.

Brs. not provided with draws, **79,** 1085.

OPERATIONS.

1877-78. 1,800′ of dike constr., incl. 100′ of shore protection, **78,** 660.
1878-79. Dike extended 400′, strengthened and repaired, **79,** 1081.
1879-80. Repair of dike at Fort Smith, **80,** 1467.
1880-81. Constr. snag boat, **81,** 1509.
1881-82. Operating snag boat bet. mouth of Grand R. and Fort Smith, **82,** 1577. Repairs to dike at Fort Smith, **82,** 1578.
1882-83. 1,047 snags and trees and 20 piles of drift removed bet. mouth of Grand R. and Fort Smith, **83,** 1169.
1883-84. 2,890 snags and trees and 2 drift piles removed, **84,** 1399.
1884-85. 1,399 snags and trees removed, **85,** 1562.
1886-87. Dike constr. at Dardanelle; commencement of operations below Little Rock under proj. of 1886, **87,** 1512, 1519.

PHYSICAL CHARACTERISTICS.

General description, **79,** 1086–1088.
Bar obstr. free access to city landing at Fort Smith, **77,** 501.
Change in R. due to constr. of dikes, **78,** 661.
Rocks and snags in chan., **79,** 1085–1087.
Erosion of R. bank in front of Fort Smith and bar formation at Van Buren, **84,** 1397.

PRIVATE (CORPORATE) WORK.

Constr. of 3 js. by the Oil & Compress Co. at Fort Smith, **84,** 1397.

PROJECTS.

By Maj. Suter, for imp. of R. at Fort Smith, with dike of brush and st., extending 1,100′ out from l. bank, and from its outer end, a longitudinal dike, 600′ l., extending downstream; thus to force main chan. toward r. bank, so, by dr. the crossing over the bar, to render the city landings accessible, **78,** 658. To w., raise, and strengthen dam at Fort Smith, to give a uniform h. of 8′ above m. l. w., **78.** 658; success of this proj., **79,** 1082. Removal of rocks, snags, and other obstr. from R. generally, at est., orig., of $900,000, subsequently reduced to $100,000, **79,** 1081, 1086, 1088; **81,** 215.
By Capt. Taber, 1885, permanent imp. of R., Little Rock to its mouth, contemplating chan. at least 6′ x 200′ l. w., by contraction and regulation of chan.; est., $2,538,544, **85,** 1602; **87,** 1525.

SURVEYS.

By Maj. Suter, 1877, **78,** 659.
By J. D. McKown, 1878, ex. of Arkansas R. from Fort Smith, Ark., to mouth of Little Arkansas R. at Wichita, Kans. **R., 79,** 1085, 1086.
Sur. from Wichita, Kans, to Fort Gibson, Ind. T., 1884, **84,** 232; **85,** 1611; **86,** 1391.
Maps. Plans for brush dike, **78,** 658. Map of Arkansas R. at points of imp., **78,** 660.

Part (e), Y-2 Arkansas River.

APPROPRIATIONS. [See part (b).]

COMMERCE.

Prospective advantages to C. to result from completed imp., **88,** 1384, 1388; **90,** 1937; **91,** 2041.
Description of, **94,** 1538; **95,** 2010; **96,** 1665.
Probable increase in future importance of, **93,** 2107; **94,** 1539.
R. has but small influence on rates, **96,** 1665.
C., 1900, 75,654 t., valued at $2,078,940, **00,** 417.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies, $10,067.02. Dickinson Hardware Co., ship supplies, $4,208. Z. Ward, jr., brush, poles, and piles, $3,661.50; st., $9,085, **95,** 2003, 2011.

1896. H. J. George Grocer Co., subsistence supplies, $3,696.51, **97,** 1969.

1899. M. A. Sweeney Shipyard & Foundry Co., steel snag boat, $32,899; steel hull, $18,549. B. B. Rogers, st., $1 c. y. ($9,285). T. Lafferty, 9,285 c. y. st., 59¢ c. y., **00,** 2583.

ENGINEERS.

Chief of Engineers. **R.,** **88,** 186; **89,** 219; **90,** 197; **91,** 250; **92,** 241; **93,** 272; **94,** 252; **95,** 281; **96,** 244; **97,** 311, 316; **98,** 302, 308; **99,** 363; **00,** 416.

Boards:

Convened, New York, Mar. 16, 1888, to **R.** upon imp. of R., Wichita, Kans., to mouth. **R.,** **88,** 1389. (Cols. Casey and Abbot, Lt. Cols. Comstock and Houston, and Maj. King.)

Constituted, S. O. No. 13, Mar. 11, 1899, to ex. and **R.** upon proj. for work on Arkansas R.; ex. in progress, **00,** 2581.

In charge:

Capt. H. S. Taber, 1884–93. **R.,** **88,** 1380, 1386; **89,** 1647; **90,** 1932; **91,** 2037; **92,** 1676; **93,** 2103.

Capt. C. F. Palfrey, 1894, **94,** 1531.

Lt. Wm. L. Sibert, 1895–98. **R.,** **95,** 1998; (Capt.) **96,** 1652; **97,** 1952, 1989, 1990; **98,** 1649, 1676.

Lt. Robert McGregor, 1899–. **R.,** **99,** 2033; (Capt.) **00,** 2581.

Assistant:

P. R. Van Frank, jr. **R.,** **94,** 1540 (steamboating on the R. before the days of railroads), **00,** 2585.

OPERATIONS.

1887-88. 2,594 l. f. of dike built bet. Little Rock and mouth, **88,** 1383.

1888-89. Dike constr. and repairs to existing dike at Pine Bluff; 2,000 l. f. of dike built at Dardanelle; spur dike built at Van Buren; dike constr. at Baring Cross Br., and at and below Little Rock, **89,** 1649.

1889-90. Dike constr. and repair at Pine Bluff; 1,500 l. f. of dike built above Fort Smith; 300 l. f. of dike built near Wilsons Rocks; constr. of 3 dikes begun below Pine Bluff; 2 quarterboats and 10 barges built, **90,** 1932.

1890-91. 800 l. f. of dike built above Fort Smith and 2 dikes partly completed; 260 c. y. r. removed at Morris Rocks; 3,257 l. f. of dike built below Pine Bluff; 10 barges built, and repairs made to plant, **91,** 2040.

1891-92. 800 l. f. st. and brush dike completed above Fort Smith; 926 c. y. r. excavated at Morris Rocks; 8,376 c. y. r. quarried at Big Rock stone quarry; 300 l. f. dike built at Pine Bluff; 1 m. of brush mattress, 125 to 150′ w., laid and riprapped below Pine Bluff; repair and constr. of plant, **92,** 1678.

1892-93. Over 15 old dikes solidified, and new ones built; nearly 15,000 c. y. r. quarried and used in the foregoing work; banks revetted; 20 barges built, and plant repaired, **93,** 2105.

1893-94. Solidifying of permeable dikes and other such structures continued; several new dikes built; nearly 7,000 c. y. st. quarried and used in foregoing work and in revet. of banks; pile-driving barge built and plant repaired, **94,** 1534.

1894-95. Small quantity of obstr. removed, and several dikes, training wall, dam, etc., built; nearly 8,000 l. f. revet. built; plant repaired, **95,** 2001.

1895-96. Over 400 snags removed; several dikes, training wall, etc., built; nearly 10,000 l. f. revet. constr.; existing works repaired; additions made to plant and plant repaired, **96,** 1655.

1896-97. Over 19,000 snags and other obstr. removed; work carried on for constr. of nearly 20 dikes, dams, training walls, etc.; repairs of several structures made; large amount dr. done; banks protected; plant repaired and additions made, **97,** 1953.

1897-98. Obstr. removed; 8 secondary chans. closed, 3 wing dams built; revet. constr. at several points, and repairs to such work made at other places; a few l.-w. chutes closed; plant repaired, **98,** 1648.

1898-99. Boats repaired, and 217 snags removed from chan., **99,** 2033.

1899-00. Boats repaired, 5 dikes, and Greathouse and Reed Bends repaired, **00,** 2585.

PHYSICAL CHARACTERISTICS.

Description of, **94,** 1537; **95,** 2009; **96,** 1664; **97,** 1953; **98,** 1656.

The bed and banks to a great extent composed of sandy loam, eroding easily; as a result the chan. continually changing, caving banks wearing away, and opposite-point bars building out, **95,** 2009.

Gauge readings (from 1872–97), **95,** 2010; **96,** 1664; **98,** 1662.

In 1897 the filling up of H. and caving of banks at Van Buren, and caving of banks in vicinity of Little Rock and Dardanelle appeared to be caused by natural agencies and not by works of imp. (see Surveys and Projects), **97,** 1989; **98,** 1676.

Description of, in vicinity of Dardanelle, **98,** 1677.

Discharge, **98,** 1656, 1664; **00,** 2587.

Chan. d. of crossings above Little Rock; comparison of, with unimpr. portions of the R., **98,** 1657.

Effects of flood on Trial Reach, just above Little Rock, **98,** 1658.

Flood of May, 1898, damaged constr. works, **00,** 417.

PLANS.

By BE. 1888, for imp. of R., Canadian R. to mouth, 424 m., giving navigable d. of 4′ m. l. w. by contraction work, shore protection, and removal of obstr.; est., $16,360,000, **88,** 1400.

PRIVATE WORK.

In 1897, 7,110 l. f. bank protection, etc., built by the St. Louis Southwestern RR. Co.; cost, $30,477.19, the plant of the U. S. being loaned for work, **97,** 1958; **98,** 1652.

PROJECTS. (See Plans.)

In 1878 Maj. Suter proposed brush-and-st. dike at Fort Smith, 1,100′ l., extending from left bank near mouth of Poteau R.; completed, 1879; cost, $19,695, **78,** 658; **79,** 1082; **85,** 1563.

1879 Maj. Suter proposed removal of snags, r., and other obstr. bet. Fort Smith and Wichita, Kans., est., $100,000, **79,** 1081, 1088; **81,** 215.

1884 Maj. Adams proposed repairing a few small dikes built by private enterprise, **84,** 1397; **85,** 1563.

By Capt. Taber, 1885, for permanent imp. of R., Little Rock to mouth, contemplating chan. at least 6′ x 200′ l. w., by contraction and regulation; est., $2,538,544, **85,** 1603; **87,** 1524.

In the general imp. of R. as proposed, 1885, special works of protection and contraction provided at Pine Bluff, Fort Smith, and Dardanelle, **88,** 1380, 1381.

In 1889 amount required for completion increased from $2,344,544 to $3,651,479, **89,** 1651; **92,** 1679.

Act 1892 provided for expend. two-fifths of the app. of 1892 on the R. from mouth to Little Rock, two-fifths thence to Fort Smith, and one-fifth above the latter point; applied to solidifying permeable dikes, etc. (see Operations), **93,** 2105.

From Aug. 29, 1896, est. for completing imp. not determinable, **97,** 1952.

Results of works for permanent imp. apparently fav., **93,** 2106, 2107; **97,** 1967.

In 1897 (see Surveys) reported that dikes and bank protection at Pine Bluff did not injure the R. banks or H., but had preserved the city from destruction, **97,** 1991.

Cost of works, 1894 to 1898, **98,** 1656.

Approv. proj., 1888, to remove r. and gravel reefs by blasting and dr., to contract chan. by dikes or dams, permeable or solid, of such constr. as the local conditions require, and to hold the chan. so obtained by revet. where necessary; proj. to include R. from Wichita, Kans., to mouth, 771 m.; cost, indefinite, **00,** 416.

SURVEYS.

Minor surs., **93,** 2106; **94,** 1535; **98,** 1649; **99,** 2033.

Surs. of R. at Little Rock, Van Buren, Fort Smith, Pine Bluff, and at Dardanelle au. act June 3, 1896, to ascertain what injuries had been caused by U. S. works of imp. in vicinity of the places named, and what steps should be taken to guard against or remedy such injuries. **R.** by Capt. Sibert in 1897, **97,** 1989–1991; **98,** 1676.

Maps. **90,** 1934; **92,** Atlas, 83, 84, 85; **95,** 2012; **00,** 2584.

Part (f), Y-2 Arkansas River.

APPROPRIATIONS. [See part (b).]

COMMERCE.

Description of, and relation and value of imp. to, **01,** 2149.

SS. line extended to Little Rock, **04,** 400.

No effect on f. rates; rail rates controlled by State commission, **10,** 602.

Details, **11,** 648; **12,** 785.

CONTRACTS.

1900. Ed. J. Howard, repairing snag boat, $17,762.92, **01,** 2105.

1902. Hunter & Frey, repairs to Red Fork revet.—st., $5.75 c. y.; brush, $10.50 cord, **03,** 1417.

1912. Dubuque Boat & Boiler Works, constr. 2 steel hull pump drs., $295,514, **12,** 2092.

ENGINEERS.

Chief of Engineers. R., 01, 426, 2128; **02,** 354; **03,** 376; **04,** 398; **05,** 412; **06,** 447; **07,** 473; **08,** 504; **09,** 532, 548; **10,** 599, 602, 617; **11,** 645; **12,** 781.

Boards:

Convened at Rock, Little Ark., by S. O. No. 13. A. G. O. (Lt. Col. Stickney, Capt. Sibert, and Lt McGregor; later Capt. Newcomer substituted for Capt. Sibert, and Capt. Potter for Capt. Newcomer) to ex. and **R.** upon Arkansas R. with view to permanent imp. (see Projects and Surveys), **01,** 2102, 2128.

Appointed act 1907 to consider plan for imp., **07,** 474.

Const. by S. O. 12, O. C. E. Apr. 27, 1911. Met St. Louis, May 23–24, 1911, to consider details of dr. operations, **11,** 1879.

In charge:

Capt. G. D. Fitch, 1901–06. **R., 01,** 2098; **02,** 1571; **03,** 1407; (Maj.) **04,** 2095; **05,** 1563; **06,** 1384.

Capt. W. D. Connor, 1907–08. **R., 07,** 1515; **08,** 1587.

Maj. M. L. Walker, 1909–10. **R., 09,** 1573; **10,** 1727, 1733.

Maj. Clarke S. Smith, 1911–. **R., 11,** 1877; **12,** 2089.

OBSTRUCTIONS.

R. bet. Wichita and Grand R. crossed by 19 fixed brs. and by 2 fixed dams, **01,** 2129.

Complaints made that ry. brs. at Fort Smith, Holtz Rock, and above Frozen Rock unreasonable obstr.; investigations, public hearings, and reports, **08,** 1588, 1589.

OPERATIONS.

1900-01. Red Fork revet. repaired; plant repaired, **01,** 2099 (statement showing, in detail, nature, locality, cost, "present" condition, etc., of former works), **01,** 2151.

1901-02. Repairs to snag boat, **02,** 1571.

1902-03. Over 14,000 snags removed, trees cut, etc.; snag boats repaired; Red Fork revet. repaired; warehouse at Little Rock torn down and removed, **03,** 1408, 1410.

1903-04. Repairs to Red Fork revet. completed; over 6,000 snags, trees, etc., removed, **04,** 2096.

1904-05. Over 20,000 snags, trees, etc., removed; snag boats repaired; cut-off made at Pawpaw Landing and one at Spellmans Pt., **05,** 1564.

1905-06. Over 29,000 snags, trees, etc., removed, **06,** 1384.

1906-07. About 8,800 snags, trees, etc., removed; dr. cuts through 5 bars, **07,** 1516.

1907-08. Over 10,300 snags, trees, etc., removed; dr. cuts through 2 shoals for 3,950′, **08,** 1588, 1589.

1908-09. Over 25,000 snags, trees, etc., removed; dr. cuts through 3 shoals for 8,525′, **09,** 1574.

1909-10. 2,118 snags removed, 24,369 trees cut, and 5 drifts broken up; reconstr. of RR. br. at Rob Roy begun, **10,** 1729.

1910-11. Repairs made to snag boat *C. B. Reese;* 2,668 snags and 14,418 trees removed; for work of mainten. at Pine Bluff, 12,540′ levee raised, **11,** 1877, 1879.

1911-12. 1,500 snags and 14,459 trees removed, **12,** 2089.

PHYSICAL CHARACTERISTICS.

Details. **R.** by BE., **01,** 2132.

Flow and discharge measurements at different localities, **01,** 2133–2144; **02,** 1572; **10,** 1729.

Flood heights compared with 1892 and 1898, **04,** 2096.

5 cut offs made in 5 years, **09,** 1577.

Details of, **10,** 601; **11,** 6451; **12,** 784.

Remarks on l. w., **11,** 1879.

Floods damage revet. at Pine Bluff, **12,** 2090.

Ft. Gibson, on Neosho (Grand) R. (463 m. above mouth of A. R.) head of "navigation," 1912. Some seasons "navigation" impossible; sometimes possible to maintain 3′ to Ft. Gibson all year, **12,** 784.

PRIVATE WORK.

St. Louis Southern Ry. Co., constr. brush structures along R. bank, **08,** 1589.

1,960′ revet. built in Cummins Bend by combined local, State, and RR. interests; 1 m. bank at Keattes Bend protected by private interests, **10,** 1730.

PROJECTS.

BE. reported, 1900—1st section, source to Grand R., 1,000 m., not worthy of immediate imp.; 2d section, Grand R. to Little Rock, 287 m., to secure open R. chan. 300′ w. and d. varying from 2′ to 2½′ at Grand R. to 4½′ or 5′ at Little Rock and Dardanelle, $15,280,925, or d. of 6′ by locks and dams, $26,677,200; and 3d section, Little Rock to mouth, 173 m., open R. chan., 5′ to 7′ d., $9,982,475;[1] grand total, $25,263,400; for open river imp., mouth to Ft. Gibson, in addition, a snag boat, (est. $75,000 with $25,000 an. for operation;) **01,** 2102, 2129, 2145, 2148.

Act June 13, 1902, merged the prior general projs. into one, to embrace imp. of A. R., mouth to head of navigation, by snagging, dr., and by contraction works, holding the imp. chan. by revet. where necessary; no definite est. given, **02,** 354, 1571; **12,** 783.

Plan by BE. for imp., mouth to Little Rock; est., $300,000 for plant, $100,000 an. for mainten.,[2] **09,** 548.

By Maj. Walker, 3 plans and est. for imp. Little Rock to Ozark; BERH asserted that cost of any one of the plans would be greater than U. S. would be justified in incurring and recom. dr. with 2 U. S dr., the work above Little Rock to be extension

[1] H. D. 150, 56th, 2d.

[2] H. D. 71, 61st, 1st.

of that recom. below by the BE **R.** in H. Doc. 71, 61st, 1st; est., plant, $349,000; $118,700 an. for operating;[1] au. act June 25, 1910, **10,** 617; **12,** 783.

Necessity of securing U. S. plant for revet. work if such works are to be maintained; est., $55,000, **10,** 1730.

Act June 25, 1910, au. mainten. at Pine Bluff, **12,** 783.

SURVEYS.

Ex. au. act Mar. 3, 1899; BE. **R.** (q. v.), **01,** 2128.

Ex. up to Muskogee and at Pine Bluff by BE., au. act Mar. 2, 1907,[2] **07,** 474; **09,** 548.

Ex., Douglass, au. act Mar. 3, 1909; made, 1909; Maj. Walker's **R.** unfav.,[3] **09,** 548.

Ex., Fort Smith, Ark., to Tulsa, Okla., au. act Mar. 3, 1909; Maj. Walker's[4] **R.** unfav. save to occasional snagging bet. Ft. Smith and mouth of Neosho (Grand) R. **10,** 617.

Ex., Little Rock to Ozark, Ark., au. act Mar. 3, 1909, with view to imp. by locks and dams; made, 1909; Maj. Walker's[1] **R.** fav. to revetments supple. by 2 U. S. dr., but BE recom. trial imp. by 2 U. S. dr. alone **10,** 617.

Maps.[1] Plans of dikes, **02,** 1576.
Little Rock district, **11,** 1877.
Arkansas R., **11,** 1878.
C. and app. chart, **11,** 1882.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 783.

Part (g), Y-2 Arkansas River—Removing Obstructions,[5]

APPROPRIATIONS. [See part (b).]

COMMERCE.

Important, **84,** 1391; **86,** 1374, 1390; **87,** 1508.

Prospective advantages from completion of imp., **88,** 1379; **89,** 1646; **91,** 2036.

Much benefited by works of imp., **94,** 1530.

CONTRACTS.

1895. J. E. Joyce & Co., subsistence supplies for snagging party, $2,142.91; Dickinson Hardware Co., boat supplies, $2,560, **95,** 1998.

1900. Ed. J. Howard, repairs to snag boat, $17,762.92, **01,** 2098.

ENGINEERS.

Chief of Engineers. R., 80, 162; **81,** 213; **82,** 211; **83,** 219; **84,** 227; **85,** 244; **86,** 238; **87,** 204; **88,** 185; **89,** 218; **90,** 196; **91,** 249; **92,** 241; **93,** 272; **94,** 251; **95,** 280; **96,** 244; **97,** 310; **98,** 302; **99,** 362; **00,** 415; **01,** 425.

In charge:

Maj. C. B. Suter, 1880–81. **R., 80,** 1401.

Capt. T. H. Handbury, 1881–83. **R., 81,** 1499; **82,** 1571; **83,** 1165.

Maj. M. B. Adams, 1883–84. **R., 84,** 1390.

Capt. H. S. Taber, 1884–93. **R., 85,** 1558; **86,** 1371; **87,** 1506; **88,** 1378; **89,** 1643; **90,** 1928; **91,** 2033; **92,** 1673; **93,** 2102.

Capt. C. F. Palfrey, 1894. **R., 94,** 1529.

Lt. Wm. L. Sibert, 1895–98. **R., 95,** 1995; (Capt.) **96,** 1649; **97,** 1949; **98,** 1647.

Lt. Robert McGregor, 1899–1900. **R., 99,** 2031; (Capt.) **00,** 2577.

Capt. G. D. Fitch, 1901–. **01,** 2095.

Assistant. P. R. Van Frank, jr. **R., 00,** 2579.

OPERATIONS.

1879–80. 34 m. of R. bet. mouth and Trustee Bend worked over; 1,238 snags and trees and 19 drift piles removed, **80,** 1403.

1880–81. 2,377 snags and trees and 44 drift piles removed bet. mouth and Webbers Falls, **81,** 1500.

1881–82. 4,436 snags and trees and 18 drift piles removed bet. mouth and Fort Smith, **82,** 1572.

1882–83. 1,287 snags and 12 drift piles removed bet. mouth and Fort Smith, **83,** 1166.

1883–84. 654 snags and 9 drift piles removed, **84,** 1390.

1884–85. 15,178 snags and trees and 19 drift piles removed bet. mouth and Fort Gibson, **85,** 1559.

1885–86. Repair of snag boat *Wichita*, **86,** 1372.

1886–87. 1,385 snags removed, **87,** 1508.

1888–89. Reconstr. of snag boat *Wichita*, **89,** 1644.

1889–90. 552 snags and 231 overhanging trees removed, **90,** 1929.

1890–91. 300 snags removed from chan., 2,000 trees cut, and 13,000 trees deadened upon banks, **91,** 2034.

1891–92. 787 snags removed, 544 overhanging trees cut away, and 4 drift piles destroyed, **92,** 1674.

1892–93. Snag boat under constr., and about 1,500 snags and other obstr. removed, **93,** 2102.

1893–94. Over 1,600 snags, etc., removed, **94,** 1530.

1894–95. Over 3,500 snags, etc., removed, **95,** 1997.

1895–96. Over 1,500 snags, etc., removed, **96,** 1650.

1896–97. About 200 snags, etc., removed, **97,** 1950.

1897–98. Nearly 15,000 snags, etc., removed, **98,** 1648.

1898–99. 134 snags and other obstr. removed from chan., **99,** 2031.

1899–00. About 7,400 snags and other obstr. removed from chan., **00,** 2580.

1900–01. About 800 snags, etc., removed; repairs to snag boat, **01,** 2096.

PHYSICAL CHARACTERISTICS.

Condition of the stream steadily imp., **94,** 1530.

Chan. not fixed, and erosion general; accumulation of obstr. rapid, **01,** 2097.

SURVEYS.

Little Rock to mouth, **85,** 1601.

Part (h), Y-2 Arkansas River, Pine Bluff.

APPROPRIATIONS. [See part (b).]

CONTRACTS.

1908. Lowrance Bros. & Leonard, constr. levee, 18.23¢ c. y.; clearing land, $75 acre, **08,** 1597.

R. L. Leonard, constr. levee, 24¢ c. y., **09,** 1583.

1909. C. E. Philpot, brush, $2 cord; poles, at 6¢ each, **09,** 1584.

ENGINEERS.

Chief of Engineers. R., 80, 168, 169; **81,** 214; **82,** 212; **83,** 220; **84,** 229, 1394; **85,** 245; **86,** 238; **87,** 205; **08,** 510, 519; **09,** 538, 539; **10,** 603, 604; **11,** 650, 651; **12,** 787.

Boards:

To ascertain what work should be done at Pine Bluff, **07,** 474; **08,** 510, 519, 1595.

[1] H. D. 510, 61st, 2d.
[2] H. D. 71, 61st, 1st.
[3] H. D. 69, 61st, 1st.
[4] H. D. 206, 61st, 2d.
[5] After 1901 incl. in Part (f).

In charge:
Maj. C. R. Suter, 1879–81. **R., 80,** 1467, 1468.
Capt. T. H. Handbury, 1881–83. **R., 81,** 1502; **82,** 1575; **83,** 1168.
Maj. M. B. Adams, 1883–84. **R., 84,** 1393, 1395.
Capt. H. S. Taber, 1884. **R., 85,** 1564, 1576; **86,** 1375; **87,** 1511, 1515, 1518.
Capt. Wm. D. Connor, 1908. **R., 08,** 1595.
Maj. M. L. Walker, 1909–10. **R., 09,** 1581, 1583; **10,** 1734.
Maj. C. S. Smith, 1911. **R., 11,** 1883; **12,** 2093.

Assistants:
Capt. T. H. Handbury. **R., 80,** 1468.
W. H. Byram. **R., 81,** 1504.
E. F. Officer. **R., 85,** 1571.
S. P. Adams. **R., 85,** 1580.

LEGAL PROCEEDINGS.

Right of way for levee at Pine Bluff to be donated to U. S., **08,** 1596.

OPERATIONS.

1880–81. 7,600 l. f. of bank revetted in front of city and at Yells Bend; 1,110 l. f. of wire curtain dike placed in chan. 2½ m. above city, **81,** 1502.
1881–82. 3,000 l. f. of bank revetted at Yells Bend, **82,** 1576.
1882–83. 3,000 l. f. of bank regraded, 2,400′ of l. w. and 1,000′ of h. w. protection placed, **83,** 1168.
1884–85. Constr. of 2 deflecting dikes, **85,** 1567. Dikes described, **85,** 1571, 1581.
1885–86. Constr. of 2 short deflecting hurdle dikes in front of Pine Bluff City, **86,** 1375.
1886–87. Extension of Dike No. 1, **87,** 1516. Successful results, **87,** 1517.
1908–09. Levee at Vaugine Neck completed; emergency bank protection at Pine Bluff; 3,100 l. f. mattress placed and 1,800′ bank paved, **09,** 1582. 1,000 l. f. mattress built and 250 l. f. bank paved at Pine Bluff, **09,** 1584.
1909–10. 3,977 l. f. mattress built, 1,901′ being reinforced with second mattress; private work reinforced with 921′ mattress; 9,360′ bank graded and paved above 6′ stage; and repairs made, at Pine Bluff, **10,** 1734.
1910–11. Mattress work of revet. along town front finished and paving completed above 6′ stage, at Pine Bluff, **11,** 1883. 658 c. y. st. placed in bare spots on mattresses, at Pine Bluff, **11,** 1884.
1911–12. Repairs to mattresses, **12,** 2093.

PHYSICAL CHARACTERISTICS.

Danger from cut-off at Pine Bluff, **80,** 1469. Erosion of bank in vicinity of, **80,** 1469; **84,** 1395; **85,** 1565. Formation of R. banks, **84,** 1395. Effect of freshet in 1884, **85,** 1565, 1567.

PLANS.

By Maj. Adams, 1884, after failure of previous proj., to protect Pine Bluff City by (1) formation of cut-off 3 m. from city; est., $37,732; (2) by mattress protection, est., $45,000; (3) by pile js. 1,500′; est., $55,000, **84,** 1396.

PRIVATE WORK.

Citizens of Pine Bluff and Jefferson Co. court built part of revet. in front of city, **09,** 538, 1582–8.

PROJECTS.

By Maj. Suter, 1880, imp. of R. in vicinity of Pine Bluff, by protection of R. bank from erosion, rectification of R. just above, and prevention of cut-off across peninsula opposite Pine Bluff; est., $100,000, **80,** 1468, 1470. Failure of proj., **84,** 1395; **85,** 1565; **87,** 1515.

By Capt. Taber, 1884, to protect threatened destruction of the city front by 2 deflecting dikes of piles, brush, and sand boxes; upper dike 1,520′ and lower dike 251′ l.; est., $49,000, **85,** 1567, 1571, 1581.

Submitted Aug. 14, 1907, for constr. of levee along Vaugine Neck opposite Pine Bluff; est., $50,000, **08,** 510, 1595.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 127; **80,** 169; made by Maj. Suter, 1879, **80,** 1468.
Ex. au. act Mar. 2, 1907; **R.,** BE., Aug. 14, 1907, **08,** 510, 1595.
Maps. **81,** 1504; **85,** 1570; **09,** 1584; **11,** 1883; **12,** 2094.

Part (i), Y-2 Arkansas River, Little Rock to Mouth.

APPROPRIATION. [See part (b).]

ENGINEERS.

Chief of Engineers. **R., 85,** 251; **86,** 244; **87,** 206.

In charge. Capt. H. S. Taber, 1884–87. **R., 85,** 1601; **86,** 1389; **87,** 1528.

Assistant. C. E. Taft. **R., 85,** 1604.

PHYSICAL CHARACTERISTICS.

Described, **85,** 1605.

PLANS.

By Capt. Taber, 1885, chan. 6′ x 200′ at l. w., Little Rock to mouth, by contraction of chan., with primary and secondary hurdles; est., $2,538,544 (see Projects, Arkansas River, Ark.), **85,** 1602.

SURVEYS.

Little Rock to mouth, **85,** 1601; **86,** 1389; **87,** 1528.

Part (j), Y-2 Arkansas River, Fort Smith, Ark.

APPROPRIATIONS. [See part (b).]

ENGINEERS.

Chief of Engineers. **R., 85,** 245; **87,** 205.

In charge:
Maj. M. B. Adams, 1884. **R., 84,** 1397.
Capt. H. S. Taber, 1884–87. **R., 85,** 1563; **87,** 1511, 1518.

Assistant. F. D. Lewis, **85,** 1564.

OPERATIONS.

History of previous operations, **85,** 1563.
1884–85. Extension of j. previously built by private enterprise, **85,** 1564.
1886–87. 1,300 l. f. of permeable dike completed, **87,** 1511.

PHYSICAL CHARACTERISTICS.

Erosion of R. bank at Fort Smith, **84,** 1397.

PRIVATE WORK. (See Operations; Projects.)

PROJECTS.

In 1878 Maj. Suter, brush and st. dike at Fort Smith, 1,100′ l., extending from left bank, and near mouth of Poteau R.; completed in 1879, at cost of $19,695, **78,** 658; **79,** 1082; **85,** 1563.

In 1884 Maj. Adams proposed repairing few small dikes built by private enterprise, **84,** 1397; **85,** 1563.

Part (k), Y-2 Arkansas River, Ark., Front of Crawford County Levee.

APPROPRIATIONS. [See part (b).]

ENGINEERS.

Chief of Engineers. **R.,** **12,** 786.

In charge. Maj. C. S. Smith, 1912–. **R.,** **12,** 2093.

PHYSICAL CHARACTERISTICS.

Details of, 14 m. below Van Buren, Ark., **12,** 787.

PROJECTS.

Act June 25, 1912, au. protecting n. bank in front of Crawford Co. Levee; est. of minimum work needed, 2 m. of revet., at $50,000 m., **12,** 786.

Y-3 METRE BAYOU (Meto), ARK.

COMMERCE.

Unimportant, **84,** 1408.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 232.

In charge. Capt. T. H. Handbury. **R.,** **84,** 1408.

PHYSICAL CHARACTERISTICS.

Details, **84,** 1408.

Rises in Pulaski Co., Ark., and flows into Arkansas R. about 20 m. above old Arkansas Post, **84,** 1408.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Handbury (**R.** unfav.), **84,** 1408.

Y-9 NEOSHO RIVER, KANS.

COMMERCE.

Unimportant, **97,** 1985.

ENGINEERS.

Chief of Engineers. **R.,** **97,** 316.

In charge. Capt. Wm. L. Sibert, 1897. **R.,** **97,** 1984.

Assistant. J. R. Van Frank. **R.,** **97,** 1986.

OBSTRUCTIONS.

3 milldams and 19 RR. and county brs. along this reach of R. that would obstruct navigation were it otherwise practicable, **97,** 1985.

PHYSICAL CHARACTERISTICS.

Description of; l.-w. discharge, **97,** 1985.

SURVEYS.

Ex. from line of Neosho Co. to the s. line of Labette Co., for straightening and otherwise imp. chan., au. act June 3, 1896; made by Capt. Sibert, 1896 (**R.** unfav.), **97,** 1984.

Y-12 VERDIGRIS RIVER, OKLA. AND ARK.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 617.

In charge. Maj. M. L. Walker, **10,** 599.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Walker, May 6, 1909[1] (unfav.), **10,** 617.

Y-18 NORTH CANADIAN RIVER, OKLA.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 617.

In charge. Maj. M. L. Walker, **10,** 599.

SURVEY.

Pre. ex. au. act Mar. 3, 1909, with view to diversion of portion of waters into Cimarron R., for imp. navigation of the latter R. **R.** by Maj. Walker, May 4, 1909[2] (unfav.), **10,** 617.

Y-21 PETIT JEAN RIVER, ARK.

APPROPRIATIONS.

1886,	$3,500,	**87,** 1530.
1888,	2,500,	**88,** 1401.
1892,	3,500,	**92,** 1683.
Total,	9,500	

COMMERCE.

Important, **71,** 353, 354.

Navigation dependent on backwater of the Arkansas R., **71,** 354.

Prospective increase to result from imp., **88,** 1401.

Probable reduction in rates consequent upon imp., **91,** 2047.

Small, **94,** 1546.

ENGINEERS.

Chief of Engineers. **R.,** **70,** 31, 66; **71,** 59; **85,** 252; **87,** 206; **88,** 187; **89,** 220; **90,** 198; **91,** 252; **92,** 243; **93,** 275; **94,** 253; **95,** 282; **96,** 245.

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[1] H. D. 343, 61st, 2d.

[2] H. D. 357, 61st, 2d.

In charge:
Lt. Col. W. F. Raynolds. **R., 71,** 350.
Capt. H. S. Taber, 1885–93. **R., 85,** 1627; **87,** 1529; **88,** 1400; **89,** 1652; **90,** 1939; **91,** 2046; **92,** 1682; **93,** 2110.
Capt. C. F. Palfrey, 1894. **R., 94,** 1546.
Lt. Wm. L. Sibert, 1895. **R., 95,** 2015.

Assistants:
J. Straszer. **R., 71,** 351.
M. A. Orlapp. **R., 85,** 1628.

OBSTRUCTIONS.

Br. at Rocky Crossing an absolute bar to SS. navigation, Danville to mouth, having no draw, **87,** 1530; **93,** 2111; **94,** 1546.

OPERATIONS.

1886-87. Removal of obstr. bet. mouth and Rocky Crossing, **87,** 1529.
1890-91. 599 snags and 340 c. y. r. and gravel removed from chan., and 4,079 trees cleared from banks, **91,** 2046.
1893-94. Brush wing dam constr. and nearly 1,000 snags and other obstr. removed, **94,** 1546.

PHYSICAL CHARACTERISTICS.

Described, **71,** 350, 351, 352; **85,** 1628; **94,** 1546.
List of obstr., **71,** 351, 353.

PLAN.

By J. Straszer, imp. by removal of obstr., such as trees, snags, etc.; est., $68,402; not considered practicable by Col. Raynolds, **71,** 351, 353.

PROJECTS.

By Capt. Taber, 1885, imp. of h.-w. navigation as far as Danville, by removal of snags and similar obstr.; est., $6,480, **85,** 1630. Increased, 1888, to $7,000, **88,** 1401. Modified in 1889 to provide for expend. $2,500 below Rocky Crossing in removing timber from l.-w. chan. and a small portion of the ledges at Slaty Crossing and Robinsons Ridge, increasing est. cost of imp. to $9,500, **89,** 1653, 1654; **92,** 1683.
Small plant trans. to Arkansas R., **94,** 1547.

SURVEYS.

By J. Straszer, 1870–71, under direction of Lt. Col. Raynolds (see Plans), **70,** 31, 36; **71,** 59, 351.
Ex. au. act July 5, 1884; made by Capt. Taber (see Projects), **85,** 1627.

Y-22 FOURCHE LE FEVRÉ RIVER (Fourche La Faive (Fevé)) RIVER, ARK.

APPROPRIATIONS.

1879,	$10,000,	**79,** 116, 971.
1880,	4,000,	**80,** 1325.
1881,	3,000,	**81,** 1514.
1882,	4,000,	**82,** 1583.
1886,	5,000,	**87,** 1532.
1890,	7,500,	**90,** 1942.
Total,	33,500	

COMMERCE.

Not unimportant, **72,** 389; **79,** 972; unimportant, **93,** 2126.
C. interests to be subserved by imp., **91,** 2045.
Description of, **95,** 2014.

ENGINEERS.

Chief of Engineers. R., 71, 59; **72,** 56; **78,** 89; **79,** 116, 118; **80,** 155; **81,** 218; **82,** 215; **83,** 223; **88,** 188; **89,** 221; **90,** 199; **91,** 251; **92,** 243; **93,** 274, 279; **94,** 252; **95,** 282; **96,** 245.

In charge:
Lt. Col. W. F. Raynolds, 1872; **72,** 386.
Maj. W. H. H. Benyaurd, 1879–81. **R., 79,** 971; **80,** 1323; **81,** 1435.
Capt. T. A. Handbury, 1881–83. **R., 81,** 1514; **82,** 1583; **83,** 1171.
Capt. H. S. Taber, 1886–93. **R., 87,** 1531; **88,** 1402; **89,** 1654; **90,** 1941; **91,** 2044; **92,** 1681; **93,** 2108, 2125.
Capt. C. F. Palfrey, 1894. **R., 94,** 1544.
Lt. Wm. L. Sibert, 1895. **R., 95,** 2013.

Assistants:
A. H. Blaisdell. **R., 72,** 387.
Z. Harrison. **R., 79,** 972.
A. Walker, jr. **R., 93,** 2127.

OPERATIONS.

1879-80. Removal by hired labor of 7,557 trees and snags, and a number of r. removed at shoals, **80,** 1324.
1880-81. 53 snags removed, rs. taken from shoals, and small dams built, **81,** 1435, 1514.
1881-82. 476 logs and snags removed, **82,** 1583.
1882-83. Removal of snags and trees, **83,** 1172. Operations discontinued to 1886, **87,** 1531.
1886-87. Partial formation of chan. through Rock Shoal, **87,** 1531.
1887-88. Chan. completed through shoal below Perryville, **88,** 1402.
1890-91. Snag boat built, **91,** 2044.
1891-92. 1,326 snags and stumps, 4 drift piles, and 923 c. y. r. and gravel removed from the chan., and 15,600 overhanging trees cleared from the banks, **92,** 1682.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 387; **79,** 972; **93,** 2127. Floods, **72,** 387. Shoals, **79,** 973.

PLANS. (See Projects.)

By A. H. Blaisdell, imp. R. by removing snags and leaning trees, $25,890, **72,** 390.

PROJECTS. (See Plans.)

By Maj. Benyaurd, 1879, removing snags, bowlders, and leaning trees; est., $23,034.50, **79,** 972, **81,** 1435.
After expending $26,000 on this proj., Capt. Taber proposed to excavate a chan. through certain r. shoals below Perryville; est., $7,650, **89,** 1655.
In 1892-93 plant was sold to app. for removing obstr. in Arkansas R., **93,** 2109.
Works of imp. effective, **95,** 2014.

SURVEYS.

Au. act Mar. 3, 1871; assigned to Lt. Col. Raynolds, and made under his direction by A. H. Blaisdell. **R., 72,** 387.
Ex. by Z. Harrison, under direction of Maj. Benyaurd. **R., 79,** 971.
Ex. au. act July 13, 1892; made, 1893, by Capt. Taber (**R.** unfav.), **93,** 2125.

Y-23 WHITE, BLACK, LITTLE RED, AND ST. FRANCIS RIVERS, ARK.[1]

Part.	Title.	Period.	Appropriations.
a	White, Black, Little Red, and St. Francis Rs.	1833–1872	$204,500
b	White and St. Francis Rs.	1873–1885	32,000
	Total		236,500

See also White R., Black R., Little Red and St. Francis Rs., Pages 829, 834, 836, respectively.

Part (a), Y-23 White, Black, Little Red, and St. Francis Rivers, Ark.

APPROPRIATIONS.

White and St. Francis Rs.:
1833, $500 (sur.), act Mar. 2.
1871, 10,000, **77,** 498.
1873, 50,000, **73,** 57, 492.
1878, 40,000, **79,** 115, 968.
1879, 12,000, **79,** 115, 968.
$112,500

St. Francis, Black and White Rs.:
1836, $1,000 (sur.), act July 4.
1,000

Black and White Rs.:
1837, $1,000 (sur.), act Mar. 3.
1,000

White, Black, and Little Red Rs.:
1871, $10,000, **71,** 58, 377.
10,000

St. Francis R.:
1871, $10,000, **71,** 58, 377.
10,000

White R.:
1874, $50,000, **74,** 63.
1876, 10,000, **76,** 80; **77,** 80.
1879, 10,000, **79,** 115, 968.
70,000

Total 204,500

COMMERCE.

St. Francis R.:
Would not justify imp., **73,** 477, 479.

Little Red R.:
Benefit of imp., **71,** 364.

White R.:
Benefit of imp., **71,** 365; **76,** 627; **77,** 501; **78,** 662.
Statistics, **77,** 501; **78,** 662; **79,** 968.

Black R.:
Benefit of imp., **71,** 376.
Statistics, **72,** 380; H. Doc. 35, 45th Cong., 1st sess.

ENGINEERS.

Chief of Engineers. Rs. on White R., **72,** 55; **74,** 63; **75,** 68; **76,** 80; **77,** 80; **78,** 92; **79,** 115, 126.
Black R., **72,** 55; **79,** 118.
St. Francis R., **72,** 53, 56; **73,** 56; **76,** 80; **77,** 79; **79,** 115.
White and St. Francis Rs., **73,** 57; **74,** 63; **75,** 68.
White, Black, and Little Red Rs., **70,** 31, 66; **71,** 58, 59; **72,** 53.

In charge:
Lt. Col. W. F. Raynolds, 1871–73. **Rs.** on White R., **71,** 364; **72,** 374.
Black R., **71,** 374; **72,** 378.
St. Francis R., **71,** 356, 361; **72,** 343.
Little Red R., **71,** 361.
White, Black, and Little Red Rs., **71,** 376; **72,** 343.
Col. J. H. Simpson, 1873. **R.** on St. Francis R., **73,** 476.
Maj. C. R. Suter, 1873–79. **R.** on White R., **75,** 516; **76,** 622; **77,** 501; **78,** 661; **79,** 1082.
Black R., **73,** 492; **74,** 371; **76,** 627; **77,** 498.
Maj. W. H. H. Benyaurd, 1879. **R.** on White R., **79,** 969; H. D. 35, 46th, 2d.
White and St. Francis Rs., **79,** 968; H. D. 35, 46th, 2d.
Little Red R., H. D. 35, 46th, 2d.

Assistants:
H. L. Koons. **R.,** St. Francis R., **71,** 356.
J. Straszer. **R.,** White R., **71,** 7370. Black R., **71,** 374. Little Red R., **71,** 362.
A. Livermore. **R.,** White R., **71,** 366; **72,** 375.
J. S. Tennyson. **R.,** White R., **71,** 366.
J. D. McKown. **R.,** St. Francis R., **73,** 477.
C. Smith. **R.,** White R., **72,** 374.
D. W. Wellman. **R.,** White R., **78,** 662.
A. H. Blaisdell. **R.,** Black R., **72,** 378.

ESTIMATES. (See Plans and Projects.)

White R.:
By Lt. Col. Raynolds, removal of snags, wrecks, and leaning trees, $170,000, **71,** 366.
By A. Livermore, constr. of wing dams and removal of obstr., $60,440, **71,** 370. Imp. from James Fork to Forsyth by wing dams, and removal of obstr., $30,375; Forsyth, Mo., to foot of Buffalo Shoals, Ark., $70,845, **72,** 376.
By Maj. Suter, permanent imp. above Jacksonport by system of dikes, and removal of snags, $710,234.37, **76,** 626. Imp. at Buffalo Shoals, $10,000, **78,** 662, 663.
By Maj. Benyaurd, completion of imp. at Buffalo Shoals, $15,000, H. D. 57, 45th, 3d.

White and St. Francis Rs.:
By Maj. Benyaurd, continuing imp., $40,000, H. D. 57, 45th, 3d.

Black R.:
By Lt. Col. Raynolds, removal of snags, trees, etc., $50,968, **71,** 374. Imp. of R., and constr. of snag boat, $110,561, **72,** 378.
By A. H. Blaisdell, removal of snags, sunken logs, leaning trees, and drift piles; also building 1,200 l. f. of wing dams, $90,561, **72,** 381.
By Maj. Benyaurd, imp. of R. by removing snags, leaning trees, and constr. of 3,500′ of dams, $80,800, H. D. 35, 46th, 2d.

[1] Sur.—**R.,** Aug. 1, 1837; est., $12,390. (H. D. 482, 55th, 2d.)

White, Black, and Little Red Rs.:
By Lt. Col. Raynolds, snag boat and running expenses for 6 months, $135,000, **71,** 377.

Little Red R.:
By Lt. Col. Raynolds, removal of obstr., $38,065, **71,** 362.

St. Francis R.:
By H. L. Koons, imp. from mouth to Wittsburgh, by means of wing dams and removal of obstr., $53,229.76, **71,** 360.

OPERATIONS.

1871-72. St. Francis R., 431 snags, 151 trees, and 2 drift piles removed; White and St. Francis Rs., 543 snags, 422 trees, and 3 drift piles removed, **72,** 53, 343.
1872-73. White and St. Francis Rs., repairs to snag boat, **73,** 492.
1873-74. White and St. Francis Rs., 87 snags, 1,668 trees, and 1 drift pile removed, **74,** 372.
1874-75. White R., 313 snags, 1,548 trees, 5 drift piles, 2 wrecks, and 681 c. f. of st. removed, **75,** 68, 516.
1875-78. White R., clearing chan. at Buffalo Shoals of bowlders, **78,** 661.
1878-79. White R., removal of loose r., **79,** 126, 1082.

PHYSICAL CHARACTERISTICS.

White R., described, **74,** 366. High and l. w., **71,** 372. Oscillations, **76,** 616.
Black R., described, **72,** 379. Table of shoals, **72,** 382.
St. Francis R., described, **73,** 477.
Little Red R., floods, **71,** 363.

PLANS. (See Estimates and Projects.)

White R.:
By A. Livermore, constr. of dams, and removal of obstr., etc., **72,** 376.
By Maj. Suter, constr. of dikes, and removal of snags, **76,** 725.

Black R.:
By Maj. Benyaurd, removal of snags and leaning trees; also constr. of 3,500′ of dams, H. D. 35, 46th, 2d.

St. Francis R.:
By H. L. Koons, imp. R. by wing dams, and removal of obstr., **71,** 360.
By Lt. Col. Raynolds, dr. in place of wing dams. **71,** 356.

Little Red R.:
By Lt. Col. Raynolds, removal of obstr., **71,** 363.

PRIVATE (STATE) WORK.

Crib dam erected by Arkansas for imp. of White R., **71,** 367. Large quantities of land donated by Missouri for imp. of Black R., **72,** 380. In 1870 the State of Missouri app. $15,000 for imp. of Black R., with proviso that Arkansas would provide for similar imp.; Arkansas failed to make any app., **72,** 380.

PROJECTS. (See Estimates and Plans.)

White R.:
By Maj. Suter, removal of snags, leaning trees, and bowlders; also constr. of dikes, **74,** 63; **78,** 92. Constr. of 7 spur dikes of st. at Buffalo Shoals, and removal of bowlders, **78,** 661.

St. Francis R.:
By Col. Simpson, removal of obstr., **73,** 476.
By Maj. Benyaurd, to cut the heavy timber along the banks of the Upper St. Francis; est., $3,000, **79,** 968.

White, Black, and Little Red Rs.:
By Lt. Col. Raynolds, removal of obstr., **71,** 377.

White and St. Francis R.:
By Maj. Suter, removal of snags and leaning trees, **73,** 492.

SURVEYS.

Of Black, White, and St. Francis Rs., 1836, au. act July 4, 1836. Of Black and White Rs., 1836, au. act Mar. 3, 1837.
Of St. Francis, Cache, Little Red, White, and Black Rs., 1870, au. act July 11, 1870, **70,** 31, 66.
Ex. of St. Francis R. by H. L. Koons, 1870. **R.,** **71,** 356.
Ex. of Little Red R. by J. Straszer, 1870. **R.,** **71,** 362.
Ex. of White R. by A. Livermore, 1870, Forsyth to Jacksonport. **R.,** **71,** 366. By J. Straszer, 1870, below Duvalle Bluff. **R.,** **71,** 370.
Of White R. from Buffalo Shoals to mouth of James Fork, Mo., by A. Livermore, 1870. **R.,** **72,** 374.
Of Black R., by A. H. Blaisdell, 1871. **R.,** **72,** 378. Of St. Francis R., from Greenville down, **72,** 56.
Ex. of St. Francis R. by J. D. McKown, 1872. **R.,** **73,** 477.
Of White R. at Buffalo Shoals by D. W. Wellman, 1877. **R.,** **78,** 662.
Of Black R. by J. D. McKown, 1879, H. D. 57, 45th, 3d.
Of Black R., Ark., au. act Mar. 3, 1879; assigned to Maj. Benyaurd, 1879, **79,** 118.
Map. Of Buffalo Shoals, White R., **78,** 662.

Part (b), Y-23 White and St. Francis Rivers, Ark. (Snagging operations on.)

APPROPRIATIONS.

1880,	$12,000,	**80,** 1311.
1881,	8,000,	**81,** 1511.
1882,	12,000,	**82,** 1575.
Total,	32,000	

App. prior to 1880, **80,** 1311.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 153; **81,** 215; **82,** 211; **83,** 220; **84,** 228; **85,** 249.

In charge:
Maj. W. H. H. Benyaurd, 1879-82. **R.,** **80,** 1311; **81,** 1428.
Capt. T. H. Handbury, 1881-84. **R.,** **81,** 1510; **82,** 1574; **83,** 1166.
Maj. M. B. Adams, 1884. **R.,** **84,** 1392.
Capt. H. S. Taber, 1885. **R.,** **85,** 1594.

OPERATIONS.

1879-80. 1,151 trees cut down, 130 snags removed, and 11 r. heaps destroyed, **80,** 1311.
1880-81. 270 snags and wreck of coal barge removed; 298 trees cut down, **81,** 1429.
1881-82. 279 snags removed, 2 sunken barges destroyed, and 122 trees cut down, **82,** 1574.
1882-83. 864 snags removed and 2,184 trees cut down, **83,** 1167.
1883-84. 93 snags removed and 95 trees cut down, **84,** 1392.
After 1884 operations were carried on under separate app. for White and St. Francis Rs.

PROJECTS.

In 1873 Maj. Suter recom. imp. of both the White and St. Francis Rs. by removal of snags, logs, wrecks, and similar obstr. from their existing chans., and also of leaning trees from the banks, **73,** 492. No definite amount est. for completion of this proj., and the work of imp. was carried on upon both Rs. by joint apps. until June 30, 1884, **86,** 1378. Separate app. made for these Rs., 1884 and 1886.

Y-23 WHITE RIVER, ARK.

Part.	Title.	Period.	Appropriations.
c	White R.	1880–1912	$454,415.00
d	White R., upper	1897–1912	813,500.00
e	White R., Buffalo Fork	1897–1900	3,500.00
f	White R., operation and care of locks and dams	1904–1912	212,284.32
g	White R., Augusta Narrows	1907–1911	25,800.00
h	White R.—lower; and Clarendon, Ark	1890–1892	.....
	Total	.....	1,509,499.32

Part (c), Y-23 White River, Ark. (Including some obstructions removed from Cache River.)

APPROPRIATIONS.

1880	[1] $5,000, **80,** 1313.	
	[2] 20,000, **80,** 1315.	
1881,	[1] 8,000, **81,** 1512.	
1882	[1] 6,000, **82,** 1580.	
	[2] 4,000, **82,** 1581.	
1884,	[3] 35,000, **85,** 1589.	
1886,	[3] 18,000, **86,** 1380.	
1888,	25,000, **88,** 1405.	
1890,	30,000, **90,** 1946.	
1892,	75,000, **92,** 1686.	
1894,	[4] 50,000, **95,** 2022.	
1896,	[4] 20,000, **96,** 1683.	
1899,	14,815, **99,** 2036.	
1902,	22,000, **02,** 1578.	
1904,	*7,100 (mainten.), **04,** 2101.	
1905,	15,000, **05,** 1569.	
1907,	30,000, **07,** 1521.	
1909,	16,000, **09,** 1579.	
1910,	17,500, **10,** 1737.	
1911,	18,000, **11,** 1885.	
1912,	18,000, **12,** 2096.	
Total,	454,415 (incl. $70,000 for this R. carried on p. 827, $524,415, **12,**2096)	

COMMERCE.

Prospective advantages to result from imp., **89,** 1657; **90,** 1944; **92,** 1685.

Description of, **94,** 1552; **95,** 2021; **96,** 1682.

Large and increasing, **93,** 2113.

Description of. After ex. of 1895, the local and DE. recom. imp. of upper R., Batesville, Ark., to Buffalo Shoals, by locks and dams, but Chief of Engineers, on account of the doubtful C. value of the stream, did not recom. such imp., **96,** 1697, 1700.

Description of, bet. Batesville and Buffalo Shoals. After ex. of 1896, slack-water navigation recom., **97,** 1993.

Statistics, 1895 to 1911, inc., **12,** 790.

In 1895, 73,759 t.; in 1911, 143,285 t., **12,** 790.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies, $3,183.57. Dickinson Hardware Co., ship supplies, $2,994.77, **95,** 2022, 2023.

1901. E. J. Howard, repairs to snag boat, $17,762.92, **01,** 2107.

1903. E. J. Howard, new hull for snag boat, $5,810, **02,** 1419.

ENGINEERS.

Chief of Engineers. **R., 80,** 153, 154; **81,** 216; **82,** 214; **83,** 221; **84,** 230; **85,** 248; **86,** 240; **87,** 207; **88,** 188; **89,** 221; **90,** 199; **91,** 252; **92,** 244; **93,** 275; **94,** 253; **95,** 283, 287; **96,** 245, 248; **97,** 312; **98,** 304; **99,** 364; **00,** 418; **01,** 427; **02,** 357; **03,** 379; **04,** 401; **05,** 415; **06,** 449; **07,** 476; **08,** 508; **09,** 536; **10,** 605; **11,** 651; **12,** 788.

In charge:

Maj. W. H. H. Benyaurd, 1879–81. **R., 80,** 1312, 1314; **81,** 1429, 1431.

Capt. T. H. Handbury, 1881–84. **R., 81,** 1511, 1512; **82,** 1578, 1580; **83,** 1169, 1170; **84,** 1409.

Maj. M. B. Adams, 1884. **R., 84,** 1401, 1402.

Capt. H. S. Taber, 1884–93. **R., 85,** 1586, 1591, 1592; **86,** 1378, 1381; **87,** 1534; **88,** 1403; **89,** 1655; **90,** 1942; **91,** 2048; **92,** 1683; **93,** 2111.

Capt. C. F. Palfrey, 1894. **R., 94,** 1547.

Lt. Wm. L. Sibert, 1895–99. **R., 95,** 2017; (Capt.) **96,** 1667, 1697; **97,** 1971; **98,** 1665.

Lt. R. McGregor, 1899–1900. **R., 99,** 2035; (Capt.) **00,** 2592.

Capt. G. D. Fitch, 1901–06. **R., 01,** 2103; **02,** 1577; **03,** 1418; (Maj.) **04,** 2100; **05,** 1568; **06,** 1387.

Capt. W. D. Connor, 1906–08. **R., 07,** 1521; **08,** 1593.

Capt. G. R. Lukesh, **09,** 532.

Maj. M. L. Walker, 1908–10. **R., 09,** 1579; **10,** 1735.

Capt. C. S. Smith, 1910–. **R., 11,** 1884; **12,** 2095.

Assistants:

J. D. McKown. **R., 80,** 1313; **81,** 1430, 1432; **82,** 1581.

Wm. Parkin. **R., 97,** 1996.

P. R. Van Frank, jr. **R., 00,** 2594.

OBSTRUCTIONS.

Piers of a proposed br. at Aberdeen dangerous, **94,** 1552.

OPERATIONS.

1879–80. Rock removed, and 2 wing dams built at Nellies Apron Shoals, **80,** 1312.

1880–81. 565 l. f. of wing dam built at Samms Shoals, 200′ at Arnolds Shoal, and 200′ at Maguires Shoal; 161 logs, snags, and trees removed from R. bet. Jacksonport and Buffalo Shoals, **81,** 1429, 1430.

1881–82. 1,450 l. f. of wing dams built at Maguires and Saffolds Shoals, and 963 snags, logs, and trees removed bet. Jacksonport and Buffalo Shoals, **82,** 1578, 1579; 1,020 l. f. wing dams built in R. above Buffalo Shoals at Crooked Creek, Red Bud, and Summers Shoals, **82,** 1581.

1882–83. 1,642 snags and trees removed, and 294 l. f. of wing dams built at Bells Pt., **83,** 1169, 1170.

1884–85. 1,621 snags and trees removed bet. Jacksonport and Buffalo Shoals; bowlders removed at Cackling Pullet and Betsy Gill Shoals; solid

*Allotment.
[1] Between Jacksonport and Buffalo Shoals.
[2] Above Buffalo Shoals.
[3] White R., Ark.
[4] Does not include $2,000 allotted to Cache R., Ark.

rock at Porter Hodge Shoal; wing dams built at Wyatts and O'Neals Shoals, **85,** 1587, 1590, 1593.

1885-86. Repair of dams at Buffalo Shoals, and removal of obstr. bet. Calico Rock and Batesville, **86,** 1379, 1380, 1382.

1886-87. 166 snags and 6 drift piles and 2,115 trees removed bet. Newport and mouth of the R., **87,** 1535, 1536.

1887-88. Snags and logs removed near Devalls Bluff and Clarendon, **88,** 1404.

1888-89. 6 barges, pile driver, and quarter-boat built; snagging operations begun, **89,** 1656.

1889-90. 620 l. f. of dam repaired; 2,440 l. f. of dam built; 367 c. y. of rock blasted and removed, **90,** 1943.

1890-91. 1,460 l. f. of dam work built, and 11 c. y. of rock removed from chan., **91,** 2048.

1891-92. 2,844 c. y. of rock and 510 cords of brush used in dam constr., **92,** 1684.

1892-93. Nearly 4,000 c. y. rock quarried and some of it transferred to location of dikes, **93,** 2112.

1893-94. Several dikes built; nearly 500 snags and other obstr. removed; nearly 300 bowlders and 50 c. y. rocky reef removed; wing dams repaired, and plant repaired, **94,** 1551.

1894-95. Nearly 2,000 snags, etc., removed; 2,310 l. f. revet. work in progress, and plant repaired, **95,** 2020, 2021.

1895-96. Wing dams constr. at about 9 places; revet. constr. continued; nearly 500 snags, etc., removed, and about 400 c. y. bowlders, loose and solid rock removed; plant repaired. Exhibit of field expend., **96,** 1672.

1896-97. Small repairs made to revet., and nearly 3,800 snags, etc., removed; plant repaired, **97,** 1971.

1897-98. Nearly 600 snags, etc., removed; over 40 shoals dr. through; nearly 1,500 snags, etc., removed from Cache R.; **98,** 1666.

1898-99. A few obstr. removed from chan., and boats repaired, **99,** 2035.

1899-00. 1,142 snags and other obstr. removed from chan., **00,** 2595.

1900-01. 136 snags pulled, 294 trees cut, and repairs made to snag boat, **01,** 2106.

1902-03. New hull for snag boat *Beauregard* constr., and snags and other obstr. removed from R., **03,** 1418.

1903-04. 754 snags removed, 9 drifts broken up, and 5,425 trees cut, **04,** 2101.

1904-05. 1,031 snags removed, and 3,259 trees cut, **05,** 1569.

1905-06. 860 snags removed, 2,881 trees cut, and neck at Augusta Narrows closed by st. filling, **06,** 1387.

1906-07. 207 snags removed, 2 drifts broken up, and 5,352 trees cut, **07,** 1521.

1907-08. 567 snags removed, 951 trees cut, and 4 drifts broken up, **08,** 1593.

1908-09. 771 snags removed, 32 drifts broken up, and 2,828 trees cut, **09,** 1580.

1909-10. 1,123 snags removed, 62 drifts broken up, and 5,549 trees cut, **10,** 1736.

1910-11. 1,307 snags removed, 15 drifts broken up, and 1,502 trees cut, **11,** 1885.

1911-12. 1,172 snags removed, 47 drifts broken up, and 4,263 trees cut, **12,** 2095.

PHYSICAL CHARACTERISTICS.

Description of, **94,** 1551; **95,** 2021; **96,** 1680; **97,** 1972.

Description of, upper White R.; above where Black R. enters, the fall increases and d. decreases, **96,** 1697; shoals, description of, and comparison of, at 1874 and 1895, **96,** 1698.

Description of, bet. Batesville and Buffalo Shoals, **97,** 1992.

PLANS. (See Projects.)

Capt. Handbury, 1883, reports that imp. of White R. at Memphis & Little Rock RR. br. not necessary or advisable, **84,** 1410.

PROJECTS. (See Plans.)

Proj. for imp. of R. bet. Jacksonport and Buffalo Shoals, made 1871–72, proposed removal of snags, logs, and rock, and imp. of shoals by the constr. of wing dams, **71,** 370; **72,** 376; **80,** 1314; **85,** 1592.

Imp. of R. at Buffalo Shoals proposed to be accomplished by removal of bowlders, and constr. of 7 spur dikes, **78,** 661.

1874 to 1879, incl., $70,000 app. for imp. of R. above Jacksonport, **74,** 63; **76,** 80; **79,** 115.

In 1887 est. that, pending plans and estimates for permanent imp. of the R., a yearly app. of $8,000 for removal of snags would be required for 1 or 2 years, **87,** 308, 1536.

By Capt. Taber, 1888, permanent imp. of R., giving min. d. of 5′ at extreme l. w. from mouth to Newport, and a d. of 2′ at l. w. from Newport to Buffalo Shoals, by constr. of spur dikes to contract the flow, and by removal of obstr.; est., $105,315, **88,** 1407–1412.

$53,815 of app. of 1892 was for completion of existing proj., and remainder to be expend. at discretion of Sec. of War, **93,** 2112.

Works of imp. apparently effective, **96,** 1680; **97,** 1972; **98,** 1666.

In 1896 Capt. Sibert est. $1,600,000 to obtain slack-water navigation bet. Buffalo Shoals and Batesville, **97,** 1992.

$378.84 of unexpended balance of July 1, 1898, was for removal of obstruction in Cache R. being the unexpended portion of $2,000 allotted from R. & H. act, 1896, from White R. to Cache R. **98,** 1667.

SURVEYS.

Ex. of White R. from Forsythe to Buffalo Shoals, made by Maj. Benyaurd, 1880, **81,** 1432.

Ex. and sur. of White R. at Memphis & Little Rock RR. br., near Devalls Bluff, made, 1882–83, by Capt. Handbury, **84,** 1409.

Misc. surs., **93,** 2112; **94,** 1551.

Ex. of upper R. au. act Aug. 17, 1894; made by Lt. Sibert, 1895 (DE. **R.** fav., C. of E. unfav.), **96,** 1697.

Sur. of R. bet. Batesville and Buffalo Shoals, with view to imp. by slack-water navigation, au. act June 3, 1896; **R.,** 1896, by Capt. Sibert (see Projects), **97,** 1992.

Maps. **96,** 1684.

Part (d), Y-23 White River (Upper), Ark.

APPROPRIATIONS.

1899,	$160,000,	**99,** 2038.
1900,	150,000,	**00,** 2597.
1902,	270,000,	**02,** 1582.
1905,	160,000,	**05,** 1573.
1907,	73,500,	**07,** 1523.
Total,	813,500	

COMMERCE.

Country rich in manganese and zinc ores and marble, in addition to the lumber and agricultural interests, **97,** 1994.

CONTRACTS.

1900. Glencoe Lime & Cement Co., Portland cement, $2.45 and $3.15 bbl. ($9,065 and $11,655). R. S. Hanford, natural cement, $1.20 bbl.; st., 74¢ and $2 c. y.; sand, $1 c. y. ($32,108). Ward & Wise, st., 70¢ c. y. ($2,450). W. H. Woodsmall, sand, 33¢ c. y. ($1,848). Kansas City & Southern Lumber Co., lumber, $15 to $40 M f. ($12,550). New Jersey Foundry & Machine Co., ironwork, $2,991.88. McCoppin, hauling material from ry. station to site of works, st., 60¢ c. y.; sand, 38¢ c. y.; and cement, 8¢ bbl. ($5,108), **00,** 2598, 2599.

1901. Alpha Portland Cement Co., 5,000 bbls. cement, $2.20 bbl.; Glencoe Lime & Cement Co.

11,000 bbls. cement, $1.82 bbl. Griffiths Iron Works Co., wrought iron, $0.049 lb.; cast iron, $0.039 lb.; steel, $0.0675 lb., **01,** 2111.

1903. Robt. W. Earnheart, st., prices given. Bryant Lumber Co., lumber, prices given. W. B. Ferguson, timber, $15 1,000′ b. m. Urania Lumber Co. (Ltd.), $9 1,000′ b. m. Edwin S. Healy, 2,600 bbls. cement, $2.70 bbl., **03,** 1430.

1904. Urania Lumber Co. (Ltd.), lumber, $15 1,000′ b. m. Allbright & Ferrill, st. riprap, 9,000 c. y., at 78¢ c. y. Jas. G. Clarke, pine lumber (prices given), **04,** 2108.

1905. R. W. Earnheart, st. and timber (prices given). Jas. G. Clarke, pine lumber (prices given), **05,** 1573.

1906. Edwin S. Healy, Portland cement, $1.84 bbl. Thomas-Fordyce Mfg. Co., iron and steel (prices given). J. E. Bell, riprap st. (prices given). Bryant Lumber Co., white oak lumber, rough (prices given), **06,** 1390.

1907. C. J. Carter Lumber Co., rough oak, gum, pine or ash lumber (prices given). Albright & Ramsey, riprap st., 83¢ c. y., **07,** 1524.

ENGINEERS.

Chief of Engineers. R., 97, 316; **99,** 365; **00,** 419; **01,** 428; **02,** 359; **03,** 381; **04,** 403; **05,** 416; **06,** 452; **07,** 478; **08,** 511; **09,** 539; **10,** 607; **11,** 653; **12,** 790.

Boards. Ex. by special BE. to determine desirability of constr. further locks and dams, au. act Mar. 3, 1905. **R.,** July 16, 1905[1] (unfav.), **06,** 460.

In charge:

Capt. Wm. Sibert, 1897. **R., 97,** 1992.

Lt. R. McGregor, 1899–1900. **R., 99,** 2038; (Capt.) **00,** 2596.

Capt. G. D. Fitch, 1901–06. **R., 01,** 2108; **02,** 1580; **03,** 1420; (Maj.) **04,** 2102, 3750; **05,** 1570; **06,** 1380.

Capt. W. D. Connor, 1906–08. **R., 07,** 1523; **08,** 1597.

Capt. G. R. Lukesh, **09,** 532.

Maj. M. L. Walker, 1908–10. **R., 09,** 1584; **10,** 1738.

Maj. C. S. Smith, 1910–. **R., 11,** 1886; **12,** 2097.

Assistant. Wm. Parkin. **R., 00,** 2600; **01,** 2112; **02,** 1580; **03,** 1421; **04,** 2103; **05,** 1571.

LEGAL PROCEEDINGS.

Complete title to land at Batesville site obtained in Mar., 1900, **00,** 2596.

OPERATIONS.

1899–00. Constr. of Lock and Dam No. 1 in progress, **00,** 2596.

1900–01. Work at Lock and Dam No. 1 in progress. At Lock and Dam No. 2, lock house completed, abutment nearly completed; cofferdam work under way, **01,** 2109.

1901–02. At Lock and Dam No. 2 lock walls, back filling, and abutment completed. Summary of concrete in Lock No. 2 given, **02,** 1580.

1902–03. At Lock and Dam No. 1, land and guide cribs, lock house, warehouse, and dam built. At Lock and Dam No. 2, upper guide and land cribs nearly completed, lower land crib built to pool level, etc.; all floating plant repaired, **03,** 1420.

1903–04. History of constr. of l. and d., with technical details, **04,** 3750. At Lock and Dam No. 1, new abutment and bank protection built; this l. and d. trans. to app. "Operation and care of canals" on Jan. 16, 1904. Work on Lock and Dam No. 2 in progress, **04,** 2102.

1904–05. Work of rebacking dam at Lock and Dam No. 1. Lock and Dam No. 2 nearly completed. Trans. to "Operation and care" on Feb. 16, 1905. Work on Lock and Dam No. 3 begun Apr. 13, 1905, **05,** 1570.

1905–06. Lock and Dam No. 2, lower R. crib rebuilt. This l. and d. now completed. At Lock and Dam No. 3 the lock walls and upper guide cribs built, and excavation for abutment commenced, **06,** 1389.

1906–07. Abutment for Dam No. 3 completed; floating plant overhauled and repaired, **07,** 1523.

1907–08. Lock and Dam No. 3 completed and placed under "Operation and care" Feb. 1, 1908. History of constr. of Lock and Dam No. 3, **08,** 1597.

1908–09. At Lock No. 3, lower crib extended 75′ downstream, **09,** 1584.

1911–12. 407 c. y. st. placed in bank protection at Dam No. 3, **12,** 2097.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 1992.

Discharge observations, **01,** 2115; **02,** 1581; **03,** 1425.

Abutment of Dam No. 1 totally destroyed by freshet on Nov. 25, 1902, **03,** 1422.

Chan. d., **08,** 511.

PROJECTS.

By Capt. Sibert, 1897, slack-water navigation, Batesville to Buffalo Shoals, by means of 10 fixed dams with masonry locks; est., $1,600,000, **97,** 1993.

By Capt. McGregor, 1900, expend. $150,000 to constr. Dam No. 2; est. of the dam, $221,171.50, **00,** 2596.

Capt. Fitch recom. discontinuance of imp. this portion of White R. after completion of Locks and Dams Nos. 1 and 2, **03,** 1426.

SURVEYS.

Sur., Batesville to Buffalo Shoals, with view to imp. by slack-water navigation, au. act June 3, 1896; **R.** by Capt. Sibert, based on sur. made, 1887, by Capt. Taber (see Projects), **97,** 1992.

Sur. for location of Dams Nos. 1 and 2, made, 1899–1900, **99,** 2038; **00,** 2596.

For sites for Locks Nos. 2 and 3, **01,** 2109.

Ex. to determine desirability of constr. further l. and d., au. act Mar. 3, 1905; made by BE., **R.** July 16, 1905. Not considered desirable,[1] **06,** 460.

Part (e), Y-23 Buffalo Fork, White River, Ark.

APPROPRIATION.

1899, $3,500, **99,** 2038.

COMMERCE.

Description of, **97,** 1995.

Very little steamboating ever attempted on this stream, **99,** 2037.

Natural chan. is "now" available to fullest extent for flatboats and rafts, **00,** 420.

For year ending May 31, 1900, 998 t.; value, $8,436, **00,** 420.

ENGINEERS.

Chief of Engineers. R., 97, 317; **99,** 365; **00,** 420; **01,** 429; **02,** 359; **03,** 382.

In charge:

Capt. Wm. L. Sibert, 1897. **R., 97,** 1994.

Lt. Robert McGregor, 1899–1900. **R., 99,** 2037; (Capt.) **00,** 2601.

Capt. G. D. Fitch, 1901–02. **R., 01,** 2119; **02,** 1583.

Assistant. Wm. Parkin. **R., 97,** 1998.

[1] H. D. 150, 59th, 1st.

OPERATIONS.

3,350 trees, 430 cords of brush, and 2,000 c. y. loose rock removed, completing the work, **00,** 2601.

PHYSICAL CHARACTERISTICS.

Description of. Table showing extent and nature of shoals, **97,** 1995, 1998.

PROJECTS.

Capt. Sibert est., 1897, $750,000 to obtain slackwater navigation, **97,** 1995.

By Capt. Sibert, 1897, removal of overhanging timber, and loose and solid rock from shoals, mouth to the mouth of Rush Creek; est., $3,500, **97,** 1995.

SURVEYS.

Sur., mouth of Buffalo Fork to mouth of Rush Creek, to determine character and extent of imp. required, au. act June 3, 1896; made, 1897, by Capt. Sibert (see Projects), **97,** 1995.

Part (f), Y-23 White River (Upper), Ark., Locks and Dams. (Operating and care.)

APPROPRIATIONS.[1]

1904,	$361.86,	**04,** 2110.
1905,	4,650.00,	**05,** 1575.
1906,	39,747.80,	**06,** 1393.
1907,	26,837.23,	**07,** 1527.
1908,	43,064.25,	**08,** 1602.
1909,	17,448.03,	**09,** 1586.
1910,	23,184.21,	**10,** 1740.
1911,	21,148.30,	**11,** 1889.
1912,	35,842.64,	**12,** 2099.
Total,	212,284.32 ($212,284.32, **12,** 2099, being total spent).	

CONTRACTS.

1906. R. W. Earnheart, gravel and st. (prices given), **06,** 1393.

1907. Urania Lumber Co. (Ltd.), pine lumber (prices given), **07,** 1527.

ENGINEERS.

Chief of Engineers. **R., 04,** 405; **05,** 417; **06,** 453; **07,** 479; **08,** 512; **09,** 540; **10,** 608; **11,** 654; **12,** 791.

In charge:

Maj. G. D. Fitch, 1904–06. **R., 04,** 2109; **05,** 1574; **06,** 1390.

Capt. W. D. Connor, 1907–08. **R., 07,** 1524; **08,** 1600.

Capt. G. R. Lukesh, **09,** 532.

Maj. M. L. Walker, 1908–10. **R., 09,** 1585; **10,** 1739.

Maj. C. S. Smith, 1910–. **R., 11,** 1887; **12,** 2097.

OPERATIONS.

1904–12. Mainten. and general repairs, **04,** 2109; **05,** 1574; **06,** 1390; **07,** 1525; **08,** 1600; **09,** 1585; **10,** 1739; **11,** 1887; **12,** 2097.

1904–05. Lock No. 1 placed under op. and c. Jan. 16, 1904, and Lock No. 2, Feb. 16, 1905, **05,** 1574.

1907–08. Lock No. 3 placed under op. and c. Feb. 1, 1908, **08,** 1600.

PHYSICAL CHARACTERISTICS.

Water stages, **06,** 1392; **07,** 1526; **08,** 512; **09,** 540; **10,** 608; **11,** 655; **12,** 792.

PRIVATE WORK.

Dr. by private parties in front of their own docks, **11,** 1888; **12,** 2098.

Part (g), Y-23 White River, Ark., Augusta Narrows.

APPROPRIATIONS.

1907, $25,800, **11,** 1883.

CONTRACTS.

1907. H. Dalhoff, levee work, 24¢ c. y.; clearing, $100 acre, **08,** 1597.

ENGINEERS.

Chief of Engineers. **R., 08,** 510, 519; **09,** 538, 539, 548; **10,** 603; **11,** 650.

Boards. BE. au. act Mar. 2, 1907, **08,** 510.

In charge:

Capt. Wm. D. Connor, 1908. **R., 08,** 1595.

Maj. M. L. Walker, 1909–10. **R., 09,** 1581; **10,** 1734.

Maj. C. S. Smith, 1911. **R., 11,** 1883.

OPERATIONS.

1907–08. 80% of levee work and revet. work done, **08,** 510.

1908–09. Remainder of proj. done, **09,** 1582.

PROJECT.

BE., 1907, recom. spending for levee and revet. at Augusta Narrows, $28,500 of the $100,000 app. for "Arkansas River at Pine Bluff and White River at Augusta Narrows," and a portion of the remainder to be reserved for repairs, etc., **08,** 510; **09,** 548.

SURVEY.

Ex. by BE. au. act Mar. 2, 1907, **08,** 510.

Part (h), Y-23 Clarendon, and Lower White River, Ark.

ENGINEERS.

Chief of Repairs. **R., 91,** 257; **92,** 247, 1697.

In charge:

Capt. H. S. Taber. **R., 92,** 1698, 1700.

Col. C. B. Comstock. **R., 92,** 1704.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1698.

PLANS.

By Col. Comstock, 1892, levee constr., 5,100,000 c. y., Helena to White R.; est., $1,100,000, **92,** 1704.

SURVEY.

Sur. to prevent injury from backwater from the Mississippi R. au. act Sept. 19, 1890; made, 1892, by Capt. Taber, **92,** 1700.

[1] Expend. under the permanent-indefinite app. acts July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

Y-25 CACHE RIVER, ARK.

APPROPRIATIONS.

1888,	$7,000,	**89,** 1659.
1892,	2,000,	**92,** 1687.
1894,	[1] 2,000,	**99,** 2039.
1896,	[1] 2,000,	**99,** 2039.
1899,	1,000,	**99,** 2039.
1902,	2,000,	**02,** 1584.
1905,	2,000,	**05,** 1576.
1907,	2,000,	**07,** 1528.
1909,	*3,000,	**09,** 1587.
1910,	3,000,	**10,** 1741.
1911,	3,000,	**11,** 1891.
1912,	3,000,	**12,** 2100.

Total, 32,000 (incl. sales, $32,100.30, **12,** 2100).

COMMERCE.

Unimportant, **71,** 354.
C. in past years quite extensive, **81,** 1480.
Great prospective advantages to C. to result from opening the R., **91,** 2052.
Description of. Rafting and small flatboats handled by the current, **94,** 1554; **95,** 2024.
C., 1900, 11,215 t.; value, $29,961, **00,** 421.
About 75% rafted, **06,** 454.
Operations of material benefit to C. in lengthening navigable periods of stream, **12,** 793.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 66; **71,** 58, 59; **81,** 213; **87,** 210; **88,** 189; **89,** 222; **90,** 200; **91,** 253; **92,** 244; **93,** 276; **94,** 254; **95,** 283, 286; **96,** 246; **99,** 366; **00,** 421; **01,** 430; **02,** 360; **03,** 383; **04,** 405; **05,** 418; **06,** 453; **07,** 480, 486; **08,** 513; **09,** 541; **10,** 608; **11,** 655; **12,** 792.

Boards. BERH. **R., 07,** 486.

In charge:
Lt. Col. W. F. Raynolds, 1871. **R., 71,** 354.
Maj. W. H. H. Benyaurd, 1881. **R., 81,** 1477.
Capt. H. S. Taber, 1887–93. **R., 87,** 1547; **89,** 1659; **90,** 1946; **91,** 2051; **92,** 1687; **93,** 2114.
Capt. C. F. Palfrey, 1894. **R., 94,** 1554.
Lt. Wm. L. Sibert, 1895. **R., 95,** 2024, 2037.
Lt. R. McGregor, 1899–1900. **R., 99,** 2039; (Capt.) **00,** 2602.
Capt. G. D. Fitch, 1901–06. **R., 01,** 2120; **02,** 1584; **03,** 1431; (Maj.) **04,** 2110; **05,** 1575; **06,** 1394.
Capt. Wm. D. Connor, 1907–08. **R., 07,** 1527; **08,** 1602.
Maj. M. L. Walker, 1909–10. **R., 09,** 1587; **10,** 1741.
Maj. Clarke S. Smith, 1911–. **R., 11,** 1890; **12,** 2099.

Assistants:
D. Fitzgerald. **R., 71,** 354.
Z. Harrison. **R., 80,** 1478.
P. R. Van Frank, jr. **R., 95,** 2038; **00,** 2603.

OBSTRUCTIONS.

Little Rock & Memphis RR. br. at Old Boyds Landing an obstr. to through steamboat navigation, and said to be the cause of steamboats leaving R., **95,** 2024.

OPERATIONS.

1888-89. Snag boat *Riverside* built; 67 snags, 14 drift piles, and 69 overhanging trees removed, **89,** 1659.
1889-90. 341 snags, 158 trees, and 20 drift piles removed, **90,** 1947.
1892-93. Nearly 1,600 snags and other obstr. removed, **93,** 2114.
1893-94. Over 500 snags, etc., removed, **94,** 1554.
1899-00. About 3,700 snags and other obstr. removed from chan., **00,** 2603.
1902-03. 2,604 snags and other obstr. removed; limbs cut from 504 trees and sunken SS. broken up, **03,** 1431.
1905-06. 1,175 snags and other obstr. removed, 2,347 trees girdled, and 58 drifts broken up, **06,** 1394.
1908-09. 8,802 snags and other obstr. removed and 123 drifts broken up, **09,** 1587.
1909-10. 2,582 snags and other obstr. removed and 8 drifts broken up, **10,** 1741.
1910-11. 927 snags removed, 63 drifts broken up, 2,244 trees cut, 771 trees girdled, and overhanging limbs trimmed from 640 trees, **11,** 1890.
1911-12. 2,231 snags removed from chan., 33 drifts broken up, 705 trees cut, and 480 trees girdled, **12,** 2099.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1479; **95,** 2024; **12,** 793.
Severe storm, 1893, blocked R. with fallen timber, **94,** 1554.
Description of, to Riverside, **95,** 2037.
Not navigable at lowest stages, **05,** 418.
Range bet. h. and l. w., from 15′ above to 32′ at mouth, **07,** 481.
300 m. l.; existing proj. covers 86 m.

PLANS.

By D. Fitzgerald, removing overhanging trees and snags; est., $4,000, **71,** 354, 355.
By Maj. Benyaurd, 1880, imp. R., mouth to Grays Ferry, 160 m., by removing snags, logs, and overhanging trees; est., $30,316, **81,** 1478.

PROJECTS.

By Capt. Taber, 1887, removing snags, mouth to Riverside; est., $7,000, **87,** 1548; increased to $10,000 in 1891, **91,** 2053.
Small plant consolidated with that of White R., **94,** 1554.
The existing proj., 1901, that au. 1896, covering removal of obstr., mouth to James Ferry, 79 m., **01,** 430.

SURVEYS.

Au. act July 11, 1870, assigned to Lt. Col. W. F. Raynolds, made by D. Fitzgerald. **R., 71,** 354.
Ex. to Riverside with view to slack-water navigation, au. act Aug. 17, 1894; made by Lt. Sibert, 1895, **95,** 2037 (**R.** fav. to snagging).
Pre. ex. upper R., au. act Mar. 3, 1905. **R.** of DO. reviewed by BERH (unfav.),[1] **07,** 486.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 793.

* Allotment. [1] Allotted from White R. [2] H. D. 176, 59th, 2d.

Y-28 BLACK RIVER, ARK. AND MO.[1]

(See also "White, Black, Little Red, and St. Francis Rivers, p. 827.)

APPROPRIATIONS.

1880,	$15,000,	**80,** 1326.
1881,	6,000,	**81,** 1517.
1882,	10,000,	**82,** 1585.
1884,	20,000,	**84,** 231.
1886,	5,000,	**86,** 1377.
1888	5,000,	**88,** 1414.
	7,000,	**88,** 190.
1890	5,000,	**90,** 1950.
	7,000,	**90,** 1951.
1892,	5,000,	**92,** 1690.
1894,	9,500,	**95,** 2027.
1896,	8,000,	**96,** 1687.
1899,	8,000,	**99,** 2040.
1902,	21,700,	**02,** 1586.
1904,	[2] 8,850,	**04,** 2113.
1905,	13,000,	**05,** 1578.
1907,	*13,000,	**07,** 1530.
1909,	*12,000,	**09,** 1589.
1910,	*13,500,	**10,** 1744.
1911,	*4,100,	**11,** 1893.
1912,	*12,000,	**12,** 2102.
Total,	208,650 (less $319.50 ret. to Treas, $208,330.50, **12,** 2102).	

COMMERCE.

Decline in C., **84,** 1403.

Benefit to be derived from imp., **88,** 1414; **89,** 1661.

Description of, **94,** 1556; **95,** 2027; **96,** 1687.

Benefits to, by opening of stream, apparently to be great, **93,** 2116.

C., 1900, 966,961 t.; value, $129,698, **00,** 422.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies, $534.71, **95,** 2028.

1902. Ed. J. Howard, hull for snag boat *Beauregard*, $5,810, **03,** 1434.

ENGINEERS.

Chief of Engineers. **R., 80,** 156, 158; **81,** 218; **82,** 215, 216; **83,** 223; **84,** 231; **85,** 247; **86,** 240; **87,** 208; **88,** 189, 190; **89,** 223; **90,** 200; **91,** 254, 255; **92,** 245; **93,** 277; **94,** 254; **95,** 284; **96,** 246; **97,** 313; **98,** 305; **99,** 367; **00,** 421; **01,** 431; **02,** 361; **03,** 384; **04,** 406; **05,** 419; **06,** 455; **07,** 481; **08,** 514; **09,** 542; **10,** 610; **11,** 656; **12,** 794.

In charge:

Maj. W. H. H. Benyaurd, 1879–81. **R., 80,** 1326; **81,** 1436.

Capt. T. H. Handbury, 1881–83. **R., 81,** 1515; **82,** 1583, 1584; **83,** 1172.

Maj. M. B. Adams, 1883–84. **R., 84,** 1403.

Capt. H. S. Taber, 1884–93. **R., 85,** 1583; **86,** 1377; **87,** 1537; **88,** 1413; **89,** 1660, 1662; **90,** 1948, 1950; **91,** 2055, 2058; **92,** 1689; **93,** 2116, 2117.

Capt. C. F. Palfrey, 1894. **R., 94,** 1555.

Lt. Wm. L. Sibert, 1895–98. **R., 95,** 2025; (Capt.) **96,** 1685; **97,** 1975; **98,** 1669.

Lt. R. McGregor, 1899–1900. **R., 99,** 2040; (Capt.) **00,** 2604.

Capt. G. D. Fitch, 1901–06. **R., 01,** 2121; **02,** 1585; **03,** 1432; (Maj.) **04,** 2111; **05,** 1576; **06,** 1394.

Capt. Wm. D. Connor, 1907–08. **R., 07,** 1528; **08,** 1603.

Maj. M. L. Walker, 1909–10. **R., 09,** 1588; **10,** 1742.

Maj. C. S. Smith, 1911–. **R., 11,** 1891; **12,** 2101.

Assistant. P. R. Van Frank, jr. **R., 00,** 2606.

OBSTRUCTIONS.

Obstr. of the R. by sunken rafts, **91,** 3868.

OPERATIONS.

1880-81. All operations carried on by hired labor; 1,350 l. f. of brush dam built at Devils Tooth and Eagles Nest Shoals; 556 snags and 586 tree removed, **81,** 1436.

1881-82. 971 snags and 3,100 trees removed. Closure of the "Chute" by brush dam, **82,** 1584.

1882-83. 1,175 snags and 5,386 trees removed, **83,** 1173.

1883-84. 1,429 snags and 2,480 trees removed, **84,** 1403.

1884-85. 120 snags and 9,291 trees removed, **85,** 1585.

1886-87. 540 snags, 10,130 overhanging trees, and 4 drift piles removed; 16,004 trees deadened, **87,** 1538.

1888-89. 293 snags and 12 drift masses removed from chan., and 19,200 trees cleared from banks, **89,** 1663.

1889-90. 433 snags and 27 drift piles removed from chan., and 22,014 trees cleared from banks, **90,** 1948, 1951.

1890-91. 406 snags, 23 drift piles, and 10,450 overhanging trees removed from R., **91,** 2059.

1891-92. 1,755 snags and 166 drift piles cleared from chan., and 24,622 trees cut from banks, **92,** 1690.

1892-93. Nearly 11,000 snags and other obstr. removed, **93,** 2116.

1893-94. Small amount of snagging done, **94,** 1555.

1895-96. Nearly 1,700 snags, etc., removed, **96,** 1686.

1896-97. About 2,500 snags, etc., removed, **97,** 1976.

1897-98. Nearly 700 snags, etc., removed; dr. done and dam built, **98,** 1669.

1898-99. About 60 obstr. removed from chan., **99,** 2040.

1899-00. About 2,500 obstr. removed from chan., **00,** 2606.

1900-01. 521 snags, 129 trees cut and removed, and 4 drifts broken up, **01,** 2121.

1902-03. 762 snags removed, 34 drifts broken up, 4,094 trees cut, **03,** 1432.

1903-04. 1,278 snags removed, 27 drifts broken up, and 2,545 trees cut, **04,** 2112.

1904-05. 1,409 snags removed, 10 drifts broken up, 1,832 trees cut, **05,** 1577.

1905-06. 1,163 snags removed, 4,332 trees cut, and 37 drifts broken up, **06,** 1395.

1906-07. 1,070 snags removed, 4,450 trees cut, and 9 drifts broken up, **07,** 1529.

1907-08. 1,596 snags removed, 2,870 trees cut, and 29 drifts broken up, **08,** 1604.

1908-09. 1,344 snags removed, 1,816 trees cut, and 15 drifts broken up, **09,** 1588.

1909-10. 1,344 snags removed, 2,979 trees cut, and 16 drifts broken up, **10,** 1743.

1910-11. Removing obstr. by snag boats, **11,** 1892.

1911-12. 2,408 snags removed, 1,862 trees cut, and 18 drifts broken up, **12,** 2101.

PHYSICAL CHARACTERISTICS.

Description of, **94,** 1556; **95,** 2026; **96,** 1687; **97,** 1976; **98,** 1669; **00,** 2606; **11,** 657.

Range bet. h. and low water, **08,** 514.

PROJECTS.

By Maj. Benyaurd, 1879, imp. of R. bet. Poplar Bluff and White R. by removal of logs, snags, and trees, and constr. of wing dams; est., $80,800, **80,** 1329.

In 1885 Capt. Taber considered that an. app. of from $8,000 to $10,000 required to keep R. available for navigation, **85,** 247, 1585; **88,** 1403; **92,** 1690.

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* Allotment.

[1] Sur.—**R.,** Aug. 1, 1837. (H. D. 482, 55th, 2d.)

[2] $319.50 returned to Treas.

Cache R. plant trans. to this work by sale, and snagging boat of this work sold to White R. app., **93,** 2116. The whole plant for this work consolidated with that of White R., **94,** 1555.

Works of imp. apparently effective, **97,** 1976.

Orig. proj. of 1880 contemplated removal of logs, shoals, and constr. of wing dams; est., $80,800; the only modification of proj. has been that of changing the est. to $8,000 a year for mainten.; Capt. Fitch recom. this be increased to $15,000 yearly, **02,** 361.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 11; **80,** 158; made by Maj. Benyaurd, 1879, **80,** 1326.

Y-29 CURRENT RIVER, ARK. AND MO.

APPROPRIATIONS.

1872,	$5,000,	**73,** 55.
1881,	2,000,	**81,** 1517.
1894,	8,000,	**95,** 2030.
1896,	2,000,	**96,** 1690.
1899,	5,000,	**99,** 2042.
1902,	6,900,	**02,** 1587.
1904,	*2,935,	**04,** 2115.
1905,	*5,000,	**05,** 1578.
1907,	*5,000,	**07,** 1530.
1909,	*6,000,	**09,** 1589.
1910,	*[illegible],000,	**10,** 1744.
1911,	*3,000,	**11,** 1893.
1912,	*3,000,	**12,** 2102.

Total, 59,835 (incl. sales, $59,850, **12,** 2102).

COMMERCE.

Amount of C. benefited by imp., **72,** 396.

Description of, small, **93,** 2128; **95,** 2030; **00,** 2616.

93% of C. for 1902 was saw logs, railway ties, and square timber in rafts; SS. navigation possible all the year to Johnsons Landing, above that point rafting impracticable for 5½ months, **02,** 363.

Statistics, 1895 to 1911, incl., **11,** 797.

1895, 31,000 t.; 1900, 65,000 t.; 1905, 74,000 t.; 1908, 28,000 t.; 1911, 24,000 t., **12,** 797.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies $863.41. D. E. Jones Co., ship supplies, $1,601.36 **9** 2031.

ENGINEERS.

Chief of Engineers. R., 71, 59; **73,** 55; **80** 158; **81,** 213, 219; **82,** 217; **83,** 224; **91,** 257; **93;** 279; **94,** 254; **95,** 285; **96,** 247; **97,** 314; **98,** 306; **99,** 367, 369; **00,** 422, 424; **01,** 431; **02,** 362; **03,** 385; **04,** 407; **05,** 419; **06,** 456; **07,** 482; **08,** 515; **09,** 543; **10,** 611; **11,** 657; **12,** 795.

In charge:

Lt. Col. W. F. Raynolds, 1871–72. **R., 72,** 395.

Col. J. H. Simpson, 1872–73. **R., 73,** 461.

Maj. W. H. H. Benyaurd, 1880–82. **R., 81,** 1467, 1517.

Capt. T. H. Handbury, 1882–83. **R., 82,** 1586; **83,** 1175.

Capt. H. S. Taber, 1890–93. **R., 91,** 2065; **93,** 2128.

Lt. Wm. L. Sibert, 1895–98. **R., 95,** 2029; (Capt.) **96,** 1689; **97,** 1978; **98,** 1671.

Lt. Robert McGregor, 1899–1900. **R., 99,** 2042; (Capt.) **00,** 2608, 2614.

Capt. G. D. Fitch, 1901–06. **R., 01,** 2124; **02,** 1587; **03,** 1434; (Maj.) **04,** 2113; **05,** 1576; **06,** 1395.

Capt. W. D. Connor, 1907–08. **R., 07,** 1529; **08,** 1603.

Maj. M. L. Walker, 1909–10. **R., 09,** 1588; **10,** 1742.

Maj. C. S. Smith, 1912–. **R., 11,** 1892; **12,** 2101.

Assistants:

J. D. McKown, **73,** 460.

A. D. Wolf, **73,** 460.

A. H. Blaisdell. **R., 72,** 395.

J. R. Van Frank. **R., 91,** 2067; **00,** 2615.

P. R. Van Frank, jr. **R., 00,** 2609.

OBSTRUCTIONS.

The Current River Railway br. the only permanent obstr., **00,** 2617.

OPERATIONS.

1871-72. 123 snags and 592 leaning trees removed, and 1,040 l. f. of brush and wing dams built, **73,** 55, 461.

1881-82. 180 snags removed, 3,000 overhanging trees cut, **82,** 1586.

1882-83. 85 snags removed, **83,** 1175.

1894-95. About 1,300 snags and other obstr. removed, **95,** 2030.

1895-96. About 2,600 snags, etc., removed, **96,** 1690.

1896-97. About 300 snags, etc., removed, **97,** 1978.

1897-98. About 1,200 snags, etc., removed, **98,** 1671.

1898-99. About 50 obstr. removed from chan., **99,** 2042.

1899-00. About 7,500 obstr. removed from chan., **00,** 2609.

1900-01. 120 snags removed and 7 trees cut, **01,** 2124.

1902-03. 160 snags removed, 749 trees cut, and 1 drift broken up, **03,** 1435.

1903-04. 566 snags removed, 862 trees cut, and 5 drifts broken up, **04,** 2114.

1904-05. 455 snags removed, 451 trees cut, and 5 drifts broken up, **05,** 1576.

1905-06. 759 snags removed, 2,395 trees cut, and 6 drifts broken up, **06,** 1395.

1906-07. 30 snags removed and 77 trees cut, **07,** 1529.

1907-08. 619 snags removed, 939 trees cut, and 10 drifts broken up, **08,** 1604.

1908-09. 666 snags removed and 1,463 trees cut, **09,** 1588.

1909-10. 948 snags removed, 2,637 trees cut, 16 drifts broken up, and 24 bowlders removed, **10,** 1743.

1910-11. 865 snags and 3 bowlders removed, 910 trees cut, and 23 drifts broken up, **11,** 1892.

1911-12. 971 snags and 3 bowlders removed, 585 trees cut, and 12 drifts broken up, **12,** 2102.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 396; **91,** 2065; **93,** 2128; **00,** 2615.

About 200 m. l., lower 94 m. (mouth to Van Buren) under proj. Empties into Black R., **12,** 795.

PRIVATE (STATE) WORK.

In 1855 Missouri app. $10,000; expend., 1857, removing snags and leaning trees, **72,** 397. In 1871 $20,000 app. by the State, **72,** 397; **73,** 460.

PROJECTS.

By Lt. Col. Raynolds, proposed removing snags, leaning trees, and constr. of dams of brush and st.; est., $25,722.62, **72,** 398.

By Maj. Benyaurd, 1880, proposed concentration of water over shoal places with brush and st. wing dams, and removal of snags, logs, and trees from chan.; est., $17,365, **81,** 1517.

By Capt. Taber, 1890, to remove logs, etc., from chan., and also to contract the water w. at worst places by wing dams; est., $10,000, **91,** 2066; **93,** 2129; apparently adopted, 1896, **96,** 1689; **12,** 796.

In 1897 Capt. Sibert est. $2,000 an. mainten., **97,** 1978.

SURVEYS.

Au. act Mar. 3, 1871, **71,** 59. Assigned to Lt. Col. Raynolds, and made by A. H. Blaisdell. **R., 72,** 395.

* Allotment.

Au. act June 14, 1880; made by Maj. Benyaurd, **81,** 1467.
Ex. made, 1890, by Capt. Taber, **91,** 2065.
Ex. au. act July 13, 1892; made, 1893, by Capt. Taber (**R.** fav. to snagging) ,**93,** 2128.
Ex., junction with Crooked Creek to the s. line of Carter Co., Mo., au. act Mar. 3, 1899; made by Lt. McGregor (**R.** unfav.), **00,** 2614.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 796.

Y-30 LITTLE BLACK RIVER, ARK. AND MO.

ENGINEERS.
Chief of Engineers. **R., 09,** 548.
In charge. Maj. M. L. Walker, **09,** 532.

SURVEY.
Pre. ex. au. act Mar. 3, 1909. **R.,** Maj. Walker, Apr. 20, 1909 (unfav.),[1] **09,** 548.

Y-45 LITTLE RED RIVER, ARK.

(See also "White, Black, Little Red, and St. Francis Rivers," on p. 827.)

APPROPRIATIONS.

1886,	$3,000.00, **87,** 1505.
1888,	5,400.00, **88,** 1378.
1894,	5.14, act Aug. 23.
Total,	8,405.14

COMMERCE.
Important, **85,** 1612.
Prospective advantages to C. to arise from imp., **91,** 2054; **92,** 1688.
Not very large; about 5,000 t. logs, etc., an., **04,** 2120.

ENGINEERS.
Chief of Engineers. **R., 81,** 219; **82,** 217; **85,** 252; **87,** 204; **83,** 185; **89,** 217; **90,** 196; **91,** 254; **92,** 245; **93,** 276; **04,** 411.

Boards. BERH. recom. approval of work as stated in **R.** of DO., **04,** 2122.

In charge:
Capt. T. H. Handbury. **R., 82,** 1587.
Capt. H. S. Taber, 1885–03. **R., 85,** 1587; **87,** 1503; **88,** 1377; **89,** 1641; **90,** 1927; **91,** 2053; **92,** 1687; **93,** 2115.
Maj. G. D. Fitch, 1904. **R., 04,** 2119.

Assistants:
F. W. Tuttle. **R., 82,** 1588.
M. A. Orlopp. **R., 85,** 1613.

OPERATIONS.[2]
1886–87. Removal of snags from below Judsonia, and of bowlders from shoal 3 m. below Judsonia, **87,** 1504.
1888–89. Dr. and 2 material barges built, **89,** 1642.
1889–90. 495 t. of r. removed from Bess Shoals below Judsonia, **90,** 1927.
1890–91. 3,331 trees and 100 cords of brush cleared from chan. and banks, **91,** 2054.
1891–92. 11,794 overhanging trees and 146 cords of brush cleared from banks, and 100 t. of r. removed from Bess Shoals, **92,** 1688.

PHYSICAL CHARACTERISTICS.
Description of R., **82,** 1588; **85,** 1613.

PLANS. (See Projects.)
By Capt. Handbury, 1881, removal of snags and similar obstr. below Judsonia, and removal of bowlders and loose r. from Utleys Shoal and Knights Bar; est., $16,100, **82,** 1587, 1589.

PROJECTS. (See Plans.)
By Capt. Taber, 1884, imp. of 3 shoals above Judsonia, by removal of obstr. bowlders, and cutting chan. 3′ d. through shoals below Judsonia; est., $8,400, **85,** 1612, 1616; **87,** 1504. Increased in 1890 to $11,400, **90,** 1927.

SURVEYS.
Ex. au. act Mar. 3, 1881; made by Capt. Handbury (see Plans), **82,** 1587.
Ex. au. act July 5, 1884; made by Capt. Taber (see Projects), **85,** 1612.
Pre. ex. and sur. au. act June 13, 1902, from mouth of R. to and incl. the U. S. quarries at Bee Rock. **R.** by Maj. Fitch, Jan. 13 and May 16, 1903; est., $3,000,[3] **04,** 411, 2119.

Y-47 ST. FRANCIS RIVER, ARK. AND MO.[4]

(See also "White, Black, Little Red, and St. Francis Rivers," on p. 827.)

Part.	Title.	Period.	Appropriations.
a	St. Francis R.	1880–1892	$56,500.34
b	St. Francis R., lower	1893–1901	109,000.00
c	St. Francis R., upper	1893–1905	15,000.00
d	St. Francis R., L'Anguille R., and Blackfish Bayou	1902–1912	61,237.19
	Total		241,737.53

[1] H. D. 74, 61st, 1st.
[2] History of previous operations, **87,** 1503.
[3] H. D. 205, 58th, 2d.
[4] Sur.—**R.,** Jan. 17, 1837. (H. D. 482, 55th, 2d.)

Part (a), Y-47 St. Francis River, Ark. and Mo.

APPROPRIATIONS.

1880,	[1] $5,000.00,	**80,** 1315.
1884,	[2] 12,000.00,	**85,** 1597.
1886,	[2] 8,000.00,	**86,** 1384.
1888	[3] 4,000.00,	**88,** 1416.
	[4] 5,000.00,	**88,** 191.
1890	[3] 4,000.00,	**90,** 1954.
	.34, act Sept. 30.	
	[5] 10,500.00, act Sept. 19.	
1892,	[3] 8,000.00,	**92,** 1694.
Total,	56,500.34	

COMMERCE.

Value of imp., **86,** 1383, 1385; **87,** 1541.

Benefits to be derived from completion of imp., **88,** 1416; **89,** 1665; **91,** 2061.

ENGINEERS.

Chief of Engineers. R., 80, 154, 158; **81,** 213, 217; **85,** 249; **86,** 242; **87,** 209, 210; **88,** 190; **89,** 224; **90,** 201, 202; **91,** 255, 256; **92,** 246, 247.

In charge:

Maj. W. H. H. Benyaurd, 1879–82. **R., 80,** 1315; **81,** 1434, 1481.

Capt. T. H. Handbury, 1881. **R., 81,** 1513.

Capt. H. S. Taber, 1884–92. **R., 85,** 1595; **86,** 1382; **87,** 1539, 1549; **88,** 1414; **89,** 1664, 1666; **90,** 1952, 1954; **91,** 2059, 2062; **92,** 1693, 1694.

Assistant. J. B. Roherer. **R., 81,** 1482.

OPERATIONS.

1880–81. 2,949 logs, snags, and trees removed, **81,** 1434.

1884–85. Constr. of snag boat, and removal of 849 snags and trees, **85,** 1596.

1885–86. Snagging operations continued, **86,** 1383.

1886–87. 189 snags removed, **87,** 1540.

1887–88. Snagging operations continued, **88,** 415.

1888–89. Snagging operations continued bet. Kenneth, Mo., and St. Francis, Ark.; 216 snags and drift piles removed from chan., and 50 trees cleared from banks bet. Greenville and Poplin, Mo., **89,** 1664, 1666.

1889–90. Snagging continued bet. Kennett and St. Francis; 309 snags and 4 drift piles cleared from chan., and 175 overhanging trees from banks bet. Wappapello and Poplin, Mo., **90,** 1952, 1955.

1890–91. Snagging operations continued on upper and lower R., **91,** 2060, 2063.

1891–92. 1,628 snags removed from upper and lower R., and 5,405 trees cleared from banks, **92,** 1693, 1695.

PLANS. (See Projects.)

By Maj. Benyaurd, 1880, to secure l.-w. navigation in St. Francis from Greenville to Cairo, Arkansas & Texas RR., by removal of snags, etc., and constr. of l.-w. dams; est., $24,426. Col. Simpson **R.** that C. would not justify the above expend., in which opinion Maj. Benyaurd concurs, **81,** 1482, 1484.

In 1887 Capt. Taber considered reach, Greenville to Arkansas State line, worthy of imp., by removal of snags and similar obstr.; est., $7,300, **87,** 1550.

PROJECTS. (See Plans.)

By Maj. Benyaurd, 1880, imp. bet. Wittsburg and Lester Landing, by cutting and marking a chan. through the lake region, removing snags and similar obstr. from the bed and banks of the stream. No est. made for completion of this proj., and only an app. of $5,000 made, 1880, **80,** 1315; **81,** 1434.

In 1887 Capt. Taber proposed imp., Greenville to the Arkansas State line, by removal of snags and similar obstr.; est., $7,300, **87,** 1550.

SURVEYS.

Greenville, Mo., to Cairo, Arkansas & Texas RR., au. act June 14, 1880; made, 1881, by Maj. Benyaurd (see Projects), **81,** 1481.

Greenville to State line, au. act Aug. 5, 1886; made by Capt. Taber (see Projects), **87,** 1549.

Part (b), Y-47 St. Francis River, Ark.

APPROPRIATIONS.

1894,	[6] $83,000,	**95,** 2033.
1896,	8,000,	**96,** 1693.
1899,	8,000,	**99,** 2043.
Total,	[7] 99,000	

COMMERCE.

Description of, **94,** 1558; **95,** 2033; **96,** 1692; **01,** 2128.

Description of; after ex. of 1897, imp. of R. from mouth to Wittsburg, etc., not recom., **98,** 1682–1683.

C., 1900, 45,056 t.; value, $194,057, **00,** 423.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies, $863.37; Dickinson Hardware Co., ship supplies, $1,619.12, **95,** 2034.

ENGINEERS.

Chief of Engineers. R., 93, 278; **94,** 255; **95,** 285; **96,** 248; **97,** 314; **98,** 307; **99,** 368; **00,** 423; **01,** 432.

In charge:

Capt. H. S. Taber, 1884–93. **R., 93,** 2118.

Capt. C. F. Palfrey, 1894. **R., 94,** 1557.

Lt. Wm. L. Sibert, 1895–98. **R., 95,** 2031; (Capt.) **96,** 1691; **97,** 1980; **98,** 1673, 1678.

Lt. R. McGregor, 1899–1900. **R., 99,** 2043; (Capt.) **00,** 2610.

Capt. G. D. Fitch, 1901. **R., 01,** 2126.

Assistant. P. R. Van Frank, jr. **R., 98,** 1683; **00,** 2612.

OPERATIONS.

1892–93. About 1,500 snags and other obstr. removed, **93,** 2118.

1893–94. Nearly 6,000 snags, etc., removed, and plant repaired, **94,** 1558.

1894–95. About 3,200 snags, etc., removed, **95,** 2032.

1895–96. Wreck removed, and about 1,200 snags, etc., also removed, **96,** 1692.

1896–97. Portion of plant rebuilt (field expend. of the same, **97,** 1981); and nearly 3,000 snags, etc., removed, **97,** 1980.

1897–98. About 900 snags, etc., removed, **98,** 1673.

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[1] Between Wittsburg and Lester Landing.
[2] St. Francis R.
[3] St. Francis R., Ark.
[4] St. Francis R., Mo.
[5] Act Sept. 19, 1890, app. $10,500 for R. between Greenville, Mo., and Arkansas line.
[6] $75,000 of this to be expend. by Mississippi R. Commission for levees. [7] See p. 827.

1899-00. About 7,000 obstr. removed from chan., **00,** 2612.

1900-01. Hand-propelled snag boat *A. B. Johnson* removed 1,658 snags and other obstr., **01,** 2126.

PHYSICAL CHARACTERISTICS.

Description of, **94,** 1556; **95,** 2032; **98,** 1673; **01,** 432.

Description of, bet. mouth and Wittsburg, etc., **98,** 1679. Movement of sand in the stream, **98,** 1680. Discharge observations, **98,** 1685.

A large portion of St. Francis Valley liable to overflow of Mississippi, which retards C. development, **98,** 1683.

PROJECTS.

Works of imp. apparently effective, **96,** 1693; **97,** 1981; navigation season lengthened about 2 months by snagging operations, **98,** 1673.

After sur., 1897, Capt. Sibert est. $659,770 to $980,720 to obtain slack-water navigation, **98,** 1682.

SURVEYS.

Sur. with view to slack-water navigation up to Wittsburg, and to Marianna on L'Anguille R., its tributary, au. act June 3, 1896; made, 1897, by Capt. Sibert (**R.** unfav.), **98,** 1678.

Part (c), Y-47 St. Francis River, Mo.

APPROPRIATIONS.

1894,	$5,000,	**95,** 2036.
1902,	10,000,	**02,** 1591.
Total,	15,000	

COMMERCE.

Description of. Solely in lumber and staves, centering at Poplin and St. Francis, **94,** 1565; **95,** 2035; **96,** 1695.

After ex., 1895, removal of obstr. from Sunk Lands to Chalk Bluff and confinement of R. to one chan. recom., as was also removal of snags from Chalk Bluff to Poplin, **95,** 2041. After sur. of 1896, imp. bet. Sunk Lands and Poplin recom., **97,** 2000.

No permanent increase of C. to be expected from imp. bet. Greenville and mouth of the Mingo, **00,** 2619.

1901, 6,420 t., **02,** 365.

1903, rafted saw logs and piling only, **03,** 389.

CONTRACTS.

1895. H. J. George & Co., subsistence supplies, $863.37; Dickinson Hardware Co., ship supplies, $1,608.71, **95,** 2036.

ENGINEERS.

Chief of Engineers. **R., 93,** 278; **94,** 255; **95,** 286; **96,** 248; **97,** 315, 317; **98,** 308; **99,** 369; **00,** 424; **02,** 365; **03,** 388; **04,** 410; **05,** 422.

In charge:

Capt. H. S. Taber, 1884–93. **R., 93,** 2119.

Capt. C. F. Palfrey, 1894. **R., 94,** 1564.

Lt. Wm. L. Sibert, 1895–98. **R., 95,** 2035, 2040; **96,** 1695; **97,** 1982, 1999; **98,** 1675.

Lt. R. McGregor, 1899–1900. **R., 99,** 2045; (Capt.) **00,** 2618.

Capt. G. D. Fitch, 1902–05. **R., 02,** 1591; **03,** 1438; (Maj.) **04,** 2117; **05,** 1581.

OPERATIONS.

1892-93. Nearly 1,500 snags and other obstr. removed, **93,** 2120.

1895-96. Nearly 1,600 snags, etc., removed, **96,** 1695.

1896-97. Nearly 700 snags, etc., removed, **97,** 1983.

1902-03. 5,861 snags and other obstr. removed, **03,** 1439.

1903-04. 835 snags and other obstr. removed, and chan. 30′ w. opened through 9 drift jams, by removal of 1,158 snags and logs; movable property shipped to Batesville, Ark., and barge and scows sold at public auction, **04,** 2118.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2035; **96,** 1695.

Description of, from Sunk Lands to Greenville, about 128 m., **95,** 2040.

In its orig. condition, this R. not navigable at low stages, on account of shoals, snags, and other obstr., **02,** 365.

PROJECTS.

Snagging apparently effective, **97,** 1983.

In 1896 Capt. Sibert est. $11,200 to imp. R., Sunk Lands to Poplin, and $2,000 an. mainten., **97,** 1999.

Act June 13, 1902, au. proj. to clear R. of snags, drifts, and overhanging trees, head of Sunk Lands to Chalk Bluff, and to confine R. to one chan.; to remove snags, drifts, and overhanging trees that interfered with navigation at medium and high stages of water, from Chalk Bluff to Poplin, Mo.; est., $11,200, and $2,000 an. mainten. (see above), **03,** 388.

Act Mar. 3, 1905, repealed provisions of previous acts providing for prosecution of imp., and no further work contemplated, **05,** 423.

SURVEYS.

Ex., Sunk Lands to Greenville, Mo., au. act Aug. 17, 1894; made by Lt. Sibert, 1895 (**R.** fav. for snag removal), **95,** 2040.

Sur. and est. of cost of imp., Sunk Lands to Poplin, Mo., called for by act June 3, 1896; **R.** by Capt. Sibert, 1896 (see Projects), **97,** 1999.

Ex. of St. Francis R., Mo., Greenville to mouth of the Mingo, au. act Mar. 3, 1899; made, 1899, by Lt. McGregor (**R.** unfav.), **00,** 2618.

Part (d), Y-47 St. Francis and L'Anguille Rivers and Blackfish Bayou, Ark.

APPROPRIATIONS.

1902,	$9,000.00,	**02,** 1591.
1904,	4,237.19,	**04,** 2116.
1905,	6,000.00,	**05,** 1579.
1907,	12,000.00,	**07,** 1531.
1909,	9,000.00,	**09,** 1591.
1910,	9,500.00,	**10,** 1747.
1911,	2,500.00,	**11,** 1896.
1912,	9,000.00,	**12,** 2105.
Total,	61,237.19	

COMMERCE.

1901, 272,609 t., **02,** 364; 1905, 137,319 t., **06,** 1398; 1911, 298,470 t., **12,** 2105.

R. in fine boating stage throughout year, **06,** 1398.

ENGINEERS.

Chief of Engineers. **R., 02,** 362; **03,** 386; **04,** 408; **05,** 421; **06,** 458, 460; **07,** 484; **08,** 517; **09,** 545; **10,** 613; **11,** 660; **12,** 798, 802.

Boards. BERH. **R., 06,** 460. (See Surveys.)

In charge:
Capt. G. D. Fitch, 1902–06. **R., 02,** 1590; **03,** 1436; (Maj.) **04,** 2115; **05,** 1579; **06,** 1397.
Capt. W. D. Connor, 1907–08. **R., 07,** 1531; **08,** 1606.
Maj. M. L. Walker, 1909–10. **R., 09,** 1590; **10,** 1746.
Maj. C. S. Smith, 1911–. **R., 11,** 1895; **12,** 2104.

OPERATIONS.

1902-03. Snag boat overhauled; 546 snags removed, 1,297 trees cut, and 1 drift broken up on St. Francis R.; 530 saw logs and snags removed from L'Anguille R., **03,** 1436–37.

1903-04. 464 snags removed and 1,013 trees cut bet. Madison and Davis Bend, **04,** 2115.

1904-05. Constr. of new hull for snag boat *A. B. Johnson* begun Aug. 20, 1904, and rebuilding of boat completed Oct. 28, 1904; 343 snags removed and 661 trees cut from 46 m. of R. worked over, **05,** 1579.

1905-06. Minor repairs to snag boat, and 424 snags removed, 5,650 trees cut, and 4 drifts broken up, **06,** 1397.

1907-08. 776 snags removed, 4,103 trees cut, and 31 drifts broken up, **08,** 1606–07.

1908-09. 999 snags removed, 5,055 trees cut, and 10 drifts broken up, **09,** 1590.

1909-10. 956 snags removed, 1,740 trees cut, and 10 drifts broken up on St. Francis R., and 177 snags removed and 100 trees cut from L'Anguille R. Extensive repairs made to snag boat, **10,** 1746.

1910-11. 654 snags removed, 709 trees cut, 53 drifts broken up, and 845 trees girdled on St. Francis R.; 189 snags removed, 412 trees cut, and 55 trees trimmed on Blackfish Bayou; 103 snags removed, 107 trees cut, and 137 trees girdled on L'Anguille R., **11,** 1895.

1911-12. 656 snags removed, 166 trees cut, and 5 drifts broken up on St. Francis R.; 62 snags removed, 37 trees cut, and 1 drift broken up on L'Anguille R.; 102 snags removed and 82 trees cut on Blackfish Bayou, **12,** 800, 2104.

PHYSICAL CHARACTERISTICS.

In its orig. condition, St. Francis R. not navigable above Lesters Landing at any stage; bet. that landing and Marked Tree, navigation possible at high stages only; and below Marked Tree, difficult at medium and lower stages, and impossible at extreme l. w., **07,** 484.

During period of l. w., neither stream is navigable, **08,** 518.

Marianna, at head of navigation on L'Anguille R., **08,** 518.

Blackfish Bayou, one of the principal drainage chans. for lower portion of St. Francis Basin, **12,** 798, 799.

PROJECTS.

Sec. of War au. expend. of allotment of $4,300, act June 13, 1902, for new hull for snag boat *A. B. Johnson,* **04,** 2116.

Act June 25, 1910, au. removal of snags and overhanging timber obstr. chan., from Blackfish Bayou, Ark., in connection with similar work "now being done" on St. Francis R.; est. an. cost, $500; and that of the consolidated app. made, an amount not exceeding that sum may be expended in the discretion of the Sec. of War for purpose stated,[1] **10,** 615.

SURVEYS.

Pre. ex. of St. Francis R., with view to open chan. imp., au. act Mar. 3, 1905. **R.** by Maj. Fitch, Oct. 12, 1905[2] (unfav.). BERH. reviewed Maj. Fitch's **R.,** and concurred in his views, **06,** 460.

Pre. ex. and sur. au. act June 25, 1910, of St. Francis R., from mouth, to mouth of L'Anguille R., and of the L'Anguille R. from mouth to Marianna (**R.** to come), **12,** 802.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 800.

Y-52 LITTLE RIVER, ARK. AND MO. (From Homersville to its junction with the St. Francis.)

APPROPRIATIONS.

1888,	$5,000.00,	**88,** 191.
1890,	3,000.00,	**90,** 1957.
1893,	.80,	act Mar. 3.
1894,	.13,	act Aug. 23.
Total,	8,000.93	

ENGINEERS.

Chief of Engineers. R., 87, 210; **88,** 191; **89,** 225; **90,** 202; **91,** 256; **92,** 247; **93,** 279.

In charge. Capt. H. S. Taber, 1887–93. **R., 87,** 1548; **89,** 1668; **90,** 1956; **91,** 2064; **92,** 1696; **93,** 2121.

OPERATIONS.

1889-90. Snagging operations begun, **90,** 1956.

1890-91. 109 snags removed from chan., 25 c. y. earth excavated, 161 trees cleared from banks, and a dam 300′ l. built across chute, **91,** 2064.

1891-92. 96 snags and 8 drift piles removed from chan., and 1,087 overhanging trees cleared from banks, **92,** 1697.

PROJECTS.

By Capt. Taber, 1887, 8 months' navigation, mouth to Homersville, by dam constr. closing cut-off, and removal of snags and similar obstr.; est., $8,000, **87,** 1549; **88,** 191. Increased in 1892 to $11,000, **92,** 1697.

SURVEY.

Ex. au. act Aug. 5, 1886; made by Capt. Taber, **87,** 1548.

Y-54 BAY RIVER, (St. Francis Bay) ARK.

ENGINEERS.

Chief of Engineers. R., 80, 158; **81,** 213.

In charge. Maj. W. H. H. Benyaurd, 1880. **R., 81,** 1497.

Assistant. J. B. Rohrer. **R., 81,** 1497.

SURVEYS.

Au. act June 18, 1878, **80,** 158; made by Maj. Benyaurd, 1880 (**R.** unfav.), **81,** 1497.

[1] H. D. 73, 61st, 1st.

[2] H. D. 163, 59th, 1st.

Y-55 L'ANGUILLE RIVER, ARK.

(See Part (d) Y-47, p. 836.)

APPROPRIATIONS.

1878,	$10,000,	**79,** 115.
1879,	5,000,	**79,** 115.
1880,	2,000,	**80,** 1315.
Total,	17,000	

COMMERCE.

Important, H. Doc. 57, 45th Cong., 3d sess., **79,** 969.

Demands of C. do not require further app., **82,** 215; **86,** 1389.

ENGINEERS.

Chief of Engineers. R., 79, 115; **80,** 154; **81,** 217; **82,** 215; **83,** 222; **84,** 231; **85,** 251; **86,** 243; **87,** 209.

In charge:

Maj. W. H. H. Benyaurd, 1878–81. **R.,** H. D. 57, 45th, 3d, **79,** 969; **80,** 1315; **81,** 1434.

Maj. T. H. Handbury, 1881–83. **R., 81,** 1514; **82,** 1582; **83,** 1171.

Maj. M. B. Adams, 1883–84. **R., 84,** 1403.

Capt. H. S. Taber, 1884–87. **R., 85,** 1600; **86,** 1388; **87,** 1543.

OPERATIONS.

App. of 1878 applied to the purchase of a snag boat to be used upon L'Anguille, White, and St. Francis Rs., H. D. 57, 45th, 3d, **79,** 969.

1880–81. Removing snags and overhanging trees, **81,** 1434.

1881–82. Removing snags and overhanging trees, **82,** 1582.

1885–86. Removing snags and trees, **86,** 1389.

1886–87. Removing snags and trees continued, **87,** 1544.

PHYSICAL CHARACTERISTICS.

Snags, logs, etc., obstr. navigation, H. D. 57, 45th, 3d, **79,** 969.

PROJECT.

By Maj. Benyaurd, removing snags, logs, and other obstr. with snag boat *John R. Meigs;* est., $10,000, H. D. 57, 45th, 3d, **79,** 969.

Accomplished in 1882 by the expend. of $14,000±, and subsequent funds held for future contingencies, **85,** 1600.

SURVEY.

Ex. by Maj. Benyaurd, 1878. **R.,** H. D. 57, 45th, 3d.

RIVER AND HARBOR WORKS—LOWER MISSISSIPPI RIVER SYSTEM.

Z.—MEMPHIS, TENN., DISTRICT.

(1st and 2d Miss. R. Comm.)

The 1st Miss. R. district extends from Cape Girardeau, Mo., to the foot of Island No. 40 (270 m.).

The 2d Miss. R. district extends from foot of Island No. 40 to White R. (173 m.).

See p. 1067 for data.

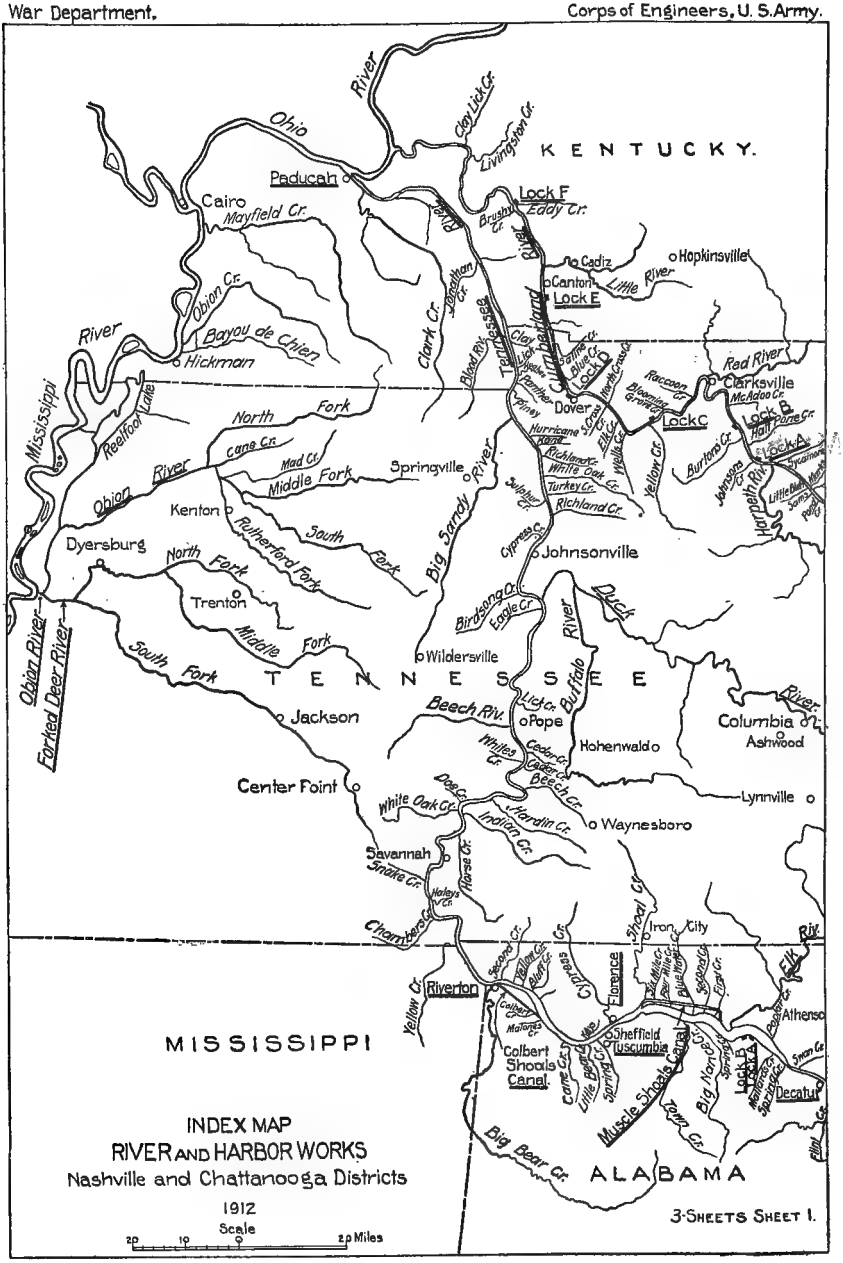
RIVER AND HARBOR WORKS.

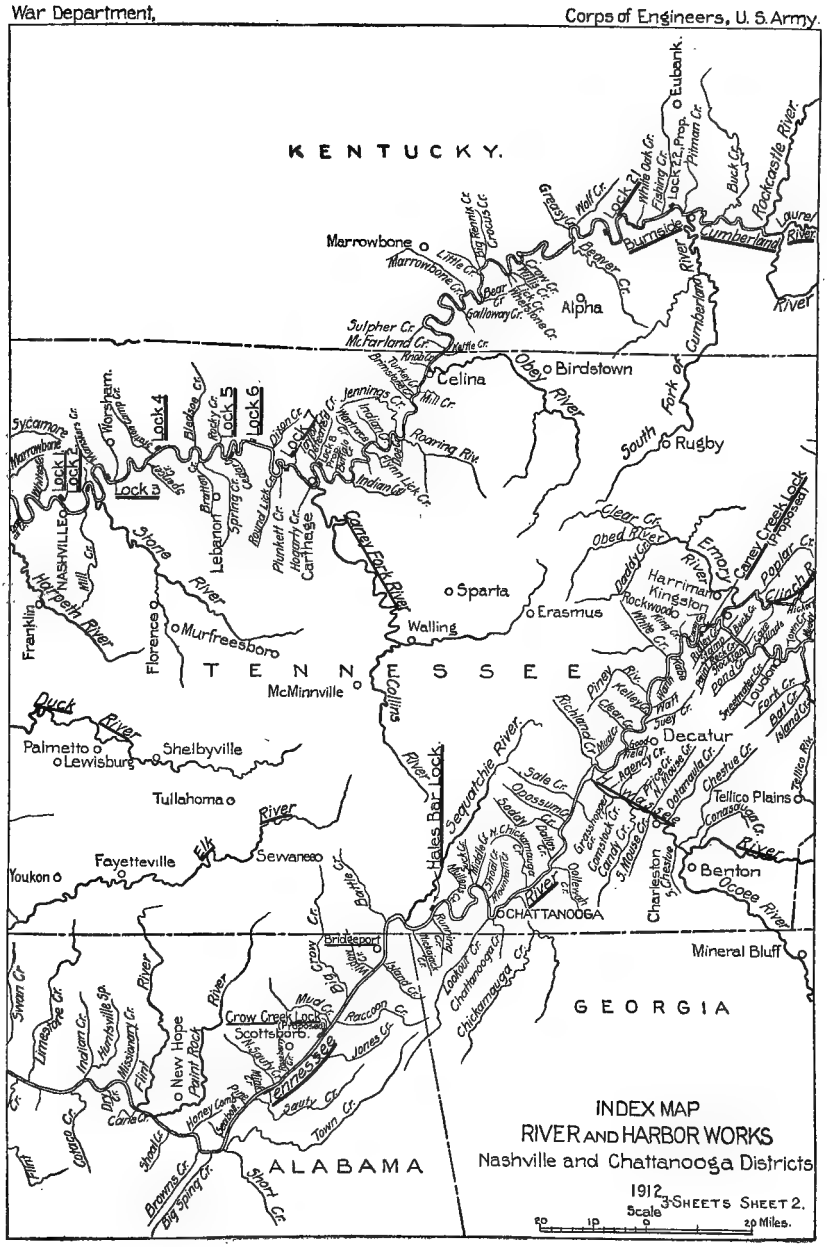
MISSISSIPPI RIVER SYSTEM—OHIO RIVER BRANCH.

The waterway groups of the Ohio R. system begin with the waterways of AA District, in the vicinity of Cairo, Ill. The list proceeds eastward toward and into Pennsylvania. The limits of the groups of waterways are outlined at the beginning of each district.

OHIO RIVER SYSTEM.

AA.—CHATTANOOGA AND NASHVILLE, TENN., DISTRICT.


War Department.
Corps of Engineers, U. S. Army.
KENTUCKY.
TENNESSEE
MISSISSIPPI
ALABAMA
Ohio River
Paducah
Cairo
Mayfield Cr.
Obion Cr.
Bayou de Chien
Hickman
Mississippi River
Reelfoot Lake
North Fork
Cane Cr.
Mad Cr.
Middle Fork
Obion River
Kenton
Dyersburg
Rutherford Fork
South Fork
North Fork
Trenton
Middle Fork
South Fork
Obion River
Forked Deer River
Jackson
Center Point
Clay Lick Cr.
Livingston Cr.
Lock F
Eddy Cr.
Brushy Cr.
Cadiz
Hopkinsville
Canton
Lock E
Little River
Clark Cr.
Jonathan Cr.
Blood Riv.
Tennessee River
Cumberland River
Lock D
Dover
Hurricane Cr.
Stone
Richland Cr.
Turkey Cr.
White Oak Cr.
Sulphur Cr.
Cypress Cr.
Big Sandy River
Springville
Johnsonville
Birdsong Cr.
Eagle Cr.
Wildersville
Beech Riv.
Lick Cr.
Pope
Hohenwald
Buffalo River
Duck River
Columbia
Ashwood
Lynnville
Waynesboro
White Oak Cr.
Doe Cr.
Indian Cr.
Hardin Cr.
Savannah
Snake Cr.
Horse Cr.
Chambers Cr.
Iron City
Shoal Cr.
Elk Riv.
Florence
Riverton
Yellow Cr.
Colbert Shoals Canal
Sheffield
Tuscumbia
Muscle Shoals Canal
Big Nortoc Cr.
Lock B
Lock A
Decatur
Athens
Big Bear Cr.
Red River
Clarksville
Lock C
Lock B
Lock A
Yellow Cr.
Burlaw Cr.
Johnsons Cr.
Harpeth Riv.
Raccoon Cr.
Bloomington Cr.
Elk Cr.
Yellow Cr.
Richland Cr.
Bamboo Cr.
Spring Cr.
Hall Cane Cr.
McAdoo Cr.
Little Bear Cr.
Swan Cr.
Town Cr.
Elm Cr.
INDEX MAP
RIVER AND HARBOR WORKS
Nashville and Chattanooga Districts
1912
Scale
20 10 0 20 Miles
3-SHEETS SHEET 1.


War Department,
Corps of Engineers, U. S. Army.
KENTUCKY.
TENNESSEE
GEORGIA
ALABAMA
Marrowbone
Alpha
Celina
Birdstown
Rugby
Sparta
Erasmus
Walling
Murfreesboro
Franklin
Florence
McMinnville
Palmetto
Lewisburg
Shelbyville
Tullahoma
Fayetteville
Sewanee
Youkon
Decatur
Tellico Plains
Benton
Ocoee River
Chattanooga
Bridgeport
Scottsboro
New Hope
Point Rock
Mineral Bluff
Harriman
Kingston
Rockwood
Charleston
Burnside
Eubank
Lock 1
Lock 2
Lock 3
Lock 4
Lock 5
Lock 6
Lock 7
Lock 8
Lock 21
Lock 22
Hales Bar Lock
Crow Creek Lock (Proposed)
Carey Creek Lock (Proposed)
Tennessee River
Cumberland River
Rockcastle River
Laurel River
Sequatchie River
Elk River
Duck River
Harpeth River
Stone River
Caney Fork River
Clinch R.
Emory River
Hiwassee R.
Ocoee River
Mud Cr.
Raccoon Cr.
Jones Cr.
Seuty Cr.
Town Cr.
Short Cr.
Big Spring Cr.
Browns Cr.
Cane Cr.
Honey Comb Cr.
Lost Cr.
Shoal Cr.
Flint
Cobbs Cr.
Swan Cr.
Limestone Cr.
Indian Cr.
Hurricane Sp.
Missionary Cr.
Big Nolichucky
Big Sandy
Big Pigeon
Big Creek
Big Cr.
Crow Cr.
Hickory Cr.
Island Cr.
Lookout Cr.
Chattanooga Cr.
Chickamauga Cr.
Tellico Riv.
Conasauga Cr.
Coosawattee Cr.
Cherokee Cr.
Fort Cr.
Blue Cr.
Hiwassee Cr.
Ocoee Cr.
Ocklawaha Cr.
Chestua Cr.
Sale Cr.
Opossum Cr.
Richland Cr.
Piney Cr.
Clear Cr.
Obed River
Daddy Cr.
Emory River
Poplar Cr.
Clinch R.
Caney Creek Lock (Proposed)
Roaring Riv.
Indian Cr.
Jennings Cr.
Mill Cr.
Sulpher Cr.
McFarland Cr.
Little Cr.
Marrowbone Cr.
Bear Cr.
Galloway Cr.
Beaver Cr.
Wolf Cr.
Grassy Cr.
Fishing Cr.
White Oak Cr.
Pitman Cr.
Buck Cr.
Rockcastle River
Sycamore Cr.
Worsham Cr.
Eleatha Cr.
Spring Cr.
Lebanon
Plunkett Cr.
Hogarty Cr.
Carthage
Indian Cr.
Elm Lick Cr.
Mill Cr.
Stone River
Harpeth River
Mill Cr.
Duck River
Elk River
Sequatchie River
Hales Bar Lock
Collins River
Piney Riv.
Richland Cr.
Sale Cr.
Opossum Cr.
Sweetwater Cr.
Fort Cr.
Blue Cr.
Hiwassee Cr.
Ocoee Cr.
Ocklawaha Cr.
Chestua Cr.
Tellico Riv.
Conasauga Cr.
Coosawattee Cr.
Cherokee Cr.
Chickamauga Cr.
Chattanooga Cr.
Lookout Cr.
Island Cr.
Hickory Cr.
Big Cr.
Crow Cr.
Big Sandy
Big Pigeon
Big Nolichucky
Big Spring Cr.
Browns Cr.
Cane Cr.
Honey Comb Cr.
Lost Cr.
Shoal Cr.
Flint
Cobbs Cr.
Swan Cr.
Limestone Cr.
Indian Cr.
Hurricane Sp.
Missionary Cr.
Flint
Big Nolichucky
Big Sandy
Big Pigeon
Big Creek
Big Cr.
Crow Cr.
Hickory Cr.
Island Cr.
Lookout Cr.
Chattanooga Cr.
Chickamauga Cr.
Tellico Riv.
Conasauga Cr.
Coosawattee Cr.
Cherokee Cr.
Fort Cr.
Blue Cr.
Hiwassee Cr.
Ocoee Cr.
Ocklawaha Cr.
Chestua Cr.
Sale Cr.
Opossum Cr.
Richland Cr.
Piney Cr.
Clear Cr.
Obed River
Daddy Cr.
Emory River
Poplar Cr.
Clinch R.
Caney Creek Lock (Proposed)
Roaring Riv.
Indian Cr.
Jennings Cr.
Mill Cr.
Sulpher Cr.
McFarland Cr.
Little Cr.
Marrowbone Cr.
Bear Cr.
Galloway Cr.
Beaver Cr.
Wolf Cr.
Grassy Cr.
Fishing Cr.
White Oak Cr.
Pitman Cr.
Buck Cr.
Rockcastle River
Laurel River
Cumberland River
Tennessee River
Sycamore Cr.
Worsham Cr.
Eleatha Cr.
Spring Cr.
Lebanon
Plunkett Cr.
Hogarty Cr.
Carthage
Indian Cr.
Elm Lick Cr.
Mill Cr.
Stone River
Harpeth River
Mill Cr.
Duck River
Elk River
Sequatchie River
Hales Bar Lock
Collins River
Piney Riv.
Richland Cr.
Sale Cr.
Opossum Cr.
Sweetwater Cr.
Fort Cr.
Blue Cr.
Hiwassee Cr.
Ocoee Cr.
Ocklawaha Cr.
Chestua Cr.
Tellico Riv.
Conasauga Cr.
Coosawattee Cr.
Cherokee Cr.
Chickamauga Cr.
Chattanooga Cr.
Lookout Cr.
Island Cr.
Hickory Cr.
Big Cr.
Crow Cr.
Big Nolichucky
Big Sandy
Big Pigeon
Big Spring Cr.
Browns Cr.
Cane Cr.
Honey Comb Cr.
Lost Cr.
Shoal Cr.
Flint
Cobbs Cr.
Swan Cr.
Limestone Cr.
Indian Cr.
Hurricane Sp.
Missionary Cr.
Flint
Big Nolichucky
Big Sandy
Big Pigeon
Big Creek
Big Cr.
Crow Cr.
Hickory Cr.
Island Cr.
Lookout Cr.
Chattanooga Cr.
Chickamauga Cr.
Tellico Riv.
Conasauga Cr.
Coosawattee Cr.
Cherokee Cr.
Fort Cr.
Blue Cr.
Hiwassee Cr.
Ocoee Cr.
Ocklawaha Cr.
Chestua Cr.
Sale Cr.
Opossum Cr.
Richland Cr.
Piney Cr.
Clear Cr.
Obed River
Daddy Cr.
Emory River
Poplar Cr.
Clinch R.
Caney Creek Lock (Proposed)
Roaring Riv.
Indian Cr.
Jennings Cr.
Mill Cr.
Sulpher Cr.
McFarland Cr.
Little Cr.
Marrowbone Cr.
Bear Cr.
Galloway Cr.
Beaver Cr.
Wolf Cr.
Grassy Cr.
Fishing Cr.
White Oak Cr.
Pitman Cr.
Buck Cr.
Rockcastle River
Laurel River
Cumberland River
Tennessee River
INDEX MAP
RIVER AND HARBOR WORKS
Nashville and Chattanooga Districts
1912 3-SHEETS SHEET 2.
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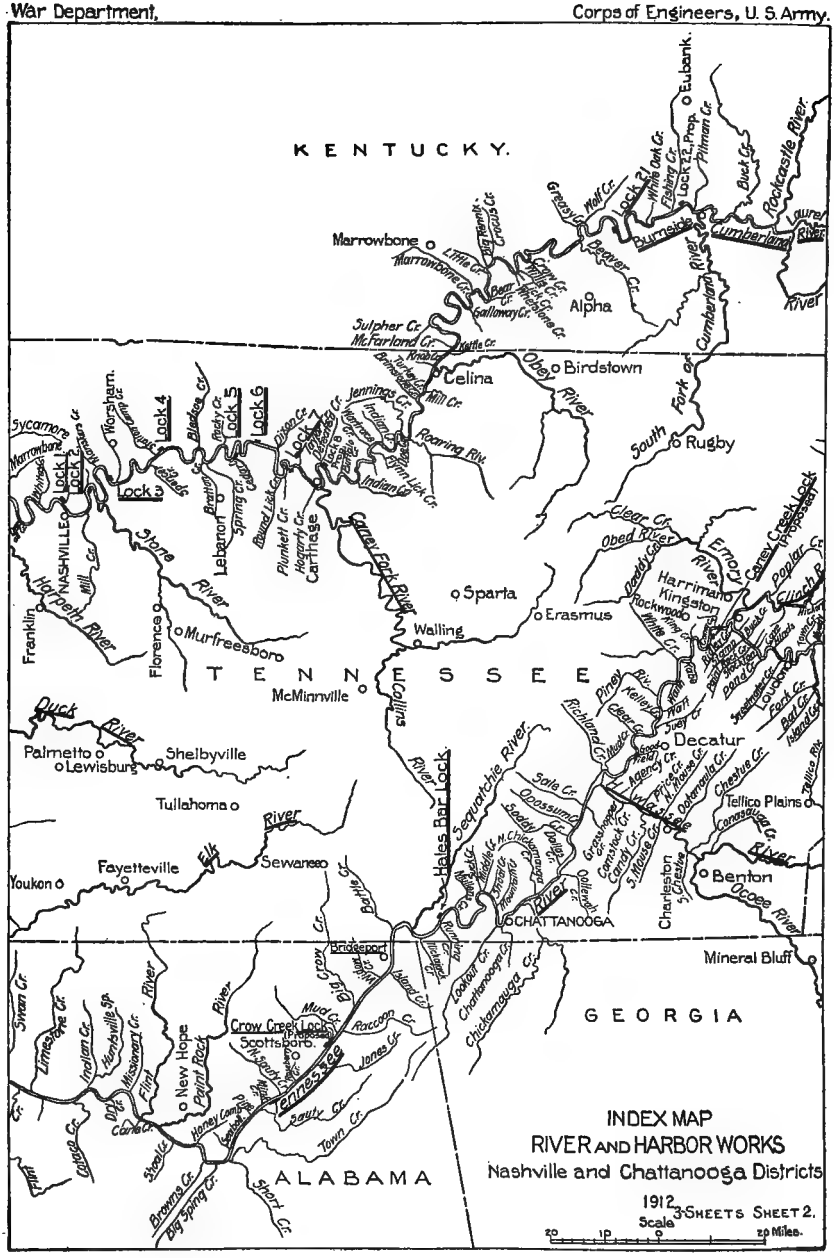

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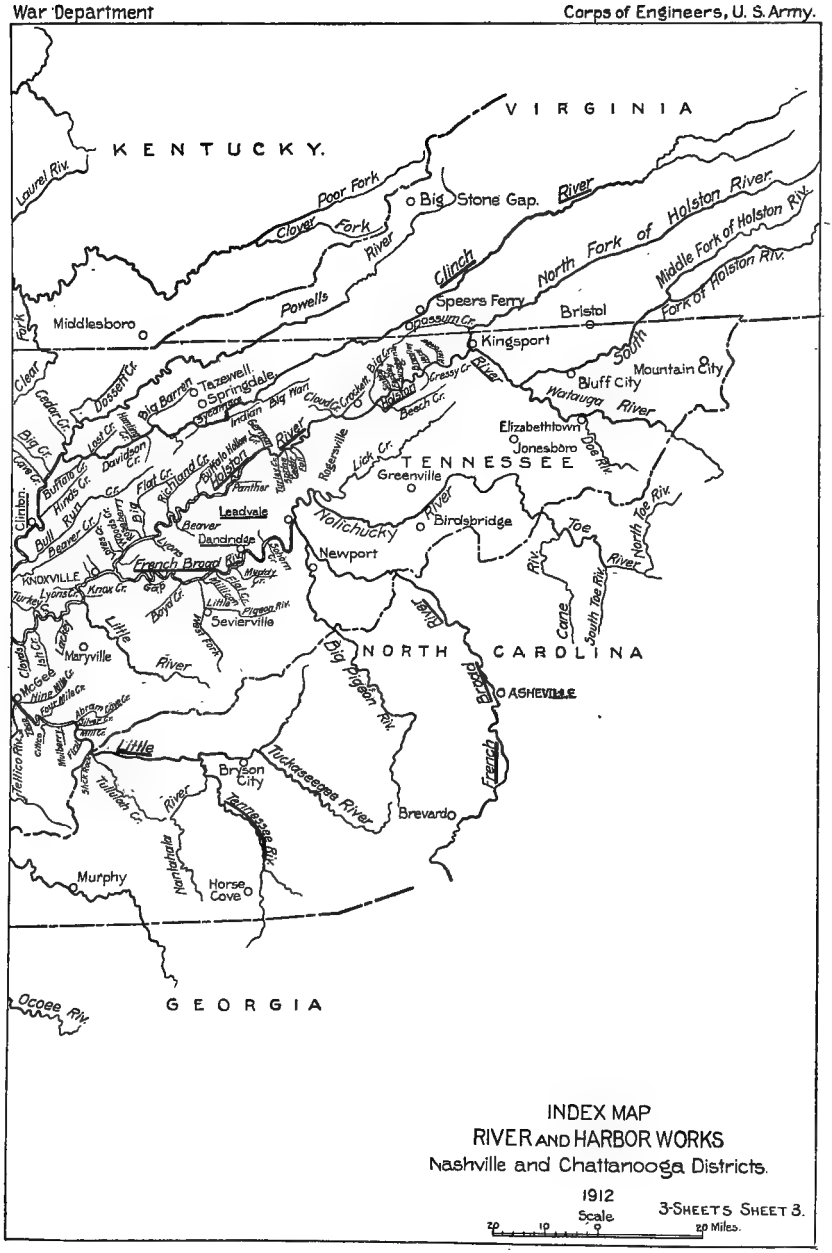

INDEX MAP
RIVER AND HARBOR WORKS
Nashville and Chattanooga Districts.
1912
Scale
20 10 0 20 Miles.
3-SHEETS SHEET 3.

AA.—CHATTANOOGA AND NASHVILLE, TENN., DISTRICT.

In charge of the U. S. Engineer Offices at Nashville and Chattanooga, Tenn.

Begins below Memphis, Tenn., proceeds along Mississippi River, east bank, into the Ohio River, ending at Tradewater River.

IN NASHVILLE ENGINEERING DISTRICT.

AA 1 Mississippi R.
AA 2 Wolf R., Tenn. and Miss. (1)
AA 3 Loosahatchie R., Tenn. (2)
AA 4 Hatchie R., Tenn. and Miss. (1)
AA 5 Obion R., Tenn. (1)
AA 6 Forked Deer R., Tenn. (5)
AA 7 South Fork R., Tenn. (6)
AA 8 North Fork R., Tenn. (6)
AA 9 Middle Fork R., Tenn. (8)
AA 10 South Fork, R., Tenn. (5)
AA 11 Rutherford Fork R., Tenn. (10)
AA 12 Middle Fork R., Tenn. (10)
AA 13 North Fork R., Tenn. (5)
AA 14 Reelfoot R. and Lake, Tenn. (5)
List returns again up Miss. R. to—
AA 15 Obion Cr., Ky. (1)
AA 16 Mayfield Cr., Ky. (1)
AA 17 Ohio R. (Cairo), Ky. (1)

IN CHATTANOOGA ENGINEERING DISTRICT.

AA 18 Tennessee R., Ky., Tenn., Ala., and Miss. (16)
AA 19 Clark R., Ky. and Tenn. (18)
AA 20 Jonathan Cr., Ky. (18)
AA 21 Blood R., Ky. and Tenn. (18)
AA 22 Big Sandy R., Tenn. (18)
AA 23 Sulphur Cr., Tenn. (18)
AA 24 Cypress Cr., Tenn. (18)
AA 25 Birdsong Cr., Tenn. (18)
AA 26 Eagle Cr., Tenn. (18)
AA 27 Beech R., Tenn. (18)
AA 28 Whites Cr., Tenn. (18)
AA 29 Doe Cr., Tenn. (18)
AA 30 White Oak Cr., Tenn. (18)
AA 31 Snake Cr., Tenn. (18)
AA 32 Chambers Cr., Tenn. and Miss. (18)
AA 33 Yellow Cr., Tenn. and Miss. (18)
AA 34 Big Bear Cr., Ala. and Miss. (18)
AA 35 Colbert Shoals Canal, Ala. (18)
AA 36 Malones Cr., Ala. (18)
AA 37 Cane Cr., Ala. (18)
AA 38 Little Bear Cr., Ala. (18)
AA 39 Spring Cr., Ala. (18)
AA 40 Town Cr., Ala. (18)
AA 41 Big Nance Cr., Ala. (18)
AA 42 Spring Cr., Ala. (18)
AA 43 Lock B, Tenn. R.
AA 44 Lock A, Tenn. R.
AA 45 Mallards Cr., Ala. (18)
AA 46 Spring Cr., Ala. (18)
AA 47 Flint Cr., Ala. (18)
AA 48 Cotaco Cr., Ala. (18)
AA 49 Dry Cr., Ala. (18)
AA 50 Cane Cr., Ala. (18)
AA 51 Shoal Cr., Ala. (18)
AA 52 Browns Cr., Ala. (18)
AA 53 Big Spring Cr., Ala. (18)
AA 54 Short Cr., Ala. (18)
AA 55 Town Cr., Ala. (18)
AA 56 Sauty Cr., Ala. (18)
AA 57 Jones Cr., Ala. (18)
AA 58 Raccoon Cr., Ala. (18)
AA 59 Island Cr., Ala. and Ga. (18)
AA 60 Nickajack Cr., Tenn. and Ga. (18)
AA 61 Running Cr., Tenn. and Ga. (18)
AA 62 Lookout Cr., Tenn., Ga., and Ala. (18)
AA 63 Chattanooga Cr., Tenn. and Ga. (18)
AA 64 Chickamauga Cr., Tenn. and Ga. (18)
AA 65 Ooltewah Cr., Tenn. (18)
AA 66 Grasshopper Cr., Tenn. (18)
AA 67 Hiwassee R., Tenn., N. C., and Ga. (18)
List now proceeds up No. 67, as follows:
AA 68 Comstock Cr., Tenn. (67)
AA 69 Candy Cr., Tenn. (67)
AA 70 South Mouse Cr., Tenn. (67)
AA 71 South Chestue Cr., Tenn. (67)
AA 72 Ocoee R., Tenn. and Ga. (67)
AA 73 Conasauga Cr., Tenn. (67)
AA 74 Chestue Cr., Tenn. (67)
AA 75 Ootanaula Cr., Tenn. (67)
AA 76 North Mouse Cr., Tenn. (67)
AA 77 Price Cr., Tenn. (67)
AA 78 Agency Cr., Tenn. (67)
List returns to Tenn. R. to—
AA 79 Goodfield Cr., Tenn. (18)
AA 80 Suey Cr., Tenn. (18)
AA 81 Watt Cr., Tenn. (18)
AA 82 Wann Cr., Tenn. (18)
AA 83 Kabe Cr., Tenn. (18)
AA 84 Ridley Cr., Tenn. (18)
AA 85 Stamp Cr., Tenn. (18)

AA 86 Paint Rock Cr., Tenn. (18)
AA 87 Stockton Cr., Tenn. (18)
AA 88 Pond Cr., Tenn. (18)
AA 89 Sweetwater Cr., Tenn. (18)
AA 90 Little Tennessee R., Tenn., N. C., and Ga. (18)
List now proceeds up No. 90.
AA 91 Fork Cr., Tenn. (90)
AA 92 Bat Cr., Tenn. (90)
AA 93 Island Cr., Tenn. (90)
AA 94 Tellico R., Tenn. (90)
AA 95 Toco Cr., Tenn. (90)
AA 96 Citico Cr., Tenn. (90)
AA 97 Mulberry Cr., Tenn. (90)
AA 98 Slick Rock Cr., Tenn. and N. C. (90)
AA 99 Cheoah R., N. C. (90)
AA 100 Tullulah Cr., N. C. (99)
AA 101 Nantahala R., N. C. (90)
AA 102 Tuckaseegee R., N. C. (90)
AA 103 Oconalufty R., N. C. (102)
AA 104 Abrams Cr., Tenn. (90)
AA 105 Four Mile Cr., Tenn. (90)
AA 106 Nine Mile Cr., Tenn. (90)
List returns to Tenn. R.
AA 107 Cloyds Cr., Tenn. (18)
AA 108 Ish Cr., Tenn. (18)
AA 109 Lackey Cr., Tenn. (18)
AA 110 Little R., Tenn. (18)
AA 111 Knox Cr., Tenn. (18)
The next 2 streams, at their junction, form the head of Tenn. R.
AA 112 French Broad R., Tenn. and N. C. (18)
AA 113 Holston R., Tenn. and Va. (18)
The list proceeds up 112 and 113 in turn, before proceeding down Tenn. R. again.
AA 114 Gap Cr., Tenn. (112)
AA 115 Boyd Cr., Tenn. (112)
AA 116 Little Pigeon R., Tenn. (112)
AA 117 Millican Cr., Tenn. (112)
AA 118 Flat Cr., Tenn. (112)
AA 119 Muddy Cr., Tenn. (112)
AA 120 Sohorn Cr., Tenn. (112)
AA 121 Big Pigeon R., Tenn. and N. C. (112)
AA 122 Nolichucky R., Tenn. and N. C. (112)
List next covers No. 113.
AA 123 Lyons Cr., Tenn. (113)
AA 124 Beaver Cr., Tenn. (113)
AA 125 Panther Cr., Tenn. (113)
AA 126 Turley Cr., Tenn. (113)
AA 127 Spring Cr., Tenn. (113)
AA 128 Cedar Cr., Tenn. (113)
AA 129 Fall Cr., Tenn. (113)
AA 130 Beech Cr., Tenn. (113)
AA 131 Cressy Cr., Tenn. (113)
AA 132 S. Fork, Holston R., Tenn. and Va. (113)
AA 133 Watauga R., Tenn., and N. C. (133)
AA 134 Doe R., Tenn. (133)
AA 135 Middle Fork, Holston R., Va. (132)
AA 136 N. Fork, Holston R., Tenn. and Va. (113)
AA 137 Alexander Cr., Tenn. (113)
AA 138 Surgainsville Cr., Tenn. (113)
AA 139 Forgey Cr., Tenn. (113)
AA 140 Sinking Cr., Tenn. (113)
AA 141 Big Cr., Tenn. (113)
AA 142 Crockett Cr., Tenn. (113)
AA 143 Cloud Cr., Tenn. (113)
AA 144 German Cr., Tenn. (113)
AA 145 Buffalo Hollow Cr., Tenn. (113)
AA 146 Richland Cr., Tenn. (113)
AA 147 Big Flat Creek, Tenn. (113)
AA 148 Roseberry Cr., Tenn. (113)
AA 149 Woods Cr., Tenn. (113)
AA 150 Loves Cr., Tenn. (113)
List now proceeds down Tenn. R.
AA 151 Lyons Cr., Tenn. (18)
AA 152 Turkey Cr., Tenn. (18)
AA 153 Muddy Cr., Tenn. (18)
AA 154 Hines Cr., Tenn. (18)
AA 155 Cove Cr., Tenn. (18)
AA 156 Buck Cr., Tenn. (18)
AA 157 Clinch R., Tenn. and Va. (18)
The list now proceeds up 157.
AA 158 Hickory Cr., Tenn. (157)
AA 159 Beaver Cr., Tenn. (157)
AA 160 Bull Run Cr., Tenn. (157)
AA 161 Hinds Cr., Tenn. (157)
AA 162 Davidson Cr., Tenn. (157)
AA 163 Indian Cr., Tenn. (157)
AA 164 Big Wan Cr., Tenn. (157)
AA 165 Sycamore Cr., Tenn. (157)
AA 166 Big Barren Cr., Tenn. (157)
AA 167 Hunting Cr., Tenn. (157)
AA 168 Lost Cr., Tenn. (157)
AA 169 Powells R., Tenn. and Va. (157)
AA 170 Big Cr., Tenn. (157)
AA 171 Cove Cr., Tenn. (157)
AA 172 Poplar Cr., Tenn. (157)
AA 173 Emory R., Tenn. (157)
List again returns down Tenn. R.
AA 174 Caney Cr., Tenn. (18)
AA 175 King Cr., Tenn. (18)
AA 176 White Cr., Tenn. (18)
AA 177 Piney R., Tenn. (18)
AA 178 Clear Cr., Tenn. (18)
AA 179 Mud Cr., Tenn. (18)
AA 180 Richland Cr., Tenn. (18)
AA 181 Sale Cr., Tenn. (18)
AA 182 Opossum Cr., Tenn. (18)
AA 183 Soddy Cr., Tenn. (18)
AA 184 Dallas Cr., Tenn. (18)
AA 185 North Chickamauga Cr., Tenn. (18)
AA 186 Mountain Cr., Tenn. (18)
AA 187 Shoal Cr., Tenn. (18)
AA 188 Middle Cr., Tenn. (18)
AA 189 Suck Cr., Tenn. (18)
AA 190 Hales Bar Lock., Tenn. (18)
AA 191 Sequatchie R., Tenn. (18)
AA 192 Battle Cr., Tenn. (18)
AA 193 Widow Cr., Ala. and Tenn. (18)
AA 194 Big Crow Cr., Ala. and Tenn. (18)
AA 195 Mud Cr., Ala. (18)
AA 196 Roseberry Cr., Ala. (18)
AA 197 North Sauty Cr., Ala. (18)
AA 198 Mink Cr., Ala. (18)
AA 199 Pine Cr., Ala. (18)
AA 200 Seabolt Cr., Ala. (18)
AA 201 Honeycomb Cr., Ala. (18)
AA 202 Paint Rock R., Ala. and Tenn. (18)

AA 203 Flint R., Ala. and Tenn. (18)
AA 204 Missionary Cr., Ala. (18)
AA 205 Indian Cr., Ala. (18)
AA 206 Limestone Cr., Ala. and Tenn. (18)
AA 207 Swan Cr., Ala. (18)
AA 208 Poplar Cr., Ala. (18)
AA 209 Elk R., Ala. and Tenn. (18)
AA 210 Head of Lower Muscle Shoals Canal, Ala. (18)
AA 211 Second Cr., Ala. and Tenn. (18)
AA 212 Bluewater Cr., Ala. and Tenn. (18)
AA 213 Four Mile Cr., Ala. (18)
AA 214 Six Mile Cr., Ala. (18)
AA 215 Shoal Cr., Ala. and Tenn. (18)
AA 216 Cypress Cr., Ala. and Tenn. (18)
AA 217 Keys Cr., Ala. (18)
AA 218 Bluff Cr., Ala. (18)
AA 219 Yellow Cr., Ala. (18)
AA 220 Second Cr., Tenn. and Ala. (18)
AA 221 Horse Cr., Tenn. (18)
AA 222 Indian Cr., Tenn. (18)
AA 223 Hardin Cr., Tenn. (18)
AA 224 Beech Cr., Tenn. (18)
AA 225 Cedar Cr., Tenn. (18)
AA 226 Lick Cr., Tenn. (18)
AA 227 Duck R., Tenn. (18)
List proceeds here up 227.
AA 228 Buffalo R., Tenn. (227)
List returns to 18.
AA 229 Richland Cr., Tenn. (18)
AA 230 Turkey Cr., Tenn. (18)
AA 231 White Oak Cr., Tenn. (18)
AA 232 Kane Cr., Tenn. (18)
AA 233 Hurricane Cr., Tenn. (18)
AA 234 Piney Cr., Tenn. (18)
AA 235 Panther Cr., Tenn. (18)
AA 236 Hughes Cr., Tenn. (18)
AA 237 Lick Cr., Tenn. (18)
AA 238 Clay Cr., Tenn. (18)

IN NASHVILLE ENGINEERING DISTRICT.

List now leaves Tenn. R., proceeds up Ohio R. to—
AA 239 Cumberland R., Tenn. and Ky. (16)
AA 240 Brushy Cr., Ky. (239)
AA 241 Lock D, Dover, Tenn. (239)
AA 242 South Cross Cr., Tenn. (239)
AA 243 Elk Cr., Tenn. (239)
AA 244 Wells Cr., Tenn. (239)
AA 245 Yellow Cr., Tenn. (239)
AA 246 Lock B, Cumberland R., Tenn. (239)
AA 247 Burtons Cr., Tenn. (239)
AA 248 Johnsons Cr., Tenn. (239)
AA 249 Harpeth R., Tenn. (239)
AA 250 Little Bluff Cr., Tenn. (239)
AA 251 Mill Cr., Tenn. (239)
AA 252 Lock No. 2, Tenn. (239)
AA 253 Stone R., Tenn. (239)
AA 254 Spencer Cr., Tenn. (239)
AA 255 Bratton Cr., Tenn. (239)
AA 256 Spring Cr., Tenn. (239)
AA 257 Cedar Cr., Tenn. (239)
AA 258 Lock No. 5, Tenn. (239)
AA 259 Round Lick Cr., Tenn. (239)
AA 260 Plunkett Cr., Tenn. (239)
AA 261 Lock No. 7, Tenn. (239)
AA 262 Hogarty Cr., Tenn. (239)
AA 263 Caney Fork R., Tenn. (239)
AA 264 Collins R., Tenn. (263)
AA 265 Indian Cr., Tenn. (239)
AA 266 Flynn Lick Cr., Tenn. (239)
AA 267 Doe Cr., Tenn. (239)
AA 268 Roaring R., Tenn. (239)
AA 269 Obey R., Tenn. (239)
AA 270 Kettle Cr., Tenn. (239)
AA 271 Galloway Cr., Ky. (239)
AA 272 Bear Cr., Ky. (239)
AA 273 Beaver Cr., Ky. (239)
AA 274 Lock No. 21, Ky. (239)
AA 275 South Fork, Cumberland R., Ky. and Tenn. (239)
AA 276 Clear Fork, Ky. and Tenn. (239)
AA 277 Clover Fork, Ky. (239)
AA 278 Poor Fork, Ky. (239)
The junction of 277 and 278 makes head of 239. List now proceeds down 239.
AA 279 Laurel R., Ky. (239)
AA 280 Rockcastle R., Ky. (239)
AA 281 Buck Cr., Ky. (239)
AA 282 Pitman Cr., Ky. (239)
AA 283 Lock 22, Ky. (239)
AA 284 Fishing Cr., Ky. (239)
AA 285 Wolf Cr., Ky. (239)
AA 286 Greasy Cr., Ky. (239)
AA 287 Crocus Cr., Ky. (239)
AA 288 Big Rennix Cr., Ky. (239)
AA 289 Little Cr., Ky. (239)
AA 290 Marrowbone Cr., Ky. (239)
AA 291 Sulphur Cr., Ky. (239)
AA 292 Macfarland Cr., Ky. (239)
AA 293 Brimstone Cr., Tenn. (239)
AA 294 Jennings, Tenn. (239)
AA 295 Indian Cr., Tenn. (239)
AA 296 Wartrace Cr., Tenn. (239)
AA 297 Buffalo Cr., Tenn. (239)
AA 298 Lock No. 8, Tenn. (239)
AA 299 Defeated Cr., Tenn. (239)
AA 300 Dixon Cr., Tenn. (239)
AA 301 Lock No. 6, Tenn. (239)
AA 302 Rocky Cr., Tenn. (239)
AA 303 Bledsoe Cr., Tenn. (239)
AA 304 Lock No. 4, Tenn. (239)
AA 305 Station Camp Cr., Tenn. (239)
AA 306 Lock No. 3, Tenn. (239)
AA 307 Manskers Cr., Tenn. (239)
AA 308 Lock No. 1, Tenn. (239)
AA 309 Whites Cr., Tenn. (239)
AA 310 Sycamore Cr., Tenn. (239)
AA 311 Lock A, Tenn. (239)
AA 312 Half Pone Cr., Tenn. (239)
AA 313 Red R., Tenn. and Ky. (239)
AA 314 Lock C, Tenn. (239)
AA 315 Saline Cr., Ky. and Tenn. (239)
AA 316 Lock E, Ky. (239)
AA 317 Little R., Ky. (239)
AA 318 Eddy Cr., Ky. (239)
AA 319 Lock F, Ky. (239)
AA 320 Livingstone Cr., Ky. (239)
AA 321 Claylick Cr., Ky. (239)
AA 322 Mouth of (239), at Ohio R. (16)

AA-2 WOLF RIVER, TENN.

APPROPRIATION.[1]

1896, $35,000, H. D. 482, 55th, 2d.

COMMERCE.

Description of. Large and important, **93,** 2136, 2137; **96,** 1703, 1704.

ENGINEERS.

Chief of Engineers. R., 93, 280; **96,** 249.

In charge:
Capt. S. W. Roessler, 1893. **R., 93,** 2136.
Capt. G. D. Fitch, 1896. **R., 96,** 1703.

OPERATIONS.

1894-95. About $8,000 expend. removing obstr. and in dr. 18,000 c. y. from the mouth, **96,** 1704.

PHYSICAL CHARACTERISTICS.

Description of. Small stream in w. Tennessee emptying into Mississippi R. just n. of Memphis. The "present" and future navigation would be confined to the lower 2 m. of course, **93,** 2136.

PRIVATE WORK.

Dr. to remove heavy deposits on sand bar at mouth, by the Memphis & Little Rock RR. Transfer Co., **93,** 2137.

SURVEYS.

Ex. au. act July 13, 1892; made, 1893, by Capt. Roessler (**R.** fav.), **93,** 2136.

Ex., mouth to point 5 m. above, au. act Aug. 17, 1894. **R.** made by Capt. Fitch, 1896 (**R.** fav.), **95,** 1703.

AA-4 HATCHEE (Big Hatchie) RIVER, TENN.

APPROPRIATIONS.

1880,	$10,000,	**80,** 1330.
1881,	3,500,	**81,** 1415.
1882,	3,000,	**82,** 1555.
1884,	2,500,	**85,** 1528.
1886,	3,000,	**86,** 1366.
1888,	5,000,	**88,** 1368.
1890,	5,000,	**90,** 1906.
1892,	3,500,	**92,** 1659.
Total,	35,500	

COMMERCE.

C. obstr. by brs. without draws, **80,** 1331.

Advantages arising from imp., **80,** 1330, 1331; **85,** 1527.

ENGINEERS.

Chief of Engineers. R., 80, 156; **81,** 210; **82,** 207; **83,** 216; **84,** 225; **85,** 242; **86,** 236; **87,** 201; **88,** 183; **89,** 215; **90,** 193; **91,** 246; **92,** 238; **93,** 269; **94,** 249; **95,** 278; **04,** 443; **08,** 571.

Boards. BERH. reviews Lt. Col. Adams, **R.;** confirms his opinion as to undesirability of imp., **04,** 2350.

In charge:
Maj. W. H. H. Benyaurd, 1880–82. **R., 80,** 1330; **81,** 1415; **82,** 1555.
Maj. A. M. Miller, 1882–84. **R., 83,** 1153; **84,** 1337.
Capt. E. Bergland, 1884–86. **R., 85,** 1527; **86,** 1366.
Capt. J. H. Willard, 1886–95. **R., 87,** 1479; **88,** 1367; **89,** 1618; **90,** 1904; **91,** 2010; **92,** 1657; **93,** 2052; **94,** 1516; **95,** 1952.
Lt. Col. M. B. Adams, 1904. **R., 04,** 2349.
Maj. W. W. Harts, **08,** 560.

Assistants:
J. Burney. **R., 80,** 1331.
J. J. Barry. **R., 85,** 1528.
J. S. Walker. **R., 04,** 2350.

LEGISLATION.

Act of Tenn. declaring the R. a navigable one, **80,** 1331.

OBSTRUCTIONS.

Obstr. of R. by brs. without draws, **80,** 1331, 1332.

OPERATIONS.

1880-81. By hired labor, 376 snags and 2,409 logs removed, and 16,243 trees cut down; R. worked over, Bolivar to mouth, **81,** 1415.

1881-82. 3,204 snags and logs removed, 636 trees cut down, and 1 wreck removed; R. worked over, Bolivar to mouth, **82,** 1555.

1882-83. 1,431 snags and logs removed and 679 trees cut down; 185 m. of R. worked over, **83,** 1154.

1884-85. 969 logs and snags removed and 1,094 trees cut down; 50 m. of R. worked over, **85,** 1528.

1886-87. 2,067 snags, stumps, and logs removed, 3,813 trees cut, and 3 cut-offs cleaned, **87,** 1480.

1888-89. 1,410 logs and snags removed from chan., and 4,300 trees and shore snags and 4,684 s. y. brush cleared from banks, **89,** 1619.

1889-90. 870 snags and 143 side jams removed from chan., and 2,860 trees and shore snags and 375 s. y. brush cleared from banks, **90,** 1905.

1891-92. 650 snags and logs removed from chan.; 14 side jams removed; 6,700 trees cut and 6,518 trees girdled on banks, **92,** 1659.

1893-94. 28,420 s. y. brush and willows cut, and about 4,500 snags and other obstr. removed, **94,** 1518.

1894-95. Several wrecks removed; 8,867 s. y. brush, etc., cut, and over 25,000 snags, etc., removed, **95,** 1954.

PHYSICAL CHARACTERISTICS.

Description of, **94,** 1517; **95,** 1953.

PROJECTS.

By Maj. Benyaurd, 1879, removing snags, leaning trees, and logs, Bolivar to mouth, 240 m.; est., $30,000, **80,** 1331, 1342; **87,** 1479. Imp. not permanent, **90,** 1904.

SURVEYS.

Made by Maj. Benyaurd, 1879, **80,** 1330.

Pre. ex., mouth to Rialto, au. act June 13, 1902. **R.,** Lt. Col. Adams, July 7, 1902 (unfav.),[1] **04,** 443, 2349.

Pre. ex. to Brownsville au. act Mar. 2, 1907. **R.,** Maj. Harts, Dec. 23, 1907 (unfav.),[2] **08,** 571.

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[1] See Mississippi River appropriation, Ohio River to Head of Passes.
[2] H. D. 243, 58th, 2d.
[3] H. D. 666, 60th, 1st.

AA-5 OBION RIVER, TENN.

APPROPRIATIONS.

1892,	$7,500.00,	**93,** 2329.
1894,	7,500.00,	**95,** 2247.
1896,	6,000.00,	**96,** 1899.
1899,	2,500.00,	**99,** 2235 (mainten.).
1902,	2,500.00,	**04,** 2339.
1905,	1,700.00,	**05,** 1722.
1907,	1,700.00,	**07,** 1608.
1910,	218.50,	**10,** 1846.
Total,	29,618.50	

COMMERCE.

R. travel and lumber traffic, **81,** 1489.
C. interests of the locality, **91,** 2294.
Chiefly lumber, **93,** 2329.
Materially benefited by works of imp., **98,** 1871.
60,269 t. an., 1899; value, $483,967.85, **99,** 2234; 1900, 170,113 t., **01,** 459; 1905, 30,555 t., **06,** 489; 1910, 18,638 t., of which nine-tenths timber products floated out at h. w., for which works of imp. are not of much benefit, **11,** 707, 2023.
Description of, **12,** 858.

ENGINEERS.

Chief of Engineers. **R., 80,** 158; **81,** 213; **91,** 285; **93,** 298; **94,** 273; **95,** 305, 310; **96,** 263, 265; **97,** 339, 341; **98,** 330, 333; **99,** 394; **00,** 451; **01,** 458; **02,** 386; **03,** 410; **04,** 436, 2351; **05,** 447; **06,** 489; **07,** 517; **08,** 551; **09,** 582; **10,** 657; **11,** 707; **12,** 857.

Boards. BERH. **R., 04,** 2352–53.

In charge:
Maj. W. H. H. Benyaurd. **R., 81,** 1486.
Lt. Col. J. W. Barlow, 1890. **R., 91,** 2292, 2296.
Capt. J. Biddle, 1893–97. **R., 93,** 2327; **94,** 1785; **95,** 2245, 2265; **96,** 1897, 1903; **97,** 2215, 2219.
Maj. D. C. Kingman, 1898. **R., 98,** 1869, 1872; **01,** 458.
Lt. Col. M. B. Adams, 1899–1903. **R., 99,** 2233; **00,** 2887; **01,** 2403; **02,** 1693; **04,** 2352, 2355.
Maj. J. G. D. Knight; **02,** 386.
Capt. W. J. Barden, 1903. **R., 03,** 1579.
Lt. Col. C. B. Sears, 1904. **R., 04,** 2337.
Maj. H. C. Newcomer, 1905–06. **R., 05,** 1721; **06,** 1501.
1st Lt. W. G. Caples, **07,** 516.
Maj. W. W. Harts, 1907–11. **R., 07,** 1607; **08,** 1681; **09,** 1675; **10,** 1845; **11,** 2023.
Maj. C. A. F. Flagler, **11,** 706; **12,** 857.
Maj. E. Jadwin, **12,** 857.
Maj. H. Burgess, 1912–. **R., 12,** 2229.

Assistants:
J. Harrison. **R., 81,** 1487.
B. B. Smith. **R., 91,** 2293, 2297.
J. S. Walker. **R., 04,** 2353.

OBSTRUCTIONS.

At Obion R. crossed by a drawless br. of Newport News & Mississippi Valley RR., obstr. navigation above that town, **93,** 2328.

OPERATIONS.

1892-93. About 20,000 snags and other obstr., and large quantity of drift removed, **93,** 2329.
1893-94. About 3,000 snags, etc., and about 1,000 cords drift removed, **94,** 1786.
1894-95. About 9,000 snags, etc., and about 1,000 cords drift removed, **95,** 2246.
1895-96. About 3,500 snags, etc., and some drift removed, **96,** 1899.
1896-97. About 3,600 snags, etc., and some drift removed, **97,** 2216.
1897-98. Over 7,000 snags, etc., removed, **98,** 1874.
1898-99. Derrick and quarter boats built, minor repairs made to floating plant, and about 9,000 snags and other obstr. removed, **99,** 2234.
1899-00. About 1,100 snags and other obstr. removed, **00,** 2887.
1900-01. 16,662 snags and other obstr. removed, **01,** 2404.
1901-02. 9,663 snags and other obstr. removed from Obion and Forked Deer Rs. combined, **02,** 1693.
1903-04. 7,957 snags and other obstr. removed, clearing 69 m., **04,** 2337–38.
1905-06. 2,389 snags and other obstr. removed, clearing 69 m., **06,** 1501, 1502.
1907-08. 2,925 snags and other obstr. removed, clearing 69 m., **08,** 1681.
1910-11. Plant cared for, **11,** 2023.
1911-12. Plant belonging to imp. condemned and destroyed, **12,** 2229.

PHYSICAL CHARACTERISTICS.

Condition of R., 1880, nature of obstr., and character of surrounding country, **81,** 1487, 1488.
Description of, **91,** 2296; **12,** 857.
Discharge, **95,** 2271, 2275.
Current increased by obstr. removal, **97,** 2216.
Sec. of War notified local interests no objection would be made to diversion of stream in interest of dr. unless such diversion should later interfere with navigation, **10,** 658.
Navigation depends on stage of water in Mississippi R., **12,** 858.

PLANS.

By Maj. Benyaurd, 1880, imp. Obion R. for 115 m. from mouth by removing snags, logs, leaning timber, and similar obstr., securing least chan. d. of 4′; est. (incl. constr. of flatboat and purchase of outfit), $28,809, **81,** 1487, 1489.

PROJECTS.

By Lt. Col. Barlow, 1891, snagging and wingdam constr., mouth to crossing of the Louisville & Memphis RR. in Obion Co. by giving chan. of not less than 3′ d. at the lowest stages; est., $50,000, **91,** 2297.
In 1897 proj. modified to provide simply for removing obstr. and for yearly chan. mainten. as imp. made (Capt. Biddle did not consider it possible to obtain 3′ by the orig. proj., and thought the est. inadequate), **97,** 2216.
Lt. Col. Adams recom., 1899, that Obion and Forked Deer Rs. be treated as a single stream under the heading "Obion and Forked Deer Rivers," making provision for them in a sum equal to what "now" separately allowed for mainten. of each, as a single app. for the mainten. of both as one item, **99,** 2234; **00,** 2888.
Act June 13, 1902, au. conjunctive imp. of Obion and Forked Deer Rs., **03,** 411.
By Maj. Harts, 1908, further app. under proj. not warranted, **08,** 1682.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Benyaurd, **81,** 1486.
Sur. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Barlow, **91,** 2297.
Ex. au. act June 13, 1902. **R.** by Lt. Col. Adams, July 7, 1902, **04,** 443, 2352.
Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 857.

AA-6 FORKED DEER RIVER, TENN.

Part.	Title.	Period.	Appropriations.
a	Forked Deer R., Tenn. (S., N., and Middle Forks)	1873–1912	$27,818.50
b	Forked Deer R., Tenn., South Fork	1880–1887	10,000.00
c	Forked Deer R., Tenn., North Fork	1880–1887	.....
	Total	.....	37,818.50

Part(a), AA-6 Forked Deer River, Tenn.

APPROPRIATIONS.

1888	[1] $2,500.00	**89,** 1621.
	[2] 4,500.00	
	[3] 2,500.00	
1890,	[4] 2,500.00,	**90,** 1908.
1892,	3,000.00,	**92,** 1662.
1896,	[4] 5,000.00,	**96,** 1904, 1905.
1898,	1,000.00,	**96,** 265.
1899,	2,000.00,	**99,** 2237.
1902,	*2,000.00,	**04,** 2339.
1905,	*1,300.00,	**05,** 1723.
1907,	*1,300.00,	**07,** 1609.
1910,	*218.50,	**10,** 1847.
Total,	27,818.50	

COMMERCE.

Large expend. not justified by C., and small expend. inexpedient, **74,** 374.

Rates exorbitant, **74,** 377.

Description of, **74,** 377, 379, 380.

Description of, Middle Fork, **96,** 1902; **97,** 2220; **98,** 1874.

Difference of opinion as to benefits received, **96,** 1903; **97,** 2218.

Est. 50,770 t. an., 1899, **00,** 2890.

Imp. has given material aid to lumber interests involved, **01,** 460.

90% consists of timber products floated out at h. w., **12,** 2230.

C. statistics unobtainable, **12,** 859.

ENGINEERS.

Chief of Engineers. R., 73, 57; **74,** 63; **88,** 183; **89,** 215; **90,** 194; **91,** 246; **92,** 239; **93,** 269; **94,** 250; **95,** 305, 310; **96,** 264, 265; **97,** 340, 341, 347; **98,** 331, 333; **99,** 396; **00,** 453; **01,** 459; **02,** 387; **03,** 411; **04,** 437; **05,** 447; **06,** 490; **07,** 517; **08,** 552, 560; **09,** 583; **10,** 658; **11,** 708; **12,** 858.

Boards. BERH. **R., 04,** 2352, 2353.

In charge:

Maj. C. R. Suter, 1873–74. **R., 74,** 372.

Capt. J. H. Willard, 1886–94. **R., 88,** 1369; **89,** 1621; **90,** 1906; **91,** 2012; **92,** 1660; **93,** 2054; **94,** 1519.

Capt. J. Biddle, 1895–98. **R., 95,** 2247, 2265; **96,** 1900; **97,** 2217, 2234; **98,** 1872.

Maj. Dan C. Kingman, 1898–99. **R., 98,** 1872; **01,** 458.

Lt. Col. M. B. Adams, 1899–1903. **R., 99,** 2235; **00,** 2889; **01,** 2405; **02,** 1693; **04,** 2352, 2355.

Maj. J. G. D. Knight, **02,** 386.

Capt. W. J. Barden, 1903. **R., 03,** 1579.

Lt. Col. C. B. Sears, 1904. **R., 04,** 2338.

Maj. H. C. Newcomer, 1905–06. **R., 05,** 1722; **06,** 1502.

1st Lt. W. G. Caples, **07,** 516.

Maj. W. W. Harts, 1907–11. **R., 07,** 1609; **08,** 1683; **09,** 1676; **10,** 1846; **11,** 2024.

Maj. C. A. F. Flagler, **11,** 706; **12,** 857.

Maj. E. Jadwin, **12,** 857.

Maj. H. Burgess, 1912–. **R., 12,** 2230.

Assistants:

O. Leibrecht, **74,** 372. **R., 74,** 372.

B. J. Smith. **R., 95,** 2270.

J. S. Walker. **R., 04,** 2353.

ESTIMATES. (See Plans and Projects.)

By O. Leibrecht, 1874, removing obstr. and building dams, $53,190.

Amended by Maj. Suter to $71,250, **74,** 374, 379.

LEGISLATION.

Tennessee declared the South Fork navigable from Yellow Bluff Levee and Bridge to its mouth, and repealed act making R. navigable above that point, **95,** 2249.

OBSTRUCTIONS.

Obstr. of South Fork by brs. without draws, **89,** 1623.

By direction of the Sec. of War, br. of the Louisville & Nashville RR. at Bells, Tenn., changed to secure a navigable opening of 50′, 1896, **96,** 1903.

OPERATIONS.

1888–89. 550 snags, 1 wreck, and 92 log jams removed from chan.; 1,635 trees and snags and 2,180 sq. y. brush cleared from banks, and 100 l. f. brush dam built on South Fork; 1,452 snags and 1 wreck removed from chan.; 1,605 trees and shore snags and 926 sq. y. brush cleared from banks on North Fork below Dyersburg; 79 shore snags and side jams removed; 528 trees and 500 sq. y. brush cleared from banks on main R., **89,** 1622, 1623.

1889–90. 274 snags and logs removed from chan.; 2,675 trees and 475 sq. y. brush cleared from banks on the main R.; 362 snags and 285 shore snags and trees cleared from North Fork, completing proj. imp.; no operations on South Fork, **90,** 1907.

1891–92. Operations confined to North Fork and main R.; 660 stumps and snags and 6 log jams removed; 1,300 trees cut and topped on banks, **92,** 1662.

1893–94. Some brush and willows cut and over 23,000 snags and other obstr. removed, **94,** 1522.

1894–95. A few obstr. removed, **95,** 2249.

1896–97. Over 3,000 snags, etc., and 391 cords drift removed, **97,** 2218. Over 1,000 obstr. removed from Middle Fork, **97,** 2219.

1897–98. Nearly 4,000 obstr. removed from Middle Fork, **98,** 1873.

1898–99. About 4,400 snags and other obstr. removed, **99,** 2237.

1899–00. About 1,800 snags and other obstr. removed, **00,** 2890.

1900–01. 9,577 snags and other obstr. removed, **01,** 2406.

*Allotment.
[1] South Fork.
[2] North Fork below Dyersburg.
[3] Main R.
[4] North Fork and Main R.

1901-02. 9,663 snags and other obstr. removed from Obion and Forked Deer Rs., **02,** 1693.
1903-04. 4,967 snags and other obstr. removed, **04,** 2338.
1905-06. 1,140 snags and other obstr. removed, **06,** 1502.
1907-08. 1,472 snags and other obstr. removed, **08,** 1683.
1911-12. Plant belonging to imp. condemned and destroyed, **12,** 2230.

PHYSICAL CHARACTERISTICS.

Description of, **74,** 372, 375, 376; **90,** 1906; **95,** 2266; **97,** 2218, 2219. High-water marks, **74,** 376. Obstr. in R., **74,** 378.

Yellow Bluff (see Legislation) about 4 m. from the junction of the North Fork, **95,** 2249. Dyersburg lies on the North or Middle Fork, about 8½ m. above its junction with the South Fork; thence to Obion R. is 21 m., and thence to Mississippi R. 3½ m.; 33 m. in all. The slopes on this portion of the stream affected by Mississippi stages, **95,** 2266.

Elevation of extreme l. w. and h. w. plane, and distances from Chesapeake, Ohio & Southwestern RR. br., **95,** 2274.

Discharge measurements, **95,** 2271, 2275.

Navigability depends largely on stage of Mississippi R.; navigation not practicable at low stages, **12,** 859.

R. formed by junct. of its n. and s. forks about 8 m. sw. of Dyersburg, flows thence sw. about 21 m., entering Obion R. 3½ m. from Miss. R. Dyersburg head of navig. on N. Fork; Jackson, Tenn., 95½ m. above mouth; head of navig. on S. Fork, but of recent years navig. limited to lower part of stream, **12,** 858.

PLANS. (See Estimates and Projects.)

By O. Leibrecht, 1874, removal of obstr. to 3′ at all seasons and constr. of dams at the lost and old chans., **74,** 378. Discussed by Maj. Suter, **74,** 373.

PRIVATE (PRIVATE AND STATE) WORK.

Cut-off to the Mississippi, made by private parties about 35 years ago, doing more harm than good, **74,** 378.

Tenn. app. $43,000 for imp. within past 20 years; no benefit derived, **74,** 379.

PROJECTS. (See Estimates and Plans.)

By Maj. Benyaurd, 1880, removing snags and similar obstr., and clearing banks of South Fork, Sharon to mouth, 114 m.; est., $19,250, **81,** 1491; **87,** 202. Operations subsequently extended to Jackson, head of navigation, 81 m. above Sharon. Imp. not considered permanent, **88,** 183, 1369; **90,** 1906.

By Capt. Willard, 1887, main R., mouth to junction of the North and South Forks, 29 m., removing logs, snags, and similar obstr.; est., $7,000; also North Fork up to Dyersburg, 9 m.; est., $4,500, **87,** 1484, 1495; **89,** 1621; **90,** 1906.

In 1894 Capt. Biddle est. $300,000 for a system of canals and locks, cost of mainten. indefinite, for North or Middle Fork, **95,** 2269.

Congress app. $5,000, 1896, for imp. Middle Fork, from Dyersburg to Mississippi R., by removing bars and shoals, etc., to make the stream navigable for small craft at 3′ stage, **96,** 1904.

Lt. Col. Adams advised, 1899, treating the Obion and the Forked Deer Rs. as one item in app. for them, **99,** 2236; **00,** 2890.

Act 1902 combines Obion and Forked Deer Rs. and app. $4,500 for them, **02,** 386, 1695.

Maj. Harts of opinion that further app. are unwarranted, **09,** 584, 1676.

SURVEYS.

O. Leibrecht, R. below Dyersburg, Tenn., **73,** 57; **74,** 63, 375.

Sur. from Dyersburg, Tenn., to junction with Obion R., thence to Mississippi R., for making it navigable for that part, au. act Aug. 17, 1894; made, 1894, by Capt. J. Biddle (**R.** unfav.), **95,** 2265. Elevation of bench marks, **95,** 2274. Resur. made in 1897, Dyersburg to Obion R., **97,** 2219.

Ex. of the South Fork made, 1896, to ascertain what was necessary for mainten., by Capt. Biddle, **97,** 2218.

Ex. of Obion and Forked Deer Rs., au. act June 13, 1902. **Rs.,** Lt. Col. Adams, July 7, 1902, and Feb. 16, 1903; est., $2,250 an.,[1] **04,** 443, 2352, 2354.

Sur. of South Fork, au. act Mar. 2, 1907. **R.,** Maj. Harts, Jan. 22, 1908 (unfav.),[2] **08,** 560.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 859.

Maps.[2]

Part (b), AA-6 Forked Deer River, South Fork, Tenn.

APPROPRIATIONS.

1882,	$3,000,	**83,** 1155.
1884,	2,000,	**84,** 1338.
1886,	5,000,	**86,** 1368.
Total,	10,000	

ENCROACHMENTS.

Obstr. to navigation from brs. and dams, **87,** 1483.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 158; **81,** 213; **83,** 216; **84,** 226; **85,** 242; **86,** 237; **87,** 202.

In charge:
Maj. W. H. H. Benyaurd, 1880–83. **R.,** **81,** 1489.
Maj. A. M. Miller, 1883–85. **R.,** **83,** 1154; **84,** 1338.
Capt. E. Bergland, 1885–86. **R.,** **85,** 1529; **86,** 1367.
Capt. J. H. Willard, 1886. **R.,** **87,** 1482.

Assistants:
Z. Harrison. **R.,** **81,** 1490.
J. J. Barry. **R.,** **84,** 1339; **85,** 1531.

OPERATIONS.

1883-84. 17,915 logs, snags, stumps, and trees removed from R. chan., **84,** 1338.
1884-85. 6,408 trees, logs, snags, etc., removed, **85,** 1530.
1886-87. 12,250 trees, logs, snags, and jams removed, **87,** 1482.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1339.
Discharge, **95,** 2271, 2275.

PROJECTS.

By Maj. Benyaurd, 1880, removing snags and similar obstr., Sharon to mouth, 114 m.; est., $19,250, **81,** 1491; **87,** 202.

SURVEYS.

Au. act June 14, 1880; made by Maj. Benyaurd, **81,** 1489.

[1] H. D. 206, 58th, 2d.

[2] H. D. 945, 60th, 1st.

Part (c), AA-6 Forked Deer River, North Fork, Tenn.

ENGINEERS.

Chief of Engineers. **R., 80,** 158; **81,** 213; **87,** 203.

In charge:
Maj. W. H. H. Benyaurd, 1880. **R., 81,** 1492.
Capt. J. H. Willard. **R., 87,** 1484, 1494.

Assistant. Z. Harrison. **R., 81,** 1493.

PHYSICAL CHARACTERISTICS.

Discharge, **95,** 2271, 2275.

PLANS.

By Maj. Benyaurd, 1880, South Fork to Obion, 24 m., removing snags and other obstr., and building wing dams; est., $15,415.75, **81,** 1496.

In 1887 Capt. Willard, removing obstr.; est., $20,000, **87,** 1484, 1494.

SURVEYS.

Au. act June 14, 1880; made by Maj. Benyaurd, **81,** 1492.

Ex. below Dyersburg, Tenn., au. act Aug. 5, 1886; made by Capt. Willard (**R.** fav.), **87,** 1494.

AA-18 TENNESSEE RIVER, KY., TENN., AND ALA.

LIST OF NOTABLE POINTS, MOUTH TO HEADWATERS.

Ohio R., Ky.
Paducah, Ky.
Big Sandy R., Tenn.
Johnsonville, Tenn.
Duck R., Tenn.
Savannah, Tenn.
Hamburg, Tenn.
Riverton, Ala.
Colbert Shoals Canal, Ala.
Florence, Ala.
Muscle Shoals Canal, Ala.
Elk R., Ala. and Tenn.
Decatur, Ala.
Flint R., Ala. and Tenn.
Guntersville, Ala.
Bridgeport, Ala.
Hales Bar, Tenn.
Chattanooga, Tenn.
Hiwassee R., Tenn.
Clinch R., Tenn.
Kingston, Tenn.
London, Tenn.
Little Tennessee R., Tenn.
Knoxville, Tenn.
French Broad R., Tenn.
Holston R., Tenn.

Part.	Title.	Period.	Appropriations.[1]
a	Tennessee R.	1827–1892	$51,406.94
b	Tennessee R., below Chattanooga	1827–1900	4,834,145.00
c	Tennessee R., below Riverton	1901–1912	468,331.74
d	Tennessee R., Riverton to Chattanooga	1901–1912	2,516,573.40
e	Tennessee R., above Chattanooga	1869–1912	971,760.37
f	Tennessee R., Colbert Shoals Canal (operating and care)	1912	7,991.96
g	Tennessee R., Muscle Shoals Canal (operating and care)	1891–1912	1,264,296.87
	Total		10,114,506.28

[1] Another division of these appropriations might be made, as follows:

Tennessee R., Knoxville to Kelleys Ferry	1852–1860	$51,406.94
Tennessee R., below Riverton	1890–1912	743,331.74
Tennessee R., Riverton to Chattanooga (open channel work only)	1827–1912	1,341,271.90
Tennessee R., above Chattanooga	1869–1912	971,760.37
Tennessee R., Colbert Shoals Canal (construction)	1890–1912	2,313,000.00
Tennessee R., Muscle Shoals Canal (construction)		3,191,726.50
Tennessee R., Hales Bar	1905–1912	229,720.00
Tennessee R., Colbert Shoals Canal (operating and care)	1912	7,991.96
Tennessee R., Muscle Shoals Canal (operating and care)	1891–1912	1,264,296.87
Total		10,114,506.28

Part (a), AA-18 Tennessee River, above and below Chattanooga.[1] [2]

APPROPRIATION.

1852,	[2]$50,000.00	**66,** iii, 37; **72,** 488.
1860,	[2]1,406.94	(claims), act June 12.
Total,	51,406.94	(See summary also).

Statements of app., **77,** 579, 585; **78,** 756, 758.
Injurious effect of partial app., **74,** 69, 574; **77,** 579.

COMMERCE.

Importance of imp., **68,** 558, 584, 586; **71,** 496, 507; **72,** 480, 488, 518; **75,** ii, 658; **77,** 88.
Distance and duration of "present" possible navigation of R. and its tributaries, **68,** 584; **78,** 755.
Possible connection bet. Tennessee R. and Rs. of the Gulf slope, **68,** 558, 585; **75,** ii, 658.
Knoxville, head of navigation, **72,** 488.
Necessity of imp. Muscle Shoals before C. is benefited, **68,** 588; **71,** 496.
List of SS. with tonnage, **77,** 578.

CONTRACTS.[3]

1869. J. H. Dennis, removing obstr. in upper and lower R., **69,** 280, 283; **71,** 502; extended, **70,** 389; reextended, **71,** 495; further contract assigned from C. De Graw; contracts abandoned and annulled Apr., 1872, **72,** 59, 476, 478; subsequent efforts to obtain reserved percentages successful, **74,** 576.
1871. A. Blaisdell, removing obstr. in upper R., **71,** 498; began operations in July, absconded n August, swindling creditors generally, **72,** 478, 81; **73,** 544.
1875. F. Ford & Co., Foster, Weihl & Co., M. G. Kennedy, Rice & Reid, and G. Williams, repair and enlargement of old canal at Muscle Shoals, **76,** 712; **77,** 580; contract extended to Oct., 1877, **77,** 580; completed, **78,** 757; **79,** 138; relief for, **79,** 138, 1253.
1877. S. N. Kimball, constr. of locks at Muscle Shoals, **78,** 757; modified to relieve contractor from building Locks Nos. 6 and 7; delay of work from lack of energy and a desire to do only the most profitable parts of his work; purchase of contractor's plant, **79,** 138, 1250.
1879. S. N. Kimball (annulled), **80,** 184, 1672.
1887. M. A. Sweeney & Bros., constr. of snag and towboat, **87,** 1745. A. R. Perry, constr. of hull for dr. boat, **87,** 1745.
1891. W. Kirk, pile and st. dike constr., $14,555, **92,** 1917. Neely & Smith, r. removal, $1.75 t., **92,** 1947.

ENGINEERS.

Chief of Engineers. R., 67, 39; **68,** 57; **69,** 49; **70,** 64; **71,** 63; **72,** 59; **73,** 61; **74,** 68, 69; **75,** 74, 78; **76,** 86; **77,** 87, 88; **78,** 102; **79,** 137, 1259; **80,** 183; **81,** 247; **82,** 242; **83,** 250; **84,** 250; **85,** 273; **86,** 264; **87,** 230; **88,** 207; **89,** 241; **90,** 216; **91,** 278, 279, 286, 287; **92,** 266, 267, 273, 275.

Boards:

Board of internal imp., 1828–32, proj. plan for passage of Muscle and Little and Elk R. Shoals by dams with connecting canals, **68,** 57, 557, 573, 588; **72,** 498; **73,** 545.
Convened, 1879, to consider claims of G. Williams (contractor), **79,** 138, 1253, 1254. Reconvened; payment of claim to the amount of $101,536.72, **79,** 1252, 1256, 1263; approv. by Sec. of War, **79,** 1264. (Col. Macomb, Maj. Poe, and Capt. Overman.)
Convened, Nashville, Tenn., Oct. 22, 1890, S. O. No. 83, to report upon proj. for removal of obstr. in the Tennessee R., known as the "Suck." **R., 91,** 2313. (Lt. Col. Barlow and Majs. Mackenzie and Adams.)
Convened, Nashville, Tenn., Oct. 23, 1890, S. O. No. 83, to report as to what changes and additions required in the Muscle Shoals Canal system. **R., 91,** 2314. (Lt. Col. Barlow and Majs. Mackenzie and Adams.)
Convened, Nashville, Tenn., Oct. 28, 1890, S. O. No. 83, to report upon imp. of Colbert and Bee Tree Shoals. **R., 91,** 2317. (Lt. Col. Barlow and Majs. Mackenzie and Adams.)

In charge:

Maj. G. Weitzel, 1868–70. **R., 68,** 555, 558; **69,** 279; **70,** 389.
Maj. W. McFarland, 1871–76; **71,** 63, 494; **76,** 86. **R., 71,** 494; **72,** 476, 488, 501; **73,** 543; **74,** 569; **75,** 786, 788, 803, 813, ii, 658.
Capt. W. R. King, 1876–86. **R., 76,** 710, 712; **77,** 577, 579; **78,** 755; **79,** 1247; (Maj.) **80,** 1669; **81,** 1839; **82,** 1837; **83,** 1477; **84,** 1639; **85,** 1751.
Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1509; **87,** 1737, 1739; **88,** 1591; **89,** 1819; **90,** 2111; **91,** 2252, 2255.
Capt. G. W. Goethals, 1891–92. **R., 91,** 2303, 2311, 2322; **92,** 1945, 1956.
Lt. Col. H. M. Robert, 1892–. **R., 92,** 1911.

Assistants:

W. B. Gaw. **R., 68,** 559; **69,** 285.
F. S. Wallace, **68,** 560.
A. T. Phelps, **68,** 560.
W. P. Homan, **68,** 560, 589.
E. McDermott, **68,** 560.
J. C. Long, **68,** 560, 589; **77,** 581; **79,** 1251.
F. T. Hampton, **68,** 560, 589; **73,** 544; **74,** 571; **77,** 577.
Lt. M. B. Adams, **71,** 491.
Capt. L. C. Overman, **75,** 75; **76,** 85; **77,** 87. **R., 71,** 502; **72,** 488.
Lt. J. F. Gregory, **72,** 59, 496.
Lt. B. D. Greene, **72,** 59, 496.
Lt. W. L. Marshall, **77,** 87, 581.
W. M. Gordon, **77,** 581; **79,** 1251.
P. Le Hardy. **R., 77,** 589.
S. Whinery, **78,** 756; **79,** 1249.
J. E. Willard, **78,** 758; **79,** 1252. **R., 81,** 1845; **82,** 1840; **83,** 1481.
J. S. Crary, **79,** 1248.
J. L. Cary. **R., 81,** 1840; **82,** 1838; **83,** 1478.
C. A. Locke. **R., 82,** 1841.
H. J. Gielow. **R., 82,** 1841; **83,** 1482.
R. Hooke. **R., 82,** 1841; **83,** 1482; **85,** 1755; **86,** 1511.
W. A. Toms. **R., 83,** 1481; **84,** 1643; **85,** 1755; **86,** 1512.
Lt. H. E. Waterman. **R., 87,** 1749.
W. A. McFarland. **R., 91,** 2307; **92,** 1954.
D. L. Sublett. **R., 92,** 1951.
W. G. Williamson. **R., 92,** 1953.
O. W. Ferguson. **R.** (precise levels), **96,** 1949.
G. T. Nelles. **R.** (discharge), **96,** 2014; **99,** 2277.

LEGISLATION.

Act of Congress, Jan. 13, 1879, relief of legal representatives of G. Williams (contractor), **79,** 1259.
Act of Apr. 6, 1889, legislature of Tennessee, fixing source and extent of the Tennessee R., **89,** 1820.

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[1] Colbert Shoals: Ex.—**R.** (fav.), May 14, 1828. (H. D. 482, 55th, 2d.)
Bee Tree Shoals: Sur.—**R.,** Feb. 12, 1830. (H. D. 482, 55th, 2d.)
Knoxville to Alabama State line: Sur.—**R.,** July 15, 1832; est. (including Holston R.), $58,161.27. (H. D. 482, 55th, 2d.)
Muscle Shoals: Ex.—**R.** (fav.), May 14, 1828. Sur.—**R.,** Apr. 14, 1836; est. (amount necessary to complete the work in progress), $1,216,859. (H. D. 482, 55th, 2d.)
[2] Knoxville to Kelleys Ferry.
[3] Advantages of hired labor over contract, **72,** 479; **73,** 545; **74,** 69, 569, 575; **77,** 757.

OBSTRUCTIONS. [See Physical characteristics.

List of brs. over Tennessee R., **89,** 1828; **90,** 2125; existing and prospective brs. over the R., more or less obstr., **95,** 2280; **96,** 1924.

OPERATIONS.[1]

1869. Operations confined to contracts on "Pot" and "Suck," below Chattanooga, **69,** 49, 280; necessity of concentrating work at "Suck," **69,** 284.

1869-70. Operations confined to contracts on work below Chattanooga; progress on, **70,** 64, 389; **71,** 63, 495.

1870-71. Operations confined to contracts on work below Chattanooga; progress on, **71,** 63, 495, 497.

1871-72. From failure of contractors to complete work on R., both above and below Chattanooga, contract annulled Apr., 1871, and work prosecuted entirely by hired labor, **72,** 59, 478, 479; **73,** 544; advantages of hired labor, **72,** 479; **73,** 545.

1872-73. Operations both above and below Chattanooga carried on by hired labor; progress of work, **73,** 61, 544.

1873-74. Operations both above and below Chattanooga carried on by hired labor; progress of work, **74,** 68, 570, 579; superior quality of work done by hired labor, and advantages of, **74,** 69, 569, 575.

1874-75. Operations both above and below Chattanooga carried on by hired labor; progress of work, **75,** 74, 75, 786, 789; R. open for 160 m. above Chattanooga, **75,** 75; successful character of work done, **75,** 787; repair of old canal at Muscle Shoals began, **75,** 75, 789.

1875-76. Operations above Chattanooga carried on by hired labor; progress of work, **76,** 86, 710, 713. Operations below Chattanooga carried on by hired labor, except repair and enlargement of Muscle Shoals Canal; progress of work, **76,** 86, 712, 713.

1876-77. Operations above Chattanooga carried on by hired labor; progress of work, **77,** 87, 577; desirability of early completion, **77,** 87. Operations below Chattanooga confined to work at Colbert Shoals by hired labor, and repair and enlargement of Muscle Shoals Canal by contract; progress of work, **77,** 88, 580, 584.

1878-79. Above Chattanooga, work at Chota Shoals resumed by hired labor; repairs to dam at Coulters Shoals, **79,** 137, 1247. Below Chattanooga: Progress by hired labor and contract at Locks Nos. 6, 7, 8, 9, and 10; enlarging prism of canal at Elk R. and Big Muscle Shoals; removal of rock from Little Muscle Shoals; repair of dams at Colbert and Duck R. Shoals; removal of bowlders from Bee Tree Shoals, **79,** 137, 138, 1248 Purchase of plant from contractors, **79,** 138, 1250 "Present" condition of work, **79,** 1251.

PHYSICAL CHARACTERISTICS.

General, **68,** 561, 578, 579, 584; **71,** 502; **72,** 488, 495, 497; **75,** 814, 818, ii, 660; **76,** 710, 711; **77,** 577, 579, 583; **88,** 1591, 1592.

Similarity bet. Tennessee and Cumberland Rs., **68,** 578.

Regimen of R. nearly fixed, **72,** 497; **76,** 710; **77,** 576.

High water at Chattanooga, **68,** 579; **72,** 495; **75,** ii, 660; **77,** 579; **78,** 756. At various points, **72,** 497; **77,** 583.

Fall of R. surface and distances, **68,** 584; **72,** 495; **76,** 711; **77,** 577.

Where does Tennessee R. begin? **75,** 813.

Obstr., list and description of, **68,** 561, 578; **71,** 502; **72,** 488.

Peculiar bed of gravel in rock forming lock foundation, **79,** 1250.

Stages of R., 1874 to 1880, **80,** 1670.

Surface velocity of current at different readings of gauge at head of Tumbling Shoals, Tennessee R., **92,** 1953.

Statement showing difference in feet bet. h. and l. w. at important points bet. Chattanooga and Bridgeport, **92,** 1953.

Description of the system. R. one of the largest of the 43 tributaries of the Mississippi. Receives waters from 7 States, and drains an area nearly equal to that of England, discharging in flood not less than 700,000 c. f. per second and 10,000 c. f. at low stages. In 1893 navigable from source to mouth, 673 m., during several months in the year; not considered impossible to make it navigable during the whole year for moderate-draft boats, **93,** 2330; **97,** 2247.

List of tributaries, and points thereon to which navigation extends, **97,** 2248.

Gauging of the R. and its tributaries. (See Mississippi River, gauging of.) Discharge records, **92,** 1952; **95,** 2279; **96,** 1921, 2014; **97,** 1936; **99,** 2277 (diagrams).

Velocity relations, **96,** 2021. Observed velocities, 1899, **99,** 2282.

Results of discharge observations, Riverton, 1899, **99,** 2285.

PLANS. (See Projects.)

By W. B. Gaw, 1868, imp. of R. below Chattanooga to extreme l.-w. d. of 3′, as follows: Between mouth and Florence, removal of obstr.; unification and deflection of currents by wing dams; est., $27,072, **68,** 558, 559, 574, 578. From Decatur to Chattanooga, by methods similar to those proposed bet. mouth and Florence; est., $58,901, **68,** 558, 561, 569, 578. Between Florence and Decatur, by imp. of Muscle Shoals, as follows: Passage of Little Muscle Shoals by canal, 4½ m. l., on n. side of R.; canal 6′ x 100′ x 118′; locks 6′ x 70′ x 300′; est., $500,000, **68,** 558, 574, 578. Passage of Big Muscle Shoals, by repair and enlargement of existing canal to above dimensions; est., $1,001,877, **68,** 558, 573, 574. Passage of Elk R. Shoals by canal 11 m. l. and of preceding dimensions, in bed of R., protected on sides by slope walls; est., $2,463,090, **68,** 558, 559, 573, 578. Aggregate of entire imp. below Chattanooga, $4,050,941, **68,** 578. Revised by Maj. Weitzel, **68,** 555, 558. Modification of lock gates proposed by Lt. Marshall, **77,** 581.

By Lt. Col. Barlow, 1887, for imp. of Colbert and Bee Tree Shoals by locks and dams; est., $973,175, **87,** 1748, 1751.

PRIVATE (STATE) WORK.

1831. Alabama began constr. of canal to secure passage of Muscle Shoals, a proj. for which had been previously reported on by board of internal imp. Congress modified proj., and work done accordingly, an error, as subsequently demonstrated; canal prism 6′ x 60′ x 42′; locks 6′ x 32′ x 120′; canal completed around Big Muscle Shoals and opened, 1836; work carried on by proceeds from sale of public lands; from lack of funds no further work done; canal at "present" (1868) in decayed condition, for years unused; repair and enlargement a part of "present" proj., **68,** 57, 557, 573, 588; **72,** 498; **73,** 545.

1832. Tennessee undertook imp. of certain points above Chattanooga to an extreme l.-w. d. of 2′ by removal of rock, and constr. of wing dams, **71,** 502; **72,** 488. Defects of work, **71,** 502; **72,** 489.

Old canal at Bluewater and Shoal Creek, built by Alabama, **80,** 1672. Obstr. arising from RR. br. at Johnsonville, **81,** 1846.

PROJECTS. [See Estimates, Plans, and Private work.]

Below and above Chattanooga:

By Maj. McFarland, 1872 (being a part of Southern Route of Transportation Routes to Seaboard), imp. mouth to Short Creek, 368 m., to 3′ during extreme l. w., and to 5′ at all other stages, incl. passage of Muscle Shoals according to his proj. previously described; est., 368 m., $4,251,000, **72,** 509, 512, 518; **75,** ii, 658.

[1] Previous to 1869 (from 1832) consisted in removal of obstr. and constr. of wing dams, **71,** 502; **72,** 488, 497.

SURVEYS.

In progress 1867, **67,** 39; completed in Dec. from Chattanooga to mouth, **68,** 555, 560. Special, required at Muscle Shoals, **68,** 555, 558; made in 1871–73, **72,** 59, 478, 480, 495; **73,** 544. History of previous surs. at, **68,** 588; **71,** 502.

From Chattanooga to Knoxville, 1871, **71,** 502; **72,** 59, 478, 488, 509. Loss by fire in 1874 of large part of maps and field notes, **74,** 570. Surs. and maps repeated, **75,** 75, 789.

General ex. of R. from Knoxville to mouth, 1874–75, being part of Southern Route of Transportation Routes to Seaboard, **75,** 78, ii, 658.

Ex. from Guntersville to head of Muscle Shoals, 1877, **77,** 589.

Of Colbert and Big Tree Shoals; made, 1888, by Lt. Col. Barlow, **87,** 1747.

Sur. of Browns Isld. Chute; made, 1888, by Lt. Col. Barlow, **88,** 1598.

Precise levels, **95,** 2278; **96,** 1920; instruments used, **96,** 1950; method of work, **96,** 1951; bench marks, **96,** 1952; connection with mean Gulf level, **96,** 1956. Index of precise-level work, field seasons, **96,** 1959.

Description and elevation of precise-level bench marks bet. Corinth and Decatur, **96,** 1960; bet. Riverton Junction and 4 m. below Pittsburg Landing, **96,** 1967.

Tabulation of results of precise-level work from Corinth, Miss., to Decatur, Ala., and from Riverton Junction to 4 m. below Pittsburg Landing, Tenn., **96,** 1971.

Surs. and observation for discharge. Organization, methods, and all details, incl. discussion (see Physical characteristics), **99,** 2277.

Maps. (See Physical characteristics.)

Of parts of R., **76,** 710, 712; **77,** 584; **82,** 1840; **90,** 2126; **92,** 2321.

Part (b), AA-18 Tennessee River. (Below Chattanooga.)

APPROPRIATIONS.

Open channel work and Muscle Shoals Canal, Chattanooga to Riverton:

1827,	$200 (sur.), act Mar. 2.	
1860,	1,350 (claim), act June 9; **03,** 1557.	
1868,	*85,000, **68,** 555; **69,** 49; **72,** 479; **77,** 584.	
1869,	*5,095, **69,** 23, 49; **72,** 479; **77,** 584; **03,** 1594, 1597.	
1871,	45,000, **70,** 65; **71,** 502; **72,** 479; **77,** 585.	
1872,	50,000, **72,** 479; **77,** 585.	
1873,	100,000, **73,** 62, 546; **77,** 585.	
1874,	100,000, **74,** 69, 575; **77,** 585.	
1875,	360,000, **75,** 76, 790; **77,** 585.	
1876,	255,000, **76,** 86, 713; **77,** 585.	
1878,	300,000, **78,** 102, 758.	
1879,	210,000, **79,** 138, 1253.	
1880,	300,000, **80,** 1674.	
1881,	250,000, **81,** 1848.	
1882,	250,000, **82,** 1842.	
1884,	350,000, **84,** 1643.	
1886,	262,500, **86,** 1513.	
1888,	250,000, **88,** 1600.	
1890,	300,000, **91,** 2256, 2311.	
1892,	175,000, **93,** 2419.	
1894,	30,000, **05,** 1742.	
1896,	50,000, **05,** 1742.	
1899,	35,000, **05,** 1742.	
Total,	3,764,145	

Below Riverton:

1890,	$25,000, **91,** 2256.	
1892,	25,000, **93,** 2377.	
1894,	125,000, **95,** 2299, 2300.	
1899,	100,000, **01,** 2430.	
Total,	275,000	

Colbert Shoals Canal:

1890,	$150,000, **91,** 2311.	
1892,	300,000, **93,** 2419.	
1894,	245,000, **05,** 1739.	
1899,	100,000, **05,** 1739.	
Total,	795,000	

COMMERCE.

Important, **81,** 1846; **82,** 1842; **86,** 1514.

Obstr. arising from RR. br. at Johnsonville, **81,** 1846.

Below Riverton: Three-fifths of entire C. of R. done on this part, navigated for several months in the year by largest boats of the Ohio and Mississippi Rs., **97,** 2262.

CONTRACTS.

1892. W. A. Kirk, rock removal, $3.75 c. y. ($26,250); gravel, $1 ($3,500); dam removal, $5 l. f. ($2,000); **93,** 2423. H. T. Morrison, 38 iron valves for locks, Muscle Shoals Canal, $11,810.20, **93,** 2426.

1893. T. E. Clark, constr. of masonry of lock, Bee Tree and Colbert Shoals Canal (rock and earth excavation, grading, etc.), $305,766, **93,** 2430. Annulled, **95,** 2294.

1896. E. J. Howard, constr. of towboat, $9,000, **96,** 1949.

1897. Huse & Loomis Ice and Transportation Co., hire of dr., $125 per day for first 30 days and $100 for each day thereafter, **98,** 1905. J. B. Neely, excavation of lift-lock entrance, **98,** 1899.

1898. Bucyrus Co., constr. of dipper dr., $14,425, **98,** 1906.

1899. Bucyrus Co., dipper dr., $13,450, $34,000. J. M. Keller, quarry privileges; dimension st., 10¢ c. y.; riprap st., 5¢ c. y. A. R. Perry, 3 dump scows, $5,778, **99,** 2263.

ENGINEERS.

Chief of Engineers. R., 93, 300, 308, 310; **94,** 274, 275, 282; **95,** 311, 312, 313; **96,** 269; **97,** 349, 350, 354; **98,** 341, 347; **99,** 403; **00,** 460, 468, 469, 477.

Boards. BE. convened, Chattanooga, June 7, 1897, to consider and report on proj. by Capt. Kingman for constr. of entrance to lift lock at Riverton. **R., 97,** 2292. (Capt. D. C. Kingman, Capt. G. W. Goethals, and Capt. J. G. Warren.)

In charge:

Capt. J. Biddle, 1893–94. **R., 93,** 2375; **94,** 1790, 1792.

Capt. G. W. Goethals, 1891–94. **R., 93,** 2419, 2430, 2431; **94,** 1821.

Capt. T. A. Bingham, 1895. **R., 95,** 2284, 2287, 2291, 2292, 2297, 2299.

Capt. D. C. Kingman, 1896–1900. **R., 96,** 1929, 1933, 1935, 1944; **97,** 2254, 2256, 2258, 2262, 2267, 2314; (Maj.) **98,** 1895, 1897, 1898, 1901; **99,** 2256; **00,** 2912, 2956, 3005, 3008.

Maj. W. H. Bixby, 1899–1900. **R., 00,** 3219.

Assistants:

W. A. McFarland. **R., 96,** 2023.

S. B. Williamson. **R., 96,** 2024; **97,** 2274; **98,** 1913; **99,** 2268; **00,** 2924.

F. B. Williams. **R., 96,** 2035; **97,** 2288.

D. W. Church. **R., 96,** 2037.

W. S. Winn. **R., 97,** 2272; **98,** 1910; **99,** 2268; **00,** 2924.

G. T. Nelles. **R.** (details of constr. of lift lock at Bee Tree and Colbert Shoals Canal), **97,** 2275;

*Allotment.

(details of cost, etc., of gates and lift lock) **97,** 2294; **98,** 1914; **99,** 2277; **00,** 2962.
J. E. Hall. **R., 98,** 1924.
C. A. Turrell. **R., 99,** 2287; **00,** 2932.
W. H. Chadbourn, jr. **R., 00,** 3223.

ESTIMATES. (See Projects.)

By board of internal imp., 1828–32, passage of Little and Big Muscle and Elk R. Shoals by dams, locks, and canal. (See Board of Engineers, Projects, and Private and corporate work.) For canal 60′ w., $1,388,102; for canal 70′ w., $1,424,453, **68,** 588.

By Maj. Weitzel, 1868, imp. to extreme l.-w. d. of 3′ by removal of obstr. and constr. of wing dams, as follows: Mouth to Florence, $40,000; Decatur to Chattanooga, $90,000; passage of Big Muscle Shoals by enlargement and repair of existing canal, $1,500,000; passage of Little Muscle and Elk R. Shoals by canal, but requiring further surs. before est. can be made, **68,** 555, 558; **69,** 280; **70,** 389; **77,** 584. Est. of W. B. Gaw for foregoing work: Mouth to Florence, $27,072; Decatur to Chattanooga, $58,901; passage of Muscle and Elk R. Shoals, $3,964,968; aggregate, $4,050,941, **68,** 558, 579. Revised by Maj. Weitzel, **68,** 555, 558.

By Maj. McFarland, 1872, modifying as much of Maj. Weitzel's est. and proj. as applied to passage of Muscle and Elk R. Shoals by formation of 3 basins, with connecting canals 6′ x 100′, locks 60′ x 300; cost, $3,676,000, **72,** 478, 480, 500, 514, 518. More careful sur. developed unexpected quantities of rock, increasing est. to $4,003,000, **73,** 61, 544; **74,** 575; **77,** 584.

For existing proj. for R. below Chattanooga, 1877, as follows: Mouth to Florence (Maj. Weitzel), $40,000; passage of Muscle Shoals (Maj. McFarland), $4,003,000; from Decatur to Chattanooga (Maj. Weitzel), $90,000; aggregate, $4,133,000, **77,** 584; **78,** 758.

By Capt. King, 1877, substitution of wing dams and removal of obstr. in place of hitherto proposed canal on Little Muscle Shoals, cost of imp. can be reduced to about one-tenth, **77,** 89, 583. Passage of Elk R. Shoals by means of wing dams and dr. and rock excavation, together with section of canal on s. shore of R., the previous (1872) est. cost can be reduced to $736,249 in place of $1,115,000, **77,** 88, 580, 590.

LEGAL PROCEEDINGS.

Acquirement of land required for locks and canal at Bee Tree and Colbert Shoals, **93,** 2427; **94,** 1827; **95,** 2293.

LEGISLATION.

Cession of jurisdiction over land required for lock and canal at Bee Tree and Colbert Shoals by Alabama, **94,** 1827; **95,** 2293.

OBSTRUCTIONS.

Removal of obstr. piers of Newport News & Mississippi Valley Co. at Gilbertsville, Ky., completed in 1893, **93,** 2378.

Plans for alteration of Nashville, Chattanooga & St. Louis Ry. Co. br. at Johnsonville, Tenn., approv. by Sec. of War, **93,** 2378. Work completed, **94,** 1793.

OPERATIONS.

1879-80. Excavation of rock and constr. of wing dams by hired labor, on Elk R. division, **80,** 1671. Canal constr. at Muscle Shoals, **80,** 1672. Chan. imp. and canal constr. on Little Muscle Shoals division, **80,** 1673.

1880-81. Chan. imp. and lock constr. on Elk R. division, **81,** 1842. Canal constr. at Muscle Shoals, **81,** 1843. Chan. imp. on Little Muscle Shoals division, **81,** 1845.

1881-82. Chan. imp. and lock constr. on Elk R. division, **82,** 1840. Canal constr. at Muscle Shoals, **82,** 1841. Removal of snags from R. below Florence, **82,** 1841.

1882-83. Chan. imp. and canal constr. on Elk R. division, **83,** 1481. Canal constr. at Muscle Shoals, **83,** 1482. Removal of snags from R. below Florence, **83,** 1482.

1883-84. Canal constr. on Elk R. division, **84,** 1642.

1884-85. Canal constr. on Elk R. and Muscle Shoals divisions, **85,** 1755.

1885-86. Canal constr. on Elk R. and Muscle Shoals divisions, **86,** 1511.

1886-87. Iron gates of Locks 4 to 9, incl., placed in position, Shoal Creek Aqueduct built, and permanent dams of rubble masonry built at Second, Bluewater, Fourmile Creeks, and at Helltown, **87,** 1740, 1743.

1887-88. 3,315 c. y. solid rock, 750 c. y. loose rock, sand, and gravel, and 48,706 c. y. earth excavated; 246 c. y. st. quarried; 2,546 c. y. masonry laid, and 2,465 c. y. of riprap and cofferdam built; misc. work upon maneuvering gear at Big Muscle and Elk R. Shoals, **88,** 1595, 1597.

1888-89. 37,000 c. y. excavated and placed in embankments; 2,313 c. y. dimension st. and riprap quarried; 4,573 c. y. rubble masonry laid at Big Muscle Shoals; 7,373 c. y. dr.; 425 c. y. riprap st. quarried, and 489 c. y. masonry laid; 8,000 c. y. material placed in dams at Elk R. Shoals, **89,** 1825, 1826.

1889-90. 24,000 c. y. earth and rock excavated, 12,000 c. y. embankment built, 2,900 c. y. dimension and riprap st. quarried, and 2,400 c. y. rubble masonry laid at Big Muscle Shoals Canal; 17,820 c. y. earth excavated, 1,284 c. y. riprap quarried, and 5,600 c. y. cut st. and rubble masonry placed at Elk R. Shoals Canal, **90,** 2117, 2118.

1890-91. 934 c. y. of st. and 210 cords of brush used in bank protection at Livingstone Pt.; 358 piles, 1,124 c. y. st., and 303 cords of brush used in dike constr., **91,** 2256, 2257. Drift sluice built in Browns Isld. Dam, Elk R. division, **91,** 2305. Dam across Second Creek, on the Muscle Shoals division, extended 30′; new abutment built; 9,000 c. y. dr. from levels of Lock 7; remains of cofferdam below Lock 9 removed; lock houses at Locks 1, 6, and 7 completed, and in progress at Locks 3 and 4, **91,** 2305, 2306. Operations and care of Muscle Shoals Canal, **91,** 2322.

1891-92. Pile and st. dike shore protection completed at Livingstone Pt. under contract, **92,** 1917. 8,083 c. y. of rock and 3,793 trees removed from Tumbling Shoals and Suck Pt., **92,** 1947. Drift sluice above Lock A completed; lock houses completed at Lock A; 20,500 c. y. excavated from chan. below Lock B, **92,** 1948. Gap at inner end of wing dam at head of canal closed; 5 m. of ry. built along towpath, **92,** 1949. Operation and care of Muscle Shoals Canal, **92,** 1956.

1892-93. Livingstone Pt.: 2,000 c. y. st. placed for shore protection, **93,** 2378.

Chattanooga to Decatur: About 13,000 c. y. dr., large part of it blasted material; 2 temporary dams built, **93,** 2422.

Decatur to Florence: Over 32,000 c. y. earth and st. excavated and used to strengthen dams and embankments; 6,800 c. y. dr., removing old towhead; nearly 6,000 c. y. earth filling placed at locks; 11,452 c. y. dr.; wooden snubbing posts replaced with iron posts; plant repaired and enlarged; banks graded; overflow ditch 1,100′ l., cross-section area of 75′ excavated, and a large quantity of misc. work done, **93,** 2424–2426.

Florence to Bee Tree Shoals: A few obstr. rocks removed; dam repaired; borings made, and misc. work done, **93,** 2427.

1893-94. Livingstone Pt.: Nearly 12,000 c. y. st. used to protect Ohio and Tennessee banks, **94,** 1792–1793.

Chattanooga to Decatur: Nearly 35,000 c. y. rock and other material dr., some of it blasted material; 400 l. f. old dam removed; riprap dam built in connection with preceding year, **94,** 1823–1824.

Decatur to Florence: 38 iron valves replaced those of wood at locks; plant repaired, and misc. work done, **94,** 1825.

Florence to Bee Tree Shoals: Nearly 47,000 c. y. excavated for lock; 685 piles driven, and 1,063 l. f. lock inclosed by sheeting; large amount of misc. work done, **94,** 1826–1827.

1894-95. Chattanooga to Decatur: Table showing amount of work done on parts of this division since 1891, **95,** 2287. Chan. at Ross Towhead diverted from wide to narrow bounds. Nearly 10,500 c. y. rock, bowlders, and other material, some of it blasted, dr. from Bridgeport, Guntersville, and Beards Reefs, **95,** 2287–2291.

Decatur to Florence: 1,305 c. y. st. quarried, **95,** 2292.

Florence to Bee Tree Shoals (by contract): Test pits dug for lock at Bee Tree and Colbert Shoals Canal; 26,000 c. y. excavated, and some material for lock delivered; 287 piles and 402 l. f. sheet piling driven, and other misc. work done before flooding of lock pit and abandoning of contract by contractor, **95,** 2293–2295. (By U. S.:) 1,245 c. y. rock and earth removed for contractor and some misc. work done. Cements tested; constr. of plant under way; levees protected; 8,257 c. y. excavated; 2,489 c. y. embankments constr.; 683 c. y. rock excavated; large quantities of misc. work done, **95,** 2295–2299.

Below Riverton: 3 wrecks removed, and nearly 200 snags, etc., removed, **95,** 2299.

1895-96. Chattanooga to Decatur: Table showing amount of work done on parts of this division since 1891, **96,** 1929. Nearly 9,000 c. y. bowlders and other material dr., some of it blasted, at the Suck, Bridgeport, Gunters Reef, and at other points, **96,** 1931–1933.

Decatur to Florence: 3 dangerous places marked; dam 2′ x 350′ above l. w. under constr. at Colbert Shoals, **96,** 1934.

Florence to Bee Tree Shoals: Much excavating done, masonry laid, and in connection with preceding years lock at Bee Tree and Colbert Shoals Canal two-thirds completed; cements tested, st. quarried, and other work done, **96,** 1936–1943.

Below Riverton: Part of snagging plant procured, **96,** 1946.

1896-97. Chattanooga to Decatur: Over 11,000 c. y. rock and other material (some of it blasted) dr. at Bridgeport, Widows Bar, and at other points, **97,** 2255–2256.

Decatur to Florence: Small dike revet.; nearly 15,000 c. y. rock and other material (some of it blasted) dr. at Wagon Factory Bar and at other points; dam 500′ l. built, and also short wing dam, **97,** 2257–2258.

Florence to Bee Tree Shoals: Lift lock at Bee Tree and Colbert Shoals Canal completed so far as masonry is concerned. During the year 8,519 c. y. st. quarried and shipped to it, 31,661 c. y. earth and rock excavated, and 12,715 c. y. masonry laid. Unit prices for all work at this locality, **97,** 2260.

Below Riverton: Over 9,000 leaning trees, etc., removed, **97,** 2267.

Livingstone Pt.: Revet. repaired by addition of about 6,000 t. of riprap, and short levees built across low places, **97,** 2269.

1897-98. Over 20,000 c. y. rock and other material (some of it blasted) dr. from Skillet, Pot and Pan, Williams Isld., and other points, **98,** 1896–1897.

Florence to Bee Tree Shoals: Over 60,000 c. y. excavated from entrance to lift lock and placed on banks; banks sodded, and 4,700 c. y. rock used to constr. wall to protect temporary earth slopes at site of cut; new quarry opened at Cherokee, and some st. quarried, **98,** 1899, 1900.

Below Riverton: Nearly 29,000 c. y. dr. in test to determine rate of dr. and probable amount required in this section, **98,** 1902. Over 1,200 snags, etc., and 8 wrecks removed, **98,** 1903.

Livingstone: Revet. repairs in progress, **98,** 1904.

1898-99. Florence to Bee Tree Shoals: Work continued on lift lock at Riverton (description of, **99,** 2271); preparations made for building uard lock.

Below Riverton: 48,344 c. y. dr. (maps), and some obstr. removed.

Livingstone Isld.: Revet. on Ohio side extended and repaired.

Tennessee Isld.: Bank at head graded and sloped, **99,** 2257–.

1899-00. Decatur to Florence: Training wall, vicinity of Nances Reef, extended and strengthened; plant cared for.

Florence to Bee Tree Shoals: Minor work done at Riverton lock (photographs), (details of cost, etc., **00,** 2924), about 11,100 c. y. st. quarried (photographs).

Below Riverton: 31,900 c. y. dr., and about 500 snags, etc., removed.

Livingstone Isld.: Revet. repaired.

Tennessee Isld.: Revet. repaired, **00,** 2914–.

PHYSICAL CHARACTERISTICS.

Chattanooga to Decatur: Description of, **93,** 2420.

Livingstone Pt.: Description of; danger of point being eroded away by Ohio and Tennessee, and consequent destruction of importance of Paducah H., **95,** 2300–2301; **96,** 1948; **98,** 1904; **99,** 2261 (incl. Tennessee Isld.).

Ice and high water damaging works, **94,** 1793–1824; **98,** 1904.

Below Riverton: Description of; list of obstr., their nature and distance apart (prepared by pilot of U. S. boat), **97,** 2263.

Colbert and Bee Tree Shoals Canal: Description of; material from test pits for guard lock, character of, **95,** 2293.

Gauge records, **96,** 2034. Lowest stage of water at Riverton, **98,** 1900. Floods of 1897 severe, height exceeding by 2′ preceding high stages, **97,** 2261–2293; **98,** 1901–1921.

Description of watershed, **97,** 2261–2262. Rainfall, **98,** 1923.

Discharge, **92,** 1952; **95,** 2279; **99,** 2274–86.

Gauging (methods, etc.), **99,** 2274.

Below Chattanooga (Suck or mountain region): Description of; navigation suspended about 3 months each year because of the mountainous torrent character of the stream, **00,** 2957, 2962. Velocity of the current, **00,** 2962–2963. Discharge, **00,** 2963. Probable effect proposed works would have on flood heights, **00,** 2985. List of early reports on the R. bet. Chattanooga and Kellers Ferry, **00,** 2986.

Chattanooga: Number of times and days R. has been above given stages, 1875–1899, **00,** 2966.

Moccasin Bend: Description of. First great bend below Chattanooga. Distance by R. around it, 5½ m.; across neck, about three-fourths m., **00,** 3005.

Bridgeport to Decatur: Description of; 25 obstr. reefs and bars in this part, **00,** 3009.

Paducah, Ky. (see Livingstone Point, above): Description of. City on Tennessee R., near mouth of the Ohio R., **00,** 3220.

PRIVATE WORK.

Bank at Burkettes Isld., Decatur to Florence division, built by owner of land but revetted by US., 1896–97. Crevasse had been caused orig. by temporary dam of the U. S. near this point, **97,** 2257.

PROJECTS. (See Estimates and Private and corporate work.)

By board of internal imp., 1828–32, passage of Little Muscle, Big Muscle, and Elk R. Shoals by formation of 3 basins, by means of dams across R., below Campbells (Bainbridge) Ferry, below Elk R. Shoals, and below Browns Ferry, and their connection with each other and the d. w. at Florence by canals along n. shore; execution of work confided to Alabama and carried on by the proceeds from sale of public lands; work began 1831, but not executed in conformity to proj. of board; est. for canal 60′ w., $1,388,102; for canal 70′ w., $1,424,453, **68,** 57, 557, 573, 588; **72,** 498; **73,** 545.

By Maj. Weitzel, 1868, imp. of R. to l.-w. d. of 3′ by removal of obstr. and constr. of wing dams bet. mouth and Florence and bet. Decatur and Chattanooga; est., $130,000; and passage of Big Muscle Shoals by enlargement and repair of existing canal, est, $1,500,000, and passage of Little Muscle and Elk R. Shoals by constr. of new canals, est. for which require further surs.; enlarged and new canals to be of the following dimensions: Canal, 6′ x 100′; locks, 6′ x 70′ x 300′, **68,** 555, 558; **69,** 280; **70,** 389; **77,** 584.

By Maj. McFarland, 1872, modifying as much of the foregoing proj. as applies to passage of Little and Big Muscle Shoals, and Elk R. Shoals, as fol-

lows: Reviving proj. of board of internal imp. (q. v.) for constr. of 3 basins, with connecting canals, but increasing dimensions of canal to 6′ x 60′ x 100′; locks, 6′ x 60′ x 300′; enlarging existing canal to above dimensions; est. cost of passing shoals, $3,676,000, **72,** 500, 501, 514, 518; increased by further sur. to $4,003,000, **73,** 61, 544; **74,** 575; **77,** 584.

By Capt. King, 1877, modifying previous proj. for passage of Little Muscle and Elk R. Shoals, as follows: Imp. Little Muscle Shoals, to give as great d. as obtainable at points above the shoals, by removal of rock, bowlders, etc., and constr. of riprap and wing dams, all in place of hitherto proposed dams and canal, and reducing est. cost to about one-tenth; this imp. to be supple., if necessary, by use of wire rope or other methods of towage, **77,** 89, 583; also modifying previous proj. for passage of Elk R. Shoals by short section of canal along s. side of R., together with rock excavation, dr., and use of wing and riprap dams, whereby the previously est. cost of this section, $1,115,000, can be reduced to $736,249, **77,** 88, 580, 590.

By Maj. King, 1879, use of locomotive at Muscle Shoals Canal for moving vessels through locks and canal, **79,** 1251.

(Projs. of 1872–77 proposed imp. of about 456 m. of R. by constr. of canal 6′ x 70′–120′ x 14½ m. around Muscle Shoals; canal 1½ m. l. around Elk R. Shoals; blasting chan. through the bed rock, and constr. wing dams at Little Muscle Shoals, and removing obstr. above Decatur and below Florence; est., $4,133,000, **70,** 389; **73,** 544; **77,** 584; **86,** 1510, 1513; **87,** 1740.)

By BE., 1890, imp. of Little Muscle Shoals by const. of canal around the shoals, and continuation of the same to the Florence Br.; est., $3,037,000, **91,** 2316.

By BE., 1890, imp. of Colbert and Bee Tree Shoals by constr. of canal around the shoals on the s. bank of the R.; est., $2,500,000, **91,** 2321.

Livingstone Pt., Ky.: Lt. Col. Merrill, 1890, proposed revet. of banks with st. and brush, and constr. of pile and st. dike along the crest of the weakest point where the Ohio cuts through at high stages. Total est., $180,000. Acts 1890 and 1892 allotted total of $50,000, **93,** 2377. Act 1894, $25,000, **95,** 2300.

Chattanooga, Tenn., to Decatur, Ala. (145 m.): Proj. of 1893 for this section was for removal of obstr. to secure least d. of 3′. Act 1890 allotted $50,000. Act 1892, $75,000, **93,** 2420. Sur. for proj., **99,** 2256.

Decatur, Ala., to Florence, Ala. (50 m.): Under act of 1892, $100,000 allotted for this section, **93,** 2419.

By Capt. Bingham, 1894–95, constr. riprap wing dam outside of Lock No. 9, est., $8,322, **95,** 2292.

Florence, Ala., to foot of Bee Tree Shoals (30 m.): After ex. of 1892, recom. that proj. for substituting 2 locks for combined lock, approved after completion of sur. of 1891, be superseded by one providing for a single lock with a lift of 25′. Allotment of $300,000 made, act of 1892, **93,** 2419–2427.

On Feb. 1, 1895, after annulment of contract in force, US. assumed charge of the work undone by the contractor. Description of condition of work. Detailed description of material used, **96,** 1935.

Cherokee Quarry, from which st. for locks of Bee Tree and Colbert Shoals was procured, **96,** 1942; **97,** 2259.

BE., 1897, provided plans for constr. of entrance to guard lock, **97,** 2292; **98,** 1899.

By Maj. Kingman, 1898, carrying 5 creeks, draining about 6,500 acres, under canal bet. the guard and lift locks, and permitting drainage of about 3,000 acres to flow into the canal by other creeks, **98,** 1901.

Straight mitering gates, with vertical framing, adopted for guard locks, **98,** 1901.

Changes of design for guard lock and canal embankment necessitated by h. w. of 1897. Profile of canal, **98,** 1900, 1901.

Substitution of slack-water system suggested by Maj. Kingman for lateral canal system not approv. by BE., **99,** 2259; **00,** 2916.

Keller Quarry, description of, **00,** 2928.

Below Riverton, Ala.: Act 1894 app. $100,000 for this part; as much of $90,000 as might be necessary for removal of obstr., and as much of the remainder as might be necessary for a sur. and submission of plans for imp., **95,** 2299. Chief of Engineers, 1895–96, au. completion of sur. with funds from the general app. for this part, **96,** 1946.

Sur. showed that a large imp. could be effected by dr. Constr. of dr. with dump scows au. (description of, **00,** 2932), **99,** 2259.

Chattanooga to Riverton: Act 1899 app. $35,000 for imp. of this part, **00,** 2956. Maj. Kingman est., 1900, $888,624 to imp. the "Suck" by slack-water system, **00,** 2961. Details of design, etc., **00,** 2972.

Paducah, Ky.: Act 1899 app. $1,000 for sur., **00,** 3219. Maj. Bixby est., 1899–1900, $166,000 would be required for imp., **00,** 3222.

SURVEYS. (See Clinch River and French Broad River, **99,** 2256.)

New bench marks estab. in 1893–94, Bee Tree and Colbert Shoals Canal, **94,** 1827.

Act 1894 called for sur., etc. (see Projects, below Riverton), section below Bee Tree Shoals. Begun in 1894 by Capt. Kingman, **96,** 1945. Completed, 1896, **97,** 2263.

Sur. to determine best method of securing Livingstone Pt. against erosion au. by Chief of Engineers, 1895, and made by Capt. Kingman, **95,** 2300, 2301. Another sur. made of this locality under act June 3, 1896; **R.** by Capt. Kingman in 1897, **97,** 2314. (See Physical characteristics.)

Surs. and borings, details of, **99,** 2274.

Sur. at the "Suck" or mountain region, for slack-water navigation, au. act Mar. 3, 1899; made, 1899, by Maj. Kingman (**R.** apparently fav.; see Projects), **00,** 2957.

Sur. from Chattanooga to Riverton, **00,** 467.

Ex. of Moccasin Bend for canal across it au. act Mar. 3, 1899; made, 1899, by Maj. Kingman (**R.** unfav.), **00,** 3005.

Sur. bet. Bridgeport and Decatur, Ala., au. act Mar. 3, 1899. Pre. **R.,** 1900, by Maj. Kingman (**R.** fav.), **00,** 3008.

Sur. of R., vicinity of Paducah, Ky., to protect city front against injury by h. w., au. act Mar. 3, 1899; made by Maj. Bixby, 1900 (**R.** fav. only to specific app.), **00,** 3219.

Maps. **95,** 2304; **96,** 2042; **97,** 2260; **98,** 1900. (See Operations, 1899.)

Photographs. (See Operations.)

Part (c), AA-18 Tennessee River. (Below Riverton.)

APPROPRIATIONS.

1890–1899,	$275,000.00 from part b.	
1902,	19,000.00,	**02,** 1715.
1902,	*3,497.74,	**06,** 1524.
1905,	30,000.00,	**05,** 1758.
1906,	*4,700.00,	**06,** 1524.
1907,	40,000.00,	**07,** 1638.
1909,	*25,000.00,	**09,** 1704.
1909,	*7,000.00,	**10,** 1871.
1910,	$150,000.00,	**10,** 1871.
1911,	80,000.00,	**11,** 2054.
1912,	110,000.00,	**12,** 2251.
	744,197.74	
	866.00	returned to treasury, **11,** 726.
Total,	743,331.74	

*Allotment.

COMMERCE.

List of boats navigating R. bet. Florence and Paducah, **02,** 1719.
Details of traffic for 1902, **03,** 1603.
1904, 871,380 t., **05,** 457; 1907, 643,077 t., **08,** 566; 1911, 431,113 t., **12,** 876.
Graphic chart of C. and app., **11,** 2053.

CONTRACTS.

1910. Bucyrus Co., machinery, etc., for dr. *Watauga*, $25,500, **11,** 2054.
1911. Vulcan Steam Shovel Co., machinery, etc., for derrick boat *Tishomingo*, $16,625, **11,** 2054.

ENGINEERS.

Chief of Engineers. R., 01, 466; **02,** 395; **03,** 419; **04,** 446; **05,** 457; **06,** 501; **07,** 530; **08,** 565; **09,** 599; **10,** 673; **11,** 724; **12,** 875, 883.

In charge:
Maj. Dan C. Kingman, 1901. **01,** 464.
Maj. J. G. D. Knight, 1901–03. **R., 01,** 2428; **02,** 1715.
Capt. W. J. Barden, 1903–04. **R., 03,** 1598.
Maj. H. C. Newcomer, 1904–07. **R., 04,** 2364; **05,** 1757; **06,** 1522.
1st Lt. W. G. Caples, **07,** 525.
Maj. W. W. Harts, 1907–11. **R., 07,** 1634; **08,** 1712; **09,** 1703; **10,** 1869; **11,** 2051.
Maj. C. A. F. Flagler, **11,** 717; **12,** 867.
Maj. E. Jadwin, **12,** 867.
Maj. H. Burgess, 1912–. **R., 12,** 2250.

Assistant. J. E. Hall. **R., 01,** 2436; **02,** 1719; **04,** 2372.

OPERATIONS.

1900-01. 203,216 c. y. dr., 249 snags pulled, 665 trees cut, and 760 saplings cut, **01,** 2429. Details of work at various localities, **01,** 2436.
1901-02. 185,695 c. y. dr. from various places, **02,** 1715, 1719.
1902-03. 211 snags pulled, 19,100 c. y. dr., resulting in chan. 6′ x 200′, **03,** 1598.
1903-04. About 300 c. y. rock removed from Big Bend Shoals, and 109,700 c. y. dr. from Beech Creek Isld., **04,** 2364, 2372.
1904-05. 17,800 c. y. dr. from Cedar Creek Bar, **05,** 1757.
1905-06. About 27,600 c. y. dr. from Cedar Creek Bar, 26,500 c. y. from Perryville Bar, and 12,900 c. y. from Densons Isld.; 39 trees and snags removed; 26,200 c. y. dr. from Rockport Bar; from Johnsonville left chan. 18,500 c. y. dr., and 12 trees and 13 submerged piles removed, and from right chan. 50,400 c. y. dr., and 8 snags and trees removed; 15,500 c. y. dr. at Danville; 19,500 c. y. dr. at Leatherwood Shoal, **06,** 1522. Repairs to floating plant, **06,** 1524.
1906-07. 7,100 c. y. dr. at head of Tennessee Isld., w. chan. 120′; 4,300 c. y. dr. at mouth of Guess Creek, w. chan. to 220′; 5,900 c. y. dr. from Little Chain Bar, adding about 120′ to w.; 39,700 c. y. dr. from foot of Threemile Isld., 15,300 c. y. from Leatherwood Shoals, 18,300 c. y. from Panther Creek Isld., 4,400 c. y. at Danville, and 5,200 c. y. from Petticoat Ripple, **07,** 1634.
1907-08. Chan. 6′ x 120′ completed at Petticoat Ripple, sunken barge removed at Clifton; repairs to sliding banks at Double Isld., 37,700 c. y. dr. from Rockport Bar, 9,200 c. y. at Johnsonville from below RR. br. and 13,000 c. y. from foot of bar, 15,200 c. y. gravel and mud at Danville incline, 35,900 c. y. cemented gravel and 63,800 c. y. loose gravel from head of Threemile Isld., and 3 piles removed from under draw span of RR. br. at Gilbertsville; sliding banks repaired, obstr. removed, etc., **08,** 1712, 1714.
1908-09. Repairs to floating plant, **09,** 1703.
1909-10. 151,000 c. y. dr. from McCulloch Bar, 107,560 c. y. at Pentecost Towhead, and 4,824 c. y. material placed in revet. at Livingstone Pt., **10,** 1869.
1910-11. 42,000 c. y. dr. at McCulloch Bar, 130,500 c. y. at Reynolds Bar, and 102,600 c. y. from Lime Works Shoals, **11,** 2052, 2053.
1911-12. New dr. *Watauga* completed; repairs to other floating plant, **12,** 2250.

PHYSICAL CHARACTERISTICS.

Discharge, **02,** 1762–64.
Max. draft over shoalest place at m. l. w., 3′. Extreme flood oscillations range from about 48′ at Johnsonville to about 55′ at Paducah, **12,** 876.

PROJECTS.

Shoaling, and recom. for imp., **09,** 1703.
Act July 25, 1912, au. modification of "present" proj. as follows: Open chan. work to secure 6′ at ordinary l. w.; est., $600,000,[1] **12,** 875.

SURVEYS.

Sur. au. act Mar. 3, 1909, from confluence of Holston and French Broad Rs. to mouth. **R.** by Maj. Harts, Mar. 21, 1910; est., $6,700,000, and $100,000 an. mainten.,[1] **12,** 883.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 875.
Maps.[1]

Part (d), AA-18 Tennessee River. (Chattanooga to Riverton.)

APPROPRIATIONS.

Open channel work and Muscle Shoals Channel—

1827–1899,	$3,764,145.00	from part b.
1903,	6,000.00,	**03,** 1597; **05,** 1742.
1904,	2,853.40,	**04,** 2363; **06,** 1518.
1905,	15,000.00,	**05,** 1741.
1907,	205,000.00,	**07,** 1627.
1909,	5,000.00,	**09,** 1697; **10,** 1865.
1910,	305,000.00,	**10,** 1865.
1911,	100,000.00,	**11,** 2046.
1912,	130,000.00,	**12,** 2247.
Total,	4,532,998.40	
	3,191,726.50	appropriated for Muscle Shoals Canal.
	1,341,271.90	appropriated for open channel work.

Colbert Shoals Canal—

1890–1899,	$795,000.00	from part b.
1902,	200,000.00,	**02,** 1714; **05,** 1739.
1903,	350,000.00,	**03,** 1597; **05,** 1739.
1905,	250,000.00,	**05,** 1739.
1906,	100,000.00,	**06,** 1521.
1907,	300,000.00,	**07,** 1632.
1908,	93,000.00,	**08,** 1710.
1909,	120,000.00,	**09,** 1700.
1910,	105,000.00,	**10,** 1867
Total,	2,313,000.00	

Hales Bar—

1905,	$10,000.00,	**05,** 1740.
1906,	40,000.00,	**06,** 1519.
1907,	62,970.00,	**07,** 1629.
1909,	15,000.00,	**09,** 1694.
1910,	101,750.00,	**10,** 1863.
Total,	[2] 229,720.00	

[1] H. D. 360, 62d, 2d.
[2] $6,000 allot. of June 30, 1904, for ex. of foundations and preparation of plans is not included.

COMMERCE.

Table giving tonnage bet. 1895 and 1899, **02,** 1769.
List of SS. plying R., **02,** 1769.
1906, 413,751 t., **07,** 529; 1911, 292,020 t., **12,** 873.
Graphic chart of C. and app., **11,** 2049.

CONTRACTS.

1903. Sheridan-Kirk Contract Co., bldg. section of Colbert Shoals Canal (unit prices given), **03,** 1597.

1905. Shippey & Outzen, excavation of Colbert Shoals Canal trunk; earth, 17.49¢ c. y.; hardpan, 50¢ c. y.; rock, $1 c. y. McGee & Co., constr. of concrete R. wall with foundations for bear-trap sluice; earth, 50¢ c. y.; rock, $3 c. y.; and concrete, $8 c. y., **06,** 1522.

1907. Baltimore Bridge Co., furn. and erecting 2 leaves of Hales Bar upper lock gate, $14,400; Atlantic Machine Works, metal work, $10,358, **07,** 1632.

1908. W. A. Shippey and The North Alabama Constr. Co., excavation of canal trunk (Colbert Shoals), 24.90¢ c. y., **08,** 1711; Penn Bridge Co., furn. sill castings and furn. and erecting lower gates at Hales Bar, $37,428, **09,** 1700. Sheridan-Kirk Contract Co., completing Colbert Shoals concrete R. wall, $1 for earth, $4 for rock, and $10.65 for concrete; Evans Bros. Construction Co., lockmen's houses (prices given); Independent Bridge Co., furn. and erecting upper and lower lock gates at Colbert Shoals, $32,665, **09,** 1701.

1910. Chas. Hegewald Co., Riverton Lock, gate-operating machinery, $2,999; Penn Bridge Co., 4 Riverton Lock sluice valves, $11,490, **10,** 1867. Chas. Hegewald Co., 4 sets Riverton Lock sluice-gate operating machinery, $4,159, **10,** 1868. Vulcan Steam Shovel Co., machinery, etc., for dr. *Tuscumbia*, $20,000; Penn Bridge Co., steel Riverton Lock gates in place, $19,649, **11,** 2050.

ENGINEERS.

Chief of Engineers. **R., 01,** 465; **02,** 393, 398; **03,** 418; **04,** 445; **05,** 455; **06,** 499; **07,** 528; **08,** 562; **09,** 595; **10,** 669; **11,** 720; **12,** 870.

Boards. Special BE. constituted, S. O. No. 11, to consider and report upon modification for imp. R. at Colbert and Bee Tree Shoals, as recom. by Capt. Barden and Maj. Newcomer (see Projects). (Lt. Col. W. H. Bixby, Maj. G. A. Zinn, Capt. H. Burgess), **05,** 1751.

In charge:
Maj. J. G. D. Knight, 1901–03. **R., 01,** 2423; **02,** 1712.
Maj. D. C. Kingman, 1902. **R., 02,** 1744.
Capt. W. J. Barden, 1903–04. **R., 03,** 1594; **05,** 1742.
Maj. H. C. Newcomer, 1904–07. **R., 04,** 2360; **05,** 1737, 1747; **06,** 1517.
1st Lt. W. G. Caples, **07,** 525.
Maj. W. W. Harts, 1907–11. **R., 07,** 1626; **08,** 1702; **09,** 1693; **10,** 1862; **11,** 2042.
Maj. C. A. F. Flagler, **11,** 717; **12,** 867.
Maj. E. Jadwin, **12,** 867.
Maj. H. Burgess, 1912–. **R., 12,** 2243.

Assistants:
S. B. Williamson. **R., 01,** 2434.
W. S. Winn. **R., 01,** 2434.
G. T. Nelles. **R., 02,** 1754.
J. M. G. Watt. **R., 05,** 1743.

LEGAL PROCEEDINGS.

Lands deeded to U. S. for constr. and operation of lock and dam, **06,** 1519.

LEGISLATION.

Act Apr. 26, 1904, au. Sec. of War to contract with city of Chattanooga or other individuals for constr. of lock and dam at Scott Pt. (Hales Bar), granting parties undertaking work water-power privileges, **04,** 445.

Sec. of War grants permission to C. E. James and J. C. Guild to build lock and dam at Hales Bar, **05,** 1739.

OPERATIONS.

1900-01. Chattanooga to Decatur: 1,22 2c. y. rock excavated at Widows Bar and other places, 170 snags removed, and 1,585 trees and 1,835 saplings cut, **01,** 2424. Decatur to Florence: Training dam at Nances Reef repaired, at Little Muscle Shoals trees overhanging chan. cut off and a longitudinal dam 75′ l. built; at Raccoon Bar, washed-off st. replaced on dam and st. quarried; at Sweetwater Bar, 1,950 c. y. dr.; repairs made to floating plant, **01,** 2425. Florence to foot of Bee Tree Shoals: Two months' quarry work done, about 3,067 c. y.; 3,341 c. y. cut and scabbled, **01,** 2427.

1901-02. Decatur to Florence: Repairs to plant, **02,** 1713. Florence to Bee Tree Shoals: Mainten., **02,** 1714.

1902-03. Chattanooga to Florence: 7,630 c. y. dr. from bar at Florence Br. and placed so as to form a dam about 3′ h.; 15,500 c. y. dr. from Sweetwater Bar, **03,** 1595. Florence to Riverton: Preliminary work by contractor for work on canal section above guard lock, **03,** 1596.

1903-04. Colbert Shoals Canal: Excavation work for canal begun (27,313 c. y. soft material and 21,908 c. y. rock removed), and 2,900 l. f. cofferdam completed, **04,** 2362.

1904-05. Colbert Shoals Canal: 35,093 c. y. earth and 42,588 c. y. rock excavated, and 1,230 c. y. concrete R. wall built, **05,** 1737. Hales Bar Lock and Dam: Preliminary work of examining foundations and preparing plans for work at this place in progress, **05,** 1739. 10,600 c. y. dr. from chan. at Sweetwater Bar, **05,** 1741.

1905-06. 18,160 c. y. dr. from Guntersville Landing, 22,815 c. y. from Browns Bar, 22,330 c. y. from Allens (or Paint Rock) Bar, **06,** 1517. At Hales Bar Lock and Dam, general plans completed, work of clearing grounds for actual operations begun, and necessary buildings and machinery for use in building this lock and dam constr., **06,** 1519. At Colbert Shoals Canal, work in progress on excavating canal and building concrete R. wall, **06,** 1520.

1906-07. 12,660 c. y. dr. from Browns Bar, 14,100 c. y. from Allens Bar, and 853 trees cut and 1 snag removed from Little Muscle Shoals, **07,** 1626–27. At Hales Bar Lock and Dam, 109,162 c. y. earth, and 1,883 c. y. rock excavated, and 5,886 c. y. concrete work done to date, and necessary structures for carrying on operations erected, **07,** 1628–29. At Colbert Shoals Canal, work on excavation of canal and building of concrete R. wall prosecuted; details of work and quantities excavated given, **07,** 1630–31.

1907-08. At Hales Bar Lock and Dam, 46,942 c. y. earth and 6,807 c. y. rock excavated, and 4,136 c. y. concrete placed; other work of cofferdam, RR. and crib constr. done, **08,** 1702–03. Dr. *Kwasind* rebuilt and removed 23,390 c. y.; 14 snags removed from Guntersville Slough; 1,828 c. y. dr. from Allens Bar; constr. of 2 reinforced concrete piers above Twin Towheads, with dams connecting them with towheads, completed, **08,** 1705. At Colbert Shoals Canal, upper section, 2,645 c. y. rock and 1,271 c. y. earth excavated, and 10,587 c. y. concrete R. wall built; for lower section wall, 652 c. y. earth excavated and 3,826 c. y. concrete placed; in lower section canal, stations 10–290, 286,461 c. y. earth and 167,281 c. y. hardpan excavated. By hired labor, work on raising lock walls 4′–10″ begun, **08,** 1710.

1908-09. At Hales Bar Lock and Dam, earth and rock excavated from lock pit and lower approach, for power house, tailrace, and dam foundation, amount 42,165 c. y.; 24,650 c. y. concrete placed in core wall, power house, lock walls and dam, **09,** 1693. At Allens Bar, 28,000 c. y. soft material, 55,600 c. y. cemented gravel, bowlders, etc., and 24,700 c. y. solid rock removed, **09,** 1695. Quarry at Coffee Bluff reopened and constr. of dam commenced at Chunn Bar; barges and dump scows built, and extensive repairs made to existing floating plant, **09,** 1696. At Colbert Shoals Canal, contract for upper portion completed Nov. 27, 1908, **09,** 1697. Downstream portion of R. wall completed; 635,707 c. y. excavated from lower section of canal, **09,** 1698. Dwellings, etc., erected, and raising height of lock walls by hired labor practically finished, **09,** 1699.

1909-10. At Hales Bar Lock and Dam, 44,268 c. y. concrete placed, 15,820 c. y. earth and 8,755 c. y. rock excavated, and 1,400 c. y. embankment

built, **10,** 1862. At Burdine Bar, 5 dikes constr., using 14,100 c. y. st., **10,** 1863. At Flint R. Towhead, 10,700 c. y. dr., and extensive repairs made to floating plant, **10,** 1864. At Colbert Shoals Canal, excavation of lower section completed, 198,316 c. y. dr. Work done at gate anchorages, lock chamber unwatered, and other minor operations by hired labor, **10,** 1866.

1910-11. At Hales Bar Lock and Dam, 60,750 c. y. concrete placed, 75,277 c. y. earth and 40,536 c. y. rock excavated, 20,566 c. y. embankment built, transformer house constr.; 663 l. f. cofferdam constr. remains to be done, **11,** 2042. A chan. 5′ x 150′ completed at Flint R. Bar, **11,** 2043. At Allens Bar, chan. excavated to full proj. d. and w.; at Guntersville Landing, 3,500 c. y. dr.; at Florence Br. Bar, 6,800 c. y. dr.; at Tuscumbia Bar, 44,200 c. y. dr. The total dr. bet. Chattanooga and Riverton during 1911, 176,800 c. y. rock and gravel, **11,** 2044, 2045. At Colbert Shoals Canal, preparation made for erecting guard gates for lock, **11,** 2046. Installation of machinery, dr. deposits from canal, building road, and other necessary work done at Colbert Shoals Canal by hired labor, **11,** 2047.

1911-12. At Hales Bar Lock and Dam, 21,360 c. y. concrete placed, 23,446 c. y. earth and 22,015 c. y. rock excavated, 14,274 c. y. embankment built, and 4972 s. y. riprap placed; erection of both lower and upper lock gates completed; installation of electrical machinery; 898 l. f. of cofferdam added to orig. estimate, **12,** 2243, 2244. At Tuscumbia Bar, 36,410 c. y. excavated, repairs made to floating plant. At Buck Isld. Shoals, 71,620 c. y. removed; 18,700 c. y. dr. from Colbert Shoals Canal, **12,** 2245. At Colbert Shoals Canal, 14,010 c. y. removed from lock chamber, cofferdam removed and other work necessary to completion done, **12,** 2247.

First commercial boat locked through Dec. 4, 1911.

PHYSICAL CHARACTERISTICS.

Gauge data, **02,** 1759, 1760.
Discharge data, **02,** 1762.
Precipitation, **02,** 1758.
Chattanooga gauge readings, **01,** 2424; **02,** 1713, 1805; mean stages, 1879–1900, **02,** 1761; no. of days above given stages, 1875–1900, **02,** 1762.
Riverton gauge readings, **01,** 2426.
Canals have not made navigation possible at all stages, **01,** 2425.
Sur. bet. Scott Pt. and Lock A. Detailed history of this section given, together with reports of assistants, containing information as to character and physical formation of R., **02,** 1743; area and distribution of drainage basin, **02,** 1757; list and character of obstructions, **02,** 1767.
Hydrographs, **02,** 1713.
Results of dam constr. at Little Muscle Shoals have been not only to stop cross current, but, also, to decrease velocity to a considerable extent; boats "now" make passage without use of a line, **08,** 1705.

PRIVATE WORK.

About 3,270 c. y. dr. by Nashville, Chattanooga & St. Louis Ry. Co. in the slough chan. leading from R. to its incline at Guntersville, **04,** 2361.

Constr. Hales Bar Lock and Dam given under Operations; work under supervision of U. S. (See Projects also, **11,** 2043.)

PROJECTS.

Sept. 5, 1901, recom. that Colbert Shoals Canal be constr., to be in part submerged when there was a 7′ stage over shoals. Further modification submitted Sept. 17, 1902, and entire subject referred to BE., Dec. 10, 1902; plans submitted to Sec. of War and approved Feb. 17, 1903. Main differences from earlier plans, location of upper section of canal in R. bed instead of in bank, resulting in constr. of R. wall, and location of guard lock at lower end instead of upper end; cost to complete, $2,200,000, **03,** 1596.

Capt. Barden proposed, 1905, at Colbert Shoals: (1) to eliminate guard lock; (2) to raise walls and gates of lift lock 4.5′, to elevation 42 (8.5′ above l. w.) at head of canal; (3) to raise weir crest 7′ to elevation 41; (4) to shift canal trunk toward land side of canal right of way; and (5) to raise R. embankment to at least elevation 43, wasting the surplus excavated material on R. side of canal, where land already purchased for latter purpose; concurred in by Maj. Newcomer, BE., and au. by Sec. of War; saving, $150,000 in total cost, **05,** 1738, 1742.

Act Mar. 2, 1907, au. proj., extended in scope by act June 25, 1910, to provide for open chan. work to secure chan. 5′ l. w. bet. Chattanooga and Riverton; est., $1,481,500, **10,** 670.

Proj. for constr. Hales Bar Lock and Dam, as follows: Lock and dam and power house; l. of pool, 40 m.; lift of lock, 37.5′; size of lock, 60′ x 312′; clear l., 300′; d. on miter sills, 6.5′; to be paid for by private corporation, except gates, valves, metal work, and superintendence. Cost to U. S., about $229,700, **12,** 2043, 2044.

Act June 25, 1912, modified proj. in accordance with recom., as follows: (a) Bet. Chattanooga and Browns Isld., lock and dam at Crow Creek Isld., and open chan. work to secure 6′ at ordinary l. w.; est., $3,000,000; (b) bet. Florence and Riverton, open chan. work to secure 6′ l. w.; est., $500,000,[1] **12,** 871.

SURVEYS.

Sur. au. act Mar. 3, 1899, Scott Pt. to Lock A, Muscle Shoals Canal, embracing reach bet. Bridgeport and Decatur. **R.** by Maj. Kingman, Mar. 25, 1901; est., $770,640,[4] **02,** 398.

Ex. au. act Mar. 2, 1907, Elk R. Shoals to Florence Ry. br., for development of water power. **R.** by BE., Nov. 7, 1907,[2] **08,** 572.

R. by BERH., Feb. 1, 1909, req. by R. and H. Com. Recom. expend. of $250,000 to securing chan. 5′ x 150′ bet. Florence Br. and Colbert Shoals Canal.[3]

Sur. au. act Mar. 3, 1909, from confluence of Holston and French Broad Rs. to mouth. **R.** by Maj. Harts, Mar. 21, 1910, and Lt. Col. Warren, May 19, 1910; est., $6,700,000, with $100,000 an. mainten.,[1] **12,** 883.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 872.

Maps.[2] **02,** 1712; **11,** 2043, 2046; **12,** 2243.

Part (e), AA-18 Tennessee River. (Above Chattanooga.)

APPROPRIATIONS.

1869,	$35,000.00,	**69,** 23, 49; **03,** 1594, 1597.
1871,	35,000.00,	**70,** 65; **71,** 494; **72,** 478; **77,** 579.
1872,	25,000.00,	**72,** 479; **77,** 579.
1873,	25,000.00,	**73,** 61, 124, 546; **77,** 579.
1874,	25,000.00,	**74,** 69, 575, 577; **77,** 579.
1875,	40,000.00,	**75,** 75, 789; **77,** 579.
1876,	15,000.00,	**76,** 86, 712; **77,** 88, 579.
1878,	15,000.00,	**78,** 102, 756.
1879,	11,500.00,	**79,** 137, 1248.
1880,	10,000.00,	**80,** 1671.
1881,	$7,000.00,	**81,** 1841.
1882,	7,000.00,	**82,** 1839.
1884,	3,000.00,	**84,** 1641.
1886,	7,500.00,	**86,** 1510.
1888,	15,000.00,	**88,** 1593.
1890,	30,000.00,	**90,** 2113.
1892,	25,000.00,	**92,** 1914.
1894,	50,000.00,	**95,** 2286.
1896,	15,000.00,	**96,** 1928.
1899,	30,000.00,	**99,** 2255.
1902,	50,000.00,	**02,** 1712.
1905,	50,000.00,	**05,** 1737.

[1] H. D. 360, 62d, 2d. [2] H. D. 781, 60th, 1st. [3] R. and H. 12, 61st, 2d. [4] H. D. 50, 57th, 1st.

1907,	$105,000.00,	**07,** 1623.
1907,	1,270.46,	**09,** 1691.
1909,	50,000.00,	**09,** 1691.
1910,	120,000.00,	**10,** 1860.
1911,	65,000.00,	**11,** 2041.
1912,	105,000.00,	**12,** 2242.
Total,	972,270.46	(from which might be deducted $510.09, trans. to Little Tenn. R.) **R., 12,** 2242.

COMMERCE.

Important, **81,** 1840; **82,** 1838; **84,** 1640.

Carried on by small steamers, barges, and rafts, the last being the most important, **98,** 1892.

C. of the upper R., advantages to, of completed imp., **88,** 1593; **89,** 1822, 1829.

Steamers plying above Chattanooga, **92,** 1918.

This section of R. navigable except during periods of very l. w., which occur during summer and fall months, **01,** 2421.

List of boats and barges navigating R. above Chattanooga, **04,** 2367.

1904, 562,677 t., **05,** 454; 1911, 394,176 t., **12,** 870.

Graphic chart of C. and app., **11,** 2041.

CONTRACTS.

1908. E. J. Howard, wooden-hull steam tenders (2), $10,000 each, **08,** 1701.

1911. Marion-Osgood Co., dr. *Tellico,* $16,248, **12,** 2242.

ENGINEERS.

Chief of Engineers. R., 93, 298; **94,** 273; **95,** 310; **96,** 268; **97,** 348; **98,** 340; **99,** 401; **00,** 458; **01,** 464; **02,** 393; **03,** 417; **04,** 444; **05,** 454; **06,** 497; **07,** 526; **08,** 561; **09,** 593; **10,** 668; **11,** 719; **12,** 868, 883.

In charge:

Lt. Col. H. M. Robert, 1892–93. **R., 93,** 2335.

Capt. J. Biddle, 1893–94. **R., 93,** 2330; **94,** 1787.

Capt. T. A. Bingham, 1895. **R., 95,** 2285.

Capt. D. C. Kingman, 1896–1901. **R., 96,** 1926; **97,** 2252; (Maj.) **98,** 1892; **99,** 2252; **00,** 2908.

Maj. J. G. D. Knight, 1901–03. **R., 01,** 2421; **02,** 1711.

Capt. W. J. Barden, 1903–04. **R., 03,** 1592.

Maj. H. C. Newcomer, 1904–07. **R., 04,** 2359; **05,** 1735; **06,** 1513.

1st Lt. W. G. Caples, **07,** 525.

Maj. W. W. Harts, 1907–11. **R., 07,** 1621; **08,** 1697; **09,** 1689; **10,** 1859; **11,** 2039.

Maj. C. A. F. Flagler, **11,** 717; **12,** 867.

Maj. E. Jadwin, **12,** 867.

Maj. H. Burgess, 1912–. **R., 12,** 2239.

Assistants:

R. R. Thacher. **R., 93,** 2378; **96,** 2021; **97,** 2271; **98,** 1909; **99,** 2267; **00,** 2923.

F. B. Williams. **R., 97,** 2289.

1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.

Capt. A. B. Putnam, **08,** 560; **09,** 593.

ESTIMATES.

By Maj. McFarland, 1871, removal of obstr., dr., and constr. of wing dams to give l.-w. d. of 3′, chan. 140′ w., as follows: Chattanooga to Kingston; $47,156, **71,** 502, 507; **74,** 572; Kingston to Knoxville, $125,000, **72,** 488, 494; **74,** 573; aggregate assumed at $175,000; necessity of increase, **74,** 573; **77,** 579; **78,** 756.

By Maj. McFarland, 1872, imp. from mouth to Short Creek (being part of Southern Route of Transportation Routes to Seaboard) to 3 and 5′, incl. imp. of Muscle Shoals, $4,251,000, **72,** 509, 512, 518; **75,** ii, 658.

OPERATIONS.[1]

1879-80. Rock excavation and constr. of wing dams on Chota and Coulters Shoals, **80,** 1669. Completion of dams, **81,** 1840.

1880-81. Constr. of wing dams at Little R. Shoals and repairing of dams at Half Moon Isld., **81,** 1840.

1881-82. Constr. of wing dams at Little R. Shoals, **82,** 1838.

1882-83. Constr. of wing dams at Little R. and William Isld. Shoals, **83,** 1478.

1884-85. Rock removal and constr. of wing dams at Chota, William Isld., Lyons, Knoxville, and Bakers Shoals, **85,** 1752.

1886-87. 466 c. y. st. quarried and 390 c. y. of same placed in dams at upper Half Moon Isld.; flat scows built and snag boat in progress, **87,** 1738.

1887-88. 140 l. f. of riprap dam built; 788 c. y. riprap quarried, and 30 c. y. loose rock removed; 127 snags removed, and 103 trees cut from banks, **88,** 1593.

1888-89. 577 c. y. riprap quarried and placed in dams at White Creek Shoals; 42 snags removed, and 1,872 trees cut from banks, **89,** 1821.

1889-90. 3,900 c. y. st. quarried and built into dams, and 510 snags removed from chan., **90,** 2113.

1890-91. White Creek Isld. Dam extended 690′, and 345 l. f. of spur dam built; 40 c. y. rock and 24 snags removed from chan., and 258 overhanging trees cleared from banks, **91,** 2254.

1891-92. Lower dam repaired and raised throughout 1,600′; upper dam at towhead, and spur dam on reef repaired; repairs to plant, **92,** 1914.

1892-93. Light-draft SS. built; 650 c. y. rock and about 500 snags and other obstr. removed; 4,052 c. y. dams built, and 1,496 c. y. old dam calked, **93,** 2332.

1893-94. St. quarried for dams, **94,** 1789.

1894-95. Caney Creek Shoals: Nearly 1,000 obstr. removed; about 500 c. y. rock excavated; 1,463 c. y. riprap dams built; banks revetted; buoys placed; 2 beacons set; 1,364 c. y. st. quarried, and plant repaired, **95,** 2286.

1895-96. Caney Creek Shoals: Nearly 8,000 c. y. st. quarried; 1,362 c. y. rock excavated from chan.; 4,211 c. y. st. used in constr. of dams and bank protection; crib 300′ l. built; plant enlarged, **96,** 1927, 1928.

1896-97. Caney Creek Shoals: About 2,800 c. y. rock blasted and removed; a low dam 877′ l. built; Dam No. 3 l. about 420′ and a check dam 80′ l. constr.; some dr. done; plant repaired, **97,** 2253, 2254.

1897-98. Knoxville: 12 old military br. piers removed, and st. used in repair of dams and training walls in vicinity; training wall 350′ l. built and 3 spur dams with average l. of 130′ each added. Caney Creek Shoals: 2,100 c. y. dr., and training wall l. 214′; nearly 10,000 snags and other obstr. removed, **98,** 1894.

1898-99. St. for Knoxville Shoals and Bakers Shoals quarried; some dr. at Dickinson Isld.; plant repaired; training wall at Maryville Br. extended (photograph); increase of plant in progress, **99,** 2254.

1899-00. Training wall at Bakers Shoals building, and bank riprapped; st. excavated from reefs at McNutt Shoals and used for protection of banks there; dams at Knoxville Shoals repaired and strengthened, and some dr. done; plant increased; cofferdam and other material removed from false work of br. of a private company, **00,** 2910.

1900-01. Care and repair of plant, **01,** 2422.

1902-03. Quarterboat, derrick boat, tender for same, tool boat, and 3 barges built; at Rockwood Landing, 2,000 c. y. dr. and 60 trees cut; at Kings Bar, 300 c. y. dr., 345 trees cut, 1,715 c. y. rock blasted, and 375 c. y. st. and 575 logs removed; at Bracketts Bar, 19,935 c. y. dr., 490 c. y. st. and 700 c. y. rock removed; at head of Half Moon Isld., 1,383 c. y. quarried from rock reef and 2,405 c. y. placed on dams; at Soddy Shoals, break in dam repaired, **03,** 1593.

1903-04. At Bracketts Bar, chan. completed to 3′ x 130′ x 2,100′, removing 21,775 c. y. sand, etc., and 925 c. y. rock; at Kings Bar, 2 wing dams built, quarry opened, 3,834 c. y. earth stripped, and 4,659 c. y. rock quarried and used in constr. dams 500′ and 950′ l.; at Richland Creek, 1,645 c. y. mud and gravel dr., 2 sunken barges removed and part of another, rock reef blasted away, and 3 trees

[1] All operations by hired labor, **80,** 1670.

cut; at Knoxville, 600 c. y. riprap put in small dam below county br.; bet. Kingston and Chattanooga, 199 snags pulled, 3 barges broken up and raised, 37 c. y. st. blasted and removed, and 154 trees cut; at Chattanooga, 8 c. y. drift and débris cleared; at mouth of Chickamauga Cr., 6 snags pulled, **04,** 2359.

1904-05. 22,000 c. y. dr. in Long Isld. Chute, and repairs made to dr. and other floating plant, **05,** 1736.

1905-06. At Long Isld., 783 c. y. solid rock, 1,177 c. y. bowlders and loose rock and 10,010 c. y. sand and gravel removed, **06,** 1513. At Shields Dam, 2,150 c. y. rock quarried, 1,004 c. y. rock placed in dams, 2,400 c. y. loose rock dr., 2,390 c. y. gravel and sand dr., **06,** 1514. At Half Moon Isld., dams repaired, overhanging trees cut, and drift removed from dams, **06,** 1514–15. At White Creek Shoals, 1,115 c. y. rock quarried and placed in dams; at mouth of Richland Creek, 1,840 c. y. dr. from bar, and repairs made to floating plant, **06,** 1515. SS. *Lookout* struck elbow of dam and sank; raised, and is now being repaired, **06,** 1515.

1906-07. At Shields Dam, 9,135 c. y. sand and gravel, 3,032 c. y. cemented sand and gravel and 4,308 c. y. cemented rock, sand, and gravel dr., about 2,925 c. y. st. quarried and 2,318 c. y. placed in dams; at Caney Creek Shoals, 2,215 c. y. loose material and 775 c. y. rock removed, **07,** 1622.

1907-08. 435 c. y. gravel and 370 c. y. loose rock dr. from head of Caney Creek Shoals and 3,048 c. y. gravel and 50 c. y. loose rock from Kings Bar, 50 c. y. rock removed by derrick boat; building of regulating dams bet. Turner Bar and Pickels Bar and at head of Caney Creek Shoals continued; repairs to floating plant, **08,** 1698, 1699.

1908-09. At Little R. Shoals, dike built to 1,450′, and 750′ of the cross dam erected; at Caney Creek Shoals, 7,280 c. y. dr., dike work commenced, dam being l. about 1,050 l. f., and repairs made to floating plant, **09,** 1690.

1909-10. At Little R. Shoals, rock reefs excavated by drilling and blasting, broken rock removed by dr., and about 4,839 c. y. rock used in constr. of 2,276 l. f. contraction works for chan. regulation, **10,** 1859. 37,325 c. y. dr., repairs to floating plant, and work at Soddy Shoals, **10,** 1860.

1910-11. At Little R. Shoals, 20,657 c. y. blasted rock, 6,095 c. y. loose rock and hardpan, and 250 c. y. soft material dr., 3 tie dams built, completing work at this place; at Kelly Shoals, 12,613 c. y. gravel, shale, and soft material removed, drilling and blasting of rock commenced, and repairs made to floating plant, **11,** 2040.

1911-12. New dr. *Tellico* completed and put in commission, and other plant built and repaired; at Kelly Shoals, 25,000 c. y. gravel and 1,800 c. y. rock removed, and 2,180 c. y. rock placed in longitudinal dike and 2,380 c. y. in cross dikes; about 85% of imp. completed, **12,** 2240. At Watts Bar, 17,600 c. y. gravel and about 1,700 c. y. rock dr. from chan., **12,** 2241.

PHYSICAL CHARACTERISTICS.

Description of; sur. of 1891–93, **93,** 2334, 2339. Details, 2341.

Table of shoals and depths, **93,** 2361.

Table of distances from junction of French Broad, and Holston Rs., along l.-w. chan., **93,** 2362.

Table of elevations, **93,** 2364.

Table of h. w., **93,** 2365.

Discharge, **93,** 2365; **96,** 2014–20; **02,** 1762–64.

Velocities, **93,** 2366.

At Little R. Shoals, chan. 3′ d. accomplished, **11,** 2040.

PRIVATE WORK. (See State work.)

Br. company obtained permission of Sec. of War to have U. S. remove false work of br. constr. near Knoxville, **00,** 2911.

U. S. plant employed in removal of several obstr. at Knoxville, expenses being assumed by city of Knoxville and private parties, **05,** 1736.

Special work paid for by Dayton Coal & Iron Co., near White Creek Shoals, 65 c. y. gravel, 25 t. iron ore, 1,475 c. y. gravel, sand, etc., removed, **07,** 1622.

PROJECTS. (See Estimates, Plans, and Private work.)

Early projs., 1832–56, seem confined to obtaining l.-w. d. of 2′ by means of wing dams and dr., and removal of obstr., **71,** 502; **72,** 488, 497. (See Operations and Private and corporate work.)

By Maj. McFarland, 1871, imp. chan. to 3′ l. w. bet. Chattanooga and Knoxville, 189 m., and requiring the removal of 29 obstr. reefs and shoals; est., $175,000, **71,** 502, 507; **77,** 579. Increased, 1887, to $225,000, **79,** 1248; **80,** 1669; **81,** 1841; **87,** 1738.

In 1890, after an expend. of $271,000, $29,000 est. as required for completion of the proj. imp., **90,** 2113, 2114.

Extent to which stream could be made navigable, **93,** 2354.

In 1893 Lt. Col. Robert est., after sur. of 1891–93, $650,000 to obtain a 3′ chan., **93,** 2335.

By Maj. Kingman, 1899, applying 1899 app. to constr. of dr. plant, part of the expense to be paid from other app. for other works, **99,** 2255.

Act Mar. 3, 1905, au. exp. of $5,000 for Little Tennessee R. in clearing obstr. from chan., **06,** 498.

Act Mar. 2, 1907, au. constr. of floating plant; est., $30,000, **07,** 1622.

Question whether Tennessee R. can ever be satisfactorily imp. by regulation to provide for a C. of national importance, **07,** 1623.

Act July 25, 1912, au. (a) constr. of lock and dam at foot of Caney Creek Shoals (incl. cost of flowage rights) suitable for 6′ navigation; est., $1,600,000; (b) open chan. work to secure 3′ extreme l. w., and 4′ at ordinary l. w.; est., $1,000,000,[1] **12,** 869.

STATE WORK.

In 1832 Tennessee undertook rock removal and constr. of wing dams. Amount done unknown, but of no lasting value, **93,** 2331.

SURVEYS.

Act Sept. 19, 1890, app. $15,000 for sur. of R. from Chattanooga to junction of Holston and French Broad Rs., to ascertain how much navigation might be benefited, and probable cost of imp. Surs. made by Lt. Cols. Barlow and Robert, and **R.** by Capt. Biddle in 1893, **93,** 2333. Field and office work, **93,** 2336. Description of bench marks, **93,** 2366. List of maps, **93,** 2374.

Sur. of part of the front of the town of Chattanooga made for the town, 1897, **97,** 2270.

Sur. au. act Mar. 3, 1909, from confluence of the Holston and French Broad R. to mouth. **R.** by Maj. Harts, Mar. 21, and by Lt. Col. Warren, May 19, 1910; est., $6,700,000, with $100,000 an. mainten.,[1] **12,** 883.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 869.

Maps.[1] **96,** 2042; **97,** 2270; **99,** 2288 (photographs, **99,** 2280; **11,** 2040).

Hydrographic charts, **02,** 1713.

[1] H. D. 360, 62d, 2d.

Part (f), AA-18 Tennessee River, Colbert Shoals Canal. (Operating and care.)

APPROPRIATIONS.[1]

1912, $7,991.96, **12,** 883.

COMMERCE.

Since opening, 14,245 t. transported through canal, **12,** 883.

ENGINEERS.

Chief of Engineers. **R., 12,** 883.

In charge. Maj. H. Burgess, 1912–. **R., 12,** 2261.

OPERATIONS.

1911-12. After deposit was removed from lower lock approach, canal opened to navigation and on Dec. 4, 1911, first commercial boat locked through; canal operated and lock, canal trunk, embankments, buildings, grounds, floating plant, and other appurtenances cared for, **12,** 2261.

Part (g), AA-18 Tennessee River, Tenn.—Muscle Shoals Canal. (Operating and care.)

APPROPRIATIONS.[1]

1891,	[3]$14,313.45	
1892,	[3] 35,686.53	
1893,	[3] 51,262.13	
1894,	[3] 58,735.63	
1895,	[3] 64,891.41	
1896,	[3] 75,409.71	
1897,	[3] 66,021.78	
1898,	[3] 65,333.85	
1899,	[3] 59,284.97	
1900,	[3] 65,281.03	
1901,	65,554.18,	**01,** 2443.
1902,	76,201.22,	**02,** 1728.
1903,	85,186.52,	**03,** 1607.
1904,	63,221.87,	**04,** 2380.
1905,	55,146.57,	**05,** 1764.
1906,	49,105.02,	**06,** 1534.
1907,	52,763.28,	**07,** 1644.
1908,	62,961.48,	**08,** 1720.
1909,	53,443.56,	**09,** 1708.
1910,	51,420.87,	**10,** 1874.
1911,	40,852.54,	**11,** 726.
1912,	52,219.36,	**12,** 883.
Total,	1,264,296.87	(total of allotments given as $1,266,764.08, and amount expended as $1,264,296.87, **12,** 883; **12,** 2259).

COMMERCE.

About 14,300 t., valued at $295,000, carried through the canal during 1899, **00,** 463.

Increase in, **01,** 2442.

In 1911, 8,962 t., **12,** 882.

CONTRACTS.

1896-98. C. J. Halter, fresh meat; J. T. Jones, provisions, **96,** 2049; **97,** 2300; **98,** 1929.

1899. Crow Bros., fresh meat; Harrison Bros., provisions, **99,** 2292.

1900. C. J. Halter, fresh meat and provisions, **00,** 2938.

ENGINEERS.

Chief of Engineers. **R., 93,** 310; **94,** 284; **95,** 313; **96,** 271; **97,** 351; **98,** 344; **99,** 406; **00,** 463; **01,** 466; **02,** 395; **03,** 419; **04,** 447; **05,** 458, 461; **06,** 502; **07,** 531; **08,** 566; **09,** 600; **10,** 674; **11,** 726; **12,** 882.

In charge:

Capt. G. W. Goethals, 1891–94. **R., 93,** 2431; **94,** 1828.

Capt. T. A. Bingham, 1895. **R., 95,** 2305.

Capt. D. C. Kingman, 1896–1901. **R., 96,** 2043; **97,** 2296; (Maj.) **98,** 1925; **99,** 2289; **00,** 2934.

Maj. John G. D. Knight, 1901–03. **R., 01,** 2440; **02,** 1726.

Capt. W. J. Barden, 1903–04. **R., 03,** 1605.

Maj. H. C. Newcomer, 1904–07. **R., 04,** 2378; **05,** 1762, 1780; **06,** 1529.

1st Lt. W. G. Caples, **07,** 525.

Maj. Wm. W. Harts, 1907–11. **R., 07,** 1639; **08,** 1716; **09,** 1705; **10,** 1872; **11,** 2055.

Maj. C. A. F. Flagler, **11,** 717; **12,** 867.

Maj. E. Jadwin, **12,** 867.

Maj. H. Burgess, 1912–. **R., 12,** 2257.

Assistants:

S. B. Williamson. **R., 97,** 2301; **98,** 1930; **99,** 2293; **00,** 2939; **01,** 2444.

W. S. Winn. **R., 02,** 1729; **03,** 1608; **04,** 2381; **05,** 1765.

LEGAL PROCEEDINGS.

Settlement of O'Neal suit by purchase of land, **03,** 1606.

Protest of owners against the discharge of dr. material on their land. In accordance with decision of Judge Adv. Gen., steps taken to purchase land, **06,** 1533.

LEGISLATION.

Senate resol. for information concerning lands and water power at Muscle Shoals Canal; **R.** by Maj. Newcomer, **05,** 1780.[2]

OPERATIONS.

1892-93. 38,964 c. y. dr.; about 1,500 drift logs removed, and broken bank repaired, **93,** 2432, 2433.

1893-94. 42,800 c. y. dr.; 1,275 drift logs removed, and misc. work done, **94,** 1829, 1830.

1894-95. 26,295 c. y. dr. and a part of the canal w. where difficult for boats to pass; large number of drift logs removed; repairs made, and misc. work performed, **95,** 2306–2309.

1895-96. 7,880 c. y. dr.; dry dock under constr. and work similar to that of preceding years performed, **96,** 2044–2047.

1896-97. 61,550 c. y. dr.; dry dock completed, and misc. work done, **97,** 2299.

1897-98. Gates at 11 locks painted after being scraped by sand blast; broken dam repaired; about 11,000 c. y. dr., and much misc. work done, **98,** 1926, 1927.

1898-99. All of the lock gates cleaned and repainted; about 40,000 c. y. dr., and other work done, **99,** 2295.

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[1] Expend. under the permanent indefinite app. provided by act of July 5, 1884, for operating and keeping in repair canals and other public works.

[2] S. D. 173, 58th, 3d.

[3] H. D. 421, 57th, 2d.

1899-00. About 59,200 c. y. dr., and various repairs made to plant, **00,** 2935.

1900-01. Aqueduct cleaned and painted; embankments reinforced, straightened, and sodded, at Locks 5, 7, 8, and 9, and 4,400′ along sections 20 and 21, **01,** 2446, 2447. 500′ rubble wall built at Lock A; 18,093 c. y. dr.; extensive repair work commenced on dam bet. Miltons Bluff and Brown Isld.; work at yard, shops, and mill, **01,** 2448–51.

1901-02. Parker gate above Lock A rebuilt; minor repairs on locks; repair of dam bet. Miltons Bluff and Browns Isld. completed; 55,764 c. y. dr., **02,** 1730–32. Work done at shops, mill, and yard, **01,** 1733–35. Description of damage done by flood and consequent repairs, **02,** 1736.

1902-03. Gates at Locks A and B cleaned and painted; minor repairs made; 38,123 c. y. dr.; **03,** 1608–10. Repair of floating plant, **03,** 1614. Work at shops, mill, and yard, **03,** 1612–14. Repair of damage done by flood completed, **03,** 1615.

1903-04. Minor repairs made; guide and retaining wall, 300′ l., built below Lock 7, and similar wall at Lock 6 rebuilt; timber revet. built along canal banks at Lock A; 100,012 c. y. dr., **04,** 2381, 2383, 2384. Work at shops, mill, and yard, **04,** 2386, 2387. Derrick boat rebuilt and dr. *Alabama* (formerly *Bucyrus*) reconstr.; other work on floating plant; levee built at weir above Lock 6, **04,** 2387, 2388.

1904-05. Hydraulic plant at Lock A replaced with hand-power appliances; trouble with drop gates at Locks 5 to 9; minor repairs; stopping leaks above Lock B and bet. Locks 2 and 4 continued, **05,** 1766–68. 105,490 c. y. dr., **05,** 1769. Work at shops and mill, **05,** 1770, 1771. Repair of floating plant, **05,** 1772. Road built on new right of way at Lock 6, **05,** 1772.

1905-06. Gates at Locks 3 to 9, incl., cleaned and painted, and various other repairs and imp. made, **06,** 1529. 146,968 c. y. dr., **06,** 1531. Repairs and imp. to floating plant, **06,** 1532. Work at shops, **06,** 1533.

1906-07. Minor repairs and imp., **07,** 1639. 111,337 c. y. dr.; timber revet. built along bank above Lock A, and wall at Lock 3 rebuilt, **07,** 1641. Repairs to floating plant; work at shops; 4 tracts (26.5 acres) along s. side of canal bought, **07,** 1642, 1643.

1907-08. Minor repairs to locks, canal, etc.; 59,372 c. y. dr.; imp. made and work done at yard and shops; repairs and additions to floating plant, **08,** 1716, 1717, 1719.

1908-09. Minor repairs and imp. made, **09,** 1705. 117,777 c. y. dr., **09,** 1706. Electric plant nstalled at Lock 6, other imp. made, and work done at yard and shops, **09,** 1707. Extensive repairs and additions to floating plant, **09,** 1708.

1909-10. Minor repairs and imp. made; 195,982 c. y. dr., **10,** 1872. Two dr. hulls, 3 dump scows, towing scow and derrick boat built and various other work done at yard and shops, **10,** 1873.

1910-11. Minor repairs to locks, canal, ry., and rolling stock; 137,088 c. y. dr.; shops operated as usual, **11,** 2055–56. Extensive repairs and additions to floating plant, **11,** 2056.

1911-12. Minor repairs to locks, canal, ry., and rolling stock; embankment 1,000′ l. built behind Sixmile Weir., 2,000 c. y. material used; shops operated as usual, **12,** 2257–58. Floating plant repaired; 2 dr., 1 barge, and 1 dump scow completed; building of 3 new barges, a dump scow, and derrick boat in progress, **12,** 2259.

PHYSICAL CHARACTERISTICS.

General description of, **98,** 1930.

Rainfall and floods damaging works, **93,** 2432, 2433; **97,** 2297; **98,** 1926.

15 streams of varying size flow into the canal and bring large quantities of sediment, **97,** 2298.

Description of canal, **01,** 2440–2441.

Description of extraordinary flood of Mar., 1902, **02,** 1736.

Dimensions and other data of locks, **01,** 2445; **02,** 1729.

Seepage from canal during freshets, **12,** 2257.

PROJECTS.

This work includes care and operation of 11 locks, 1 steel aqueduct, 16 m. canal trunk and embankment, 30 m. telephone line, 15 m. of RR. and RR. plant, a large plant incl. dry dock, sawmill, machine shop, and 19 other buildings, and dr. plant, **97,** 2297.

Au. given, 1895, to constr. dry dock bet. Locks Nos. 6 and 7, at a cost not to exceed $3,000, to furnish a place for repairing U. S. plant, **96,** 2047.

Special allotment of $2,000 made in 1897–98 for repair of partly destroyed dam bet. Browns Isld. and Lock A, **98,** 1926, 1927.

Unit cost of operating and caring for locks, etc.; for dr. and mainten. of canal trunk and embankment, **98,** 1932.

By Maj. Harts, to change location of shipyard at Lock No. 6 to some point on R. where supplies might be delivered by rail, **11,** 727, 2057.

SURVEYS.

Maps. **11,** 2056.

AA-18(h) TENNESSEE AND COOSA RIVERS. (Canal to connect.)

COMMERCE.

Requirements discussed, **72,** 518.

ENGINEERS.

Chief of Engineers. **R., 71,** 64; **72,** 60.

In charge. Maj. W. McFarland, 1871. **R., 72,** 510, 514, 516, 518.

Assistant. J. C. Long. **R., 72,** 520.

ESTIMATES. (See Plans.)

By J. C. Long, 1872, incl. canal, slack-water navigation, and feeders, $9,518,415; storage reservoirs, $552,192; total, $10,070,607, **72,** 516, 522, 525. Increased by Maj. McFarland, 1872, to $11,570,607, **72,** 516, 518.

PHYSICAL CHARACTERISTICS.

General description, **72,** 514, 520.

PLAN. (See Estimates.)

By J. C. Long, 1872, canal 33 m. l. and slack-water navigation 17½ m.; proposed dimensions of canal 70′ w. at water surface and 5′ d., **72,** 511, 521.

SURVEY.

From near Guntersville to near Gadsden, Ala., being part of proposed line of water communication from the Mississippi R. to the Atlantic; made by J. C. Long, 1871–72, under direction of Maj. W. McFarland. **R., 72,** 520.

AA-18(i) TENNESSEE AND ALABAMA RIVERS. (Canal to connect.)[1]

[1] Ex.—**R.** (fav.) Nov. 26, 1828. (H. D. 482, 55th, 2d.)

AA-18(j) TENNESSEE AND ALTAMAHA RIVERS. (Canal to connect.)[1]

AA-18(k) MISSISSIPPI TO ATLANTIC. ("Transportation Routes to Seaboard." Tennessee R., Coosa R., Ocmulgee R., Altamaha R., and Hiwassee R.)

APPROPRIATION.*

1874, $46,000, **75,** ii, 658.

DOCUMENTS. (Not printed in reports.)

Maj. McFarland's final **R.** on sur. of Tennessee R., **75,** ii, 669. **R.** of Maj. McFarland, J. E. Thomes, and J. C. Anderson on sur. of the Coosa, Ocmulgee, and Altamaha Rs., **75,** ii, 673–675.

ENGINEERS.

Chief of Engineers. R., 75, 37.

In charge. Maj. W. McFarland, 1872–75. **R., 72,** 509; **75,** ii, 658.

Assistants:

B. W. Frobel. **R., 75,** ii, 662, 668, 670.
W. B. Gwynn, **75,** ii, 663.
H. M. Smith, **75,** ii, 663.
J. E. Thomes, **75,** ii, 663, 674.
J. C. Anderson, **75,** ii, 674, 675.

ESTIMATES. (See Plans.)

By Maj. McFarland, 1875, completion of sur. of Tennessee R. from Knoxville to Paducah, $30,000, **75,** ii, 661.

By B. W. Frobel, 1875, chan. in Coosa R., from Rome, Ga., to mouth of Great Wills Creek, 4′ x 80′ at extreme l. w., 120 m., $81,679, **75,** ii, 668. Revised by Maj. McFarland, 1875, by increase of cost to $180,000, **75,** ii, 662.

By B. W. Frobel, 1875, chan. 4′ x 80′ extreme l. w. in Ocmulgee and Altamaha Rs., bet. Macon and Darien, Ga., $72,901, **75,** ii, 670.

By Maj. McFarland, 1875, increased to $162,000, **75,** ii, 670.

PHYSICAL CHARACTERISTICS.

Of Tennessee R.; heavy floods, **75,** ii, 660; shoals sur., **75,** ii, 660.

Coosa R.; height above mean l. t. in Mobile B., **75,** ii, 662; average fall per m., **75,** ii, 662, formation of bed, **75,** ii, 663; list of shoals; h. w. and l. w. at Rome and Gadsden, **75,** ii, 664, 667.

Ocmulgee and Altamaha Rs.; height of Macon above mean l. t.; list and description of bars and shoals, **75,** ii, 669, 670–673.

Railway, Guntersville route; max. grade, 52.8′ per m.; table of grades; max. curve, 4°, **75,** ii, 673, 674, 675.

Hiwassee route; table of grades; max. curve, 6°, **75,** ii, 675.

PLANS. (See Estimates.)

By Senate Com., 1874: (1) 3′ chan. in Tennessee R., mouth to Knoxville, at lowest stage of water; (2) communication by canal or freight ry. from Tennessee R. to the Atlantic, **75,** ii, 658.

By. B W. Frobel, 1875: (1) Chan. 4′ x 80′ in Coosa R. from Rome, Ga., to Great Wills Creek, Ala., by l. and d. at Horse Leg Shoal; excavation and removal of loose r. from various bars and shoals, **75,** ii, 664–668; (2) chan. 4′ x 80′, Macon to Darien, Ga., in the Ocmulgee and Altamaha Rs., by removal of snags, logs, etc., **75,** ii, 668–673.

By Maj. McFarland, 1875, freight ry. from Tennessee R. to the Atlantic, Guntersville route and Hiwassee route, **75,** ii, 673–676.

SURVEYS.

Under direction of Maj. McFarland by B. W. Frobel, 1874–75, of Tennessee R. from Knoxville to Paducah, and of Coosa R. from Rome, Ga., to mouth of Wills Creek, Ala. **R., 75,** ii, 659, 661, 662 (see also **72,** 509).

By B. W. Frobel, 1874–75, of Ocmulgee and Altamaha Rs. from Macon to Darien. **R., 75,** ii, 668.

By J. E. Thomes, 1875–76, freight ry. from Tennessee R. to the Atlantic, Guntersville route, **75,** ii, 673.

By J. C. Anderson, 1874–75, of Hiwassee route. **R., 75,** ii, 674.

AA-22 BIG SANDY RIVER, TENN.

ENGINEERS.

Chief of Engineers. R., 06, 507; **08,** 571.

In charge:
Maj. H. C. Newcomer, 1906, **06,** 496.
Maj. W. W. Harts, 1908, **08,** 560.

SURVEYS.

Pre. ex., mouth to Big Sandy, au. act Mar. 3, 1905; **R.,** Maj. Newcomer, Oct. 18, 1905 (unfav.),[2] **06,** 507.

Pre. ex. au. act Mar. 2, 1907; **R.,** Maj. Harts, Oct. 26, 1907 (unfav.),[3] **08,** 571.

AA-27 BEECH RIVER, TENN.

ENGINEERS.

Chief of Engineers. R., 08, 571.
In charge. Maj. W. W. Harts, 1908, **08,** 560.

SURVEY.

Pre. ex. au. act Mar. 2, 1907; **R.,** Maj. Harts, Oct. 28, 1907 (unfav.),[4] **08,** 571.

AA-34 BIG BEAR CREEK (branch of the Tennessee River), MISS.

ENGINEERS.

Chief of Engineers. R., 81, 258; **88,** 213.

In charge:
Maj. W. R. King, 1882. **R., 82,** 1869.
Lt. Col. J. W. Barlow, 1888. **R., 88,** 1639.

Assistants:
J. H. Mayhew. **R., 82,** 1870.
Lt. H. E. Waterman. **R., 88,** 1640.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1870; **88,** 1639.

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* Allotment.
[1] Sur.—**R.,** 1828; est., $4,443,734.42. (H. D. 482, 55th, 2d.)
[2] H. D. 153, 59th, 1st.
[3] H. D. 217, 60th, 1st.
[4] H. D. 58, 60th, 1st.

PLANS.

By Maj. King, 1881, imp. 12 m. of creek by removing snags and fish traps; est., $5,900, **82,** 1869, 1871.

By Lt. Col. Barlow, 1887. (1) Imp. creek, Southards Ford to mouth, 30 m., with works of contraction, and by removing snags and overhanging trees; est., $50,000. (2) For 3′ slack-water navigation at all stages, with 8 locks and dams; est., $500,000, **88,** 1641.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1881, by Maj. King, **82,** 1869.

Au. act Aug. 5, 1886; made, 1887, by Lt. Col. Barlow, **88,** 1639.

AA-53 GUNTERS (Big Spring) CREEK, ALA.

ENGINEERS.

Chief of Engineers. **R., 91,** 288.

In charge. Lt. Col. J. W. Barlow, 1890. **R., 91,** 2325.

Assistant. J. W. Walker. **R., 91,** 2326.

PHYSICAL CHARACTERISTICS.

Description of, trib. of Tenn. R.; town of Guntersville is county seat of Marshall Co., **91,** 2326.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Barlow (**R.** unfav.), **91,** 2326.

AA-67 HIWASSEE (Hiawassee) RIVER, TENN.

APPROPRIATIONS.

1876,	$10,000.00,	**77,** 91.
1878,	10,000.00,	**78,** 104.
1879,	3,000.00,	**79,** 140.
1880,	3,000.00,	**80,** 1679.
1881,	1,500.00,	**81,** 1860.
1882,	1,500.00,	**82,** 1848.
1884,	2,500.00,	**84,** 1650.
1886,	2,500.00,	**86,** 1520.
1888,	1,000.00,	**88,** 1606.
1890,	1,500.00,	**90,** 2131.
1902,	10,000.00,	**02,** 1742.
1905,	4,500.00,	**05,** 1778.
1907,	55,282.40,	**07,** 1650.
1909,	5,000.00,	**09,** 1714.
1910,	10,000.00,	**10,** 1879.
1912,	5,000.00,	**12,** 2256.
Total,	126,282.40 (incl. misc., $126,290.63, **12,** 2256).	

COMMERCE.

Important, **75,** 810; **79,** 140, 1269.

Description of; not unimportant, **93,** 2412, 2413. Largest parts of the C. to Chattanooga from the upper Tennessee comes out of Hiwassee R., **95,** 2313.

An. C., 9,000 t. ±; value, $150,000±, **00,** 3018.

In 1902, 16,041 t. increase over previous years, **03,** 422.

In 1907, 7,040 t., **08,** 570.

In 1911, 3,717 t., **12,** 882.

CONTRACTS.

1908. Ed. J. Howard, constr. wooden hull steam tender, $10,000, **08,** 1725.

ENGINEERS.

Chief of Engineers. **R., 75,** 77; **77,** 91; **78,** 104; **79,** 140; **80,** 186; **81,** 252; **82,** 245; **83,** 253; **84,** 254; **85,** 276; **86,** 267; **87,** 232; **88,** 209; **89,** 244; **90,** 220; **91,** 280; **92,** 267; **93,** 301, 307; **94,** 275; **95,** 313; **96,** 271; **99,** 410; **00,** 468; **01,** 469; **02,** 396; **03,** 422; **04,** 449, 451; **05,** 460; **06,** 505; **07,** 534; **08,** 569; **09,** 603; **10,** 677; **11,** 730; **12,** 880.

In charge:

Maj. W. McFarland, 1875. **R., 75,** 809.

Capt. W. R. King, 1877–86. **R., 77,** 598; **78,** 761; **79,** 1268; (Maj.) **80,** 1678; **81,** 1860; **82,** 1847; **83,** 1493; **84,** 1649; **85,** 1764.

Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1519; **87,** 1754; **88,** 1605; **89,** 1833; **90,** 2130; **91,** 2259.

Lt. Col. H. M. Robert, 1892–93. **R., 92,** 1920; **93,** 2412.

Capt. J. Biddle, 1893–94. **R., 93,** 2381, 2412; **94,** 1795.

Capt. T. A. Bingham, 1895. **R., 95,** 2311.

Capt. D. C. Kingman, 1896–1901. **R., 96,** 2049; (Maj.) **00,** 3010, 3016; **01,** 2459.

Maj. J. G. D. Knight, 1901–03. **R., 02,** 1742.

Capt. W. J. Barden, 1903–04. **R., 03,** 1622.

Maj. H. C. Newcomer, 1904–07. **R., 04,** 2394; **05,** 1778; **06,** 1538.

1st Lt. W. G. Caples, **07,** 525.

Maj. Wm. W. Harts, 1907–11. **R., 07,** 1649; **08,** 1725; **09,** 1712; **10,** 1878; **11,** 2063.

Maj. C. A. F. Flagler, **11,** 717; **12,** 867.

Maj. Edgar Jadwin, **12,** 867.

Maj. H. Burgess, 1912–. **R., 12,** 2256.

Assistants:

M. Kingsley. **R., 75,** 810.

J. S. Carey, **77,** 598; **78,** 761.

G. T. Nelles. **R., 01,** 2464.

H. S. Bosler. **R., 01,** 2477.

1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.

Capt. Alfred B. Putnam, **08,** 560; **09,** 592.

OBSTRUCTION.

Obstr. to navigation from RR. br. without draw, **87,** 1754.

OPERATIONS.

1876-77. Rock quarried for dams, 600 c. y., **77,** 91, 599.

1877-78. Removal of 403 c. y.; 879 c. y. st. quarried; 2,784 c. y. st. placed in dams; logs and bowlders removed; completion of 270′ of s. dam, **78,** 104, 761.

1878-79. Removal of 648 c. y. r. and gravel from chan.; 2,292 c. y. r. quarried and 2,104 c. y. placed in dams; constr. of 174 c. y. riprap and retaining walls, **79,** 140, 1268.

1879-80. 581 c. y. r. quarried; 98 c. y. r. blasted; 656 c. y. placed in dams, **80,** 1679.

1880-81. 157 c. y. r. blasted; 280 c. y. r. quarried; 500 c. y. put into dams, **81,** 1860.

1881-82. 788 c. y. bowlders removed from R. and placed in dams, **82,** 1847.

1882-83. 65 c. y. r., 219 c. y. bowlders, and 82 snags removed from chan.; 104 c. y. riprap dam built, **83,** 1493.

1885-86. 64 c. y. removed from chan.; 55 snags and trees removed; 432 c. y. st. quarried; 287 c. y. riprap dam built, **86,** 1520.

1886-87. Removal of snags, gravel, and r., and constr. of dams at Mathews Shoal, Canefield Reefs, Bunker Hill Shoal, and Magills Isld., **87,** 1754.

1889-90. 476 logs and snags removed from chan., and 955 trees cut from banks, **90,** 2130.

1891-92. 65 overhanging trees cleared from banks, and repairs made to plant, **92,** 1921.

1892-93. Portion of an old dam removed, and 167 l. f. new spur dam built at Mathews Shoal; dams strengthened and other work done on them

where necessary; banks protected, and some obstr. removed, **93,** 2382.

1902-03. Constr. quarterboat; removed obstr., viz, trees, logs, snags, etc., **03,** 1622.

1903-04. Imp. chan. by dam constr.; placed, leveled, and graded 3,664 c. y. r.; 43 c. y. r. removed, **04,** 2394.

1906-07. Work on dams and removing obstr. at Mathews and Blackbird Shoals, **07,** 1649.

1907-08. 9,780 c. y. dr.; new quarterboat built, **08,** 1725.

1908-09. Dr.; removing obstr.; dam building, **09,** 1712.

1909-10. Dr.; work on dikes; clearing chans., **10,** 1878.

1910-11. Chan. excavation; constr. of 3 wing dams at Blackbird, Graves, and Mathews Shoals; removal of snags, **11,** 2063.

1911-12. 150 c. y. gravel and 565 c. y. r. excavated; 330 l. f. dams repaired; 2 snags removed, **12,** 2256.

PHYSICAL CHARACTERISTICS.

Description, **75,** 810; **93,** 2412; **00,** 3011; **01,** 2461; 2466; shoals, **01,** 2467, 2471; drainage area and rainfall, **01,** 2467; discharge, **93,** 2366; **01,** 2468.

Mineral resources, **75,** 810, 811.

List of obstr., **75,** 811, 812; **79,** 1268.

H. R. rises mountains of w. N. C. and n. Georgia, flows nw. and enters Tenn. R. 35± m. above Chattanooga; many shoals, **12,** 880, 881.

PRIVATE (STATE) WORK.

App. by Tenn., 1844, for imps. badly applied, **75,** 811.

PROJECTS.

By Maj. McFarland, 1874, chan. 2′ x 40′ l. w., mouth to Savannah, distance of 33 m.; est., $20,000, **75,** 810, 813. Reest., $30,000, **78,** 762; **79,** 140, 1269. Increased by Maj. King, 1882, to $34,000, **82,** 1848; in 1885, to $36,500, **85,** 1764; **87,** 1755; **91,** 2261; **92,** 1920.

Act June 13, 1902, au. chan. 30″ x 116′, by using spur dikes, training walls, and submerged sills; cost, $71,125,[1] **03,** 422.

SURVEYS.

By M. Kingsley, 1874, Savannah Ford to a point below Benton, Tenn., **75,** 809, 810; **77,** 599.

Ex. by J. S. Carey, 1877, of Mathews Shoal and Magils Isld., **77,** 91, 598.

Ex., from its confluence with the Tenn. to mouth of Ocoee R., au. act July 13, 1892; made, 1892, by Lt. Col. Robert (**R.** fav.), **93,** 2412.

Ex. and sur. to the mouth of the Ocoee R. au. act Mar. 3, 1899; made, 1899–1900, by Maj. Kingman (**R.** fav.), **00,** 3011, 3016. Final **Rs.,** Maj. Kingman, 1899 and 1900,[1] **01,** 469, 2458.

Pre. ex. au. act June 13, 1902. **R.,** Maj. Knight, Aug. 19, 1902 (unfav.),[2] **04,** 451; 2401.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 881.

AA-90 LITTLE TENNESSEE RIVER, TENN.

APPROPRIATIONS.

1882,	$5,000,	**82,** 1869.
1905,	[3] 1,000,	**06,** 1516.
1907,	[3] 1,000,	**07,** 1625.
Total,	7,000 (less $1,489.91 trans. to Tennessee R. above Chattanooga, $5,510.09, **10,** 1861).	

COMMERCE.

Important, **75,** 815.

Insignificant, outside of timber products, **08,** 1701.

ENGINEERS.

Chief of Engineers. R., 75, 78; **76,** 87; **81,** 258; **82,** 252; **83,** 259; **84,** 259; **85,** 278; **86,** 270; **87,** 232; **88,** 209; **01,** 469; **06,** 498; **07,** 527; **08,** 562; **09,** 594; **10,** 669.

In charge:

Maj. W. McFarland. **R., 75,** 813; **76,** 715.

Maj. W. R. King, 1881–86. **R., 82,** 1868, 1871; **83,** 1507; **84,** 1659; **85,** 1769.

Lt. Col. J. W. Barlow, 1886–88. **R., 86,** 1524; **87,** 1752; **88,** 1604.

Maj. D. C. Kingman, 1901. **R., 01,** 2492, 2496.

Maj. H. C. Newcomer, 1906. **R., 06,** 1516.

1st Lt. W. G. Caples, **07,** 525.

Maj. W. W. Harts, 1907–11. **R., 07,** 1624; **08,** 1700; **09,** 1691; **10,** 1861.

Assistants:

M. Kingsley. **R., 75,** 814; **76,** 716.

J. H. Mayhew. **R., 82,** 1872.

G. T. Nelles. **R., 01,** 2502.

1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.

Capt. A. B. Putnam, **08,** 560; **09,** 592.

OBSTRUCTIONS. (See Physical data.)

Illegal obstr. (rock dumping) removed by contractors for RR. along banks, **08,** 1700.

OPERATIONS.

1882-83. 110 c. y. rs. and bowlders excavated from chan.; 156 c. y. riprap dam and 11 c. y. embankment built; 110 snags and trees removed, **83,** 1507.

1883-84. 1,409 c. y. r., bowlders, and gravel, 182 snags, and 421 trees removed, and 1,380 c. y. r. placed in wing dams, **84,** 1660.

1905-06. Inspection of stream made, **06,** 1516.

1906-07. Dam at Stratton Shoals repaired by placing 45 c. y. st. therein, trees cut, trimmed, removed, and girdled, and snags removed, **07,** 1624.

PHYSICAL CHARACTERISTICS.

General, **75,** 814; **76,** 715–717; **88,** 1604.

Products of the country adjacent, **75,** 815; **76,** 717.

List of obstr., **75,** 816; **76,** 716.

Description of, **01,** 2492; 2502.

Shoals, **01,** 2503, 2506; discharge, drainage area, and rainfall, **01,** 2504.

PLAN.

By M. Kingsley, imp. wing dams, excavation of r. and gravel, and clearing off of brush, snags, and trees; est., orig., $45,000; subsequently increased by Maj. McFarland to $55,000, **75,** 814, 817.

PROJECTS.

By Maj. King, 1882, imp., mouth to the mouth of the Tellico R., about 13 m., by removal of snags, logs, bowlders, and similar obstr., and constr. of st. wing dams, securing a chan. 2′ x 40′; est., $23,724, **82,** 1868, 1869.

Considered inadvisable to further imp. this stream, and further allotments not recom., **09,** 1691.

SURVEYS.

By M. Kingsley, 1874–75. **R., 75,** 814; **76,** 716.

Ex. au. act Mar. 3, 1881; made, 1882, by Maj. King, **82,** 1868.

Pre. ex. and sur. au. act Mar. 3, 1899, mouth to slate quarries on Abrams Creek. **R.,** Maj. Kingman, 1899 and 1900; est., $208,505,[4] **01,** 469, 2491.

[1] H. D. 77, 56th, 2d.
[2] H. D. 183, 58th, 2d.
[3] Allotted from app. for Tenn. R. above Chattanooga.
[4] H. D. 66, 56th, 2d.

AA-112 FRENCH BROAD[1] AND LITTLE PIGEON RIVERS, N. C. AND TENN.

Part.	Title.	Period.	Appropriations.
a	French Broad R., N. C. and Tenn.	1870–1879	[2] $30,000
b	French Broad R., N. C.	1880–1888	13,000
c	French Broad and Little Pigeon Rs., Tenn.	1880–1912	142,000
	Total (**12**, 2253, 2254)		185,000

Part (a), AA-112 French Broad River, Tenn. and N. C.

APPROPRIATIONS.

1876, $10,000, **76,** 140; **77,** 66, 368.
1878, 15,000, **78,** 74, 523.
1879, 5,000, **79,** 88, 649.

Total, [2] 30,000

COMMERCE.

Unimportant, **71,** 63, 491; **75,** 818; **76,** 720.

ENGINEERS.

Chief of Engineers. R., 70, 32, 65; **71,** 63; **75,** 78; **76,** 87; **77,** 66; **78,** 74; **79,** 87.

In charge:
Maj. G. Weitzel, 1870. **R., 71,** 491.
Maj. W. McFarland, 1875–77. **R., 75,** 817; **76;** 718.
S. T. Abert, U. S. C. E., 1877–81. **R., 77,** 368; **78,** 522, 525; **79,** 648.

Assistants:
Lt. M. B. Adams. **R., 71,** 491.
R. C. McCalla. **R., 75,** 818; **76,** 720.

OPERATIONS.

Early operations, **71,** 492, 493.
History of operations, **79,** 648.
1877–78. Removal of snags, etc., and quarrying r. for wing dams, **78,** 74, 537.
1878–79. Dr., and constr. wing dams, **79,** 87, 648.

PHYSICAL CHARACTERISTICS.

Description, **71,** 491; **75,** 819; **76,** 721; **78,** 528.

PLANS. (See Projects.)

By Lt. Adams, 1870, rendering the R. navigable, Dandridge to mouth, with dams at various shoals; est., $150,000, **71,** 493, 494.
By R. C. McCalla, 1875, 2½′ chan., Brevard to Buncombe Co., by removal of loose r., bowlders, etc.; est., $29,687.50; revised by Maj. McFarland to $41,610, **75,** 818, 820.
By Maj. McFarland, 1876, 2½′ chan., Henderson Co. line to Holston R., by wing dams on upper and lower sections and ls. and ds. on middle section; est., upper section, $125,000; lower section, $150,000, **76,** 719.
By S. T. Abert, 1878, chan., Brevard to Asheville: 1st, with French movable dams, $82,816.20; 2d, American system of ls. and ds., $78,290; 3d, wing dams and excavations, $45,530, **78,** 534, 538.

PROJECTS. (See Plans.)

By S. T. Abert, 1878, 2½′, by removing snags and constr. groins and wing dams; est., $45,500, **78,** 74, 527, 538; **79,** 648.

SURVEYS.

By Lt. M. B. Adams, 1870, under direction of Maj. Weitzel. **R., 71,** 491.
By R. C. McCalla, 1874–75, under direction of Maj. McFarland. **R., 75,** 817, 818. In 1875. **R., 76,** 718, 720.
By S. T. Abert, 1877. **R., 78,** 522, 525.

Part (b), AA-112 French Broad River, N. C.

APPROPRIATIONS.

1880, $3,000, **80,** 793.
1881, 5,000, **81,** 980.
1882, 5,000, **82,** 1059.

Total, 13,000

ENGINEERS.

Chief of Engineers. R., 80, 117; **81,** 157; **82,** 153; **83,** 160; **84,** 162; **85,** 152; **86,** 147; **87,** 113; **88,** 116; **91,** 280; **12,** 883.

In charge:
S. T. Abert, U. S. Agent, 1878–88. **R., 80,** 791; **81,** 978; **82,** 1057; **83,** 832; **84,** 1002; **85,** 997; **86,** 929; **87,** 958; **88,** 843.
Lt. Col. J. W. Barlow, 1891–92. **R., 91,** 2261.

OPERATIONS.

History of operations, **80,** 791.
1879–80. Reef at Little Buck Shoals removed by blasting and dr.; 14 cribwork wing dams completed; banks protected by brush and st.; 2 scows built, **80,** 792.
1880–81. 575 c. y. r. blasted; 657 c. y. r. removed; 2,215 c. y. sand and gravel dr.; 170 logs, snags, and trees removed, **81,** 980.
1881–82. Dr. and removal of obstr. continued; wing dams built and repaired, **82,** 1058.

PROJECTS.

By S. T. Abert, 1878, chan. 2½′ x 35′, Brevard to Big Buck Shoals, with wing dams, dr., and r. removal; est., $45,500, **78,** 74, 537, 538; **79,** 648; **80,** 791; **87,** 958; **88,** 884.
By S. T. Abert, 1883, continuing imp., Smiths Br. to foot of Long Shoal, by r. removal and dr.; est., $76,000, **83,** 835; **85,** 998; **87,** 958; **88,** 844.

SURVEYS.

Ex., 1882, **82,** 1058.
Sur. from Smiths Br. to foot of Long Shoal, 1883, **83,** 832.

[1] Sur.—**R.** July 15, 1832. (H. D. 482, 55th, 2d.)

[2] All for imp. in N. C.

Part (c), AA-112 French Broad and Little Pigeon Rivers, Tenn.

APPROPRIATIONS.

1880,	$10,000,	**80,** 1680.
1881,	3,500,	**81,** 1862.
1882,	5,000,	**82,** 1850.
1884,	3,500,	**84,** 1650.
1886,	6,000,	**86,** 1521.
1888,	10,000,	**88,** 1603.
1890,	10,000,	**90,** 2129.
1892,	15,000,	**92,** 1924.
1894,	[1] 7,000,	**95,** 2317.
1896,	5,000,	**96,** 2055.
1899,	5,000,	**99,** 2302.
1902,	15,000,	**02,** 1739.
1905,	2,000,	**05,** 1774.
1907,	2,000,	**07,** 1646.
1909,	*5,000,	**09,** 1710.
1910,	23,000,	**10,** 1876.
1912,	15,000,	**12,** 2254.
Total,	142,000 (incl. receipts from other sources, $142,503.01, **12,** 2254).	

COMMERCE.

In 1893 C. was increasing, and the stream was of vital importance, especially as a means of communication, to the adjacent country, **93,** 2386. Country adjacent rich in minerals, etc., **97,** 2310.

Total value of freight, French Broad R., during 1899, $779,705.10, more than 10 times amount expend. on R. since imp. begun by the U.S., 1880, **00,** 464.

Description of, **00,** 3031.

Traffic above marble quarry district, extending only a few miles above mouth of R., not considered sufficiently important to justify expensive imp., **03,** 1617.

Streams do not parallel RR., therefore effect of imp. on rates indeterminate, though doubtless important, **08,** 567.

Considerable traffic bet. Dandridge and mouth of French Broad R., **12,** 2253.

In 1911, 30,224 t., French Broad R., **12,** 878.

ENGINEERS.

Chief of Engineers. R., 80, 187; **81,** 252; **82,** 246; **83,** 254; **84,** 254; **85,** 276; **86,** 268; **87,** 231; **88,** 208; **89,** 243; **90,** 219; **91,** 280, 285, 2287; **92,** 268; **93,** 301, 302, **94,** 276, 277; **95,** 314, 315; **96,** 272, 273; **97,** 352; **98,** 344, 345; **99,** 406; **00,** 463, 468; **01,** 467; **02,** 395; **03,** 420; **04,** 447; **05,** 458; **06,** 503; **07,** 531; **08,** 567; **09,** 601; **10,** 675; **11,** 727; **12,** 876.

In charge:

Maj. W. R. King, 1880–86. **R., 80,** 1679; **81,** 1861; **82,** 1848; **83,** 1494; **84,** 1650; **85,** 1765.

Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1520; **87,** 1751; **88,** 1602; **89,** 1831; **90,** 2127; **91,** 2261, 2287.

Lt. Col. H. M. Robert, 1892. **R., 92,** 1922.

Capt. J. Biddle, 1893–94. **R., 93,** 2383; **94,** 1797.

Capt. T. A. Bingham, 1895. **R., 95,** 2313.

Capt. D. C. Kingman, 1896–1901. **R., 96,** 2051; **97,** 2308, 2310; (Maj.) **98,** 1937; **99,** 2300; **00,** 2944, 3018.

Maj. J. G. D. Knight, 1901–03. **R., 01,** 2452; **02,** 1739.

Capt. W. J. Barden, 1903–04. **R., 03,** 1616.

Maj. H. C. Newcomer, 1904–07. **R., 04,** 2389; **05,** 1774; **06,** 1535.

1st Lt. W. G. Caples, **07,** 525.

Maj. W. W. Harts, 1907–11. **R., 07,** 1645; **08,** 1721; **09,** 1709; **10,** 1875; **11,** 2059.

Maj. C. A. F. Flagler, **11,** 717; **12,** 867.

Maj. Edgar Jadwin, **12,** 867.

Maj. H. Burgess, 1912. **R., 12,** 2252.

Assistants:

R. R. Thacher. **R., 96,** 2056; **98,** 1941.

G. T. Nelles. **R., 00,** 3025.

J. E. Hall. **R., 00,** 3052.

1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.

Capt. A. B. Putnam, **08,** 560; **09,** 593.

OPERATIONS.

1880–81. 520 c. y. gravel dr., 957 c. y. r. quarried, 300 c. y. earth embankment and 575 l. f. crib dams built, and 1,250 l. f. old (State) dams repaired, **81,** 1861.

1881–82. 5,282 c. y. r. put into 25 dams; bowlders and gravel removed from chan., **82,** 1849.

1882–83. 1,386 c. y. st. quarried; 3,871 c. y. riprap dams built; bowlders, snags, and trees removed from chan., **83,** 1494.

1883–84. No operations for lack of funds, **84,** 1650.

1884–85. 164 c. y. r. blasted; 569 c. y. gravel and 374 bowlders excavated; 795 c. y. r. quarried and 468 c. y. r. placed in dams, **85,** 1765.

1885–86. Riprap dam at Sewee Shoals completed, **86,** 1521.

1886–87. Repair to dams at Fains Isld., **87,** 1751.

1887–88. 37 snags, 112 c. y. solid and loose r., and 650 c. y. earth removed from chan.; 1,726 c. y. riprap quarried, and 1,072 c. y. riprap placed in spur dams; work done by hired labor, **88,** 1602.

1888–89. 40 snags and 1,977 c. y. r. and gravel removed from chan.; 1,734 c. y. riprap placed in dams, **89,** 1832.

1889–90. 1,433 c. y. r. and gravel excavated, 240 trees cut from banks, 104 l. f. of cofferdam built, 240 c. y. riprap quarried, and 1,523 c. y. of same built into dams, **90,** 2129.

1890–91. 195 c. y. loose r. removed from chan. at Bryants Shoals, 495 c. y. st. quarried, and 195 c. y. of riprap dam built, **91,** 2263.

1891–92. 6,000 c. y. st. used in constr. of 3,492 l. f. of wing dams, **92,** 1924.

1892–93. Bank revetted with st., spur dam raised, some obstr. removed, dams strengthened, and small, light-draft SS. built, **93,** 2385.

1893–94. 1,803 c. y. old dams repaired and extended, 1,390 c. y. riprap dams built, and some obstr. removed at Hanging Rock Shoals and other points, **94,** 1799.

Little Pigeon R.: Some obstr. removed, and nearly 1,000 c. y. dams built and extended, **94,** 1800.

1894–95. Work at Hanging Rock Shoals continued, and begun at Zimmermans Ford; fleet repaired, **95,** 2315.

1895–96. 2,642 c. y. riprap dam built in repairs, etc., r. and other material excavated, some obstr. removed, banks riprapped, and crib constr. at Hanging Rock and Fains Isld. Shoals, **96,** 2053.

Little Pigeon R.: 363 c. y. st. placed in dams, and 360 c. y. excavated from chan., **96,** 2055.

1897–98. About 5,000 c. y. dr. and placed in repairs to dams, training walls, etc., at Hanging Rock Shoals and other points, **98,** 1939.

Little Pigeon R.: Nearly 500 c. y. dr. at the mouth, and some of it used for riprapping, etc., **98,** 1940.

1902–03. Quarterboat and 4 r. barges built by hired labor; dams constr. at Pennyroyal and Red Bank (Seven Isld.) Shoals with riprap from quarries opened near each; gauges established and timber cut for repairing cribs; surs. made of chan. at Tuckahoe and Red Bank, **03,** 1616–17.

1903–04. At Red Bank Shoals, 3,778 l. f. riprap dams built, old crib bank protection repaired and 290 l. f. new crib built; at Hanging Rock Shoals, dams restored and chan. dr.; at Campbells Shoals Dam, 800′ l. constr., **04,** 2389–90.

1904–05. Minor repairs to plant, **05,** 1774.

1906–07. Minor repairs to works at Fains Shoals, Red Bank Shoals, and Wesley Chute, **07,** 1646.

1907–08. Snags, bowlders, and other obstr. removed from chan. at various places; dike at Zimmermans Ford repaired, **08,** 1721.

1908–09. Preparation of floating plant for work in coming season, **09,** 1710.

1909–10. Chan. excavation and repair of dikes at 6 localities below Dandridge, **10,** 1875.

*Allotment. [1] See Projects.

1910-11. Chan. excavation and repair of dikes bet. head of Hanging Rock Shoals and foot of Wild Bull Shoals, and at Old Mill Shoals; gasoline towboat *Niota* built, **11,** 2059.

1911-12. 22,400 c. y. dr. and dikes and spur dams built at Seven Isld. Shoals, **12,** 2252.

PHYSICAL CHARACTERISTICS.

Description of, Little Pigeon R., **91,** 2287; **94,** 1800; **99,** 2301; **00,** 2947.

Description of, French Broad R., **99,** 2300; **00,** 3019.

Ice, etc., damaging works, **95,** 2316.

At Fains Isld., sur. made, 1895–96, disclosed 2½′ where 1½′ existed before, **96,** 2053.

The great slope of the Little Pigeon R. subjects it to sudden and violent freshets that bring down coarse gravel and bowlders, tending to re-form the 2 obstr. bars, **00,** 465.

The area drained by the French Broad R. about 5,600 sq. m., **00,** 3022.

Description of; shoals, soundings, and discharge observations, **00,** 3027, 3038, 3052, 3053.

Description of, **12,** 877–78.

French Broad R. one of the largest tributaries of the Tennessee. Rises in N. C., flows nw.; to unite with Holston R. in Tenn. about 4.5 m. above Knoxville, to form Tenn. R. Leadvale head of navigation in Tenn. Little Pigeon R. composed of 2 forks (e. and s.) at Sevierville, Tenn.; flows n. for 5 m., to empty into French Broad R. 29 m. above its mouth; is navigable only about 2 m. above mouth, **12,** 877.

SS. rarely go above Dandridge, 46.5 m. above mouth of F. B. R., **12,** 878.

PROJECTS.

By Lt. Adams, 1870, chan. 2½′ d. at ordinary l. w. from Leadvale to mouth, 90 m., with wing dams, and by removing snags and obstr.; est., $150,000, **71,** 493, 494; **80,** 187, 1680; **86,** 1520; **91,** 2263.

Act 1892 allotted $1,000 for removal of bar in Little Pigeon R. near the mouth, **93,** 2385; **94,** 1800. Act 1894 allotted $1,000, **95,** 2317.

Act Mar. 3, 1899, made provision, from app. for Tennessee R. bet. Chattanooga and Riverton, for a sur. of French Broad R., Leadvale to its mouth; $3,600 allotted, **99,** 2301.

Of the $5,000 app. act Mar. 3, 1899, for French Broad R., $2,000 allotted, to be used in connection with allotments from the app. for Clinch R., and Tennessee R. above Chattanooga, for the purchase of a dr. with dump scows, **99,** 2301.

Maj. Kingman est., 1900, $278,052.50 to imp. French Broad and Little Pigeon Rs., **00,** 3019.

Maj. Harts recom., 1908, biennial app. of $10,000 for mainten. of navigable waterway, **08,** 1721.

SURVEYS.

Ex. Little Pigeon R. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Barlow (**R.** unfav.), **91,** 2288.

Fains Isld. (See Physical characteristics.)

Sur. of French Broad R., in Tennessee, au. act Mar. 3, 1899; made, 1900, by Maj. Kingman (**R.** fav.), **00,** 3019.

Pre. ex. and sur. au. act June 25, 1910, of French Broad R. (**R.** to come), **12,** 883.

Cong. docs., etc., relating to exs., survs., plans, etc., **12,** 877.

AA-113 HOLSTON RIVER, TENN. AND VA.[1]

APPROPRIATIONS.

1902,	$5,000.00,	**02,** 1743.
1907,	1,017.17,	**07,** 1651.
Total,	6,017.17	

COMMERCE.

Description of, **00,** 3065.

No regular upstream navigation, occasionally a small SS. runs up 30 to 60 m. from mouth; 1906, 19,800± t. logs rafted, **07,** 535.

ENGINEERS.

Chief of Engineers. **R., 80,** 190; **81,** 258; **85,** 279; **87,** 236; **99,** 410; **00,** 469; **01,** 469; **02,** 397; **03,** 423; **04,** 450; **05,** 461; **06,** 506; **07,** 535; **08,** 570; **09,** 605; **10,** 679; **11,** 732.

In charge:

Maj. W. R. King. **R., 81,** 1878; **85,** 1773.

Lt. Col. J. W. Barlow. **R., 87,** 1772.

Maj. D. C. Kingman, 1900–1901. **R., 00,** 3058, 3063; **01,** 2518.

Maj. J. G. D. Knight, 1901–03. **R., 02,** 1743.

Capt. W. J. Barden, 1903–04. **R., 03,** 1624.

Maj. H. C. Newcomer, 1904–07. **R., 04,** 2396; **05,** 1779; **06,** 1539.

1st Lt. W. G. Caples, **07,** 525.

Maj. W. W. Harts, 1907–10. **R., 07,** 1651; **08,** 1726; **09,** 1714; **10,** 1880.

Assistants:

W. G. Sanborn. **R., 81,** 1880.

C. A. Locke. **R., 87,** 1773.

G. T. Nelles. **R., 01,** 2524.

H. S. Bosler. **R., 01,** 2530.

1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.

Capt. A. B. Putnam, **08,** 560; **09,** 593.

OBSTRUCTIONS.

Fishtrap dams, **01,** 2538.

Bridges, **01,** 2541.

OPERATIONS.

1902-03. Removing snags, etc., and 3 flatboats and 2 batteaux built, **03,** 1624.

1906-07. Dam repaired at Cloud Shoals; 226 c. y. quarried st. and st. taken from R. bed placed on dams; trees cut and trimmed, **07,** 1651.

1907-08. 352 snags, trees, and other obstr. removed; 162 c. y. r. blasted and removed, **08,** 1727.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1880; **87,** 1774; **00,** 3060; **01,** 2526, 2535.

Rainfall and discharge, **00,** 3062, 3064; **01,** 2526, 2534.

R. formed by junction of its n. and s. forks at Kingsport, Tenn.; flows thence 142 m. in sw. direction and unites with French Broad R. 4.5 m. above Knoxville to form Tennessee R., **07,** 535.

PLANS.

By Maj. King, 1881, chan. 1½′ x 60′–80′ extreme l. w., for 171 m., Saltville to North Fork Junction, by r. excavation, wing-dam constr., and removal of trees and snags; est., $242,913, **81,** 1879, 1883, 1885.

By Lt. Col. Barlow, chan. 20″ x 100′ d. at l. w., Forks to Knoxville, distance of 154 m., by removal of obstr. and contraction of chan. by wing dams; est., $347,000, **87,** 1773.

PROJECTS.

Act 1902 au. removal of obstr. and overhanging trees, etc.,[2] **02,** 397.

SURVEYS.

Sur. about 1832. (H. D. 482, 55th, 2d.)

Au. act June 14, 1880; made, 1880, by Maj. King, **81,** 1878.

Sur. about 1881 (est., $322,913). (H. D. 482, 55th, 2d.)

Ex. au. act Aug. 5, 1886; made by Lt. Col. Barlow, **87,** 1772.

Ex. and sur., Holston R., mouth to Kingsport, Tenn., au. act Mar. 3, 1899. Pre. **R.,** 1899, by Maj. Kingman, **00,** 3059. Final **R.** by Maj. Kingman, Nov. 30, 1900; est., $5,000 for imp. by removal of obstr.; also plan and est. for extensive imp.; cost, $778,250; of opinion that R. not worthy of such large expend.,[2] **01,** 469, 2518.

[1] Sur.—**R.** July 15, 1832; est. (incl. Tennessee R.), $58,161.27. (H. D. 482, 55th, 3d.)
[2] H. D. 218, 56th, 2d.

AA-122 NOLICHUCKY RIVER, TENN.[1]

AA-146 RICHLAND RIVER (Creek), TENN.

COMMERCE.

Unimportant, **00,** 3075.

ENGINEERS.

Chief of Engineers. R., 99, 410; **00,** 469; **08,** 571.

In charge:

Maj. D. C. Kingman, 1899–1900. **R., 00,** 3074.
Maj. W. W. Harts, **08,** 560.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 3075.
Discharge, **00,** 3076.

SURVEYS.

Ex., mouth to Dayton, au. act Mar. 3, 1899; made, 1899, by Maj. Kingman (**R.** unfav.), **00,** 3075.

Pre. ex. au. act Mar. 2, 1907. **R.** by Maj. Harts, Aug. 20, 1907[2] (unfav.), **08,** 571.

AA-157 CLINCH RIVER, TENN. AND VA.

APPROPRIATIONS.

1880,	$10,000.00,	**80,** 1680.
1881,	3,000.00,	**81,** 1864.
1882,	3,000.00,	**82,** 1851.
1884,	5,000.00,	**84,** 1651.
1886,	5,000.00,	**86,** 1522.
1888,	5,000.00,	**88,** 1609.
1890,	4,000.00,	**90,** 2132.
1892,	4,000.00,	**92,** 1927.
1894,	2,500.00,	**95,** 2320.
1899,	8,500.00,	**99,** 2305.
1902,	*3,000.00,	**02,** 1741.
1905,	*1,500.00,	**05,** 1776.
1907,	*325.43,	**07,** 1648.
1910,	*7,000.00,	**10,** 1878.
Total,	61,825.43	(incl. sales, $61,826.53, **12,** 2256).

COMMERCE.

Value of farm products exported, $2,000,000, **76,** 741, 745.

In 1893 about 78% of the logs reaching Chattanooga came by this R. and its tributaries, **93,** 2388.

Business on the R. done at high or intermediate stages, **98,** 1944.

1898, 160,000 t., **00,** 3067; 1911, 23,897 t., **12,** 880.

SS. traffic small, occasional trips on h. w. to Harriman on Emory R. (4½ m. on Clinch R.) made by one SS.; rafting principal traffic, **09,** 1711.

Effect of U. S. imp. on C. unknown, **12,** 880.

ENGINEERS.

Chief of Engineers. R., 76, 87; **80,** 187, 190; **81,** 253, 258; **82,** 246; **83,** 254; **84,** 255; **85,** 277; **86,** 268; **87,** 233; **88,** 209; **89,** 244; **90,** 220; **91,** 281; **93,** 303; **94,** 277; **95,** 315; **96,** 273; **97,** 353; **98,** 346; **99,** 408; **00,** 465, 469; **01,** 468, 469, 2542; **02,** 396; **03,** 421; **04,** 449; **05,** 459; **06,** 504; **07,** 533; **08,** 568; **09,** 602; **10,** 676; **11,** 729; **12,** 879.

In charge:

Maj. W. McFarland, 1876, **76,** 87. **R., 76,** 741, 745.
Maj. W. R. King, 1880–86. **R., 80,** 1680; **81,** 1862, 1864; **82,** 1850; **83,** 1495; **84,** 1651; **85,** 1766.
Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1521; **87,** 1755; **88,** 1606; **89,** 1835; **90,** 2131; **91,** 2264.
Lt. Col. H. M. Robert, 1892. **R., 92,** 1925.
Capt. J. Biddle, 1893–94. **R., 93,** 2387; **94,** 1801.
Capt. T. A. Bingham, 1895. **R., 95,** 2318.
Capt. D. C. Kingman, 1896–1901. **R., 96,** 2058; **97,** 2311; (Maj.) **98,** 1943; **99,** 2303; **00,** 2948, 3065.
Maj. J. G. D. Knight, 1901–03. **R., 01,** 2455; **02,** 1741.
Capt. W. J. Barden, 1903–04. **R., 03,** 1619.
Maj. H. C. Newcomer, 1904–07. **R., 04,** 2392; **05,** 1776; **06,** 1537.
1st Lt. W. G. Caples, **07,** 525.
Maj. W. W. Harts, 1907–11. **R., 07,** 1647; **08,** 1723; **09,** 1711; **10,** 1877; **11,** 2061.
Maj. C. A. F. Flagler, **11,** 717; **12,** 867.
Maj. Edgar Jadwin, **12,** 867.
Maj. H. Burgess, 1912–. **R., 12,** 2255.

Assistants:

W. M. Gordon. **R., 76,** 742.
E. C. Tollinger. **R., 81,** 1865.
E. R. Nelles. **R., 98,** 1946.
G. T. Nelles. **R., 01,** 2551.
1st Lt. W. G. Caples, **06,** 496; **07,** 525; **08,** 560.
Capt. A. B. Putnam, **08,** 560; **09,** 593.

LEGISLATION.

State of Tennessee in reference to "fish traps" in the Clinch R., **88,** 1608.

OBSTRUCTIONS.

Fish traps, dams, complaints of, **04,** 2392.

OPERATIONS.

1880–81. 549 c. y. r. excavated; 140 c. y. r. placed in wing dams, and 248 snags and trees removed, **81,** 1863.

1881–82. 2,556 c. y. r. removed; 1,686 c. y. dam built, and 586 snags removed, **82,** 1850.

1882–83. 1,816 c. y. r. removed; 1,624 c. y. gravel excavated; 1,526 c. y. earth embankment, and 4,666 c. y. of riprap dam built, **83,** 1496.

1883–84. 95 c. y. r. and 700 c. y. gravel removed; 106 c. y. st. put in dams, **84,** 1651.

1884–85. 11,476 c. y. r., sand, and gravel excavated; 398 l. f. timber cribs and 3,812 c. y. st. dams constr.; 233 trees and snags removed, **85,** 1767.

1887–88. 540 c. y. r. and gravel excavated; 715 c. y. riprap quarried; 1,309 c. y. of dam and 30 l. f. of cribwork built, **88,** 1607.

1888–89. 224 c. y. r. excavated; 1,160 c. y. riprap quarried; 889 c. y. riprap dam built, **89,** 1836.

1889–90. 80 l. f. of crib dam built; 528 c. y. st. placed in dams, and 28 overhanging trees cut, **90,** 2132.

1890–91. Removal of obstr. and dam constr. continued, **91,** 2265.

1891–92. 544 c. y. r. excavated, and 875 c. y. r. used in constr. of wing dams at Llewellyn and Youngs Isld. Shoals, **92,** 1926.

1893–94. About 60 c. y. loose r. removed from chan. and placed on riprap dam, **94,** 1803.

1897–98. 6,547 c. y. r. blasted; 4,602 c. y. gravel and other material removed; nearly 1,000 obstr. removed, **98,** 1945.

1898–99. About 1,500 obstr. removed from R., **99,** 409.

1899–00. About 4,000 c. y. of bowlders and ledges excavated; 1,600 c. y. dams built; 392 c. y. bank riprapped, and 1,220 snags and other obstr. removed from R., **00,** 2951.

1902–03. Chan. cleared of snags, logs, bowlders, and other obstr. from mouth of Guests R. to mouth of Clinch R., and riprap and crib dams built at 12 localities, **03,** 1619–20.

1905–06. 50 c. y. r. removed from chan. and 183 c. y. r. used in repairing dams, **06,** 1537.

1907–08. 618 snags and trees and 105 c. y. loose material removed; 56 c. y. r. blasted and 138 c. y. r. placed in dikes, **08,** 1723.

1910–11. Flatboat, supply house, magazine, and blacksmith shop constr., and progress made in constr. of a tripod dam, **11,** 2062.

1911–12. Work on dike constr. and r. excavation in progress, and about 80% completed; details given, **12,** 2255.

* Allotment. [1] Ex., **R.** (unfav.), July 15, 1832 (H. D. 482, 55th, 2d). [2] H. D. 223, 60th, 1st.

PHYSICAL CHARACTERISTICS.

Description of, **76,** 741, 742, 743; **88,** 1606; **00,** 3066; **01,** 2552; drainage area and rainfall; **93,** 2366; **00,** 3066; **01,** 2554; **11,** 729, 2061, 2062.

Obstr., **76,** 743.

Detailed description of the location and nature of the obstr. removed in 1897–98, **98,** 1947.

Table showing discharge observations, **00,** 3066; **01,** 2554.

R. rises in Va., flows sw. and into Tenn. R. 104 m. above Chattanooga. Aver. slope below Clinton, 1.3 per m. 193 m. of R. in Tenn.; **12,** 879.

PLANS. (See Projects.)

By Maj. McFarland, 1876, h.-w. chan. from 3′ to 4′ d. with wing dams, and by removing obstr.; est., $44,025, **76,** 742, 744. Slack-water navigation possible, but the interests of C. would not justify expense, **76,** 747.

By Maj. King, 1881, Nashs Ford to Haynes, with wing dams and by removing obstr.; est., $24,510, **81,** 1867.

PRIVATE (STATE AND CORPORATE) WORK.

Tennessee expend., 1845, $10,000 removing obstr. bet. State line and mouth of R.; work unsatisfactory, **76,** 743.

Clinch River Improvement Co. expend. $1,000, 1872, with good results, **76,** 743.

PROJECTS. (See Plans.)

By Maj. McFarland, 1876, h.-w. chan. 1½′ to 2′, mouth to Haynes (or Walkers) Ferry, 145 m., with wing dams, and by removing obstr. for 230 m.; est., $26,400, **76,** 741; **80,** 1680.

After expend. of $21,000, est. increased by Maj. King, 1885, to $50,000, **85,** 1767; **87,** 1755, 1757; **91,** 2265.

By Capt. Kingman, 1896–97, expend. available funds to remove obstr., Osborne, head of navigation, to mouth, **97,** 2313.

Act Mar. 3, 1899, provided that as much of the app. for imp. Tennessee R. bet. Chattanooga and Riverton as might be necessary could be used for sur., Clinch R.; $4,800 allotted for sur. Clinch R. from Haynes (Walkers) Ferry to mouth, **99,** 2304.

$3,000 allotted from app. 1899 to remove obstr. to lengthen navigation season, **99,** 2305; $3,000 applied, together with other allotments from certain app., to constr. light-draft dipper dr., for use on the upper Tennessee R., the Clinch, and certain other tributaries, **00,** 2950.

Maj. Harts recom., 1908, that app. be suspended until radical form of imp., other than mainten., be adopted, **08,** 1724.

Act June 25, 1910, au. expend. not exceeding $2,000, in Va.,[1] **10,** 676.

Maj. Harts proposed that $2,000 apportioned to Va. section be available for expend. in Tenn.; no further app. desirable, **11,** 2062.

SURVEYS.

Ex., mouth of Indian to junction of Clinch and Powells Rs., **76,** 87, 745.

By W. M. Gordon, below Emory R., **76,** 87, 745.

Au. act June 14, 1880; made, 1881, by Maj. King, **81,** 1864.

Sur. au. act Mar. 3, 1899; made, 1899, by Maj. Kingman (pre. **R.** fav.), **00,** 3066.

Au. act Mar. 3, 1899; made by Maj. Kingman, 1900; est., $1,460,000,[1] **01,** 469, 2542–2596.

R. by BERH., Nov. 16, 1908, req. by R. and H. Com. reviewing Maj. Kingman's **R.** of 1901. It would cost over $1,500,000 to secure a 4′ navigation by slack water, and in the opinion of the board it would be inadvisable to undertake this large expend.[2]

Ex., 1910, to see where funds could be applied to advantage, **11,** 2061.

Minor sur., Clinton Isld. Shoals, **11,** 2062.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 879.

AA-169 POWELLS RIVER, TENN. AND VA.

COMMERCE.

Important, **76,** 737, 740, 741.

Losses occasioned by insufficient chan. ways, **81,** 1887.

Description of, **00,** 3068.

ENGINEERS.

Chief of Engineers. R., 76, 87; **80,** 190; **81,** 258; **99,** 410; **00,** 469.

In charge:
Maj. W. McFarland, 1876. **R., 76,** 736.
Maj. W. R. King. **R., 81,** 1886.
Maj. D. C. Kingman, 1899–1900. **R., 00,** 3067.

Assistants:
W. M. Gordon. **R., 76,** 737.
W. G. Sanborn. **R., 81,** 1887.
G. T. Nelles. **R., 00,** 3071.

PHYSICAL CHARACTERISTICS.

Description of, **76,** 736, 737, 738; **00,** 3069.

Scarcity of water, **76,** 737.

List of obstr., **76,** 738, 739; **81,** 1887.

Difference of level more than 500′ in 130 m. bet. mouth and Shavers Ford, **00,** 3071.

Discharge, **00,** 3069, 3072.

PLANS. (See Projects.)

By Maj. McFarland, 1876, removing obstr., building wing dams, and procuring h.-w. chan. 3½′ to 4′; est., $25,000, **76,** 737, 739, 740. Slack-water navigation impossible, **76,** 746.

By Maj. King, 1881, imp. Powell R. by dr., r. removal, and removal of snags and drift, and constr. of 4,000 c. y. of wing dams; est., $35,580, **81,** 1887.

PRIVATE (STATE AND COUNTY) WORK.

1845. Tenn. expend. $7,000 removing obstr. and building wing dams, **76,** 738. Tenn. expend. $7,000 and Union Co. Zinc Co. about $2,000 for imp., **00,** 3069.

PROJECTS. (See Plans.)

Maj. Kingman est., 1899, imp. could be made at the cost of a sur., **00,** 3070.

SURVEYS.

Ex. by W. M. Gordon, 1876, from Three Forks to mouth of Clinch R., **76,** 87, 736.

Au. act June 14, 1880; made, 1881, by Maj. King, **81,** 1886.

Ex. and sur., mouth to Kyles Ford, au. act Mar. 3, 1899. As there is no such place as Kyles Ford on Powells R., ex. (sur. could serve no useful purpose) made, 1899, by Maj. Kingman, from Shavers Ford, Va., to junction of Powells R. with Clinch R., Tenn. (**R.** fav. only to snag removal; see Projects), **00,** 3067.

AA-173 EMORY RIVER, TENN. AND VA.

COMMERCE.

Important, **76,** 745, 746.

Description of. Small, but U. S. imp. would probably open up the adjacent rich country, **93,** 2414; **97,** 2317.

ENGINEERS.

Chief of Engineers. R., 76, 87; **93,** 308; **97,** 354.

In charge:
Maj. W. McFarland, **76,** 87. **R., 76,** 745.

[1] H. D. 75, 56th, 2d.

[2] R. and H. Com. 19, 61st, 2d.

Lt. Col. H. M. Robert, 1892. **R., 93,** 2413.
Capt. J. Biddle, 1893. **R., 93,** 2413.
Capt. D. C. Kingman, 1897. **R., 97,** 2316.

Assistants:
W. M. Gordon. **R., 76,** 745.
Lt. J. Biddle. **R., 93,** 2415.

PHYSICAL CHARACTERISTICS.

Description of, **76,** 745, 746; **97,** 2317.
Wholly in Tennessee; enters Clinch R. about 4 m. above where the Clinch enters Tennessee R., **97,** 2317.

PLANS. (See Projects.)

Of Maj. MacFarland, 1876, 800′ of wing dams and removing obstr.; est., $17,625; not recom., **76,** 745, 746. Slack-water navigation reported impracticable, **76,** 746.

PROJECTS. (See Plans.)

Lt. Col. Robert est., 1892, $600 for a sur., **93,** 2414.
Capt. Kingman est., 1897, $260,000 for lock and dam to procure l.-w. navigation to Harriman, **97,** 2316.

SURVEYS.

Ex. above its mouth by W. M. Gordon, **76,** 87, 745.
Ex., mouth to Harriman, au. act July 13, 1892; made, 1892, by Lt. Col. Robert (**R.** fav.), **93,** 2413.
Sur. of the same part au. act June 3, 1896; made, 1897, by Capt. Kingman (see Projects), **97,** 2316.

AA-191 SEQUATCHIE RIVER, TENN.

COMMERCE.

Description of; country very rich, **93,** 2410.

ENGINEERS.

Chief of Engineers. R., 93, 307.

In charge:
Lt. Col. H. M. Robert, 1892–93. **R., 93,** 2408.
Capt. J. Biddle, 1893. **R., 93,** 2408.

PHYSICAL CHARACTERISTICS.

Description of; part of R. has fall that would require 14 locks and dams to make it navigable, **93,** 2410.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Robert (**R.** unfav.), **93,** 2408.

AA-209 ELK RIVER, ALA. AND TENN.

APPROPRIATION.

1899, $4,000, **99,** 2307.

COMMERCE.

Description of (small), **01,** 469.

ENGINEERS.

Chief of Engineers. R., 85, 279; **99,** 409, 410; **00,** 467, 469; **01,** 469; **04,** 451, 2397; **08,** 572.

Boards. BERH. **R., 04,** 2400.

In charge:
Maj. W. R. King. **R., 85,** 1771.
Maj. D. C. Kingman, 1899–1901. **R., 99,** 2306, 2308; **00,** 2952, 3077.
Maj. J. G. D. Knight, 1901. **R., 01,** 2457.
Maj. H. C. Newcomer, 1904. **R., 04,** 2357.
Maj. W. W. Harts, **08,** 560.

Assistants:
E. R. Nelles. **R., 00,** 2954.
J. E. Hall. **R., 00,** 3081.

OBSTRUCTIONS.

Ten wagon brs., 2 RR. brs., 6 milldams, and 20 fish-trap dams the principal obstr. to navigation, **99,** 2307.

OPERATIONS.

1899–00. About 7,000 snags and other obstr., and 6,700 c. y. r. removed, and a training wall built with the excavated material, **00,** 2955.

PHYSICAL CHARACTERISTICS.

Until completion of Muscle Shoals Canal, Tennessee R., mouth of R. would be inaccessible, **85,** 1771.
Description of, **99,** 2306, 2308; **00,** 3078; **01,** 2457.
Situation of obstr. removed, **00,** 2955.
Description of, discharge observations, and soundings, **00,** 3081.

PROJECTS.

By Maj. Kingman, removal of fish-trap dams from the chan., last milldam near the crossing of the Louisville & Nashville RR. to the mouth, together with bar at the mouth; est., $4,000, **99,** 2307.
Maj. Kingman est., 1899, $882,854.61 to secure a 4′ navigation, Tennessee R. to Fayetteville, **00,** 3080.

SURVEYS.

Ex. au. act July 5, 1884; made by Maj. King (**R.** unfav.), **85,** 1771.
Sur. au. act May 4, 1898; pre. **R.,** 1899, by Maj. Kingman, **99,** 2308; final **R.,** 1899 (see Projects), **00,** 3077.
Ex. au. act June 13, 1902; made, 1902, by Maj. Knight (**R.** unfav.),[1] **04,** 451, 2398.
Ex. au. act Mar. 2, 1907; made, 1907, by Maj. Harts (**R.** unfav.),[2] **08,** 572.

AA-227 DUCK RIVER, TENN.

APPROPRIATIONS.

1880,	$7,000,	**80,** 1681.
1881,	3,000,	**81,** 1868.
1882,	3,000,	**82,** 1852.
Total,	13,000	

COMMERCE.

Requirements of, fairly provided for by imp. made, **86,** 1523.

Description of: small, but R. runs through a rich country, which imp. of chan. might develop, **93,** 2407.

ENGINEERS.

Chief of Engineers. R., 80, 187, 190; **81,** 253; **82,** 247; **83,** 255; **84,** 255; **85,** 277; **86,** 269; **87,** 233; **88,** 210; **93,** 307; **96,** 424; **08,** 571.

In charge:
Maj. W. R. King, 1879–86. **R., 80,** 1681; **81,** 1867; **82,** 1851; **83,** 1497; **84,** 1651; **85,** 1768.

[1] H. D. 211, 58th, 2d.

[2] H. D. 951, 60th, 1st.

Lt. Col. J. W. Barlow, 1886–88. **R., 86,** 1523; **87,** 1757; **88,** 1610.
Lt. Col. H. M. Robert, 1893. **R., 93,** 2406.
Capt. J. Biddle, 1893. **R., 93,** 2406.
Maj. W. W. Harts, **08,** 560.

Assistants:
D. L. Sublett. **R., 80,** 1682.
Lt. J. Biddle. **R., 93,** 2407.
1st Lt. W. G. Caples, **08,** 560.
Capt. A. B. Putnam, **08,** 560.

OPERATIONS.

1880-81. Boats built, and 55 snags and 1,281 trees removed by hired labor, **81,** 1868.

1881-82. 1,005 snags and trees cut out, 659 c. y. excavated from chan., and 537 c. y. r. quarried and placed in dams, **82,** 1852.

1882-83. 53 c. y. r., 567 of gravel, and 1,637 of earth excavated from chan., 755 c. y. st. quarried and placed in dams, and 1,174 trees and snags removed, **83,** 1498.

PHYSICAL CHARACTERISTICS.

Condition of R., character of obstr., etc., **80,** 1683.
Description of: Flows into the Tennessee; navigable for about 68½ m., **93,** 2406.

PROJECTS.

By Maj. King, 1879, imp. R., mouth to Centerville, 68 m., by r. and gravel excavation, constr. of wing dams, and removal of snags and overhanging trees, to give 3′ navigation during 6 months of the year; est., $35,118, **80,** 1684.

SURVEYS.

Au. act Mar. 3, 1879; made, 1880, by Maj. King, **79,** 142; **80,** 1681.
Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Robert (**R.** fav.), **93,** 2406.
Pre. ex. mouth to Centerville au. act Mar. 2, 1907. **R.,** Maj. Harts, Aug. 20, 1907 (unfav.),[1] **08,** 571.

AA-239 CUMBERLAND RIVER, KY. AND TENN.

NOTE.—The C. R. rises in e. Ky., on w. slope of Cumberland Mtns., flows tortuously for 688 m. through e. Ky., middle Tenn., and w. Ky., to discharge into Ohio R. near Smithland, Ky. Head of navigation is Burnside, Ky.; to Smithland, Ky., is 518 m. (203 m. in Ky. and 315 m. in Tenn.). Part above Nashville is 325 m.; below, 193 m., **12,** 860.

LIST OF NOTABLE POINTS, MOUTH TO HEADWATERS.

Ohio R., Ky.
Lock F, Eddy Cr., Ky.
Little R., Ky.
Canton, Ky.
Lock E.
Lock D, Dover, Tenn.
Lock C, Tenn.
Red R., Tenn. and Ky.
Clarksville, Tenn.
Lock B, Tenn.
Burtons Cr., Tenn.
Lock A, Johnsons Cr., Tenn.
Harpeth R., Tenn.
Lock 1, Tenn.
Nashville, Tenn.
Lock 2, Tenn.
Stone R., Tenn.
Locks 3, 4, 5, 6, 7, Tenn.
Carthage, Tenn.
Caney Fork R., Tenn.
Lock 8, Tenn.
Buffalo Cr., Tenn.
Roaring R., Tenn.
Celina, Tenn.
Obey R., Tenn.
Beaver Cr., Ky.
Locks 21, 22, Ky.
South Fork R., Ky. and Tenn.
Burnside, Ky.

Part.	Title.	Period.	Appropriations.
a	Cumberland R., Smithland H., Ky	1890–1891	
b	Cumberland R	1832–1879	[2] $491,000.00
c	Cumberland R., below Nashville	1880–1912	1,348,000.00
d	Cumberland R., above Nashville	1880–1912	3,161,500.00
e	Cumberland R., locks and dams—operating and care	1906–1912	225,215.54
	Total		5,225,715.54

Part (a), AA-239 Cumberland River, Smithland Harbor, Ky.

ENGINEERS.

Chief of Engineers. **R., 91,** 285, 2289.
In charge. Lt. Col. J. W. Barlow, 1890. **R., 91,** 2289.

PHYSICAL CHARACTERISTICS.

Description of (near mouth of Cumberland R.), **91,** 2289.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Barlow (**R.** unfav.), **91,** 2289.

[1] H. D. 348, 60th, 1st.
[2] $151 000 for "above Nashville," and $340,000 for "below Nashville."

Part (b), AA-239 Cumberland River.

APPROPRIATIONS.

1832, [1] $30,000, act July 3.
1834, [1] 30,000, act June 28.
1836, [1] 20,000, act July 2.
1837, [1] 55,000, act Mar. 3.
1838, [1] 20,000, act July 7.
1871, [1] 30,000, **71,** 62, 467; **72,** 462; **74,** 578.
1872, [1] 20,000, **72,** 58, 462; **74,** 578.
1873, [1] 25,000, **73,** 62, 548; **74,** 578.
1875, [1] 25,000, **75,** 76, 790.
1876, [2] 15,000, **77,** 90, 593, 596.
1876, [3] 25,000, **77,** 90, 595, 596.
1876, [4] 2,000, **77,** 90, 596.
1876, [5] 10,000, **77,** 90, 594, 596.
1878, [1] 45,000, **78,** 103, 759.
1878, [2] 20,000, **78,** 103, 760.
1878, [5] 8,000, **78,** 103, 760.
1878, [3] 30,000, **78,** 103, 761.
1878, [4] 2,000, **78,** 104, 761.
1879, [1] 40,000, **79,** 139, 1265.
1879, [2] 18,000, **79,** 139, 1266.
1879, [5] 6,000, **79,** 139, 1266.
1879, [3] 15,000, **79,** 139, 1267.

Total, [6] 491,000

COMMERCE.

Justification of imp. and importance of R., **71,** 468, 480, 485; **74,** 70, 578, 579; **75,** 791; **77,** 596.
Transit of coal barges on upper R. by "coal tides," **71,** 470, 471; **75,** 795, 798.
Necessity of increased facilities for C., **75,** 795, 798; **77,** 594.
Duration of navigable stages, **71,** 478; **75,** 795; **77,** 597.
Obstr. to navigation, list of, **71,** 470.
Coal transportation, cost of, **71,** 482; **75,** 798.
Coal and iron mines, description of, **71,** 481.
Projs., 1877, designed to imp. downstream navigation on upper R. alone, **75,** 790, 795; **77,** 595; **79,** 1266.
Imp. condition of R., **79,** 1266.

CONTRACTS.

Advantages of hired labor over contract work, **74,** 578.
1871. J. H. Maddox, removal of obstr., r. excavation, constr. of wing dams, and dr., **71,** 467, 468; death of, Oct., 1871, contract annulled, **73,** 547.
1872. P. L. Dewes, r. excavation, constr. of wing dams, and dr., **73,** 547; extended to 1874; re-extended to Jan., 1875, **74,** 577; completed Aug., 1874, **75,** 76, 790; all work done thereafter by hired labor.

ENGINEERS.

Chief of Engineers. R., 71, 62; **72,** 58, 59; **73,** 62; **74,** 70; **75,** 76; **76,** 86; **77,** 89; **78,** 103; **79,** 138.

In charge:
Maj. G. Weitzel, 1870–73. **R., 71,** 467, 490; **72,** 462, 463.
Maj. W. McFarland, 1873–76; **73,** 61, 547. **R., 73,** 547; **74,** 577; **75,** 790, 795.
Capt. W. R. King, 1876; **76,** 86. **R., 76,** 714; **77,** 592; **78,** 759; **79,** 1264, 1279.

Assistants:
S. T. Abert, **71,** 468. **R., 71,** 469.
E. Mead, **71,** 469.
F. Hellner, **71,** 469.
Capt. L. C. Overman, **74,** 577; **75,** 74. **R., 76,** 714; **77,** 596.
R. C. McCalla. **R., 75,** 796.
F. R. Leavitt, **75,** 799.
S. Whinery. **R., 79,** 1280.

ESTIMATES. (See Plans and Projects.)

Pre., of S. T. Abert, 1871. Upper R.: Laurel to Pt. Burnside, 35 m., $40,116, **71,** 479; Pt. Burnside to Nashville, 358 m., $163,724, **71,** 479. Lower R.: Nashville to mouth, 192 m., $248,821, **71,** 480; **72,** 462; **78,** 759.
Final, of S. T. Abert, 1872. Laurel to Pt. Burnside, $41,000, **72,** 471; **77,** 596. Pt. Burnside to Nashville, $194,331, **72,** 471; **77,** 596. Aggregate increased by Maj. Weitzel to $258,864, **72,** 472; **74,** 578.
Assistant McCalla, 1875, Smiths Shoals, upper R., wing dams, $52,044, **75,** 798. Increased by Maj. McFarland to $70,000, **75,** 796; **77,** 596. Increased by Capt. King to $100,000, **79,** 139, 1265.
Maj. Weitzel, 1872, upper R. l. and d., $4,000,000, **72,** 472; **75,** 795.
Capt. King, 1877, Smiths Shoals l. and d., to cost, in all probability, more than $1,000,000, **77,** 595.
S. Whinery, 1879, passage of Cumberland Falls by locks and canal; cost, $368,500, **79,** 1281.

OBSTRUCTIONS. (See Commerce; Private work.)

OPERATIONS.[7]

1871-72. Removal of obstr. at Nashville, Nashville Isld., and Gowers Isld.; 1,100 c. y. dr., and 7,580 c. y. of wing dam built at Flax Patch; 300 c. y. of r. removed from Harpeth Shoals, **72,** 58, 462.
1872-73. At Sycamore Creek, 789 c. y. of wing dam built; 141 c. y. r. and 346 c. y. gravel removed from chans. bet. Sycamore Creek and Harpeth R., **73,** 547.
1873-74. Delay of contractor at Harpeth Shoals followed by use of hired labor independent of contract; 12,000 c. y. st. for wing dams at, quarried, **74,** 577.
1874-75. 500 c. y. r. removed from chan. at Harpeth Shoals and Reeds Reef; 10,265 c. y. st. placed in wing dams at, **75,** 76, 790. All operations after Aug., 1874, carried on by hired labor, **77,** 90, 592.
1875-76. At Harpeth Shoals, 4,740 c. y. wing dam built, and 175 c. y. r. removed from chan. At Davis Ripple, 525 c. y. wing dam built, **76,** 714.
1876-77. At Harpeth Shoals, 1,500 c. y. wing dam built, and 335 c. y. r. removed. At Davis Ripple, 1,625 c. y. wing dam built, **77,** 90, 593. At points above Nashville, i. e., Cub Creek, Sand, Smiths, Wild Goose, Hollimans Isld. Shoals, and Bartletts Bar, aggregate of 16,440 c. y. st. quarried for wing dams; 530 c. y. r., 1,790 c. y. gravel, and 36 logs and overhanging trees removed from chans.; 3,060 c. y. st. placed in wing dams, **77,** 90, 593, 594, 595.
1877-78. No work below Nashville, **78,** 103, 759. Above Nashville, 9,466 c. y. chan. excavation of earth and r.; 441 trees and snags removed; 12,197 c. y. r. placed in wing dams; 2,147 c. y. r. quarried and ready for wing dams, **78,** 103, 759.
1878-79. 27,983 c. y. earth and r. removed from chans.; 2,299 snags, logs, and overhanging trees removed; 33,625 c. y. r. placed in dams; 22,717 c. y. r. quarried for dams, **79,** 138, 1264.

PHYSICAL CHARACTERISTICS. (See under main title.)

Description of R., **71,** 469, 483.
Canyon-like character of upper, **71,** 471.
Elevation of divide bet. Cumberland and Tennessee Rs., **71,** 469.
Distances bet., and elevation of points on R., **71,** 469; **72,** 465; **75,** 799.
Slope of w. surface, **71,** 469, 473; **72,** 465.
Range of w. surface, **71,** 470; **75,** 798; **76,** 714.
Discharge below Nashville, **71,** 475.

[1] Below Nashville.
[2] Nashville to Kentucky State line.
[3] At Smiths Shoals.
[4] Smiths Shoals to Falls of Cumberland.
[5] State line to Smiths Shoals.
[6] $151,000 for above Nashville, and $340,000 for below Nashville.
[7] Previous to Feb., 1877, confined to R. below Nashville.

Character of R. deposits, **71,** 489.
Description of coal fields, **71,** 484; **75,** 799.
Description of, Cumberland Falls, **79,** 1280.

PLANS. (See Estimates and Projects.)

Maj. Weitzel, 1871, considers l. and d. the only feasible plan for imp. of l. w. above Nashville, **71,** 478, but its cost ($4,000,000) precludes adoption, **71,** 478; **72,** 472; **75,** 795; **77,** 595.

Capt. King, 1877, suggests use of wire rope on upper Cumberland to permit ascending boats to pass rapids during h. w., **77,** 595.

S. Whinery, 1879, passage of Cumberland Falls by canals and locks; canal 3,700′ l.; locks, 35′ x 100′; total lift, 80′; est., $368,500, **79,** 1281. Capt. King did not consider that requirements of C. justified this imp., **79,** 1279.

PRIVATE (STATE AND CORPORATE) WORK.

1830–40. Tenn. and Ky. made app. for imp.; little benefit. Cumberland Navigation Co. incorporated by Tenn., 1846, for imp. navigation below Nashville with l. and d.; nothing effective done, **12,** 860.

Wing dams built by coal interest, **71,** 471, 475; by Ky., **71,** 472.

Brs. bet. Nashville and mouth, **71,** 474.

PROJECTS. (See Estimates and Plans.)

R. divided into—upper, Falls of the Cumberland to Nashville, 372 m., and lower, Nashville to mouth, 192 m., **71,** 469, 470; **72,** 465.

Maj. Weitzel, 1872, upper Cumberland, excavation of ledges, sand and gravel bars, concentration of water by wing dams, removal of snags and bowlders, restriction of tributaries to determined chans. On upper R. the proj. to l. the duration of existing h.-w. navigation. On lower R. to give l.-w. d. about 3′, **71,** 470, 478; **72,** 471; **77,** 594. Est., upper R. imp., $258,864, **72,** 472; **74,** 578; lower R. imp., $248,821, **71,** 480; **72,** 462.

R. C. McCalla, 1875, Smiths Shoals wing dams, of timber cribs filled with st., the dams to give descending coal boats a d. of 4′ during medium h. w. Est., $52,044, **75,** 795, 798. Revised by Maj. McFarland, **75,** 796. (See Estimates.)

SURVEYS.

Reconnoissance, 1870, Falls of the Cumberland to Nashville, 403 m., **71,** 469.

Sur. from Nashville to mouth, 1870, 192 m., **71,** 469.

Sur. from Pt. Burnside to Nashville, 1871, 326.7 m., **72,** 461, 465.

Special sur. of Smiths Shoals, 1874, **75,** 795.

Of Falls of Cumberland R., **79,** 142, 1279.

Part (c), AA-239 Cumberland River. Below Nashville.

APPROPRIATIONS.[1]

1880,	$20,000,	**80,** 1675.
1881,	15,000,	**81,** 1850.
1882,	15,000,	**82,** 1844.
1884,	7,500,	**84,** 1647.
1886,	12,500,	**86,** 1517.
1888,	10,000,	**88,** 1614.
1890,	40,000,	**90,** 2136.
1892,	40,000,	**92,** 1931.
1894,	30,000,	**95,** 2254.
1896,	80,000,	**96,** 1909.
1899,	100,000,	**99,** 2241.
1902,	180,000,	**02,** 1698.
1905,	10,000,	**05,** 1726.
1909,	10,000,	**09,** 1678.
1910	213,000 / 10,000	**10,** 1848.
1911,	250,000,	**11,** 2026.
1912	5,000 / 300,000	**12,** 2231.
Total,	[2] 1,348,000	(incl. receipts from other sources, and $340,000 under AA-239(b), app. for this section, $1,689,002.80, **12,** 2231).

COMMERCE.

Extension of season of navigation, **84,** 1645.

Valued at $1,500,000, **97,** 2223; at nearly $8,000,000, **98,** 1877; 1899, at nearly $4,771,049, **00,** 2893.

If large boats could navigate all year, there would probably be a reduction of 40 to 50% in rates, **00,** 2894.

Expected imp. to lower rates 30 or 40%, **01,** 2409.

Discussion of the value of C. statistics, **02,** 1697.

Freight rates of from 18 to 26¢ per 100 lbs. reduced to 6 to 12¢ since completion of Lock and Dam A, **05,** 450.

Increase in grain shipments, **07,** 521.

Favorable effect of imp. on rates, **09,** 587.

Season of navigation prolonged 45 to 90 days, **10,** 661.

Description and diagram, **11,** 2026, 2027.

In 1911, 223,278 t., **12,** 862.

"Little doubt" that R., "even in present condition," the cause of fav. rates into Nashville, **12,** 862.

CONTRACTS.

1902. Featherstone Foundry & Machine Co., dr., $18,650, **03,** 1584.

1903. Ed. J. Howard, 2 steam tenders, $4,535 each; 2 dump scows, $3,650 each; 6 decked barges, $1,503 each; and 2 derrick-boat hulls, $1,440 each, **03,** 1584. Penn Br. Co., 2 pair steel lock gates, filling valves, etc., at Lock A, $17,550, **04,** 2342.

1904. W. C. Rodgers, yellow pine timber, for Dam A, $23 per M, **04,** 2342.

1912. Mansfield Engineering Co., building concrete Locks B and C (separate contract for each lock), prices listed, **12,** 2232.

ENGINEERS.

Chief of Engineers. R., 80, 185; **81,** 249; **82,** 244; **83,** 251; **84,** 252; **85,** 274; **86,** 266; **87,** 233; **88,** 210, 1627; **89,** 245, 248; **90,** 221, 223; **91,** 282; **92,** 270; **93,** 304; **94,** 278; **95,** 306; **96,** 265; **97,** 342, 347; **98,** 334; **99,** 399; **00,** 454; **01,** 461; **02,** 388; **03,** 412; **04,** 438; **05,** 448; **06,** 491; **07,** 519; **08,** 553, 560; **09,** 585, 592; **10,** 660, 667; **11,** 710; **12,** 860.

Boards. Convened, Chattanooga, June 16, 1888, by S. O. No. 22, to **R.** upon a plan for the imp. of the mouth of the Cumberland. **R., 88,** 1628. (Lt. Cols. Merrill and Barlow, Maj. Mackenzie, and Lt. Waterman.)

In charge:

Maj. W. R. King, 1876–86. **R., 80,** 1674; **81,** 1849; **82,** 1843; **83,** 1487; **84,** 1644; **85,** 1760.

Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1515; **87,** 1758; **88,** 1611, 1626, 1631; **89,** 1837; **90,** 2133, 2151, 2152; **91,** 2268.

Lt. Col. H. M. Robert, 1892. **R., 92,** 1928.

Capt. J. Biddle, 1893–97. **R., 93,** 2390; **94,** 1805; **95,** 2251; **96,** 1906; **97,** 2220, 2242.

Maj. D. C. Kingman, 1898–99. **R., 98,** 1875; **01,** 458.

Lt. Col. M. B. Adams, 1899–1903. **R., 99,** 2242; **00,** 2891; **01,** 2407; **02,** 1695.

Maj. J. G. D. Knight, **02,** 386.

Capt. W. J. Barden, 1903. **R., 03,** 1581.

Lt. Col. C. B. Sears, 1904. **R., 04,** 2340.

Maj. H. C. Newcomer, 1905–07. **R., 05,** 1724; **06,** 1503.

1st Lt. W. G. Caples, **07,** 516.

Maj. W. W. Harts, 1907–11. **R., 07,** 1610; **08,** 1684; **09,** 1678; **10,** 1848; **11,** 2025.

Maj. C. A. F. Flagler, **11,** 706; **12,** 857.

Maj. E. Jadwin, **12,** 857.

Maj. H. Burgess, 1912–. **R., 12,** 2230.

[1] 1832–79, $340,000.

[2] See Appropriations, AA-239(b).

Assistants:
C. A. Locke. **R., 90,** 2158.
B. B. Smith. **R., 90,** 2159.
J. S. Walker. **R., 98,** 1885.

LEGAL PROCEEDINGS.

Site for land at dam, about 2½ m. below mouth of Harpeth R., condemned. Title vested in U. S. by court, **94,** 1806–07; **95,** 2253; **98,** 1877.

Right of way through U. S. reservation sold to Tennessee Central RR. Co. for $800, **03,** 1582; **04,** 2341.

Abstracts of titles to the necessary lands required for lock and abutment sites B and C, prepared and in hands of U. S. dist. atty. for middle Tennessee, for ex., **11,** 2026.

Titles to lock and abutment sites B, C, D, E, and F, acquired with exception of a parcel forming part of site of Lock E, to be acquired by condemnation; table showing acreage acquired and prices paid, **12,** 2231.

OPERATIONS.

1879-80. 571 c. y. r., 5,535 c. y. gravel, and 52 snags removed from the chan.; also 19,510 c. y. of r. quarried, and 23,453 c. y. of dam built; work done at Palmyra Isld. and Harpeth, Dover, Ingram, Race Track, and Little R. Shoals, **80,** 1675.

1880-81. 676 snags, roots, and overhanging trees removed, and 11,367 c. y. r. quarried, and 23,206 c. y. dam built, **81,** 1850.

1881-82. 583 snags and roots, 305 c. y. gravel, and 67 c. y. r. removed from chan.; also 6,390 c. y. r. quarried and built into dams, **82,** 1844.

1882-83. 938 snags, 1,628 c. y. r. and gravel, and 2 wrecks removed; 3,397 c. y. r. placed in dams, and 740 l. f. brush dam built, **83,** 1489.

1883-84. 200 c. y. material dr., 1,778 c. y. r. quarried, and 1,240 c. y. r. put in dams, **84,** 1646.

1884-85. 1,100 c. y. r. quarried and placed in dams, 128 snags and 2,595 c. y. gravel removed, **85,** 1761.

1885-86. 171 c. y. st. quarried, and 230 c. y. riprap dam built; 12 snags, 276 c. y. sand and gravel, and 361 c. y. of loose r. removed, **86,** 1515.

1886-87. 26 snags and 15 trees removed bet. Nashville and Robinsons Isld., **87,** 1758.

1887-88. 5,780 c. y. riprap dam built; 4,800 c. y. riprap st. quarried; 517 snags removed from chan., and 1,065 from banks, **88,** 1612.

1889-90. 116 snags and stumps and 10 c. y. solid r. removed from chan.; 330 c. y. st. quarried, and repairs to dams, **90,** 2134.

1890-91. 40 c. y. sand and gravel removed at Lower Gatlin Shoal; 748 c. y. r. removed from longitudinal dam, and 923 c. y. of new spur riprap dam built; 22 snags and 550 overhanging trees cleared from chan. and banks, **91,** 2268.

1891-92. 1,210 snags, 61 c. y. r., 1,050 c. y. gravel, and 15 t. of wreckage removed from chan., and 1,139 trees cleared from banks; reconstr. of spur dams at Cumberland Isld., **92,** 1929.

1892-93. 1,047 piles driven, 6,577 c. y. st., and some brush placed in dike at R. mouth; over 1,000 obstr. removed; dam repaired; old dams removed, comprising about 800 c. y. loose r., etc.; 1,092 piles, 6,041 c. y. st., and 545 cords brush used in protecting 3,150 l. f. bank at foot of Cumberland Isld., **93,** 2391, 2392.

1893-94. 2,000 c. y. st. and 255 cords brush placed in dike at mouth, **94,** 1806.

1894-95. Preparations made for constr. of l. and d. at Harpeth Shoals; nearly 12,000 leaning trees cut and over 2,000 other obstr. removed; about 500 c. y. r. and earth removed; willows planted for bank protection; and riprap dam repaired, **95,** 2253.

1895-96. Lock site and surrounding land at Harpeth Shoals cleared, temporary buildings erected, cofferdam built, some r. and 3,892 c. y. sand and other material excavated for foundation.

Old dam at upper end of Cumberland Isld. partly torn out; boundary of U. S. land marked; some obstr. material removed; hull for snag boat built, **96,** 1908.

1896-97. Some obstr. removed; small chan. cut, riprap dam built; preparations made for continuance of work at Harpeth Shoals, **97,** 2222, 2223.

1897-98. St. quarried and cut, and a large amount of misc. work performed at Lock and Dam A, **98,** 1877.

New hull built for *Weitzel*, old machinery repaired, and new added; boat renamed *Cumberland*, **98,** 1877.

1898-99. Work at Lock A continued, **99,** 2240.

1899-00. Work of preceding year continued (st. quarried, lock pit excavated, filling, st. cutting, masonry work, etc.); obstr. removed, **00,** 2892.

1900-01. Work continued on Lock A until stopped by lack of funds, **01,** 2408.

1902-03. Work continued on lock and abutment of dam at Lock A; repairs and additions made to floating plant; changes made to buildings and tracks on account of Tennessee Central RR. Co., **03,** 1582. 380 snags removed, 2,024 snags, trees, and logs cut, and 13 trees deadened, **03,** 1583.

1903-04. Quarrying and boating st., dr., grading and riprapping bank, and other work carried on at Lock A, **04,** 2340.

1904-05. Gates erected and dam completed, road built (st. quarried), bank protection repaired, lower approach dr., needle dam built, plant repaired, and other work at Lock A, **05,** 1724. Roof of Dam A damaged by drift; lock placed in operation Nov., 1904, **05,** 1724, 1725.

1905-06. Bank graded and riprapped 500′ below US. property line; damage to dam repaired, lockmaster's house built, and minor repairs made at Lock A; 331 snags removed, 867 snags, trees, and logs cut, and 48 trees deadened, **06,** 1504.

1907-08. 244 snags removed, 1,925 snags, trees, and logs cut, and 24 trees deadened, **08,** 1684.

1910-11. 553 obstr. removed from R. bed, and left clean for a distance of 191 m., **11,** 2025.

1911-12. 780 snags and other obstr. removed, and 32 c. y. taken from r. reefs; sites of Locks B and C cleared and inspector's quarters constr., **12,** 2231.

PHYSICAL CHARACTERISTICS.

Description of, lower Cumberland, **90,** 2154.

Current velocities, lower Cumberland, **90,** 2161.

Harpeth Shoals looked on as the most formidable obstr. of the lower Cumberland, **95,** 2253.

Description of, at mouth. Conditions improving, **97,** 2243.

H. w. of 1896 especially disastrous to banks, **96,** 1908.

Table showing stages at certain points on R., 1898–1902, **02,** 390.

Discharge, **02** (suppl.), 73; **04** (suppl.), 76; H. D. 1481, 60th, 2d.

Description of, R., **03,** 412.

R. below Nashville usually navigable for all SS. 6 mos. an.; for boats not drawing over 3′, 6 to 8 months; and for boats drawing 16″ or less, the whole year (see table of stages above), **12,** 862.

PROJECTS.

From 1832 to 1871, incl., $185,000 app. for this part of the R., **74,** 578.

By Maj. Weitzel, 1872, Cumberland R. below Nashville, to give a l.-w. d. of 3′, excavation of ledges, sand and gravel bars, removal of snags and bowlders, concentration of water by wing-dam constr., and restriction of tributaries to determined chans.; est., $248,821, **71,** 480; **72,** 462. Total est. increased in 1884 to $348,000, **84,** 1646; **87,** 1759.

In 1888 the BE. provided for the imp. of the Cumberland at its mouth, closing the left chan. around the towhead by a pile and brush dam 20′ w. and rising to l.-w. level, capped by cribwork built up to the 8′ stage of the R.; est., $129,600. (Lt. Cols. Merrill and Barlow, Maj. Mackenzie, and Lt. Waterman.) This, together with $20,000 proposed by Lt. Col. Barlow, 1888, for snagging at Gatlin Shoals, increases the total est. for the imp. of the lower Cumberland to $497,600, **88,** 1613, 1614, 1630, 1631; **90,** 2158.

By Lt. Col. Barlow, 1889, Cumberland R., Nashville to Big Eddy, 144 m., 7 l. and d.; est., $1,783,350, **90,** 2157.

Proj. in force 1893–94 consisted of (1) extension of l. and d. system of upper to lower R., 7 l. and d., from near the mouth of Harpeth R. (A) to Big Eddy Shoals (G), to be constr., to be 52′ x 280′, the lifts of the locks varying from 8½′–11½′, aggregating about 70′; (2) imp. of Kentucky Chute at mouth of R.; (3) chan. work below Lock G; (4) snagging and removal of surface obstr. below Nashville. Total est., $1,964,500, **94,** 1806. Cost of mainten. at 1894 was est. at about $5,000 per an., with a probable increase of from $4,000 to $6,000 per lock. When the whole system of locks completed, $50,000 would be required for an. mainten., **96,** 1909; **09,** 586.

After sur. of 1897 Capt. Biddle believed that $20,000 should be app. for mainten. of works at the mouth, to be used when necessary, **97,** 2245.

Immediate constr. of Lock B urged, 1900, **99,** 2241.

Immediate completion of lower R. scheme of imp. and of the lower part of the upper R. scheme urged, **00,** 2894.

Completion of lower R. proj. urged by Lt. Col. Adams, **01,** 2409.

BERH **R.,** in favor of continuing imp.[1] **07,** 1610.

By Maj. Harts, 1908–09, au. 1910, constr. of 5 locks (B, C, D, E, and F), 52′ x 280′, lifts varying from 10′–13.1′; also dr. remainder of R. to 6′; est., $3,164,882.40,[2] **10,** 661.

SURVEYS.

Sur. of the lower Cumberland, for slack-water navigation, au. act Aug. 11, 1888; made, 1889, by Lt. Col. Barlow, **90,** 2152.

Sur. for site of Lock and Dam A, near mouth of Harpeth R., as provided for by act July 13, 1892; made, 1892–93, by Capt. Biddle, **93,** 2392.

Sur. for Lock and Dam B, made 1896–97, **97,** 2222.

Resur. of the mouth au. act June 3, 1896; made, 1896, by Capt. Biddle (see Projects), **97,** 2242.

Au. act Mar. 2, 1907; made, 1908–09, by Maj. Harts,[2] **08,** 560; **09,** 592.

Ex., Lock No. 7, below Carthage, Tenn., to Lock No. 21, below Burnside, Ky., au. act Mar. 3, 1909; made, 1909, by Maj. Harts (**R.** unfav.),[3] **10,** 667.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 861.

Maps.[2] **88,** 1631; **90,** 2156; **12,** 2230.

Part (d), AA-239 Cumberland River, Above Nashville.[4]

APPROPRIATIONS.[5]

1880	[6] $15,000,	**80,** 1676.
	[7] 10,000,	**80,** 1677.
	[8] 20,000,	**80,** 1677.
1881	[6] 15,000,	**81,** 1851.
	[7] 15,000,	**81,** 1851.
	[8] 10,000,	**81,** 1853.
	[9] 10,000,	**81,** 1853.
1882	[10] 30,000,	**82,** 1845.
	[8] 15,000,	**82,** 1846.
	[9] 5,000,	**82,** 1847.
1884,	[11] 50,000,	**84,** 1648.
1886,	75,000,	**86,** 1517.
1888,	200,000,	**88,** 1616.
1890,	250,000,	**90,** 2139.
1892,	250,000,	**92,** 1939.
1894,	200,000,	**95,** 2261.
1896,	20,000,	**96,** 1916.
1897,	350,000,	**97,** 2228.
1898,	250,000,	**99,** 2247.
1899,	100,000,	**00,** 2902.
1902,	200,000,	**02,** 1705.
1905,	124,000,	**05,** 1732.
1906,	120,000,	**06,** 1508.
1907	150,000 / 30,000	**07,** 1616.
1908,	200,000,	**08,** 1691.
1909	*10,000,	**09,** 1684.
	250,000,	**09,** 1684.
1910	10,000 / 85,000	**10,** 1854.
1911,	85,000,	**11,** 2032.
1912,	7,500,	**12,** 2234.
Total,	[12] 3,161,500	(incl. receipts from other sources, and $151,000 under AA-239(b), app. fort his section, $3,313,079, **12,** 2234).

COMMERCE.

C. and agricultural resources of country bordering on the Cumberland R., **81,** 1854.

Resources of upper Cumberland, **84,** 1670.

Existing and prospective benefits to C., **90,** 2138.

In 1897, 54,994 t. below Burnside and 27,681 t. above Burnside, **97,** 2228.

Bowman transportation line established, **01,** 463.

Discussion of value of C. statistics, **02,** 1703.

Doubtful extent of, and value of coal fields above Carthage, **02,** 1704.

Diagram and statistics, **11,** 2033.

In 1911, 181,029 t., **12,** 866.

At 1912, canalization above Nashville practically completed, and material reduction of rates looked for. Lock 21 has reduced rates 50% within pool area. New barges and boats going into use, **12,** 865.

CONTRACTS.[13]

1888. Holmes & Wilk, l. and d. constr., $57,080, **89,** 1844. P. L. Hedrick, lockkeeper's house, $2,937.80, **89,** 1844.

1891. F. Hartney, timber and st. dike constr., $16,979, **91,** 2275. H. F. Holmes, completion of masonry at Lock No. 1, $35,490, **91,** 2276. Rich & Holmes, cofferdam, excavation of lock pit, and completion of masonry of Lock No. 2, $163,550, **91,** 2277.

Contract of 1891 with Rich & Holmes terminated by supple. agreement, Aug., 1892, **93,** 2397.

Open-market purchases of st., **94,** 1811.

1894. Petitdidier & Allen, st. for Lock No. 2, $57,864.50. J. H. Connor, st. for Lock No. 5, $57,724, **95,** 2262, 2263.

1897. McArthur Bros., constr. of lock and abutment of Dam No. 6, $164,871.75; No. 7, $181,689.50, **97,** 2231, 2232.

1899. J. E. Sloan & Co., constr. of lock approaches, abutments, Lock No. 1, about $78,000, **00,** 2905.

1903. Penn. Bridge Co., 3 prs. steel lock gates, filling valves, etc., for Lock 1, $15,400, **04,** 2392.

1904. W. C. Rodgers, yellow pine timber for Dam 1, $22.50 per M., **04,** 2342.

1905. Lawrence D. Weaning, lock gates, etc., $15,715, **05,** 1726. Continental Engineering & Contracting Co., building concrete Lock and Dam No. 21; unit prices given, **06,** 1509. W. C. Rodgers, furnishing yellow pine timber, Dam No. 2, $29 per M, **06,** 1510. Estate Temple O. Harris, rent of

*Allotment.

[1] H. D. 699, 59th, 1st.

[2] H. D. 758, 60th, 1st., and 1481, 60th, 2d.

[3] H. D. 632, 61st, 2d.

[4] Sur.—**R.,** Feb. 12, 1835; est., $45,192.10. (H. D. 482, 55th, 2d.)

[5] 1876–79, $151,000. All app. from 1886 are for l. and d. and mainten.

[6] Nashville to Kentucky line.

[7] Kentucky line to Smiths Shoals.

[8] Smiths Shoals.

[9] Above mouth of Jellico.

[10] Nashville to Smiths Shoals.

[11] Nashville to head of Smiths Shoals.

[12] See Appropriations, AA-239(b).

[13] See Cumberland R. below Nashville for floating plant contract.

office, $60 per month; Thos. W. & H. B. Chadwell, rent of land for storage, $60, **05,** 1727.

1906. Port Huron Shipbuilding Co., constr. and erecting 2 steel lock gates, filling valves, etc., Lock No. 21, $17,900, **06,** 1509.

1907. Penn Bridge Co., constr. and erecting steel lock gates, filling valves, etc., Locks 3 to 7, $85,100; **08,** 1692. J. K. Joice, yellow pine timber, Dams 3 and 5, $25.25 per M, **08,** 1692.

1909. W. C. Rodgers, yellow pine timber, Dam No. 4, $28.50 per M, **09,** 1684.

1910. T. H. Johnston & Co., yellow pine timber, Dams 6 and 7, $31.45 and $30.75, resp., per M, **10,** 1855.

ENGINEERS.

Chief of Engineers. R., 80, 185; **81,** 250, 258; **82,** 244, 252; **83,** 252; **84,** 253; **85,** 275; **86,** 266; **87,** 234; **88,** 211; **89,** 246; **90,** 222; **91,** 283; **92,** 270; **93,** 305; **94,** 279; **95,** 308; **96,** 267; **97,** 344; **98,** 336; **99,** 399; **00,** 456; **01,** 462; **02,** 390; **03,** 414; **04,** 440; **05,** 450; **06,** 493; **07,** 521; **08,** 556; **09,** 588; **10,** 663, 667; **11,** 713; **12,** 863.

Boards:

Convened, Chattanooga, Mar. 30, 1887, by S. O. No. 43, to ex. and **R.** upon Lt. Col. Barlow's proj. for a l. and d. at Lower Nashville Isld. **R., 88,** 1622. (Lt. Cols. Poe and Merrill, and Lt. Waterman.) **R.** by Maj. King, **88,** 1625.

Convened, Nashville, Tenn., Nov. 16, 1899, by S. O. No. 68, to ex. and **R.** upon proposed dam at Lock No. 1, Cumberland R. **R., 90,** 2144. (Col. Poe and Lt. Cols. Merrill and Barlow.)

Convened, Nashville, Tenn., Aug. 26, 1896, under S. O. No. 21, dated Aug. 3, 1896, to consider and **R.** on modification of proj. for constr. of Lock No. 5. **R., 96,** 1916. (Maj. F. A. Mahan, Maj. W. L. Marshall, Capt. J. Biddle.)

BERH. **R.** on proj., **06,** 495.

In charge:

Maj. W. R. King, 1876–86. **R., 80,** 1675; **81,** 1850, 1854; **82,** 1844, 1862; **83,** 1489; **84,** 1647, 1661, 1662, 1663; **85,** 1762.

Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1516; **87,** 1760; **88,** 1614, 1618; **89,** 1840; **90,** 2136; **91,** 2270.

Lt. Col. H. M. Robert, 1892. **R., 92,** 1931.

Capt. J. Biddle, 1893–97. **R., 93,** 2393; **94,** 1807; **95,** 2254; **96,** 1909; **97,** 2223.

Maj. D. C. Kingman, 1898–99. **R., 98,** 1878; **01,** 458.

Lt. Col. M. B. Adams, 1899–1903. **R., 99,** 2242; **00,** 2896; **01,** 2411; **02,** 1699.

Maj. J. G. D. Knight, **02,** 386.

Capt. W. J. Barden, 1903. **R., 03,** 1585.

Lt. Col. C. B. Sears, 1904. **R., 04,** 2343.

Maj. H. C. Newcomer, 1905–07. **R., 05,** 1728; **06,** 1506.

1st Lt. W. G. Caples, **07,** 516.

Maj. W. W. Harts, 1907–11. **R., 07,** 1613; **08,** 1687; **09,** 1680; **10,** 1849; **11,** 2027.

Maj. C. A. F. Flagler, **11,** 706: **12,** 857.

Maj. E. Jadwin, **12,** 857.

Maj. H. Burgess, 1912–. **R., 12,** 2233.

Assistants:

Capt. L. C. Overman. **R., 80,** 1678.

Lt. W. L. Marshall. **R., 81,** 1854.

W. C. Crozer. **R., 82,** 1865.

C. A. Turrill. **R., 84,** 1667.

J. S. Walker. **R., 98,** 1889.

LEGAL PROCEEDINGS.

Purchase and condemnation of land for l. and d. sites, **93,** 2398; **94,** 1812, 1813; **95,** 2257, 2258; **96,** 1913; **97,** 2226; **98,** 1881, 1882; **99,** 2244; **00,** 2900.

$450.17 collected on bond of J. H. Connor, a failing contractor, **02,** 1701.

Claims arising on account of overflowed lands, due to raising of w. l. by constr. of Dams 6 and 7; actual damages investigated, and **R.** in detail submitted, **11,** 2031.

OBSTRUCTIONS.

Complaint made of effect of imp. on ford across Spencers Creek; Maj. Harts recom. that U. S. bear only small part of expense of proposed br., **10,** 1853.

OPERATIONS.

1879-80. Nashville to Kentucky line: 985 c. y. r., 6,982 c. y. gravel, and 100 snags removed; 4,323 c. y. r. quarried and 5,604 c. y. dam built; also 596 snags, logs, and trees removed.

Kentucky line to Smiths Shoals: 1,196 snags, logs, and trees, and 50 c. y. bowlders removed.

Smiths Shoals: 15,652 c. y. loose and solid r. and gravel excavated from chan., 4,403 c. y. r. quarried, and 11,993 c. y. dam built.

Smiths Shoals to Falls of Cumberland: 218 c. y. r. removed, **80,** 1676, 1677, 1678.

1880-81. Nashville to Kentucky line: 10,269 c. y. r. and gravel excavated, 1,847 c. y. r. quarried, and 4,854 c. y. r. placed in dams and bank riprap.

Kentucky line to Smiths Shoals: 5,139 c. y. r. and gravel excavated, 1,094 c. y. r. quarried, and 3,970 c. y. placed in dams and riprap.

Smiths Shoals: 4,710 c. y. loose and solid r. excavated from chan., 2,038 c. y. masonry and concrete laid, 4,676 c. y. st. quarried, and 12,217 c. y. placed in dams, **81,** 1850, 1851, 1852.

1881-82. Nashville to Kentucky line: 10,808 c. y. r. quarried and 12,215 c. y. placed in dams; 8,585 c. y. gravel, 830 c. y. r., and 376 snags removed.

Kentucky line to Smiths Shoals: 3,789 c. y. r. quarried and 7,048 c. y. of same placed in dams; 13,518 c. y. r. and gravel and 516 snags removed.

Smiths Shoals: 3,264 c. y. r. quarried, 6,700 c. y. placed in dams, and 210 c. y. excavated from chan.

Above mouth of Jellico: 2,414 c. y. r. excavated and 769 snags and trees removed, **82,** 1844, 1845, 1846.

1882-83. Nashville to foot of Smiths Shoals: 4,700 c. y. r. quarried, and 16,184 c. y. placed in dams; 5,090 c. y. r., 410 snags, and 2 wrecks removed.

Smiths Shoals: 655 c. y. r. excavated from chan., 3,424 c. y. r. quarried, and 4,129 placed in dams, **83,** 1489, 1490.

1883-84. Nashville to foot of Smiths Shoals: 360 c. y. dr., 550 snags and trees removed, and 1,475 c. y. r. placed in dams, **84,** 1647.

1884-85. Nashville to head of Smiths Shoals: 370 l. f. of dam built, containing 1,007 c. y. of r.; 480 c. y. r., 341 snags, and 69 trees removed; 8,812 c. y. r. quarried, and 1,955 l. f. riprap dam built; 6,010 c. y. r. and gravel removed at upper Nashville Isld.; 809 c. y. r. and gravel excavated and 1,543 c. y. riprap dam built at Waitsboro Shoals, **85,** 1762, 1763.

1885-86. Nashville to head of Smiths Shoals: 1,249 c. y. solid r., 200 c. y. sand and gravel, and 463 c. y. riprap dam removed; 2,710 c. y. st. quarried and 1,904 c. y. riprap dam built, **86,** 1516.

1886-87. Nashville to head of Smiths Shoals: At Smiths, Forbush, and Priestlys Shoals, 133 c. y. solid r. and 1,545 c. y. loose r. removed; 1,385 c. y. embankment built and 1,072 c. y. of st. placed in dams, **87,** 1761.

1887-88. 150 c. y. r. and gravel removed; 215 c. y. riprap st. quarried; 721 c. y. riprap dam built; 602 snags removed from chan., and 926 trees from banks, **88,** 1615.

1888-89. 500 c. y. riprap dams built; 81 c. y. brush and st. bank protection placed; 193 snags removed from chan., and 753 trees from banks; 100 l. f. of cofferdam built, and 865 c. y. r. excavated from lock pit, **89,** 1841, 1842.

1889-90. Constr. of Lock No. 1 continued; cofferdam completed; 5,204 c. y. r. excavated from lock pit; 1,840 c. y. st. quarried, **90,** 2137.

1890-91. 1,700 c. y. of earth and 10,855 c. y. r. excavated from lock pit at Lock and Dam No. 1; 842 c. y. of masonry quarried, **91,** 2271. 3,000 c. y. of earth excavated for lock site at Lock and Dam No. 2, and constr. of cofferdam begun, **91,** 2272. 1,011 snags and 1,708 bowlders removed from chan., and 7,795 trees cleared from banks, **91,** 2273.

1891-92. 300 snags removed from chan., and 1,643 overhanging trees cleared from banks, **92,** 1935. Constr. of Lock and Dam Nos. 1 and 2 continued, **92,** 1936.

1892-93. Old dr. purchased and machinery from it transferred to new hull; constr. of Lock No. 1 in progress, and work begun on No. 3 and No. 4; nearly 12,000 snags and other obstr. removed; some r. excavated and placed in dams; dam that was at left bank of Holleman Isld. transferred to right bank, **93,** 2399.

1893-94. Constr. of Locks Nos. 1, 3, and 4 continued, and work on Nos. 2 and 5 begun, **94,** 1812. Small SS. built, and additions made to plant, **94,** 1814. At Wild Goose Shoals, old main dam was cut down to l. w. for about 450′; check dam built and chan. cleared. At Kettle Creek Shoals, dam 116′ l. built with r. from chan., some r. and nearly 1,200 obstr. removed; dams repaired, **94,** 1815.

1894-95. Work continued on Locks Nos. 2, 3, 4, and 5, **95,** 2257. Small SS. built. Dams repaired and extended at Fishing Creek and at Forbush Shoals, **95,** 2259. Nearly 19,000 leaning trees and 4,000 snags, etc., removed, **95,** 2259, 2260.

1895-96. Locks Nos. 2, 3, 4, and 5, in course of constr., **96,** 1912, 1913. Nearly 600 snags and other obstr. removed, **96,** 1914.

1896-97. Work on Locks Nos. 2 and 5 continued, **97,** 2225. About 1,700 obstr. of various kinds removed, **97,** 2226.

1897-98. Work continued on Locks Nos. 3 and 5 and begun on Nos. 6 and 7, **98,** 1880. New hull built for *Weitzel*. Snag boat repaired and refitted, **98,** 1881, 1882.

1898-99. Work at Lock No. 5 carried on by hired labor, and at Nos. 6 and 7 by contract; work of clearing obstr. from chan. above Nashville begun; about 2,000 obstr. removed, **99,** 2243.

1899-00. Work of last year continued; work begun at Lock No. 1; over 2,000 obstr. removed, **00,** 2897.

1900-01. Work carried on at Lock No. 1 under contract, and at Lock No. 5 by hired labor, **01,** 2412, 2413.

1901-02. Work on constr. of lock approaches and abutment protections under contract at Lock No. 1 completed; work carried on by hired labor at Lock No. 5, **02,** 1700, 1701.

1902-03. Work in progress on Locks Nos. 1, 2, 3, 4, and 5, **03,** 1585. 506 snags removed, 848 snags, trees, and logs cut, and 13 trees deadened, **03,** 1586.

1903-04. Work in progress on Locks Nos. 1, 3, and 4, **04,** 2344. 778 snags removed, 2,404 snags, trees, and logs cut, and 22 trees deadened, **04,** 2345.

1904-05. Lock gates erected, dam completed, and Lock No. 1 placed in operation Nov., 1904, **05,** 1729. 70 snags removed, 360 snags, trees, and logs cut, and 39 trees deadened, **05,** 1730.

1905-06. Work continued at Lock No. 2, and begun at Lock No. 21; 637 snags removed, 1,641 snags, trees, and logs cut, and 657 trees deadened, **06,** 1506, 1507.

1906-07. Work in progress at Lock No. 2, by hired labor, **07,** 1613. Work in progress at Lock No. 4, by hired labor, and at Lock No. 21, under contract; 330 snags removed, 559 snags, trees, and logs cut, and 41 trees deadened, **07,** 1614.

1907-08. Work on Lock and Dam No. 2 continued, dam completed, 17,540 c. y. dr. from lower approach, and lock placed in operation, Oct., 1907; gates and filling valves for Locks Nos. 3, 4, and 5, and filling valves for Locks Nos. 6 and 7 delivered, **08,** 1687. Work in progress on Locks and Dams Nos. 3, 4, and 5; 9,140 c. y. dr. from lower approach and dam foundation, Lock No. 3, **08,** 1688. Work on Lock and Dam No. 21 carried on under contract until Dec., 1907, when contractor failed, and U. S. took possession of plant and carried on work with hired labor, **08,** 1689. 643 snags removed, 1,418 snags, trees, and logs cut, and 85 trees deadened, **08,** 1690.

1908-09. Dam at Lock No. 3 completed, lock placed in operation Oct., 1908, and 6,643 c. y. dr. from lower approach; work in progress at Locks and Dams Nos. 4, 5, 6, and 7, **09,** 1680, 1681. Work in progress at Lock and Dam No. 21, **09,** 1682.

1909-10. Work in progress on Locks and Dams Nos. 4, 5, 6, and 7, and Locks Nos. 4 and 5 placed in operation Nov. 17 and Oct. 18, 1909, resp., **10,** 664, 1850, 1851. Work in progress on Lock and Dam No. 21, **10,** 1851.

1910-11. Two lock houses at Lock No. 5 completed and banks riprapped; building dam and bank riprapped at Lock No. 6; building dam, bank protection and putting lock in operation at Lock No. 7; work on Lock No. 21 in progress and about 80% completed; snagging operations continued, trees cut, trimmed, and deadened, and sunken barge removed, **11,** 2027.

1911-12. Work in progress for completion and putting in operation Lock No. 21; riprapping banks at Locks Nos. 6 and 7; excavating chans. at shoal places bet. Locks Nos. 4 and 7; snagging operations continued; boat yard near Nashville purchased; general work continued; Lock No. 21 put in operation in Oct., 1911, **12,** 865, 2233.

PHYSICAL CHARACTERISTICS.

Discharge, **84,** 1666; **12,** 3854.

Table of distances, with fall of water on shoals, and average d. in pools on the lower Cumberland R. from Lock No. 1; upper R. imp. to the Ohio R., **90,** 2140.

Description of, after ex. made 1893–94, at Wild Goose, Kettle Creek, and Smiths Shoals, **94,** 1815.

Bank slides, **96,** 1914.

Navigation hampered by l. w. during 1904, **05,** 1730.

Complaint made by citizens of effect produced at Spencers Creek Ford by backwater from Dam No. 3; petition urges constr. of br. by U. S., **11,** 2031.

Completion of locks resulted in good H. at Nashville; affords 6′ navigation, Nashville to West Pt., Tenn., **11,** 715.

Completion of Lock and Dam No. 21 affords SS. navigation the year round for 30 m. below Burnside, Ky.; creates fairly good H. at that locality, **12,** 865.

Proj. section, 1912, from Nashville to mouth of Rock Castle R., (357 m.) is about 160 m.; the lower end of proj. 190 m. from R. mouth, **12,** 863.

At 1912, R. had been made navigable—Nashville to West Pt. (125 m.) for 6′ dr. boats all year; thence to Burnside (325 m. above Nashville) for SS. of 2½′ draft for 6 to 8 mos.; for boats of greater draft, 2 to 3 mos. R. above Burnside, for 35 m., navigable for rafting and logging, **12,** 865, 866.

PLANS. (See Projects.)

By Maj. King, 1881, Smiths Shoals, l. and d., using the R. itself as a canal, by the constr. of a dam at head of Mill Shoal in connection with 4 locks of 16′ lift and 55′ x 140′ in chambers. Est., $560,000, or for a more complete imp. an additional dam, with 3 locks near Shadowen Shoal; est., $965,000, **82,** 1863, 1864.

Recom. that existing system of dams be tried 1 year longer before attempting a more radical imp., **82,** 1865.

PRIVATE WORK.

Value and description of the private dams above the mouth of the Jellico, **83,** 1491, 1492; **87,** 1762, 1763.

Act Mar. 3, 1905, au. Cumberland River Improvement Co. to improve R. and tributaries, incl. the South Fork above Burnside, by l. and d. and to use resulting water power, with certain provisions, and under U. S. supervision; also to collect toll for 40 years at rates to be fixed by Sec. of War, **05,** 451.

PROJECTS. (See Plans.)

By Maj. Weitzel, 1872, Falls of the Cumberland to Nashville, 372 m., excavation of ledges, sand and gravel bars, concentration of water by wing dams, removal of snags and bowlders, and the restriction of tributaries to determined chans.; est., $258,864, **71,** 470, 478; **72,** 471; **77,** 594.

By Maj. McFarland, 1875, Smiths Shoals wing dams to give descending coal boats 4′ during m. h. w., **75,** 795, 796.

Above mouth of Jellico: By Maj. King, 1881, Jellico to Cumberland Ford, 110 m., removal of snags, trees, and similar obstr.; est., $55,000, **81,** 1853; **87,** 1763.

By Maj. King, 1884, Nashville to the head of Smiths Shoals; slack-water navigation, with 23 locks bet. Nashville and Pt. Burnside, and 7 locks

at Smiths Shoals, giving 5′ on the lower miter sills; est., $4,077,922, **84,** 1663, 1665; **87,** 1761.

Dimensions of locks, as fixed by BE., 52′ x 280′, **87,** 1760.

In 1891 locks of larger dimensions than those contemplated in the orig. proj. and est. having been recom. by the BE., the est. was revised, making the cost of the 23 l. and d. bet. Nashville and Pt. Burnside $5,750,000; and to continue the imp. to the head of Smiths Shoals, with 7 additional l. and d., was est. to cost $1,750,000, making the total est., revised proj., $7,500,000, **91,** 2270; **92,** 1938.

Proj. for canalization of C. R. given, 1912 **R.,** as follows: Based on ex. and sur., 1882 and 1883, **84,** 1661. Calls for 22 l. and d. below Burnside, Ky., and 6 l. and d. at Smiths Shoals, above Burnside, the intention being to provide a complete system of lockage, Nashville to Rockcastle R., to gain 6′ chan.; l. to be 52′ x 280′, with lifts varying from 10′ to 12′; est., $8,500,000, **12,** 864.

List of lands acquired for l. and d. sites, distances from Nashville, acreage and cost—Nos. 1, 2, 3, 4, 5, 6 (new site of No. 2 incl.), **94,** 1814; Nos. 1 to 8, and Nos. 21 and 22, **95,** 2259; **96,** 1914.

Constr. by hired labor and open-market purchases au., **93,** 2399.

Act of 1892 app. $20,000 to be applied to l. and d. Nos. 21 and 22, and provided for completing the whole or any parts of Nos. 5, 6, and 7, at a cost not to exceed $600,000, **96,** 1914; **99,** 2243.

By Capt. Biddle, 1896, for increasing, because of the small app., the est. cost of the imp. to $9,000,000. Est. cost of an. mainten., $5,000, to be increased from $4,000 to $6,000 as each lock would be completed. Est. cost of an. mainten. of the whole system of 30 locks when completed, $150,000, **96,** 1916.

Smiths Shoals: Act 1892 allotted $5,000, **93,** 2399; **94,** 1816. Act 1894 allotted $5,000, **95,** 2261. Sites of Locks and Dams Nos. 1 to 6 approved, **96,** 1915. Proj. revised by Capt. Biddle, 1896, to provide for increasing height of 6 locks to save the constr. of a seventh, **96,** 1915.

Lt. Col. Adams, 1899, est. $898,740.15, and 2 years to make Locks 1 to 7 operative, and to give 6′ navigation, **99,** 2245.

Lt. Col. Adams recom., 1902, proj. below Nashville be completed first, bet. Nashville and Carthage next, and that above Carthage be abandoned, **02,** 1704.

Lt. Col. Sears recom., 1904, that balances for work on special locks be made available for general imp., **04,** 2346.

Act 1905 au. Lock and Dam No. 21 at cost of $200,000, and made applicable for such work any balances remaining to credit of any proj. above said dam, and also au. application of balances on hand or general imp. above Nashville and for Locks Nos. 5, 6, and 7, to constr. of Lock and Dam No. 2, **05,** 1730.

Maj. Newcomer est., 1905, $550,000 to make Locks and Dams Nos. 3 to 7 available for navigation, **05,** 1730.

BERH., 1906, reported the constr. of 6 l. and d. below Nashville, and completion of Locks and Dams Nos. 3, 4, 5, 6, and 7 bet. Nashville and Carthage, at est. of $2,950,000, in addition to work already provided for, as worthy of being continued; but proposed imp. bet. Carthage and Burnside, except Lock and Dam No. 21, not justified by C. involved,[1] **06,** 495; **07,** 522. Act Mar. 2, 1907, au. modified proj. for completing the imp. in accordance with this **R.,** by providing for completion of Locks and Dams Nos. 3, 4, 5, 6, and 7; additional expend. $550,000, **07,** 522.

Maj. Harts increased est. for Dam No. 21 to $77,000 for dam, and $44,000 for protection work, **08,** 1689; making est. as modified by act Mar. 2, 1907, $2,854,000, **08,** 556.

Maj. Harts recom., 1909, that further app. for Lock No. 21 be coupled with requirement that a suitable public landing place be provided at Burnside, without expense to U. S., to prevent a monopoly of the freight resulting from the imp., **09,** 1683.

Act July 25, 1912, app. $5,000 for mainten. by open-chan. work, and $2,500 for purchase of flowage rights over lands submerged from constr. of Dams 6 and 7, **12,** 864.

SURVEYS.

For canal around Smiths Shoals au. act Mar. 3, 1881; made by Maj. King, **82,** 1862.

Ex. of Cumberland R. and principal tributaries above Pineville; made, 1882, by Maj. King, **84,** 1661.

Ex. and sur. for location of l. and d., from Nashville to Cincinnati Southern RR.; made, 1882, 1884, by Maj. King, **84,** 1662, 1663.

Surs. and exs. made almost every year from 1893–1900 for l. and d. sites. (See references, Engineers in charge.)

Au. act Mar. 3, 1909, Lock No. 7 to Lock No. 21; made, 1909, by Maj. Harts (**R.** unfav.),[2] **10,** 667.

R. by BERH., Dec. 5, 1910, req. by R. and H. Com. to report whether Dam 20 would be worthy as a separate proposition from the R. as a whole. Maj. Flagler, **R.,** Oct. 3, 1910, gives existing physical and commercial conditions, and states it is not advisable to undertake constr. of Lock and Dam No. 20, at an est. of approx. $385,000 at this time. Board concurs.[3]

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 865.

Maps. **98,** 1888.

Part (e), AA-239 Cumberland River, Tenn. and Ky., Locks and Dams on. (Operating and care.)

APPROPRIATIONS.[4]

1906,	$5,601.30,	**06,** 1511.
1907,	6,950.58,	**07,** 1618.
1908,	16,623.95,	**08,** 1694.
1909,	31,801.58,	**09,** 1686.
1910,	33,055.73,	**10,** 1857.
1911,	32,508.78,	**11,** 2037.
1912,	98,673.62,	**12,** 2237
Total,	225,215.54	

COMMERCE.

For lockage an., see each **An. R.**

CONTRACTS.

1912. Lee Vecchione, delivering cut st. for raising walls of Locks Nos. 2 and 3; quantities and prices listed, **12,** 2237. J. & J. B. Milholland Co., filling valves, anchorages, etc., for Lock No. 2, $2,661.57; Independent Bridge Co., delivering and erecting, at Lock No. 2, entire steel work for raising leaves of lock gates, adjusting and rehanging gates, etc., $3,793, **12,** 2238.

ENGINEERS.

Chief of Engineers. R., 06, 496; **07,** 524; **08,** 558; **09,** 591; **10,** 666; **11,** 717; **12,** 866.

In charge:

Maj. H. C. Newcomer, 1906–07. **R., 06,** 1511.

1st Lt. W. G. Caples, **07,** 516.

Maj. W. W. Harts, 1907–11. **R., 07,** 1618; **08,** 1694; **09,** 1686; **10,** 1856; **11,** 2033.

[1] H. D. 699, 59th, 1st.
[2] H. D. 632, 61st, 2d.
[3] R. and H. Com. 3, 62d, 2d.
[4] Expend. under the permanent indefinite appr. act July 5, 1884, for operating and keeping in repair canals and other public works.

Maj. C. A. F. Flagler, **11,** 706; **12,** 857.
Maj. E. Jadwin, **12,** 857.
Maj. H. Burgess, 1912–. **R., 12,** 2235.

LEGAL PROCEEDINGS.

20 claims, aggregating $33,825 during 1912, on account of overflowed lands, due to raising of w. l. by dams; no funds available for payment of claims; congressional legislation required, **12,** 2236.

Negotiations to acquire, by purchase, flowage rights, pending, **12,** 867.

OPERATIONS.

1905-06. Minor repairs made and 1,470 c. y. dr. at Locks Nos. 1 and A, **06,** 1511.

1906-07. Repairs and imp. made to buildings, bank protected, dam repaired, and other minor work done at Lock A, **07,** 1618.

1907-08. Preparations made for repair of dam at Lock A; minor repairs at Locks Nos. 1 and 2, **08,** 1694.

1908-09. Lock and upper approach dr. at Lock No. 1; lock and upper approach dr. and dam backed with sand and gravel at Lock No. 2; extensive repairs made to dam, and lower approach excavated at Lock A, **09,** 1686.

1909-10. Dr. at Locks A, Nos. 1, 2, and 5; extensive repairs to dam at Lock No. 3; banks; protected at Locks Nos. 3 and 5; new suction dr. built at Muscle Shoals Canal, **10,** 1856.

1910-11. Dr. done at all locks; riprapping for bank protection at Lock A and Lock No. 4; constr. of 3 barges for Lock A begun, **11,** 2033–35.

1911-12. Bank protection, riprapping banks, removing sediment from lock pits, dr. lock approaches, constr. of 4 barges and 2 derrick boats, and general mainten. work carried on, **12,** 2235.

PHYSICAL CHARACTERISTICS.

Description of, **11,** 717, 2034, 2035.

Vessels unable to pass over dam or use locks during certain periods of year (see Projects), **11,** 2034.

PRIVATE WORK.

City of Nashville purchased 330′ ground for wharf purposes, **12,** 867.

PROJECTS.

Maj. Harts recom. raising lock walls from 3′ to 6′, so that boats can pass over dam, and use locks during certain seasons of year; est. submitted; plan app. by Chief of Engineers, and au. given to carry on work, **11,** 2034–37.

AA-263 CANEY FORK RIVER, TENN.

APPROPRIATIONS.

1880,	$6,000,	**80,** 1689.
1881,	4,000,	**81,** 1870.
1882,	4,000,	**82,** 1855.
1884,	3,000,	**84,** 1654.
1886,	3,000,	**86,** 1524.
1888,	2,500,	**88,** 1634.
1890,	2,500,	**90,** 2150.
1907,	3,000,	**07,** 1619.
Total,	28,000 (incl. receipts from other sources, $28,012.25, **09,** 1687).	

COMMERCE.

Benefit to C. by imp., **79,** 1275.

Merchandise transported on R., **84,** 1654; **88,** 1635.

Unimportant; 1906, 815 t. **07,** 525; 1908, 16,480 t.; **09,** 1688.

ENGINEERS.

Chief of Engineers. **R., 78,** 105; **79,** 142; **80,** 188; **81,** 254; **82,** 248; **83,** 256; **84,** 256; **85,** 278; **86,** 269; **87,** 235, 236; **88,** 212; **89,** 247; **90,** 223; **91,** 284; **92,** 272; **93,** 306; **94,** 282; **95,** 309; **07,** 524; **08,** 559; **09,** 591; **10,** 666, 667.

In charge:

Capt. W. R. King, 1878–86, **78,** 105; **79,** 142. **R., 79,** 1275; (Maj.) **80,** 1688; **81,** 1869; **82,** 1854; **83,** 1499; **84,** 1653; **85,** 1768, 1774.

Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1523; **87,** 1766, 1768; **88,** 1634; **89,** 1847; **90,** 2149; **91,** 2284.

Lt. Col. H. M. Robert, 1892. **R., 92,** 1941.

Capt. J. Biddle, 1893–95. **R., 93,** 2402; **94,** 1818; **95,** 2264.

Maj. W. W. Harts, 1907–09. **R., 07,** 1619; **08,** 1695; **09,** 1687.

Assistants:

C. A. Turrill. **R., 79,** 1275.

C. A. Locke. **R., 87,** 1769.

OBSTRUCTIONS. (See Physical characteristics.)

OPERATIONS.

1880-81. 91 c. y. r., 2,368 c. y. gravel, and 3,956 logs, snags, etc., removed from chan.; 555 c. y. st. placed in dams, and 260 l. f. of wing dam built, **81,** 1870.

1881-82. 2,598 c. y. log and st. dams built, 200 c. y. gravel and loose r. excavated, and 2,196 trees and snags removed, **82,** 1854.

1882-83. 365 trees, snags, and stumps cut down and removed, 775 c. y. gravel put in dams, and 250 c. y. st. quarried for dam, **83,** 1500.

1883-84. 347 c. y. st. quarried, 1,735 c. y. riprap dam built, and 2,595 c. y. r. and gravel excavated from chan.; 928 trees, stumps, and snags removed, **84,** 1653.

1884-85. 600 c. y. r. quarried and placed in riprap dams, 310 l. f. riprap dam built, 2,595 c y. gravel and loose r. excavated, and 1,609 trees stumps, and snags removed, **85,** 1769.

1887-88. 1,550 c. y. r., sand, and gravel excavated; 593 c. y. riprap st. quarried; 568 l. f. spuriprap dams built; 219 snags removed from chan. and 4,151 trees from banks, **88,** 1635.

1888-89. 15 c. y. r. and 28 snags removed from chan.; 1,316 c. y. riprap st. quarried, **89,** 1848.

1889-90. 4 snags removed, 65 bowlders and 388 c. y. st. quarried, and 1,223 c. y. riprap dam built, **90,** 2150.

1890-91. 4,787 trees cut, and 49 snags and 440 c. y. r. removed from chan., **91,** 2285.

1891-92. 30 c. y. r., 227 snags, and 5,969 overhanging trees removed from chan. and banks, **92,** 1941.

1906-07. Material ordered for constr. of 2 flatboats, **07,** 1619.

1907-08. Snags, logs, trees, and bowlders removed over 15 m. of R., **08,** 1695.

1908-09. Snags, logs, trees, and bowlders removed over 76 m. of R., completing clearing up R., Franks Ferry to mouth, **09,** 1687. Until further action is taken by U. S., work will be dropped, **10,** 666.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 1276, 1277.

List of obstr., **79,** 1276.

PLANS. (See Projects.)

By C. A. Turrill, 1879, imp. Caneys Fork ($30,228) by dr., excavating r., and building riprap dams, **79,** 1246, 1277.

PROJECTS. (See Plans.)

By Capt. Overman, 1878, formation of navigable chan. during 5 months of the year, mouth to Sligo, by removal of obstr., dr., and r. removal, and

constr. of riprap dams; est., $30,228, **79,** 1275, 1277; **83,** 1500; **87,** 1767.

By Lt. Col. Barlow, 1886, extending navigation, Sligo to Franks Ferry; est., $15,000; entire est., $45,000, **87,** 1767, 1769; **92,** 1941.

SURVEYS.

Ex. au., **78,** 105; completed by C. A. Turrill, **79,** 142, 1275, 1277.

Ex. with view to extension of Caney Fork R, sur. to Franks Ferry; made, 1884, by Maj. King, **85,** 1774.

Ex. au. act Aug. 5, 1886; made by Lt. Col. Barlow, **87,** 1768.

Pre. ex. au. act Mar. 3, 1909, from mouth 80 m. upstream; made, 1909, by Maj. Harts (**R.** unfav.),[1] **10,** 667.

AA-269 OBEY (Obeys) RIVER, TENN.

APPROPRIATIONS.

1880,	$4,000,	**80,** 1688.
1881,	2,500,	**81,** 1869.
1882,	5,000,	**82,** 1853.
Total,	11,500	

COMMERCE.

Benefit to C. by imp., **79,** 1277–79.

ENGINEERS.

Chief of Engineers. R., 78, 105; **79,** 142; **80,** 187; **81,** 254; **82,** 247; **83,** 255; **84,** 255; **87,** 236; **88,** 213; **10,** 666.

In charge:
Maj. W. R. King, 1878–84. **R., 80,** 1688; **81,** 1868; **82,** 1853; **83,** 1498; **84,** 1652.
Lt. Col. J. W. Barlow, 1886–88. **R., 88,** 1636.
Maj. W. W. Harts, **10,** 657.

Assistant.
C. A. Turrill. **R., 79,** 1277.
W. C. Crozer. **R., 88,** 1637.

OPERATIONS.

1880–81. 45 c. y. solid r. and 1,782 c. y. gravel and loose r. removed from chan.; 1,758 logs, snags, and trees also removed, **81,** 1869.

1881–82. 691 c. y. riprap dam built; 2,644 c. y. loose r. and gravel, and 63 c. y. solid r. removed, **82,** 1853.

1882–83. 63 c. y. r. and 481 c. y. gravel excavated, 220 c. y. st. quarried, and 418 c. y. riprap dam built, **83,** 1499.

1883–84. 1,516 c. y. st. quarried; 2,363 c. y. riprap dam built; 370 c. y. solid r. and 3,365 c. y. gravel removed from R.; 268 snags removed, completing work of imp., **84,** 1652.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 1277–79.
List of obstr., **79,** 1278.

PLANS.

By C. A. Turrill, 1879, imp., Obeys R., ($11,869), by dr., building riprap dams, etc., **79,** 1279.

By Lt. Col. Barlow, 1887, clearing 15 m. R. by dr., removing overhanging trees, r., snags, and riprap dam constr.; est., $4,352, **88,** 1638.

PROJECTS.

By Capt. Overman, 1879, 3′ navigation, by dr. and r. excavating, with riprap dams, and by removing snags, logs, trees, and similar obstr.; est., $11,869, **79,** 1275, 1279. Proj. completed, **84,** 1652.

SURVEY.

Ex. au., **78,** 105, completed by C. A. Turrill, **79,** 142, 1277.

Au. act Aug. 5, 1886, **87,** 236; made, 1887, by Lt. Col. Barlow, **88,** 1636.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Harts, June 22, 1909[2] (unfav.), **10,** 666.

AA-275 CUMBERLAND RIVER, KY. (South Fork.)

APPROPRIATIONS.

1882,	$3,000,	**82,** 1862.
1884,	4,000,	**84,** 1661.
1886,	5,000,	**86,** 1525.
Total,	12,000	

ENGINEERS.

Chief of Engineers. R., 80, 190; **81,** 258; **82,** 252; **83,** 259; **84,** 259; **85,** 279; **86,** 270; **87,** 235; **88,** 211; **89,** 247; **90,** 222; **91,** 285; **92,** 273.

In charge:
Maj. W. R. King, 1881–86. **R., 81,** 1896; **82,** 1862; **83,** 1508; **84,** 1660; **85,** 1770.
Lt. Col. J. W. Barlow, 1886–92. **R., 86,** 1525; **87,** 1765; **88,** 1633; **89,** 1846; **90,** 2148; **91,** 2286.
Lt. Col. H. M. Robert, 1892. **R., 92,** 1943.

Assistant. W. C. Crozer. **R., 81,** 1897.

OPERATIONS.

1882–83. Brush dam built, 50 trees cut, 60 c. y. st. quarried for dams, **83,** 1508.

1884–85. 556 c. y. solid r. blasted, 368 c. y. loose r. excavated, 108 c. y. st. quarried for riprap, 1,665 c. y. riprap dam built, 161 trees cut and removed, **85,** 1770.

1886–87. 230 c. y. solid and 583 c. y. loose r. removed, 2,066 c. y. st. placed in wing dams at Sloans and Roberts Shoals, **87,** 1765.

1887–88. 607 c. y. riprap quarried, and 2,000 c. y. of spur dam built, **88,** 1633.

PROJECTS.

By Maj. King, 1881, 44 m. of R. below Devils Jump, removal of gravel bars and bowlders, excavating chan. through rocky reefs, and constr. of wing dams, to secure safe navigation at stages when at least 3′ above l. w.; est., $62,803, **81,** 1897, 1898; **86,** 270; **87,** 235; **90,** 2149.

SURVEY.

Au. act June 18, 1878; made, 1879, by Maj. King, **81,** 1896.

[1] H. D. 693, 61st, 2d.

[2] H. D. 319, 61st, 2d.

AA-280 ROCKCASTLE RIVER, KY.

COMMERCE.
Not unimportant, **75,** 802.

ENGINEERS.
Chief of Engineers. **R., 75,** 77.
In charge. Maj. W. McFarland, 1875. **R., 75,** 800.
Assistant. R. C. McCalla. **R., 75,** 801.

PHYSICAL CHARACTERISTICS.
Description of the R., **75,** 801.
Coal beds in the vicinity, **75,** 802.
Table of distances and elevations, **75,** 803.

PLANS.
By R. C. McCalla, blasting r. and removal of timber from banks, to provide a safe outlet for coal barges and timber rafts, at high stages of water; est., $5,000, **75,** 802.

SURVEYS.
By R. C. McCalla, 1874–75. **R., 75,** 801.

AA-313 RED RIVER, TENN.

APPROPRIATION.
1881, $5,000, **81,** 1878.

COMMERCE.
C. unknown, **84,** 1659.

ENGINEERS.
Chief of Engineers. **R., 80,** 190; **81,** 257, 258; **82,** 251; **83,** 258; **84,** 259.
In charge. Maj. W. R. King, 1880–84. **R., 81,** 1878, 1894; **82,** 1861; **83,** 1507; **84,** 1659.
Assistant. C. A. Turrill. **R., 81,** 1894.

OBSTRUCTIONS.
3 brs. not provided with draws, **81,** 1878.

OPERATIONS.
1881-82. 1,458 c. y. fish-trap dam, 60 c. y. solid r., 1,463 c. y. loose r. and gravel, and 485 snags and logs removed; 1,664 overhanging trees cut, and 1,050 c. y. riprap dam built, **82,** 1861.

PROJECTS.
By Maj. King, 1881, Red R., Port Royal to mouth, removing snags, logs, overhanging trees, and similar obstr., and with riprap dams; est., $10,103, **81,** 1878.

SURVEYS.
Au. act June 14, 1880; made, 1880, by Maj. King, **81,** 1879.

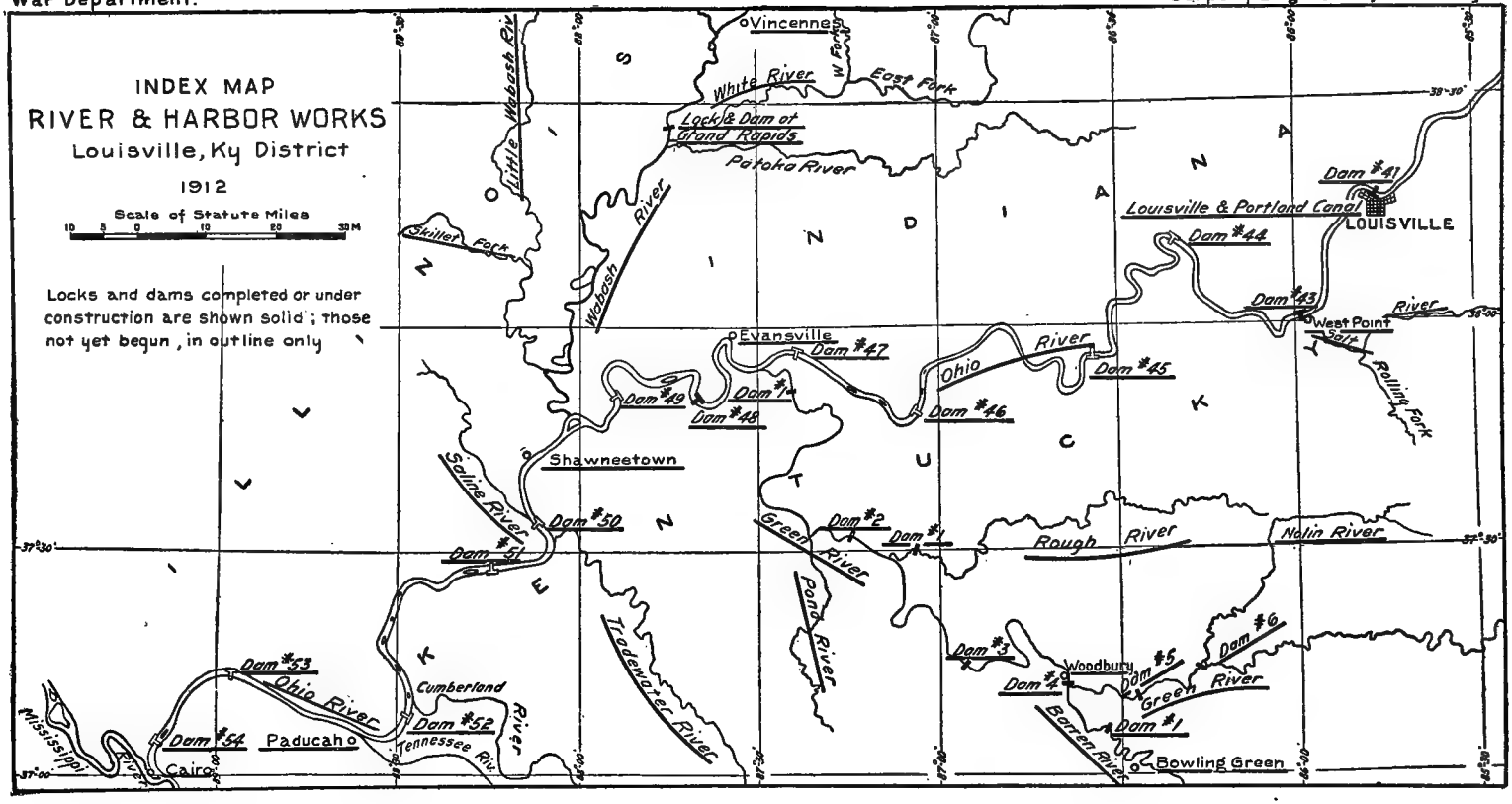
AA-317 LITTLE RIVER, KY.

ENGINEERS.
Chief of Engineers. **R., 85,** 279.
In charge. Maj. W. R. King. **R., 85,** 1772.

SURVEY.
Ex. au. act July 5, 1884; made by Maj. King (**R.** unfav.), **85,** 1772.

RIVER AND HARBOR WORKS—OHIO RIVER SYSTEM.

BB.—LOUISVILLE, KY. DISTRICT.


INDEX MAP
RIVER & HARBOR WORKS
Louisville, Ky District
1912
Scale of Statute Miles
10 5 0 10 20 30 M
Locks and dams completed or under construction are shown solid; those not yet begun, in outline only
Vincennes
White River
W Fork
East Fork
Lock & Dam at Grand Rapids
Patoka River
Little Wabash Riv
Skillet Fork
Wabash River
Evansville
Dam #47
Dam #49
Dam #1
Dam #48
Ohio River
Dam #46
Dam #45
Dam #44
Dam #43
Dam #41
Louisville & Portland Canal
LOUISVILLE
West Point
Salt River
Rolling Fork
Shawneetown
Saline River
Dam #50
Dam #51
Green River
Dam #2
Dam #1
Rough River
Nolin River
Pond River
Tradewater River
Dam #3
Dam #4
Woodbury
Dam #5
Dam #6
Green River
Barren River
Dam #1
Bowling Green
Dam #53
Ohio River
Cumberland River
Dam #52
Tennessee Riv
Dam #54
Paducah
Mississippi River
Cairo
INDIANA
KENTUCKY
ILLINOIS

BB.—LOUISVILLE, KY., DISTRICT.

In charge of U. S. Engineer Office,
Customhouse, Louisville, Ky.

(NOTE.—This group of waterways embraces the tributaries on left bank of the Ohio from Tradewater R. to Salt R., inclusive—on right bank, from Louisville to mouth of the Ohio.)

BB 1 Mississippi R.
BB 2 Ohio R., Ill., Ky., and Ind. (1) (See Dist. CC)
BB 3 Vicinity opp. Cairo H., Ill. (See CC and HH)
BB 4 Tennessee R. (Paducah, Ky.) (2) (See Dist. AA)
BB 5 Cumberland R. (2) (See Dist. AA)
BB 6 Tradewater R., Ky. (2)
BB 7 Green R., Ky. (2)
BB 8 Pond R., Ky. (7)
BB 9 Barren R., Ky. (7)
The list now goes downstream of 7 with—
BB 10 Nolin R., Ky. (7)
BB 11 Rough R., Ky. (7)
The list now turns up Ohio R.
BB 12 Blackford Cr., Ky. (2)
BB 13 Salt R., Ky. (2)
BB 14 Louisville, Ky. (2) (See Dist. CC)
The list now proceeds down Ohio R. toward mouth thereof.
BB 15 Big Blue R., Ind. (2)
BB 16 Little Blue R., Ind. (2)
BB 17 Bear Cr., Ind. (2)
BB 18 Little Sandy Cr., Ind. (2)
BB 19 Puppy Cr., Ind. (2)
BB 20 Hurricane Cr., Ind. (2)
BB 21 Pigeon Cr., Ind. (2)
BB 22 Cypress Cr., Ind. (2)
BB 23 Wabash R., Ill., Ind., and Ohio. (2)
BB 24 Patoka R., Ind. (23)
BB 25 White R., Ind. (23)
BB 26 White R., East Fork, Ind. (25)
BB 27 White R., West Fork, Ind. (25)
BB 28 Eel R., Ind. (27)
BB 29 Wild Cat Cr., Ind. (23)
BB 30 Mississinnewa R., Ind. (23)
BB 31 Salamonie R., Ind. (23)
BB 32 Eel R., Ind. (23)
BB 33 Tippecanoe R., Ind. (23)
BB 34 Vermilion R., Ind. and Ill. (23)
BB 35 Embarras R., Ill. (23)
BB 36 Little Wabash R., Ill. (23)
BB 37 Skillet Fork, Ill. (36)
BB 38 Saline R., Ill. (2)
BB 39 Massac R., Ill. (2)
BB 40 Cache R., Ill. (2)

BB-6 TRADEWATER RIVER, KY.

APPROPRIATIONS.

1881,	$3,000,	**82,** 1959.
1882,	3,500,	**82,** 1962.
1884,	2,000,	**84,** 1748.
1886,	2,000,	**86,** 1618.
1888,	6,000,	**88,** 1748.
Total,	16,500	

COMMERCE.

Development of C. due to imp., **85,** 1884. Description of, **97,** 2478. Much coal, timber, and logs brought out of the stream, **96,** 2266.

RR. shipment is secured, and apparently "just now" it does not pay to use R., **04,** 2723.

ENGINEERS.

Chief of Engineers. R., 80, 197; **81,** 265; **82,** 260; **83,** 268; **84,** 264; **85,** 289; **86,** 284; **87,** 248; **88,** 221; **89,** 262; **90,** 236; **91,** 304; **92,** 290; **93,** 329; **94,** 301; **95,** 336; **96,** 292; **97,** 369, 372; **98,** 352; **04,** 502; **10,** 730.

Boards. (See Surveys.)

In charge:
Maj. J. W. Cuyler, 1880–83. **R., 81,** 1991; **82,** 1959.
Maj. J. C. Post, 1883–87. **R., 83,** 1574; **84,** 1747; **85,** 1883; **86,** 1617.
Maj. A. Stickney, 1887–89. **R., 87,** 1895; **88,** 1747.
Maj. D. W. Lockwood, 1889–95. **R., 89,** 1964; **90,** 2253; **91,** 2438; **92,** 2073; **93,** 2606; **94,** 1967; **95,** 2470.
Maj. J. F. Gregory, 1896. **R., 96,** 2265.
Capt. J. G. Warren, 1897–98. **R., 97,** 2456, 2476; **98,** 1985.
Maj. E. H. Ruffner, 1904. **R., 04,** 2723.
Lt. Col. J. G. Warren, **10,** 719.

Assistants:
A. L. Duvall. **R., 81,** 1992; **82,** 1962; **84,** 1748.
D. A. Watt. **R., 97,** 2479.

OPERATIONS.

1881-82. 435 c. y. r. blasted, 633 snags removed and 3,033 trees cut and deadened, **82,** 1963.

1883-84. 2,446 stumps, logs, and snags removed and 18,711 trees cut and deadened, **84,** 1749.

1884-85. 1,222 logs and snags removed and 42,703 trees cut and girdled, **85,** 1884.

1886-87. Removal of obstr. to Fish Trap Ford, **87,** 1895.

1887-88. Removal of obstr. over 19 m. of R., **88,** 1747.

1889-90. 415 snags removed from chan., and 12,000 trees and logs cleared from banks, **90,** 2254.

1890-91. 669 snags and 511 logs removed from chan., and 2,551 stumps and 279 trees cleared from banks, **91,** 2438.

1892-00. Snagging and removal of other obstr. done at intervals. (See references attached to Engineers in Charge.)

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1991; **96,** 2265; **97,** 2477.

A tributary, small and very crooked, of the Ohio emptying into it 79 m. below Evansville, Ind., **93,** 2606; **94,** 1967; **95,** 2470; **96,** 2265. To imp. it properly would require a l. and d. at the mouth, which would be of doubtful value on account of the uncertain supply of water, **97,** 2478.

PROJECTS.

By Capt. Cuyler, 1880, imp. of descending navigation on the Tradewater R. by removal of snags, logs, and similar obstr., and excavation of a chan. through the natural r. barrier at the mouth of the R., to give chan. 40′ w. with a min. d. of 2½′ during 8 months of the year, for 41 m.; est., $10,000, **81,** 1992; **88,** 1747.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Capt. Cuyler, **81,** 1991.

Ex. au. act June 3, 1896; made by Maj. Gregory, 1897 (**R.** fav. only to snag removal), **97,** 2476.

Pre. ex. au. act June 13, 1902. **R.** by Maj. Ruffner, July 25, 1912[1] (unfav.), **04,** 502, 2722. Maj. Ruffner's views concurred in by BERH., **04,** 2725.

Pre. ex. au. act Mar. 3, 1909. **R.** by Lt. Col. Warren, June 12, 1909[2] (unfav.), **10,** 730.

BB-7 GREEN AND BARREN RIVERS, KY.

LIST OF NOTABLE POINTS, MOUTH TO HEADWATERS.

Ohio R., Ky.
L. and D. 1, Ky.
Pond R., Ky.
Rumsey and Calhoun, Ky.
L. and D. 2, Ky.
Rough R., Ky. L. and D. 1.
L. and D. 3, Ky.
L. and D. 4, Ky.
Barren R. and
L. and D. 1, Bowling Green, Ky.
L. and D. 5 and 6, Ky.
Nolin R., Ky.
Mammoth Cave, Ky.
Murfordville, Ky.

Part.	Title.	Period.	Appropriations.
a	Green R. and tributaries	1880–1912	$135,000.00
b	Green R., above mouth of Big Barren	1891–1911	365,673.20
c	Green R., Lock No. 2 (Rumsey)	1893–1901	170,000.00
d	Green R., operating and care of locks and dams	1889–1912	1,718,215.59
	Total		2,388,888.79

Part (a), BB-7 Green River and Tributaries, Ky. (Purchase of improvements, and their repair.)

APPROPRIATION.

1888, $135,000, **89,** 1965.

COMMERCE.

(See Physical Characteristics, Private Work, and Operating and Care.)

Details, **97,** 2510.

CONTRACTS.

1889. J. T. Williams & Bro., 4 lock houses, $12,000, **89,** 1968. Eigenmann & Hollerbach, dimension st., $8,137, **89,** 1968. M. A. Sweeney & Bro., snag-boat constr., $18,400, **89,** 1968.

1890. S. W. Coflin, 2 dump scows, $1,293 per scow, **90,** 2258.

ENGINEERS.

Chief of Engineers. R., 80, 195; **85,** 292; **87,** 249; **89,** 263; **90,** 237; **91,** 304; **92,** 290; **06,** 558; **12,** 943.

Boards. R. of Board of 1886 upon the C. value and importance of the works of the Green & Barren River Navigation Co., **87,** 1903. (Majs. King, Stickney, and Mackenzie.)

In charge:

Maj. W. E. Merrill. **R., 80,** 1799.
Capt. J. C. Post. **R., 85,** 1904.
Maj. D. W. Lockwood, 1888–92. **R., 89,** 1965; **90,** 2255; **91,** 2439; **92,** 2074.
Maj. J. F. Gregory. **R., 97,** 2504.
Capt. H. Burgess, **06,** 543.
Lt. Col. H. Jervey, **12,** 929.

Assistants:

R. H. Fitzhugh. **R., 80,** 1802.
A. L. Duval. **R., 85,** 1910.
Lt. W. L. Sibert. **R., 89,** 1969; **90,** 2258; **91,** 2443; **92,** 2078.
G. F. Stickney. **R., 97,** 2509.

LEGISLATION.

Green & Barren River Navigation Co., chartered by Ky., **80,** 1799.

Effort and failure to repeal act, **80,** 1801.

Acts of incorporation, **80,** 1822; **85,** 1907.

OPERATIONS.

1888–89. Repairs to buildings, etc., at Locks 1 and 2 on Green R.; 12,000 c. y. dr. from lock approaches; plant built at Lock 3, Green R.; work of removing fallen lock walls begun; constr. of plant, **89,** 1969.

1889–90. 8 lock houses built; dr. at lock approaches; constr. of new walls at Lock No. 3 begun; removal of old walls at Lock No. 1, Barren R., **90,** 2256.

[1] H. D. 179, 58th, 2d.

[2] H. D. 346, 61st, 2d.

1890-91. Repairs to lock, dam, guide cribs, and abutment at Lock and Dam No. 4, and Dam No. 1; 10,000 c. y. dr. from upper and lower lock entrances at Lock No. 2; repairs to Lock and Dam No. 3; 1,035 snags cleared from R. chan., **91,** 2444, 2445.

1891-92. Repairs to Locks and Dams 1, 2, 3, and 4, Green, and 1, Barren; 28,716 c. y. dr. at lock entrances; 1,043 snags, 6,000 l. f. of old crib timber, and old cofferdam removed; 472 trees cut or deadened, **92,** 2078, 2079.

PHYSICAL CHARACTERISTICS.

Description of ores and coals on Green R., **80,** 1808, 1810, 1812.

Distances and elevations, **80,** 1817.

Details, vicinity of mouth of Green R., **97,** 2509.

PLANS. (See Projects.)

By Maj. Merrill, 1880. Slack-water navigation, Green and Big Barren Rs., with l. and d.; est., $834,805 to $893,184, **80,** 1801, 1818. State, by virtually closing the R. by its charter to the navigation co., not considered entitled to aid from U. S., **80,** 1801.

See Private work.

PRIVATE (CORPORATE) WORK.

Orig. system of l. and d. (4 in Green R. and 1 in Barren R.) completed by Ky., 1841. Total l. of pools, 200 m.± 1868, Ky. leased to Green & Barren R. Navigation Co. for 30 yrs. Ky., 1886, ceded system to US., but lease above to be bought by US., **80,** 1799; **12,** 950.

Existing dams, **80,** 1816.

Rates of toll, **80,** 1800.

In accordance with the requirements act July 5, 1885, Capt. Post **R.** on the condition of Green and Barren Rs., with est. cost of relieving the same from incumbrance, so as to render them free to C., **85,** 1904, 1914.

R. of BE., 1886, on the C. value and importance of the works of the navigation co., **87,** 1903; when taken possession of by the U. S. (see Projects), the locks, dams, and appurtenant works were badly in need of repair, **12,** 940.

PROJECTS. (See Plans.)

US. took possession of imps. on the Green and Barren Rs., Dec., 1888, and repair of l. and d. begun. In 1888 $46,557 was expended, and Maj. Lockwood est. $256,221 as required for works of repair during 1890, **89,** 263, 1965.

At 1912, system included 7 l. and d.—Nos. 5 and 6, Green R., having been added—giving slack-water navigation from Lock 1, Green R., to Bowling Green, Ky., on Barren R. and to Mammoth Cave, Ky., on Green R. Total l. of pool, 219 m., **12,** 941.

SURVEYS.

Sur. au. act Mar. 3, 1879, **79,** 147; made, 1879, by R. H. Fitzhugh, **80,** 1802.

By Maj. Gregory, for new l. and d. at or near mouth of Green R. au. act June 3, 1896. **R.,** 1897, not fav. to immediate imp., **97,** 2504.

Pre. ex. and sur. au. act Feb. 27, 1911, for extension of existing system of l. and d., **12,** 943.

Pre. ex. and sur. au. act Feb. 27, 1911, of Green R., Ky., at and near Lock and Dam No. 3, near Rochester, for diversion of the waters of Mud R. from its mouth above said l. and d. to a suitable point below, **12,** 943.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 942.

Part (b), BB-7 Green River, Above Mouth of Big Barren River, Ky.

APPROPRIATIONS.

1892,	$50,000.00,	**93,** 2609.
1894,	25,000.00,	**95,** 2474.
1896,	20,000.00,	**96,** 2272.
1899,	85,673.20,	**99,** 2583.
1902,	180,000.00,	**02,** 1988.
1905,	5,000.00,	**05,** 1951.
Total,	365,673.20	

COMMERCE.

Development of a probably valuable C. dependent upon thorough imp. of the R., **96,** 2271.

Unimportant from Greensburg to Mammoth Cave, **00,** 3546.

Increase in traffic since lock completed, **01,** 2805.

CONTRACTS.

1897. Commercial Wood & Cement Co., cement, $10,360, **97,** 2460.

1899. Commercial Wood & Cement Co., Portland cement, $2.58 bbl. ($12,267.90), **99,** 2584.

1904. Hollerbach & May Contract Co., building Lock and Dam No. 6, prices given, **04,** 2678; supple. agreement to cover modifications in specifications, **05,** 1951.

ENGINEERS.

Chief of Engineers. R., 91, 310; **93,** 329; **94,** 302; **95,** 337; **96,** 293; **97,** 370; **98,** 353; **99,** 446, 448; **00,** 510, 512; **01,** 502; **02,** 427; **03,** 461; **04,** 497; **05,** 504; **06,** 554; **07,** 580; **08,** 622; **09,** 655; **10,** 727; **11,** 784.

In charge:

Maj. D. W. Lockwood, 1891–95. **R., 91,** 2478, 2481; **93,** 2608; **94,** 1971; **95,** 2473.

Maj. J. F. Gregory, 1896. **R., 96,** 2271.

Capt. J. G. Warren, 1897–98. **R., 97,** 2459; **98,** 1985.

Capt. G. A. Zinn, 1899–1900. **R., 99,** 2583; **00,** 3501, 3542.

Capt. W. L. Sibert, 1900–01. **R., 01,** 2805.

Lt. Col. E. H. Ruffner, 1901–02. **R., 02,** 1988.

Maj. G. McC. Derby, 1902–03. **R., 03,** 1775.

Capt. H. Burgess, 1903–08. **R., 04,** 2677; **05,** 1949; **06,** 1676; **07,** 1809; **08,** 1877.

Lt. Col. J. G. Warren, 1909–. **R., 09,** 1883.

Capt. Lytle Brown, 1909–10. **R., 10,** 2031.

Assistants:

W. M. Hall. **R., 97,** 2460; **98,** 1990.

D. A. Watt. **R., 00,** 3502.

LEGAL PROCEEDINGS.

Procuring of title to land, **95,** 2474; condemnation proceedings for some land, **96,** 2271; title procured, **98,** 1986.

Negotiations in progress to purchase additional land, **00,** 3502.

Complaint of Capt. Burgess on slowness of Dept. of Justice in ex. of land titles, **07,** 1809.

Condemnation proceedings instituted Apr. 10, 1908, to acquire land needed for bank protection and for a roadway, **08,** 1877.

Land acquired for roadway from Dam No. 6 to nearest public highway, by condemnation proceedings, **10,** 2031.

OBSTRUCTIONS.

Any imp. of the R. would require reconstr. of the br. below Canmer, **00,** 3545.

OPERATIONS.

1894-95. Site of l. and d. selected, **95,** 2474.

1895-96. Preparations made for beginning work, **96,** 2271.

1896-97. Constr. of lock begun, **97,** 2459.

1897-98. Lock constr. continued (table showing details of work and giving unit cost, etc.), **98,** 1990.

1898-99. Banks protected and minor work done, **99,** 2583.
1899-00. Lock completed and opened to navigation Jan. 17, 1900; all obstr. cleared from pool above lock, **00,** 3502.
1900-01. Cribwork and bank protection at Lock No. 5 completed; cottage built for lock tender, **01,** 2805.
1901-02. Completing cottage, walks, etc., **02,** 1988.
1902-03. Preparing plans for second lock (No. 6, Green R.), **03,** 1775.
1903-04. Constr., by contract, of Lock and Dam No. 6 in progress; 8,421 trees cleared from banks by U. S. plant; lock tender's cottage under constr. by hired labor, **04,** 2678.
1904-05. Constr. of Lock and Dam No. 6 continued; snagging in Pool No. 6, 4,981 trees cut and 1,152 deadened; lock tender's cottage completed; fencing U. S. grounds, etc., **05,** 1949.
1905-06. Work on Lock and Dam No. 6 continued, incl. guide cribs and protection works, **06,** 1676–78. Snagging and clearing banks of Nolin R., **06,** 1678–79.
1906-07. Lock opened to traffic Jan. 1, 1906, though not quite completed; work on guide walls and bank protection in progress, **07,** 1809.
1909-10. Land for roadway acquired by condemnation, **10,** 2031.
1910-11. Balance of app. returned to Treas., the proj. having been completed, **11,** 784.

PHYSICAL CHARACTERISTICS.

Description of, Pool No. 4 to Mammoth Cave, **91,** 2480.
R. within limits of proposed slack-water chan. wholly obstr. by snags, rs., overhanging trees, etc., **97,** 2459.
Description of country and R., Greensburg to Mammoth Cave, **00,** 3544.

PROJECTS.

In 1891 Maj. Lockwood proposed 2 l. and d. to extend slack-water navigation from the upper limit of Pool No. 4 to Mammoth Cave; est., $361,-346.40, each lock to be 36′ x 161′; combined lift, 27′, **91,** 2479.
Act 1892 au. Lock and Dam No. 5, **93,** 2608. Site below mouth of Bear Creek approved by BE., **95,** 2474.
By Capt. Warren, 1897, lock and abutment of concrete instead of st.; est. cost of l. and d., $180,-173.18, **98,** 1986, 1988.
Capt. Zinn est., 1899, $27,000 for snagging operations bet. Mammoth Cave and Munfordville, and about $2,500 an. for mainten., **00,** 3546.
Est. by Capt. Burgess, 1904, of $5,000 for clearing banks of lower Nolin R. of timber and snags, **04,** 497.
In opinion of DO., R. unworthy of further imp., **10,** 2031.

SURVEYS.

Ex. up to Mammoth Cave au. act Sept. 19, 1890; made, 1891, by Maj. Lockwood, **91,** 2481.
Ex. for location of works, **93,** 2608; **94,** 1971; **95,** 2474.
Ex. of Green R., Ky., Mammoth Cave to Greensburg, au. act Mar. 3, 1899; made, 1899, by Capt. Zinn (**R.** fav. to removing snags; see Projects), **00,** 3543.
Pre. ex. au. act Mar. 3, 1905, Green R., Lock No. 6 to Munfordville, Ky. **R.,** Capt. Burgess, fav., but **Rs.** of DE. and BERH. unfav., **06,** 558.[1]

Part (c), BB-7 Green River, Rumsey, Ky., Lock No. 2.

APPROPRIATIONS.

1893,	$65,000,	**93,** 2607.
1894,	105,000,	**95,** 2471.
Total,	170,000	

COMMERCE.

Nearly all the C. of Green R., Barren R., and Rough R. consists of through shipments which pass through this lock, **96,** 2267.

CONTRACTS.

1893. Eigenmann & Hollerbach, st. (special, $18 c. y.; cut, $11 and $13 c. y.; backing st., $7 c. y. ($25,068.78), **93,** 2607). Not completed, **94,** 1968.
J. B. Speed & Co., cement, $1.34½ bbl. ($2,017.50), **93,** 2607.
1895. Evansville, Ohio & Green River Transportation Co., st. (special and coping, $11.75 c. y.; cut, $7 and $10 c. y.; and backing, $5 c. y.), $42,-324.80), **95,** 2472.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 329; **94,** 302; **95,** 337; **96,** 293; **97,** 369; **98,** 352; **99,** 445; **00,** 509; **01,** 502.

In charge:
Maj. D. W. Lockwood, 1888–95. **R.,** **93,** 2606; **94,** 1968; **95,** 2470.
Maj. J. F. Gregory, 1895. **R.,** **96,** 2266.
Capt. J. G. Warren, 1897–98. **R.,** **97,** 2457; **98,** 1985.
Capt. G. A. Zinn, 1899–1900. **R.,** **99,** 2581; **00,** 3501.
Capt. W. L. Sibert, 1900–. **R.,** **01,** 2805.

Assistants:
Lt. J. J. Meyler. **R.,** **94,** 1969; **95,** 2472.
G. F. Stickney. **R.,** **96,** 2268; **97,** 2457.
D. A. Watt. **R.,** **99,** 2581.

OPERATIONS.

1892-93. Preparations made for constr. new lock, **93,** 2607.
1893-94. Lock constr., **94,** 1969.
1894-95. Lock constr., **95,** 2471.
1895-96. New lock opened in Dec., 1895, but constr. continued, **96,** 2267.
1896-97. Lock constr. continued, **97,** 2457.
1897-98. Lock constr. to be continued, **98,** 1985.
1898-99. One lower shore crib, 4 upper cribs, 1 shore dike built, and grading completed, **99,** 2581.
1900-01. Laying walkways, and d. and straightening chan. approaches to locks, **01,** 2805.

PHYSICAL CHARACTERISTICS.

Material excavated from the lock site tough, fibrous, slaty r. that blasted poorly, **95,** 2471; **96,** 2267.
Lock No. 2, the second in the slack-water system of the R., **96,** 2267.

PROJECTS.

By Maj. Lockwood, 1893, for new lock alongside the old one, which had become dangerous; est. $170,000, **93,** 2606; **96,** 2266.

[1] H. D. 377, 59th, 1st.

Part (d), BB-7 Green and Barren Rivers, Ky. (Locks and dams, care and operating.)

APPROPRIATIONS.[1]

1889,	$34,189.84
1890,	147,973.75
1891,	150,146.42
1892,	78,610.88
1893,	48,968.36
1894,	48,088.06
1895,	42,315.42
1896,	42,217.81
1897,	63,090.18
1898,	64,779.61
1899,	48,627.20
1900,	71,025.25
1901,	61,816.40
1902,	61,057.03
1903,	50,281.49
1904,	60,060.06
1905,	74,388.02
1906,	46,492.81
1907,	79,228.02
1908,	96,577.49
1909,	114,195.26
1910,	75,884.85
1911,	90,423.52
1912,	67,777.86

Total, 1,718,215.59 (**12,** 941).

COMMERCE.

Description of; during the 9 years up to 1896 in which the imp. had been in charge of the U. S. the average an. value of the C. $2,328,595, **96,** 2274.

Additional regulations for use, administration, and navigation of Rs., **01,** 2809.

Traffic passing through locks, 1911–12, over 1,000,000 t., **12,** 942.

CONTRACTS.

Details of expend. (See each an. report.)

1901. J. P. McGuire, steel lock gates, prices given, **01,** 2811.

1902. Monongahela River Consolidated Coal & Coke Co., 2 scows, $3,067 each, **02,** 1990. Hollerbach & May, repairs to Dam No. 1, Green R., prices given, **03,** 1778.

1908. Ed. J. Howard, steel hull, cabin, etc., for snag boat, $30,830, **08,** 1885.

1909. R. M. Cunningham, lumber, prices given, **10,** 2042.

ENGINEERS.

Chief of Engineers. R., 93, 330; **94,** 302; **95,** 338; **96,** 294; **97,** 370; **98,** 354; **99,** 446; **00,** 511; **01,** 503; **02,** 427; **03,** 461; **04,** 498; **05,** 505; **06,** 555; **07,** 581; **08,** 623; **09,** 656; **10,** 728; **11,** 784; **12,** 940.

In charge:

Maj. D. W. Lockwood, 1888–95. **R., 93,** 2609; **94,** 1972; **95,** 2475.

Maj. J. F. Gregory, 1896. **R., 96,** 2272.

Capt. J. G. Warren, 1897–98. **R., 97,** 2462; **98,** 1993.

Capt. G. A. Zinn, 1899–1900. **R., 99,** 2584; **00,** 3516.

Capt. W. L. Sibert, 1900–01. **R., 01,** 2806.

Lt. Col. E. H. Ruffner, 1901–02. **R., 02,** 1988.

Maj. G. McC. Derby, 1902–03. **R., 03,** 1776.

Capt. H. Burgess, 1903–08. **R., 04,** 2679; **05,** 1952; **06,** 1680; **07,** 1810; **08,** 1878.

Lt. Col. J. G. Warren, 1909. **R., 09,** 1884.

Capt. Lytle Brown, 1909–11. **R., 10,** 2032; **11,** 2234.

Lt. Col. H. Jervey, 1912–. **R., 12,** 2430.

Assistants:

Lt. J. J. Meyler. **R., 93,** 2612; **94,** 1975; **95,** 2478.

G. F. Stickney. **R., 96,** 2276; **97,** 2466.

D. A. Watt. **R., 98,** 2000; **99,** 2595; **00,** 3530.

W. S. Overstreet. **R., 02,** 1994; **03,** 1783; **04,** 2692; **05,** 1960.

LEGAL PROCEEDINGS. (See Water power.)

LEGISLATION.

State and U. S. laws pertaining to Green, Barren, and Rough Rs., Ky., **04,** 2686.

OPERATIONS.

1892-93. L. and d. repaired; over 25,000 c. y. dr.; over 1,000 snags removed; a large quantity of other obstr. removed, and a large amount of general work done, **93,** 2613.

1893-94. L. and d. repaired, and portions renewed and strengthened; about 30,000 c. y. dr.; over 1,200 snags removed; large quantities of various kinds of obstr. removed; snag boat repaired, and a great amount of general work performed, **94,** 1976.

1894-95. About 45,000 c. y. dr. from lock entrances and portions of Barren R. where w. and d.; l. and d. repaired; over 2,000 snags removed; large quantities of obstr. of various kinds removed, and a great amount of general work performed, **95,** 2478.

1895-96. L. and d. repaired; Lock No. 2 was closed and navigation through it abandoned on account of its dangerous condition, Aug., 1895, and navigation resumed through new lock, Dec., 1895; over 16,000 c. y. dr.; constr. of new hull for dr. boat in progress; over 2,300 snags removed, and other obstr. removed, and much general work performed, **96,** 2273, 2276.

1896-97. Extensive repairs made at Lock No. 1, Green R.; warehouse constr. and ground graded; new hull of dr. completed and U. S. plant repaired; 2 barges and 4 derrick boats built; about 1,000 snags and other like obstr. removed; over 30,000 c. y. dr., and a large amount of misc. work done, **97,** 2467–2471.

1897-98. Reinforcement of Lock No. 4, Green R., completed; portion of dam at Lock No. 2 reconstr.; l. and d. repaired; U. S. plant repaired; over 1,200 snags and other obstr. removed, and over 6,000 trees deadened; over 30,000 c. y. dr., and much general work done, **98,** 2000–2005.

1898-99. Dr. 35,373 c. y.; rebuilding dams at Lock No. 2; backing dams at Lock No. 1, Barren R., and Lock No. 1, Green R., and minor repairs **99,** 2584.

1899-00. Upper and lower guide cribs built at Lock No. 1, Green R.; placing a comb stick on Dam No. 2; replacing the wooden lower gates at Lock No. 3 with steel ones, and rebuilding upper gates above water; repairing and extending the crib abutment and the lock-wall paving at Lock No. 4, and 14,541 snags and other obstr. removed, **00,** 3516.

1901-12. General mainten. work done each year, such as cleaning mud deposit and drift from lock walls, cribs, and approaches; removing snags and other obstr. from pools; lock gates, gauges, flagpoles, rowboats, and metal roofs repainted; fences and outbuildings whitewashed; grass, weeds, and other refuse removed from reservation as needed; buildings and fences repaired, and minor repairs as necessary to maintain system in good navigable condition. (For details of expend. and work done, see each an. **R.**)

PHYSICAL CHARACTERISTICS.

Prolonged h. w. in the Rs. a cause for landslides and damages to completed structures, **93,** 2610; **94,** 1972; **95,** 2475; **96,** 2273.

Oak timber in dam attacked by hellgramite larvæ, **06,** 1682.

[1] Amount expend. under the permanent-indefinite app. provided by acts of July 5, 1884, for operating and keeping in repair canals and other public works.

PRIVATE WORK.

Description of work done before control was acquired by the U. S., **93,** 2609; **94,** 1972; **95,** 2475; **96,** 2272.

WATER POWER.

Leases in force for water power, etc., and collections made, **93,** 2610; **94,** 1973; **95,** 2476; **96,** 2274; **97,** 2462; **01,** 2810; **02,** 1990; **03,** 1777; **04,** 2681; **05,** 1954; **06,** 1684; **07,** 1815; **08,** 1885; **09,** 1891; **10,** 2041; **11,** 2244; **12,** 2441.

Part (e), BB-7 Big Barren River, Ky. (Extension of slackwater improvement.)

ENGINEERS.

Chief of Engineers. **R., 91,** 310, 2474.
In charge. Maj. D. W. Lockwood, 1890. **R., 91,** 2475.

Assistant. Lt. W. L. Sibert. **R., 91,** 2476.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2475.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Lockwood (**R.** unfav.), **91,** 2475.

BB-8 POND RIVER, KY.

COMMERCE.

Logging only practicable navigation, **04,** 2717.

ENGINEERS.

Chief of Engineers. **R., 87,** 249; **04,** 502.

In charge:
Maj. J. C. Post. **R., 87,** 1901.
Capt. H. Burgess. **R., 04,** 2711.

SURVEY.

Ex. au. act Aug. 5, 1886; made by Maj. Post (unfav.), **87,** 1901.
Pre. ex. au. act June 13, 1902. **R.** by Maj. Ruffner, July 26 and Sept. 13, 1902[1] (unfav.), **04,** 502.

BB-11 ROUGH RIVER, KY.

LIST OF NOTABLE POINTS, MOUTH TO HEADWATERS.

Green R., Ky.
L. and D. No. 1.

Hartford, Ky.
Falls.

Part.	Title.	Period.	Appropriations.
a	Rough R.	1885–1908	$105,500.00
b	Rough R., operating and care	1898–1912	19,862.74
	Total		125,362.74

Part (a), BB-11 Rough River, Ky.

APPROPRIATIONS.

1890,	$25,000,	**91,** 2448.
1892,	15,000,	**92,** 2082.
1894,	[2] 22,500,	**95,** 2482.
1896,	43,000,	**96,** 2281.
Total,	105,500	

COMMERCE.

Imp. of R. of much benefit to, **96,** 2281.
Small, **96,** 2281.

CONTRACTS.

Details of expend. for materials, labor, etc., **96,** 2282; **97,** 2474, 2475.

ENGINEERS.

Chief of Engineers. **R., 85,** 292; **91,** 305; **92,** 291; **93,** 330; **94,** 303; **95,** 338; **96,** 294; **97,** 371; **98,** 354; **99,** 447; **00,** 511; **01,** 504; **02,** 428; **03,** 463; **04,** 500; **05,** 507; **06,** 556; **07,** 582; **08,** 625.

In charge:
Capt. J. C. Post. **R., 85,** 1893–94.
Maj. D. W. Lockwood, 1890–95. **R., 91,** 2446; **92,** 2081; **93,** 2616; **94,** 1978; **95,** 2481.
Maj. J. F. Gregory, 1896. **R., 96,** 2280.
Capt. J. G. Warren, 1897–98. **R., 97,** 2471; **98,** 2009.
Capt. G. A. Zinn, 1899–1900. **R., 99,** 2599; **00,** 3539.
Capt. W. L. Sibert, 1900–01. **R., 01,** 2814.

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[1] H. D. 174, 58th, 2d.

[2] $10,000 of which was allotted from Kentucky R.

Maj. E. H. Ruffner, 1901–02. **R., 02,** 1998.
Maj. G. McC. Derby, 1902–03. **R., 03,** 1788.
Capt. H. Burgess, 1903–08. **R., 04,** 2696; **05,** 1963; **06,** 1689; **07,** 1820; **08,** 1890.

Assistants:
A. L. Duvall. **R., 85,** 1900.
Lt. W. L. Sibert. **R., 92,** 2082.
Wm. M. Hall. **R., 95,** 2482; **96,** 2281; **97,** 2473.
G. F. Stickney. **R., 97,** 2476.
D. A. Watt. **R., 98,** 2010; **00,** 3539.

LEGAL PROCEEDINGS.

Title to land for l. and d. obtained, **93,** 2616; **94,** 1979.

LEGISLATION.

Act of Ky. ceding State's works to U. S., **85,** 1902.

OPERATIONS.

1890-91. 1,969 trees deadened from banks and 290 logs removed from chan., **91,** 2448.
1891-92. 29,499 trees deadened, 8,807 trees cut upon banks and in R., and 5,637 snags and 8 c. y. of st. removed from chan., **91,** 2082.
1894-95. Preparations made to constr. l. and d., **95,** 2482.
1895-96. Constr. l. and d. in progress; small amount of dr. and snagging done, **96,** 2281.
1896-97. L. and d. completed and opened to navigation on Dec. 12, 1896. Snags and other obstr. removed from R., **97,** 2471, 2472.
1897-98. Some snagging done and lock grounds inclosed by a fence, **98,** 2009.
1898-99. 279 snags and other obstr. removed; constr. lock tender's house in progress, **99,** 2602.
1899-00. 246 obstr. removed and lock tender's house completed; new comb stick placed on dam, grounds graded, and minor repairs made, **00,** 3539.
1900-01. Obstr. removed, protection crib built, grading and riprapping banks below abutment and lock, **01,** 2814.
1902-03. Obstr. removed, **03,** 1788.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2616; **96,** 2280.

PLANS. (See Projects.)

By Capt. Post, 1885, to extend navigation to Greens Mill; 5 l. and d., and clearing banks of R.; est., $270,000 to $421,000, **85,** 1896.

PRIVATE (CORPORATE) WORK.

L. and d. built by Rough Creek Navigation & Mfg. Co., **80,** 1814; **85,** 1894.
Description of work performed before the U. S. undertook imp., **93,** 2616; **94,** 1978; **95,** 2481; **96,** 2280.

PROJECTS. (See Plans.)

By Maj. Lockwood, 1890, l. and d.; cost, $96,556; and removal of snags and similar obstr. bet. Hartford, Ky., and the mouth; cost, $9,000; total, $105,556, **91,** 2448.
By Maj. Lockwood, 1895, substituting concrete for masonry work in the constr. of l. and d., **95,** 2482.
Plan of concrete lock, **96,** 2284.

SURVEYS.

Au. act July 5, 1884; made by Capt. Post, **85,** 1894.
Map. Plan of concrete lock, **96,** 2284.

Part (b), BB-11 Rough River, Ky. (Operating and care of lock and dam.)

APPROPRIATIONS.[1]

1898,	$859.08	
1899,	639.39	
1900,	684.41	
1901,	752.36,	**01,** 2815.
1902,	949.82,	**02,** 1999.
1903,	843.78,	**03,** 1789.
1904,	838.91,	**04,** 2697.
1905,	1,037.24,	**05,** 1964.
1906,	880.70,	**06,** 1690.
1907,	1,245.62,	**07,** 1821.
1908,	904.15,	**08,** 1891.
1909,	1,328.64,	**09,** 1897.
1910,	1,304.39,	**10,** 2047.
1911,	6,549.38,	**11,** 2250.
1912,	1,044.87,	**12,** 2445.
Total,	19,862.74	(**12,** 943).

CONTRACTS.

List of expend., **98,** 2011; **99,** 2603; **00,** 3541.

ENGINEERS.

Chief of Engineers. **R., 98,** 355; **99,** 448; **00,** 512; **01,** 504; **02,** 428; **03,** 464; **04,** 501; **05,** 508; **06,** 558; **07,** 583; **08,** 626; **09,** 657; **10,** 730; **11,** 786; **12,** 942.

In charge:
Capt. J. G. Warren, 1898. **R., 98,** 2010.
Capt. G. A. Zinn, 1899–1900. **R., 99,** 2602; **00,** 3541.
Capt. W. L. Sibert, 1900–01. **R., 01,** 2815.
Maj. E. H. Ruffner, 1901–02. **R., 02,** 1999.
Maj. G. McC. Derby, 1903. **R., 03,** 1789.
Capt. H. Burgess, 1903–08. **R., 04,** 2697; **05,** 1964; **06,** 1690; **07,** 1820; **08,** 1891.
Capt. Lytle Brown, **09,** 644.
Lt. Col. J. G. Warren, 1908–09. **R., 09,** 1897.
Capt. Lytle Brown, 1909–12. **R., 10,** 2046; **11,** 2249.
Lt. Col. H. Jervey, 1912–. **R., 12,** 2445.

Assistant. D. A. Watt. **R., 98,** 2011.

OPERATIONS.

1900-12. For general repairs and mainten. to works, see each an. **R., 01,** 2815; **02,** 1999; **03,** 1789; **04,** 2697; **05,** 1964; **06,** 1690; **07,** 1820; **08,** 1891; **09,** 1897; **10,** 2046; **11,** 2248; **12,** 2445.
1907-11. Snags and other obstr. removed, **07,** 1821; **08,** 1891; **09,** 1897; **10,** 2046; **11,** 2249.

PHYSICAL CHARACTERISTICS.

Gauge readings, **98,** 2011.

[1] Expend. under permanent-indefinite app., acts of July 5, 1884, for operating and keeping in repair canals and other public works.

BB-13 SALT RIVER, KY.

COMMERCE.

Local, and insufficient to justify expend. to imp., **04,** 2721.

Table of C. to be benefited by imp., **04,** 2721.

ENGINEERS.

Chief of Engineers. **R., 88,** 229; **04,** 502.

In charge:
Maj. A. Stickney, 1888. **R., 88,** 1799.
Maj. G. McC. Derby, 1904. **R., 04,** 2719.

Assistants:
Lt. W. L. Sibert. **R., 88,** 1800.
W. R. Curtis. **R., 88,** 1800.

PHYSICAL CHARACTERISTICS.

Description of the, **88,** 1798.

L. and d. would be necessary to carry navigation to Shepherdsville. R. flows through rich agricultural country, **04,** 2719.

PLANS.

By Maj. Stickney, 1888, imp. of 11 m. of R. above Keys Ripple by constr. of l. and d. with lift of 10′, giving navigable d. of 5′ for 8½ m. and 2½′ for remaining 2½ m.; est., $175,000, **88,** 1799.

SURVEY.

Au. act Aug. 5, 1886; made, 1888, by Maj. Stickney, **87,** 249; **88,** 1799.

Pre. ex. and sur., mouth to Shepherdsville, au. act June 13, 1902. **R.** by Maj. Derby, Feb. 5, 1903, on pre. ex. (fav. to sur. and est.); BERH. (unfav.),[1] **04,** 502, 2719, etc.

BB-23 WABASH RIVER, ILL. AND IND.

LIST OF NOTABLE POINTS, MOUTH TO HEADWATERS.

Ohio R., Ky. and Ind.
Little Wabash, Ill.
Patoka R., Ind.
Mt. Carmel, Ill.
White R., Ind.
Vincennes, Ind.
Terre Haute, Ind.
Lafayette, Ind.
Tippecanoe Cr., Ind.
Delphi, Ind.

Part.	Title.	Period.	Appropriations.
a	Above and below Vincennes	1828–1892	$746,000.00
b	Below Vincennes	1893–1912	50,000.00
c	Above Vincennes	1893–1909	15,000.00
d	Locks and dams, operating and care		75,858.02
	Total		886,858.02

Part (a), BB-23 Wabash River.

APPROPRIATIONS.

1828,	$500, sur., act May 23.
1870,	[2] 2,000, **71,** 486, 489.
1871,	*14,000, **71,** 489.
1872,	50,000, **72,** 58, 463.
1873,	50,000, **73,** 59, 510.
1874,	25,000, **74,** 67, 487.
1875,	40,000, **75,** 73, 740.
1876,	70,000, **76,** 90, ii, 58.
1878,	50,000, **78,** 109, 840.
1879,	20,000, **79,** 148, 1454.
1880,	25,000, **80,** 1842.
1881	[3] 25,000, **81,** 2000.
	[4] 25,000, **81,** 2002.
1882	[3] 40,000, **82,** 1973.
	[4] 30,000, **82,** 1974.
1884	[3] 30,000, **85,** 1640.
	[4] 10,000, **85,** 1641.
1886,	[3 5] 60,000, **86,** 278.
1888	[3] 60,000, **88,** 1739.
	[4] 5,000, **88,** 1744.
1890	[3] 60,000, **90,** 2229.
	[4] 5,500, **90,** 2232.
1892	[3] 60,000, **92,** 2032.
	[4] 5,000, **92,** 2035.
Total,	746,000

COMMERCE.

Injury to, by "present" condition of R., **71,** 486; **72,** 475.

List of bostr., **71,** 486.

Reduction of RR. freights through imp. of navigation, **82,** 1975.

CONTRACTS.

1873. R. McKenzie, r. excavation, wing dams, snagging, and dr., **73,** 510; completed, **74,** 485. Myers & De Ham, r. excavation at Grand Chain (23,000 c. y.), **73,** 59, 511; **74,** 486; completed, **75,** 72, 738; **79,** 1451.

1875. J. & R. Kerr, dam at New Harmony Cut-off, **75,** 72, 739; **76,** ii, 57; **79,** 1440; for lack of sufficient progress contract annulled and work completed by hired labor, **77,** 95, 667; **79,** 1440. C. M. Cole, cleaning out cut-off at Little Chain, **75,** 739; completed, **76,** 90, ii, 57. M. W. Nolan, r. excavation at Warwicks Ripple, **75,** 72, 739; **76,** ii, 57; contract extended, **77,** 95, 669; annulled Dec., 1877, **78,** 831.

1879. D. S. Barmore, 2 snag boats complete, $10,430, to be completed by Aug., 1879, **79,** 1448.

1884. Carmody & Maple, lock st., **85,** 1639.

1888. M. Cox, dr. hull, $995; C. E. Rees, furnishing lock st., $36,338.56, **88,** 1740.

*Allotment.
[1] H. D. 203, 58th, 2d.
[2] Allotment for sur.
[3] Below Vincennes.
[4] Above Vincennes.
[5] $9,000 to be expend. at Grayville, **87,** 1864.

1889. Salem Stone & Lime Co., lock st., $22,400, **89,** 1930.

1891. Romona Oolitic Stone Co., st. for constr. of dam abutment, $6,541.80, **91,** 2403. Dark Hollow Quarry Co., lock st., $16,631.75, **91,** 2404.

ENCROACHMENTS.

Obstr. of R. at Terre Haute by highway br., **83,** 1584; obstr. of R. by brs. bet. Delhi and Logansport, **85,** 257, 1650.

ENGINEERS.

Chief of Engineers. R., 71, 62; **72,** 58; **73,** 59; **74,** 66; **75,** 72; **76,** 90; **77,** 95; **78,** 109; **79,** 148; **80,** 197; **81,** 266; **82,** 260; **83,** 268; **84,** 267; **85,** 255, 257; **86,** 277; **87,** 246; **88,** 220; **89,** 256, 257; **90,** 231; **91,** 297, 298; **92,** 284.

Boards. Convened, 1877, to consider proj. for imp. of R. by dam closing Harmony Cut-off, essentially approv. the recom. of officer in charge, **77,** 669; **79,** 1441. (Majs. Weitzel, Merrill, and Smith.)

In charge:

Maj. Weitzel, 1871–72. **R., 71,** 485, 489; **72,** 463.

Maj. W. E. Merrill, 1873–77. **R., 73,** 510; **74,** 485; **75,** 738; **76,** ii, 57.

Maj. J. A. Smith, 1877–84. **R., 77,** 667; **78,** 831; **79,** 1439; **80,** 1837; **81,** 1995; **82,** 1969; **83,** 1577; **84,** 1757.

Capt. J. C. Post, 1884; **85,** 1638.

Maj. A. M. Miller, 1884–86. **R., 85,** 1638, 1649.

Maj. A. Stickney, 1886–90. **R., 86,** 1582; **87,** 1864; **88,** 1738; **89,** 1928.

Capt. E. Maguire, 1890–91. **R., 90,** 2223; **91,** 2411.

Maj. G. J. Lydecker, 1891–92. **R., 91,** 2402; **92,** 2031.

Assistants:

F. Stien, **72,** 463; **73,** 510; **74,** 485; **75,** 738; **76,** ii, 57; **77,** 667. **R., 71,** 487; **72,** 514.

Capt. M. B. Adams, **73,** 514.

C. B. Bateman. **R., 78,** 833.

E. J. Carpenter. **R., 78,** 835.

A. L. Duvall. **R., 85,** 1650.

O. L. Petitdidier. **R., 87,** 1865, 1869; **88,** 1740, 1744; **89,** 1931, 1935; **90,** 2229, 2233; **91,** 2408, **92,** 2032, 2036.

ESTIMATES. (See Plans and Projects.)

By F. Stien, 1871, imp. Wabash to mouth, by l. and d., removal of rs. at rapids, snagging, and dr., $1,163,253, **71,** 489.

By Maj. Weitzel, 1872, imp. Lafayette to mouth (175 m.), by l. and d. at Grand Rapids, removal of r. at rapids, snagging, and dr. to give chan. 4′ x 100′, $312,673, **72,** 475. L. at Grand Rapids, $110,000; repairing dam, $25,000, **72,** 474; **73,** 514.

By F. Stien, 1873, lock, $110,000, **73,** 517; **74,** 487.

By Maj. Merrill, 1875, lock, $130,000, **75,** 740; **76,** ii, 58.

LEGISLATION.

Joint act of Illinois and Indiana (1846–47) chartering Wabash Navigation Co. (see Private and corporate work), **73,** 512. Provision in app. act of Congress, 1874, to extinguish rights of Wabash Navigation Co., **74,** 486; **79,** 1451.

Act of Indiana giving U. S. au. to acquire lands, for imp. of Wabash R., by purchase or condemnation, **77,** 673; **79,** 1451.

OPERATIONS.

1872–73. 6,450 c. y. r. taken from Coffee Isld. Chute; snagging and dr. open chan., mouth to Little Chain (31 m.), **73,** 59, 510; **74,** 486.

1873–74. Snagging and dr. completed for 31 m. above mouth; also r. excavation at Coffee Isld. Chute; 10,809 c. y. r. taken from Grand Chain, **74,** 66, 485.

1874–75. Excavation of r. at Grand Chain completed (Dec., 1874) by removal of 26,630 c. y., **75,** 72, 738.

1875–76. Cleaning out Little Chain Cut-off completed; progress on New Harmony Cut-off Dam, **76,** 90, ii, 57.

1876–77. Failure of contractor on New Harmony Dam to prosecute work; contract annulled and work completed by hired labor, **77,** 95, 667; **79,** 1440. Breach formed in, by ice (Jan., 1877), **77,** 95, 668; **79,** 1440. H. w. delays work at Warwicks Ripple, **77,** 669. Removal of 14,125 c. y. r. from Little Chain, **77,** 670.

1877–78. Repairs by hired labor to dams at Grand Chain and New Harmony Cut-off, **78,** 109, 833, 836. Dr. by hired labor and use of U. S. dr. from Ohio R., removing 2,731 c. y. earth, 143 snags, and part of cofferdam at Warwicks Ripple, **78,** 109, 834.

1878–79. Repairs by hired labor to dams at Grand Chain and New Harmony, **79,** 147, 1439. Comparison of cost by hired labor and contract, **79,** 1440. Protection of shore near Grayville, Ill., **79,** 147, 1443. Constr. of dams at Kingdom Bar and Turkey Isld., **79,** 148, 1445. History of previous operations, **79,** 1451.

1879–80. Snag boat built under contract; 136 snags removed from R. chan.; dam completed across New Harmony Cut-off; pile, brush, and st. bank protections at Grayville completed, 250′ of dike at Grand Chain raised to grade; bank protection at New Harmony; dam across cut-off at Little Chain and at Winklers Bar built; removal of cofferdam at Warwicks Ripple commenced, **80,** 1838.

1880–81. 202 snags and 103 trees removed; 987 c. y. r. removed at Warwicks Ripple; 830 l. f. dike built and 160 c. y. r. removed at Grand Chain; 750 l. f. pile and brush wing dams built at Winklers Bar; 550 l. f. bank protection built at McIntyres Bar; repairs to New Harmony Dam and st. protection at same, **81,** 1996.

1881–82. Below Vincennes: 825 l. f. cribwork completed at Little Chain; wing dam at McIntyres Bar completed, and that at Winklers Bar extended 900′; shore protection at New Harmony Dam extended; 267 snags and 70 piles removed from R.; repairs to plant. Above Vincennes: 210 snags and 51 trees removed from chan., **82,** 1970.

1882–83. Below Vincennes: 764 c. y. st. removed from chan. through reef at Little Chain, extensive repairs to brush and st. dam at same; timber dike at Grand Chain repaired; repairs to Turkey Isld. and New Harmony Dams; 134 snags removed bet. Little Chain and mouth. Above Vincennes: 262 snags removed from chan. bet. Vincennes and Terre Haute; crib, brush, and st. dam constr. at Eightmile Isld., **83,** 1578–1583.

1883–84. Below Vincennes: 8,690 c. y. st. removed from cut and placed in dike at Little Chain; 504 c. y. st. quarried and 369 l. f. cribwork built in same; 400 l. f. of wing dam built; repairs to New Harmony Dam. Above Vincennes: 610 snags and 39 piles removed; work continued on dam at Horseshoe Isld., **84,** 1758–1762.

1884–85. Above Vincennes: 377 snags removed from R.; dam at Horseshoe Isld. completed, **85,** 1641.

1886–87. Below Vincennes: Delivery of st. for l. and d. at Grand Rapids; removing old lock walls and preparing site for new work; constr. of levee at Grayville, **87,** 1864, 1867. Above Vincennes: Clearing out old dam cut-off at Horseshoe Bend, **87,** 1869.

1887–88. Below Vincennes: 2,583 c. y. earth placed in levee across Grayville Bend Cut-off, extending same 250′; excavation of old lock walls completed, and foundation for new l. and d. at Grand Rapids begun, **88,** 1741–1743.

1888–89. Below Vincennes: 1,743 c. y. masonry laid, partly completing land and R. walls and lower miter sill of Grand Rapids Lock and Dam; 990 l. f. st. dike built in continuation of e. end of "present" levee; 151 snags removed bet. Mt. Carmel and mouth of R. Above Vincennes: 448 snags removed from chan. bet. Wolfs Cut-off and Terre Haute, **89,** 1931–1936.

1889–90. Below Vincennes: 3,078 c. y. masonry laid, completing lower and upper miter sills and left wall, R. and land walls, **90,** 2230–2235.

1890-91. Below Vincennes: 3 timber and st. spur dikes completed, and levee at Grayville Bend extended 1,750′, **91,** 2404. Constr. of l. and d. at Grand Rapids in progress, **91,** 2405. Snag removal bet. Mt. Carmel and Coffee Chute, **91,** 2406.

1891-92. Below Vincennes: West abutment of dam completed; lock constr. in progress; crib dike at Little Chain repaired and filled with st.; 430 snags removed, **92,** 2031.

PHYSICAL CHARACTERISTICS.

Description of R., **71,** 486, 487.
Distances from mouth to points on R., **72,** 472.
Height of h. w., **76,** ii, 57.
Cut-off at New Harmony, **79,** 1440.

PLANS. (See Estimates and Projects.)

After ex., 1890, Capt. Maguire did not consider portion of R. bet. Terre Haute and Lafayette worthy of imp., **91,** 2412.

PRIVATE, CORPORATE, AND STATE WORK.

Wabash Navigation Co. chartered by Indiana and Illinois (1846–47), with right to enter on and imp. R. by locks, dams, or other devices, for 250 m. above mouth, provided that the first work be a l. and d. at Grand Rapids; State reserved right to make navigation free under certain conditions, **73,** 512. L. and d. at Grand Rapids built, but no other work done; dam 10′ x 57′ x 1,030′; lock 10′ x 50′ x 210′; l. and d. of cribwork filled with st., **71,** 488; **73,** 513. Cost of l. and d., $105,000, **73,** 514; "present" (1873) decayed condition of, **73,** 59, 514. Offer of company to transfer to U. S.; recom. (Maj. Merrill) that U. S. obtain transfer, **73,** 515. Provision in act of Congress (1874) to extinguish title of company, **74,** 486. Effected (1875) at cost of $7,000, **75,** 72, 738; **79,** 1451. Erie and Wabash Canal, from Toledo (Lake Erie) to Evansville (mouth of Wabash R.), generally following valley of R., **77,** 672.

PROJECTS. (See Estimates and Plans.)

By Maj. Weitzel, 1872, imp. of R., mouth to Lafayette (175 m.) by reconstr. of l. and repair of d. (formerly built by Wabash Navigation Co.) at Grand Rapids; removal of r. at rapids, closing of cut-offs, removal of sand and gravel bars, constr. of wing dams and dikes, and removal of snags and logs, **72,** 463, 472; **73,** 59, 511. Approval of proj., **72,** 463; est., $312,673, **72,** 475.

Maj. Merrill, 1873, believed imp. of R. useless until l. and d. at Grand Rapids would be rebuilt, **73,** 516; **74,** 66; **75,** 739. Recom. reconstr. of dam on old site, **74,** 66, 486.

Maj. Smith, 1878, did not believe C. demanded l. and d. at Grand Rapids, **78,** 838.

Proj. of 1872 proposed imp. of R. to give navigable chan. of 3½′ at extreme l. w.; also, to imp. R., Vincennes to Terre Haute, by closing cut-offs, concentration of current by training walls and wing dams, and removal of snags and r. obstr., **72,** 463, 472; **73,** 59, 511; **74,** 66, 486; **80,** 1841.

From 1871 to 1886, incl., $573,000 app.

In 1887 est. $250,600 would be required to complete proj. for that part of R. below Vincennes, and $20,000 for R. above Vincennes, **87,** 1864, 1869.

In 1888, est. for completion of imp. below Vincennes increased to $276,600, **88,** 1739.

In 1889 the est. for completion of the imp. above Vincennes increased to $20,000, **89,** 1935.

SURVEYS.

Au. act 1870, **71,** 62, 485. Reconnoissance made in 1871, **71,** 487.

Sur., 1872, mouth to Lafayette (175 m.), **72,** 472.

Special sur. in 1874–75, **75,** 739; in 1875–76, **76,** ii, 58; in 1877–78, **78,** 837; in 1878–79, **79,** 1447.

Detailed sur. of R. from Bone Bank to its mouth, 9 m., made, 1880, **80,** 1840.

Sur. extended from head of Grand Chain to Little Chain, **81,** 1998.

Above Vincennes, **82,** 1973; **83,** 1583; **84,** 1759.

Ex. from Logansport to Delhi, **85,** 1649.

Ex. bet. Terre Haute and Lafayette au. act Sept. 19, 1890; made, 1890, by Capt. Maguire (see Plans), **91,** 2411.

Maps:

Drawings of dam across New Harmony Cut-off, **79,** 1440.

Of Grand Chain, showing location of locks and chutes; sketch of details of work, **79,** 1442.

Sketch of Grayville Bend, showing location of Kingdom Bar, wing dam, and bank protection; sketch of Turkey Isld. Dam; map showing location of dams at New Harmony and Turkey Isld., and map of Warwicks Ripple, showing location of proposed cut, **79,** 1444.

Of Little Chain and cut-off, showing proposed imp., **79,** 1448.

Part (b), BB-23 Wabash River, Ill. and Ind., Below Vincennes.

APPROPRIATIONS.

1872–92,	$665,000 [see BB-23(a)].
1894,	15,000, **95,** 2444.
1896,	15,000, **96,** 2242.
1899,	15,000, **99,** 2577.
1902,	5,000, **02,** 1984.
Total,	50,000

COMMERCE.

Diminution, 1893, partly due, probably, to RR. facilities, **93,** 2562.

Would probably be largely increased if the R. were properly imp., **98,** 1981.

Wabash Valley essentially an agricultural district. Marked increase in manuf. has taken place due to presence of coal veins in Indiana counties, **04,** 2732.

CONTRACTS.

1892. H. C. Jones, lumber, $22,407.84, **93,** 2561.
1896. E. J. Howard, towboat, $6,750,[1] **97,** 2453.

ENGINEERS.

Chief of Engineers. **R., 93,** 322; **94,** 296; **95,** 331; **96,** 287; **97,** 367; **98,** 350; **99,** 443; **00,** 507; **01,** 500; **02,** 425; **03,** 457; **04,** 493, 503; **05,** 501; **06,** 551; **07,** 577; **08,** 619; **09,** 651; **10,** 730; **12,** 943.

Boards. BERH. reviews Capt. Burgess's **R.** on sur., and concurs in his opinion as to inadvisability of imp. at "present" time, **04,** 2738.

In charge:

Lt. Col. G. J. Lydecker, 1891–93. **R., 93,** 2560.
Capt. J. G. Warren, 1894–99. **R., 94,** 1943; **95,** 2443; **96,** 2240; **97,** 2452; **98,** 1970, 1981.
Capt. G. A. Zinn, 1899–1900. **R., 99,** 2577; **00,** 3497.
Capt. W. L. Sibert, 1900–01. **R., 01,** 2800.
Maj. E. H. Ruffner, 1901–02. **R., 02,** 1984.
Maj. Geo. McC. Derby, 1902–03. **R., 03,** 1772.
Capt. Harry Burgess, 1903–08. **R., 04,** 2672, 2729 **05,** 1945; **06,** 1673; **07,** 1805; **08,** 1873.
Capt. Lytle Brown, **09,** 644.
Lt. Col. J. G. Warren, 1908–09. **R., 09,** 1879.

Assistants:

O. L. Petitdidier. **R., 93,** 2563.
W. W. Duffield. **R., 94,** 1945.
T. P. Shanks. **R., 97,** 2454; **98,** 1974.

[1] Part of this cost is shared by app. for the R. above Vincennes and part by White R.

OPERATIONS.

1892-93. 9,095 c. y. st. quarried and most of it conveyed to dam site; 7,050 c. y. dr. from foundation bed of dam; reconstr. of snag boat completed, **93,** 2561.

1893-94. 1,100′ l. dam in course of constr., **94,** 1943.

1894-95. Dam almost completed, and lock in use, **95,** 2443.

1895-96. 6,094 c. y. gravel filling placed in dam; 2 fishways constr. (drawings showing details), **96,** 2240.

1896-97. Guide dikes above Grand Rapids Lock built; snag boat changed to scow, **97,** 2452.

1897-98. 2 cribs constr. below Grand Rapids Lock and misc. work done, **98,** 1981.

1903-04. 238 snags and stumps removed, **04,** 2673.

1904-05. Removal of snags and other obstr., **05,** 1945.

1905-06. Removal of snags, etc., **06,** 1673.

PHYSICAL CHARACTERISTICS.

Elevation. (See Projects.)

Since suspension of general work previous to 1893, the chan. unnavigable, dikes and dams destroyed, shoals in continual formation from material coming from caving banks, **93,** 2561; **94,** 1944; **98,** 1973.

Description of, parts ex. in 1898, **98,** 1974.

Lower Wabash w. and shallow, obstr. by sand and gravel bars, and r. reefs. Near New Harmony the R. has formed a cut-off, which takes very nearly the whole l.-w. discharge, **04,** 2733.

PROJECTS.

Elevation of the works above sea level, **98,** 1973.

By Capt. Warren, 1898, closing New Harmony Cut-off by dam; est., $50,000, and for no expend. of funds at other places until a sur., est. to cost $20,000 or less, had been made below Mt. Carmel, and proj. prepared for entire imp. (map showing location of old dam and proposed dam near Harmony Cut-off), **98,** 1978.

SURVEYS.

Ex. and sur. made in 1897–98 by Capt. Warren to determine what work would be necessary to reestab. navigable chan., **98,** 1973.

Au. act June 13, 1902, Vincennes to mouth. **R.** by Capt. Burgess, Dec. 16, 1903. Plan presented at cost of $3,405,000, but not deemed advisable to undertake imp. at "present" time,[1] **04,** 503, 2729.

Pre. ex. au. act Mar. 3, 1909, from mouth to Mt. Carmel. **R.** by Lt. Col. J. G. Warren, June 12, 1909[2] (unfav.), **10,** 730.

Act June 25, 1910, au. ex. and sur. from mouth to Terre Haute (**R.** to come), **12,** 943.

Maps. (See Operations and Projects.)

Part (c), BB-23 Wabash River, Ind. and Ill., Above Vincennes.

APPROPRIATIONS.

1881–92,	$80,500 [see BB-23(a)].
1894,	5,000, **95,** 2444.
1896,	6,000, **96,** 2243.
1899,	4,000, **99,** 2577.
Total,	15,000

COMMERCE.

Small, **95,** 2444.

Valley of Wabash is a country rich in agricultural resources; below Perrysville there is also mineral wealth in the shape of coal and fire clay, **04,** 2727.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 323; **94,** 296; **95,** 331; **96,** 287; **97,** 367; **98,** 351; **99,** 444; **00,** 508; **01,** 501; **02,** 426; **03,** 459; **04,** 495, 502; **05,** 502; **06,** 552; **07,** 578; **08,** 620; **09,** 652.

Boards. BERH. reviews Maj. Derby's **R.** on pre. ex. and concurs in his opinion that locality is not worthy of imp., **04,** 2728.

In charge:

Lt. Col. G. J. Lydecker, 1891–93. **R.,** **93,** 2562.

Capt. J. G. Warren, 1894–98. **R.,** **94,** 1946; **95,** 2444; **96,** 2242; **97,** 2453; **98,** 1970, 1982.

Capt. G. A. Zinn, 1899–1900. **R.,** **99,** 2577; **00,** 3497.

Capt. W. L. Sibert, 1900–01. **R.,** **01,** 2801.

Maj. E. H. Ruffner, 1901–02. **R.,** **02,** 1985.

Maj. Geo. McC. Derby, 1902–03. **R.,** **03,** 1773; **04,** 2727.

Capt. H. Burgess, 1903–08. **R.,** **04,** 2673; **05,** 1946; **06,** 1674; **07,** 1806; **08,** 1874.

Capt. Lytle Brown, **09,** 644.

Lt. Col. J. G. Warren, 1908–09. **R.,** **09,** 1879.

Assistants:

O. L. Petitdidier. **R.,** **93,** 2565.

W. W. Duffield. **R.,** **94,** 1947.

T. P. Shanks. **R.,** **97,** 2454; **98,** 1974.

OPERATIONS.

1892-93. 3,870 t. snags removed, **93,** 2562.

1893-94. Some snagging done, **94,** 1946.

1895-96. Some snagging done, **96,** 2242.

1897-98. Some snagging done, **98,** 1982.

1899-00. 250 obstr. removed, **00,** 3497.

1900-01. 375 snags, trees, and other obstr. removed, **01,** 2801.

PHYSICAL CHARACTERISTICS.

The bed of the chan. is full of dangerous snags, so that the traffic on the R. is only nominal, **04,** 2727.

SURVEYS.

Pre. ex. au. act June 13, 1902, from Vincennes to Perrysville, Ind. **R.** by Maj. Derby, Sept. 19, 1903[3] (unfav.), **04,** 502, 2726.

[1] H. D. 568, 58th, 2d. [2] H. D. 246, 61st, 2d. [3] H. D. 196, 58th, 2d.

Part (d), BB-23 Wabash River. (Lock and dam, operation and care.)

APPROPRIATIONS.[1]

1897,	$113.25	
1898,	539.15	
1899,	1,359.12	
1900,	6,640.69	
1901,	10,721.40,	**01,** 501.
1902,	1,998.44,	**02,** 1985.
1903,	2,119.52,	**03,** 1774.
1904,	1,206.58,	**04,** 2676.
1905,	1,675.94,	**05,** 1947.
1906,	2,315.20,	**06,** 1675.
1907,	2,621.11,	**07,** 1807.
1908,	1,117.00,	**08,** 1876.
1909,	2,452.66,	**09,** 1881.
1910,	20,306.40,	**10,** 2029.
1911,	17,663.58,	**11,** 2232.
1912,	3,007.98,	**12,** 2429.
Total,	75,858.02 (**12,** 939).	

CONTRACTS.

1909. Roetzel & Chipman, repairs to l. and d. (prices given), **09,** 1881.

ENGINEERS.

Chief of Engineers. **R., 97,** 368; **98,** 351; **99,** 444; **00,** 508; **01,** 501; **02,** 426; **03,** 459; **04,** 495; **05,** 502; **06,** 553; **07,** 578; **08,** 621; **09,** 653; **10,** 726; **11,** 783; **12,** 939.

In charge:

Capt. J. G. Warren, 1897–98. **R., 97,** 2455; **98,** 1983.

Capt. G. A. Zinn, 1899–1900. **R., 99,** 2578; **00,** 3498.

Capt. W. L. Sibert, 1900–01. **R., 01,** 2802.

Maj. E. H. Ruffner, 1901–02. **R., 02,** 1985.

Maj. Geo. McC. Derby, 1902–03. **R., 03,** 1773.

Capt. Harry Burgess, 1903–08. **R., 04,** 2675; **05,** 1947; **06,** 1674; **07,** 1807; **08,** 1875.

Lt. Col. J. G. Warren, 1908–09. **R., 09,** 1880.

Capt. Lytle Brown, 1909–12. **R., 10,** 2028; **11,** 2232.

Lt. Col. Henry Jervey, 1912–. **R., 12,** 2429.

LEGISLATION.

Mt. Carmel Development Co. given au. to draw water from Wabash R., **08,** 1875.

OPERATIONS.

Misc. work essential to operating and care performed each year. (See references to Engineers in Charge.)

PROJECTS.

On Mar. 1, 1897, l. and d. at Grand Rapids put under app. for operating and care of canals, etc., **97,** 2455.

BB-25 WHITE RIVER, IND.

APPROPRIATIONS.

1879,	$25,000,	**79,** 148.
1880,	20,000,	**80,** 1844.
1881,	20,000,	**81,** 2007.
1882,	20,000,	**82,** 1978.
1884,	10,000,	**85,** 1643.
1886,	7,500,	**86,** 279.
1888,	5,000,	**88,** 1745.
1892,	5,000,	**92,** 2037.
1894,	5,000,	**95,** 2446.
1896,	2,500,	**96,** 2245.
Total,	120,000	

COMMERCE.

Benefit of imp., **79,** 1454.
Description of, 1896, **96,** 2486.

CONTRACT.

1887. M. Cox, dr. hull, $995, **88,** 1746.

ENCROACHMENT.

Evansville & Terre Haute RR. br. an obstr. to navigation, **81,** 2007.

ENGINEERS.

Chief of Engineers. **R., 78,** 109; **79,** 148, 149; **80,** 198; **81,** 267; **82,** 262; **83,** 270; **84,** 268; **85,** 257; **86,** 279; **87,** 247; **88,** 221; **89,** 258; **90,** 232; **91,** 298; **92,** 285; **93,** 323; **94,** 297; **95,** 332; **96,** 288; **97,** 368, 372; **98,** 351; **99,** 445; **00,** 509; **01,** 501; **02,** 426; **03,** 460; **04,** 496; **05,** 503; **06,** 553; **07,** 579; **08,** 621; **09,** 654.

In charge:

Maj. J. A. Smith, 1878–85. **R., 78,** 109; **79,** 1454; **80,** 1842; **81,** 2005; **82,** 1975; **83,** 1587; **84,** 1765.

Maj. A. M. Miller, 1885–86. **R., 85,** 1642.

Maj. A. Stickney, 1886–89. **R., 86,** 1586; **87,** 1871; **88,** 1745; **89,** 1937.

Capt. E. Maguire, 1890. **R., 90,** 2234.

Lt. Col. G. J. Lydecker, 1891–93. **R., 91,** 2409; **92,** 2037; **93,** 2567.

Capt. J. G. Warren, 1894–98. **R., 94,** 1948; **95,** 2445; **96,** 2244, 2245; **97,** 2456, 2483; **98,** 1984.

Capt. G. A. Zinn, 1899–1900. **R., 99,** 2580; **00,** 3500.

Capt. W. L. Sibert, 1901. **R., 01,** 2804.

Maj. E. H. Ruffner, 1902. **R., 02,** 1987.

Maj. G. McC. Derby, 1903. **R., 03,** 1775.

Capt. H. Burgess, 1904–08. **R., 04,** 2677; **05,** 1949; **06,** 1676; **07,** 1808; **08,** 1877.

Lt. Col. J. G. Warren, 1909. **R., 09,** 1882.

Assistants:

O. L. Petitdidier. **R., 87,** 1871; **88,** 1746; **89,** 1938; **90,** 2235; **91,** 2410; **92,** 2038; **93,** 2568.

W. W. Duffield. **R., 94,** 1949.

T. P. Shanks. **R., 97,** 2487.

OPERATIONS.

1879–80. 277 snags removed, **80,** 1843.

1880–81. 218 snags removed from chan.; barges built; 1,500 l. f. of logs framed into cribwork; quarry opened and material obtained for wing dam, **81,** 2005, 2006.

1881–82. 454 snags and 176 trees removed; 1,500 l. f. of round timber cribwork built; 2,491 c. y. st. removed from cut at Kellys Ripple; 375 l. f. of pile, brush, and st. wing dams built at Thornes Eddy, **82,** 1976.

1882–83. 420 l. f. of cribwork extension at Kellys Ripple; dr. built; 273 snags and 177 trees removed from chan., **83,** 1588.

1883–84. 2,675 c. y. st. removed from Kellys Ripple, **84,** 1765.

1884–85. 17,701 c. y. r. removed from cut at Kellys Ripple, **85,** 1642.

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[1] Amount expend. under the permanent-indefinite app. provided by acts of July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

1886-87. 2,625 c. y. r. removed from Kellys Ripple, **87,** 1871.
1887-88. 5,190 c. y. r. removed, **88,** 1745.
1888-89. 7,835 c. y. r. removed, **89,** 1938.
1891-92. 350 l. f. of guiding dike built at Kellys Ripple, **92,** 2038.
1892-93. 915 t. snags, etc., and 86 piles removed, **93,** 2567.
1893-94. 2,229 t. snags, etc., removed, **94,** 1948.
1894-95. 726 t. snags, etc., removed, **95,** 2445.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 2484. Consists of main R., 48 m. l.; of East Fork, 20¾ m. l.; and of West Fork, 14 m. l. L.-w. navigation of the forks is impracticable for even small boats, **95,** 2445.
H.-w. marks, **97,** 2491.

PROJECTS.

By Maj. Smith, 1879, chan. with clear d. of 2′, mouth to Portersville on the East Fork and Falls on the West Fork, by removal of snags and d. chan. by wing dams and dikes, **79,** 148, 1454; **81,** 2007.

Modified in 1880 to obtain chan. 3½′ d. from mouth to Hazelton by r. removal at Kellys Ripple, dike constr., and removal of snags, **80,** 1843; **86,** 279.
1879 to 1886, incl., $102,500 app.; amount est. to complete proj., $17,500, **87,** 247.
Capt. Warren, 1896, est. $465,946 or $549,977 to imp. R., and an. expend. of $6,000 for mainten., **97,** 2484.
Work under old proj. completed "several years ago," and as there is no proj. in force at "present," no further report will be made until additional app. becomes available, **09,** 655.

SURVEYS.

Ex. au., 1878, incl. East Fork to new br., near Bedford, and West Fork to town of Gosport, **78,** 109; **79,** 149.
Resur. au. act Aug. 17, 1894. **R.** by Capt. Warren, 1896 (unfav.; see Projects), **96,** 2245; **97,** 2483.
Bench marks, East and West Forks and R. proper, **97,** 2489, 2490.
White R. proper and a portion each of East Fork and West Fork, resur., **02,** 1987.
Maps. Of Kellys Ripple, **80,** 1842.

BB-35 EMBARRAS RIVER, ILL.

COMMERCE.

None, 1892. Outlook for future not fav., **93,** 2574.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 324.
In charge. Lt. Col. J. G. Lydecker, 1892. **R.,** **93,** 2573.
Assistant. O. L. Petitdidier. **R.,** **93,** 2574.

PHYSICAL CHARACTERISTICS.

Description of. About 180 m. l., shallow, and obstr. by numerous snags, etc., **93,** 2573.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Lydecker (**R.** unfav.), **93,** 2573.

BB-36 LITTLE WABASH RIVER, ILL.

COMMERCE.

Description of; chiefly grain. Value of the stream to C. dependent on Wabash R., a but partly imp. stream, **93,** 2570.
Description of, **04,** 2700.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 324; **04,** 502.

Boards. BERH. reviews Maj. Derby's **R.** and concurs in his opinion that it is not desirable to undertake imp., **04,** 2700.

In charge:
Lt. Col. J. G. Lydecker, 1892–93. **R.,** **93,** 2569.
Maj. G. McC. Derby, 1904. **R.,** **04,** 2699.

Assistants:
O. L. Petitdidier. **R.,** **93,** 2571.
G. W. Shaw. **R.,** **04,** 2701.

OBSTRUCTIONS.

Navigation obstr. by a milldam at Carmi, and bet. this point and the mouth there is a drawless wagon br., **93,** 2570.

PHYSICAL CHARACTERISTICS.

Description of. About 250 m. l., emptying into the Wabash about 15 m. from the latter's confluence with the Ohio, **93,** 2570.
Description of, **04,** 2700.

PRIVATE (STATE) WORK.

L. and d. was completed, 1868, by State of Illinois, but after being operated for a year it was destroyed by fire, **93,** 2570.

SURVEYS.

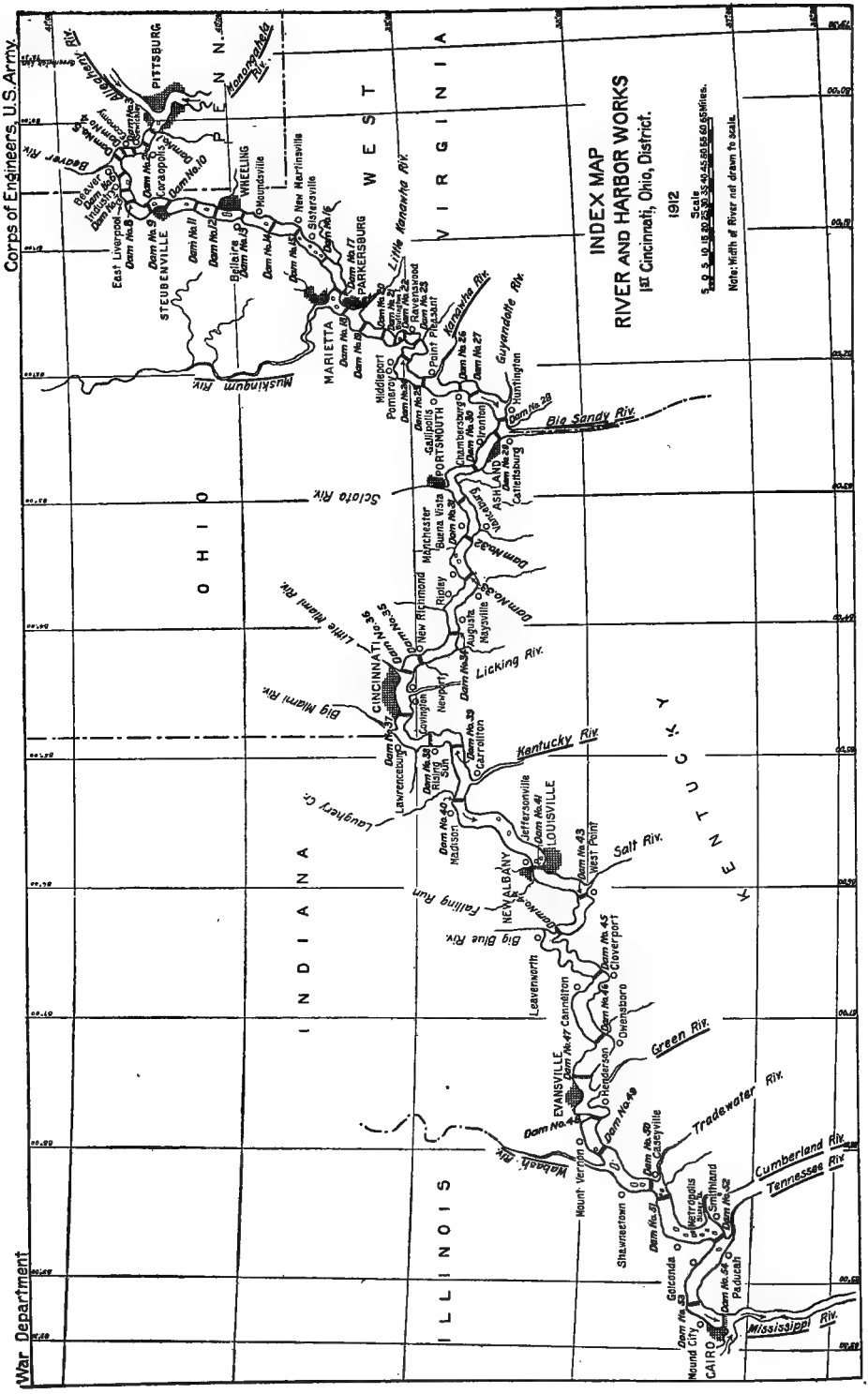
Ex. au. act July 13, 1892; made by Lt. Col. Lydecker, 1892 (**R.** unfav.), **93,** 2569.
Pre. ex. au. act June 13, 1902, mouth to Carmi. **R.,** Maj. Derby, Sept. 3, 1903 (unfav.),[1] **04,** 502, 2698.

[1] H. D. 38, 58th, 2d.

RIVER AND HARBOR WORKS.

OHIO RIVER.

CC.—1st CINCINNATI, O., DISTRICT.



Corps of Engineers, U.S. Army.
War Department
INDEX MAP
RIVER AND HARBOR WORKS
1st Cincinnati, Ohio, District.
1912
Scale
Note: Width of River not drawn to scale.
PENN.
WEST VIRGINIA
OHIO
INDIANA
ILLINOIS
KENTUCKY
PITTSBURG
WHEELING
STEUBENVILLE
PARKERSBURG
MARIETTA
PORTSMOUTH
ASHLAND
CINCINNATI
LOUISVILLE
NEW ALBANY
EVANSVILLE
CAIRO
Allegheny Riv.
Monongahela Riv.
Beaver Riv.
Muskingum Riv.
Little Kanawha Riv.
Kanawha Riv.
Guyandotte Riv.
Big Sandy Riv.
Scioto Riv.
Little Miami Riv.
Big Miami Riv.
Licking Riv.
Kentucky Riv.
Laughery Cr.
Falling Run
Big Blue Riv.
Salt Riv.
Green Riv.
Tradewater Riv.
Cumberland Riv.
Tennessee Riv.
Mississippi Riv.
Wabash Riv.
Dam No. 5
Dam No. 6
Dam No. 7
Dam No. 8
Dam No. 9
Dam No. 10
Dam No. 11
Dam No. 12
Dam No. 13
Dam No. 14
Dam No. 15
Dam No. 16
Dam No. 17
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Dam No. 35
Dam No. 36
Dam No. 37
Dam No. 38
Dam No. 39
Dam No. 40
Dam No. 41
Dam No. 42
Dam No. 43
Dam No. 44
Dam No. 45
Dam No. 46
Dam No. 47
Dam No. 48
Dam No. 49
Dam No. 50
Dam No. 51
Dam No. 52
Dam No. 53
Dam No. 54
Beaver
Industry
Coraopolis
East Liverpool
Bellaire
Moundsville
New Martinsville
Sistersville
Ravenswood
Point Pleasant
Middleport
Pomeroy
Gallipolis
Chambersburg
Ironton
Huntington
Catlettsburg
Vanceburg
Manchester
Buena Vista
Ripley
New Richmond
Augusta
Maysville
Newport
Covington
Carrollton
Lawrenceburg
Rising Sun
Madison
Jeffersonville
West Point
Cloverport
Leavenworth
Cannelton
Owensboro
Henderson
Caseyville
Mount Vernon
Shawneetown
Metropolis
Smithland
Golconda
Paducah
Mound City

CC.—1st CINCINNATI, O., DISTRICT.

In charge of U. S. Engineer Office,
Cincinnati, Ohio.

The principal work of this office is the charge of Ohio River (tributary to Mississippi R.), at least from the mouth to the Big Sandy, the tributaries being in charge of other district offices.

CC-1. OHIO RIVER, KY., ILL., IND., O., W. VA., and PA.[1]

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[1] Ex.—**R.** (fav.), Dec. 22, 1822. Indiana side: Sur.—**R.**, Feb. 3, 1844; ests., $1,405,146 and $7,476,603. (H. D. 482, 55th, 2d.) The river is the largest eastern tributary of the Mississippi. Ohio and Schuylkill Canal: Ex.—**R.** (indefinite), Feb. 3, 1825. (H. D. 482, 55th, 2d.)

[2] See also Part (f), CC-1.

CC-1(a) Plan followed in presenting data under head of "Ohio River."

The Ohio flows through several States, and thereby through several engineering districts or waterway groupings. The engineering districts are those of Nashville and Chattanooga, Tenn.; Louisville, Ky.; Cincinnati, Ohio; Wheeling, W. Va.; and Pittsburgh, Pa. Almost all these offices have charge of some portions of the improvement works on the Ohio. For the sake of clearness, however, and for the sake of getting together all the data about Ohio River, the data concerning it is grouped in this work (but not in the reports of the Chief of Engineers, U. S. Army), under the significant letter of the 1st Cincinnati (Ohio) District, i. e., "CC."

The following is a list of the notable points on the river from the mouth at Cairo, Ill., to the headwaters at Pittsburgh, Pa., and each point is numbered according to this order. The abstracts, or parts, already referred to are numbered on this basis, and they are printed in that order.

CC-1(b) List of notable points on Ohio River, arranged and numbered from the mouth at Cairo, Ill., to Pittsburgh, Pa.

1	Ohio R., in general (trib. to Miss. R.)	
2	Cairo	Ill.
3	O. R. Lock and Dam 54.	
4	Mound City	Ill.
5	O. R. Lock and Dam 53.	
6	Metropolis	Ill.
7	Paducah	Ky.
8	Tennessee R.	Ky.
9	O. R. Lock and Dam 52.	
10	Smithland	Ky.
11	Cumberland R.	Ky.
12	Sister Islands.	
13	Golconda	Ill.
14	O. R. Lock and Dam 51.	
15	Tradewater R.	Ky.
16	O. R. Lock and Dam 50.	
17	Shawneetown	Ill.
18	Wabash R.	Ind.
19	Uniontown	Ky.
20	O. R. Lock and Dam 49.	
21	Mt. Vernon	Ind.
22	O. R. Lock and Dam 48.	
23	Henderson	Ky.
24	Evansville	Ind.
25	Green R.	Ky.
26	O. R. Lock and Dam 47.	
27	Owensboro	Ky.
28	O. R. Lock and Dam 46.	
29	Hawesville	Ky.
30	Cannelton	Ind.
31	O. R. Lock and Dam 45.	
32	O. R. Lock and Dam 44.	
33	Big Blue R.	Ind.
34	O. R. Lock and Dam 43.	
35	Salt R.	Ky.
36	New Albany	Ind.
37	O. R. Lock and Dam 41.	
38	Jeffersonville	Ind.
39	Louisville	Ky.
40	Madison	Ind.
41	O. R. Lock and Dam 40.	
42	Kentucky R.	Ky.
43	O. R. Lock and Dam 39.	
44	Rising Sun	Ind.
45	O. R. Lock and Dam 38.	
46	Lawrenceburg	Ind.
47	Big Miami	Ind. and Ohio.
48	O. R. Lock and Dam 37.	
49	Licking R.	Ky.
50	Cincinnati	Ohio
51	Little Miami R.	Ohio
52	O. R. Lock and Dam 36.	
53	O. R. Lock and Dam 35.	
54	New Richmond	Ohio
55	O. R. Lock and Dam 34.	
56	Maysville	Ky.
57	O. R. Lock and Dam 33.	
58	O. R. Lock and Dam 32.	
59	O. R. Lock and Dam 31.	
60	Scioto R.	Ohio
61	O. R. Lock and Dam 30.	
62	Ashland	Ky.
63	O. R. Lock and Dam 29.	
64	Big Sandy R.	Ky. and W. Va.
65	O. R. Lock and Dam 28.	
66	Guyandotte R.	W. Va.
67	O. R. Lock and Dam 27.	
68	O. R. Lock and Dam 26.	
69	Kanawha R.	W. Va.
70	O. R. Lock and Dam 25.	
71	Middleport	Ohio
72	O. R. Lock and Dam 24.	
73	O. R. Lock and Dam 23.	
74	O. R. Lock and Dam 22.	
75	O. R. Lock and Dam 21.	
76	O. R. Lock and Dam 20.	
77	O. R. Lock and Dam 19.	
78	Little Kanawha R.	W. Va.
79	Parkersburg	W. Va.
80	O. R. Lock and Dam 18.	
81	Muskingum R.	Ohio
82	O. R. Lock and Dam 17.	
83	O. R. Lock and Dam 16.	
84	Sistersville	W. Va.
85	O. R. Lock and Dam 15.	
86	O. R. Lock and Dam 14.	
87	O. R. Lock and Dam 13.	
88	Bellaire	Ohio
89	Wheeling	W. Va.
90	O. R. Lock and Dam 12.	
91	O. R. Lock and Dam 11.	
92	Steubenville	Ohio
93	O. R. Lock and Dam 10.	
94	O. R. Lock and Dam 9.	
95	O. R. Lock and Dam 8.	
96	O. R. Lock and Dam 7.	
97	O. R. Lock and Dam 6.	
98	Beaver R.	Pa.
99	Rochester	Pa.
100	O. R. Lock and Dam 5.	
101	O. R. Lock and Dam 4.	
102	O. R. Lock and Dam 3.	
103	O. R. Lock and Dam 2.	
104	O. R. Lock and Dam 1.	
105	Allegheny R. (q. v.), Pittsburgh, Pa. (q. v.), and Monongahela R. (q. v.), Pa.	

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CC-1(d) General facts concerning Ohio River.

"Ohio River (general open-channel improvement).—This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, the average annual range during the past 30 years is 48.6 feet.

"The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals, by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interest of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous improvement, including surveys, establishment of harbor lines, regulation of encroachment and deposits on the banks of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles. * * * **12,** 883.

Commerce—"The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 12,046,294.5 short tons, at an estimated value of $82,074,878.77; passengers, 3,827,365." **12,** 883.

Locks and dams.—Prior to the project authorized 1910 various lock and dam works had been authorized. Perhaps the earliest beginning of the system of locks and dams is covered in the instance of the Louisville and Portland Canal, at Louisville. This was a private enterprise, stock in which was acquired by the U.S. in 1826; later on complete control was obtained, the U.S. buying the outstanding bonds. The dam at Davis Island forms a good example of the movable dam system of canalizing streams. **12,** 1277.

The new lock and dam system. 12, 1277.—Act of June 25, 1910, authorized the canalization of the Ohio with locks and dams, from Pittsburgh to the mouth, 54 in all, to gain navigable depth of 9 feet, in accordance with H. D. 492, 60th Cong., 1st sess., or such modification thereof as, in the discretion of the Secretary of War, may be advisable, the work to be completed in 12 years. Prior to the adoption of this project Congress had provided for the completion of at least 12 locks and dams. H. D. 492 referred to estimates $63,731,488 in addition to appropriations already made. At 1912, 26 of these works had been completed, or begun, leaving 28 to be begun under future appropriations. Out of the lump appropriations made for the system, a special Board of Engineers makes allotments for specific parts of the work. The following is a table of such allotments up to 1912:

Dam No.	River and harbor act of June 25, 1910.	River and harbor act of Feb. 27, 1911.	Sundry civil act of Mar. 4, 1911.	River and harbor act of July 25, 1912.	Sundry civil act of Aug. 24, 1912.
7	$150,000		$250,000	$150,000	$122,000
9	150,000		400,000	150,000	282,000
10	40,000			470,000	
12	150,000		300,000		
14		$330,000		100,000	
15		305,000		150,000	
19	220,000		300,000	100,000	
20	40,000	248,000			167,000
28		250,000		300,000	
29	150,000	52,000	460,000		
31				330,000	
41	50,000	300,000		420,000	570,000
43				550,000	
48	50,000	435,000			
Movable parts				230,000	
Surveys, etc	150,000	80,000		250,000	
Total	1,150,000	2,000,000	1,710,000	3,200,000	1,141,000

CC-1 (e) Appropriations, etc., for Ohio River.

NOTE.—It is impracticable to attempt to reconcile the different reports of appropriations and allotments; this is particularly true of the earlier reports. The clearest view of Ohio River funds is had, perhaps, by taking the appropriations listed in the reports of 1912, and adding to them additional items listed in H. D. 421, 57th Cong., 2d sess., which is done according to the following tables.

In addition to the sums specified below, the combination appropriations referred to on page 1090 should be considered.

APPROPRIATIONS—SUMMARY.

Table.	Title.	Period.	Total.
1	General improvement	1827–1912	$7,866,449.71
2	Snag boats	1891–1912	672,911.83
3	Snag boats, Pennsylvania	1906–1912	12,793.93
4	Listed in H. D. 421, 57th Cong., 2d sess	1826–1890	2,199,261.43
5	Lock and Dam 48	1910–1911	485,000.00
6	Lock and Dam 43	1912	1,150,000.00
7	At "Falls" and Lock and Dam 41	1880–1912	4,787,368.86
8	Lock and Dam 37	1902–1910	1,300,000.00
9	Lock and Dam 31	1912	330,000.00
10	Lock and Dam 29	1910–1911	662,000.00
11	Locks and dams, Steubenville to Big Sandy (11–28)	1899–1912	7,833,537.42
12	Locks and Dams 1–10	1877–1912	10,042,927.52
	Total		37,342,250.70
13	Operating and care,[1] Louisville and Portland Canal	1881–1912	3,039,558.30
14	Operating and care, Lock and Dam 37		18,189.04
15	Operating and care, Locks and dams (Steubenville to Big Sandy)		50,141.68
16	Operating and care, Locks and Dams 1–10		1,223,542.50
	Total for operating and care		4,331,431.52
	Grand total, Ohio River		[2] 41,673,682.22

Table 1.—FOR GENERAL IMPROVEMENT.[3] (Quoted from **12**, 2263–2280.)

Act of Congress.	Appropriation.	Allotment.	Remarks.
Mar. 3, 1827	$30,000.00		
Mar. 3, 1835	50,000.00		
July 2, 1836	20,000.00		
Mar. 3, 1837	60,000.00		
July 7, 1838	50,000.00		
June 11, 1844	100,000.00		
Mar. 3, 1847	6,479.25		
Aug. 30, 1852	90,000.00		
June 23, 1866		$172,000.00	Improving Mississippi, Missouri, Arkansas, and Ohio Rivers.
Do		80,000.00	Snag boats and apparatus for improving western rivers.
Mar. 2, 1867	100,000.00		
July 25, 1868		85,000.00	Repair, preservation, extension, and completion of rivers and harbor works.

[1] See also "Snag boats" above.

[2] To which might be added totals for Pittsburgh, Pa. (q. v.), and of all tributaries of the Ohio R., such as Tennessee R., Big Sandy, Kanawha, Monongahela, Allegheny, etc.

[3] The app. for 1880 provided for the application of $10,000 to the imp. of Indiana Chute; the app. of 1881 for $50,000.

The app. of 1884 provided for $7,500 for ice H. at the mouth of Great Kanawha R., and $50,000 for constr. of levees at Jeffersonville.

The app. of 1886 provided for $18,750 for embankment at mouth of Great Miami R., $37,500 for ice piers at various localities, $18,750 for the removal of obstr. at mouth of Licking R., and $11,250 for completion of ice H. near Cincinnati.

1888, imp. of Ohio R., $380,000, **88**, 1666.

1888, Ohio R. below Pittsburgh, to defray expenses of BE., $10,000, **88**, 1666.

$250,000, 1900, and $100,000, 1892, for movable dam near mouth of Beaver R., Pa., **91**, 2355; **92**, 1984.

Table 1.—FOR GENERAL IMPROVEMENT. (Quoted from **12,** 2263–2280)—Continued.

Act of Congress.	Appropriation.	Allotment.	Remarks.
July 11, 1870	$50,000.00		
Mar. 3, 1871	50,000.00		
June 10, 1872	200,000.00		
Mar. 3, 1873	200,000.00		
June 23, 1874	150,000.00		
Mar. 3, 1875	300,000.00		
Aug. 14, 1876	175,000.00		
June 18, 1878	300,000.00		
Do	50,000.00		Harbor of refuge at or near Cincinnati.
Mar. 3, 1879	250,000.00		
June 14, 1880	250,000.00		
Mar. 3, 1881	350,000.00		
Mar. 21, 1882	100,000.00		Continuing work on Davis Island Dam.
Aug. 2, 1882	350,000.00		
Do	16,000.00		Harbor of refuge near Cincinnati, Ohio.
July 5, 1884	600,000.00		
Do	17,000.00		Do.
Aug. 5, 1886	375,000.00		
Aug. 11, 1888	380,000.00		
Sept. 19, 1890	300,000.00		
Jan. 19, 1891	2,128.87		Relief of Stubbs & Lackey. Treasury settlement No. 2593.
July 13, 1892	360,000.00		
Aug. 18, 1894	250,000.00		
June 3, 1896	250,000.00		
July 1, 1898		$15,000.00	For restoring levee and banks of Ohio River at or near Shawneetown, Ill.
Mar. 3, 1899	375,000.00		
June 13, 1902	359,000.00		Amount appropriated, $400,000, $41,000 being for Falls of Ohio River at Louisville, Ky.
July 1, 1902	25,000.00		Between Cairo and Mound City.
Mar. 3, 1905	211,331.60		Amount appropriated, $300,000, $17,638.40[1] being for dredging in Pool 6, Ohio River, $56,000 for survey of Ohio River, and $15,000 for rock removal at head of canal at falls at Louisville, Ky.
Mar. 2, 1907	450,000.00		
Do	20,000.00		For Great Miami embankment east of Lawrenceburg, Ind.
Mar. 3, 1909	150,000.00		Preservation and maintenance of river and harbor works.
June 25, 1910	550,000.00		
Feb. 27, 1911	229,500.00		
July 25, 1912	200,000.00		
Do	250,000.00		Raising and strengthening levees at Cairo, Ill.
Do	20,000.00		Raising and strengthening levees at Mound City, Ill.
Total	8,671,439.72	352,000.00	

Total of appropriations, 1827–1912	$8,671,439.72	
Total of allotments, 1827–1898	352,000.00	
Received from sales, etc., 1866–1912	10,184.69	
Received from Treasury settlements, 1904, 1906	261.70	
Transferred from other appropriations	18,468.36	
		$9,052,354.47
Appropriations not drawn, 1827, 1852, 1902	30,023.47	
Allotments not drawn, 1866, 1868	43,134.60	
Returned by Treasury settlements	30.07	
Amount transferred to other works	125,168.44	
Amount expended in construction of Davis Island Dam, Ohio River	973,689.87	
Deposited to credit of "Miscellaneous receipts"	1,654.25	
Deposited to "Surplus fund"	12,204.06	
		1,185,904.76
Total		7,866,449.71

12, 2263.

[1] Original allotment, $20,800, of which $3,131.60 was returned.

Table 2.—SNAG BOATS.[1]

1891	$12,264.45	H. D.421, 57th, 2d.
1892	25,135.55	
1893	23,178.13	
1894	24,849.27	
1895	20,782.19	
1896	30,216.90	
1897	27,739.80	
1898	18,426.83	
1899	28,937.78	
1900	37,079.05	
1901	43,385.12	**01,** 2652.
1902	42,004.14	**02,** 1867.
1903	32,655.08	**03,** 1649.
1904	36,229.83	**04,** 2432.
1905	34,688.23	**05,** 1822.
1906	31,303.33	**06,** 1569.
1907	34,439.74	**07,** 1677.
1908	35,109.69	**08,** 1758.
1909	34,090.98	**09,** 1752.
1910	32,917.64	**10,** 1914.
1911	28,569.62	**11,** 2103.
1912	38,908.48	**12,** 2294.
Total	672,911.83	

Table 3.—SNAG BOATS—PENNSYLVANIA.

EXPENDED UNDER ALLOTMENTS.

For fiscal year ending June 30—	
1906	$1,790.84
1907	1,324.39
1908	1,953.71
1909	2,300.97
1910	1,580.25
1911	2,488.42
1912	1,355.35
Total	12,793.93

12, 2325.

Table 4.—MISCELLANEOUS—LISTED IN H. D. 421, 57TH CONG., 2D SESS.

1826 (Falls and Louisville and Portland Canal, stock subscription)	$100,000.00
1829 (Falls and Louisville and Portland Canal, stock subscription)	133,500.00
1849[2]	651.76
1852 (Survey, Falls)	5,000.00
1873–74 (Falls and Louisville and Portland Canal)	[3] 1,675,354.31
1879	[4] 30,000.00
1880	[4] 70,255.36
1881	[4] 22,000.00
1882	[4] 5,000.00
1884	[4] 40,000.00
1886	[4] 17,500.00
1888	[4] 70,000.00
1890	[4] 30,000.00
Total	2,199,261.43

[1] Amounts expended under allotments from permanent app. provided by acts of Sept. 19, 1890, and June 3, 1896. Prior to the fiscal year 1891 the funds for carrying on this work were derived from the general app. for imp. the R.

[2] Damages to James Moorehead from suspension of erection of dam at O. R.—Laws, R. & H., vol. 1.

[3] Expended under an. act Mar. 11, 1874, for payment of the bonds of the Louisville and Portland Canal Co. See Laws, R. & H., vol. 1.

[4] These sums represent the remainder left after deducting various items shown in the other tables herewith from the totals given for these years on p. 352 of H. D. 421, 57th, 2d. They may not be chargeable wholly against the Falls, and Louisville and Portland Canal.

MONEY FOR LOCK AND DAM CONSTRUCTION.

NOTE.—"The lists below are correct for allotments originally made, but changes are made in allotments for l. and d. construction on the Ohio as the needs of the work may indicate to be advisable. Hence no list of allotments since 1909 can be depended upon to be permanently correct."—O. C. E.

Table 5.—LOCK AND DAM 48.

ALLOTMENTS.

From act of June 25, 1910	$50,000
From act of Feb. 27, 1911	435,000
Total	485,000

12, 2428.

Table 6.—LOCK AND DAM 43.

1912	$550,000.00	
	600,000.00	
Total		1,150,000.00

12, 937.

Table 7.—"FALLS" AND LOCK AND DAM 41.

APPROPRIATIONS.

Completion of new locks, enlargement of canal, and cross dam at head of canal, payment of bonds, etc.:		
July 25, 1868 (allotment)	$85,000.00	
Apr. 10, 1869 (allotment)	178,200.00	
July 11, 1870	250,000.00	
Jan. 18, 1871	200,000.00	
Mar. 3, 1871	250,000.00	
June 10, 1872	300,000.00	
Mar. 3, 1873	100,000.00	
Mar. 3, 1875	100,000.00	
		$1,463,200.00

12, 936.

Enlargement at head of canal and of basin at lock:		
July 5, 1884	$300,000.00	
Aug. 5, 1886	150,000.00	
Aug. 11, 1888	150,000.00	
Sept. 19, 1890	60,000.00	
July 13, 1892	60,000.00	
Aug. 18, 1894	60,000.00	
		780,000.00
Allotments for Indiana Chute from appropriations for improving Ohio River: [1]		
June 14, 1880	10,000.00	
Mar. 3, 1881	50,000.00	
Aug. 2, 1882	35,000.00	
July 5, 1884	10,000.00	
Aug. 5, 1886	20,000.00	
		[1] 125,000.00
Appropriations for work on Indiana Chute:		
Aug. 11, 1888	15,000.00	
Sept. 19, 1890	25,000.00	
July 13, 1892	35,000.00	
Aug. 18, 1894	20,000.00	
		95,000.00

[1] The net total for "General improvement" has these amounts deducted.

Table 7.—"FALLS" AND LOCK AND DAM 41—Continued.

APPROPRIATIONS—Continued.

Net allotment from appropriations for maintenance of river and harbor improvements, act of Apr. 28, 1904		$14,545.06
Net allotment from appropriation for improving Ohio River, general improvement, act of Mar. 3, 1905		5,353.80
Appropriations for improving Falls of Ohio River and Indiana Chute, Falls of Ohio River		
June 3, 1896	$10,000.00	
June 4, 1897	350,000.00	
July 1, 1898	152,250.00	
Mar. 3, 1899	15,000.00	
June 13, 1902	41,000.00	
Mar. 3, 1905	80,000.00	
Mar. 2, 1907	314,000.00	
		962,250.00
Oct. 17, 1906, sale of property		[1] 350.00
Allotments for Lock and Dam No. 41:		
From act of June 25, 1910	$50,000.00	
From act of Feb. 27, 1911 (net)	300,000.00	
July 25, 1912	420,000.00	
Aug. 24, 1912	570,000.00	
		1,340,000.00
Mar. 1, 1912, sale of property		[1] 1,670.00
Total		4,787,368.86

12, 2414.

Table 8.—LOCK AND DAM 37.

APPROPRIATIONS.

June 13, 1902	$100,000
Mar. 3, 1903	400,000
Mar. 3, 1905	50,000
Mar. 4, 1907	270,000
May 27, 1908	100,000
Mar. 4, 1909	230,000
June 25, 1910	150,000
Total	1,300,000

12, 2291.

Table 9.—LOCK AND DAM 31.

July 25, 1912	*$330,000

12, 2291.

Table 10.—LOCK AND DAM 29.

June 25, 1910 (allotment)	$150,000.00
Feb. 27, 1911 (allotment)	52,000.00
Mar. 4, 1911 (allotment)	460,000.00
Total	662,000.00

12, 2289.

*Allotment.

[1] As this is really a reimbursement or equivalent for property parted with, it should not, perhaps, be added to total of appropriation.

Table 11.—LOCKS AND DAMS—STEUBENVILLE TO BIG SANDY.

APPROPRIATIONS.

Mar. 3, 1899:	
Dam No. 13	$50,000.00
Dam No. 18	50,000.00
June 6, 1900, Dams Nos. 13 and 18	470,000.00
Mar. 3, 1901, Dams Nos. 13 and 18	40,000.00
June 13, 1902:	
Lock and Dam No. 11	50,000.00
Lock and Dam No. 19	25,000.00
June 28, 1902, Dams Nos. 13 and 18	46,600.00
Mar. 3, 1903:	
Lock at Dam No. 11	200,000.00
Dams Nos. 13 and 18	450,000.00
Apr. 28, 1904, Dam No. 11	50,000.00
Mar. 3, 1905:	
Lock at Dam No. 11	80,000.00
Dams Nos. 13 and 18	100,000.00
June 30, 1906:	
Lock at Dam No. 11	80,000.00
Dams Nos. 13 and 18	160,400.00
Mar. 2, 1907:	
Lock and Dam No. 11	198,343.00
Locks and Dams Nos. 13 and 18	174,778.00
Lock and Dam No. 19	200,000.00
Lock and Dam No. 26	235,000.00
Mar. 4, 1907, Dams Nos. 13 and 18	278,000.00
May 27, 1908:	
Lock and Dam No. 11	200,000.00
Dams Nos. 13 and 18	15,000.00
Locks and Dams Nos. 13 and 18	45,000.00
Lock and Dam No. 26	110,000.00
Mar. 4, 1909:	
Lock and Dam No. 11	300,000.00
Locks and Dams Nos. 13 and 18	220,000.00
Lock and Dam No. 26	300,000.00
June 25, 1910:	
Lock and Dam No. 11	48,000.00
Lock and Dam No. 12	150,000.00
Locks and Dams Nos. 13 and 18	50,000.00
Lock and Dam No. 19	220,000.00
Lock and Dam No. 20	40,000.00
Lock and Dam No. 26	400,000.00
Feb. 27, 1911:	
Lock and Dam No. 14	330,000.00
Lock and Dam No. 15	305,000.00
Lock and Dam No. 20	248,000.00
Lock and Dam No. 28	250,000.00
Mar. 4, 1911:	
Lock and Dam No. 12	300,000.00
Lock and Dam No. 19	300,000.00
Lock and Dam No. 26	155,000.00
July 25, 1912:	
Lock and Dam No. 14	100,000.00
Lock and Dam No. 15	150,000.00
Lock and Dam No. 19	[2] 190,000.00
Lock and Dam No. 28	300,000.00
Aug. 24, 1912:	
Lock and Dam No. 20	167,000.00
Total of appropriations	7,831,121.00
Received from sales	[1] 2,416.42
	7,833,537.42

12, 2348.

[1] Should not, perhaps, be considered otherwise than as a reimbursement.
[2] $90,000 of this was allotted from act July 5, 1912, for movable parts for Dam No. 19—made to Pittsburgh office, to purchase parts.

NOTE.—The act of Mar. 3, 1905, appropriated $135,000 for Dams Nos. 19 and 26, but this is not shown above, as it was repealed by act of Mar. 2, 1907.

Table 12.—LOCKS AND DAMS 1-10.

APPROPRIATIONS.

For previous project (see H. Doc. 421, 57th Cong., 2d sess.,[1] total as shown on p. 352 of it)		$960,034.01
Dec. 9, 1885, amount transferred from Falls of the Ohio River		10,000.00
		970.034.01
Received from other sources:		
Sales of land	$3,350.00	
Sales of condemned property	305.86	
		[2] 3,655.86
		[3] 973,689.87
For present project:		
Sept. 19, 1890, construction of Lock and Dam No. 6		250,000.00
July 18, 1892, construction of Lock and Dam No. 6 and purchase of land for No. 2		100,000.00
Aug. 18, 1894, construction of Lock and Dam No. 6		75,000.00
Mar. 2, 1895, construction of Lock and Dam No. 6		150,000.00
June 3, 1896:		
Construction of Lock and Dam No. 6		25,000.00
Construction of Locks and Dams Nos. 2, 3, 4, and 5, and purchase of sites for Nos. 3, 4, and 5		30,000.00
June 4, 1897:		
Construction of Dams Nos. 2, 3, and 4		400,000.00
Construction of Dam No. 6		300,000.00
July 1, 1898, continuing construction of Dams Nos. 2, 3, 4, and 5		595,000.00
Mar. 3, 1899, continuing construction of Dams Nos. 2, 3, 4, and 5		400,000.00
June 6, 1900, continuing construction of Dams Nos. 2, 3, 4, and 5		595,000.00
June 13, 1902:		
Continuing construction of Locks and Dams Nos. 2, 3, 4, and 5		100,000.00
Completing Lock and Dam No. 6		175,000.00
Construction of Lock and Dam No. 7		23,000.00
Construction of Lock and Dam No. 8		50,000.00
Mar. 3, 1903, continuing construction of Dams Nos. 2, 3, 4, and 5		300,000.00
Mar. 3, 1903, construction of Lock and Dam No. 8		200,000.00
Apr. 28, 1904, construction of Lock and Dam No. 8		50,000.00
Mar. 3, 1905, completion of Locks and Dams Nos. 2, 3, 4, and 5, and modification of said locks and dams and of Lock and Dam No. 6, so as to secure a stage of 9 feet in the pools belonging thereto		500,000.00
Mar. 3, 1905, construction of Lock and Dam No. 8		80,000.00
June 30, 1906, for continuing improvement by the completion of Locks and Dams Nos. 2, 3, 4, and 5, and the modification of said locks and dams and of Lock and Dam No. 6, so as to secure a stage of 9 feet in the pools belonging thereto		1,281,376.00
June 30, 1906, construction of Lock and Dam No. 8		80,000.00
Mar. 2, 1907:		
Lowering of sill of Lock No. 6		70,000.00
Construction of Lock and Dam No. 8		251,845.00
May 27, 1908, construction of Lock and Dam No. 8		136,000.00
Mar. 4, 1909, construction of Lock and Dam No. 8		364,000.00
June 25, 1910 (allotment Locks and Dams Nos. 2–5)		75,000.00
June 25, 1910 (allotment Lock and Dam No. 7)		150,000.00
June 25, 1910 (allotment Lock and Dam No. 8)		2,000.00
June 25, 1910 (allotment Lock and Dam No. 9)		150,000.00
June 25, 1910 (allotment Lock and Dam No. 10)		40,000.00
Mar. 4, 1911 (allotment Lock and Dam No. 7)		350,000.00
Mar. 4, 1911 (allotment Lock and Dam No. 9)		300,000.00
July 25, 1912 (allotment Lock and Dam No. 7)		150,000.00
July 25, 1912 (allotment Lock and Dam No. 9)		150,000.00
July 25, 1912 (allotment Lock and Dam No. 10)		470,000.00
July 25, 1912 (allotment Locks and Dams Nos. 7, 9, and 19, for movable parts)		230,000.00
Aug. 24, 1912 (allotment Lock and Dam No. 7)		122,000.00
Aug. 24, 1912 (allotment Lock and Dam No. 9)		282,000.00
Total of appropriations and allotments		10,025,910.87
Received from other sources:		
Sale of land	$14,500.00	
Sales of condemned property	1,999.25	
Sales of transferred property	250.00	
Sales of blue prints	267.40	
		[2] 17,016.65
Total for both projects		10,042,927.52

12, 2323.

[1] Does not show this item, in detail at least.
[2] Should, perhaps, be considered as a reimbursement only.
[3] Amount spent on constructing Dam No. 1 (Davis Island).

MONEY FOR OPERATING AND CARE OF LOCKS AND DAMS.

Table 13.—"FALLS"—OPERATING AND CARE.

FUNDS DERIVED FROM COLLECTIONS FOR TOLLS, RENTS, ETC.

Fiscal year:		
1874	$2,490.78	
1875	45,887.15	
1876	59,266.48	
1877	66,138.47	
1878	62,203.70	
1879	73,720.91	
1880	77,106.53	
1881	22,640.18	
1882	7,615.18	
		$417,069.38

APPROPRIATION.

Act of Mar. 3, 1881		40,562.91

ALLOTMENTS.

[From act of Mar. 3, 1881.]

Fiscal year:		
1882	54,105.66	
1883	61,333.14	
1884	53,189.18	
1885	4,872.02	
		173,500.00

[From act of July 5, 1884.]

1885	67,496.56	
1886	64,262.75	
1887	76,969.00	
1888	52,376.97	
1889	66,292.06	
1890	58,136.21	
1891	64,497.18	
1892	73,979.26	
1893	69,348.74	
1894	118,377.68	
1895	111,859.66	
1896	118,766.09	
1897	87,901.56	
1898	87,569.12	
1899	68,083.78	
1900	92,273.51	
1901	75,330.09	
1902	106,539.04	
1903	85,937.58	
1904	86,119.11	
1905	91,762.52	
1906	88,048.14	
1907	128,328.13	
1908	103,114.15	
1909	90,196.94	
		2,133,565.83

[From act of Mar. 3, 1909.]

1910	75,094.88	
1911	80,116.09	
1912	119,649.21	
		274,860.18
Total		3,039,558.30

Table 14.—LOCK AND DAM 37—OPERATING AND CARE.

	ALLOTMENTS.
Fiscal year:	
1911 (actually expended)	$2,424.08
1912 (actually expended)	15,764.96
Total	18,189.04

12, 2293.

Table 15.—LOCKS AND DAMS, STEUBENVILLE TO BIG SANDY (11, 13, 18)—OPERATING AND CARE.

	ALLOTMENTS.
Fiscal year:	
1910 (actually expended)	$1,032.77
1911 (actually expended)	12,877.80
1912 (actually expended)	36,231.11
Total	50,141.68

12, 2356.

Table 16.—LOCKS AND DAMS 1-10—OPERATING AND CARE.

EXPENDED UNDER ALLOTMENT FROM ACTS OF JULY 5, 1884, AND MAR. 3, 1909.

Fiscal year ending June 30—		
1886	$5,865.00	H. D. 421, 57th, 2d.
1887	18,720.45	
1888	15,812.35	
1889	14,958.81	
1890	14,480.55	
1891	29,767.67	
1892	10,772.76	
1893	11,406.49	
1894	13,297.83	
1895	13,590.93	
1896	11,387.53	
1897	35,753.86	
1898	9,504.68	
1899	11,973.54	
1900	18,024.82	
1901	17,662.76	
1902	45,299.61	
1903	43,267.74	
1904	19,288.83	
1905	104,138.95	
1906	66,306.37	
1907	56,027.44	
1908	78,700.21	
1909	119,954.97	
1910	134,980.89	
1911	139,355.80	
1912	163,241.66	
Total	1,223,542.50	

12, 2337.

CC-1(b) Ohio River (except the Falls).

APPROPRIATIONS. (See p. 912.)

COMMERCE.

1866–1869.

Important, **66,** iv, 245, 250, 260, 317.

C. importance of R., **66,** iv, 260, 268, 317; **77,** 645.

Obstr. to navigation, **66,** iv, 249, 251.

High rate of insurance resulting therefrom, **66,** iv, 250.

1870–1879.

C. imp. of R., **77,** 645.

Duration of l.-w. season, **66,** iv, 270.

Length of navigable waters of Ohio and tributaries (4,020 m.), **66,** iv, 268.

Distances from Pittsburgh to Cairo, air line and R., **66,** iv, 270; corrected by sur. 1867–68–69, **69,** 52, 353.

Obstr. from brs., **70,** 416; **72,** 404; **73,** 502; **77,** 653; see special reports on, **68,** 316; **70,** 67; **71,** 61, 397; **72,** 440; **73,** 63; **76,** 92, ii, 298, 299; **77,** 96, 817.

Necessity of lights, ranges, and buoys, **70,** 415; **71,** 391; **72,** 404; **73,** 59, 502.

In unimproved condition of R. coal transportation is only possible at high water; requirements of chan. for **66,** iv, 245, 262, 264; **73,** 541; **74,** 416; **77,** 638, 645.

Coal transportation, an. amount of, **77,** 638, 655.

Freight rates of, **66,** iv, 316, 321.

Tolls, rate of and effect of, **77,** 640.

Opposition of coal interest to permanent imp. by movable dams, **76,** ii, 14; **77,** 637, 645, 677, 745; **78,** 803.

C. requires a minimum d. of 6′, **74,** 416.

Closing chan. at Marietta might destroy trade, **69,** 371; **71,** 393, 396.

Obstr. to navigation by abandonment of wrecks and yet claimed by owners, **73,** 502; **77,** 629.
Imp. to navigation by work done, **70,** 415.
Summary of shipping, 1875, **77,** 658.
Hs. of refuge against ice floes, **77,** 95, 636; **78,** 817; at Cincinnati and Newport, **72,** 420; at Muskingum R., **79,** 1367.

1880–1889.

Vessel statistics, **80,** 1749; **81,** 1920; **82,** 1925; **83,** 1531; **84,** 1687; **85,** 1802; **86,** 1539; **87,** 1794.
R. freight rates, **80,** 1749; **81,** 1920; **82,** 1925; **83,** 1532; **84,** 1686; **85,** 1801; **86,** 1539; **87,** 1793; **88,** 1669; **89,** 1867; **90,** 2182; **91,** 2347; **92,** 1976; **93,** 2474; **94,** 1861; **95,** 2352; **96,** 2092; **97,** 2349; **98,** 2058; **99,** 2331; **00,** 3113.
Losses by collisions with brs., **82,** 1925.
Vessels passing the Falls, **83,** 1529; **84,** 1683; **86,** 1539; **87,** 1794.
Vessels passing Davis Isld. Dam, **87,** 1799.
Diagram of largest coal tow, **84,** 1685.
Duration of ice season, **87,** 1795.
C., Cincinnati, 1887–89, **88,** 1668; **89,** 1866.
C. passing Falls of Ohio, 1880 to 1888, **88,** 1670; **90,** 2183.

1890–1899.

Freight rates. See 1880–1889.
Falls of Ohio. See 1880–1889.
Comparative statement of C. passing Falls of Ohio R. by canal and by R., 1882 to 1891, **91,** 2348; **92,** 1976.
"Present" condition of Ohio R. C., **91,** 2339.
Coal shipments from Pittsburgh, 1890, **91,** 2345.
C., Cincinnati, 1890, **91,** 2346; 1891, **92,** 1975.
C., 1890, **91,** 2348.
C., 1892, **92,** 1973, 1977.
Coal shipments from Pittsburgh, 1891, **92,** 1974.
Great and growing, **93,** 2441; **00,** 3100.
Description of. Total population of about 1,900,000 in the territory adjacent to the R. and its tributaries, **96,** 2062.
Description of, at Madison, Ind., **93,** 2444. City of considerable local importance, **00,** 3217.
Livingstone Pt., Ky.: Larger part of vessel interests, Paducah, Ky., opposed to closure of gap bet. the point and Tennessee Isld., **93,** 2404.
Evansville, Ind.: Considered one of the most important places on the lower R., **93,** 2523.
Ironton, Ohio, to above Guyan R. mouth: This division dotted with thriving manuf. and shipping towns, **93,** 2529.
Ironton, Ohio: General C. would not be benefited by protection of the city R. front, **95,** 2385.
Marietta, Ohio, to mouth of R.: C. said to be probably the largest in mile-tons in the U. S., **97,** 2381.

1900–1912.

Mound City to Cairo, Ill.: Description of C. Private interests mainly affected by caving banks, **00,** 3186.
New Liberty, Ill.: Description of C. in vicinity; small, **00,** 3193.
Marietta to mouth of Big Miami R.: Probable special advantages resulting to C. from constr. of dams across the R. a short distance below large tributaries and large cities, **00,** 3208.

Letters from navigation interests giving their opinion on proposed imp. for slack-watering R. (See H. D. 492, 60th, 1st, pp. 52–90, 116–138.)
Prospective C. on an imp. stream; remarks in regard to C. on Rhine R., Germany, and Volga R., Russia. (See H. D. 492, 60th, 1st, pp. 19, 23.)
Timber and agricultural resources very large and valuable. (See H. D. 492, 60th, 1st, p. 25.)
Table of industries, C., etc., of 4 leading cities of this R. (See H. D. 492, 60th, 1st, p. 49.)
Advantage possessed by RRs. as transportation agencies. (See H. D. 492, 60th, 1st, p. 113.)
Methods of navigation. (See H. D. 492, 60th, 1st, p. 18.)

In 1900, 14,054,322 t.; passengers, 3,881,588, **01,** 2623.
In 1901, 4,989,000 t. coal trans. by Mon. R. C. C. & C. Co., **02,** 1853.
General packet C., 1902, 12,202,017 t., freight 4,517,635 passengers, **03,** 1637; 1904, 10,142,551 t. freight, 3,951,384 passengers, **05,** 1816; 1906, 11,427,784 t. freight, 4,349,069 passengers, **07,** 1670; 1908, 8,498,754 t. freight, 3,960,965 passengers, **09,** 1743; 1910, 11,112,216 t. freight, value $358,899,889.49, and 4,313,528 passengers, **11,** 2091.
Comparative rates bet. Pittsburgh, Pa., and Memphis, Tenn., by rail and R.; by rail, 807 m., $3.73 t.; by steamboat, 1,218 m., 42¢ t., **06,** 509.
Table showing navigability of Ohio R. for 10 years, **11,** 2087; **12,** 2283.
Graphic chart showing total freight carried, value and app., from 1890 to 1910, **11,** 2090.
Imp. can not bring full benefit until it becomes more continuous than past app. have permitted, **11,** 734.
Tonnage, 1899, Maysville, Ky., 6,400,000 t.; value, $12,800,000, **01,** 2672.
C. at Elizabethtown, Ill., so limited chan. is not desirable, **04,** 2455.
C., 1903, Lock No. 1, Green R., 457,386 t., **04,** 2470.

CONTRACTS.[1]

Labor and material for constr. dikes and riprap dams:
Swan & Fenton, **67,** 397; **68,** 682; **69,** 353.
Roth & Lane, **67,** 397; **68,** 682; **69,** 353.
Manfull & Kerr, **67,** 397; **68,** 682.
King, Reinhart & Co., **67,** 397; **68,** 682.
C. M. Cole, **67,** 397; **68,** 682; **69,** 353; **70,** 407 **71,** 386, 389; **72,** 399; **73,** 493, 497; **74,** 400, 403; **75,** 679; **76,** ii, 3.
T. J. Power, **67,** 397; **68,** 682; **69,** 353; **70,** 407.
C. Cable, **68,** 682; **71,** 386; **72,** 399; **73,** 493; **74,** 400.
Routh & Watts, **69,** 353; **70,** 407; **71,** 386.
J. Bradley, **69,** 353; **70,** 407; **71,** 386.
Meyers & Keer, **70,** 407; **71,** 386.
Maddox & Slemmens, **71,** 386; **72,** 399.
J. Routh, **73,** 493; **74,** 403; **75,** 679; **76,** ii, 3.
Miller & Bedard, **73,** 493; **74,** 400.

Dr. and R. excavation:
B. L. Wood, **69,** 353; **70,** 407; **71,** 386; **72,** 399; **73,** 493.
Meyers & Keer, **69,** 353.
H. Baker, **69,** 353.

Removing rocks, snags, and logs:
C. M. Cole, hire of snag equipment, **68,** 687; **69,** 363; **70,** 407; **71,** 389.
J. Rodgers, for hire of light-draft steamer, crane scow, and flats, **67,** 402; **68,** 687; **70,** 407.
J. Routh, for hire of similar plant, **68,** 687.
M. A. Bryson, removing rs., **75,** 679.
J. Porter, removing wrecks, **71,** 389; **72,** 399.
S. B. Alger, for Oswego dr. and 2 scows complete, $18,500, **73,** 497; completed Nov., 1873, **74,** 404.
Swift Iron Works, for constr. of hull for iron snag boat, $84,350, **74,** 403, 404; completed Mar., 1875, **75,** 71, 679, 681.
Hartupee & Richardson, machinery for snag boat, **75,** 682; completed May, 1876, **76,** ii, 3, 6.
N. F. Richardson, painting and joiner work for snag boat, **76,** ii, 3.

1879. E. G. Penn, dikes, Portland Bar, **80,** 1738. C. M. Cole, dikes, Grand Chain, **80,** 1740.
1880. Hill Wrecking Co., removal of wreck, Grand Chain, **81,** 1911.

1881. Covington Dock Co., 4 dump scows, **81,** 1912. H. A. Ramsay & Co., iron work, Davis Isld. Dam, **81,** 1912. N. W. Tucker, dam and dike constr., Brown Isld., **81,** 1912. Clendinen &

[1] Saving in cost of dr. by hired labor over contract, **73,** 498; **75,** 71, 685. Unfav. action of laws governing awards of contracts, **67,** 416; **71,** 386.

Graham, dike, Twelve-Pole Bar, **81,** 1912. J. Clark, dike, Puppy Creek Bar, **81,** 1913.

1882. Pittsburgh Bridge Co., ironwork, Davis Isld. Dam, **82,** 1910. W. Cook, W. H. Sherwood & Co., Sewickley Lumber Co., Walter & Darrah, H. B. Nease, timber, **82,** 1911, 1912. F. O. Norton, cement, **82,** 1912. Allen & Blaisdell, iron dr. hull, **83,** 1512.

1883. Miller Chain Co., chain, **83,** 1512. W. H. Ewing, lock-gate timber, **83,** 1512. Queen City Bridge & Steam Forging Co., ironwork, **83,** 1512. J. W. Cook, 2 barges, **83,** 1513.

1884. J. B. Thompson, towing dr., **85,** 1776. Scaife Foundry & Machine Co., W. Kirkup & Son, Cincinnati Iron Co., Queen City Bridge & Steam Forging Co., and Oliver Bros. & Phillips, ironwork, Davis Isld. Dam, **85,** 1777, 1778. F. O. Norton, cement, **85,** 1778. J. B. Holbrook, dikes, Merriman Bar, **85,** 1778. Porter, Tucker & Mahon, dams, Blacks and Browns Islds., **85,** 1779. I. V. Hoag, dam, Wheeling Isld., **85,** 1779. J. B. Holbrook, dam, Captina Isld. and Fish Creek Isld., **85,** 1780. J. F. King, dike, Three Brothers, **85,** 1781. J. C. Graham, dike, Sand Creek, **85,** 1781. J. J. Shipman, dike, Eightmile Bar, **85,** 1782. Kirk & Co., dike, Rising Sun, **85,** 1782. J. H. Morris, dike, Flint Isld., **85,** 1783. I. V. Hoag, dike, Grand Chain, **85,** 1783.

1885. Allen & Blaisdell, repairs to snag boat Woodruff, **85,** 1784. J. Coyne, levee, Jeffersonville, **85,** 1798. Stubbs & Lackey, dike, Merriman Bar, **86,** 1529. Queen City Bridge & Steam Forging Co., maneuvering boat, Davis Isld. Dam, **86,** 1536.

1886. J. G. Fritsch, repairs to snag boat, **86,** 1536. N. W. Tucker, riprap st., **86,** 1536. Fulton Tow-Boat Co., towing, **87,** 1789. J. S. Routh, cribwork, Davis Isld. Dam, **87,** 1790. F. Gwinner, filling and paving, **87,** 1790. Crescent City Wrecking Co., r. removal, Grand Chain, **87,** 1790.

1887. J. G. Fritsch, lock-gate engines, **87,** 1790. S. D. Davis, towing U. S. dr., **87,** 1791.

1888. S. D. Davis, hire of towboat, $45 day, **89,** 1862.

1889. Ella Layman Towboat Co., towboat hire, $33.80 day. O. Reed, dams, $6,761. J. T. Hart, dams, $8,629. J. J. Shipman, dikes, $14,978. J. J. Shipman, dikes, $16,868. W. Kirk, dikes, $12,595. W. Kirk, dikes, $25,453. Ohio & Mississippi RR. Co., earth filling, 20¢ c. y. H. S. Brown, r. removal, $1.10 t. J. F. King, r. removal, $3.97 c. y., **89,** 1862–65. B. R. Harsha & Co., paving embankment, $9.13 s. f. J. Shipman, ice-pier constr., $3,798. J. W. Scott & Co., embankment extension, 21¢ c. y., **90,** 2180.

1891. J. C. Graham, crib superstr., $6,572. Richardson & Monroe, dams, $21,685. J. J. Shipman, dikes, $19,850, **91,** 2341. J. J. Shipman, dikes, $15,580. Wm. Kirk, cribs, superstr. constr., $10,975. Wm. Kirk, dikes, $25,080. V. P. Collins, towboat hire, $13.44 day, **91,** 2342. Ohio & Mississippi River Co., raising roadbed, $8,611. S. W. Coffin & Son, 2 dump scows, $3,537 scow. J. Johnson, embankment extension, $7,310. Ohio & Mississippi RR. Co., earth on embankment, $2,862.50, **91,** 2343. J. R. Ware, ice piers, $3,747. J. R. Ware, ice piers, $4,289. J. R. Ware, ice piers, $4,526. S. D. Davis, hire of steamboat, $43 day, **91,** 2344. J. Short, riprapping levee, $1.50 c. y., **92,** 1973.

1892. E. J. & H. B. Hulings, furnishing towboat, $39.50 day, **93,** 2467. T. T. Annis, E. McElfresh, B. H. Lowe, and C. S. Guard, completing Great Miami earth embankment, $6,475, **93,** 2467.

1893. E. J. & H. B. Hulings, towboat, $36.50 day, **93,** 2467. L. Cramer & Son, constr. of dikes and dams at Clusters, $18,110.45, **93,** 2468; at Scuffletown, $9,433.93, **93,** 2469. W. Kirk, similar work, French Isld., $13,428.25, **93,** 2469; near Tradewater R., $10,539.93, **93,** 2470. F. Hartweg, similar work, near Mound City, $16,635.96, **93,** 2470. W. Wolfshafer, dwelling, Davis Isld. Dam, $3,550, **93,** 2470.

1894. Hulings Bros., furnishing towboat, $37.50 day, **94,** 1845. Du Pont Improvement Co., earth embankment at Shawneetown, $3,600; H. G. Grainger, st., $3,315, **95,** 2335.

1895. E. J. Howard, furnishing dump scow, $2,750. W. A. Kirk, dr. plant, per day, active, $70; inactive, $27.50. H. S. Brown, active, $75; inactive, $25. J. T. Hart, loose st. dikes at Blennerhassetts Isld., $2,572.24. W. A. Kirk, similar work, Gunpowder Bar, $4,840. J. C. Thomas, Guyandotte Bar, $6,324, **95,** 2336. Patterson & Shipman, Flint Isld., $4,347.20. Bedford, Weikel & Nugent, Vanada Reef, Falls Slough Crossing, and Threemile Crossing, $8,371.28, $10,097.73. C. Hook and J. Shoup, towboat, $35 day, **95,** 2337.

1896. F. P. Lynch, towboat, $30.75 day, **96,** 2072. W. S. Ware, 3 ice breakers, Middleport, Ohio, and Hartford, W. Va., $4,997.71, **96,** 2073. W. A. Kirk, dr. plant, per day, active, $65; inactive, $42.50. H. S. Brown, active, $75; inactive, $30, **97,** 2335. Eichel & Arnold and Eigenmann & Hollerbach, dikes and bank protection at and near Evansville, Ind., $20,909, **97,** 2336.

1897. Richardson & Kraft, towboat, $30 day. W. A. Kirk, dr. plant, per day, active, $70; inactive, $48. H. S. Brown, active, $70; inactive, $48, **97,** 2336.

1898. C. Hook, hire of towboat as tender to dr., $34 day, **99,** 2315.

1899. C. W. Posey, hire of towboat and crew as tender to dr. W. A. Kirk, hire of dr. plant, $35 to $40 day. H. S. Brown, $35 to $40 day. J. W. Scott, repairing embankment, $18,071.25. F. F. Harrison, repairing embankment, $26,957.50.

1900. New Jersey Foundry & Machine Co., steel crane, $3,375. McNutt & Hornbrook, dike extension, $3,500; repairing bank protection, $1,200. Brown & Kirk, dr. plant, $42.50 to $50 day. J. T. Duffy, hire of towboat as tender to dr., $45 day. J. Short, dike constr., $18,935, **00,** 3101. W. A. Kirk, hire of dr. plant; H. S. Brown, hire of dr. plant; J. T. Duffy, hire of towboat and crew as tender to dr., **01,** 2615. H. G. Grainger, constr. dike below mouth of Tradewater R.; J. Short, constr. dike in Ohio R. near Mound City, Ill., **01,** 2616.

1901-12. Misc. emergency contracts for hire of towboat, tenders, dr., flatboats, rebuilding gauges, etc., **02,** 1847; **03,** 1632; **04,** 2411; **05,** 1809; **07,** 1663; **08,** 1743–44–45; **09,** 1735–36–37; **10,** 1896–97; **11,** 2085–86; **12,** 2282–83.

1904. The Fridman Lumber Co., oak timber for Eight-mile Dike, $23.40 M f. b. m., **05,** 1809, F. J. Du Vall, 738 c. y. st. for Buffington Isld. Dam, $1,366.13; D. P. Price, 1,205.94 c. y. st. for Marietta Isld. Dam, $1 c. y.; Queen City Marine RR. Co., rent of storage room, $20 mo., **05,** 1810.

1905. W. F. Robertson Steel & Iron Co., steel plates for repairing hull of U. S. dr. *Ohio* (unit prices given; $3,000); Parkersburg Dock Co., docking and repairing boats, $900.60 (unit prices given); O. F. Barrett, extension and repair of dikes at Mound City, Ill., $37,212.50, **05,** 1810. W. L. Glazier, completing concrete ice p. at Maysville, Ky., $9,032.40; F. J. & F. C. Du Vall, constr. concrete section of ice p. at Gallipolis, $10,239.21; US. Lithograph Co., printing charts of R., $538 for series, **06,** 1553. Virginia Portland Cement Co., cement, $2,923.20; The Edison Portland Cement Co., cement, $2,247.30; Henry Vogt Mach. Co., repairing and remodeling U. S. dr. *Ohio*, $5,671; Queen City Marine Ry. Co., rent of storage room, $240, **06,** 1555.

1906. Howard Shipyards Co., constr. steel dr hull, $19,830, **07,** 1663.

1907. Springfield Boiler & Mfg. Co., constr. 10 pontoons, $13,800; Knobloch & Shelton, constr. dam at head of Marietta Isld., $53,204.60; O. F. Barrett, bldg. dike at Grand Chain, Ill., $27,275, **08,** 1743. The Edison Portland Cement Co., 800 bbls. cement in sacks, $1,391.84, **08,** 1744.

1908. T. J. McKim, repairing and protecting Great Miami embankment at Lawrenceburg, Ind., $15,478; American Bridge Co., constr. steel flatboat, $7,425; Kanawha Dock Co., towing, docking, and repairing boats, $2,331.43; Howard Shipyards Co., bldg. cabin and upper works on steel dr., $7,859; The Edison Portland Cement Co., cement in sacks at Gallipolis, $347.50, **08,** 1744. Kanawha Dock Co., reconstr. of 1 dump scow, $4,250, **08,** 1745. Ellicott Machine Co., mach. in place on

steel dr., $59,925; Ohio River Contracting Co., repairs and bank protection to dikes at Evansville, Ind., $4,672.92; Henry Vogt Machine Co., pontoon pipe line and fittings, $2,048, **09,** 1735. Advance Sand & Constr. Co., constr. dam at head of Browns Isld., $44,670.75; Henry Niemes, plumbing, etc., on U. S. dr. *Indiana,* $814; Triumph Elec. Co., electric-light plant for U. S. dr. *Indiana,* $1,715.95, **09,** 1736.

1909. Frick Co., refrigerating and ice-making plant, etc., $1,848; Parkersburg Dock Co., docking and repairing decked flatboat, $473.27; O. F. Barrett, constr. decked flatboat, $1,750, **09,** 1736. E. J. Howard, replating hull of dr. *Oswego,* $7,500, **09,** 1737.

1910. L. E. Bedinger, gasoline motor, $424; Kanawha Dock Co., docking and repairing 2 dump scows, $978.49, **10,** 1896. The McIlvain & Spiegel Boiler & Tank Co., constr. 1 dr. dipper, $490, **10,** 1897. O. F. Barrett, constr. loose st. dam near foot of Sisters Isld., $10,990; New Jersey Foundry & Machine Co., constr. dam across back chan. head of Buffington Isld., $31,639.40, **11,** 2085. Monongahela & Western Dredging Co., removal of Sand Creek Dike and dr., $11,167.50, **11,** 2086.

1911. The Queen City Marine Ry. Co., docking and repairing 2 dump scows, $1,500; American Bridge Co., constr. 3 steel flatboats and 3 fuel barges, $33,300; F. A. Bone, reconstr. ice p. at Middleport, Ohio, $33,164; American Bridge Co., constr. 3 steel fuel barges, $15,000; The Charles Barnes Co., constr. 3 towboats, $130,122, **12,** 2282.

1912. Dubuque Boat & Boiler Works, constr. snagging plant, $43,677, **12,** 2282. The Hollerbach & May Constr. Co., bldg. 5 dikes opposite Sisters Isld., $48,245, **12,** 2283.

DOCUMENTS. (Not printed in reports.)

Ex. Doc. 56, 39th Cong., 2d sess., **67,** ii, 416. H. Doc. 72, 41st Cong., 3d sess., **75,** ii, 608. H. Doc. 34, 44th Cong., 2d sess.; S. Doc. 39, 44th Cong., 2d sess., **77,** 636.

ENGINEERS.

Chief of Engineers. R., 66, ii, 24; iv, 243; **67,** 40; **68,** 60; **69,** 52; **70,** 66; **71,** 59; **72,** 56; **73** 58; **74,** 64; **75,** 70; **76,** 88; **77,** 92, 654; **78,** 106; **79,** 143; **80,** 191; **81,** 260, 263, 1927; **82,** 254; **83** 260; **84,** 260, 263, 1689; **85,** 280; **86,** 271, 272; **87** 236, 238; **88,** 213, 214; **89,** 248, 250, 1868; **90,** 224 226; **91,** 288, 290; **92,** 275, 277, 278; **93,** 307, 310, 318 319; **94,** 285; **95,** 316, 322, 323; **96,** 274, 279; **97** 355, 359; **98,** 356, 372; **99,** 410, 417; **00,** 469, 476 477, 513; **01,** 470, 477; **02,** 398, 400; **03,** 423; **04** 451, 456, 457; **05,** 462; **06,** 507, 512; **07,** 536; **08** 572, 578; **09,** 606; **10,** 679; **11,** 733; **12,** 883.

Boards:

Recom., 1870, closing chan. at Marietta Isld. by l.-w. dam on Virginia side of isld., **71,** 396. (Majs. Warren, Weitzel, and Merrill.)

Convened, 1873, to ex. and report upon plan of F. R. Brunot for movable hydraulic gates for chutes and locks, and its applicability to the imp. of Ohio and other Rs. (pre. **R.**), recom. experiment with movable hydraulic gate with navigable chute, to be made on Dam No. 1 on Monongahela R., in conjunction with Monongahela Navigation Co., **73,** 540; **74,** 415.

(Final **R.**) 1874, review of plans for imp. Rs. by movable dams and hydraulic gates, **74,** 415. Recom. testing Brunot hydraulic gate in preference to adopting French system, **74,** 477. That test be made as recom. in pre. **R.** (1873) by single dam on Monongahela, **74,** 481. (Majs. Weitzel and Merrill.)

Supple. to **R.** transmitting descriptive papers on dam at Port-a-l'Anglais; also details of Girard shutters, **75,** 688; **76,** ii, 28.

Convened, 1875, to ex. proj. of Maj. Merrill (see Projects) for plan and location of movable dam (being the first of a series of dams for the radical imp. of the Ohio R.) opposite Davis Isld. (6½ m. below Pittsburgh), **76,** ii, 25. Approval of plan and location, **76,** ii, 26. Recom. use of Chanoine wickets on navigable pass, leaving for future consideration the kind of wickets on high and low weirs, **76,** ii, 27. (Lt. Col. Wright, Majs. Weitzel, Poe, and Merrill, and Lt. Mahan.)

Convened, 1877, to consider and report on the objections urged by the Coal Exchange & Steamboat Assn. of Pittsburgh against imp. by locks and dams with adjustable chutes, **77,** 644. Copy of memorial, **77,** 645. Board consider that the objections urged are not well taken, and should not prevent trial of proposed dam at Davis Isld., **77,** 637–643. (Col. Tower, Lt. Col. Wright, Majs. Weitzel and Merrill, and Lt. Mahan.)

Summary of advantages of proj. by Majs. Weitzel and Merrill, **77,** 643. Individual comments, by members of board, on relative importance of coal interest, **77,** 655.

To ex. and report on lock and gate, 1878, proposed by Maj. Merrill to be substituted for lock and gate hitherto proposed for first movable dam. Board recom. an increase of lock-gate w. from 78′ to 110′; also adoption of gate proposed by Maj. Merrill, **78,** 805. (Lt. Col. Wright, Majs. Weitzel, Poe, and Merrill.)

Approv. by Chief of Engineers, **78,** 805.

Convened Nov., 1880, to ex. and report upon plans submitted by H. Haupt for imp. of Ohio R. **R., 81,** 1928–35.

Plans not considered practicable by the board, **81,** 1934.

Report reviewed by H. Haupt, **81,** 1936–1943. (Cols. Tower and Newton, Lt. Col. Abbot, and Maj. Merrill.)

Convened at Pittsburgh, Sept. 7, 1888, by S. O. No. 41, to ex. and report upon the imp. of Ohio R. below Pittsburgh by means of movable dams. **R., 89,** 1869. (Lt. Col. Merrill and Majs. Stickney and Mackenzie.)

Convened at Pittsburgh, June 8 and 9, 1893, under S. O. No. 1, Par. No. 1, Jan. 10, 1893, to consider and report upon proj. for imp. chan. at Logstown Bar. **R., 93,** 2476. (Col. C. B. Comstock, Lt. Col. A. Stickney, and Maj. A. Mackenzie.)

Ex. at Elizabethtown, Ill.; not desirable, **04,** 2456. (See Surveys.)

Ex. of Mound City H., Ill. Imp. further than provided by "present" proj. unnecessary, **04,** 2459.

Ex. from Mound City to Cairo; special imp. unnecessary, **04,** 2464.

At Lock No. 1, Green R., not desirable to constr. movable dam, **04,** 2474.

BERH. concurs in recom. for constr. of dikes and dr. at Ogden Landing, **04,** 2480.

Act Mar. 3, 1905, constituted BE. to ex. R. and report upon system of imp. (Lt. Cols. D. W. Lockwood, E. H. Ruffner, C. B. Sears, Majs. Geo. A. Zinn, W. L. Sibert, and Capt. Burgess). Meetings: Cincinnati, June 8 and 9, 1905; Pittsburgh, Oct. 16 and 17, 1905; on board SS. *Maj. Mackenzie,* Louisville, Dec. 14 and 15, 1905. (See H. D. 492, 60th, 1st, pp. 5 and 6.) No proj. by dr. practicable; recom. locks and movable dams to provide 9′ (see Surveys); reviewed by BERH. (see H. D. 492, 60th, 1st, pp. 37, 40, 115).

In charge:

W. Milnor Roberts, superintending engineer Ohio R. imp., 1866–70, **67,** 395. **R., 66,** iv, 244; **67,** 395; **68,** 680; **69,** 352, 366, 371; H. Doc. 72, 41st Cong., 3d sess., **75,** ii, 608.

Maj. W. E. Merrill, 1870–92, **70,** 406. **R., 70,** 406; **71,** 385; **72,** 398, 409; **73,** 493; **74,** 400, 410; **75,** 678, ii, 608; **76,** ii, 3; **77,** 625; **79,** 1299; (Lt. Col.) **80,** 1737; **81,** 1911, 1922; **82,** 1909; **83,** 1511; **84,** 1677, 1689, 1715; **85,** 1776, 1802; **86,** 1528, 1540; **87,** 1781, 1796; **88,** 1645, 1656, 1670; **89,** 1851, 1873; **90,** 2163, 2183, 2186; **91,** 2328, 2334, 2349, 2350, 2354.

Maj. G. Weitzel, in temporary charge, 1869, **70,** 406.

Lt. F. Mahan, in temporary charge. **R., 78,** 795.
Maj. A. Stickney, 1892–95. **R., 92,** 1960, 1978, 1980, 1983; (Lt. Col.) **93,** 2438, 2518, 2520, 2523, 2527, 2533; **94,** 1836; **95,** 2322, 2385, 2388.
Maj. W. H. Heuer, 1896–97. **R., 96,** 2062, 2122; **97,** 2325, 2379.
Maj. W. H. Bixby, 1898–1902. **R., 98,** 2042, 2157; **99,** 2311, 2367; **00,** 3085, 3185, 3191, 3196, 3201, 3215; **01,** 2597, 2671, 2675; **02,** 1868.
Col. G. J. Lydecker, 1902–04. **R., 02,** 1839; **03,** 1627; **04,** 2406, 2454, 2456, 2460, 2478.
Col. E. H. Ruffner, 1905. **R., 05,** 1786.
Maj. J. G. Warren, 1906 and 10. **R., 06,** 1541; (Lt. Col.) **10,** 1881.
Lt. Col. W. T. Rossell, 1907–09. **R., 07,** 1653; (Col.) **08,** 1729; **09,** 1717.
Maj. J. C. Oakes, 1910. **10,** 732.
Maj. H. Jervey, 1911–. **R., 11,** 2067; **12,** 2263.

Assistants:
T. P. Roberts, **66,** iv, 248; **68,** 681; **69,** 365; **70,** 407; **71,** 385.
S. Low, **67,** 396; **68,** 680; **69,** 352.
A. Livermore, **67,** 396; **68,** 680.
J. E. Day, **67,** 396; **68,** 680; **69,** 352.
G. Barrett, **69,** 352.
P. H. Morel, **70,** 407.
W. Weston, **71,** 385; **72,** 406, 410; **75,** ii, 631; **77,** 626.
Lt. F. A. Mahan, **73,** 58; **74,** 64; **75,** ii, 631; **76,** 88; **77,** 92. **R., 76,** ii, 14; **78,** 795; **79,** 1309; (Capt.) **83,** 1513; **84,** 1678.
G. S. Kinsley, **75,** 681, ii, 631.
W. H. Christian, **75,** 681.
I. V. Hoag. **R., 78,** 795.
E. J. Carpenter. **R., 83,** 1524; **90,** 2184; **91,** 2333; **92,** 1964; **93,** 2450; **94,** 1852, 1856; **95,** 2344, 2348; **96,** 2083; **97,** 2340; **98,** 2064; **99,** 2334; **00,** 3116, 3218; **01,** 2634; **02,** 1858–59; **03,** 1641; **04,** 2424.
P. J. Schopp. **R., 83,** 1528; **84,** 1681; **85,** 1795.
O. A. Clark. **R., 84,** 1691.
W. Martin. **R., 85,** 1784; **86,** 1540; **87,** 1797; **88,** 1673; **89,** 1876; **90,** 2188; **91,** 2352; **92,** 1981; **93,** 2447; **94,** 1845; **95,** 2338.
P. Golay. **R., 88,** 1644.
Lt. H. F. Hodges. **R., 93,** 2524, 2529.
Lt. W. C. Langfitt. **R., 94,** 1850; **95,** 2386.
E. Schenk. **R., 93,** 2447; **94,** 1857.
H. Devereux. **R., 93,** 2449, 2460; **94,** 1850, 1858; **95,** 2340.
R. R. Jones. **R., 93,** 2449, 2462; **94,** 1845, 1848, 1849; **95,** 2339, 2340; **96,** 2075–2081; **97,** 2338; **98,** 2059, 2068, 2070; **99,** 2331, 2332; **00,** 3113, 3114, 3115, 3210; **01,** 2625, 2631, 2632, 2674; **02,** 1854, 1855, 1857; **03,** 1638, 1640, 1641; **04,** 2417, 2420, 2422, 2471.
J. F. Coleman. **R., 93,** 2456.
J. N. Caldwell. **R., 93,** 2459; **95,** 2338, 2389; **96,** 2074, 2081; **98,** 2060.
C. H. Meeds. **R., 93,** 2461; **96,** 2124.
E. Moeser. **R., 95,** 2338; **97,** 2339; **98,** 2060.
C. A. Turrell. **R., 95,** 2341.
M. W. Venable. **R., 95,** 2342.
A. F. Spreen. **R., 95,** 2343.
W. G. Price. **R., 96,** 2082.
W. A. Christian. **R., 98,** 2061; **00,** 3127.
A. B. McGrew. **R., 98,** 2068; **99,** 2339.
W. H. Chadbourne. **R., 00,** 3129, 3199.
W. H. Hall. **R., 01,** 2627, 2629.

ESTIMATES. (See Plans and Projects.)

By W. M. Roberts, 1866, flatboat and crane flat for removing snags, logs, and wrecks, $2,400, **66,** iv, 259. Of cost to complete sur., $22,000, **66,** iv, 315; **67,** 41, 397. Of cost of completion of "present" system of wing dams from Pittsburgh to Cairo (1,015 m.), $836,000, **67,** 41, 413; **68,** 686.

By W. Weston, 1872, repair of Cumberland Dam; cost, $36,750, **72,** 412.

By Maj. W. E. Merrill, 1874 (see Projects), imp. of R. from Pittsburgh to Wheeling, by locks and movable dams, with Chanoine wickets, to give min. d. of 6′, $7,474,623; **74,** 64, 409; **75,** 687. Revised est. for locks and dams, **75,** ii, 616. For radical imp. of Ohio R. from Pittsburgh to Cairo (967 m.), to give a min. d. of 6′ by locks, with movable dams, with Chanoine wickets, $40,000,000, **75,** ii, 629. Details, **75,** ii, 616–630.

For cost of trial dam, approved by BE., 1875, to consist of movable dam, closed with Chanoine wickets in pass, and located at Davis Isld., $421,425, **75,** ii, 621.

Revised est., 1876, introducing service br., and closing high weir by a Poirée needle dam, $465,000, **76,** ii, 22. Details of, **76,** ii, 18–23.

LEGAL PROCEEDINGS.
Prosecution for dumping. (See Obstructions.)
Permits issued by Sec. of War. (See Obstructions.)

LEGISLATION.
Necessity of legislative protection to public works of imp., **70,** 416; of laws regulating the bridging of navigable streams, **72,** 404.
Draft of proposed act permitting U. S. to remove stranded or wrecked boats that obstr. navigation, **73,** 502; **77,** 629.
Necessity of State legislation to enable U. S. to condemn lands for public uses, **75,** 71, 686.
History of efforts to obtain proper legislation permitting U. S. to condemn lands, **76,** ii, 11; passage of bill (Mar., 1877), **77,** 635.
Unfav. action of "present" laws governing awards of contracts, **67,** 416; **71,** 386.
Legislation needed regarding placing of illegal structures, **01,** 2603, 2613.
Plans submitted and approv. for brs. across R., **04,** 408; **05,** 1797; **08,** 1733.

OBSTRUCTIONS. (See Commerce.)
Obstr. to navigation by abandonment of wrecks and yet claimed by owners, **73,** 502; **77,** 629.
List of brs. over the Ohio R., **88,** 1659, and subsequent an. reports.
List of losses by collision with piers of Ohio R. brs. from 1862 to 1888, **88,** 1660; **90,** 2175.
Losses by collision with brs., **91,** 2337, and subsequent an. reports. Total of 1912, $1,147,060.42.
Operation of draws in brs. (See each an. report.)
Dumping in the R. restrained by prosecution, **93,** 2445; **94,** 1841; **95,** 2332; **96,** 2069.
Encroachments. (See each an. report.)
Required alterations in certain existing and proposed brs., **97,** 2331.
List of structures placed in the R., under permission of the Sec. of War, **98,** 2047; **99,** 2317; **00.** 3094.
Abandoned wrecks removed. Material at br. bet. Cincinnati, Ohio, and Newport, Ky., removed by the owners, Pennsylvania RR., **98,** 2047.

OPERATIONS.
Previous to 1866 (from 1837), imp. of l.-w. chan. to 2½′, by wing dams and dr., with removal of wrecks and snags, **66,** iii, 24, iv, 244, 246, 261, 271. Points below Pittsburgh (where previous work has been done), which demand early operations, **66,** iv, 246. List of obstr. bet. Pittsburgh and Cairo which should be removed at once, **66,** iv, 249, 251; **67,** 403, 405. Points where it is decided to go on with riprap dams, **66,** iv, 272, 310; **67,** 395; where work is required only at extreme l. w., **66,** iv, 272, 313.
1867–68. Progress on riprap dams and dr., **68,** 682; on removing obstr., **68,** 687; delayed by h. w., **68,** 60, 681.

1868–72. Riprap dams and dr., removing obstr., **69,** 353, 359, 363; **70,** 67, 407, 410; **71,** 59, 386; **71,** 60, 387, 390; **72,** 56, 399; **72,** 56, 401.
1872–73. Riprap dams and dr., **73,** 58, 493; removing obstr., **73,** 58, 496. Large saving obtained in dr. by U. S. boats over contract, **73,** 498.
1873–74. Riprap dams and dr., **74,** 64, 401; removing obstr., **74,** 64, 405. Second dr. completed Nov., 1873. Description of, **74,** 404.
1874–75. Riprap dams and dr., **75,** 70, 679; removing obstr., **75,** 71, 682. Cost of dr. (21 to 25¢ c. y.). Saving by hired labor over contract, **75,** 685.
1875–76. Dams and dr., **76,** 88, ii, 38; removing obstr., **76,** 89, ii, 6; cost of dr. (17¢ c. y.), **76,** 89, ii, 9; completion (Jan., 1876), of iron-hulled snag and wrecking boat, **76,** ii, 6; description of,

76, ii, 7. Cumberland Dam, unfav. action of, **72**, 410; **76**, ii, 23; removal recom., **76**, ii, 24. Operations on proposed movable dam at Davis Isld. delayed for lack of State legislation ceding jurisdiction of lands to U. S., **75**, 686; **76**, 89, ii, 12; **77**, 635.

1876-77. Dams and dr., **77**, 93, 626; removing obstr., **77**, 93, 627; cost of dr. (17¢ c. y.), **77**, 634; opening cut 420′ l. in Cumberland Dam, **77**, 631.

1877-78. Repair and extension of dike at Whites Ripple, **78**, 106, 795. Removal of 1,037 snags and 51 wrecks, **78**, 106, 797. Dr. by hired labor and U. S. drs., **78**, 106, 798. Site purchased for movable dam at Davis Isld., **78**, 107, 802. Increasing opening in Cumberland Dam, **78**, 799.

1878-79. Commencement of work on movable dam at Davis Isld., Aug., 1878, **79**, 143, 1299. Cross dams built at the Trap, **79**, 143, 1300. Repairs at French Isld. Dike, **79**, 144, 1301. Removal of r. from Grand Chain, **79**, 144, 1301. Removal of 511 snags and 31 wrecks, and dr. of 82,443 c. y., by hired labor and U. S. dr., **79**, 144, 1302.

1879-80. Progress on Davis Isld. Dam, **80**, 1737. Dike and dam constr. and repair of Portland Bar, French Isld., Evansville, Henderson Isld., and Grand Chain, **80**, 1737–1741. Rock removed by hired labor, **80**, 1741, 1742. Operations of snag boat *Woodruff*, **80**, 1742. 75,693 c. y. gravel and clay and 5,487 c. y. r. removed by U. S. drs., **80**, 1743–1746.

1880-81. Progress on Davis Isld. Dam, **81**, 1913. Dike constr. at Portland Bar and Grand Chain, **81**, 1914. 62,740 c. y. gravel and 7,955 c. y. r. removed by U. S. drs., **81**, 1914–1917. Operations of snag boat *Woodruff*, **81**, 1917. Rock removed by contract at Little Chain, **81**, 1917.

1881-82. Progress on Davis Isld. Dam, **82**, 1912. Dike and dam constr. at Browns Isld., Twelve-Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, **82**, 1914. 37,294 c. y. gravel and 10,378 c. y. loose r. removed by U. S. drs., **82**, 1916, 1919. Operations of snag boat *Woodruff*, **82**, 1920. Rock removal, by contract, at Grand Chain, **82**, 1921.

1882-83. Progress at Davis Isld. Dam, **83**, 1513; dike and dam constr. at Browns Isld., Twelve-Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, **83**, 1518, 1520. 110,775 c. y. gravel, 4 wrecks, and 60 t. r. removed by U. S. drs., **83**, 1520. Completion of new iron-hull dr., **83**, 1524. Operations of snag boat *Woodruff*, **83**, 1526. Rock removal at Mustapha Isld., **83**, 1526. Operations at Indiana Chute, **83**, 1527, 1528.

1883-84. Progress at Davis Isld. Dam, **84**, 1678, 1679. Dike and dam constr. at the Trap, Browns Isld., Twelve-Pole Bar, Portland Bar, Puppy Creek Bar, and Grand Chain, **84**, 1680. No operations of dr. or snag boat, **84**, 1681. Rock removal at mouth of Licking R., **84**, 1681. Progress at Falls of the Ohio, **84**, 1681.

1884-85. Progress at Davis Isld. Dam, **85**, 1784. Dike and dam constr. at Merriman Bar, Blacks Isld., Browns Isld., Captina Isld., Fish Creek Isld., Twin Brothers, Sand Creek, Eightmile Bar, Rising Sun, and Grand Chain, **85**, 1786, 1787. 20,611 c. y. gravel 23,756 c. y. r., 5 wrecks, and 7 snags removed by U. S. dr., **85**, 1788–1791. Cost of dr., **85**, 1791, 1792. Operations of snag boats, **85**, 1793. 5,547 t. of r. removed by contract, **85**, 1794, 1795. 3,763 c. y. r. removed and guiding dikes built, by hired labor, at Indiana Chute, **85**, 1795. Jeffersonville levee commenced, **85**, 1798.

1885-86. Davis Isld. Dam opened to navigation Oct. 7, 1885, **86**, 1528. Operation of dam, **86**, 1540. Dike and dam constr. at Merriman Bar, Blacks Isld., Browns Isld., Wheeling Isld., Captina Isld., Fish Creek Isld., Three Brothers, Sand Creek, Eightmile Bar, Rising Sun, and Grand Chain, **86**, 1529–1533. No operations by U. S. dr., **86**, 1533. Operations of snag boats, **86**, 1533. Progress on Jeffersonville Levee, **86**, 1534.

1886-87. Operation and care of Davis Isld. Dam, **87**, 1782, 1796. Dike and dam constr. at Merriman Bar, Blacks Isld., Browns Isld., Wheeling Isld., Captina Isld., Fish Creek Isld., Three Brothers, Sand Creek Bar, Eightmile Bar, Rising Sun Bar, and Grand Chain, **87**, 1782. 897 t. of r. removed from Grand Chain, **87**, 1785. Jeffersonville Levee completed, **87**, 1786. 46,855 c. y. gravel and 34 t. of r. removed by U. S. dr., **87**, 1787. Cost of dr., **87**, 1787, 1788. Operations of snag boat, **87**, 1788.

1887-88. Dam at Three Brothers Isld. repaved; 276 l. f. substr. and 578 l. f. of superstr. built at Grand Chain Dike; 11,472 t. r. blasted and removed at Grand Chain, **88**, 1644. 1,384 c. y. r. removed at mouth of Licking R.; 64,500 c. y. material placed in Great Miami Embankment, **88**, 1647. 147,808 c. y. gravel, shell, loose r., etc., removed at Davis Isld. Dam, Wheeling Creek Bar, Three Brothers Isld., and Rowlands Race; also 12 rs., 60 logs and snags, and 3 wrecks, **88**, 1649. Snagging operations; 1,225 snags, 127 rs., and 46 wrecks removed, **88**, 1651. Third dike at Fourmile Bar completed, **88**, 1652. Operation and care of Davis Isld. Dam, **88**, 1670.

1888-89. Constr. of drift gap begun in Davis Isld. Dam, **89**, 1852. Repairs to dike at Trap below Pittsburgh; 1,500 c. y. riprap placed in Marietta Isld. Dam; 150 l. f. of crib dike built at Eightmile Isld.; 300 l. f. of dike built at Bonanza Bar; 200 l. f. of dike completed at Madison; constr. of dike at Caseyville begun, **89**, 1853. Middle dike at Grand Chain extended 1,848′; constr. of ice piers at Pomeroy, Middleport, and Gallipolis begun; ice pier at Ironton completed, **89**, 1854. 45,781 c. y. dr.; 15 rs. and 8 wrecks removed, **89**, 1857. 329 snags and 24 wrecks removed in the course of snagging operations, **89**, 1859. Operation and care of Davis Isld. Dam, **89**, 1873.

1889-90. Drift gap at Davis Isld. Dam completed; 500 l. f. of timber and st. dam completed bet. Davis and Neville Islds.; constr. of dam at Marietta Isld. continued, **90**, 2164. 1,846 l. f. of dike built at Eightmile Isld.; constr. of dike at Bonanza Bar continued; dike at Madison completed for 1,600′; dike at Caseyville completed for a length of 2,450′, **90**, 2165. Operations on middle dike at Grand Chain continued; 5,938 t. r. removed from bar at mouth of Licking R., **90**, 2166. Ice piers completed at Pomeroy, Middleport, and Gallipolis; Shawneetown Embankment completed, **90**, 2167. 121,460 c. y. dr. from R., **90**, 2171. Operation and care of Davis Isld. Dam, **90**, 2186.

1890-91. Ends of dam bet. Davis and Neville Islds. straightened by cribwork; repairs to timber and filling of dike at the Trap, **91**, 2328. Dam at Marietta Isld. completed; 700 l. f. of abutment completed at Blennerhasset Isld. Dam; constr. of dam at Eightmile Isld. completed; dike completed at Bonanza Bar, **91**, 2329. 6701 l. f. of dike completed at Cullum; 400 l. f. of piling driven in constr. of dike at lower bar, Rising Sun; 2,250 l. f. of Madison Dike substr. completed; 950 l. f. of dike completed at Flint Isld.; dike at Caseyville completed, **91**, 2330. Two-thirds of total proposed dike at middle of Grand Chain completed, **91**, 2331. 3 sections of ice pier at Portsmouth completed; embankment strengthened at Shawneetown; 450 c. y. r. removed from chan. of Big Hocking R., **91**, 2332. 10,772 c. y. dr. at Marietta Isld., Harmar, and Blennerhasset Isld., **91**, 2334. 204 snags and 17 wrecks removed by snag boat, **91**, 2349. Operation and care of Davis Isld. Dam, **91**, 2350.

1891-92. Repairs to dam bet. Davis and Neville Islds.; repairs to dam at Marietta Isld.; crest of dike at foot of Marietta Isld. raised; reconstr. of dam at head of Blennerhasset Isld. completed; dike completed at Eightmile; dike at Cullums completed; dike at lower bar, Rising Sun, completed, **92**, 1961. Dike at Madison nearly finished; dike at Flint Isld. completed; 2,235 c. y. r. removed from r. bar at the mouth of Licking R., **92**, 1962. Fourth section of ice pier at Portsmouth completed, and ice pier built at Ripley; 19,640 c. y. material placed in Great Miami Embankment, **92**, 1963. Exposed faces of levee at Shawneetown riprapped and paved; 627 c. y. st. and 48 logs removed from Big Hocking R.; 81,564 c. y. gravel and sand,

23,232 c. y. r. and st., 6 wrecks, and 171 piles removed from the R. at various points, **92,** 1964, 1966. 473 snags and 34 wrecks removed by snag boat, **92,** 1979. Operation and care of Davis Isld. Dam, **92,** 1980.

1892-93. Dike at Logstown under constr.; ice piers at Kerrs Run completed; 2 loose st. spur dikes, one 450′ and the other 210′ l., built at Eightmile Bar; preparations made for blasting and dr. at mouth of Licking R.; some snags and drift removed from Cullums Ripple; Great Miami Embankment almost completed; 3,320 c. y. dr. to w. and straighten chan. opposite upper dike on Indiana shore near Rising Sun; dike at Madison, Ind., completed; embankment at Shawneetown enlarged; 39,286 c. y. dr. from Brooklyn H.; dike at middle of Grand Chain, 3,008, a long time under constr., completed; 24,230 c. y. sand and 16,805 c. y. loose r., gravel, 1 wreck, and some snags dr. at French Isld., Bowlesville, Caseyville, and Sisters, **93,** 2439–2445.

1893-94. Dam bet. Davis and Neville Islds. repaired; dam bet. Neville Isld. and Towhead extended 583′ to close gap caused by erosion; main dike at Logstown completed, training dike nearly completed; dam and dikes at Clusters Islds. under constr., and 23,554 c. y. dr. from bar; 4,215 c. y. blasted and dr. from r. bar at mouth of Licking R.; gauge erected near Cullums Ripple; 1,200 c. y. excavated at Flint Isld.; 300 c. y. gravel, and large quantity of driftwood and logs removed at Chenaults Reach; dikes and dam constr. in progress at French Isld., and 1,250 l. f. old dike removed; constr. of 2 dikes at Scuffletown in progress; work on dike at mouth of Tradewater R. begun and suspended; constr. of 2 dikes at Mound City, Ill., begun and suspended; 164,475 c. y. dr. from various places, **94,** 1837–1841.

1894-95. Dam bet. Davis and Neville Islds. repaired; training dike at Logstown completed, and portion of an old dike built in 1832 removed; 4 dikes and dam at Clusters Isld. completed, and 17,678 c. y. dr.; dam requiring 1,479 c. y. st. built across back chan., Marietta Isld.; 11,680 c. y. dr. at foot of Blennerhassetts Isld., and constr. of 550′ dike begun; 4 dikes under constr. at Guyandotte Bar, and dr. in progress; 6,882 c. y. material removed, but much more blasted; at r. bar at Licking R. mouth; dike at Medoc Bar built, and portion of an old dike removed; 2 dikes at Gunpowder Bar almost completed; 3 dikes in process of constr. at Flint Isld., and 14,750 c. y. dr.; 2 dikes and dam at French Isld. completed, and removal of old dike in progress; 1 dike each at Vanada Reef and Falls Slough Crossing in process of constr.; the 2 dikes at Scuffletown Bar completed; constr. of 6 dikes at Threemile Isld. in progress, and dr. done; levee at Shawneetown, Ill., strengthened, revetted, and repaired; dike at mouth of Tradewater R. completed for 1,879′, and some wrecks, snags, and bowlders removed, and dr. in progress; 2 dikes at Mound City, Ill., almost completed, and some dr. done; 216,584 c. y. dr. from various places, **95,** 2323–2331.

1895-96. Dam bet. Davis and Neville Isld. repaired; dam at head of Marietta Isld. repaired; dike below Marietta Isld. repaired; dike at Blennerhassetts Isld. completed; 4 dikes at Guyandotte Bar completed, and No. 4 of the series removed from West Virginia side of the R. to the Ohio side, and additional dike built, 58,044 c. y. gravel, bowlders, and loose r. dr., and also 1,144 t. r. and about 100 t. snags: spur dike, half completed, built to 320′ at Eightmile Bar; dike 14′ x 225′ built with material taken from bar at mouth of Licking R., and 5,567 c. y. dr. at Fivemile Bar; 2,736 c. y. solid r. blasted and 15,147 c. y. dr. at mouth of Licking R.; 3,022 c. y. dr. from Cullums Bar; lower dike at Medoc Bar completed, new dike begun to replace old curved dike built in 1870–71; dikes at Gunpowder Bar completed, and 14,196 c. y. loose r. and cemented gravel, and 18,351 c. y. gravel and bowlders removed; 2 dikes completed at Flint Isld., and 52,370 c. y. sand and gravel removed; dr. removed 11,260 c. y., remains of old dike and other material, at French Isld., and 2 loose-st. dikes in course of constr.; 2 loose-st. dikes completed at Vanada Reef and Falls Slough Crossing; 6 loose-st. dikes completed at Threemile Isld.; 62,560 c. y. dr. at Tradewater Bar; 96,613 c. y. material, 1,144 r., and about 100 snags removed during year by dr. at various places, **96,** 2063–2068.

1896-97. Dam bet. Davis and Neville Islds. repaired; chan. leveled at Duffs Bar; 16,024 c. y. dr. at Phillis Isld.; 2 dams repaired at Marietta Isld., and loose-st. dikes constr.; dr. done at Guyandotte Bar; 2 loose-st. dikes built at Craigs Bar, and 54,319 c. y. dr.; 17,115 c. y. dr. at Flint Isld.; 2 loose-st. dikes at French Isld. almost completed, and 4,459 c. y. dr.; constr. of 3 dikes for bank protection at Evansville, Ind., in progress; 73,736 c. y. material removed by dr. during the year from various points; ice piers built at Hartford and Middleport, **97,** 2326–2330.

1897-98. Davis Isld. bank protection repaired; dam bet. Davis and Neville Islds. repaired; 16,150 c. y. dr., and wreck also removed at Raccoon Bar; protection dike at Marietta Isld. repaired; bank at head of Blennerhassett Isld. protected by 2 short spur dikes and revet. of brush and st.; 18,220 c. y. dr. at Rising Sun Bar; 82,304 c. y. dr. at Craigs Bar, and 2 loose-st. dikes completed; chan. at Madison, Ind., w. 260′; 67,190 c. y. dr. at Flint Isld.; 2 dikes at French Isld. completed; dikes at Evansville, Ind., completed, and bank protection in progress; 2 wrecks removed at Mt. Vernon, Ind.; embankment at Shawneetown repaired; 16,930 c. y. dr. at Golconda, Ill.; 4,040 c. y. dr. at Paducah, Ky., and old city waterworks crib removed by dynamite; 19,695 c. y. dr. at Brooklyn, Ill.; small number of obstr. removed from various parts of the R., **98,** 2042–2047.

1898-99. Dr. and fender piling at the Trap; dr. at Twin Creek and Cullum Bars and at Brooklyn H. and Mound City, Ill.; wrecks of 9 barges and 3 coal boats removed; some snags removed; levee at Lawrenceburg repaired with 12,320 c. y. earth filling, and that at Shawneetown with 50,166 c. y. earth and some sheet piling; 82,816 c. y. dr. from the various places; plant repaired, **99,** 2312.

1899-00. Dr. to small extent at each of 16 bars bet. Cincinnati and Cairo; work at Lawrenceburg continued; work continued at Shawneetown embankment; 91,095 c. y. dr. from vicinity of Madison and Mound City, and 52,896 c. y. removed at other points; plant repaired; hired dr. plant dr. 39,523 c. y. at Madison, Golconda, and Mound City, and 30,905 c. y. at other points, **00,** 3086.

1900-01. Tradewater Bar Dike half completed, **01,** 2598. Repairs to Browns Isld. and Marietta Isld. Dams, **01,** 2599. 54,241 c. y. dr. at Mound City and Brooklyn, Ill., by U. S. plant, and reef of gravel blocks removed at Hillerman Landing, Ill., **01,** 2600. 125,682 c. y. dr. at Madison, Evansville, Ind., and other points, by hired plant, **01,** 2600, 2616. 16,300 c. y. solid r., 13,400 c. y. loose r. dr. at Licking Bar, **01,** 2600. Inspection of H. lines, dumpage, etc., **01,** 2603. Dangerous portion of ice pier at Portsmouth being removed, **01,** 2605. Lawrenceburg, Evansville, and Shawneetown Dikes and Embankments completed, Mound City Dike work under way, 1,000 c. y. st. delivered, **01,** 2606.

1901-02. 112,500 c. y. dr. at Evansville, Ind., Golconda and Mound City, Ill., and at Tradewater and Weston Bars, and 10,184 c. y. r. excavated at mouth of Licking R., **02,** 1840. 1,400′ new dike constr. near mouth of Tradewater R., reconstr. dam at Blennerhassett Isld., and minor repairs of other dams, **02,** 1841. Reconstr. water gauge at Evansville, Ind., **02,** 1844.

1902-03. Dr. at Fivemile Bar (76,166 c. y. by U. S. and 43,949 by contract), **03,** 1627. Plant repaired, 4,345 c. y. dr. at Twin Creek Bar; 4,564 c. y. r. drilled by U. S., 28,121 c. y. sand, etc., removed from bar at mouth of Licking R., borings and surs. made for rebuilding ice piers, and preparations made for commencing operations at Harris Ferry, **03,** 1628.

1903-04. Rock excavation and dr. of bar at mouth of Licking R., Ky., by drilling and blasting 4,089 c. y. solid r. and excavating 19,576 c. y. r., gravel, and sand, completing proj. for a l.-w. chan. 4′ d. and 200′ w. through this ledge of bed r.; U. S.

dr. excavated 198,437 c. y. sand, gravel, and bowlders, and removed 57.8 t. of r. and sunken logs, resulting in imp. chan. with l.-w. d. of from 4′ to 6′ at Twin Creek Bar, Sand Cr. Bar, Coon Run Bar, and Blair Run Bar; 4,000 c. y. st. and 11,000′ b. m. of oak timbers were used in repairing low dams and dikes at Newberry and Belleville Isld. and Eightmile Bar, the constr. of new ice pier at Maysville, Ky., completed to an elevation of 13′ above l. w., **04,** 452, 2406.

1904-05. U. S. dr. *Ohio* and *Oswego* excavated 292,865 c. y. sand, gravel, and bowlders, and removed 501.5 t. r. and sunken logs, 431 piles, and 2 wrecks, resulting in imp. chans. with l.-w. d. of from 4′ to 6′ at Short Cr. Bar, Blair Run Bar, Coon Run Bar, Opossum Cr. Bar, Barnes Run Bar, Mill Cr. Bar, Matamoras, W. Va., Reas Run Bar, Ohio R. Bar at mouth of Muskingum R., and mouth of Muskingum R.; 5,625.2 c. y. st., 112,676′ b. m. oak timber, and 13,264 lbs. iron used in repairing low dams and dikes at Browns, Marietta, Buffington, and Raccoon Islds., and at Eightmile and Fourmile Bars; 298.3 c. y. st., 63,120′ b. m. oak timber, and 11,707 lbs. iron used in repairing ice piers at Middleport and Gallipolis, Ohio, **05,** 463, 1786, etc. Tabulated description of location and amt. of dr. work, **05,** 1806. Unit cost of work done, **05,** 1804.

1905-06. U. S. dr. excavated 140,766 c. y. sand, gravel, etc., and 25.4 t. r. and sunken logs, and dr. borrowed from Louisville Dist. removed 905 c. y. sand and gravel, resulting in imp. chan. with l.-w. d. of from 4′ to 6′ at Blair Run Bar, Opossum Cr. Bar, Reas Run Bar, Newberry Isld. Bar, Little Indian Cr. Bar, Fivemile Bar, Grassy Flats Bar, Chenaults Reach, and Fulton Bar. The upper dike at Rising Sun, Ind., repaired, extension and repair of 2 dikes near Mound City, Ill., confined to depositing st.; cement for additional section of ice pier at Gallipolis, Ohio, delivered; at Maysville, Ky., 3 sections of ice pier completed; ex. to prevent encroachments and in connection and supervision of War Dept. permits made, **06,** 508, 1541. Tabulated dr. statement, **06,** 1549.

1906-07. U. S. plant dr. 77,496 c. y. gravel, sand, etc., and 8.6 t. r. and sunken logs, and hired plant excavated 6,105 c. y. sand, gravel, loose r., etc., making d. 4′ to 6′ below l. w. at Fulton Bar, Chenaults Reach, Big Blue R. Bar, Short Cr. Bar, Wells Bar, Bakers Isld., Captina Isld., and Fish Cr. Isld. Work on ice piers at Gallipolis, Ohio, **07,** 537, 1653.

1907-08. U. S. dr. excavated 190,141 c. y. gravel, sand, etc., and 92.41 t. r. and sunken logs, and hired dr. plant excavated 90,820 c. y. gravel, sand, etc., 20 t. sunken logs, and 12,800′ b. m. wreckage, resulting in imp. of chan., making a d. of 4′ to 6′ below l. w. at Captina Isld. Bar, Fish Cr. Isld., Opossum Cr. Bar, Bat and Grape Islds., Short Cr. Bar, Newberry Isld. Bar, Eightmile Isld., Gallipolis Isld., Twin Cr. Bar, and Gallipolis Ice H., and dr. carried on at various other points; work on constr. of concrete dam at head of Marietta Isld. started, work on ice pier at Gallipolis completed; work on new hydraulic and grapple dr. and plant continued, **08,** 573, 1729.

1908-09. U. S. dr. excavated 215,953 c. y. gravel, sand, etc., 62.8 t. r., 107.85 t. snags, and hired dr. plants excavated 80,626 c. y. gravel, sand, etc., 375 t. snags, and 1,100′ b. m. wreckage. Dr. has resulted in imp. of chan., making d. of 5′ to 6′ below l. w. at Wills Cr., Jonathan Run, Wheeling Cr., Jenny Lind, Connoconneque, and Falling Run Bars, Big Blue R. Islds., Big Blue R., Fivemile, Fourmile, Peckenpaugh, and Fulton Bars, Troy Reach, The Cabbage Patch, Rockport, Ind., Puppy Cr. Dike, Yellow Bank Towhead, Head of French Islds., French Islds., Vanada Reef, Indian Hill, Flint Isld., Evansville H., Henderson Dike, Coseyville, Ky., Tradewater and Walkers Bars, and Sisters Isld.; installation of boilers, machinery, etc., on dr. *Indiana;* work on concrete dam at head of Marietta Isld. (details given); repair and bank protection dikes opposite Evansville, Ind., completed; work on constr. dike at head of Grand Chain, Ill., continued; work on dikes at Mound City, Ill., completed; work on Great Miami Embankment completed, **09,** 607, 1717, etc.

1909-10. U. S. dr. excavated 376,893 c. y. gravel, sand, etc., 47.1 t. r., 190.2 t. snags, and 6 wrecks of coal bottoms and barges, and hired plant excavated 31,480.2 c. y. sand, gravel, etc., 11 t. r., 273.1 t. snags, resulting in imp. of chan., making a d. of from 4′ to 6′ below l. w. at Bakers Isld., Wills Cr., Bat and Grape Islds., Jenny Lind Bar, Gallipolis Ice H., Bonanza Bar, Straight Ripple, Grassy Flats, Hughes Bar, Tradewater Bar, Walkers Bar, Sisters Isld., and Brookport, Ill.; work on dam at head of Browns Isld., dam at head of Marietta Isld., dike at head of Grand Chain, removing r. at Grand Chain, Ill., **10,** 680, 1881, etc.

1910-11. U. S. dr. excavated 497,158 c. y. sand, gravel, etc., 323.97 t. r., and 40.8 t. snags, and hired plant and U. S. dr. *Louisville* excavated 127,504 c. y. gravel, sand, etc., 3.55 t. r., 35.84 t. snags, and 70 c. y. wreckage, making a d. of 4′ to 6′ below l. w. at Bakers Isld., Deep Run Bar, Patton Run Bar, head of Bat and Grape Islds., Island Bar, Middle Brothers Isld., Raccoon Isld., Guyandotte Bar, Fivemile Bar, Richmond Bar, mouth of Licking R., Gunpowder Bar, Salt R. Bar, Lewisport, Ky., Henderson Isld., Walkers Bar, Golconda, Ill., Sisters Isld., Cottonwood Bar, and Little Chain; dam at head of Browns Isld. completed; riprap placed to prevent erosion at Marietta Isld.; work on dam across chan. at Buffington Isld. commenced; 1,260 l. f. dike removed at Sand Cr., and 15,359 c. y. chan. dr.; removal of pier nearly completed at Middleport Ice Pier; st. prepared for constr. of dike at Sisters Isld., **11,** 734, 2067, etc.

1911-12. U. S. dr. excavated 502,573 c. y. gravel, sand, etc., 164.6 t. r., and 34.4 t. snags, and hired plants excavated 69,676 c. y. gravel, sand, etc., 95.25 t. r., 56 t. logs, and part of 1 coal barge, making d. of from 3′ to 6′ below l. w. at Clusters Islds., Blacks Isld., Deep Run Bar, Paddy Run Bar, Wheeling Cr. Bar, Caldwell Run Bar, Captina Isld., Fishing Cr., Middle Brother Isld., Guyandotte Bar, Richmond Bar, Medoc Bar, Fourmile Bar, Flint Isld., Tradewater Bar, Walkers Bar, and Sisters Islds.; work on dam at Buffington Isld., removal of Sand Cr. Dike and dr. completed; constr. of st. dike at Sisters Islds., reconstr. in concrete of Middleport Ice Pier, 6 fuel barges and 3 steel flatboats completed, **12,** 885, 2263.

PHYSICAL CHARACTERISTICS.

Table of tributary navigable Rs., **66,** iv, 266, 268; length of Ohio, **66,** iv, 268; corrected by subsequent sur., **69,** 353; distance by air line, **66,** iv, 270; surface slope, **66,** iv, 270; **74,** 416; elevation of R. at Pittsburgh, above mean tide, **76,** ii, 27.

Heights of h. w., **73,** 493; **75,** ii, 612; **77,** 644; duration of l. w. season, **66,** iv, 270; **75,** ii, 612; average duration of 15′ and 6′ stage, **66,** iv, 321; **75,** ii, 612; stages of R. for 22 years, **77,** 644; **79,** 1310.

Discharge, **66,** iv, 270, 271, 272; **69,** 367; **75,** ii, 615.

List of islds., **66,** iv, 268.

Traveling sands, difficulty from, **74,** 404, 411, 414; theory of, **76,** ii, 5.

Slope, **81,** 1929.

Discharge, **81,** 1929.

Floods of, **84,** 1687.

Duration of ice season, **87,** 1795.

Gauge records, 1888, **88,** 1653.

Slope of the Ohio at l. w., **88,** 1653.

Gauge readings for 1891 and 1892 at Davis Isld, Dam, Cincinnati, and Evansville, **92,** 1970.

Stages, **93,** 2464; **94,** 1842; **95,** 2332; **96,** 2070, 2073; **97,** 2332, 2337; **98,** 2048; **99,** 2321, 2325; **00,** 3097, 3105; **01,** 2611; **02,** 1847; **03,** 1632; **04,** 2412; **05,** 1811; **06,** 1554; **07,** 1664; **08,** 1745; **09,** 1737; **10,** 1897; **11,** 2088; **12,** 2284.

Stages at Cincinnati from 1860 (incl. 1832 and 1847), **95,** 2351; **96,** 2074; **97,** 2337; **98,** 2053, and each subsequent an. **R.**

Gauging, at mouth of Tradewater R., **95,** 2343.

Discharge measurements, **93,** 2439, 2445; **96,** 2082 (at Bay City and in the vicinity of Paducah, Ky.).

Discharge observations, from Davis Isld. Dam (about 5 m. below Pittsburgh) to a point some 4 m. below the mouth of the Tennessee, **93,** 2456.

Current observations at Mound City, Ill., **95,** 2344.

L. w. limiting navigation to light-draft boats, **98,** 2050.

Monthly comparisons of R. and rainfall, **95,** 2351; **96,** 2074; **97,** 2338; **98,** 2053; **99,** 2326; **00,** 3105; **01,** 2617; **02,** 1849; **03,** 1634; **05,** 1813; **06,** 1556; **07,** 1666; **08,** 1747; **09,** 1739; **10,** 1899; **11,** 2089; **12,** 2285.

Ice suspending navigation or damaging works, **93,** 2466; **94,** 1843; **95,** 2334; **96,** 2069, 2071; **97,** 2333; **99,** 2322; **00,** 3099.

Scour produced at mouth of Tradewater by dike, **94,** 1840.

Causes of deterioration of works of imp., **99,** 2319.

Depth on bars as reported from private sources, **00,** 3106.

Sand reef formation at Bonanza Bar, **00,** 3087.

Elizabethtown, Ill.: A troublesome crossing in existence, 1892, **93,** 2519; **96,** 2123.

Evansville, Ind.: A possibility of the R. cutting through a neck of land about 6 m. above the city, 1892, leaving the city inland. A lack of navigable depth in front of the public landing in the same year, **93,** 2521; **95,** 2388. Extreme low and high water during 1897–98, **98,** 2044.

Ludlow and Covington to Cincinnati, **93,** 2524.

Ironton to above Guyan R. mouth: At 1892, this section, 25 m. long, was obstr. by many sand and gravel bars, **93,** 2528.

Logstown Bar, **93,** 2477.

Upper part of the R., **93,** 2440.

Livingstone Pt. (see Tennessee River): Ohio and Tennessee are nearly parallel above their junction, and thus make a narrow peninsula known as Livingstone Pt. About three-fourths of a m. below the point begins Tennessee Isld., **93,** 2404.

Shawneetown, Ill.: Description of embankment at, **94,** 1849.

Marietta Isld.: Erosion of bank at head of, by waters pooled by a dam across the branch of the R. back of it, **95,** 2324.

Ironton, Ohio: Slow erosion of R. bank at this locality, 1895, **95,** 2385.

Pittsburgh, Pa., to confluence of the R. with the Mississippi near Cairo, Ill.: About 1,000 m. long and drains approximately 210,000 sq. m., **96,** 2062.

Fourmile and Fivemile Bars, **96,** 2077.

Eightmile Bar, **96,** 2075.

Marietta to the mouth, **97,** 2380.

New Liberty, Ill.: Caving banks in this vicinity that after ex. of 1896–97 were not found to be dangerously eroded, **97,** 2329.

Marietta to Pittsburgh, **97,** 2338.

Cullums Ripple: Cincinnati H. practically limited at one end by this bar, one of the worst obstr. bet. Cincinnati and Louisville, **99,** 2367.

Mound City to Cairo, Ill.: Extent of caving banks, **00,** 3186.

New Liberty, Ill.: Caving banks, and probability of R. making break, **00,** 3199.

Marietta to mouth of Big Miami R.: Probable sites of proposed dams, and vicinity, **00,** 3205.

Madison City, Ind., **00,** 3217.

Losses by collision, **01,** 2612; **02,** 1850; **03,** 1634; **04,** 2414; **05,** 1813; **06,** 1557; **07,** 1667; **08,** 1748; **09,** 1740; **10,** 1900; **11,** 2089; **12,** 2286. (See Obstructions.)

Depths on bars at l. w., **01,** 2617.

Depths vary greatly with fluctuation in R. stages, **08,** 574.

Table showing navigability of Ohio R. for 10 years, **11,** 2087; **12,** 2283.

Maysville, Ky.: An excellent natural H., lacking only protection against ice, **01,** 2676.

Mound City to Cairo, Ill.: Caving banks not greater than at other places; description of, etc., **04,** 2460.

Lock No. 1, Green R.: General characteristics, bed and banks, advantages of site, **04,** 2472.

Ogden Landing, Ky.: Rocky foundation crosses Ohio at an oblique angle, near Grand Chain, remains of prehistoric chain of hills, **04,** 2481.

Ohio R. is 967 m. long, drains an area of 210,000 sq. m., with population of 12,000,000; highest recorded floods (H. D. 492, 60th, 1st, p. 7; see Table of Stages below); principal tributaries are Allegheny, Monongahela, Muskingum, Little Kanawha, Kanawha, Big Sandy, Kentucky, Green, Wabash, Cumberland, Tennessee, Beaver, Little Beaver, Big Hocking, Shade, Raccoon, Guyandotte, Big Scioto, Licking, Big Miami, Salt, Saline, and Tradewater (see H. D. 492, 60th, 1st, p. 8).

Historical sketch of R. (See H. D. 492, 60th, 1st, p. 9.)

Bars below mouth of Green R. (See H. D. 492, 60th, 1st, p. 94.)

See p. 907. **OHIO RIVER.** See special index, p. 909.

Highest, lowest, and average stages of the Ohio R. at Cincinnati each calendar year from 1858 to 1911, inclusive, with the highest stage during the floods of 1832 and 1847.

Calendar years.	Highest stage.		Lowest stage.		Average for the year.
	Date.	Stage.	Date.	Stage.	
		Feet.		*Feet.*	*Feet.*
1832	Feb. 18	64.2	.....	.....	.....
1847	Dec. 17	63.6	.....	.....	.....
1858	June 16	43.7	Sept. 28	2.4	13.9
1859	Feb. 22	55.3	Sept. 18	3.3	18.7
1860	Apr. 16	49.2	Oct. 3	5.3	16.0
1861	Apr. 19	49.4	July 13	5.1	19.1
1862	Jan. 24	57.3	Oct. 31	2.3	17.4
1863	Mar. 12	42.7	Oct. 6	2.5	15.0
1864	Dec. 23	45.1	Aug. 6	3.1	16.7
1865	Mar. 7	56.2	Oct. 19	5.7	21.8
1866	Sept. 26	42.5	Aug. 17	4.7	19.2
1867	Mar. 14	55.7	Oct. 19	3.0	17.0
1868	Mar. 30	48.2	July 21	5.1	18.7
1869	Apr. 2	48.7	Aug. 21	5.3	19.7
1870	Jan. 19	55.2	Oct. 4	3.8	17.8
1871	May 13	40.5	Oct. 12	2.7	11.8
1872	Apr. 13	41.7	Oct. 14	3.0	11.7
1873	Dec. 18	44.4	Oct. 12	3.7	18.4
1874	Jan. 11	47.9	Sept. 22	2.3	15.7
1875	Aug. 6	55.3	Sept. 19	4.2	18.9
1876	Jan. 29	51.8	Sept. 4	6.2	18.2
1877	Jan. 20	53.7	Oct. 9	3.2	15.0
1878	Dec. 15	41.3	Oct. 24	4.3	16.7
1879	Dec. 27	42.7	Oct. 23	2.5	14.5
1880	Feb. 17	53.2	Oct. 28	3.8	17.0
1881	Feb. 16	50.6	Sept. 18	1.9	16.9
1882	Feb. 21	58.6	Nov. 1	6.1	[1] 22.1
1883	Feb. 15	66.3	Sept. 21	3.6	[1] 19.5
1884	Feb. 14	71.1	Sept. 26	2.5	[1] 17.3
1885	Jan. 20	46.0	Sept. 26	2.5	[1] 15.6
1886	Apr. 9	55.7	Nov. 1	3.3	[1] 17.8
1887	Feb. 5	56.2	Sept. 23	2.7	[1] 15.1
1888	Apr. 1	39.9	Aug. 7	5.2	[1] 17.9
1889	Feb. 22	38.2	Sept. 13	5.2	[1] 18.5
1890	Mar. 26	59.2	Aug. 30	5.7	[1] 25.7
1891	Feb. 25	57.3	Oct. 7	4.4	[1] 20.5
1892	Apr. 25	43.7	Nov. 5	3.4	[1] 16.5
1893	Feb. 20	54.9	Aug. 30	3.6	[1] 17.7
1894	Feb. 15	35.6	Sept. 14	3.1	[1] 12.9
1895	Jan. 14	48.4	Oct. 28	2.3	[1] 12.2
1896	Apr. 4	47.8	Sept. 25	5.5	[1] 16.7
1897	Feb. 26	61.2	Oct. 18	3.1	[1] 16.5
1898	Mar. 29	61.4	Oct. 6	4.5	[1] 19.7
1899	Mar. 8	57.4	Nov. 2	3.4	17.1
1900	Dec. 1	40.0	Oct. 21	3.2	13.8
1901	Apr. 27	59.7	Nov. 11	4.2	17.6
1902	Mar. 5	50.9	Sept. 24, Sept. 25	3.9	16.8
1903	...do.....	53.1	Oct. 7, Nov. 11–16.	4.5	17.9
1904	Mar. 9	45.9	Oct. 6–7	3.3	14.5
1905	May 16	48.2	Oct. 11	6.5	18.2
1906	Apr. 2	50.2	Sept. 22	7.1	17.6
1907	Jan. 21, Mar. 19	65.2, 62.1	Oct. 31	7.0	22.7
1908	Apr. 4	55.7	Oct. 6–7	2.8	17.7
1909	Feb. 28	54.6	Oct. 15	3.6	[2] 17.0
1910	Mar. 7	51.8	Aug. 28–31, Sept. 1	4.0	16.4
1911	Feb. 3	49.1	July 25	4.6	20.5

[1] Prepared from the stages as shown by the waterworks marks daily at 6 a. m. and 6 p. m., the previous and succeeding years having been made from one daily observation at 6 a. m.
[2] Prepared from observations taken at 7 a. m. by Weather Bureau.

PLANS. (See Estimates and Projects.)

By C. Ellett, to maintain 6′ in chan. by artificial reservoirs on headwaters and tributaries of Ohio, and using the stored supply during otherwise l. w., **66,** iv, 263, 315; objection to, and great cost of, **73,** 501, 541; **74,** 416.

By H. Haupt, constr. of longitudinal banks along one side of R. creating a canal 200′ w., **66,** iv, 264, 315.

By A. Livermore, slack-water navigation by dams, arranged with navigable chutes of peculiar constr., **66,** iv, 315; **67,** 348. Objections to chutes or sluices, **75,** ii, 609. For obtaining increased supply of water during low stage by a through cut from Lake Erie, not feasible, **73,** 499. For making Lake Chautauqua, N. Y., a storage reservoir, to be used during otherwise l. w. on Ohio; amount obtained too small to be of use, **73,** 499. For pumping into Lake Chautauqua from Lake Erie and using supply during l. w., impracticable from cost ($625,000,000), **73,** 500. For obtaining slack-water navigation by ordinary locks and dams; peculiar requirements of coal fleets make passage through locks inadmissible, **73,** 541; **74,** 416.

By W. M. Roberts, 1870, **73,** 502, 541; **75,** ii, 608; H. Doc. 27, 43d Cong., 1st sess.; **67,** 349. Of dr. on lower Ohio by ordinary methods useless, **74,** 414. Only plan under "present" experience for imp. of lower Ohio is concentration of current by wing dams and dikes, aided by dr. or scraping. Doubtful whether d. of more than 4′, with w. of 600′, can be obtained, **74,** 404, 410, 414, 416; **76,** ii, 5. Description and discussion of various systems of movable dams and hydraulic gates, **74,** 406, 417; **75,** 688, 910, ii, 609; **76,** ii, 14, 28; **79,** 1316.

Maj. Merrill did not consider that the suggested changing of the chan. at Elizabethtown, Ill., to the n. side of Hurricane Isld. should be entertained, **81,** 1922–26.

By H. Haupt, imp. of Ohio R., by series of dams at heads of the ripples and the contraction of the chan. along the ripple to w. of 300′; where necessary the 300′ chan. to be further contracted by movable wickets, **81,** 1937, 1938.

Plan not considered admissible by the BE. of 1881, **81,** 1934.

By Col. Merrill, 1884, for levee to prevent overflow of floods at Jeffersonville, Ind.; est., $50,000, **84,** 1689–1692.

PRIVATE, CITY, STATE, AND CORPORATE WORK. (See Ohio River Falls.)

A company chartered by Kentucky to build canal and locks at Louisville began work in 1825, completed 1828, **66,** iv, 264.

Shawneetown, Ill.: $231,000 expend. by city, and $40,000 from State taxes, for imp. of R. at this place before commencement of work by the U. S., **94,** 1849.

Guyandotte Bar: Dike built by the town, in an attempt to imp. the chan., to be removed by projs. in force at 1895, **95,** 2326.

For permits concerning structures across R., such as pipe lines, overhead wires and cables, logway, etc., see each an. report.

PROJECTS. (See Estimates and Plans.)

1837 1866.

From 1837 to 1866, the imp. of l.-w. chan. by riprap dams, concentrating water in narrow chan. to min. d. of 2½′; also removal of snags and wrecks, **66,** iii, 25, iv, 244, 246, 259, 261, 271.

1866–1869.

See also below, 1870-1879.

Continuation of previous proj., 1866–67, under direction of W. M. Roberts, **66,** iv, 259; **67,** 41, 397, 402, 404; aided by constr. of U. S. dr. boats and snag boats, **73,** 58, 497; **74,** 404; **76,** ii, 6; the orig. proj. continued to date, 1877 (see Operations); radical defect of "present" proj. is but 2′ can be given where 6′ are required, **73,** 499.

1870–1879.

See also above, 1866–1869.
See also below, 1880–1889.

Question of closing chan. at Marietta, **69,** 371; **71,** 393, 396.

By W. M. Roberts, 1870, slack-water navigation by means of locks and dams, the dams to be provided with navigable pass, chute, or sluice, closed by Brunot's hydraulic gate, **67,** 349; **73,** 501, 541; **74,** 415, 480; **75,** ii, 608; ex. by BE., 1873–74, who recom. trial of proj. by building experimental dam, sluice, and gate on Monongahela R., **73,** 542; **74,** 415, 480; objections to Brunot's gate; it is largely experimental, and the long incline, or sluice, above and below the gate is objectionable, **75,** ii, 608.

By Maj. Merrill, 1874, radical imp. of Ohio (above Falls) to secure min. d. of 6′, by movable dams, with lock, weir, and navigable pass; pass to be closed with Chanoine wickets; should the experiment with Brunot's gate be successful, "it is to be" introduced in the weir; locks to be 6′ x 75′ x 630′, **74,** 64, 406–410. Description and discussion of system of movable dams and hydraulic gates, **74,** 424–480; **75,** 688–735, 918, 924; **75,** ii, 611–617; **76,** ii, 14, 28; **79,** 1316. Reasons for change of opinion from recom. expressed as a member of BE., 1873–74 (see Board of Engineers), **75,** ii, 608, 613.

By Maj. Merrill, 1875, radical imp. of Ohio from Pittsburgh to Cairo, to secure min. d. of 6′ or 7′, **75,** ii, 608; by locks and dams, having navigable passes (400′ w.) closed with Chanoine wickets, **75,** ii, 613; and low and high weirs, the former (400′ w.) with sill at level of l. w., the latter with sill 2′ above l. w., and closed with Desfontain's wickets or Brunot's gates (to be decided by experiment); lock 78′ x 679′, lift from 4′ to 7′, **75,** ii, 613, 614, 627, 629; **78,** 803. Wickets of dams to be worked from maneuvering boat, **75,** ii, 631. Location of first dam proposed at Davis Isld. (4.7 m. below Pittsburgh), navigable pass 400′, weirs each 400′, lift of lock 6′, **75,** ii, 622, 629. Entire proj. requires 68 locks and dams; approx. location and cost, $38,696,671, **75,** ii, 629. Necessity of continuous dr. and constr. of wing dams during work above proj., **75,** ii, 630. Approv. by BE., **76,** ii, 25. By Sec. of War, **75,** 686. Effect on proj. of traveling sands on lower Ohio, **74,** 404, 411; **76,** ii, 5. Feasibility of dams on sand foundation, **74,** 414.

Modified, 1876, by introduction of service br. instead of maneuvering boat, also Poirée needle dam for closing high weir, **76,** ii, 18. Discussion of movable dams with high lifts, **76,** ii, 28. Objections urged against proj. by coal interest, **77,** 645. Considered by BE., **77,** 637. Delay of Davis Isld. Dam from lack of State legislation, **75,** 71, 686; **76,** ii, 11, 13; **77,** 635; **78,** 803. (See Legislation.)

By Maj. Merrill, 1878, lock gate, moving laterally into recesses; lock gate to fill an opening 110′ w., and to be used at the lock, movable dam at Davis Isld., **78,** 803. Approved by BE., **78,** 805.

1880–1889.

The general method of imp. has been to remove snags and r., to close up duplicate chan. by low dams, to hold up and guide the water by dikes where the R. had an excessive w., and to remove by dr. hard bars and projecting points, **84,** 261.

The radical imp. of the R. so as to secure a l.-w. d. of 6′ was commenced in 1878 by the constr. of the Davis Isld. Dam, **79,** 143, 1299, which was opened to navigation in 1885, **86,** 1528. Cost of this work, about $910,000, **86,** 271.

In 1888 Lt. Col. Merrill proposed erection of 2 additional movable dams, the continuation of low dam and dike constr., removal of obstr. in mouth of the Licking, with snagging and dr.; est., $1,051,500, **88,** 1666.

In 1888 the BE. recom. extension of the slack-water system of imp. to point 25 m. below Pittsburgh by constr. of 4 additional movable dams at Merrimans Bar, at the Trap, near Economy, and just below the mouth of Beaver R.; est., $3,600,000, with an. cost of $26,000 for mainten., **89,** 1869, 1873.

1890–1899

Cullums Ripple: In response to numerous requests of those interested in shipping, gauge estab., 1893–94, **94,** 1838, 1848.

Medoc Bar: By Lt. Col. Stickney, 1895, removing portion of 1871 dike and constr. of a new dike, **95,** 2326.

Marietta, Ohio, to Pittsburgh, Pa.: Act 1896 au. expend. of not more than $25,000 for sur., **97,** 2326. Maj. Bixby, 1898, est. that from 13 to 18 dams would be required for imp. of this section, at total est. cost of from $9,750,000 to $13,500,000, **98,** 2158.

Davis Isld. Bank: In 1897–98, the Chief of Engineers approv. recom. for protecting bank with piling and riprap st., at est. cost of $1,300, **98,** 2042.

Golconda, Ill.: By Maj. Heuer, 1896–97, dr. to not more than 6′ below l. w. and as wide as practicable with the amount available, $3,000, **97,** 2329; **98,** 2044. Act of 1899 allotted $10,000 for blasting and dr. for ½ m. in front of the city, **99,** 2318.

Cullums Bar (see Cullums Ripple): Proj. approv. 1896 for w. chan. in this locality by gradually dr. as opportunity offered, and experience indicated, at an est. cost of from $10,000 to $20,000, and, if necessary, to extend the dike here at an est. cost of $1,000, **98,** 2048.

Maj. Bixby est., 1899, $1,050,000 for lock and movable dam, **99,** 2370.

Gunpowder. Bar: Proj. approv. in 1895 for 2 dikes, and probable dr. At 1897–98 dikes had not caused necessary scour, and dr. to 5′ below l. w. for about 3,800′ and w. of 200′ was proposed by Maj. Bixby. Approv., **98,** 2048.

The Trap: By Maj. Bixby, 1899, making 2 cuts by dr., through the bar, and also for a fender of piles, **99,** 2312.

Lawrenceburg, Ind.: By Maj. Bixby, 1899 (on request of town), for application of $3,000 remaining from 1892 app. to repair of storm-damaged embankment. Act 1899 allotted $15,000 for continuing work, **99,** 2313.

Deterioration of works of imp., **99,** 2319; **00,** 3096.

Needed chan. dr. for coal-tow service, **01,** 2601.

Sur. shows 20 dams with average lift of 7.2′ can be placed to give desired results, **01,** 2609. Deterioration of past works of imp. and cost of repairs, **01,** 2609. Constant calls by navigation interests makes it advisable to recom. that funds be expend. in procuring a large number of drs., **05,** 1803.

Shawneetown, Ill.: Act 1892 allotted $7,000, **93,** 2438. Lt. Col. Stickney est., 1894, $12,000 to strengthen and protect levee, **94,** 1849; allotted by act of 1894, **95,** 2329. Maj. Heuer, 1897, proposed repairs with available funds, about $1,300. Approv., **98,** 2044. Act 1898 allotted $15,000 from app. for imp. Falls of Ohio at Louisville, Ky., for repair of flood-damaged levee. Act 1899 allotted $25,000 for continuing the work, **99,** 2314.

Great Miami Embankment: Act 1892 allotted $13,000, **93,** 2438.

Act Mar. 2, 1907, provides for repairing damages caused by "recent" flood of Ohio R. and trib., if necessary; cost, $20,000, **07,** 537.

Mound City, Ill.: Act 1892 allotted $30,000, **93,** 2438. Act 1896 allotted $5,000. Maj. Heuer proposed removal of cemented gravel bar by dr. to least d. of 6′, **97,** 2329; and drilling and blasting if necessary. W. of proposed dr., about 300′. Est. expend., $10,583.97. Approv., **98,** 2048. Act 1899 allotted $25,000 for dr. and dikes, **99,** 2318; **00,** 3090. Work on general imp. includes this place, making unnecessary any special proj., **04,** 2459.

Brooklyn H., Ill.: Act of 1892 allotted $10,000, or as much of it as might be necessary, for dr., **93,** 2438. Act 1896 allotted $10,000 for continuing work, **97,** 2329. Applied to obtaining 5′ chan. by removing obstr. and blasting rocky ledge, **99,** 2314. Act Mar. 3, 1899, allotted $10,000 for dr. one-third m. of H. front, **99,** 2318.

Logstown, Pa.: After protest of Pittsburgh Coal Exchange, BE., 1893, omitted some spur dikes from plan for work in this vicinity, **93,** 2441.

Old dike reported removed 1868 discovered 1894–95, and was removed, as it prevented scour required to remove a bar in front of the new dike at that locality, **95,** 2323.

Ice harbors: Efficiency thoroughly tested, **93,** 2446. Of great benefit to C., **95,** 2325.

Table showing locality, distance below Pittsburgh, and distance from each other, **95,** 2325; **96,** 2069.

Act 1894 allotted $18,750 or as much of it as might be necessary for constr. of pier at Middleport, Ohio, for enlarging and imp. pier at Pomeroy, Ohio, and for constr. a pier at or near Syracuse, Ohio, or at or near Hartford, W. Va., **95,** 2325. Site selected at Hartford, **96,** 2068. Act 1896 required constr. of additional pier at Middleport, one at Syracuse, and one at or near the mouth of Big Hocking R., **96,** 2068. Maj. Heuer est. cost of these last at $7,000 each. Sec. of War ordered postponement, **97,** 2331.

Elizabethtown, Ill.: Lt. Col. Stickney est. $600 for sur., **93,** 2519; in 1896, $95,040 for imp. R. at this locality, **96,** 2123.

Evansville, Ind.: Lt. Col. Stickney est., 1892, $300 for sur., **93,** 2523. Act 1894 allotted $25,000 to prevent threatened cut-off near this place, **95,** 2329. Lt. Col. Stickney, 1895, est. $39,592.25 to imp. R. in this vicinity, **95,** 2388.

By Maj. Heuer, 1896, for 6 dikes, with l. of from 180′ to 500′ and bank revet. at some 11 places, 1 to 6 m. above the town, grading of the bank to be done where necessary, **97,** 2328. Modification, **98,** 2044.

Act 1899 allotted $20,000 for dr. city front about 1 m., **99,** 2318.

Ironton to above Guyan R. mouth: Lt. Col. Stickney, 1892, est. $2,500 for sur., **93,** 2529.

Caseyville, Ky. (see Tradewater R.): By Maj. Bixby, 1899, additional dike near mouth of Tradewater R.; est., $25,000, **00,** 3086.

Marietta to mouth of Big Miami R.: Act June 6, 1900, allowed continuation of the sur. begun with $35,000 app. by act 1899 for sur. with general funds, **99,** 2312; **00,** 3093. Maj. Bixby est., 1900, it would cost $19,500,000 for 21 movable dams with locks, **00,** 3207; final **R.** by Maj. Bixby gives est. of $19,950,000 for 20 locks and dams, ranging from $950,000 to $1,100,000 each, numbered 19 to 38, inc., **02,** 400. 1867. Location and principal data of these dams, **02,** 1872.

New Liberty, Ill.: Maj. Bixby est., 1900, $730,000 for levees to protect adjacent lands (see Surveys), **00,** 3198.

Madison, Ind.: Act 1899 allotted $20,000 for dr. and also for sur. for extension of H. Maj. Bixby est., 1900, it would cost $50,000 in addition to funds available ($14,000), **00,** 3218.

Mound City to Cairo, Ill.: Caving in this section no greater than in other parts of R., and special imp. not essential, **04,** 2462.

Mouth of Green R.: While constr. of movable dam would be a local benefit, it would not aid through traffic while forming an isolated pool, **04,** 2476.

Proj. submitted for general imp., Pittsburgh to Cairo, makes provision for an enormous C.; est. that 20,000 t. can be locked from one pool to another in 1½ hours, or 100,000,000 t. an. (See H. D. 492, 60th, 1st, p. 112.)

Table showing what has been done and what remains to be done to provide 6′ bet. Pittsburgh and Cairo. (See H. D. 492, 60th, 1st, p. 30.)

Act June 25, 1910, au. securing navigable d. of 9′ with 54 locks and dams, to cost $63,731,488; also

authorizes purchase of sites for 18 locks and dams, beginning constr. of 9, and sur., etc., for others,[1] **10,** 1006.

SURVEYS.

By Capt. Sanders, 1837–38 and 1843–44, **66,** iv, 246, 264.

By Capt. Hughes, 1842, ex., Pittsburgh to Louisville—H. D. 50, 27th, 3d.

By W. M. Roberts, 1866, **66,** iii, 24, iv, 243, 264; progress of, 1867–68, **67,** 40, 396; **68,** 60, 680; **69,** 352. Completed Nov., 1868, **69,** 353.

Special sur. at Evansville, 1872, **72,** 405, 406; of dam near mouth of Cumberland R., **72,** 405, 410.

For location of movable dams, **76,** ii, 11.

For H. of refuge against ice, 1877, **77,** 636.

Sur. from Hurricane Isld. to Elizabethtown, au. act June 14, 1880; made by Maj. Merrill, 1881, **81,** 1922.

Sur. for location of movable dam in Ohio R. below the mouth of Beaver R., Pa.; made, 1891, by Maj. Stickney, **92,** 1983.

Harbor lines: Pittsburgh, Pa., Wheeling, W. Va., and Cincinnati, Ohio, **93,** 2445; **94,** 1841; **95,** 2332. Permission was given, 1897, to the Wheeling Bridge & Terminal Ry. Co. to lay some track outside the estab. H. lines on the e. side of the R. at Benwood, W. Va.; and to the Pennsylvania Sand Co. to maintain a platform, previously constr., on e. bank of R. at Wheeling, W. Va., **97,** 2331; **98,** 2046. At Ironton, **98,** 2046; **99,** 2316. At Ashland, Ky., **00,** 3088. Davis Isld. and vicinity, **00,** 3088. Cincinnati, **08,** 1732.

Supervision of H. lines at Pittsburgh transferred to there, **99,** 2316.

Misc. sur., ex., and inspections made almost every year (see references to reports, Engineers in Charge).

Livingston Pt.: Ex. of R. bet. this point and head of Tennessee Isld., with view to protecting H. of Paducah, Ky., au. act July 13, 1892; made, 1892, by Lt. Col. Robert, **93,** 2404.

Elizabethtown, Ill.: Ex. at or near this place to determine most practical method of imp. H., au. act July 13, 1892; made, 1892, by Lt. Col. Stickney, **93,** 2518. Sur. au. act Aug. 17, 1894; made, 1895, by Lt. Col. Stickney, **96,** 2122. Pre. ex. au. act June 13, 1902. **R.** by Col. Lydecker, Aug. 7, 1903[2] (unfav.), **04,** 456, 2454.

Ludlow and Covington, Ky., to Cincinnati, Ohio: Ex. with view to prevention of damages to banks bet. these points, au. act July 13, 1892; made, 1893, by Lt. Col. Stickney (**R.** unfav.), **93,** 2523.

Ironton, Ohio, to 3 m. above Guyan R. mouth, W. Va.: Ex. au. act July 13, 1892; made by Lt. Col. Stickney in that year (**R.** fav.), **93,** 2527.

Ironton, Ohio: Ex. au. act Aug. 17, 1894, with view to protecting R. front within limits of the city; made, 1895, by Lt. Col. Stickney (see Commerce), **95,** 2385.

Marietta, Ohio, to mouth of R.: Sur. au. act June 3, 1896, but ex. made instead in 1896 by Maj. Heuer (**R.** fav.), **97,** 2379.

Marietta to Pittsburgh: Sur., with view to imp. by means of dams, to give 6′ at m. l. w., au. act June 3, 1896. Begun by Maj. Heuer in 1896, **97,** 2380; **98,** 2042, 2059. Pre. **R.,** 1898, by Maj. Bixby, **98,** 2157. (See Ohio River; Movable dams.)

Cullums Bar (Ripple): Minor sur., **99,** 2313. Sur. for lock and dam for 6′ d. au. joint resolution of Jan. 10, 1899; made, 1899, by Maj. Bixby (**R.** fav.), **99,** 2367.

Marietta to mouth of Big Miami R.: Sur. for movable dams for 6′ d. au. act Mar. 3, 1899; begun, 1899, by Maj. Bixby, **99,** 2312; **00,** 3092, 3113. Pre. **R.** (fav.; see Projects), and details of sur. methods, **00,** 3203; **01,** 2608. Final **R.** by Maj. Bixby, Jan. 14, 1902; est., $19,950,000,[3] **02,** 401, 1867.

New Liberty, Ill.: Ex. and sur. for prevention of caving banks and cutting of R. through banks into slough and chain of lakes, au. act Mar. 3, 1899; made, 1899, by Maj. Bixby (**R.** unfav.), **00,** 3196.

Paducah, Ky. (see Tennessee R.): Act Mar. 3, 1899, au. sur. for protection of banks against h. w., **99,** 2319.

Mound City to Cairo, Ill.: Ex. au. act Mar. 3, 1899, for protection of banks and levees on Illinois side; made by Maj. Bixby, 1899 (**R.** unfav.), **00,** 3185.

Pre. ex. au. act June 13, 1902, for bank protection and levees. **R.** by Col. Lydecker, Dec. 7, 1903[4] (unfav.), **04,** 456, 2459.

Madison, Ind.: Sur. for 6′ d. to front of city au. act Mar. 3, 1899; made, 1899, by Maj. Bixby (**R.** fav. only to specific app.), **00,** 3215.

Evansville, Ind.: Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Stickney, **93,** 2520. Sur. au. act Aug. 17, 1894; made, 1895, by Lt. Col. Stickney, **95,** 2388.

Maysville, Ky.: Pre. ex. and sur., with view to constr. of a pier for a H. of refuge on s. shore, au. act June 6, 1900. **R.** by Maj. Bixby, Sept. 5 and Nov. 24, 1900.[5] Est., $21,000, **01,** 477, 2670.

Mound City H., Ill.: Pre. ex. au. act June 13, 1902. **R.** by Col. Lydecker, Oct. 27, 1903[6] (not desirable), **04,** 456, 2456.

Mouth of Green R., Ky.: Pre. ex. au. act June 13, 1902, constr. movable dam to make H. at Henderson, Ky., and Evansville, Ind., and to give 6′ d. on lower miter sill at Lock No. 1, Green R. **R.** by Col. Lydecker, Dec. 10, 1903[7] (unfav.), **04,** 456, 2465.

Ogden Landing: Pre. ex. au. act June 13, 1902, with view to constr. of wing dam. **R.** by Col. Lydecker, Aug. 6, 1903. Recom. dike constr. and dr., to be paid from funds for general imp.,[8] **04,** 457, 2477.

Metropolis, Ill.: Pre. ex. au. act Mar. 3, 1905. **R.** by Lt. Col. Ruffner, Apr. 6, 1905[9] (unfav.), **06,** 512.

General improvement, Pittsburgh to Cairo: Ex. au. act Mar. 3, 1905, with view to obtaining chan. d. of 6′ and 9′, resp. **R.** by BE., Dec. 15, 1906; est. for 6′, $50,962,266, and for 9′, $63,731,488,[1] **08,** 578.

Maps:[1]
Of Davis Isld. Dam, **83,** 1518.
Of Indiana Chute, **85,** 1795.
Plans of movable dams of La Mulatière, **79,** 1338.
Plans of movable dams at Poses, **79,** 1342.
88, 1643, 1652; **89,** 1872; **90,** 2166, 2178; **92,** Atlas, 91, 92, 93.
Profile maps showing chan. bottom and l. w., Pittsburgh to Louisville, and approx. l. w., 1904, Louisville to Cairo, with proposed pools of a 6′ and 9′ navigation. (See H. D. 492, 60th, 1st, p. 110.)
Types of boats in use. (See H. D. 492, 60th, 1st, p. 18.)
Photos. showing departure of coal floats from Pittsburgh. (See H. D. 492, 60th, 1st, p. 18.)
Louisville and Portland Canal. (See H. D. 492, 60th, 1st, p. 28.)

[1] H. D. 492, 60th, 1st.
[2] H. D. 79, 58th, 2d.
[3] H. D. 336, 57th, 1st.
[4] H. D. 308, 58th, 2d.
[5] H. D. 148, 56th, 2d.
[6] H. D. 171, 58th, 2d.
[7] H. D. 643, 58th, 2d.
[8] H. D. 57, 58th, 2d.
[9] H. D. 135, 59th, 1st.

CC-1(g) Ohio River. (Operating snag boat on.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1897. The Cincinnati Marine Railway Co., replating the hull of snag boat, $3,200, **98,** 2074.

1901. The Chas. Hegewald Co., constr. steam launch, $2,495, **01,** 2651–52.

1908. Littleford Bros., repairing deck, etc., of snag boat *E. A. Woodruff*, $318; S. F. Johns and W. H. Hildreth, rebuilding wheelhouse, etc., on snag boat *E. A. Woodruff*, $3,490, **08,** 1757.

1909. Sheridan-Kirk Co., removing wrecked coal barge at Rising Sun, Ind., $135 day, **08,** 1758. Monongahela & Western Dredging Co., hire of dr. plant, $72, and for removing rs. at Steubenville Ohio, $160; Littleford Bros., new chimneys and repairs to iron main deck of snag boat *E. A. Woodruff*, $812; The Chas. Barnes Co., cast-iron suction pipe, etc., for snag boat *E. A. Woodruff*, $160; The Cincinnati Butchers' Supply Co., constr. cold-storage room on snag boat *E. A. Woodruff*, $700, **09,** 1752. Sheridan-Kirk Contracting Co., hire of snagging plant, $56.25, **10,** 1913.

1910. Columbia Iron Works, repairing deck of snag boat *E. A. Woodruff*, $623; The Triumph Electric Co., refrigerating plant for snag boat *E. A. Woodruff*, $2,350, **10,** 1913. Lewis Tanner, hire of plant for removing snags, $2,794.80, **11,** 2103.

1911. The McIlvain & Spiegel Boiler & Tank Co., installing 5 new double-flue boilers, $3,600, **11,** 2103.

ENGINEERS.

Chief of Engineers. R., 93, 312; **94,** 287; **95,** 319; **96,** 23, 276; **97,** 23, 356; **98,** 358; **99,** 38, 413; **00,** 472; **01,** 473; **02,** 400; **03,** 426; **04,** 455; **05,** 465; **06,** 511; **07,** 540; **08,** 577; **09,** 611; **10,** 684; **11,** 738; **12,** 889.

In charge:

Lt. Col. A. Stickney, 1892–95. **R., 93,** 2478; **94,** 1864; **95,** 2355.

Maj. W. H. Heuer, 1896–97. **R., 96,** 2093; **97,** 2349.

Maj. W. H. Bixby, 1898–1901. **R., 98,** 2070; **99,** 2340; **00,** 3129; **01,** 2646.

Col. G. J. Lydecker, 1902–04. **R., 02,** 1864; **03,** 1647; **04,** 2430.

Lt. Col. E. H. Ruffner, 1905. **R., 05,** 1819.

Maj. J. G. Warren, 1906 and 1910. **R., 06,** 1567; **10,** 1912.

Lt. Col. W. T. Rossell, 1907–09. **R., 07,** 1673; (Col.) **08,** 1757; **09,** 1751.

Maj. H. Jervey, 1911–. **R., 11,** 2102; (Lt. Col.) **12,** 2293.

Assistants:

W. H. Christian. **R., 93,** 2479; **94,** 1865; **95,** 2356; **96,** 2095; **97,** 2351; **98,** 2074; **99,** 2345; **00,** 3137; **01,** 2652, 2656.

Newton Tebow. **R., 01,** 2655.

Wm. Martin. **R., 01,** 2655.

OBSTRUCTIONS.

Sunken coal boats, **01,** 2647.

Damage to R. craft by ice gorges, **05,** 1820.

OPERATIONS.

1892–93. 532 snags and 45 wrecks removed, **93,** 2479.

1893–94. 810 snags, 70 wrecks, and some piles and st. removed, **94,** 1864.

1894–95. 1,201 snags, 52 wrecks, and 2,182 c. y. st. removed, **95,** 2356.

1895–96. 48 wrecks, 391 snags, and 5,056 c. y. st. removed, **96,** 2094.

1896–97. 805 snags, 62 wrecks, and some r. and trees removed, **97,** 2350.

1897–98. 623 snags, 6 SS., 2 hulls, 22 barges, and other obstr. removed, **98,** 2070.

1898–99. Boats repaired and 296 snags, 9 SS., 36 wrecks, and 2 piers removed from R., **99,** 2341.

1899–00. 1,365 snags, 6,276 c. y. r., sand, etc., and 92 wrecks removed from R., **00,** 3131.

1900–01. 1,093 snags, 16,764 c. y. r., 1,000 c. y. earth, 40 cords drift, 38 large ice-pier timbers, 15 piles, and 86 wrecks removed, **01,** 473, 2646.

1901–02. 955 snags, 31,848 c. f. r., and 48 wrecks removed, **02,** 400, 1864.

1902–03. 461 snags, 8 r., 81 wrecks removed by U. S. snag boat *Woodruff*; 5 sunken coal boats and 4 barges destroyed by U. S. launch *Wenonah*, **03,** 427, 1647.

1903–04. Snag boat *E. A. Woodruff* removed 526 snags, 80 wrecks, 38 coal boats, and at Ripley, Ohio, 1,650 c. y. st., 373 pieces timber; U. S. launch *Wenonah* removed 3 coal barges, 2 coal boats, 1 model barge; hired SS. removed 3 coal barges and 1 coal boat; hired dr. removed 267 large timbers, 11.5 cords broken timbers, 9 steel rails, and 4,250 c. y. gravel at Rising Sun, Ind., **04,** 455, 2430.

1904–05. 694 snags, 8 r., 79 wrecks, and at Pomeroy and Gallipolis ice piers 5,097 cords of drift removed by snag boat *E. A. Woodruff*; 8 coal boats and parts of 2 others, 4 coal barges, 1 covered barge, and 1 large r. removed by launch *Wenonah*, **05,** 466, 1819.

1905–06. 769 snags, 8 r., 78 wrecks, and 105 cords of drift removed, **06,** 512, 1567.

1906–07. 1,031 snags, 4 r., 235 cords drift, 50 wrecks removed by snag boat, **07,** 541, 1675.

1907–08. 792 snags, 12 r., 364 cords drift, and 40 wrecks, **08,** 577, 1757.

1908–09. Snag boat *E. A. Woodruff* removed 1,357 snags, 6 r., 294.71 cords drift; 1 cofferdam, 57 wrecks, and about 50 c. y. loose r. removed, **09,** 1751.

1909–10. 1,146 snags, 93.75 cords drift, and 29 wrecks removed, **10,** 1913.

1910–11. 866 snags, 34 wrecks removed by U. S. snag boat and 313 snags and 2 wrecks by hired plant, **11,** 739, 2102.

1911–12. 441 snags, 32 wrecks removed, and oil, etc., supplied to beacon-light keepers, **12,** 2294.

PROJECTS.

Act 1890 provided that not more than $25,000 could be drawn from the Treas. each year for snagging on the R., **93,** 2478.

Act June 3, 1896, increased yearly app. to $50,000, **06,** 2093.

Recom. for increase in 1906 app. of $15,000 to be used in building and equipping combination snag and derrick boat, **05,** 460; amount increased to $50,000, **07,** 541.

CC-1(h) Ohio River. (Operating snag boats on, in Pennsylvania.)

APPROPRIATIONS. (See p. 912.)

ENGINEERS.

Chief of Engineers. R., 06, 526; **07,** 553; **08,** 589; **09,** 623; **10,** 696; **11,** 749; **12,** 904.

In charge:

Maj. W. L. Sibert, 1906. **R., 06,** 1606.

Maj. H. C. Newcomer, 1907. **R., 07,** 1726; **08,** 1794; **09,** 1778; (Lt. Col.) **10,** 1939; **11,** 2134; **12,** 2325.

OPERATIONS.

1905-06. 3 coal boats, 3 fuel flats, and a large snag removed, **06,** 1607.

1906-07. 3 fuel flats, 2 coal barges, coal boat, and dismantled hull of U. S. str. *Slackwater* removed, **07,** 553.

1907-08. 2 coal barges, 2 fuel flats, and 2 snags removed, **08,** 1795.

1908-09. 1 coal boat and 1 barge removed, **09,** 1779.

1909-10. 1 coal boat and 1 barge removed. **10,** 1939.

1910-11. 1 flat, 2 coal boats, and 1 snag removed, **11,** 2134.

1911-12. 5 SS. hulls, 1 coal flat, 2 sunken trees, 10 snags, and a large number of rs. removed, **12,** 2325.

PROJECTS.

Proj. au. July 27, 1905, removal of snags, wrecks, and similar obstr., in portions of Ohio R. in Pennsylvania, **06,** 526.

CC-2(a) Cairo, Ill., to Brunswick, Ga. Survey. Mississippi River to the Atlantic.

(Transportation Routes to Seaboard.)

COMMERCE.

Requirements, **72,** 511, 518.

ENGINEERS.

Chief of Engineers. **R., 72,** 59, 60.

In charge. Maj. W. McFarland. **R., 72,** 405, 502, 509.

Assistants:

Lt. J. F. Gregory, **72,** 496, 510.

Lt. B. D. Greene, **72,** 496, 510.

J. C. Long. **R., 72,** 520.

R. C. McCalla. **R., 72,** 526.

PHYSICAL CHARACTERISTICS.

Description, **72,** 7, 512–517, 520, 526.

PLANS.

By Maj. McFarland, 1872, for chans., allowing passage of barges, carrying 170 t. of freight at l. w., and 300 t. at ordinary stages.

Divisions.	River improvements (distance).	Canal and slack-water (distance).	Estimated cost.	Divisions.	River improvements (distance).	Canal and slack-water (distance).	Estimated cost.
	Miles.	*Miles.*			*Miles.*	*Miles.*	
Ohio	50	.....	$45,000	Georgia	.....	211¼	$20,435,684
Tennessee	255	.....	500,000	Altamaha	410	45	2,500,000
Muscle Shoals	.....	38	3,676,000	To Brunswick	.....	20	1,000,000
Alabama	75	.....	75,000				
Sand Mountain	.....	50½	11,570,607	Total	943½	364¾	39,902,291
Coosa	153½	.....	100,000				

By J. C. Long, 1872, Sand Mountain division; est., $10,070,607, **72,** 516, 522, 525.

By R. C. McCalla, 1872, Georgia division, $20,435,634, **72,** 516, 535.

SURVEYS.

By Lts. Gregory and B. D. Greene, 1871–72, under direction of Maj. McFarland, Tennessee division. **R., 72,** 495, 510.

By J. C. Long, 1871–72, Sand Mountain division. **R., 72,** 510, 520.

By R. C. McCalla, 1871–72, Georgia division **R., 72,** 510, 526.

CC-2(b) Ohio River, Cairo to Pittsburgh.[1]

("Transportation Routes to Seaboard.")

COMMERCE.

Requirements, **75,** ii, 629.

DOCUMENTS. (Not printed in reports.)

R. of W. Milnor Roberts in 1870, H. D. 70, 41st, 3d; **75,** ii, 608.

ENGINEERS.

Chief of Engineers. **R., 75,** 37.

Boards. Of 1872 recom. that Maj. Merrill prepare practical details for constr. of the Brunot movable gates for chutes and locks. **R., 74,** 415–481. (Majs. Weitzel and Merrill.)

In charge. Maj. W. E. Merrill, 1874–75. **R, 75,** ii, 608–631.

Assistants:

Lt. F. A. Mahan, **75,** ii, 631.

W. Weston, **75,** ii, 631.

ESTIMATES. (See Plans.)

By Maj. W. E. Merrill, 1875, imp. of Ohio R. with—

12 locks on rock	$2,153,320
56 locks on gravel	15,969,408
8 navigable passes on rock	532,480
60 navigable passes on gravel	5,445,840

[1] See also **R.** by BE., Dec. 15, 1906, on general imp.—H. D. 492, 60th, 1st.

6 low weirs on rock	$332,544
62 low weirs on gravel	5,259,584
3 high weirs on rock	234,486
65 high weirs on gravel	6,492,923
23 piers on rock	116,127
113 piers on gravel	604,663
68 abutments on gravel	705,500
10,840 l. f. dam across island chutes	847,796
Total	38,696,671

About $40,000,000, or $41,365 per m., **75,** ii, 629.

PHYSICAL CHARACTERISTICS.

Of slope, **75,** ii, 609; of discharge, **75,** ii, 615; freshets, **75,** ii, 612, 613; proposed location of dams, **75,** ii, 627, 628.

PLANS. (See Estimates.)

By Senate committee, thorough imp. to give 6′ or 7′ navigation at l. w., **75,** ii, 608.

By W. Milnor Roberts, slack-water navigation, with freshet chutes to be opened and closed with Brunot's hydraulic gates, **75,** ii, 608. Approv. by BE. of 1872, **75,** ii, 608.

By Maj. Merrill, the French (Chanoine) system of movable dams, instead of the Brunot system; navigable passes of w. of 400′; approx. location of proposed dams; est., $40,000,000, **75,** ii, 608, 614, 627, 628, 629.

SURVEYS.

By Maj. Merrill, 1874–75. **R., 75,** ii, 608–631.

Map. Sketch showing proposed arrangement of lock and dam, **75,** ii, 630.

CC-2(c) Ohio River. (Levees at Cairo, Ill.)

APPROPRIATIONS. (See p. 912.)

ENGINEERS.

Chief of Engineers. R., 12, 889.

In charge. Lt. Col. H. Jervey, 1912–. **R., 12,** 2295.

PROJECT.

Act July 25, 1912, au. raising and strengthening levees in the city of Cairo, Ill., on the Ohio and Mississippi Rs., and in the Cairo drainage district, and that city of Cairo should expend same amount ($250,000), **12,** 889.

CC-4 Ohio River. (Levees at Mound City, Ill.)

APPROPRIATIONS. (See p. 912.)

ENGINEERS.

Chief of Engineers. R., 12, 890.

In charge. Lt. Col. H. Jervey, 1912–. **R., 12,** 2295.

PROJECT.

Act June 25, 1912, au. raising and strengthening levees at Mound City, Ill., on condition that city should furnish equal amount for same purpose ($20,000), **12,** 2295.

CC-7 Paducah, Ky.

ENGINEERS.

Chief of Engineers. R., 85, 284; **87,** 243.

In charge. Lt. Col. W. E. Merrill, 1884–87. **R., 85,** 1830; **87,** 1833.

Assistants:
Lt. G. W. Goethals. **R., 85,** 1830.
Lt. L. H. Beach. **R., 87,** 1833.

PHYSICAL CHARACTERISTICS.

Washing of R. banks, **85,** 1830.

SURVEYS.

Ex. au. act July 5, 1884; made by Lt. Col. Merrill (**R.** unfav.), **85,** 1830.

CC-17 Shawneetown Harbor, Ill.

ENGINEERS.

Chief of Engineers. R., 85, 284.

In charge. Lt. Col. W. E. Merrill. **R., 85,** 1828.

PHYSICAL CHARACTERISTICS.

In 1884 the object desired was a levee to protect the town against flood, **85,** 1828.

SURVEY.

Ex. au. act July 5, 1884; made by Col. Merrill (**R.** unfav.), **85,** 1828.

CC-21 Mount Vernon Harbor, Ind.

COMMERCE.
Mainly local, **73,** 526.

ENGINEERS.
Chief of Engineers. R., 73, 60.

In charge. Maj. Wm. E. Merrill, 1872–73. **R., 73,** 523.

PHYSICAL CHARACTERISTICS.
Gradual formation of a bar and towhead in the R., **73,** 524.

PLANS.
By Maj. Merrill: (1) Dr. chan. 200′ w. through the bar; est., $9,000, trusting to the scouring action of the induced currents to widen the artificial chan. and remove the bar; (2) dr. away the towhead to 3′ below l. w.; est., $22,500; (3) increasing the velocity of the R. current, directing it upon the towhead to wear it away, with brush and st. dikes 3,200′ l. and 14′ above l. w.; est., $23,650. Discussion of relative merits of the various plans, **73,** 525.

SURVEYS.
Ex. by Maj. Merrill, 1872. **R., 73,** 523.

CC-22 Ohio River. (Constructing Lock and Dam No. 48.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.
1911. Ohio River Cont. Co., building Lock and Dam No. 48, $1,361,900.03, **12,** 2428.

ENGINEERS.
Chief of Engineers. R., 10, 725; **11,** 782; **12,** 938.

In charge:
Capt. Lytle Brown, 1911. **R., 11,** 2231.
Lt. Col. H. Jervey, 1912–. **R., 12,** 2427.

OPERATIONS.
1910-11. Sur., borings, preparation of drawings, negotiations for purchasing land, etc., in progress, **11,** 2231.
1911-12. Materials assembled and quarters being built; beginning constr. of lock cofferdam, **12,** 2428.

PROJECT.
Act June 25, 1910, au. purchase of site and beginning constr. of lock and dam near Henderson, Ky.; est., $1,840,000,[1] **10,** 726; **11,** 782.
Maps.[1]

CC-24(a) Ohio River near Evansville, Ind.

ENGINEERS.
Chief of Engineers. R., 88, 218; **91,** 294.

In charge. Lt. Col. W. E. Merrill, 1887–91. **R., 88,** 1715, 1716; **91,** 2382, 2383.

Assistants:
Lt. L. Beach. **R., 88,** 1715.
J. N. Caldwell. **R., 88,** 1718; **91,** 2385.

PHYSICAL CHARACTERISTICS.
Description of, **88,** 1716.
A possibility of the R. cutting through a neck of land about 6 m. above the city, 1892, leaving the city inland. A lack of navigable depth in front of the public landing in the same year, **93,** 2521; **95,** 2388. Extreme low and high tides during 1897–98, **98,** 2944.

PLANS.
By Lt. Col. Merrill, 1887, purchase of land, tree planting, and erection of wire fencing to serve as a barrier to catch drift and sediment, reducing the velocity of the overflow; est., $49,000, **88,** 1717; **91,** 2384.

PROJECTS.
Evansville, Ind.: Lt. Col. Stickney est., 1892, $300 for sur., **93,** 2523. Act 1864 allotted $25,000 to prevent threatened cut-off near this place, **95,** 2329. Lt. Col. Stickney, 1895, est. $39,592.25 to imp. R. in this vicinity, **95,** 2388.
By Maj. Heuer, 1896, for 6 dikes, with l. of from 180′ to 500′ and bank revet. at some 11 places, 1 to 6 m. above the town, grading of the bank to be done where necessary, **97,** 2328. Modification, **98,** 2044.

SURVEYS.
Au. act Aug. 5, 1886, to determine means for preventing change of R. chan. in front of city; made, 1887, by Lt. Col. Merrill, **87,** 244; **88,** 1716; **91,** 2383.

CC-27 Owensboro Harbor, Ky.

ENGINEERS.
Chief of Engineers. R., 85, 284; **89,** 254; **91,** 294, 2380.

In charge. Lt. Col. W. E. Merrill, 1884–91. **R., 85,** 1831; **89,** 1903; **91,** 2380.

Assistant. G. W. Goethals. **R., 85,** 1831.

SURVEYS.
Ex. au. act July 5, 1884; made by Lt. Col. Merrill (**R.** unfav.), **85,** 1831.
Ex. au. act Aug. 11, 1888; made, 1889, by Lt. Col. Merrill, **89,** 1903.
Ex. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Merrill (**R.** unfav.) **91,** 2380

[1] H. D. 492, 60th, 1st.

CC-34 Ohio River. (Constructing Lock and Dam No. 43.)

APPROPRIATIONS. (See p. 912.)

ENGINEERS.

Chief of Engineers. R., 12, 937.

In charge:
Maj. Lytle Brown, **12,** 929.
Lt. Col. H. Jervey, **12,** 929.

PROJECT.

Act June 25, 1912, au. constr. lock and dam near New Amsterdam, Ind.; est., $1,480,000,[1] **12,** 937.
Maps.[1]

CC-36 New Albany Harbor, Ind. (and river and shores adjacent).

ENGINEERS.

Chief of Engineers. R., 85, 284.

In charge. Lt. Col. W. E. Merrill, 1884. **R., 85,** 1829.

Assistant. Lt. G. W. Goethals. **R., 85,** 1829.

SURVEY.

Ex. au. act July 5, 1884; made, 1884, by Lt. Col. Merrill (**R.** unfav.), **85,** 1829.

CC-39(a) Ohio River Falls—(1) Louisville and Portland Canal, and (2) Indiana Chute.[2]

APPROPRIATIONS. (See p. 912.)

COMMERCE.

Important, **68,** 533, 538; **69,** 48, 279; **70,** 385; **71,** 461; **73,** 537, 539.
Dimensions of largest vessels on the Ohio, **66,** iv, 265; **68,** 537.
Dimensions of canal and locks to meet requirements of C., **68,** 529, 537.
"Present canal" (see Private and corporate work) a severe tax on C., **69,** 48, 279; **73,** 537.
Canal as modified and enlarged by U. S. nearly ready for passage of boats when miter sills gave way, Nov. 23, 1871, **72,** 444.
Repair of, and passage of largest boats, Feb. 26, 1872, **72,** 444; **73,** 529, 537.
Proposition of Congress, 1872, to assume charge of work and fix tolls at 25¢ t., **73,** 527; considered onerous, and that a toll of 5¢ t. sufficient, **73,** 527, 529, 537.
Transfer of canal to U. S., June 11, 1874 (see Legislation; and Private and corporate work), **75,** 778.
Rules proposed for passage of boats, **75,** 784; **76,** 756, 765.
Necessity of, **75,** 775, 776, 784; **76,** 750; **77,** 607, 614, 619.
Tolls, amount of, collected by canal company, 1831 to 1873, $5,157,247, **73,** 536.
Rate of, **73,** 538.
An onerous tax on C., **69,** 48, 279; **73,** 537.
New rate of tolls fixed on transfer of canal to U. S., **75,** 775, 778; **76,** 761; **77,** 612, 613, 616, 619, 640.
Recom. reduction to 5¢ t. on returning empty barges, **76,** 756; **77,** 616.
Amount of tolls received. (See Financial statements.)
Statement of vessels passing canal. (See each an. report.)
Statistics, **68,** 533; **71,** 416. (See Commerce, Ohio River.)
Tolls abolished after July 1, 1880, **80,** 191.
Statement of C. passing Falls by canal and by R., 1880 to 1887, **87,** 1852.
Dry-dock facilities on Ohio R., **87,** 1896–1901.
Large and important; chiefly coal. Decrease of shipments in 1893 probably due to ice and l. w., **93,** 2545, 2546; **94,** 1930.
Indiana Chute: Important; coal traffic largest, **93,** 2551; **96,** 2225. Coal tows, if the stage of water is less than 10′, must be broken up and passed through the canal, a tedious and expensive operation. A coal-boat stage usually brings many tows together, and it often happens that before all have passed the canal, the water falls to a point which prevents their further progress until another rise occurs. When Indiana Chute is navigable for descending tows on an 8′ stage, all delays of coal tows will be avoided, **96,** 2225.
1899 to 1903, about 4,035,000 t. and 1,563,650 passengers, **04,** 2705.
Imp. believed to have had considerable influence in reducing transportation charges and regulating rates, **06,** 548.

CONTRACTS.[3]

1869. D. C. Hill, timber for upper dam, **69,** 277.
Lewis, Oliver & Phillips, iron for upper dam, **69,** 277.
Shipley & Loyal, labor in constr. of upper dam, **69,** 277; delay of contractors, and requirement of funds on other work cause unfilled contract to be concluded, **71,** 458.
M. P. Wood, for r. excavation inside of the apron dam (entrance), **70,** 389; after unsuccessful efforts to do the work, contract abrogated, **71,** 453.

1870. H. T. Cook, completing new locks, and branch into canal, **70,** 389; **71,** 467; completed, **72,** 443.
Deveraux & Son, enlarging section, No. 1, **70,** 389; completed, **71,** 457.

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[1] H. D. 492, 60th, 1st.
[2] Ohio R. at the Falls: Sur.—**R.** Feb. 3, 1844; est., $526,695 and $351,777. Ex.—**R.** (fav.) May 6, 1845. Ohio R., Louisville and Portland Canal: Sur.—**R.,** Feb. 3, 1844, est., $1,266,438; Feb. 14, 1853, est., $2,500,000. (H. Doc. 482, 55th, 2d.)
[3] Method of partial app. increasing est. cost of work. **74,** 568; **75,** 774; **76,** 749; **77,** 607.

McGlincey & Co., enlarging section No. 2, **70,** 389; extension of time given, **71,** 457; completed, **73,** 527.
Black & Co., enlarging sections Nos. 3 and 4, **70,** 389; extension of time given, **71,** 457; completed, **72,** 443.

1871. Sheehan & Loler, constr. of retaining walls, and grading canal slopes, **72,** 444, 448; completed, **74,** 567.
Byrne & McKenzie, constr. of retaining walls of section No. 1, **71,** 467; completed, **72,** 443.
J. C. Dennis, constr. of retaining walls of section No. 2, **71,** 467; completed, **72,** 443.
Boyle & Roach, constr. of retaining walls of sections Nos. 3, 4, and 5, **71,** 467; completed, **72,** 443; also constr. of guide walls, and r. excavation below new locks, **71,** 467; **73,** 527; completed, **74,** 567.
M. Gleason, earth and r. excavation in new branch, **71,** 467; completed, **72,** 443.
M. S. Lord, moving outer protection wall at railroad br., **71,** 467; **73,** 527; completed, **74,** 567.
Ferrell & Clark, constr. of lower dam, **71,** 467; completed, **73,** 527.

1873. Since Nov. all work done with hired labor, **75,** 772.

1884. Salem Stone & Lime Co., lock-sill st., **84,** 1693.
Burnet & Co., iron dr. hull, **85,** 1803.

1885. I. Malloy and G. W. Lewis, earth and r. excavation, **85,** 1811, 1812; **86,** 1569.
Gleason & Gosnell, r. excavation, 85¢ c. y., **86,** 1571.

1886. M. A. Sweeney & Bros., towboat, **86,** 1577. A. H. Dugan, coal, $2,238; M. A. Sweeney & Bro., towboat machinery, **87,** 1847.

1887. Gleason & Gosnell, earth excavation, 17½¢ c. y.; r. removal, $1.05 c. y., **87,** 1840.
Salem Stone & Lime Co., masonry, $10.43 c. y., **87,** 1840.
A. H. Dugan, coal, $3,301, **87,** 1847.

1888. P. H. Sweeney, st. revet.; face st., $2.22 c. y.; gravel backing, 74½¢ c. y.; building revet., 39½¢ c. y., **88,** 1733.
A. H. Dugan, coal, $4,622, **88,** 1731, 1732.

1889. A. H. Dugan, coal, $4,318.50, **89,** 1923, 1924.
1890. A. H. Dugan, coal, $4,316.50, **90,** 2224.

1891. Salem Stone & Lime Co., st., $7.40 and $8 c. y., **91,** 2390.
A. H. Dugan, coal, $4,375, **91,** 2398.

1892. A. H. Dugan, coal, $6,085, **92,** 2028.
1899. C. Hegewald Co., steel, iron, and woodwork of movable dam, $8,915.71, **99,** 2548.
1905. The Brackett Bridge Co., steel and iron work for new Boulé dam (unit prices given), **06,** 1668.
1907. Chas. Hegewald Co., trestles for Boulé dam (prices listed); Grainger & Co., steel and iron parts for Chanoine dam (unit prices given), **07,** 1799.
1911. The Ohio R. Contract Co., constr. Lock and Dam No. 41, $1,016,809.50 (unit prices given), **12,** 2415.

DOCUMENTS. (Not printed in reports.)

Misc. H. Doc. 83, 40th Cong., 2d sess. (History of State and Federal legislation relative to Louisville and Portland Canal), **73,** 530, 540.

ENCROACHMENTS.

Relating to discharge of sewage of city of Louisville into the canal, **87,** 1852–1863.

ENGINEERS.

Chief of Engineers. R., 67, 38; **68,** 56; **69,** 47, 277; **70,** 63; **71,** 61; **72,** 58; **73,** 60; **74,** 68; **75,** 73; **76,** 87; **77,** 92; **78,** 106, 782; **79,** 143, 1289; **80,** 191, 1728; **81,** 258; **82,** 252, 253; **83,** 261, 263; **84** 261, 262; **85,** 281, 282; **86,** 276, 277; **87,** 244–249, 1854; **88,** 218, 219; **89,** 254–256; **90,** 229, 230; **91,** 295, 296; **92,** 283, 284; **93,** 320 321; **94,** 293, 295; **95,** 328, 329; **96,** 284, 285; **97,** 364; **98,** 347; **99,** 440; **00,** 503; **01,** 496, 505; **02,** 421; **03,** 452; **04,** 484, 502; **05,** 493; **06,** 544; **07,** 570; **08,** 612; **09,** 644; **10,** 719; **11,** 775; **12,** 929.

Boards:
Convened, 1871, to ex. new locks (Louisville and Portland Canal) and report cause of failure of miter sills (Nov. 23, 1871), and plan for repair or modification. Considers that buoyant effect of gate (in excess of weight), added to pressure of gate against miter sill, caused a lifting of voussoirs, permitting water to pass under. Board consider plan of repair adopted by Maj. Weitzel as sufficient when added to recom. that each voussoir be bolted to those below, **72,** 460. (Col. Barnard, Lt. Col. Foster, and Maj. Poe.)

Convened at Louisville, Ky., Jan. 28, 1890, by S. O. No. 68, to ex. and report upon revised proj. for imp. of Indiana Chute and Falls of the Ohio at the head of the Louisville and Portland Canal. **R., 90,** 2217. (Lt. Col. Merrill and Majs. Stickney and Mackenzie.)

Constituted by S. O. No. 13, Mar. 11, 1899, convened Mar. 30, 1899, Louisville, Ky., to consider and report on revision of proj. for imp. of the Falls. **R.** (maps), **99,** 2562. (Lt. Col. A. Stickney, Maj. Bixby, and Capt. Zinn.)

Constituted by S. O. No. 41, Oct. 29, 1901, to consider and report upon subject of imp. of Falls of Ohio R. at Indiana Chute. (See Projects.) (Col. Amos Stickney, Lt. Col. T. H. Handbury, Capt. W. L. Sibert.) **R., 02,** 1970.

Ex. head of Falls. **R., 04,** 2708, 2710.

In charge:
Maj. G. Weitzel, 1867–82, **67,** 38. **R., 68,** 523, 528; **69,** 273; **70,** 382; **71,** 457; **72,** 442, 452; **73,** 526, 529; **74,** 566; **75,** 772; **76,** 747; **77,** 605, 607, 612; **78,** 783; **79,** 1283, 1284, 1290; (Lt. Col.) **80,** 1723, 1724, 1727, 1729; **81,** 1899, 1904; **82,** 1877, 1880, 1903.
Capt. A. Mackenzie, in temporary charge, **78,** 106, 769. **R., 78,** 769.
Maj. F. U. Farquhar, 1882. **83,** 260.
Lt. Col. W. E. Merrill, 1882–86. **R., 83,** 1527, 1533, 1539; **84,** 1681, 1692, 1699; **85,** 1803, 1811.
Maj. A. Stickney, 1886–90. **R., 86,** 1569, 1572, 1574; **87,** 1838, 1842, 1843, 1855, 1896; **88,** 1723, 1727, 1728; **89,** 1913, 1917, 1920.
Capt. E. Maguire, 1890–91. **R., 90,** 2211, 2215, 2221.
Lt. Col. G. J. Lydecker, 1891–93. **R., 91,** 2387, 2393, 2394; **92,** 2015, 2020, 2024; **93,** 2543, 2549.
Capt. J. G. Warren, 1894–98. **R., 94,** 1929, 1933; **95,** 2427, 2431; **96,** 2221, 2224; **97,** 2441; **98,** 1951.
Capt. G. A. Zinn, 1899–1901. **R., 99,** 2545; **00,** 3463; **01,** 2817.
Capt. W. L. Sibert, 1901–02. **R., 01,** 2783; **02.** 1964.
Maj. E. H. Ruffner, 1902 and 1904. **R., 02,** 1961; **04,** 2712.
Maj. G. McC. Derby, 1903. **R., 03,** 1763; **04,** 2703.
Lt. H. Burgess, 1904–08. **R., 04,** 2662, 2710; (Capt.) **05,** 1929; **06,** 1665; **07,** 1795; **08,** 1865.
Lt. Col. J. G. Warren, 1909. **R., 09,** 1857.
Capt. Lytle Brown, 1910–11. **R., 10,** 2013; **11,** 2215.
Lt. Col. H. Jervey, 1912–. **R., 12,** 2411.

Assistants:
G. R. Eichbaum. **R., 68,** 539.
Capt. M. B. Adams, **73,** 60; **74,** 67. **R., 74,** 566.
Capt. A. Mackenzie, **75,** 778. **R., 75,** 772, 774, 784; **76,** 747, 751, 757; **77,** 605, 610; **79,** 769.
P. J. Schopp, **75,** 778. **R., 81,** 1902, 1905; **82,** 1879, 1903; **83,** 1537; **84,** 1694; **85,** 1805, 1813.
S. E. Palmer, **75,** 778.
Capt. A. N. Lee. **R., 78,** 769, 773, 786; **79,** 1284, 1285, 1293.
T. H. Taylor. **R., 86,** 1578; **87,** 1847; **88,** 1733.
G. W. Shaw. **R., 86,** 1571; **87,** 1840; **88,** 1727; **89,** 1915, 1918; **90,** 2212, 2216; **91,** 2391; **92,** 2020, 2022; **93,** 2547, 2552; **98,** 1955; **99,** 2551; **00,** 3479; **01,** 2789; **02,** 1963; **05,** 1933.

C. L. Cornwell. **R., 86,** 1573; **87,** 1862.
J. P. Claybrook. **R., 87,** 1842; **88,** 1726.
R. R. Jones. **R., 89,** 1916, 1924; **90,** 2213, 2225; **91,** 2391, 2399; **92,** 2018, 2028.
Lt. H. M. Chittenden. **R., 94,** 1931.
J. H. Casey. **R., 98,** 1954; **99,** 2549; **00,** 3467; **01,** 2785; **05,** 1934.

ESTIMATES. (See Plans and Projects.)

By Maj. Weitzel, 1868 (see Projects), canal on Indiana side of Falls, $3,470,000, **68,** 57, 530, 536, 537, 548, together with an extension and enlargement of Louisville and Portland Canal, $933,500, **68,** 57, 531, 535, 536, 537, 548, 554; also constr. of 2 dams, one at crest and other below Falls, $225,000. Aggregate cost of proj., $4,628,500; modified by required substitution of lock in lower dam to $4,818,500, **68,** 524. If canal on Indiana side be omitted, est. reduced by omission of $3,470,000, and reduction in cost of dams and lock of $105,000 to $1,243,500, **68,** 524; **69,** 274; **78,** 772; **79,** 1283. Cost exceeds ests.; cause of, **74,** 568; **75,** 774; **76,** 749; **77,** 607; **79,** 1283. Est. cost of accessories to mainten. and management (for 1875–76), $40,000, **75,** 784; of mainten. and superintendence (for 1876–77), $60,087, **76,** 764; (for 1877–78) $45,600, **77,** 617.

FINANCIAL STATEMENTS.

Liabilities: Amount to be assumed by U. S. in taking control of canal, **73,** 536. Receipts and disbursements in management of canal, **75,** 776, 781, and subsequent an. reports.

LEGISLATION.

Charter granted by Kentucky to build canal and locks at Falls, **66,** iv, 264.
History of State and Federal legislation relative to Louisville and Portland Canal.
Misc. H. Doc. 83, 40th Cong., 2d sess., **73,** 530, 540.
Action of Congress, 1872, toward freeing canal from incumbrance and reduction of tolls (not to exceed 5¢ t.) to an amount only sufficient to provide for superintendence and repair, **72,** 444.
Opposition of canal company to rates of toll fixed by U. S., **72,** 445.
Supreme Court of U. S. granted injunction (Aug., 1872) against canal company interfering with work done by U. S., but decided that canal company alone had power to regulate tolls, **72,** 452; **73,** 60, 527, 530.
Legislative action of Kentucky, 1872, au. surrender of canal to U. S. upon certain conditions, **73,** 534.
Act of Congress May 11, 1872, providing for payment of bonds of canal company and transfer of all property to U. S., **74,** 68.
Necessity of legislation regulating passage of boats through canal, **75,** 775, 776, 784; **76,** 750; **77,** 607, 614, 619.
Rules proposed, **75,** 784; **76,** 756, 765.
History of canal, **82,** 1881–83.
Laws relating to the Louisville and Portland Canal, **83,** 1540; **87,** 1857.
Act of Congress making canal free from tolls after July 1, 1880, **80,** 1724.

OPERATIONS.[1]

1869-70. Completion of apron dam at head of canal and one-third of upper dam, **70,** 382. Accident to cofferdam prevented removal of r. from entrance, **70,** 383.

1870-71. Progress on widening prism, enlargement of entrance, and work on new locks, **71,** 457. Contract for removal of r. inside apron dam (entrance) abrogated; dam across R. (upper) delayed, and contract concluded, **71,** 458.

1871-72. Upper dam half completed by hired labor, **72,** 57, 443. Enlargement to entrance; widening prism; excavation of basin and new branch; locks, gates, and machinery; r. excavation at outlet; new locks and lower dams from Indiana side to Sand Isld. completed, **72,** 57, 443, 444. Water let in Nov. 23, 1871, when miter sills gave way, **72,** 57, 444. (See Board of Engineers.) Cause of accident, **72,** 452, 460. Miter sills repaired, **72,** 57, 444, 452, 460. Canal opened to C. Feb. 26, 1872, **72,** 444; **73,** 529.

1872-73. After Nov., 1873, all work done by hired labor, **75,** 772. Widening section No. 2, lower dam; guide walls completed, **73,** 527.

1873-74. Rock excavation at head and foot of canal; also upper dam nearly completed; on account of high proposals work done by hired labor, **74,** 68, 567. Cost of r. excavation, $8.83 and $9.32 c. y., **74,** 568.

1874-75. Repairs and extension of lower dam, repairs to upper dam, r. excavation at head of canal; cost, $4.95 c. y., **75,** 772.

1875-76. Limited (by h. w. and accident to cofferdam) to removal of 600 c. y. r. from entrance, **76,** 748.

1876-77. No work done on account of h. w., **77,** 92, 605.

1877-78. 5,659 c. y. r., 817 c. y. earth, and iron barge removed from head of canal. Cross dam at head of Falls extended 128′, **78,** 106, 769, 782.

1878-79. Progress on movable dam at head of Falls, **79,** 143, 1283, 1285, 1288.

1879-80. Progress on imp. of Indiana Chute, **80,** 1723. Operation and mainten. of canal, **80,** 1724, 1729; 60,934 c. y. excavated from canal, **80,** 1727.

1880-81. Progress on Indiana Chute, **81,** 1899, 1902. Operation and mainten. of canal, **81,** 1904; 66,598 c. y. dr. from canal, **81,** 1909.

1881-82. Progress on Indiana Chute, **82,** 1877. Operation and mainten. of canal, **82,** 1903, 1908; 82,198 c. y. dr. from canal, **82,** 1908.

1882-83. Progress on Indiana Chute, **83,** 1527. Operation and mainten. of canal; 111,916 c. y. dr. from canal, **83,** 1533, 1537.

1883-84. Progress on Indiana Chute, **84,** 1681. Operation and mainten. of canal; 100,760 c. y. dr. from canal, **84,** 1692, 1694.

1884-85. Operation and mainten. of canal, **85,** 1803; 79,975 c. y. dr. from canal; rebuilding middle miter sill; pipes for removal of débris placed in new locks; new dr. in process of constr. with repairs to old dr., **85,** 1804, 1805; 817 c. y. earth and 2,363 c. y. r. removed in enlargement of canal entrance, **85,** 1811, 1813.

1885-86. On canal enlargement 121,406 c. y. earth, 16,986 c. y. solid r., 4,484 c. y. loose r., and 15,226 c. y. dry wall removed, **86,** 1571; 451 c. y. r. removed from Indiana Chute, and repairs made to cross dam, **86,** 1572, 1573. Operation and mainten. of canal, **86,** 1574, 1578; 102,312 c. y. dr. from canal; completion of dr. hull; repair of locks, **86,** 1574, 1578.

1886-87. On canal enlargement, 29,143 c. y. earth, 40,666 c. y. solid r., 8,963 c. y. loose r., and 5,785 c. y. dry wall removed; 630 c. y. masonry laid, **87,** 1838, 1841. On enlargement of canal basin, 66,246 c. y. earth and 341 c. y. r. removed, **87,** 1838, 1842. Repairs to dams at Indiana Chute, **87,** 1842. Operation and mainten. of canal, **87,** 1843, 1847; 106,720 c. y. dr. from canal, **87,** 1849.

1887-88. 49,883 c. y. solid r., 195 c. y. loose r., 1,908 c. y. dry wall, and 9,185 c. y. earth excavated in enlargement of upper portion of Louisville and Portland Canal; 4,928 c. y. masonry laid in new canal wall; 42,549 c. y. earth and 3,234 c. y. r. excavated from basin at head of locks; constr. and repair of plant, **88,** 1726. Removal of r. reef and repairs to cross dam and guiding dike at Indiana

[1] History of early operations, **78,** 776.

Chute, **88,** 1728. Operation and care of canal, **88,** 1728, 1733. 104,195 c. y. dr from canal, **88,** 1735.

1888-89. 2,499 c. y. earth and 2,491 c. y. r. excavated in canal enlargement; purchase and constr. of plant, **89,** 1916; 7,682 c. y. earth excavated in enlargement of canal basin, **89,** 1917. Operation and care of canal, **89,** 1920. 82,000 c. y. dr. from canal, **89,** 1926.

1889-90. 12,998 c. y. r. excavated in canal enlargement, **90,** 2213; 13,356 c. y. earth and 10,805 c. y. r. excavated in enlargement of canal basin, 1,585 c. y. st. removed from old wall, and 108 c. y. concrete and 1,331 c. y. st. placed in new wall, **90,** 2214, 2215. Operation and care of canal, **90,** 2221. 101,540 c. y. dr. from canal, **90,** 2227.

1890-91. 3,784 c. y. earth and 171 c. y. r. excavated in enlargement of canal basin above the locks, and 469 c. y. masonry built, **91,** 2388; 8,072 c. y. r. removed in enlargement of upper portion of canal, **91,** 2389. Operation and care of Louisville and Portland Canal, **91,** 2394. 100,585 c. y. dr. from canal, **91,** 2398.

1891-92. 15,299 c. y. earth and 42,856 c. y. r. excavated in enlargement at head of canal, **92,** 2016; 11,760 c. y. earth and 3,364 c. y. r. excavated in canal enlargement above the locks, and 3,704 c. y. masonry placed in new wall; 1,570 c. y. r. removed from old canal wall, **92,** 2017. Old guiding dike at Indiana Chute raised and repaired; cross dam repaired and rebuilt above water line; 1,474 c. y. r. removed, **92,** 2021. Operation and care of Louisville and Portland Canal, **92,** 2024. 86,825 c. y. dr. from canal, **92,** 2024.

1892-93. 13,362 c. y. r. and 34,486 c. y. earth excavated and removed; 3,371 c. y. masonry laid, in enlargement of canal (progress map), **93,** 2544.

Indiana Chute: 27,585 c. y. r. excavated and removed, and some deposited in dikes (progress map), **93,** 2551.

1893-94. Enlargement of basin above locks completed, about 6,000 c. y. r. and mud removed; guiding dike at head of canal repaired, **94,** 1930-1932.

Indiana Chute: Cross dam at falls crest repaired, **94,** 1934.

1894-95. 7,467 c. y. st. removed from old n. wall and transf. to s. bank of canal; 1,032 c. y. masonry placed in new wall; temporary dam, requiring 202,349′ b. m. lumber and 5,500 c. y. st. filling built; 43,724 c. y. earth excavated and removed; 5,192 c. y. solid r. blasted; guide dike repaired, requiring 10,000′ lumber b. m.; storehouse built (progress map), **95,** 2429.

Indiana Chute: 1,736 c. y. r. excavated and most of it removed from chan. above RR. br.; cross dam repaired, using 63,000 c. f. b. m. lumber; and movable dam repaired (progress map), **95,** 2431, 2432.

1895-97. No operation. No funds.

1897-98. Retaining wall at the w. end of enlargement at the head of canal completed; drilling, blasting, and removal of material continued s. of the new n. wall; guiding dike and cross dam repaired bet. Middle and Indiana Chutes; water diverted from Indiana Chute, and exposed r. drilled and blasted; st. dike w. of Willow Pt. under constr. (progress maps, plans, photographs of compressor boat, and photographs of exposed bed of Indiana Chute), **98,** 1952.

1898-99. 103,833 c. y. earth and mud, and 19,110 c. y. r. removed from the head of the canal, unsuccessful attempt made to close opening in cross dam at Indiana Chute; st. dike at Willow Pt. completed; area to be excavated, drilled, graded, and partly blasted; dike increased at Wave Rock; blasting and drilling in progress, **99,** 2546.

1899-00. At head of canal concrete and Boulé dams completed; earth and r. excavation on old section 3 practically completed; almost all of guide dike and cross dam removed; drilling; in Indiana Chute excavation carried on; 16,242 c. y. r. removed, and 26,083 c. y. r. excavated from Wave Rock and placed in base of dike; dike almost finished to subgrade (photographs), **00,** 3464.

1900-01. Drilling and blasting, and dr. r. ledge e. of cross dam, under cross dam and strip w., and under guiding dike; constr. new hull for dr.; completion of chan. excavation above RR. br., at Willow Pt.; repairs to Willow Pt. dike; excavation at Wave Rock; and part of Wave Rock Dike completed, **01,** 2784.

1901-02. 1,385.5 c. y. r. removed toward enlargement of Louisville and Portland Canal. Indiana Chute work consisted in completion of Wave Rock Dike, repair Willow Pt. Dike, placing buoys on Wave Rock Dike, and repairing breaks in Wave Rock Dike, **02,** 1962.

1902-03. 24,167 c. y. disrupted r. removed at head of canal, repair of Wave Rock Dike, new scows delivered, and new boiler set up on Scow No. 2, **03,** 1764.

1903-04. 17,571 c. y. r. removed e. of former cross dam, **04,** 2662.

1904-05. Repairs to Wave Rock and Willow Pt. Dikes, 14,021 c. y. r. excavated for enlargement, **05,** 1930.

1905-06. Repairs to Wave Rock Dike damaged by ice, 3,227.80 c. y. solid r. disrupted. 4,287 c. y. disrupted r. dr. from R. near Falls; making of wickets for new Boulé dam, sec. No. 7 completed, **06,** 1666.

1906-07. Unfav. weather prevents work, **07,** 1797.

1907-08. Work on new sections of dam under progress; secs. 2 and 3 erected in place, and other misc. work done. Conditions of water seriously retarded progress at head of Falls, 6,851.19 c. y. r. disrupted, 10,999.55 c. y. r. removed, **08,** 1866.

1908-09. Description of operations on Boulé dam, secs. 5, 6, 7, 8, 9, Chanoine dam, sec. 10, concrete dam, sec. 11; removal of disrupted r. from head of Falls, **09,** 1857.

1909-10. Work on constr. Boulé dam, secs. 6, 7, 8, and 9, and Chanoine dam, sec. 10, in progress; 2,000 c. y., p. m., r. and 3,290, s. m., mud and gravel removed from head of Falls, **10,** 2013.

1910-11. Work on new Boulé dam practically completed; barges for operating dams built, borings to determine foundation for new lock made, **11,** 2217.

1911-12. Repairs to dam, constr. 2 new maneuver boats, operations on building new lock commenced, contractor excavating 269,559 c. y. common material, 586 c. y. r., and placed 38,599 c. y. fill, **12,** 2411.

PHYSICAL CHARACTERISTICS.

At Falls, **66,** iv, 264.

Distance from Pittsburgh to Falls, 615 m.; from Falls to Cairo, 400 m., **66,** iv, 264.—Corrected by subsequent surs., 967 m., **69,** 52, 353.

Amount of sediment deposited in locks, **76,** 759; **77,** 611.

Description of Falls, **82,** 1881.

Analysis of water in Louisville and Portland Canal, **87,** 1863. (See Encroachments.)

Ice and l. w. hinder, in their season, navigation, **93,** 2545, 2546.

Physical data, such as R. discharge, etc., **02,** 1965.

Depth over Wave Rock and Willow Pt., 8′, **04,** 487.

Development of water power, **04,** 2704.

Lightning explodes dynamite, sinking scow, **04,** 2662.

PLANS. (See Estimates and Projects.)

Description of various routes examined, **68,** 541.

System of suspending lock gates defective; abandonment of rollers, **77,** 618.

By Maj. Weitzel, 1882, conversion of 1,300′ additional dam on crest of the Falls into movable dams; enlargement at head of canal; constr. of an independent coal canal; for w. present canal; for gates in canal branch above new locks; for new lock parallel to present locks; for new dry dock; for enlarging basin at head of locks; est., $5,915,108, **82,** 1893-1902. Reasons for modifications, **83,** 1539.

By Maj. Stickney, 1887, enlargement of the dry dock at Louisville; est., $310,416, **87,** 1896-1900.

PRIVATE (STATE AND CORPORATE) WORK.

Louisville & Portland Canal Co., chartered by Kentucky, with au. to build locks and a canal on Kentucky side of Falls. Canal commenced 1825 and boats passed through 1828. Locks orig. 50′ x 184′; in 1865 2 new locks completed, 80′ x 390′, **66,** iv, 264.

History and description of, **68,** 531; **69,** 278; **70,** 385; **73,** 531, 538; **78,** 776; **82,** 1881; **87,** 1852. Misc. H. Doc. 83, 40th Cong., 2d sess., **73,** 530, 540.

Canal Co. claimed that the app. of 1872 ($300,000) was upon condition that tolls be reduced to 5¢ t.; deny right of U. S. to so reduce, and oppose application of app., **72,** 445, 449; injunction granted by Supreme Court against Canal Co. interfering with work, **72,** 452; **73,** 527, 530.

Kentucky, 1872, au. transfer of canal to U. S., **73,** 534.

Proposal of company to surrender, **73,** 530, 534, 539; accepted by U. S. and provision made by Congress to complete transfer, **75,** 777; transfer made June 11, 1874, **75,** 778. Right of the city of Louisville to grant use of canal property interferes with management of, by U. S., **76,** 759, 765. (See Legislation.)

History of the canal, **82,** 1881–1893; **87,** 1852.

PROJECTS. (See Estimates and Plans.)

See above.

By acts of Congress of May 13, 1826, and Mar. 2, 1829, U. S. became the owner of 2,335 shares of the stock of the company at a cost of $233,500.

Maj. G. Weitzel, 1868, canal and locks on Indiana side, canal 120′ w.; 6′ of water on miter sill; locks 100′ x 400′, **68,** 529; lockage 24′ in 2 lifts; l. of canal, 2.7 m., **68,** 530, together with extension and completion of Louisville and Portland Canal (see Private and corporate work) to w. of 90′, with 6′ of water on miter sills; locks 80′ x 335′, **68,** 531, together with masonry dam on crest of rs. in front of Louisville, and a timber dam at (foot of Falls) Falling Run; both dams to be provided with proper sluices, **68,** 535. Proj. modified by substitution of crib in place of masonry dam (upper), also lock in lower dam, **68,** 523; so much of above proj. as the constr. of upper and lower dam, with lock at latter, and extension and enlargement of "present" Louisville and Portland Canal approved, **69,** 48, 273; development of proj. requires enlargement of entrance (upper) to canal, with extension and completion of apron dam (to prevent boats being drawn on rocks), with removal of all r. within area to 6′, **69,** 273; necessity of protecting upper dam by substitution of r. on the apron in place of sand and gravel, **70,** 385; location of lower dam changed to head of Sand Isld., **71,** 459; necessity of raising outer protection wall (next to R.), **72,** 446; miter sills gave way upon filling of the locks, **72,** 452, 458, 460; modified constr. of (see Board of Engineers), **72,** 458, 460.

1868 to 1875, $1,463,300 app. for the imp. of Falls of the Ohio, and applied to the enlargement of the canal and the imp. of Indiana Chute.

In 1874 the U. S. assumed control of the canal, and on July 1, 1880, in accordance with the act of May 18, 1880, the canal made free from tolls.

Summarized cost of the works stated as about $4,800,000, **82,** 1882–93.

Modification, 1875, of orig. proj., i. e., to diminish opening of Indiana Chute (upper dam) to 600′, and increasing by 400′ the middle chute, **75,** 773; closing middle chute and 400′ of Indiana Chute by Chanoine wickets, **76,** 748; **77,** 605. (See Operations.) History and description of the work, **78,** 776. Description of lock details, **78,** 780.

Proj. modified, 1883, to provide for enlargement of existing canal by moving its n. wall to n. limit of canal property; removing "present" guiding dike and cross dam; constr. of dam along e. line of Louisville Cement Co.'s property, thence to the s. end of opening for Middle Chute; est., $1,335,363, **83,** 1539; **85,** 1812.

Indiana Chute: Object of this work was to render chan. over the Falls navigable for coal boats at all stages when they could reach Louisville, by w. the crooked and narrow chan. by r. removal, and facilitating navigation by building guiding dikes. Amount app. for the work to June 30, 1887, $125,000; est. cost of completion, $130,000, **87,** 1843.

In 1890 BE. recom. excavation of the reduced area at the head of the canal, the extension of the bear-trap structures, and the constr. of a dam parallel to the Kentucky shore, as planned by Maj. Stickney; also continuation of excavations in Indiana Chute, the extension of the guiding dike upstream, and the elevation of the crib dike on n. side of Indiana Chute; est. cost of completing enlargement at head of Louisville and Portland Canal as recom. by Board, $710,230.40, and for completion of work at Indiana Chute, $138,610.97, **90,** 2218–2220; **91,** 2390, 2393.

Est. quantity of work required to be done under existing proj., and table showing amount accomplished, **95,** 2428; **96,** 2222.

By Capt. Warren, 1894–95, applying available funds to building a 750′ l. temporary crib dam bet. guide dike and new wall, to allow completed part of work to be thrown open to traffic; and to misc. work, **95,** 2428.

Act 1896 consolidated with this work that for the imp. of Indiana Chute, **96,** 2223.

In 1897, after water had been diverted from Indiana Chute, it was found that the quantity of r. to be excavated had been underestimated, **98,** 1952.

BE., 1899, modified extent of area to be excavated, and determined definitely the character of the structures to be erected in the enlargement of the head of the canal, **99,** 2553.

Board, cons. S. O. No. 41, submits report upon additional work necessary to produce an 8′ chan. Contemplates forcing into Indiana Chute enough water to make a chan. of required w. and d., to be controlled by concrete dikes on either side of chute, and by submerged dams, if latter are found necessary; cost, $466,180. Approved by Chief of Engineers, Dec. 30, 1901, **02,** 1970. Capt. Sibert submits est. of $645,185 for this work, **02,** 1964.

Act Mar. 3, 1905, au. mainten. and alteration of existing dams, and for removing rs. in chan. of R. or canal near Falls, **05,** 1931.

Act Mar. 2, 1907, au. raising dam to give a min. d. of 9′ upstream to Madison, Ind., and min. d. of 6′ on lower miter sill at Lock No. 1, Kentucky R.; also removal of rs. in chan., **07,** 1796.

Work remaining to be done under "present" approv. proj., with additions thereto, **07,** 1796.

In H. D. 492, 60th, 1st, Ohio R. Board recom. omission of items submitted in est. of $466,180 (1901), except removing old dam and building movable dam at head of Falls, and in lieu of such omitted items submit new proposals, est. $1,760,000, as follows: (1) To w. narrow portion of canal to 170′; (2) to constr. new single-lift concrete lock; (3) to create a pool above Falls, elevation at 412.004 (9′ upper canal gauge); (4) to remove r. necessary to complete w. of basin at head of canal; (5) to reconstr. the 3 sections of Boulé dam n. of head of canal with crest of 415.704, instead of 412.504, **09,** 647.

In order that Lock and Dam No. 41 may be of same dimensions as other locks and dams on Ohio

R., Sec. of War, by au. act June 25, 1910, modified existing proj. by increasing canal prisms from 170′ to 200′, and increasing w. of new lock from 85′ to 110′; increased cost by $431,500,[1] **11,** 778.

SURVEYS.

For ship canal around Falls began July, 1867, **68,** 56, 528; previous sur. (Capt. Cram, 1844; Col. Long, 1849) not to supersede required sur.; minute character of last (1867), **68,** 528, 541, 552; various routes ex., **68,** 541.

Showing proposed changes at head of canal, **83,** 1539; **85,** 1812.

Indiana Chute, **86,** 1572.

Pre. ex. au. act June 6, 1900, with view to desirability of acquiring Sand Isld., and probable cost. **R.** by Capt. Zinn, June 20, 1900. Probable cost would be $25,000[2] (aq. not desirable nor necessary), **01,** 505, 2817.

Pre. ex. au. act June 13, 1902, at head of Falls. **R.** by Maj. Derby, Sept. 22, 1903, and Lt. Burgess, Dec. 1, 1903; 2 plans presented at ests. of $298,000 and $219,000,[3] **04,** 502, 2702. BERH., **R., 04,** 2708, 2710.

Pre. ex. au. act June 13, 1902, with view to acquiring Sand Isld. **R.** by Maj. Ruffner, July 26, 1902[4] (unfav.), **04,** 2712. BERH. concurs in recom. of DO., **04,** 2713.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 933.

Maps. (See Operations, 1892–1900.)
In vicinity of Falls, **78,** 780.
02, 1976; **11,** 2218.

CC-39(b) Louisville and Portland Canal, Operation and Care of.

APPROPRIATIONS. (See p. 912.)

COMMERCE.

1895, 1,129,644 t.; 1900, 1,574,194 t.; 1907, 1,533,327 t., **07,** 576; 1912, 1,243,050 t., **12,** 937.

Diagram showing relation of freight, cash value, and app., **12,** 2426.

CONTRACTS.

1893. Louisville Bridge & Iron Co., erection of 2 new drawbrs., 1 new fixed span, removal of old drawbr., and reerection of 1 of them, $17,176, **94,** 1941. C. L. Cornwell, st. revet. and masonry, $5,792.67, **94,** 1942.

1894. A. H. Dugan, coal, $4,918, **94,** 1942. C. L. Cornwell, 6 lock houses, $9,654, **95,** 2441.

1895. R. C. Arnold, 2 barges, $1,180, **96,** 2238. E. J. Howard, new towboat hull, $4,560, **96,** 2239.

1896. C. L. Cornwell, st., $12,272.32, **97,** 2450.

1901. C. F. Fitch, concrete pavement alongside lower lock, 67¢ c. y., and pavement in lock engine houses, 47¢ c. y., **01,** 2799. John Mitchell, for all material and setting up boilers, tearing out old boilers of U. S. towboat *Maj. Mackenzie,* $2,315, **01,** 2797.

1902. C. L. Cornwell, 500 c. y. sandst., $6.70 c. y., **02,** 1982. Jacob Bornstein, 1 gray pressed-brick power house, $8,035, and 1 brick warehouse, $7,210, **02,** 1983. Chas. Hegewald Co., 2 new boilers, $660 and $630, **03,** 1771.

1903. Jacob Bornstein, blacksmith shop, $8,629, **04,** 2670.

1907. American Bridge Co., 2 steel barges, $7,050 each, **08,** 1872.

1910. Jacob Bornstein, combined stable and storehouse, $7,018.35, **11,** 2224.

ENGINEERS.

Chief of Engineers. R., 93, 322; **94,** 295; **95,** 330; **96,** 286; **97,** 366; **98,** 349; **99,** 442; **00,** 506; **01,** 499; **02,** 424; **03,** 455; **04,** 489; **05,** 498; **06,** 548; **07,** 575; **08,** 617; **09,** 649; **10,** 724; **11,** 780; **12,** 935.

In charge:

Lt. Col. G. J. Lydecker, 1891–93. **R., 93,** 2554.

Capt. J. G. Warren, 1894–99. **R., 94,** 1935; **95,** 2434; **96,** 2226; **97,** 2444; **98,** 1957.

Capt. G. A. Zinn, 1899–1900. **R., 99,** 2565; **00,** 3482.

Capt. W. L. Sibert, 1901. **R., 01,** 2791.

Maj. E. H. Ruffner, 1902. **R., 02,** 1976.

Maj. G. McC. Derby, 1903. **R., 03,** 1765.

Capt. H. Burgess, 1904–08. **R., 04,** 2664; **05,** 1936; **06,** 1668; **07,** 1800; **08,** 1869.

Lt. Col. J. G. Warren, 1909. **R., 09,** 1871.

Capt. Lytle Brown, 1910–11. **R., 10,** 2020; **11,** 2219.

Lt. Col. H. Jervey, 1912–. **R., 12,** 2416.

Assistants:

Lt. H. M. Chittenden. **R., 94,** 1935.

J. H. Casey. **R., 98,** 1963; **99,** 2570; **00,** 3488; **01,** 2792; **02,** 1979; **03,** 1767; **04,** 2668; **05,** 1940.

OBSTRUCTIONS.

Sec. of War approv. regulations June 29, 1896, for obviating necessity for delay in assuming charge of wrecks or other such causes of obstr. of the canal, **96,** 2232.

OPERATIONS.

1892–93. 68,000 c. y. dr.; new pair of middle gates erected; dangerous projections removed from side walls and underlying r., and other such work done; completion of machine shop, boiler and engine house, to replace those destroyed by fire during 1892; 3 brs. crossing the canal repaired; repairs to plant, **93,** 2554–2556.

1893–94. 111,550 c. y. dr.; new pair of guard gates erected at old lock; 3 old brs. removed, constr. of 2 new brs., and 1 old br. reerected; plant repaired, and a large amount of misc. work done, **94,** 1937–1940.

1894–95. 6 new lock engine houses built; 8,323 c. y. r. blasted below locks and about half of it removed; over 85,000 c. y. dr.; much misc. work done, **95,** 2436.

1895–96. About 50,000 c. y. dr.; rebuilding of dry dock retaining wall, and retaining wall of n. side of canal; building and setting up new guard gates; plant repaired, 12,000 bushels of coal dr. from wreck, and much misc. work, **96,** 2227.

1896–97. 91,348 c. y. dr.; 2 wrecks removed, and much misc. work, **97,** 2445–2448.

1897–98. Combined dr. and derrick boat built (description of, drawings, etc., **98,** 1957, 1966); 106,795 c. y. dr.; new hull for drill boat built; large amount of misc. work, **98,** 1965–1970.

1898–99. 110,595 c. y. mud and r. and 16,000 bu. coal dr.; work on retaining wall, unprotected bank, and retaining wall, dry dock in progress; completing automatic gate in old lock; rebuilding roadway, and minor work, **99,** 2570, 2572.

1899–00. 128,217 c. y. dr.; work on retaining wall, unprotected bank, and retaining wall, dry dock continued; 2 dump scows built, and minor work done, **00,** 3482.

1900–01. 113,201 c. y. dr.; repairs to floating plant; work on retaining walls in front of unprotected bank and dry dock completed; dry-dock gates placed; general repairs and work of mainten., **01,** 2792.

1901–02. 143,765 c. y. soft material dr. from canal, 3,340 c. y. from Speeds Basin, 9,130 c. y. r. removed; 1,325 c. y. dr. by Green R. dr.; misc. repair work; projecting r. removed and wall built at 9th St. basin; ledge of s. wall cleaned; new buildings erected, **02,** 1980.

[1] H. D. 492, 60th, 1st. [2] H. D. 68, 56th, 2d. [3] H. D. 349, 58th, 2d. [4] H. D. 251, 58th, 2d.

1902-03. 143,749 c. y. soft mud dr. from canal; 2,069 c. y. r. removed; 5,975 c. y. removed from Speeds Basin; disrupted and projecting r. removed; 9th and 14th St. walls completed; repairs to dry dock, floating plant, **03,** 1765.

1903-04. 161,920 c. y. mud dr. from canal and lock chambers; 2 r. drills working in chan. below locks disrupted 2,637 c. y. r.; new blacksmith shop built under cont.; slope revet. at 9th St. done by hired labor; boiler and engine house damaged by fire repaired; automatic gate, damaged by operating it, repaired; floating plant overhauled, **04,** 2664–72.

1904-05. 143,479 c. y. mud and r. removed; repairs to sill and sill masonry at lower gates of new lock; repairs to 6,400′ of concrete surface of fixed dam bet. Boulé dam at head of n. canal wall and s. abutment of Boulé dam in Middle Chute; repairs to abutment of movable dam in Indiana Chute; floating plant repaired, **05,** 1936–45.

1905-06. 137,889 c. y. mud dr. from canal and 13 c. y. r. from chan.; 345 c. y. loose r. removed bet. stations 80 and 81; repairs to middle gates of new lock in progress; new guard gates of old lock completed and hung; gap in n. canal wall closed; work on s. canal wall in progress; dr. *Louisville No. 2* destroyed by fire Dec., 1905; new combined clamshell and hydraulic dr. and derrick boat in progress of constr., **06,** 1669–70.

1906-07. 224,399 c. y. dr. from canal; repairs to floating plant, buildings, bridges, roadways, fences, locks, and lock machinery; work on combined hydraulic dr. and derrick boat in progress; new 60-horsepower boiler, double cylinder, double-drum hoisting engine for U.S. dr. *Wabash* installed; s. canal wall practically completed, **07,** 1801.

1907-08. 310,053 c. y. mud and r. dr. from canal and from in front of new s. canal wall; work at s. canal wall completed; floating plant overhauled and painted; 2 new steel barges being built under contract; 2 dump scows to be built by hired labor, **08,** 1870.

1908-09. 160,185 c. y. dr. from canal; repairs to floating plant, canal, shops, etc.; repair work done at canal for Green and Barren Rs., and sur. of Ohio R.; misc. work, **09,** 1872.

1909-10. 182,755 c. y. dr. from canal; repairs to floating plant; removal of ice gorge; repair and mainten. work; SS. *Shawnee* and 2 dump scows for Green and Barren Rs. completed; work for Ohio R. sur., **10,** 2020.

1910-11. 111,325 c. y. dr.; repairs to floating plant, canal, shops, etc.; new stable and storehouse completed; new engines for dr. *Casey;* misc. work done; work was also done for Green and Barren Rs., 14th Lighthouse Dist., Wabash R. sur., and Ohio R. sur., **11,** 2219.

1911-12. 147,460 c. y. dr.; general repairs to floating plant, canal, shops, etc.; work on new lock gates in progress, and work for various other places done, details given, **12,** 2416.

PHYSICAL CHARACTERISTICS.

Available at all stages of the R. less than 12.7′, **03,** 456.

Canal used as ice H., **07,** 576.

Lowest reading, upper gauge, 1.7′; highest reading, 46.7′, **07,** 576.

Ice gorge, Wolf Creek, **10,** 2024.

(For details of accidents in canal, damages, etc., see an. **R.**)

PRIVATE WORK.

1903-04. 17,770 c. y. mud dr. for city of Louisville and for Byrne & Speed Coal Co., at their expense, **04,** 2664.

1904-05. 3,815 c. y. mud dr. from Speeds Basin at their expense, **05,** 1937.

1905-06. 16,400 c. y. mud and cinders dr. from city wharf; 5,075 c. y. mud dr. from basin used by Byrne & Speed Coal Co., at their expense, **06,** 1669.

1906-07. 4,680 c. y. dr. from basin and 14,830 c. y. from city wharves and canal wall, and paid for by Byrne & Speed Coal Co., and city of Louisville, resp., **07,** 1801.

1907-08. 28,125 c. y. dr. from in front of city wharf, 4,500 c. y. from basin used by Byrne & Speed Coal Co., and 2,300 c. y. from landing of O'Neil Coal & Coke Co., and paid for by interested parties, **08,** 1869.

1908-09. 2,050 c. y. dr. from Byrne & Speed Basin at their expense, **09,** 1873.

1909-10. 6,545 c. y. dr. from in front of city wharf, and 4,550 c. y. from Byrne & Speed Basin, and paid for by these parties, **10,** 2022–23.

1910-11. 7,075 c. y. mud dr. for city of Louisville, and 600 c. y. for Ohio River Sand Co. at their landing, and expenses paid by these parties, **11,** 2221.

1911-12. 10,125 c. y. mud and cinders dr. from in front of city wharf, 3,300 c. y. from Speeds Basin, and 715 c. y. from Ky. & Ind. Terminal RR. Co.'s Pier No. 5, cost being paid for by interested parties, **12,** 2417–18.

PROJECTS.

Canal built by private corporation under Ky. charter of 1825 and subsequent years; completed 1830; having 3 locks, each with lift of 8⅔′±, w. of 50′, l. of 200′. W. of canal, 64–68′, with d. of nearly 3′ at ex. low stages. There was no dam at head of canal. U. S. became stockholder, 1826, and finally bought all certificates. 1860, the canal enlarged and extended; w. increased to 90′, with 3 basins; 2 new lift locks built with lift of 26′ (80′ x 350′), opened 1872. In 1874 entire control assumed by U. S., under act May 11, 1874, the canal to be free of all tolls and charges, except such as are necessary to pay the current expenses of said canal and keep the same in repair. Tolls abolished entirely, 1880.

General proj. covers operation, mainten., and dr., **04,** 489; **12,** 935, 936. Interest of U. S. in canal, special report of Treas. Dept., H. Mis. Doc. 83, 40th Cong., 2d sess. Freeing tolls, H. Rept. 348, 46th Cong., 2d sess.

Canal is available to C. at all stages of R. less than 12.7′ upper canal gauge, and affords free navigation around the Falls of the Ohio R. at stages of water when the passage can not be made by R. chan. Under regulations of Sec. of War max. draft of boats is limited to d. above zero at time boats enter canal, **12,** 936.

By Lt. Col. Lydecker, 1893, simplifying the management of the canal by consolidating the duties of assistant engineer and those of master lock manager, **93,** 2554. (See **94,** 1940, for supposed reseparation of the offices.)

SURVEYS.

Resol. of Sen. reg. **R.** on what additional works necessary. **R.** giving history, etc.—Sen. Ex. Doc. 129, 47th Cong., 1st, **82,** 1880; **12,** 937.

R. on drainage rights, with map, showing sewers, etc. (H. Ex. Doc. 51, 49th Cong., 2d), **87,** 1852; **12,** 937.

R. on dry dock, **87,** 1896–1901.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 937.

Maps. (See Operations, 1897–98.) Photos of automatic gate and sketch of bridge piers, **99,** 2572, 2576; photos of enlargement, head of canal, dam constr., etc., **00,** 3482.

Drawings with plans, **02,** 1976.

Sketch of gate, showing probable cause of accident, **04,** 2671.

Repairs to lower miter sill, and miter sill cofferdam, **05,** 1942.

CC-46 Lawrenceburg Harbor, Ind.

ENGINEERS.

Chief of Engineers. R., 85, 285.
In charge. Lt. Col. W. E. Merrill. **R., 85,** 1839, 1840.

PLANS.

By Lt. Col. Merrill, 1885, removing part of the projecting bar at the mouth of the Great Miami R. Est., $20,000, **85,** 1842.

SURVEY.

Au. act July 5, 1884; made by Lt. Col. Merrill, **85,** 1840.

CC-48(a) Ohio River. (Constructing Lock and Dam No. 37.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1902. Geo. W. Icenhower, borings, **03,** 1645.
1904. John R. Steele, constr. of temporary office bldg., site of Dam No. 37, $773.85, **05,** 1818. Sheridan-Kirk Contract Co., constr. Lock and Dam No. 37, $796,152.70, **05,** 1819.
1905. Atlas Portland Cement Co., cement, $1.46 bbl., **06,** 1567.
1908. The Lehigh Portland Cement Co., cement, $8,220, **09,** 1750.
1909. The M. Marcus Building Co., bldg. warehouse, $6,947; Kaps & Brehm, bldg. power house, $12,200, **09,** 1750. The Superior Portland Cement Co., cement, $6,030; The Ironton Portland Cement Co., cement, $6,030; The Lehigh Portland Cement Co., cement, $6,030, **10,** 1908.
1910. G. & W. Mfg. Co., furn. and installing operating machinery, $29,533.26, **10,** 1909. Des Moines Bridge & Iron Co., steel tower, water tank, etc., $2,488; Jas. Kinney, jr., drilling well, water system, $1,320; The Wm. T. Johnston Co., material, $1,454.46, **10,** 1911. The Monongahela River Consolidated Coal & Coke Co., constr. hull of maneuvering boat, $2,311; Sheridan-Kirk Contract Co., fitting and connecting pipes, $502.65, **10,** 1912. The Marbleized Fiber Co., marbleized fiber covering, $531.66; D. Meinken, constr. 4 lock tenders' dwellings, $22,687, **11,** 2101.

ENGINEERS.

Chief of Engineers. R., 02, 399; **03,** 426; **04,** 454; **05,** 464; **06,** 511; **07,** 539; **08,** 575; **09,** 609; **10,** 683; **11,** 736; **12,** 888.

In charge:
Col. G. J. Lydecker. **R., 02,** 1864; **03,** 1645; **04,** 2428.
Lt. Col. E. H. Ruffner. **R., 05,** 1816.
Maj. J. G. Warren. **R., 06,** 1564.
Lt. Col. W. T. Rossell. **R., 07,** 1670; (Col.) **08,** 1751; **09,** 1743.
Lt. Col. J. G. Warren. **R., 10,** 1903.
Maj. H. Jervey. **R., 11,** 2092; (Lt. Col.) **12,** 2291.

Assistant. R. R. Jones. **R., 03,** 1647; **04,** 2430.

LEGAL PROCEEDINGS.

Condemnation of land necessary for lock site, **04,** 2429.

OPERATIONS.

1902-03. Site located at Fernbank, Ohio, test borings, etc., made, **03,** 1645, 1646.
1903-04. Acquisition of land for lock site, **03,** 2429, 2430.
1904-05. Constr. work commenced, temporary office erected, land cleared, filling, bldg. cofferdam, assembling, iron, etc., **05,** 1818.
1905-06. Timber cofferdam completed, 15,000 c. y. earth filling placed, concrete masonry for foundations placed, other misc. work done, **06,** 1564.
1906-07. Work on lock and dam constr. in progress, delayed by floods, addl. land secured, **07,** 1671.
1907-08. Work of bldg. cofferdam, excavation, filling, concrete masonry, iron and steel, lowering gate tracks, etc., continued. Details given, **08,** 1751; **09,** 1743.
1909-10. Constr. lock and dam nearing completion, **10,** 1903.
1910-11. Work practically completed, machinery installed, buildings constr., **11,** 2092.
1911-12. Lock and dam completed and placed under "Operation and care" Jan. 1, 1911, **12,** 2291.

PROJECTS.

Act June 13, 1902, au. constr. lock and dam at Home City, bet. Cullums Ripple and Medoc Bar, below Cincinnati, Ohio, to be No. 37; cost, $1,050,000,[1] **02,** 399.
Act Mar. 2, 1907, au. expend. $100,000 to provide 9′, **07,** 1670.

SURVEYS.

Maps. **12,** 2292.

CC-48(b) Ohio River. (Operation and care of Lock and Dam No. 37.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1911. Cincinnati & Suburban Bell Telephone Co., telephone service, $25 per quarter, **12,** 2293.

ENGINEERS.

Chief of Engineers. R., 11, 738; **12,** 888.
In charge. Maj. H. Jervey, 1911–. **R., 11,** 2102; (Lt. Col.) **12,** 2292.

OPERATIONS.

1910-11. Lock and dam placed under operating and care Jan. 1, 1911, and work consisted in cleaning up grounds and caring for property and machinery, **11,** 2102.
1911-12. Lock force engaged in operating lock and dam, making minor repairs, planting trees, etc.; 305 lockages made, **12,** 2293.

[1] H. D. 336, 57th, 1st.

CC-50(a) Cincinnati, Ohio. (Harbor of refuge from ice floes.)

APPROPRIATIONS. (See p. 912.)

COMMERCE.

Losses occasioned by ice floods of 1876–77, **78,** 817–819.

Area required for a H. of refuge, **78,** 820.

Table showing dates of closing and reopening of navigation, **78,** 821.

Necessity of some imp. at Fourmile Bar, **78,** 829.

In 1893 C. not of sufficient importance to justify cost of ice Hs., **94,** 1891.

CONTRACT.

1879. J. J. Shipman, dikes, **79,** 1355.

DOCUMENTS. (Not printed in reports.)

S. Doc. 39, 44th Cong., 2d sess., on availability of Mill or Taylors Bottom for an ice H., **78,** 824. H. Doc. 34, 44th Cong., 2d sess., on availability of Mill Creek for an ice H., **78,** 826.

ENGINEERS.

Chief of Engineers. R., 78, 108; **79,** 146; **80,** 194; **81,** 262; **82,** 256; **83,** 265; **84,** 263; **85,** 284; **86,** 275; **87,** 241; **93,** 320; **94,** 289.

Boards. Convened, 1878, to report upon constr. of H. or Hs. of refuge from ice floes at or near Cincinnati, Ohio. Board reported that app. of 1878 could be best expended by constr. dikes at Fourmile Run (10 m. above Suspension Br.), which, by holding the ice, would prevent the habitual gorging at Medoc Bar (19 m. below the br.), from which point the ice eventually backs up to Cincinnati. **R., 79,** 1356. (Col. Z. B. Tower and Majs. Merrill and C. R. Suter.)

In charge:

Maj. W. E. Merrill, 1878–87. **R., 78,** 814; **79,** 1355; (Lt. Col.) **80,** 1788; **81,** 1948; **82,** 1934; **83,** 1557; **84,** 1703; **85,** 1825; **86,** 1549; **87,** 1822.

Lt. Col. Stickney, 1894. **R., 94,** 1890.

Assistants:

W. Weston and L. Petitdidier, **78,** 829.

Lt. W. C. Langfitt. **R., 94,** 1891.

ESTIMATES. (See Plans and Projects.)

By Maj. Merrill, ice Hs.: 1st, at the mouth of Little Miami R., $813,983, **78,** 823, 824; 2d, at Crawfish Creek, $322,600, **78,** 824; 3d, at mouth of Licking R., $741,000, **78,** 825; 4th, at Willow Run, $615,600, **78,** 825; 5th, at Pleasant Run, $701,350, **78,** 826. For ice breakers, $176,000, **79,** 1362.

OPERATIONS.

1879–80. Dike on Ohio side extended to full l. of 2,135 l. f.; Kentucky dike located and work commenced, **80,** 1788.

1880–81. Ohio dike finished and Kentucky dike partly completed, **81,** 1948.

1884–85. 450 l. f. of dike built, **85,** 284.

1885–86. 2,050 l. f. of dike built, completing second dike, **86,** 1549.

1886–87. Constr. of the third dike at Fourmile Bar, **87,** 1822.

PHYSICAL CHARACTERISTICS.

History of ice flood of 1876–77, **78,** 814.

Table of gauge readings, **78,** 822.

Sedimentary deposits. **79,** 1360.

Description of. Much excavating would be required at Crawfish and Mill Creeks to make a basin that could be entered at low stages without locks, **94,** 1891.

PLANS. (See Estimates and Projects.)

By Maj. Merrill, constr. of Hs. of refuge from ice floes:

1st, at mouth of Little Miami R., by dr., paving, and constr. of sluices, dams, etc., affording an area of 31 acres, **78,** 823; objections, **78,** 827.

2d, at Crawfish Creek, affording an area of 13 acres, **78,** 824; advantages, **78,** 827; objections, **79,** 1360.

3d, at Mill or Taylors Bottom, **78,** 824; objections, **78,** 825.

4th, at mouth of Licking R., affording an area of 9.8 acres, **78,** 825.

5th, at Willow Run, affording an area of 19.3 acres, **78,** 825; advantages, **78,** 827; objections, **79,** 1360.

6th, at Mill Creek, objectionable, **78,** 826.

7th, at Pleasant Run, affording an area of 30.3 acres, **78,** 826; objections, **78,** 827.

Other methods of protection: 1st, ice breakers; 2d, sheer booms; 3d, H. boats, **78,** 828; **79,** 1361–1368.

PROJECTS. (See Estimates and Plans.)

By Maj. Merrill, 1878, protection from ice floes by constr. of dikes at Fourmile Bar; est., $18 l. f., **78,** 829; **79,** 1364. Approved by BE. (see Board of Engineers), **79,** 1364.

By Maj. Merrill, 1881, third dike at Fourmile Bar, 2,200′ l.; est., $33,000, **81,** 1949.

Lt. Col. Stickney, 1893, est. $600 to make sur. of mouth of Crawfish Creek and $1,800 for sur. of Mill Creek, **94,** 1891.

Ex. and sur. of mouth of Crawfish Creek and mouth of Mill Creek to determine availability of either or both as locations for ice Hs. au. act July 13, 1892; made by Lt. Col. Stickney, 1893 (**R.** unfav.), **94,** 1890.

CC-51 Little Miami River, Ohio.

ENGINEERS.

Chief of Engineers. R., 93, 318.

In charge. Lt. Col. A. Stickney, 1892–93. **R., 93,** 2525.

Assistant. Lt. H. F. Hodges. **R., 93,** 2527.

PHYSICAL CHARACTERISTICS.

Description of; exceedingly small stream at its mouth and locality unsuited for ice H., **93,** 2526.

SURVEY.

Ex. for ice H. at the mouth au. act July 13, 1892; made, 1892, by Lt. Col. Stickney (**R.** unfav.), **93,** 2525.

CC-59 Ohio River. (Constructing Lock and Dam No. 31.)

APPROPRIATIONS. (See p. 912.)

ENGINEERS.

Chief of Engineers. **R., 12,** 887.

In charge. Lt. Col. H. Jervey, 1912–. **R., 12,** 2291.

PROJECT.

Act July 25, 1912, provides for constr. Lock and Dam No. 31,[1] **12,** 887.
Maps.[1]

CC-63 Ohio River. (Constructing Lock and Dam No. 29.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1911. Bates & Rogers Cons. Co., constr. Lock and Dam No. 29, $631,440.86, **11,** 2091.

ENGINEERS.

Chief of Engineers. **R., 10,** 682; **11,** 736; **12,** 886.

In charge. Maj. H. Jervey, 1911–. **R., 11,** 2091; (Lt. Col.) **12,** 2289.

OPERATIONS.

1910-11. Land on Kentucky side purchased, contract for constr. of lock and dam entered into, land cleared, and constr. of cofferdam begun, **11,** 2091.

1911-12. Cofferdam constr. and excavation for foundations for lock walls and gate recesses carried on, **12,** 2289.

PROJECT.

Act June 25, 1910, au. constr. Lock and Dam No. 29, to obtain 9',[1] **10,** 682.
Maps.[1]

CC-64(a) Ohio River. (Constructing locks and dams on, between the Pennsylvania State line and mouth of Big Sandy River, Ky.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1902. The Preslar-Crawley Co., drilling test holes at Dams Nos. 8 and 11, $3 l. f.; C. F. Preslar Mfg. Co., drilling test holes at Dam No. 13, $2.50 l. f., **03,** 1718. The Evansville Cont. Co., constr. lock for movable Dam No. 18 (prices given), **03,** 1717.

1903. Atlas Portland Cement Co., Portland cement, $2.34 bbl., **03,** 1717.

1904. Atlas Portland Cement Co., Portland cement for Dams Nos. 13 and 18, $1.60 bbl., **04,** 2570. T. A. Gillespie Co., lock for movable Dam No. 8 (prices given); Finley Bros. Co., temporary bldg. at Dam No. 8, $735; A. S. Craig and John Exner, temporary bldgs., $748.85, **04,** 2571. Aetna Cons. Co., lock for movable Dam No. 11 (prices given), **05,** 1877.

1905. Atlas Portland Cement Co., Portland cement for Dam No. 13, $1.32 bbl., **05,** 1877. Baker Cont. Co. (Inc.), movable Dam No. 18 (unit prices given), **05,** 1878.

1906. The Hollerbach & May Cont. Co., movable Dam No. 13 (prices given); Pittsburgh Mfg. Co., bars, rods, etc., for Dam No. 13 (prices given); Riverside Bridge Co., anchor beams, etc., for Dam No. 13, 3.45¢ lb.; Atlas Portland Cement Co., Portland cement for Dams Nos. 13 and 18, $1.48 bbl. in paper sacks, and $1.75 bbl. in wood, **06,** 1619.

1907. The Preslar Prospecting & Eng. Co., drilling test holes for Dam No. 8, $2.50 f., **07,** 1741. G. Elias & Bro., surfaced lumber for Dam No. 13 (prices given); J. & J. B. Milholland Co., iron and steel for Dam No. 13 (prices given); Atlas Portland Cement Co., cement for Dam No. 18 (prices given), **07,** 1742. Pittsburgh Industrial Iron Works, iron and steel for Dam No. 18 (prices given), **07,** 1743. Kiel Bros. Plumbing & Heating Co., pipes, etc., for Dam No. 11, **08,** 1812. Monongahela & Western Dredging Co., dr., etc., at Dam No. 18, common excavation, 17¢ c. y. and r. $1.25 c. y., **08,** 1813.

1908. T. A. Gillespie Co., constr. navigable pass for Dam No. 8 (prices given), **08,** 1811; and navigable pass for Dam No. 11 (prices given), **08,** 1812. The Hollerbach & May Cont. Co., constr. guide walls, grading, etc., at Dam No. 13 (prices given); Atlas Portland Cement Co., cement for Dam No. 18, $1.568 bbl. in duck sacks, and $1.59 in wood; Parkersburg & Marietta Sand Co., sand and gravel for Dam No. 18; sand, 55¢, and gravel, 50¢ c. y., **08,** 1813.

1909. The T. A. Gillespie Co., constr. abutment, piers and weirs for Dam No. 11, $249,537; Pittsburgh Valve, Foundry & Construction Co., pipe, air receivers, etc., in place in Dams Nos. 13 and 18, $11,566.55; W. Bateson & Co., air compressors, winches, etc., in place in Dams Nos. 13 and 18, $25,836.80; Hile & Higgs, bldg. power house at Dam No. 18, $24,207, **09,** 1793. James Kinney, jr., drilling and installing well at Dam No. 18, $1,572.50; Duff Patents Co. (Inc.), tank and tower in place at Dam No. 18, $1,130; McClure Timber Co., yellow pine timber at Dam No. 18, $682.50; Penn Bridge Co., structural steel, etc., at Dam No. 18, $608.16; The Hollerbach & May Cont. Co., constr. 500' foundation for navigable pass for Dam No. 19, $111,305; The Home Telephone Co., constr. telephone line at Dam No. 26; J. H. Beans, iron castings for Dam No. 26, $2,768, **09,** 1794. Rosedale Foundry & Machine Co., castings for Dam No. 26, $1,831.20; W. Bateson & Co., structural steel, etc., for Dam No. 26, $2,616.75, and $2,424; Universal Portland Cement Co., cement for Dam No. 26, $13,230; L. D. Weaning, structural steel, etc., for Dam No. 26, $1,610.75; Mohler Lumber Co., white oak timber for Dam No. 26, $2,761.15; J. & J. B. Milholland Co., structural steel, etc., for Dam No. 26, $4,519.60; The Campbell's Creek Coal Co., coal at Dam No. 26, $3,600; Penn Bridge Co., structural steel, etc., for Dam No. 26, $3,617.48, **09,** 1795. American Bridge Co., horses and props for Dam No. 26, $12,127.50, **09,** 1796.

1910. The Hollerbach & May Cont. Co., constr. abutments, piers, and weirs at Dam No. 8, $229,954.50; The Guy Johnston Cont. Co., constr. 2 lock-

[1] H. D. 492, 60th, 1st.

keepers' houses at Dam No. 8, $10,429.88; American Bridge Co., structural steel, etc., at Dam No. 8; $6,756.84, and at Dam No. 11, $3,452.40, **10,** 1954. Independent Bridge Co., lock gates in place at Dam No. 8, $34,093.36, and at Dam No. 11, $34,-093.36; New Jersey Foundry & Machine Co., lock-operating mechanism in place at Dams Nos. 8 and 11, $9,841.55 each; Jas. Kinney, jr., drilling well and fitting it with air lift at Dam No. 8, $1,065, and at Dam No. 11, $1,046; Hile & Higgs, bldg. power house at Dams Nos. 8 and 11, $27,524.50 each; J. J. Walker Co., air compressor and pipe work in place at Dams Nos. 8 and 11, $9,051.45 each, **10,** 1955. Bury Compressor Co., 2 air receivers at Dams Nos. 8 and 11, $760 each; Gee Electric Cons. Co., installing gas engines at Dams Nos. 8 and 11, $8,052 each; Thos. Carlin's Sons Co., maneuvering boats for Dams Nos. 8, 11, and 26, 3 at $5,200 each; The Superior Portland Cement Co., cement at Dam No. 18, $434, **10,** 1956. Stephen Davidson, bldg. 2 lock-keepers' houses at Dam No. 18, $12,100, and at Dam No. 26, $12,370; The Hollerbach & May Cont. Co., constr. 200' foundation for navigable pass, $27,162; The Atlas Portland Cement Co., cement, $5,985; Universal Portland Cement Co., cement for Dam No. 26, $26,800; The Campbell's Creek Coal Co., coal at Dam No. 26, $5,250, **10,** 1957. Independent Bridge Co., bolts for Dam No. 26, $594.75; J. H. Beans, iron castings for Dam No. 26, $1,030.63; American Bridge Co., structural steel, etc., for Dam No. 26, $14,057.05; The Hamilton Lumber Co., timber for Dam No. 26, $1,799.65; J. & J. B. Milholland Co., iron and steel for Dam No. 26, $9,244.85; Pittsburgh Valve, Foundry & Cons. Co., pipe fittings, etc., for Dam No. 26, $1,839.37; G. Elias & Bro., timber at Dam No. 26, $1,576.19, **10,** 1958. The Guy Johnston Cont. Co., constr. 2 lock-keepers' houses at Dam No. 11, $11,937.74, **11,** 2152. American Bridge Co., furn. Poiree-dam trestles for Dams Nos. 11, 13, and 18, $3,600 for each dam; The Pneumatic Caisson Co., constr. Lock and Dam No. 12, $908,492; Ohio River Cont. Co., constr. Poiree-dam foundations and extension of piers at Dam No. 13, $39,029; The Guy Johnston Cont. Co., constr. 2 lock-keepers' houses at Dam No. 13, $12,077.74, **11,** 2153. The Pneumatic Caisson Co., constr. Lock and Dam No. 19, $649,739, **11,** 2155. Pioneer Boat & Pattern Co., gasoline boat for Dam No. 26, $1,980; Hile & Higgs, constr. power house at Dam No. 26, $30,960; J. J. Walker Co., boiler feed pump for Dam No. 26, $210; New Jersey Foundry & Machine Co., feed water heater for Dam No. 26, $4,055; Universal Portland Cement Co., cement for Dam No. 26, $12,320; E. J. Howard, towboat for Dam No. 26, $27,550; E. Keeler Co., 2 boilers and accessories in place at Dam No. 26, $4,697, **11,** 2157. The Foundation Co., substituted for the Pneumatic Caisson Co. for constr. Lock and Dam No. 12, $908,942, **12,** 2350; also for constr. Lock and Dam No. 19, $649,-739, **12,** 2351.

1911. Monongahela & Western Dredging Co., dr. at Dam No. 11, $11,400, **11,** 2152. McDevitt & Erskine, installing a pipe line and furn. natural gas at Dam No. 11, $600, **11,** 2153. The Missouri Valley Bridge & Iron Co., constr. Lock and Dam No. 14, $862,091, **11,** 2154. Sheridan-Kirk Cont. Co., constr. Lock and Dam No. 20, $653,825.10, **11,** 2155. Bury Compressor Co., air compressors, receivers, and accessories in place at Dam No. 26, $6,812; Independent Bridge Co., furn. and erecting lock gates at Dam No. 26, $31,560.86; American Bridge Co., Poiree-dam trestles, gate-recess covers, and tank-pit covers for Dam No. 26, $7,432.99; W. N. Kratzer & Co., steel leaves for 2 bear-trap weirs in place at Dam No. 26, $28,150.78; Allis-Chalmers Co., generating set for U. S. sand digger *Rosecrans,* $521; E. J. Thomas, lumber at Dam No. 26, $2,645.50; The Campbell's Creek Coal Co., coal at Dam No. 26, $5,250; Sliger Bros., lumber at Dam No. 28, $6,138, **11,** 2158. E. N. Everson, constr. 2 lock-keepers' houses at Dam No. 12, $11,838, **12,** 2350. The Dravo Cont. Co., constr. Lock and Dam No. 15, $742,451; Dayton & Francis, constr. 2 lock-keepers' houses at Dam No. 15, $11,738, **12,** 2351. The Guy Johnston Cont. Co., constr. 2 lock-keepers' houses at Dam No. 19, $11,994.40, and 2 at Dam No. 20, $12,054.40, **12,** 2352. Vermilye & Power, 4 air tanks for Dam No. 26, $156; New Jersey Foundry & Machine Co., 2 gate engines for Dam No. 26, $1,530; Aetna Foundry & Mach. Co., 32 valve jacks and 2 gate winches for Dam No. 26, $4,770; The Marion Steam Shovel Co., dipper dr. at Dam No. 26, $43,500; Sliger Bros., lumber at Dam No. 28, $6,138; J. & J. B. Milholland Co., structural steel for Dam No. 28, $2,637.96, **12,** 2354. Pittsburgh Screw & Bolt Co., bolts, etc., for Dam No. 28, $476.99; G. Elias & Bro., white oak timber at Dam No. 28, $5,486.43; The Parkersburg Mill Co., white oak timber at Dam No. 28, $269.41; Pittsburgh Trolley & Forge Co., forgings for Dam No. 28, $736.29; The Monongahela River Consolidated Coal & Coke Co., 2 wooden hull gravel barges for Dam No. 28, $6,100, **12,** 2355.

1912. M. L. Bayard, erecting power house and machinery at Dam No. 19, $26,319.35, **12,** 2351. The Monongahela River Consolidated Coal & Coke Co., 2 dump scows for Dam No. 26, $11,790, **12,** 2354. L. D. Weaning, structural steel and forgings for Dam No. 28, $19,534.25; J. & J. B. Milholland, steel castings, etc., for Dam No. 28, $5,051.28; Union Foundry & Mach. Co., bolts, etc., for Dam No. 28, $496.27; The Aetna Foundry & Mach. Co., iron castings for Dam No. 28, $3,777.28, **12,** 2355. G. Elias & Bro., lumber for Dam No. 28, $3,673.29; Sliger Bros., lumber for Dam No. 28, $3,000; The Ironton Portland Cement Co., cement for Dam No. 28, $32,500; V. E. Taylor, erecting 2 lock-keepers' houses at Dam No. 28, $12,672, **12,** 2356.

ENGINEERS.

Chief of Engineers. R., 03, 441; **04,** 470; **05,** 481; **06,** 529; **07,** 556; **08,** 593; **09,** 627; **10,** 701; **11,** 754; **12,** 909.

In charge:

Maj. G. A. Zinn, 1903–06. **R., 03,** 1713; **04,** 2566; **05,** 1872; **06,** 1615.

Capt. F. C. Boggs, 1907. **R., 07,** 1735.

Capt. F. W. Altstaetter, 1908–. **R., 08,** 1805; **09,** 1787; **10,** 1949; (Maj.) **11,** 2147; **12,** 2343.

OPERATIONS.

1902-03. At Dam No. 8, site located, approved, and land being acquired, **03,** 1713. At Dam No. 11, site located; at Dam No. 13, R. wall foundation built to height of 8', and three-fourths of power-house foundations completed; at Dam No. 18, work on lock and guide walls in progress; at Dam No. 19, site located, approved, and land being acquired, **03,** 1714.

1903-04. Preparations in progress for commencing work on lock and guide walls at Dams Nos. 8 and 11; work on driving and sheet piling for foundation of land wall, gate recesses, and gate track well under way at Dam No. 13; about one-third of filling behind land wall in place at Dam No. 18; practically all land purchased at Dam No. 19, **04,** 2566.

1904-05. At Dam No. 8, work on lock and guide walls in progress; at Dam No. 11, work confined to land wall, lower gate recess, and upper guide wall; at Dam No. 13, 640 l. f. land wall, upper gate recess and track, 75% lower gate recess, and driving of piles for foundation for track completed; at Dam No. 18, lock and guide walls completed and considerable filling and paving placed in lock yard; at Dam No. 19, operations suspended until completion of survey, **05,** 1872.

1905-06. At Dam No. 8, work on guide walls continued; at Dam No. 11, work on lock and guide walls continued, progress unsatisfactory; at Dam No. 13, work on lock and guide walls continued and work on building dam begun; at Dam No. 18, work on lock and guide walls, filling, grading, and paving of lock yard completed, **06,** 1615.

1906-07. At Dam No. 8, work on lock and guide walls completed, and are being raised to meet required 9′ navigation; at Dam No. 11, land wall, R. wall, walls for upper and lower gate recesses, and 215 l. f. lower guide wall completed, and work begun of raising to provide 9′ d.; at Dam No. 13, lock walls, part of guide walls, paving lock chamber, and portion of power-house foundation completed; at Dam No. 18, masonry of lock and filling of esplanade completed, **07,** 1735.

1907-08. At Dam No. 8, work on pass commenced, **08,** 1805. At Dam No. 11, work on lock and guide walls progressing slowly, and constr. of 700′ navigable pass begun; at Dam No. 13, building of dam commenced, completion of guide walls, power-house foundation, and grading and paving esplanade, **08,** 1806. At Dam No. 18, constr. of dam by hired labor begun, approaches dr.; at Dam No. 19, site changed from Ohio to W. Va., **08,** 1807. At Dam No. 26, site located, tests made, **08,** 1808.

1908-09. At Dam No. 8, 350 l. f. pass next to R. wall completed and second 350′ section under way; at Dam No. 11, lock and guide walls completed with exception of paving esplanade, and navigable pass practically completed; at Dam No. 13, lock and dam completed, lock gates placed, power house built, and gate recesses and lock raised, **09,** 1787–88. At Dam No. 18, lock and dam completed, lock gates placed, and constr. of power house in progress, **09,** 1789. At Dam No. 19, abutment for dam completed, and work on 500′ navigable pass begun; at Dam No. 26, abutment for dam completed, and cofferdam for lock and dam under way, **09,** 1790.

1909-10. At Dam No. 8, navigable pass completed, foundations for Chanoine weir and Pier No. 3 and crib below Chanoine weir completed, piles for Piers Nos. 1 and 2 and bear-trap weirs driven, and work in progress on lock houses, power house, lock gates, gas engines, etc., **10,** 1949. At Dam No. 11, lock and guide walls completed, 700′ navigable pass completed, riprap placed, and work continued on abutment, piers, weirs, power house, gas engines, etc., **10,** 1950. At Dam No. 13, gas engines, air compressors and receivers, pipe work, etc., installed, practically completing work at this site, **10,** 1951. At Dam No. 18, power house completed, gas engines, compressors, etc., installed, and constr. lock houses, **10,** 1951. At Dam No. 19, 234 l. f. pass of 500′ section and 50 l. f. of 200′ section completed; at Dam No. 26, constr. of lock and dam carried on by hired labor, and constr. of lock houses begun, **10,** 1952.

1910-11. At Dams Nos. 11, 13, and 18, locks and dams practically completed; at Dams Nos. 12, 14, 15, 20, contracts for constr. entered into and work will shortly begin; at Dam No. 19, dr., cofferdam constr., navigable pass abutment and foundation completed; at Dam No. 26, lock and dam about 80% completed; at Dam No. 28, to be constr. by hired labor, contracts for material entered into, **11,** 2147–50.

1911-12. At Dam No. 11, power house completed, machinery installed, and lock and dam placed under operating and care Aug. 1, 1911; at Dam No. 12, 2 lock-keepers' houses constr., **12,** 2343. At Dam No. 13, Poiree-dam foundations and extension to piers for bear-trap weirs completed, and lock and dam placed under operation and care Aug. 1, 1911; at Dam No. 14, work on lock and dam continued, 900 l. f. cofferdam 85% completed, and 2 lock-keepers' houses completed; at Dam No. 15, work on lock and dam continued and 2 lock-keepers' houses constr.; at Dam No. 18, lock and dam completed and placed under operating and care May 1, 1910; at Dam No. 19, work on lock and dam in progress, and 2 lock-keepers' houses constr.; at Dam No. 20, work on lock and dam in progress and 2 lock-keepers' houses constr.; at Dam No. 26, work practically completed; at Dam No. 28, work continued and about 17% completed, **12,** 2343.

PROJECTS.

Act Mar. 2, 1907, au. navigable d. of 9′ at Dams Nos. 8, 11, 13, 18, and 26, increasing cost, **07,** 556.

Capt. Altstaetter invites attention to advantages of adopting seme system for the imp. of the Ohio which would insure a regular rate of progress with a certain number of new dams—say, 5 to 10—begun each year. Training of help, etc., delays progress considerably, **08,** 1808.

Act June 25, 1910, au. continuing imp. with view to securing 9′ by constr. Dams Nos. 12, 14, 15, 16, 17, 20 to 25, incl., 27, and 28,[1] **10,** 701.

Dam No. 8 trans. to Pittsburgh district Aug. 23, 1910, **11,** 2147.

Act June 25, 1910, au. canalization proj. for entire R.[1] (see Ohio R., general imp.), **11,** 754.

SURVEYS.

Maps.[1] **11,** 2148.

CC-69 Kanawha River, Great, W. Va. (Harbor of refuge at mouth.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1884. Porter, Tucker & Mahan, constr. 2 ice piers, **85,** 1827.

1885. J. J. Shipman, constr. ice pier, **86,** 1550.

ENGINEERS.

Chief of Engineers. **R.,** **85,** 284; **86,** 275; **87,** 241; **88,** 223.

In charge:

Lt. Col. W. E. Merrill, 1884–87. **R.,** **85,** 1826; **86,** 1550; **87,** 1822.

Col. W. P. Craighill. **R.,** **88,** 1759.

OPERATIONS.

1884-85. Partial constr. of 2 ice piers at mouth of R., **85,** 1827.

1885-86. Completion of 3 ice piers, proj. completed, **86,** 1550; **88,** 1759.

PROJECTS.

By Lt. Col. Merrill, for making H. of refuge at mouth of Great Kanawha with 3 ice piers; est., $15,000, **85,** 1827; **86,** 1550; **87,** 1822.

SURVEYS.

Maps. **92,** Atlas, 100.

[1] H. D. 492, 60th, 1st.

CC-71 Middleport, Ohio. (Ice harbor.)

COMMERCE.

Benefit to C. from ice Hs., **84,** 1708.

ENGINEERS.

Chief of Engineers. R., 84, 263.

In charge. Lt. Col. W. E. Merrill. **R., 84,** 1707, 1708.

Assistant. E. J. Carpenter. **R., 84,** 1709.

PLANS.

By Col. Merrill, 4 ice breakers at Middleport; est., $9,500; exact location of ice Hs. to be left to the discretion of the Chief of Engineers, **84,** 1708, 1710.

SURVEYS.

Au. act Aug. 2, 1882; made by Col. Merrill, **84,** 1708.

CC-79 Ohio River, Parkersburg, W. Va. (Ice breakers.)

ENGINEERS.

Chief of Engineers. R., 80, 195; **81,** 263.

In charge. Maj. W. E. Merrill. **R., 81,** 1954.

PLANS.

By Maj. Merrill, 1880, 2 ice breakers or cribs filled with st.; est., $6,000, **80,** 1795, 1796.

SURVEY.

Au. act June 14, 1880; made, 1880, by Maj. Merrill, **81,** 1954.

CC-80(a) Ohio River. (Operating and care of Locks and Dams Nos. 11, 13, and 18.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1911. McDevitt & Erskine, furn. natural gas at Dam No. 11, $600, **12,** 2357.

ENGINEERS.

Chief of Engineers. R., 10, 706; **11,** 760; **12,** 915.

In charge. Capt. F. W. Altstaetter, 1910–. **R., 10,** 1959; (Maj.) **11,** 2159; **12,** 2356.

OPERATIONS.

1909-10. Lock and Dam No. 18 placed under operating and care May 1, 1910, **10,** 1959.

1910-11. Mainten. work and minor repairs made, **11,** 2159.

1911-12. Locks and Dams Nos. 11 and 13 placed under operating and care Aug. 1, 1911, **12,** 915.

PHYSICAL CHARACTERISTICS.

Pool formed by Dam No. 18 extends about 12 m. upstream and is of benefit to craft entering and leaving Muskingum R., **10,** 706.

CC-81 Muskingum River, Ohio. (Ice harbor at mouth.)

APPROPRIATIONS. (See p. 912.)

COMMERCE.

Important, **79,** 1367.

CONTRACTS.

1880. T. B. Townsend, dimension st., **80,** 1790.

1882. S. G. Sprague, round timber, **82,** 1937. W. H. Ewing & Co., sq. timber, **82,** 1937.

1884. Marietta Chair Co., timber, **85,** 1822. Dawes, Irish & Co., round piles, 12¢ l. f., **85,** 1822.

1889. D. M. Wolf, white oak timber, $32 M f. b. m., **89,** 1890.

1891. Griffith & Wedge Co., lock machinery, $2,706.64, **92,** 1998.

DOCUMENTS. (Not published in reports.)

Maj. Merrill's **R.,** H. Doc. 60, 41st Cong., 3d sess., **71,** 392.

ENGINEERS.

Chief of Engineers. R., 70, 32; **71,** 60; **78,** 108; **79,** 146; **80,** 194; **81,** 262; **82,** 257; **83,** 264; **84,** 263; **85,** 283; **86,** 274; **87,** 240; **88,** 216; **89,** 252; **90,** 227; **91,** 293; **92,** 281; **93,** 316; **94,** 288; **95,** 320; **96,** 277.

In charge:

Maj. W. E. Merrill, 1871–92. **R., 71,** 392, 393, 394; **79,** 1365; (Lt. Col.) **80,** 1789; **81,** 1949; **82,** 1934; **83,** 1555; **84,** 1703; **85,** 1821; **86,** 1546; **87,** 1813; **88,** 1683; **89,** 1888; **90,** 2198; **91,** 2367.

Maj. A. Stickney, 1892–95. **R., 92,** 1997, 1998; (Lt. Col.) **93,** 2502; **94,** 1874; **95,** 2368.

Maj. W. H. Heuer, 1896. **R., 96,** 2103.

Assistants:

T. P. Roberts. **R., 79,** 1366.

W. Weston. **R., 85,** 1823; **88,** 1684.

Lt. C. E. Gillette. **R., 91,** 2368.

E. Moeser. **R., 92,** 1997, 1999.

ESTIMATES. (See Projects.)

By T. P. Roberts, new masonry lock, $225,500, **79,** 1365, 1371.

LEGAL PROCEEDINGS.

Steps taken to obtain title to certain ground about lock, **96,** 2104.

LEGISLATION.

Immediate action under app. of 1879 prevented by legal difficulties, **80,** 1789.

OBSTRUCTIONS.

Baltimore & Ohio Southwestern Ry. br., proposed change of draw to opposite side (see Projects), **93,** 2504; **94,** 1874.

OPERATIONS.

1879-80. 549 c. y. dimension st. and 1,280 c. y. rubble delivered, **80,** 1790.

1880-81. Cofferdam built; upper end of lock extended 40′ into bank, **81,** 1950.

1881-82. 2,587 c. y. dimension st. and the same quantity of rubble delivered; 5,500 c. y. excavated; foundation piles driven; 9,000 s. f. lock floor and 2,700 c. y. concrete and masonry laid, **82,** 1936.

1882-83. 2,600 c. y. excavated; piles driven; 1,350 s. f. lock floor and 1,099 c. y. concrete and masonry laid; 2 lock gates hung, **83,** 1556.

1884-85. 11,080 c. y. excavated; foundation piles driven; 4,855 c. y. concrete and masonry laid, **85,** 1824.

1886-87. St. cutting for lock masonry in progress; failure of masonry on part of the work through action of cement used, **87,** 1814.

1887-88. 300 l. f. of cofferdam built; 10,700 c. y. excavated from lock chamber; 1,474 bearing piles driven and capped for lock floor and walls; 2,150 s. f. of lock floor laid, **88,** 1684.

1888-89. 250 c. y. concrete and 300 c. y. of masonry laid, and quantity of st. cut, **89,** 1889.

1889-90. Lock floor and lower miter sills laid, and lock walls partly completed, **90,** 2199.

1890-91. R. wall completed; land wall in process of constr.; miter sills completed and upper gates in position, **91,** 2368.

1891-92. Land wall completed; lower gates built and placed in position, and lock machinery completed and placed; 2,287 c. y. mud removed from lock chamber; lock opened to navigation, **92,** 1997. Operation and care of ice H. and lock, **92,** 1998.

1895-96. Alterations made to Ry. br. (see Projects), **96,** 2104.

PHYSICAL CHARACTERISTICS.

Discharge of the Ohio at Marietta Isld., **71,** 393.

PRIVATE (STATE AND CITY) WORK.

Snags removed by city of Marietta; also agree to keep chan. on Ohio side clear for 5 years, **71,** 395. Lock 11½′ x 35′ x 180′, and dams built by Ohio in 1838, **79,** 1367, 1368.

PROJECTS. (See Estimates.)

By Lt. Col. Merrill, 1879, ice H. by means of lock and dam, admitting boats from the Ohio to Muskingum; lock 400′ l. bet. miter sills, and 56′ w.; new masonry inlet to mill race; extending dam through "present" lock, and constr. of new dam br.; also dr. below lock; est., $216,400, **79,** 1365; **80,** 1790; **83,** 265.

Increased, 1883, to $246,000, **83,** 265, 1557.

Increased, 1885, to $296,000, **85,** 1821.

In 1889 $15,000 est. as required for completion, **89,** 1890.

In 1893 Lt. Col. Stickney est. $10,000 to put lock in good order, **93,** 2503.

Act 1894 au. that as much as necessary of the funds belonging to the "Taylorsville lock app." might be used for completing work at ice H. lock, and also au. necessary alterations in Baltimore & Ohio Southwestern Ry. br. to make lock accessible to Ohio R. commerce, requiring substitution of drawspan for existing fixed span, the U. S. to do all the work except that for the superstr., payment to be made from available funds for care and mainten. of public works, **95,** 2369.

SURVEYS.

Au. act July 11, 1870; made by Maj. Merrill, 1871, **71,** 392. **R., 71,** 393.

Of Muskingum R. below second dam, to ascertain its adaptability for an ice H., 1878, **78,** 108; made by T. P. Roberts. **R., 79,** 1368.

Maps. **85,** 1824.

CC-88 Bellaire, Ohio. (Ice harbor.)

ENGINEERS.

Chief of Engineers. **R., 80,** 195; **81,** 263.

In charge. Maj. W. E. Merrill, 1881. **R., 81,** 1951.

Assistant. J. H. Harlow. **R., 81,** 1952.

PLANS.

By Maj. Merrill, 1881, protection of landing against ice, by 2 crib piers intermediate bet. the "present" piers in the RR. br.; est., $7,500, **81,** 1951, 1953.

SURVEYS.

Au. act Mar. 3, 1879, **80,** 195; made by Maj. Merrill, 1881, **81,** 1951.

CC-93(a) Ohio River, Pa. (Constructing Locks and Dams Nos. 1-10.)

APPROPRIATIONS. (See p. 912.)

COMMERCE.

Diagram of freight, value, and app., **12,** 2322.

CONTRACTS.

1902. Robt. A. Cummings, bldg. 400′ Chanoine Dam No. 5 (unit prices given); The Evansville Cont. Co., bldg. 2 masonry piers and s. shore abutment, Dam No. 6 (unit prices given), **03,** 1679. Preslar-Crawley Mfg. Co., drilling test holes, Lock and Dam No. 7, $3 l. f. loose material, $5 l. f. hard material; Aetna Cons. Co., paving slopes, Lock No. 4, $1.25, **03,** 1680.

1903. Atlas Portland Cement Co., Portland cement for Dams Nos. 4 and 6; John P. McGuire, furn. cover plates, Dam No. 6, $995, **03,** 1679. American Hoist & Derrick Co., hoisting engine, $1,235, **03,** 1680; Penn Bridge Co., 2 steel lock gates at Lock 6, $36,000; W. W. Wood Co., power house at Dam No. 6, $15,890; T. J. Williams, 2 lock-keepers' houses at Dam No. 6, $5,671 for each building, $30 each for mantles, grates, and hearths; The Evansville Cont. Co., 600′ Chanoine dam, navigable pass, Dam No. 3 (unit prices given); Aetna Cons. Co., reconstr. 140 l. f. land wall, Dam No. 5, $7.75 c. y. for concrete, and $5 c. y. for coping st. in place; Aetna Cons. Co., 4,000 t. riprap st., $1.10 t., **04,** 2518.

1904. E. Brown Baker, bldg. 376′ Chanoine dam, and a bear-trap dam, 102′ 4″ w., Dam No. 2 (unit prices given), **04,** 2519. The Dravo Cont. Co., bldg. foundation of 2 lockkeepers' houses at Dam No. 2, excavation, 40¢ c. y.; concrete, $6.20 c. y.; Brady Cons. Co., bldg. power houses at Dam No. 2, $12,459, **05,** 1847. Baker & Egan, bldg. 352′ Chanoine dam, Dam No. 4, also supple. contract (prices given), **05,** 1848.

1905. The Ohio River Cont. Co., dr., Dam No. 2, 29¢ c. y., **05,** 1847. The Ohio River Cont. Co., bldg. 100′ Chanoine dam, 2 bear-trap foundations, and a Chanoine weir 160′ l., 3 piers and abutment Dam

No. 3, (unit prices given), **05,** 1847, 1848. Baker Cont. Co. (Inc.), bldg. about 98′ Chanoine dam, 2 bear-trap foundations, each 93′ l., a Chanoine weir 160′ l., 3 piers and abutments. Dam No. 4 (prices given); The Dravo Cont. Co., bldg. 303′ Chanoine dam, 2 bear-trap dam foundations, Chanoine weir, 3 piers and abutment, Dam No. 5 (prices given), **05,** 1848; Wm. F. Panke, bldg. 2 lock-keepers' houses at each of Dams 2 and 5, $4,800 each; J. Carrol Barr, bldg. concrete foundations for 2 lock-keepers' houses at each of Dams 3 and 4 (prices given); Brady Cons. Co., bldg. power house at each of Dams 3, 4, and 5. $12,789, **05.** 1849.

Contracts for necessary machinery, etc., for these locks and dams, **06,** 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605; **07,** 1719, 1720, 1721, 1722, 1723, 1724, 1725.

1909. The Hollerbach & May Co., constr. abutment, piers, and weirs ($229,954.50), Dam No. 8, **11,** 2132.

1910. The T. A. Gillespie Co., constr. lock and bear trap and guide walls; R. wall, power house, navigable pass, Chanoine weirs, abutment, etc., Dam No. 7 (unit prices given), $750,645.79, **11,** 2131, 2132. The Guy Johnston Cont. Co., constr. 2 lock-keepers' houses, $10,429.88, at Dam No. 8; American Bridge Co., furn. structural steel, etc., $6,756.84, Dam No. 8; Independent Bridge Co., furn. and erecting lock gates, $34,093.36, Dam No. 8, **11,** 2132. New Jersey Foundry & Machine Co., furn. and installing lock-operating mechanism, $9,841.55, Dam No. 8; James Kinney, jr., drilling well and fitting it with air lift, $1,065, Dam No. 8; Hile & Higgs, bldg. power house, $27,524.50, Dam No. 8; Jas. J. Walker Co., furn. and installing air compressors and pipe work, $9,051.45, Dam No. 8; Bury Compressor Co., furn. and installing 2 air receivers, $380 each, Dam No. 8; Gee Electric Construction Co., furn. and installing gas engines, $8,052, Dam No. 8, **11,** 2133. Thos. Carlin's Sons Co., bldg. maneuver boat, $5,200, Dam No. 8; National Contracting Co., constr. lock and guide walls, river-wall power house, the dam, abutment, grading and paving, etc., $912,455.66, Dam No. 9, **11,** 2134.

ENGINEERS.

Chief of Engineers. R., 03, 435; **04,** 464; **05,** 475; **06,** 522; **07,** 550; **08,** 587; **09,** 621; **10,** 693; **11,** 747; **12,** 899.

In charge:
Capt. W. L. Sibert, 1903–06. **R., 03,** 1672; **04,** 2514; (Maj.) **05,** 1845; **06,** 1592.
Maj. H. C. Newcomer, 1907–. **R., 07,** 1706; **08,** 1783; **09,** 1776; (Lt. Col.) **10,** 1936; **11,** 2124; **12,** 2318.

Assistants:
Wm. Martin. **R., 04,** 2519.
W. H. Chadbourn, jr. **R., 04,** 2520; **05,** 1853.
J. W. Arras. **R., 05,** 1849.
1st Lt. Geo. R. Spalding. **R., 05,** 1851.
1st Lt. E. N. Johnston. **R., 05,** 1851.

OPERATIONS.

1902–03. Dam No. 2, constr. of 500′ navigable pass completed; Dam No. 3, chan. 300′ x 5,000′ l. almost completed; Dam No. 4, about 100′ navigable pass completed; Dam No. 5, cofferdam for navigable pass constr. and repaired; Dam No. 6, practically complete except constr. of buildings; Dam No. 7, location of site selected, surs., drilling, etc., **03,** 1672.

1903–04. Dam No. 2, dr. chan. two-thirds completed; Dam No. 3, substr. constr. carried away by rise of R.; Dam No. 5, work on Chanoine dam cont.; Dam No. 6, work on piers, abutment, lock gates, etc.; Dam No. 7, site secured, **04,** 2519.

1904–05. Lock and Dam No. 2, steps taken to raise piers and abutments and to alter movable parts to meet requirements of 9′ proj., chan. dr. 200′ x 400′; constr. of houses, etc., **05,** 1850. Lock and Dam No. 3, 400′ navigable pass and foundation for 200′ more constr., abutment excavation completed, **05,** 1851. Lock and Dam No. 4, riprap st. placed, work on Chanoine dam in progress, foundation piers for power house built, dr. of bar, 18,697 c. y. removed, **05,** 1852; Lock and Dam No. 5, Chanoine dam foundation for distance of 397′ completed, work on foundation to complete dam, etc., in progress, **05,** 1852, 1853. Lock and Dam No. 6, minor work incidental to putting same into operation, **05,** 1853. Lock and Dam No. 7, plans for commencing work in preparation, **05,** 1854.

1905–06. Lock and Dam No. 2, dam practically completed, chan. dr., power house constr., wickets, etc., removed, altered and replaced, **06,** 1592. Lock and Dam No. 3, remainder of pass completed, work on completion of dam, constr. of power house, wickets, etc., **06,** 1593. Lock and Dam No. 4, U. S. assumed charge of navigable pass constr., power house finished, **06,** 1594. Lock and Dam No. 5, masonry of weirs, piers, and abutment completed, lock sill lowered 3′, **06,** 1595. Lock and Dam No. 6, filling, grading, and protection work in progress. Lock and Dam No. 7, preparatory work in progress, **06,** 1596. Summary of materials placed and unit quantities of work accomplished, **06,** 1596.

1906–07. Lock and Dam No. 2 practically completed and in operation; Lock and Dam No. 3, lock completed, dam nearly completed, and in order to meet 9′ d., land wall raised 30″ and lower guide wall 4′; Lock and Dam No. 4, lock completed, machinery installed; Lock and Dam No. 5, lock practically completed, work on completion of dam under way; Lock and Dam No. 6 all completed, plant for lowering sill for 9′ navigation being assembled, **07,** 1706, etc.

1907–08. Lock and Dam No. 3, dam first raised June 25, 1905, constr. navigable pass, bear-trap gates, erection of lock gates completed, installation machinery, dr., etc., **08,** 1783. Lock and Dam No. 4, dam first raised June 30, 1908, all constr. work of dam foundation, movable parts of Chanoine dam and bear-trap gates were completed; installation of machinery, etc., **08,** 1785. Lock and Dam No. 5, all constr. work practically finished, machinery installed, etc., dam first raised Nov. 21, 1907. Lock and Dam No. 6, work of lowering lock sill for 9′ navigation practically completed Jan. 11, 1908, **08,** 1788.

1908–09. Lock and Dam No. 2, raising lower guide wall to an elevation of 4′ above level of Pool 3, **09,** 1776.

1909–10. Filling and paving of lock grounds, Locks 2–5, **10,** 1936.

1910–11. Work on Locks and Dams Nos. 7 and 9 commenced, purchase of land for No. 10 under way; Lock and Dam No. 8, buildings, floating plant, machinery, etc., completed, **11,** 2125, 2126.

1911–12. Filling and paving of lock grounds 2 to 6, incl., practically completed. Lock and Dam No. 7, lock walls, gate recesses, gate tracks, and 100 l. f. guide wall constr.; Lock and Dam No. 9, lock walls, gate tracks, and recesses practically finished, 482 l. f. navigable pass constr., excavation for abutment, weir, etc., nearly finished, **12,** 2318.

PROJECT.

Act Mar. 3, 1905, modified projs. so as to secure 9′ at pool stage, **05,** 475.

Act June 25, 1910, au. purchase of sites, and commencing constr. of Locks and Dams Nos. 9 and 10.[1]

SURVEYS.

Cong. docs., etc., relating to exs., surs., plans, etc.,

Maps.[1] **11,** 2124, 2130; **12,** 2318.

[1] H. D. 492, 60th, 1st.

CC-93(b) Ohio River, Pa. (Operating and care of Locks and Dams Nos. 1–10.)

APPROPRIATIONS. (See p. 912.)

COMMERCE.

Constr. of dams of great benefit, especially to coal interests by allowing harborage at Pittsburgh while awaiting stages of water suitable to passage of boats down R., **03,** 435.

In 1903, 4,724,938 t., **03,** 435; in 1907, 4,021,806 t., **08,** 1802; in 1912, 4,105,649 t., **12,** 2337.

Saving of 30 to 50¢ t. on coal shipped by water, **10,** 697.

CONTRACTS.

1895. Riter & Conley, steel maneuvering boat, $1,988, **95,** 2360.

1896. J. P. McGuire, gate track rails and 2 steel lock gates, $19,690, **97,** 2355.

1899. B. A. Groah, brick power house, $1,985, **00,** 3142.

1901. R. A. Cummings, rebuilding 600′ upper guide wall, $29,215.60; Evansville Contract Co., rebuilding 230′ lower guide wall, $13,575.50; Lawrence Cement Co., 4,000 bbls. cement, $6,320, **01,** 2658.

1902. Scaife Foundry & Machine Co., 6 wrought iron or steel horses; Evansville Contract Co., iron and steel trestles and platforms, and 30 white oak wickets complete, **02,** 1899.

1903. Dravo Contracting Co., bldg. 435 l. f. movable dam, together with 2 abutments and 2 piers, on site of present fixed dam; also rebuilding apron of present fixed dam (unit prices given), **04,** 2513.

1904. Rodgers & Abel, bldg. concrete wall at Davis Isld. Dam (excavation, 30¢ c. y.; concrete, $4.39 c. y.; and steel, 3¢ lb.), **05,** 1841.

1905. Baker Contract Co., removing old bear-trap gate, remodeling foundation and piers, and bldg. and erecting new bear-trap gate at Davis Isld. Dam (prices given), **05,** 1841.

1907. Penn Bridge Co., 22 horses and irons for 40 Chanoine wickets (cast iron, 2.95¢ lb., and wrought iron and steel, 6.65¢ lb.), **07,** 1731.

1909. Penn Bridge Co., reconstr. bear-trap gates at Dam No. 6 (prices given), **10,** 1946.

1912. Hope Eng. & Supply Co., installing gas engines and starting air plant at Lock No. 1 (prices given); Blaisdell Mach. Co., installing air compressor at Lock No. 1, $3,575, **12,** 2337.

ENGINEERS.

Chief of Engineers. **R., 93,** 312; **94,** 287; **95,** 320; **96,** 276; **97,** 356; **98,** 358; **99,** 413; **00,** 473; **01,** 473; **02,** 407; **03,** 435; **04,** 464; **05,** 474; **06,** 521; **07,** 553; **08,** 589; **09,** 624; **10,** 696; **11,** 749; **12,** 904.

In charge:

Lt. Col. A. Stickney, 1892–95. **R., 93,** 2481; **94,** 1867; **95,** 2359.

Maj. W. H. Heuer, 1896–97. **R., 96,** 2097; **97,** 2354.

Maj. W. H. Bixby, 1898–1901. **R., 98,** 2077; **99,** 2347; **00,** 3140; **01,** 2657.

Capt. W. L. Sibert, 1902–06. **R., 02,** 1897; **03,** 1671; (Maj.) **04,** 2512, 2513; **05,** 1841; **06,** 1588.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1727; **08,** 1795; **09,** 1779; **10,** 1940; **11,** 2135; (Lt. Col.) **12,** 2326.

Assistants:

W. Martin. **R., 93,** 2482; **94,** 1867; **95,** 2360; **96,** 2098; **97,** 2356; **98,** 2079; **99,** 2351; **00,** 3145; **01,** 2659; **04,** 2512.

J. W. Arras. **R., 05,** 1842.

W. H. Chadbourne, jr. **R., 05,** 1843.

OBSTRUCTIONS.

By approval of Sec. of War, P. & L. E. RR. Co. removed old br. over R. at Beaver, **11,** 2143.

OPERATIONS.

1892-93. Dam lowered twice and raised twice, **93,** 2481.

1893-94. Dam lowered twice and raised twice, **94,** 1867.

1894-95. Dam lowered twice and raised twice, **95,** 2359.

1895-96. Dam lowered twice and raised once, **96,** 2097.

1896-97. Old wooden gates replaced with new steel gates; dam raised 5 times and lowered 4, **97,** 2354.

1897-98. Dam raised 6 times and lowered 5, **98,** 2077.

1898-99. Dam raised 5 times and lowered 4 times; several wheel axles being broken, the entire system was renewed with new and heavier axles; water tanks, badly decayed, were cut down one-half to prevent accident from being blown over, and minor repairs made to wickets, etc., **99,** 2347.

1899-00. Dam raised and lowered 3 times constr. of power house in progress; a small dike near isld. end of dam completed, and minor repairs made, **00,** 3140.

1900-01. Power house completed, repair work begun on lock engines and machinery, and steam launch purchased, **01,** 2658, 2659.

1901-02. New trestles for service br. secured, 30 new wickets built and placed in dam, new engine for lower lock gate placed, 322′ upper guide wall and 90′ lower guide wall rebuilt; dam raised, lowered, and raised 4 times, **02,** 1897.

1902-03. Dam raised and lowered 7 times, erection of service br. for Weir No. 3, fuel for lock-gate boilers changed from coal to natural gas, timber floors in lock-gate boiler houses replaced by concrete, 278′ new concrete upper guide wall rebuilt, and rebuilding of lower guide wall completed, **03,** 1671.

1903-04. Renewal of a few horses and wickets in weirs, **04,** 2513. Lower lock-gate valves changed and replaced by balanced butterfly valves, work on movable Back Channel dam begun, 150′ of old structure removed and portion of balance dismantled. Dam raised 8 times and lowered 7 times, **04,** 2514.

1904-05. At Lock No. 1, reconstr. of back chan. dam at Davis Isld. Dam completed, concrete wall 8′ high above level of land wall built, sand and slag deposited on U. S. property behind lock, and dam lowered and raised 5 times. At Lock No. 6, placed in operation Aug., 1904, about 2,000 t. riprap laid to protect piers and foundations; dam raised and lowered 3 times, **05,** 1842.

1905-06. At Lock and Dam No. 1, worn-out parts of dam repaired, work of removing old bear-trap gate and replacing with new gate completed, extension of retaining wall to lower end of lock and constr. concrete cover over lower gate recess completed, waste material deposited, repairs to boilers, raising boiler house, shops, etc., débris cleared, wickets replaced, and dam raised and lowered 7 times, **06,** 1589. At Lock and Dam No. 6, air compressor replaced, bar above lock removed, and dam raised 11 times and lowered 10 times, **06,** 1590.

1906-07. At Lock and Dam No. 1, misc. repairs made, trestle erected, culvert constr., pipe lines repaired, boiler for launch installed, wickets removed and replaced, etc.; dam raised and lowered 4 times, **07,** 1727. At Lock and Dam No. 2, assigned to operating and care Oct. 13, 1906, minor changes and repairs made, 1,350 c. y. dr. from lock-gate recesses, and dam raised 3 times and lowered 2 times, **07,** 1728. At Lock and Dam No. 6, slight repairs to main structures, repairs to in-

jured lock bldgs., 300 c. y. deposit removed, and dam raised 3 times and lowered 4 times, **07,** 1729.

1907-08. At Lock and Dam No. 1, repairs and renewal of parts, removal of drift, st. deposited to prevent scour, earth filling placed on lock grounds, new wickets placed, and dam raised 10 times and lowered 9 times, **08,** 1795. At Lock and Dam No. 2, horse boxes, horses, props, and wickets repaired and replaced, placing and painting cover plates on lock walls and other necessary renewals and repairs, earth placed on lock grounds, monoliths of both bear-trap p. repaired against settling, 6″ x 12″ oak blocks below the hurters removed, drift removed, and dam raised 8 times and lowered 7 times, **08,** 1797. At Lock and Dam No. 3, assigned to operating and care Feb. 1, 1908, necessary changes to machinery, etc., made and drift removed; dam raised once, **08,** 1799. At Lock and Dam No. 4, assigned to operating and care Feb. 1, 1908, necessary changes to machinery, etc., made and drift removed; dam raised once, **08,** 1799. At Lock and Dam No. 5, assigned to operating and care Nov. 21, 1907, dam raised, necessary changes, repairs, etc., made in commencing operations, and dam raised 2 times and lowered once, **08,** 1799. At Lock and Dam No. 6, removing lower lock gate, lowering sill and foundations 3′, erecting new lower gate, minor repairs, 5,500 c. y. dr., and dam raised 2 times and lowered once, **08,** 1801.

1908-09. At Lock and Dam No. 1, dam raised and lowered 2 times, necessary repairs to gates, extension of lower guide wall completed, filling and grading lock grounds, etc., **09,** 1781. At Lock and Dam No. 2, dam raised and lowered 2 times, monoliths of p. anchored, 4,135 c. y. dr. from bar, upper guide wall raised 2′, and storage tank installed, **09,** 1782. At Lock and Dam No. 3, dam raised and lowered 2 times, movable parts replaced and repaired, storage tank installed, rough st. placed to prevent scour, **09,** 1783. At Lock and Dam No. 4, dam raised and lowered 4 times, unusually large number of breakages repaired, and storage tank installed, **09,** 1783. At Lock and Dam No. 5, dam raised and lowered 3 times, repairs to damaged horses and broken horse boxes, rough st. placed to prevent scour, 3,910 c. y. dr. from bar, and lock wall anchored, **09,** 1783. At Lock and Dam No. 6, dam raised and lowered 3 times, repairs to gap in "A"-frame dam, machinery of maneuvering boat replaced, and st. placed to prevent scour, **09,** 1784.

1909-10. At Lock and Dam No. 1, masonry repointed, repairs to dam and other structures, scouring prevented, machinery installed and repaired, and dam raised and lowered 4 times, **10,** 1941. At Lock and Dam No. 2, new gate wheels placed, boiler installed, and dam raised and lowered 5 times, **10,** 1943. At Lock and Dam No. 3, st. placed to prevent scour, steps and entrances to basements of power bldgs. and lock houses constr., and dam raised and lowered 4 times, **10,** 1943. At Lock and Dam No. 4, repairs to excessive breakages, st. and concrete blocks placed below protection cribs, dr. material deposited behind upper guide wall, and dam raised and lowered 4 times, **10,** 1943. At Lock and Dam No. 5, st. placed to prevent scour, and dam raised and lowered 3 times, **10,** 1943. At Lock and Dam No. 6, reconstr. of bear-trap gates commenced, one practically finished and the other under way, about 1,540 c. y. dr. from bar, and dam raised 3 times and lowered 4 times, **10,** 1943.

1910-11. Hull for pump boat constr. at Govt. yard, **11,** 2137. At Lock and Dam No. 1, dam raised and lowered 2 times, considerable repairs made to lock gates and movable dam, paving and grading lock grounds, and repairing break in dam, **11,** 2138. At Lock and Dam No. 2, dam raised and lowered 2 times, minor repairs to movable dam, 38,692 c. y. dr. to obtain chan., **11,** 2140. At Lock and Dam No. 3, dam raised and lowered 2 times, repairs to horses, props, etc., heavy st. added to protection crib, 21,515 c. y. dr. from bar adjoining lock, and 12,410 c. y. dr. from bar below dam, **11,** 2140. At Lock and Dam No. 4, dam raised and lowered 2 times, and repairs to props and hurter extension plates, **11,** 2141. At Lock and Dam No. 5, dam raised and lowered 2 times, slight repairs made to horses, props and 2 wickets, and bank protection placed, **11,** 2142. At Lock and Dam No. 6, dam raised 4 times and lowered 3 times, and reconstr. of bear-trap gates completed, **11,** 2142.

1911-12. At Lock and Dam No. 1, dam raised and lowered 5 times, work on removal of lock gates begun, cofferdam constr., unwatering of inclosure, lock gates completed, etc., new hydraulic operating plant with gas-engine compressor plant installed and needed repairs made, **12,** 2332. At Lock and Dam No. 2, dam raised and lowered 5 times, and repairs made to dam and maneuvering boat, **12,** 2334. At Lock and Dam No. 3, dam raised and lowered 7 times, excessive number of breakages repaired, steamer which collided with wickets and sank, raised, and 31,462 c. y. dr. from bar, **12,** 2334. At Lock and Dam No. 4, dam raised and lowered 6 times, repairs to parts of dam, blacksmith shop constr., **12,** 2335. At Lock and Dam No. 5, dam raised and lowered 6 times, small number of repairs made, st. placed to prevent scour, and coping of lock-gate wall reset and anchored, **12,** 2335. At Lock and Dam No. 6, dam raised and lowered 5 times, wicket replaced, repairs made to buildings, maneuvering boat overhauled, **12,** 2336. At Lock and Dam No. 8, dam raised 3 times and lowered 2 times, pipe guard rail constr., dike to prevent scour constr., flues placed in maneuvering-boat boiler, and cement walks and steps under constr., **12,** 2336.

PHYSICAL CHARACTERISTICS.

Ice damaging works, **93,** 2481.

Duration in days of stages in the R. at the dam, from 1885, **93,** 2483; **94,** 1869; **96,** 2099; **97,** 2357.

Damage to service br. for operating wiers of Davis Isld. Dam, **01,** 2657.

High water, scour, damages, etc., **07,** 1728.

Mainten. of pools and water stages; effect of cold weather on navigation, **11,** 2136.

Droughts, effect of, on pools; excessive rainfall, **12,** 2327.

Difficulty in maneuvering dams; damages by rise, **12,** 2328.

Lowest average temperature in Pittsburgh district; heavy ice, **12,** 2329.

Accident causes loss of steam launch *Wenonah;* man drowned, **12,** 2330.

PROJECTS.

By Maj. Bixby, 1900, rebuilding 710′ of the upper and 250′ of the lower guiding wall of lock; substituting Portland cement concrete for the previous cribs of timber and st.; est., $45,000, **00,** 3141.

SURVEYS.

Minor, **11,** 2142.

CC-97(a) Ohio River. (Dredging Pools Nos. 3, 4, and 6.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1905. Monongahela & Western Dredging Co., dr. at Dam No. 6, 19¢ c. y.; The Ohio River Cont. Co., hire of dr. plant, $11 per hour, **06,** 1606.

ENGINEERS.

Chief of Engineers. R., 05, 478; **06,** 525; **07,** 552; **08,** 589; **09,** 623; **10,** 696.

In charge:
Maj. W. L. Sibert, 1905–06. **R., 05,** 1854; **06,** 1605.
Maj. H. C. Newcomer, 1907–. **R., 07,** 1725; **08,** 1794; **09,** 1778; (Lt. Col.) **10,** 1938.

OPERATIONS.

1905–06. 35,161 c. y. dr. from bar at Lock No. 6, and 36,162 c. y. from bar at Lock No. 3, **06,** 1606.
1906–07. 6,132 c. y. dr. from Pool No. 6, and 2,622 c. y. from Pools Nos. 3 and 4, **07,** 1725.
1907–08. Work suspended above and below Dam No. 3 owing to interference with cofferdam of contractor constr. the dam, **08,** 1794.
1908–09. 12,755 c. y. dr. from Pool No. 4, **09,** 1778.

PROJECTS.

Act Mar. 3, 1905, provides for removal of material from bar in upper approach to Lock No. 6, **05,** 478.
Aug. 30, 1905, a reallotment of $10,350 was made for dr. Pools Nos. 3 and 4, Ohio R., **06,** 525.

CC-97(b) Ohio River. (Construction of movable Dams Nos. 2 to 6.)

APPROPRIATIONS. (See p. 912.)

CONTRACTS.

1892. Iron City Sand Co., sand, $2,550; Wilson Bros. & Co., st., $68,378.75; S. Harrold, brick, $3,093.50, **93,** 2488.
1896. Fort Pitt Bridge Works, ironwork of Dam No. 6, $11,706.65, **97,** 2361.
1897. Hulings Bros., Chanoine dam and pier for No. 6, $90,613.89, **97,** 2362. Eigenmann & Hollerbach and Eichel & Arnold, locks, No. 2, $205,509.60; Nos. 3, 4, and 5, $206,509.60 each, **98,** 2086, 2088, 2090, 2092.
1899. The Evansville Contract Co., building weirs, piers, abutments, and portion of pass at Dam No. 6, $174,980.95; Cummings Cement Co., natural hydraulic cement, 15,000 bbls., 73½¢ bbl. in sacks, or 93½¢ bbl. in bbls., **00,** 3150.
1901. The Evansville Cont. Co., constr. Chanoine Dam No. 2, $18,967.50, **01,** 2662, 2665. E. J. Hingston, removing White's and trap dikes and dr. near Dam No. 3, **01,** 2666. The Sheridan-Kirk Cont. Co., lock for movable Dam No. 13 (unit prices given); The Atlas Portland Cement Co., Portland Cement, $1.38 and $1.60 bbl. for Dam No. 13, and $1.33 and $1.55 bbl. for Dam No. 4, **02,** 1924. The Lawrence Cement Co., Portland cement for Dam No. 2, $1.43 and $1.60 bbl.; Aetna Cons. Co., constr. navigable pass, Dam No. 4 (unit prices given); L. S. McKallip & Co., natural cement, 81¢ bbl.; Monongahela & Western Dredging Co., dr., 33¢ c. y., and depositing behind Lock No. 3, 22¢ c. y., **02,** 1925.

ENGINEERS.

Chief of Engineers. R., 93, 313; **94,** 287; **95,** 320, 323; **96,** 276, 278; **97,** 356; **98,** 359; **99,** 414, 417; **00,** 473; **01,** 474; **02,** 410.

In charge:
Lt. Col. A. Stickney, 1892–95. **R., 93,** 2484; **94,** 1870; **95,** 2363.
Maj. H. W. Heuer, 1896–97. **R., 96,** 2100, 2120; **97,** 2358.
Maj. W. H. Bixby, 1898–1901. **R., 98,** 2080; **99,** 2352, 2361; **00,** 3146; **01,** 2661.
Capt. W. E. Craighill, 1902. **R., 02,** 1919.

Assistant. W. Martin. **R., 93,** 2485; **94,** 1871; **95,** 2364; **96,** 2102; **97,** 2363; **98,** 2092; **99,** 2357; **01,** 2666.

LEGAL PROCEEDINGS.

Purchase of land for locks and dams, **98,** 2082.
Acquisition of land, and ex. of title for Dams Nos. 13 and 18, **00,** 3148.

OPERATIONS.

1892–96. Work in progress on Lock No. 6, **93,** 2485; **94,** 1871; **95,** 2364; **96,** 2101.
1896–97. Lock No. 6 almost completed, and work on navigable pass begun, **97,** 2358.
1897–98. Navigable pass work continued, and constr. of Locks Nos. 2 and 4 commenced, **98,** 2081, 2082.
1898–99. Constr. of Dams Nos. 2, 4, and 6 almost completed, and that of Dams Nos. 3 and 5 begun, **99,** 2353.
1899–00. Dam No. 2 completed, constr. of Dams Nos. 3, 4, 5, and 6 in progress, **00,** 3146.
1900–01. Work in progress on constr. of dams: Dam No. 3, 72% completed; removal of dikes in progress; Dam No. 4 completed Jan. 31, 1901; Dam No. 5, 96% completed; Dam No. 6, 80% completed; Dam No. 13, negotiations for land site completed and preliminary work begun; Dam No. 18, location changed and work begun. **01,** 2664.
1901–02. Work on constr. of locks and dams at Dam No. 2; work of completing 500′ navigable pass near completion; Dam No. 3, about four-fifths of masonry lock completed, 12,245 c. y. temporary chan. dr.; Dam No. 4, masonry lock completed; about 300′ navigable pass completed; 147,581 c. y. dr. for temporary chan.; Dam No. 5, masonry lock completed; Dam No. 6, work suspended on account of lack of funds; Dam No. 13, cofferdam constr.; Dam No. 18, preparation for work, **02,** 1920.

PHYSICAL CHARACTERISTICS.

Ice damaging works, **93,** 2485; **95,** 2364.
Bed of gravel 30′ to 40′ thick found by means of borings to extend across the R. at site of Dam No. 6, **94,** 1871.
Descriptions of, sites of dams, Marietta to Pittsburgh, **99,** 2364.

PROJECTS.

Lt. Col. Stickney est., 1892, $2,800 for sur., **93,** 2534.
Act 1892 provided for sur. for Lock and Dam No. 2, and for acquiring title to land, **96,** 2100.
Constr. of Locks and Dams Nos. 3, 4, and 5 au. act 1896, **96,** 2100. Value of work au. reduced from $2,290,000 to $1,990,000 by act of 1897, **97,** 2360.
By Lt. Col. Stickney, 1896, locating Lock and Dam No. 2 at Merriman, No. 3 at "The Trap," No. 4 at Legionville, and No. 5 at Freedom; est., each, $750,000, **96,** 2121, 2122.
By Maj. Heuer, 1896–97, navigable pass of Lock and Dam No. 6, **97,** 2358.

By Maj. Bixby, 1897, employment of men and purchase of materials to hasten work of dilatory contractor for navigable pass of No. 6, **98,** 2081.

By Maj. Bixby, 1897, constr. of Lock No. 2. Approv. by Sec. of War. Modified later by Chief of Engineers, to include constr. of Nos. 3, 4, and 5, **98,** 2082.

By Maj. Bixby, 1898, 6′ of water the year round, by 12 movable dams, bet. Marietta and Pittsburgh; est., $850,000 for each dam, **99,** 2365.

SURVEYS.

Ex. for location of locks and dams bet. Davis Isld. Dam and Beaver R. Dam au. act July 13, 1892; made, 1892, by Lt. Col. Stickney, **93,** 2533. Sur., under acts 1892 and 1894, **96,** 2120.

Sur., Marietta, Ohio, to Pittsburgh, Pa., for movable dams to provide 6′ of water, l. w., au. act June 3, 1896; made, 1899, by Maj. Bixby (see Projects), **99,** 2361.

CC-99(a) Ohio River at Rochester and Freedom, Pa. (Ice harbor.)

COMMERCE.

Necessity for ice breakers, **84,** 1710, 1712, 1714.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 263.

In charge. Lt. Col. W. E. Merrill. **R.,** **84,** 1710, 1711.

Assistant. E. J. Carpenter. **R.,** **84,** 1713.

PLANS.

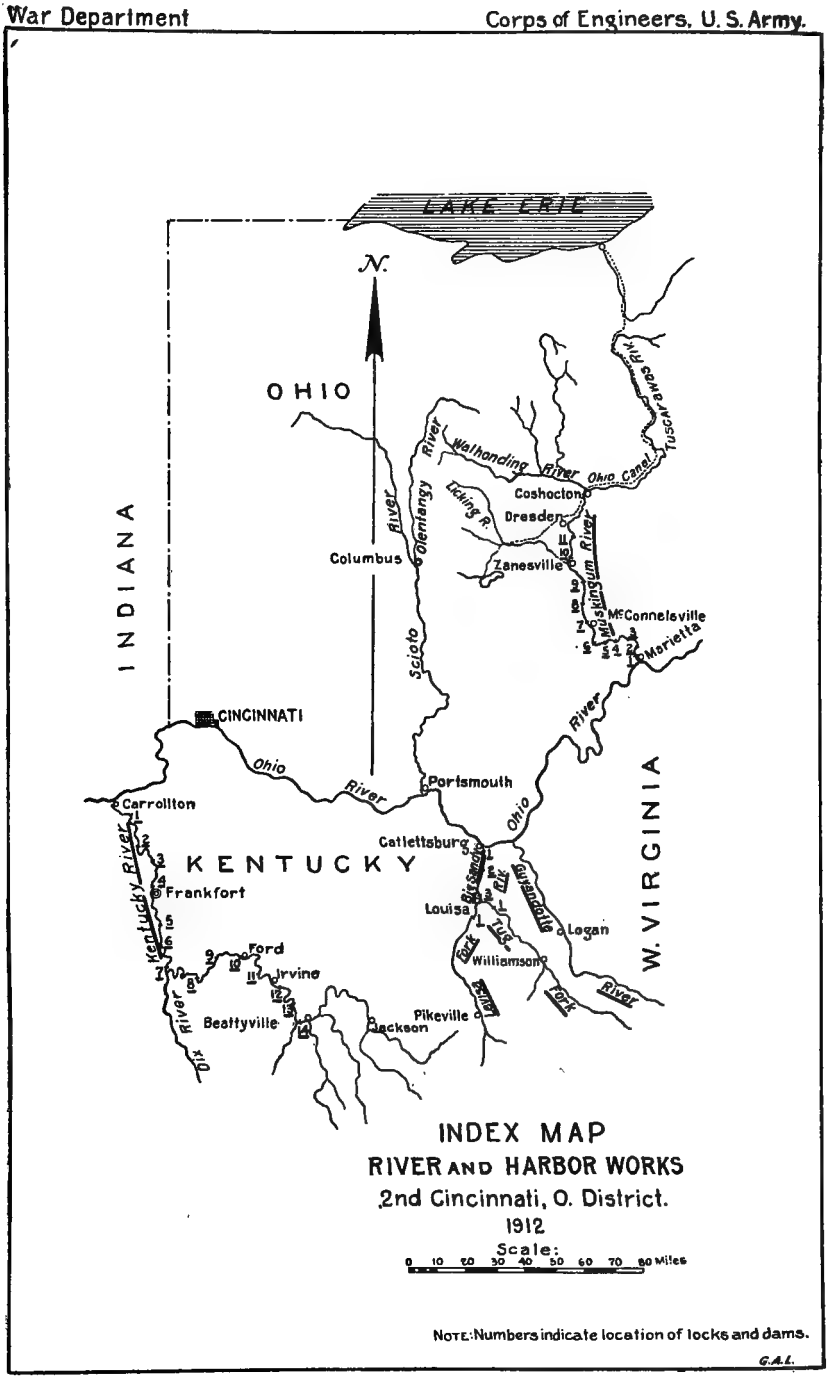
By Lt. Col. Merrill, 1883, ice breaker at the mouth of Elkhorn Creek; est., $5,500, **84,** 1712, 1713.

SURVEY.

Au. act Aug. 2, 1882; made by Lt. Col. Merrill, **84,** 1710.

RIVER AND HARBOR WORKS—OHIO RIVER SYSTEM.

DD.—2d CINCINNATI, O., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
LAKE ERIE
N.
OHIO
INDIANA
KENTUCKY
W. VIRGINIA
Tuscarawas Riv.
Walhonding River
Ohio Canal
Coshocton
Dresden
Licking R.
Olentangy River
Columbus
Zanesville
Muskingum River
McConnelsville
Marietta
Scioto River
CINCINNATI
Ohio River
Portsmouth
Carrollton
Catlettsburg
Kentucky River
Frankfort
Big Sandy Rk.
Louisa
Guyandotte River
Logan
Tug Fork
Williamson
Ford
Irvine
Beattyville
Dix River
Jackson
Pikeville
Levisa Fork
INDEX MAP
RIVER AND HARBOR WORKS
2nd Cincinnati, O. District.
1912
Scale:
0 10 20 30 40 50 60 70 80 Miles
NOTE: Numbers indicate location of locks and dams.
G.A.L.

DD.—SECOND CINCINNATI, O., DISTRICT.

In charge of U. S. Engineer Office,
Customhouse, Cincinnati, Ohio.

NOTE.—District limits considered to be tributaries of left side of Ohio R. from the vicinity of Louisville, Ky., to Big Sandy R., inclusive, and tributaries of the right side of Ohio R. from Madison, Ind., to Steubenville, Ohio.

DD 1 Ohio R. (see Dist. CC)
DD 2 Louisville, Ky. (see Dist. CC) (1)
DD 3 Ohio R., Dam 40 (see Dist. CC) (1)
DD 4 Kentucky R., Ky. (1)
DD 5 Drennon Cr., Ky. (4)
DD 6 Six Mile Cr., Ky. (4)
DD 7 Flat Cr., Ky. (4)
DD 8 Stony Cr., Ky. (4)
DD 9 Benson Cr., Ky. (4)
DD 10 Dix R., Ky. (4)
DD 11 Sugar Cr., Ky. (4)
DD 12 Paint Lick, Ky. (4)
DD 13 Silver Cr., Ky. (4)
DD 14 Tates Cr., Ky. (4)
DD 15 Jacks Cr., Ky. (4)
DD 16 Calloway Cr., Ky. (4)
DD 17 Otter Cr., Ky. (4)
DD 18 Muddy Cr., Ky. (4)
DD 19 Drowning Cr., Ky. (4)
DD 20 Clear Cr., Ky. (4)
DD 21 Station Camp, Ky. (4)
DD 22 Buck Cr., Ky. (4)
DD 23 Ross Cr., Ky. (4)
DD 24 Sturgeon Cr., Ky. (4)
DD 25 South Fork, Ky. R. (4)
DD 26 Buck Cr., Ky. (25)
DD 27 Betty Bowman Cr., Ky. (25)
DD 28 White Oak Cr., Ky. (25)
DD 29 Island Cr., Ky. (25)
DD 30 Sexton Cr., Ky. (25)
DD 31 Lower Teges Cr., Ky. (25)
DD 32 Upper Teges Cr., Ky. (25)
DD 33 Crane Cr., Ky. (25)
DD 34 Goose Cr., Ky. (25)
DD 35 Wildcat Br., Ky. (34)
DD 36 Laurel Cr., Ky. (34)
DD 37 Island Cr., Ky. (34)
DD 38 Little Goose Cr., Ky. (34)
DD 39 Horse Cr., Ky. (34)
DD 40 Collins Fork, Ky. (34)
DD 41 Otter Cr., Ky. (34)
DD 42 Asher Fork, Ky. (34)
DD 43 Timbertree Cr., Ky. (34)
DD 44 Martin Fork, Ky. (34)
DD 45 White Fork, Ky. (34)
DD 46 Pace Cr., Ky. (34)
DD 47 Hart Branch, Ky. (34)
DD 48 Buck Cr., Ky. (34)
DD 49 Red Bird Cr., Ky. (25)
DD 50 Bullskin Cr., Ky. (25)
DD 51 Buffalo Cr., Ky. (25)
DD 52 Indian Cr., Ky. (25)
DD 53 Cow Cr., Ky. (25)
DD 54 Meadow Cr., Ky. (25)
DD 55 Buffalo Cr., Ky. (25)
DD 56 Pawpaw Cr., Ky. (25)
DD 57 Blain Br., Ky. (4)
DD 58 Meeting House Br., Ky. (4)
DD 59 Middle Fork, Ky. R., Ky. (4)
DD 60 Donigan Br., Ky. (59)
DD 61 Long Shoal Cr., Ky. (59)
DD 62 Coal Cr., Ky. (59)
DD 63 Lineman Cr., Ky. (59)
DD 64 Mill Cr., Ky. (59)
DD 65 Bryant Cr., Ky. (59)
DD 66 Turkey Cr., Ky. (59)
DD 67 Longs Cr., Ky. (59)
DD 68 Squabble Cr., Ky. (59)
DD 69 Leatherwood Cr., Ky. (59)
DD 70 Rush Cr., Ky. (59)
DD 71 Elkhorn Cr., Ky. (59)
DD 72 Hell for Certain Cr., Ky. (59)
DD 73 Bull Cr., Ky. (59)
DD 74 Rockhouse Cr., Ky. (59)
DD 75 Short Cr., Ky. (59)
DD 76 Stinnett Cr., Ky. (59)
DD 77 Harmond Cr., Ky. (59)
DD 78 Beech Fork, Middle Fork, Ky. R. (59)
DD 79 Greasy Cr., Ky. (59)
DD 80 Laurel Fork, Ky. (79)
DD 81 Lewis Cr., Ky. (79)
DD 82 White Oak Cr., Ky. (79)
DD 83 Lower Bad Cr., Ky. (59)
DD 84 Burnt Camp Branch, Ky. (59)
DD 85 Hurricane Branch, Ky. (59)
DD 86 Hurst Branch, Ky. (59)
DD 87 Cutshin Cr., Ky. (59)
DD 88 Coon Cr., Ky. (87)
DD 89 Laurel Branch, Ky. (87)
DD 90 Trace Branch, Ky. (87)
DD 91 Pauls Cr., Ky. (87)
DD 92 Wooten Cr., Ky. (87)
DD 93 Mackintosh Cr., Ky. (87)
DD 94 Grassy Branch, Ky. (59)
DD 95 Guys Cr., Ky. (59)
DD 96 Lick Branch, Ky. (59)
DD 97 Turner Br., Ky. (59)
DD 98 Canoe Fork, Ky. (59)
DD 99 Puncheoncamp Cr., Ky. (59)
DD 100 Cope Br., Ky. (59)
DD 101 Upper Twin Cr., Ky. (59)

DD 102 Lower Twin Cr., Ky. (59)
DD 103 Bear Cr., Ky. (59)
DD 104 North Fork, Ky. R. (4)
DD 105 Laurel Br., Ky. (104)
DD 106 Hurricane Br., Ky. (104)
DD 107 Brinks Cr., Ky. (104)
DD 108 Fraley Cr., Ky. (104)
DD 109 Brush Cr., Ky. (104)
DD 110 Rock Lick Cr., Ky. (104)
DD 111 War Cr., Ky. (104)
DD 112 Caney Cr., Ky. (104)
DD 113 Stray Br., Ky. (104)
DD 114 Lick Br., Ky. (104)
DD 115 Wolf Cr., Ky. (104)
DD 116 Bush Br., Ky. (104)
DD 117 Eversole Br., Ky. (104)
DD 118 Willard Cr., Ky. (104)
DD 119 Big Cr., Ky. (104)
DD 120 Macies Cr., Ky. (104)
DD 121 Leatherwood Cr., Ky. (104)
DD 122 Owens Br., Ky. (121)
DD 123 Beech Fork, Ky. (121)
DD 124 Clover Fork, Ky. (121)
DD 125 Stony Fork, Ky. (121)
DD 126 Little Leatherwood Cr., Ky. (121)
DD 127 Line Fork, Ky. (104)
DD 128 Turkey Cr., Ky. (127)
DD 129 Defeated Cr., Ky. (127)
DD 130 King Cr., Ky. (104)
DD 131 Kingdom Come Cr., Ky. (104)
DD 132 Big Cowan Cr., Ky. (104)
DD 133 Boone Fork, Ky. (104)
DD 134 Millstone Cr., Ky. (104)
DD 135 Thornton Cr., Ky. (104)
DD 136 Colly Cr., Ky. (104)
DD 137 Sand Lick Cr., Ky. (104)
DD 138 Dry Fork, Ky. (104)
DD 139 Smoot Cr., Ky. (104)
DD 140 Rockhouse Cr., Ky. (104)
DD 141 Little Colly Cr., Ky. (140)
DD 142 Camp Br., Ky. (140)
DD 143 Bull Run, Ky. (104)
DD 144 Big Br., Ky. (104)
DD 145 Carrs Fork, Ky. (104)
DD 146 Buckeye Cr., Ky. (104)
DD 147 Second Cr., Ky. (104)
DD 148 Lots Cr., Ky. (104)
DD 149 First Cr., Ky. (104)
DD 150 Second Cr., Ky. (104)
DD 151 Grapevine Cr., Ky. (104)
DD 152 Caney Cr., Ky. (104)
DD 153 Big Branch, Ky. (104)
DD 154 Troublesome Cr., Ky. (104)
DD 155 Lost Cr., Ky. (154)
DD 156 Clear Cr., Ky. (154)
DD 157 Mill Cr., Ky. (154)
DD 158 Big Branch, Ky. (154)
DD 159 Right Fork, Ky. (154)
DD 160 Mill Cr., Ky. (154)
DD 161 Montgomery Br., Ky. (154)
DD 162 Big Branch, Ky. (154)
DD 163 Buckhorn Cr., Ky. (154)
DD 164 Fuggitt Br., Ky. (154)
DD 165 Russell Cr., Ky. (154)
DD 166 Quicksand Cr., Ky. (104)
DD 167 Frozen Cr., Ky. (104)
DD 168 Holly Cr., Ky. (104)
DD 169 Upper Devil Cr., Ky. (104)
DD 170 Lower Devil Cr., Ky. (104)
DD 171 Big Branch, Ky. (104)
DD 172 Walker Cr., Ky. (104)
DD 173 Crystal Cr., Ky. (4)
DD 174 Silver Cr., Ky. (4)
DD 175 Contrary Cr., Ky. (4)
DD 176 Millers Cr., Ky. (4)
DD 177 Cow Cr., Ky. (4)
DD 178 White Oak Cr., Ky. (4)
DD 179 Red R., Ky. (4)
DD 180 Howards Cr., Ky. (4)
DD 181 Indian Cr., Ky. (4)
DD 182 Lower Howards Cr., Ky. (4)
DD 183 Boone Cr., Ky. (4)
DD 184 Raven Run, Ky. (4)
DD 185 Hickman Cr., Ky. (4)
DD 186 Jessamine Cr., Ky. (4)
DD 187 Clear Cr., Ky. (4)
DD 188 Glenns Cr., Ky. (4)
DD 189 Elkhorn Cr., Ky. (4)
DD 190 Cedar Cr., Ky. (4)
DD 191 Severn Cr., Ky. (4)
DD 192 Eagle Cr., Ky. (4)
DD 193 Ohio R., Locks and Dams 39, 38, and 37 (see Dist. CC) (1)
DD 194 Gunpowder Cr., Ky. (1)
DD 195 Licking R., Ky. (1)
DD 196 Blackwater, Ky. (195)
DD 197 Grassy, Ky. (195)
DD 198 Caney, Ky. (195)
DD 199 White Oak, Ky. (195)
DD 200 Johnsons Cr., Ky. (195)
DD 201 Middle Fork, Ky. (195)
DD 202 Oakley Cr., Ky. (195)
DD 203 Burning Fork, Ky. (195)
DD 204 State Road Fork, Ky. (195)
DD 205 Lick Cr., Ky. (195)
DD 206 Rockhouse Cr., Ky. (195)
DD 207 Elk Fork, Ky. (195)
DD 208 Ohio R., Locks and Dams 36-29 (see Dist. CC) (1)
DD 209 Limestone Cr., Ky. (1)
DD 210 Conoconneque Cr., Ky. (1)
DD 211 Tygert Cr., Ky. (1)
DD 212 Little Sandy, Ky. (1)
DD 213 Big Sandy R., W. Va. and Ky. (1)
DD 214 Kentucky Whites Cr., Ky. (213)
DD 215 Bear Cr., Ky. (213)
DD 216 Big Blaine Cr., Ky. (213)
DD 217 Cat Fork, Ky. (216)
DD 218 Irish Cr., Ky. (216)
DD 219 Cherokee Cr., Ky. (216)
DD 220 Caney Cr., Ky. (216)
DD 221 Keaton Fork, Ky. (216)
DD 222 Upper Laurel Cr., Ky. (216)
DD 223 Lower Laurel Cr., Ky. (216)
DD 224 Hood Fork, Ky. (216)
DD 225 Brush Fork, Ky. (216)
DD 226 Little Blaine Cr., Ky. (216)
DD 227 Levisa Fork, Ky. (213)
DD 228 Lick Cr., Ky. (227)
DD 229 Georges Cr., Ky. (227)
DD 230 Toms Cr., Ky. (227)
DD 231 Paint Cr., Ky. (227)

DD 232 Mud Lick, Ky. (231)
DD 233 Little Paint, Ky. (231)
DD 234 Jennies Cr., Ky. (231)
DD 235 Abbott Cr., Ky. (227)
DD 236 Middle Cr., Ky. (227)
DD 237 Bull Cr., Ky. (227)
DD 238 Beaver Cr., Ky. (227)
DD 239 Salt Lick Cr., Ky. (238)
DD 240 Rock Fork, Ky. (238)
DD 241 Jones Fork, Ky. (238)
DD 242 Caney Fork, Ky. (238)
DD 243 Turkey Cr., Ky. (238)
DD 244 Left Fork, Ky. (238)
DD 245 Prater Cr., Ky. (227)
DD 246 Mud Cr., Ky. (227)
DD 247 Hurricane Cr., Ky. (227)
DD 248 Island Cr., Ky. (227)
DD 249 Shelby Cr., Ky. (227)
DD 250 Robinson Cr., Ky. (249)
DD 251 Long Fork, Ky. (249)
DD 252 Caney Cr., Ky. (249)
DD 253 Little Cr., Ky. (249)
DD 254 Greasy Cr., Ky. (227)
DD 255 Russell Fork, Ky. and Va. (227)
DD 256 Marrowbone Cr., Ky. (255)
DD 257 Elkhorn Cr., Ky. (255)
DD 258 Pound R., Va. (255)
DD 259 South Fork, P. R., Va. (258)
DD 260 Indian Cr., Va. (258)
DD 261 Bowlecamp Cr., Va. (258)
DD 262 George Cr., Va. (258)
DD 263 Cranes Nest R., Va. (258)
DD 264 McClure Cr., Va. (255)
DD 265 Lick Cr., Va. (255)
DD 266 Fryingpan Cr., Va. (255)
DD 267 Indian Cr., Va. (255)
DD 268 Hurricane Cr., Va. (255)
DD 269 Little Fox Cr., Va. (255)
DD 270 Big Fox Cr., Va. (255)
DD 271 Russell Prater Cr., Va. (255)
DD 272 Grassy Cr., Va. (255)
DD 273 Bull Cr., Va. (227)
DD 274 Little Prater Cr., Va. (227)
DD 275 Prater Cr., Va. (227)
DD 276 Garden Fork, Va. (227)
DD 277 Dismal Cr., Va. (227)
DD 278 Slate Cr., Va. (227)
DD 279 Home Cr., Va. (227)
DD 280 Big Cr., Ky. (227)
DD 281 Grapevine Cr., Ky. (227)
DD 282 Upper Chloe, Ky. (227)
DD 283 Johns Cr., Ky. (227)
DD 284 Buffalo Cr., Ky. (283)
DD 285 Coon Cr., Ky. (283)
DD 286 Brushy Fork, Ky. (283)
DD 287 Daniel Cr., Ky. (283)
DD 288 Greasy Cr., Ky. (227)
DD 289 Nats Cr., Ky. (227)
DD 290 Griffiths Cr., Ky. (227)
DD 291 Three Mile Cr., Ky. (227)
DD 292 Tug Fork, Ky. (213)
DD 293 Rockcastle Cr., Ky. (292)
DD 294 Rockhouse Fork, Ky. (293)
DD 295 Coldwater Fork, Ky. (293)
DD 296 Wolf Cr., Ky. (292)
DD 297 Big Cr., Ky. (292)
DD 298 Pond Cr., Ky. (292)
DD 299 Blackberry Cr., Ky. (292)
DD 300 Peter Cr., Ky. (292)
DD 301 Knox Cr., Ky. and Va. (292)
DD 302 Bull Cr., W. Va. (292)
DD 303 Panther Cr., W. Va. (292)
DD 304 Horse Cr., W. Va. (292)
DD 305 Dry Fork, W. Va. and Va. (292)
DD 306 Bradshaw Cr., W. Va. (305)
DD 307 Little State Cr., W. Va. (305)
DD 308 Beech Cr., W. Va. and Va. (305)
DD 309 Jacob Fork, W. Va. (305)
DD 310 Crane Cr., W. Va. (305)
DD 311 Clear Fork, W. Va. (292)
DD 312 Spice Cr., W. Va. (292)
DD 313 Sand Cr., W. Va. (292)
DD 314 South Fork, W. Va. (292)
DD 315 North Fork, W. Va. (292)
DD 316 Elkhorn Cr., W. Va. (292)
DD 317 Brown Cr., W. Va. (292)
DD 318 Long Pole Cr., W. Va. (292)
DD 319 Ben Cr., W. Va. (292)
DD 320 Beech Cr., W. Va. (292)
DD 321 Mate Cr., W. Va. (292)
DD 322 Millers Cr., W. Va. (292)
DD 323 Pigeon Cr., W. Va. (292)
DD 324 Rockhouse Fork, W. Va. (323)
DD 325 Elk Fork, W. Va. (323)
DD 326 Trace Fork, W. Va. (323)
DD 327 Laurel Fork, W. Va. (323)
DD 328 Marrowbone Cr., W. Va. (292)
DD 329 Jennies Cr., W. Va. (292)
DD 330 Camp Cr., W. Va. (292)
DD 331 Mill Cr., W. Va. (292)
DD 332 Big Hurricane Cr., W. Va. (213)
DD 333 Gragston Cr., W. Va. (213)
DD 334 W. Va. Whites Cr., W. Va. (213)

Right Bank of Ohio R.

DD 335 Steubenville, Ohio (upper limit of Dist. DD on Ohio side) (1)
DD 336 McMahan Cr., Ohio (1)
DD 337 Little Captina Cr., Ohio (1)
DD 338 Sunfish Cr., Ohio (1)
DD 339 Little Muskingum, Ohio (1)
DD 340 Duck Cr., Ohio (1)
DD 341 Muskingum R., Ohio (1)
DD 342 Cats Cr., Ohio (341)
DD 343 Bear Cr., Ohio (341)
DD 344 Big Run Cr., Ohio (341)
DD 345 Olive Green Cr., Ohio (341)
DD 346 Little Olive Green Cr., Ohio (345)
DD 347 Meigs Cr., Ohio (341)
DD 348 East Fork, Ohio (347)
DD 349 Salt Cr., Ohio (341)
DD 350 Symmes Cr., Ohio (341)
DD 351 Wills Cr., Ohio (341)

DD 352 White Eyes Cr., Ohio (351)
DD 353 Crooked Cr., Ohio (351)
DD 354 Buffalo Cr., Ohio (351)
DD 355 Seneca Falls Cr., Ohio (351)
DD 356 Beaver Run Cr., Ohio (351)
DD 357 Leatherwood Cr., Ohio (351)
DD 358 Salt Fork, Ohio (351)
DD 359 Sugar Tree Fork, Ohio (358)
DD 360 Birds Run, Ohio (351)
DD 361 Tuscarawa, Ohio (341)
DD 362 Dunlap Cr., Ohio (361)
DD 363 Big Stillwater, Ohio (361)
DD 364 Skull Fork, Ohio (363)
DD 365 Spencer Fork, Ohio (363)
DD 366 Brushy Fork, Ohio (363)
DD 367 Little Stillwater Cr., Ohio (363)
DD 368 Standing Stone Fork, Ohio (367)
DD 369 Beaver Cr., Ohio (361)
DD 370 One Leg Cr., Ohio (361)
DD 371 Conotton Cr., Ohio (370)
DD 372 McGuires Fork, Ohio (370)
DD 373 Indian Fork, Ohio (370)
DD 374 Sandy Cr., Ohio (361)
DD 375 Clear Fork, Ohio (374)
DD 376 Hughes Cr., Ohio (374)
DD 377 Little Sandy Cr., Ohio (374)
DD 378 Black Cr., Ohio (377)
DD 379 Big Indian Cr., Ohio (374)
DD 380 Reeds Run, Ohio (374)
DD 381 Nimishillen, Ohio (374)
DD 382 Sippo Cr., Ohio (361)
DD 383 Nimisila Cr., Ohio (361)
DD 384 Pigeon Cr., Ohio (361)
DD 385 Wolf Cr., Ohio (384)
DD 386 Chippewa Cr., Ohio (361)
DD 387 Styx Cr., Ohio (386)
DD 388 Newman Cr., Ohio (361)
DD 389 Sugar Cr., Ohio (361)
DD 390 Walnut Cr., Ohio (389)
DD 391 Stone Cr., Ohio (361)
DD 392 Old Town Cr., Ohio (361)
DD 393 Evans Cr., Ohio (361)
DD 394 White Eyes Cr., Ohio (361)
DD 395 Walhonding R., Ohio (341)
DD 396 Mill Cr., Ohio (395)
DD 397 Killbuck Cr., Ohio (395)
DD 398 Doughty Fork, Ohio (397)
DD 399 Martins Cr., Ohio (397)
DD 400 Salt Cr., Ohio (397)
DD 401 Apple Cr., Ohio (397)
DD 402 Little Kilbuck Cr., Ohio (397)
DD 403 Paint Cr., Ohio (397)
DD 404 Black Cr., Ohio (397)
DD 405 Wolf Cr., Ohio (397)
DD 406 Beaver Run, Ohio (397)
DD 407 Mohican R., Ohio (395)
DD 408 Muddy Fork, Ohio (407)
DD 409 Jerome Fork, Ohio (407)
DD 410 Black Fork, Ohio (407)
DD 411 Honey Cr., Ohio (410)
DD 412 Rocky Fork, Ohio (410)
DD 413 Clear Fork, Ohio (410)
DD 414 Kokosing R., Ohio (395)
DD 415 Jelloway Cr., Ohio (414)
DD 416 Shench Cr., Ohio (414)
DD 417 Middle Branch, Ohio (414)
DD 418 Dry Cr., Ohio (414)
DD 419 Wakatomika Cr., Ohio (341)
DD 420 Sand Fork, Ohio (419)
DD 421 Mill Fork, Ohio (420)
DD 422 Licking R., Ohio (341)
DD 423 Rocky Fork, Ohio (422)
DD 424 North Fork, Ohio (422)
DD 425 Otter Fork, Ohio (422)
DD 426 Drakes Fork, Ohio (422)
DD 427 South Fork, Ohio (422)
DD 428 Raccoon Cr., Ohio (427)
DD 429 Lobdell Cr., Ohio (427)
DD 430 Moxahala Cr., Ohio (341)
DD 431 Jonathans Cr., Ohio (430)
DD 432 Poplar Fork, Ohio (431)
DD 433 Brush Cr., Ohio (341)
DD 434 Duncans Run, Ohio (341)
DD 435 Wolf Cr., Ohio (341)
DD 436 West Branch, Ohio (435)
DD 437 Little Bear Cr., Ohio (341)
DD 438 Rainbow Cr., Ohio (341)
DD 439 Muskingum R., mouth (Marietta, Ohio) (1)
DD 440 Ohio R., (See Dist. CC) downstream to mouth of—
DD 441 Little Hocking R., Ohio (1)
DD 442 Big Hocking R., Ohio (1)
DD 443 Shade R., Ohio (1)
DD 444 Raccoon Cr., Ohio (1)
DD 445 Little Scioto R., Ohio (1)
DD 446 Scioto R., Ohio (Portsmouth) (1)
DD 447 Bear Cr., Ohio (446)
DD 448 Beaver Cr., Ohio (446)
DD 449 Salt Cr., Ohio (446)
DD 450 Middle Fork (Salt Cr.), Ohio (449)
DD 451 Pigeon Cr., Ohio (450)
DD 452 North Fork (Salt Cr.), Ohio (449)
DD 453 Walnut Cr., Ohio (446)
DD 454 Kinnikinnick Cr., Ohio (446)
DD 455 Little Walnut Cr., Ohio (446)
DD 456 Gahanna Cr., Ohio (446)
DD 457 Alum Cr., Ohio (456)
DD 458 Olentangy R., Ohio (446)
DD 459 East Br. Olentangy R., Ohio (458)
DD 460 Whetstone Cr., Ohio (458)
DD 461 Little Scioto R., Ohio (446)
DD 462 Panther Cr., Ohio (446)
DD 463 Rush Cr., Ohio (446)
DD 464 Fulton Cr., Ohio (446)
DD 465 Bokes Cr., Ohio (446)
DD 466 Mill Cr., Ohio (446)
DD 467 Blues Cr., Ohio (466)
DD 468 Darby Cr., Ohio (446)
DD 469 Little Darby Cr., Ohio (468)
DD 470 Spring Fork, Ohio (468)
DD 471 Yellow Bud Cr., Ohio (446)
DD 472 Deer Cr., Ohio (446)
DD 473 Paint Cr., Ohio (446)
DD 474 North Fork (Paint Cr.), Ohio (473)
DD 475 East Fork (Paint Cr.), Ohio (473)
DD 476 Sugar Cr., Ohio (473)
DD 477 Rattlesnake Cr., Ohio (473)
DD 478 Rocky Fork, Ohio (473)
DD 479 Clear Cr., Ohio (478)
DD 480 Sunfish Cr., Ohio (446)
DD 481 Brush Cr., Ohio (446)

DD 482 South Fork (Brush Cr.), Ohio (481)
DD 483 Rocky Fork, Ohio (482)
DD 484 Ohio R., (See Dist. CC) mouth of Scioto R. to Little Marietta.
DD 485 Brush Cr., Ohio (1)
DD 486 Eagle Cr., Ohio (1)
DD 487 Redoak Cr., Ohio (1)
DD 488 Little Miami R., Ohio (1)
DD 489 Mill Cr., Ohio (1)
DD 490 Ohio R., Cincinnati, Ohio.
DD 491 Big Miami R., Ohio (1)
DD 492 Ohio R. (See Dist. CC) downstream to—
DD 493 Laughery Cr., Ind. (1)
DD 494 Tanners Cr., Ind. (1)
DD 495 Hogans Cr., Ind. (1)
Dam No. 40, and Madison, Ind., the next lowest points on Ohio R. (See Dist. CC)

DD-4 KENTUCKY RIVER.

Part.	Title.	Period.	Appropriations.
a	Kentucky R. and tributaries	1878–1912	$4,113,500.00
b	Kentucky R., locks and dams, operating and care	1885–1912	2,204,348.26
	Total		6,317,848.26

Part (a), DD-4 Kentucky River and its Tributaries, Ky. (Including North Fork, Boone Fork, Middle Fork, Troublesome Creek, and South Fork.)

APPROPRIATIONS.

1879, $100,000, **79,** 146.
1880, 100,000, **80,** 1827.
1881, 125,000, **81,** 1976.
1882, 225,000, **82,** 1949.
1884, 250,000, **84,** 1725.
1886, 187,500, **86,** 1606.
1888, 180,000, **88,** 1771.
1890, 180,000, **90,** 2263.
1892, 150,000, **92,** 2085.
1894, 125,000, **95,** 2485.
1896, 50,000, **96,** 2288.
1896, 83,000, **97,** 2514.
1897, 200,000, **97,** 2514.
1898, 350,000, **98,** 2016.
1900, 75,000, **00,** 3365.
1901, 150,000, **01,** 2745.
1902, 200,000, **02,** 1953.
1903, 200,000, **03,** 1750.
1905, 50,000, **05,** 1916.
1907, 175,000, **07,** 1783.
1908, 309,000, **08,** 1852.
1909, 210,000, **09,** 1835.
1910, 106,000, **10,** 1994.
1911, 165,000, **11,** 2195.
1912, 168,000, **12,** 2393.

Total, 4,113,500 (incl. misc., $4,122,399.95, **12,** 2393).

COMMERCE.

Description of, **79,** 1400, 1401 1403, 1405, 1406; **98,** 2016; **05,** 492.

Mineral and timber resources tributary to R., **79,** 1401–1405.

At 1896 the value of the C. of the entire R. during the preceding 17 years was est. at $47,999,578, **96,** 2288.

Before the reopening of the stream by the U. S. rates on the RR. of the vicinity were so high as to almost prohibit shipments, **96,** 2288.

Description of actual and probable coal business, **98,** 2015.

Principal C. timber, and imp. is rather detrimental to it, both logs and dams being damaged. (See K. R., operating and care.) When imp. is carried to head of R., coal lands there may be developed, **12,** 927.

CONTRACTS.

1882. Stratham & Price, ironwork, **82,** 1949.

1884. M. Williams, materials and labor for abutment constr., **85,** 1873. H. C. Jones, timber for guard-crib repair, **85,** 1873. Kirk & Abraham, materials, **85,** 1874. T. J. Hardin, timber, **85,** 1874. W. L. Pence, timber, **85,** 1874. I. V. Hoag, jr., materials and labor, **85,** 1875.

1885. Lomas Forge & Bridge Works, cast and wrought iron work, **85,** 1875. J. J. Cox, material and labor, **85,** 1876. Lomas Forge & Bridge Works, materials and labor, **86,** 1606.

1886. T. J. Hardin & Co., timber and piles. **86,** 1607. T. J. Congleton & Bro., lumber, **86,** 1607. T. Morris, cast and wrought iron, **86,** 1608. T. H. Carruthers, wrought-iron spikes, **86,** 1608, Scully & Peter, riprap st., **86,** 1609. E. M. Pryse & Bro., coal, 6¢ bushel, **86,** 1609. G. W. Gourley, coal, 6¢ bushel, **86,** 1609.

1887. O'Brien & Co., lock st., **87,** 1875.

1888. Mason, Gooch & Hoge Co., furnishing lock st., $87,238, **89,** 1972.

1889. G. S. Adams, cement, $1.21 bbl., **89,** 1973. Choate & Brawner, 3 lock houses, $2,041 each, **89,** 1978.

1890. D. K. Sprinkle, constr. of 2 dump scows, $1,750 each, and dr. boat hull, $2,590, **90,** 2269.

1891. E. W. Fisher, Portland cement, $2.68 bbl., **91,** 2450. J. B. Speed & Co., American natural cement, $1.01 bbl., **91,** 2450.

1892. C. Barnes, constr. towboat, $16,800. **93,** 2619.

1896. M. P. Grey, moving st., $7.68 c. y. ($38,400). J. B. Speed & Co., cement, $1.07 bbl. ($4,280). J. C. Thomas, st., special, $14.50 c. y.; coping, $13 c. y.; backing, $5.50 c. y. ($47,437), **96,** 2289.

1897. Enterprise Lumber Co., white oak or yellow pine timber, $16.40 M f. b. m. ($12,086.80). J. P. McGuire, ironwork, $2,557.68, **97,** 2515.

1898. E. J. Young, 4 lock-tenders' houses at Locks Nos. 7 and 8, $11,232. T. A. Sheridan, masonry of lock and abutment, Lock No. 8, $188,397.50, **99,** 2515, 2516.

1899. T. A. Sheridan, lock gates for Lock No. 8, $7,679.30; timber-crib dam and approach cribs, Lock No. 8, $30,800, **99,** 2517.

1901. M. F. Wharton, constr. of dwellings, prices given; The Sheridan-Kirk Contract Co., building Lock and Dam No. 9, prices given; Virginia Portland Cement Co., furnishing cement for Lock and Dam No. 9, $1.73 bbl.; J. B. Speed & Co., cement for Lock and Dam No. 9, 84¢ bbl., **01,** 2746.

1902. Virginia Portland Cement Co., cement for Lock and Dam No. 10; Mason & Hoge Co., constr. Lock and Dam No. 10, **02,** 1955.

1903. Todd & Sons, building dwellings and outhouses, Lock No. 11; H. E. Talbott & Co., building Lock and Dam No. 11, prices given; Virginia Portland Cement Co., cement, prices given, **04,** 2647.

1906. H. E. Talbott & Co., 2 supple. contracts, substitution of armored concrete pavement, $7.25 c. y., and constr. a movable dam in place of fixed dam as orig. contemplated, prices given, **06,** 1654.

1907. The Ohio River Contract Co., constr. of Lock and Dam No. 12, prices given; W. P. Eckley, building 2 dwellings, etc., at Lock No. 12, **07,** 1784.

1909. Smith, Towles & Co., constr. buildings, etc., and building Lock and Dam No. 13, prices given, **09,** 1835.

1910. Augustus Snyder, constr. dwelling, outbuilding, etc., at Lock and Dam No. 12, prices given, **10,** 1995. The Oregonia Bridge Co., constr. steel highway br. over Tates Creek, $2,800; W. F. Garretson, constr. Dam No. 13, prices given, **11,** 2197.

1911. Lyons Lumber Co., constr. dwellings, etc., at Dam No. 14, prices given; Gahren, Dodge & Maltby, constr. Lock and Dam No. 14, prices given, **11,** 2197.

ENGINEERS.

Chief of Engineers. **R., 78,** 109; **79,** 146, 147; **80,** 195; **81,** 263; **82,** 257; **83,** 265; **84,** 264, 1728; **85,** 288; **86,** 282; **87,** 247; **88,** 226, 227; **89,** 263, 264; **90,** 237, 238; **91,** 305, 306; **92,** 291, 292; **93,** 331; **94,** 303; **95,** 338; **96,** 295; **97,** 373; **98,** 355; **99,** 437; **00,** 500; **01,** 494; **02,** 419; **03,** 450; **04,** 481; **05,** 491; **06,** 541; **07,** 568; **08,** 608; **09,** 641; **10,** 716; **11,** 771; **12,** 925.

Boards:

Convened, Cincinnati, Ohio, Nov. 19, 1883, by S. O. No. 146, C. of E., to **R.** upon the erection of a lock and movable dam at junction of the "Three Forks of Kentucky R." **R., 84,** 1729, 1731. (Lt. Cols. Craighill and Merrill and Capt. Post.)

Convened, Frankfort, Ky., Mar. 9, 1887, by S. O. No. 23, to ex. and **R.** upon Maj. Post's proj. for Lock and Dam No. 6. **R., 87,** 1879. (Lt. Cols. Poe and Merrill and Maj. Stickney.)

Convened, Washington, D. C., May 30, 1887, by S. O. No. 146, to **R.** upon the subject of modifications required for remedying the difficulties experienced in passing boats through the chutes of the movable dam at Beattyville. **R., 87,** 1882. (Col. Craighill, Lt. Col. Merrill, and Maj. Post.)

In charge:

Maj. W. E. Merrill, 1879–80; **80,** 195. **R., 79,** 1398.

Maj. J. W. Cuyler, 1880–83. **R., 80,** 1825; **81,** 1971; **82,** 1945.

Capt. J. C. Post, 1883–87. **R., 83,** 1559; **84,** 1723, 1728, 1731; **85,** 1869, 1878; **86,** 1603, 1610.

Maj. A. Stickney, 1887. **R., 87,** 1872, 1885.

Maj. D. W. Lockwood, 1888–95. **R., 88,** 1769, 1775; **89,** 1970, 1975; **90,** 2261, 2266; **91,** 2449, 2455; **92,** 2083, 2091; **93,** 2618; **94,** 1980; **95,** 2484.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2286; **97,** 2513.

Capt. J. G. Warren, 1898. **R., 98,** 2012.

Capt. G. A. Zinn, 1899.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 2513; **00,** 3363.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2744; **0,2** 1953; (Lt. Col.) **03,** 1748; **04,** 2644; **05,** 1912.

Maj. J. G. Warren, 1905–10. **R., 06,** 1653; **07,** 1781; (Lt. Col.) **08,** 1851; **09,** 1833.

Maj. J. C. Oakes, 1910–. **R., 10,** 1992; **11,** 2193; **12,** 2391.

Assistants:

R. H. Fitzhugh. **R., 79,** 1399, 1407.

D. L. Sublett. **R., 84,** 1726; **85,** 1876; **86,** 1613.

R. S. Burnett. **R., 87,** 1875, 1889; **88,** 1772, 1777; **89,** 1973, 1978; **90,** 2264, 2269; **91,** 2450, 2457; **92,** 2085, 2094.

Lt. H. E. Waterman. **R., 93,** 2619; **94,** 1981; **95,** 2485.

Lt. W. W. Harts. **R., 96,** 2290; **97,** 2516.

J. M. G. Watt. **R., 98,** 2015; **99,** 2518; **00,** 3365.

W. H. McAlpine. **R., 03,** 1751.

Lt. P. S. Bond, **05,** 486; **06,** 536; **07,** 564; (Capt.) **08,** 602.

1st Lt. E. D. Peek, **06,** 536.

1st Lt. Arthur Williams, **07,** 564; **08,** 602; **09,** 636.

ESTIMATES. (See Plans and Projects.)

By Maj. Merrill. Repairs to old and constr. of new locks and dams, $1,074,402; slack-water system on North Fork, $1,386,000; imp. of chan., North Fork, $10,000; slack-water system on Middle Fork, $786,000; slack-water system on South Fork, $968,000; **79,** 1399, 1401, 1411.

Tables of est., by R. H. Fitzhugh, **79,** 1411–1421.

LEGAL PROCEEDINGS.

Difficulty in obtaining title to land for site of Lock No. 7, **94,** 1980; **95,** 2485. Purchase of some of the land; some acquired by condemnation proceedings, **96,** 2287.

Title secured to Lock No. 8, **98,** 2016.

Proceedings for site of Lock No. 9, not concluded, **00,** 3364.

Title to site of Lock No. 9 secured by purchase; title to site of Lock No. 10 investigated and referred to U. S. atty. for opinion, **01,** 2744. Title for site of Lock and Dam No. 10 acquired, **02,** 420.

Land for site of Lock and Dam No. 11 acquired, **03,** 1749.

Claims against U. S. for damages to land overflowed by pools of Locks 9 and 10, **05,** 1915.

LEGISLATION.

Act Mar. 3, 1905, au. repayment to Clark Co., Ky., of sum expend. in constr. br. across Twomile Creek; also repair to road damaged by constr. of Lock and Dam No. 10 at Ford, Ky., **05,** 1915.

Act July 25, 1910, au. Sec. of War to reimburse county of Madison, Ky. (not exceeding $1,500), for restoring county road near Otter Creek, **12,** 926.

Not believed that U. S. should bear entire cost of restoring roads, etc., damaged through imp.

OBSTRUCTIONS.

The Beattyville Dam an obstr. since the constr. of a RR. from the dam to the Kentucky Union RR., **93,** 2618.

OPERATIONS.

1879–80. Removal of State Dams Nos. 1, 2, and 3 nearly completed, **80,** 1826.

1880–81. New dam half completed upon site of Dam No. 1; 130′ breach in Dam No. 2 closed by cribwork; new dam nearly completed on site of Dam No. 3; new upper gates built for Dam No. 4; repairs to lock houses; constr. of quarterboats and derricks, **81,** 1973, 1974.

1881–82. Breach through bank above abutment at Dam No. 1 repaired, **82,** 1947.

1882–83. Old gates removed and grounds inclosed at Lock No. 5; guard cribs built and filled with st.; extensive repairs to old dam at Lock No. 4; guard cribs and lower end of st. abutment raised, and lower R. crib lengthened at Lock No. 3; dam at Lock No. 2 completed; work in breach at Lock and Dam No. 1 capped by 196 l. f. of cribwork filled with st.; 675 l. f. guard cribs built above and below lock; gap below dam permanently closed by piling, brush, and cribwork, **83,** 1560.

1883–84. Dam No. 1 resheeted and sheet piling placed on rear of same; leak in Dam No. 2 repaired; 528 l. f. new apron constr. at Dam No. 4, **84,** 1724.

1884-85. Outlet to breach at Lock and Dam No. 1 raised and 5,000 c. y. backing placed behind the dam; bar below lock removed; st. crib built; lock chamber and upstream approach cleaned at Dam No. 5; miter sills rebuilt; walls and coping repaired; guard cribs reconstr.; gates framed and new abutment built; 169 snags removed and 1,200 trees cut and girdled, **85,** 1869, 1871.

Operation and repair of locks and dams, **85,** 1878.

1885-86. Lock-keeper's dwelling completed at Dam No. 1; reconstr. of Dam No. 5 completed and repairs made to lock and approaches; work commenced on the foundations for movable dam and abutment at Beattyville; 29,769 c. y. gravel, 9,354 c. y. of r., and 7,316 snags removed; 10,808 l. f. wing dams built, **86,** 1604, 1605.

Operations and repair of locks and dams, **86,** 1610.

1886-87. Constr. of Beattyville Dam continued to completion; removal of obstr. continued by the snag boat, **87,** 1873.

Operation and repair of locks and dams, **87,** 1885.

1887-88. Crest, upper steps, portions of guide walls, and floors of passes of Beattyville Dam removed; chan. 100′ x 350′ cut through high bar below the chutes; 378 l. f. of protection wall built along Proctor bank below passes; quarry stripped and track laid for st. for Lock No. 7, **88,** 1772–1774.

Operation and repair of locks and dams, **88,** 1775–1786.

1888-89. Removal of guide walls of Beattyville Dam continued; protection wall along the Proctor bank raised 3′; quarrying st. for Lock No. 7 begun; repair and constr. of plant, **89,** 1973, 1974.

Operation and repair of locks and dams, **89,** 1975–1982.

1889-90. Removal of guide walls, gates, and floors of Beattyville Dam continued; cofferdam built; lower wing of Beattyville abutment strengthened by cribbing; 1,555 c. y. dimension st. cut, and 215 c. y. special st. prepared; 336 c. y. backing quarried, **90,** 2264, 2265.

Operation and care of locks and dams, **90,** 2266.

1890-91. Dr. built; dr. and excavation for cofferdam; excavation for abutment, and constr. and erection of plant for Lock No. 6, **91,** 2450. 37,000 c. y. dr., **91,** 2453. Constr. of Beattyville Dam continued, **91,** 2454.

Operation and repair of locks and dams, **91,** 2455.

1891-92. Lock and Dam No. 6 completed; Beattyville Dam extended to Proctor side of the R.; 2,947 c. y. r. blasted and removed, and 852 c. y. sand dr., **92,** 2083, 2084.

Operation and repair of locks and dams, **92,** 2091.

1892-93. Constr. of Lock No. 6 and its approaches in progress; about 15,000 c. y. dr., and much general work done, **93,** 2620, 2621.

1893-94. Work on Lock No. 6 in progress; preparations made for work on Lock No. 7; a small amount of dr. done; general work done, **94,** 1981, 1982.

1894-95. General work at Lock No. 6; constr. of 2 barges in progress and nearly completed at Lock No. 4; work at Lock No. 7 in progress, **95,** 2488.

1895-96. Constr. of Lock No. 7 in progress, involving among other kinds of work the dr. of over 37,000 c. y., **96,** 2290–2292.

1896-97. Work on Lock and Dam No. 7 in progress, **97,** 2516–2519.

1897-98. Same work as last year, and plans prepared for constr. of Lock and Dam No. 8, **98,** 2017–2021.

1898-99. 4 houses built for lock tenders at Locks Nos. 7 and 8; finishing the paving and misc. work at Lock No. 7; purchasing the site and beginning work at Lock No. 8, **99,** 2514.

1899-00. 2 coal bins built; cribs and culvert at Lock No. 7 finished; masonry and cribs at Lock No. 8 nearly finished, and about 15,400 obstr. removed from pool of Lock No. 8, **00,** 3363.

1900-01. Masonry crib and dam at Lock 8 finished; overhanging trees removed from Pool 8; ex. of r. at Lock 9; R. sur. at sites of proposed Locks and Dams 10, 11, and 12, **01,** 2744.

1901-02. Lock-tenders' dwellings completed; work on constr. of Lock 9 in progress; cement delivered, **02,** 1953.

1902-03. Constr. work on Lock 9 progressing fav.; lock houses, outbuildings, and working plant at Lock and Dam No. 10 constr., **03,** 1748.

1903-04. Work on Lock and Dam 9 described; constr. work on Lock and Dam 10 commenced; lock houses and outhouses built; also equipment estab. for constr. Lock and Dam 11, **04,** 2644.

1904-05. Lock No. 10 completed; work on Lock 11 in progress, **05,** 1914.

1905-06. Description of work in progress at Lock No. 11; sur. made to determine site for Lock No. 12, **06,** 1652.

1906-07. Work on Lock and Dam No. 11 finished; preliminary work on Lock No. 12 commenced; sites selected and sur. for Locks Nos. 13 and 14; repairs made to Locks Nos. 9 and 10, damaged by flood, **07,** 1782.

1907-08. Lock-keepers' dwellings, buildings, etc., completed; work on building of Lock and Dam No. 12 in progress; sites for Locks and Dams Nos. 13 and 14 purchased and paid for; ex. of private property overflowed by Locks and Dams Nos. 9, 10, and 11 made, **08,** 1851.

1908-09. Work on constr. of Lock and Dam No. 12 in progress; preparations made for constr. of dwellings, etc., at Lock and Dam No. 13, **09,** 1834.

1909-10. Lock and Dam No. 12 completed; work on Lock and Dam No. 13 in progress, **10,** 1993.

1910-11. Br. constr. across Tates Creek; work commenced on constr. of dwellings, etc., at Lock and Dam No. 14; progress of work at Lock and Dam No. 13; frame dwelling completed at Lock and Dam No. 12, **11,** 2193.

1911-12. Constr. of lock gates, dwellings, etc., at Lock and Dam No. 13 completed; dwellings, outbuildings, cisterns, etc., at Lock and Dam No. 14 completed; excavations begun for lock and dam constr., **12,** 2392.

PHYSICAL CHARACTERISTICS.

Description, **79,** 1398–1408.

Mineral, timber, and st. resources tributary to R., **79,** 1401–1403.

Tables of distances and elevations, **79,** 1411–1421.

A tributary of the Ohio, entering it bet. Cincinnati, Ohio, and Louisville, Ky., **93,** 2618; is formed 258 m. from Ohio R by junction of N., S., and Middle Forks. **12,** 925.

Description of, at Lock No. 7, **95,** 2484–2487; **96,** 2287.

Description of, upper R., **98,** 2013.

Increase in l. of R. by completion of Lock and Dam No. 9, **04,** 482. Washouts at Locks 9 and 10; contents of local office destroyed by fire; increase in l. of R. due to completion of Lock and Dam No. 10, **05,** 1913.

Description of damages to highways, and est. of cost of restoration, **09,** 641.

PLANS. (See Estimates and Projects.)

1879. By Maj. Merrill, slack-water navigation, North Fork, 121 m., 14 locks and dams; average lift, 14.5′ per lock; est., $1,386,000; and for removing old mill dams and other obstr. to 44 m. above Leatherwood Creek; est., $10,000. Slack-water navigation up Middle Fork, 68 m., 13 locks and dams; average lift, 13′; est., $786,000. Slack-water navigation, 69 m. up South Fork, 14 locks and dams; average lift, 15′; est., $968,000, **79,** 1399.

By R. H. Fitzhugh, repairing and constr. locks and dams, **79,** 1400, 1406, 1421.

PRIVATE (STATE) WORK.

Kentucky imp. the lower 95 m. of R. with 5 locks and dams (in a dilapidated condition), **79,** 146, 1398.

Description of work done before acquirement of control by U. S., **96,** 2286.

PROJECTS. (See Estimates and Plans.)

By Maj. Merrill, 1879, slack-water navigation for draft of 6′ on Kentucky R., mouth to Three Forks, 258 m., repairing old locks and dams, and constr. 12 new locks and dams; est., $1,074,402, **79,** 1399; **80,** 1826.

In 1883, after total app. of $550,000, Capt. Post revised est. and concluded that $2,471,639.26 would be required to complete proj., **83,** 1562.

Plan and location of Lock and Dam No. 6, as proposed by Maj. Post, approved by BE. of 1887, **87,** 1880. The BE. of 1887 considered the chutes at the Beattyville movable dam did not meet requirements of navigation, and that the st. lock and dam orig. contemplated should be substituted, **87,** 1881, 1884.

By Maj. Lockwood, 1893–94, building Lock No. 7 a short distance below High Bridge, **94,** 1980.

In 1893, Maj. Lockwood est. that by increasing the lift of the locks above No. 6 navigation could be extended to Three Forks, with 9 additional dams and locks; est., $2,740,782.30. Est., Lock No. 7, in course of constr., $300,000, **96,** 2287; **98,** 2013.

In 1894 the Chief of Engineers sanctioned use of st. cut for the Beattyville Dam to constr. Lock No. 7, **96,** 2287.

In 1898, Capt. Warren believed that by increasing the lift of the remaining locks to be built to 18′ only 7 more would be required, to cost $4,865,550, as against $5,179,200 for locks, etc., with 15′ lift. Chief of Engineers approved, 1898, the plans, etc., for Lock No. 8, providing for a lift of 18′, **98,** 2015.

Capt. Hodges est., 1899, it would cost $2,560,000 in excess of the sums app. to complete proj., **99,** 438.

Capt. Hodges, 1899–1900, reported cost of the complete imp. would exceed, by a large sum, the limit of au. for continuing contracts, and that this limit would probably be reached while the last 4 locks and dams would be untouched or incomplete, **00,** 501.

Orig. working proj., at 1912, covers, with modifications, repair and rebuilding of 5 locks and dams, and the constr. of 9 addl. locks and dams; est., $4,865,550, **12,** 925.

SURVEYS.

By R. H. Fitzhugh, sur. of the North Fork, Boone Fork, Troublesome Creek, Middle and South Forks, and the main stream, **78,** 109; **79,** 147, 1398, 1399, 1407.

For location of lock and dam at Beattyville, **83,** 1560.

Of open R. from Oregon to Beattyville, **85,** 1871.

Sur. for Lock No. 7, **94,** 1980; **95,** 2485; Lock No. 8, **98,** 2021; Locks Nos. 9 and 10, **99,** 2514.

Bench marks: Hickman to Lock No. 6, **95,** 2486. Above Hickman, **96,** 2487.

Act Feb. 27, 1911, au. ex. and sur. of North Fork, Kentucky R., for removal of obstr., **12,** 929.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 925.

Maps. **83,** 1562; **84,** 1744, 1746.

Part (b), DD-4 Kentucky River, Ky., Locks and Dams. (Care and operation.)

APPROPRIATIONS.[1]

1885,	$12,118.60,	**85,** 1880.
1886,	23,174.28	H. D. 421, 57th, 2d.
1887,	31,384.97	
1888,	89,427.21	
1889,	79,643.24	
1890,	51,123.29	
1891,	44,462.21	
1892,	48,759.14	
1893,	46,429.08	
1894,	54,765.96	
1895,	41,757.76	
1896,	67,677.93,	**96,** 2295.
1897,	71,552.03,	**97,** 2526.
1898,	49,084.03,	**98,** 2030.
1899,	39,887.38,	**99,** 2528.
1900,	58,726.97,	**00,** 3377.
1901,	71,419.10,	**01,** 2748.
1902,	65,107.03,	**02,** 1957.
1903,	119,355.43,	**03,** 1754.
1904,	80,583.90,	**04,** 2650.
1905,	89,203.42,	**05,** 1921.
1906,	103,313.71,	**06,** 1658.
1907,	178,025.73,	**07,** 1787.
1908,	119,223.79,	**08,** 1855.
1909,	135,750.95,	**09,** 1844.
1910,	159,644.20,	**10,** 2004.
1911,	130,860.04,	**11,** 2206.
1912,	141,886.88,	**12,** 2403.
Total,	2,204,348.26	($2,204,348.26, **12,** 928; allotted, $2,330,154.73).

COMMERCE.

1912, 209,000± t.; imp. has had no material effect on nature of C., **12,** 928.

List of boats plying on R., **12,** 2408.

CONTRACTS.

For list of expend., see each an. report.

1901. Disken & Cox, st. filling, $2,860, **01,** 2748.

1902. Hollerbach & May, renewal of dam and abutment crib at Lock No. 1; John Short, renewal of cribs at Locks Nos. 2 and 3, and removal of r. ledge at Lock No. 2; J. B. Speed & Co., cement for Dam No. 1; Castalia Portland Cement Co., cement for Dam No. 1, **02,** 1958.

1904. Virginia Portland Cement Co., Portland cement, **04,** 2650.

1905. Alma Cement Co., cement, $1.71 bbl.; Meeds-Gray Lumber Co., lumber, prices given; O. T. Soper, rent of land, $100; J. G. Frelinger, driftbolts, prices given; The C. W. Sowles Lumber Co., lumber, prices given, **05,** 1922–23. Virginia Portland Cement Co., cement, $2.01 bbl., **06,** 1660.

1906. F. J. Cullen, building work at Dam No. 10, prices given, **06,** 1660.

1907. The Monongahela River Cons. Coal & Coke Co., 2 dump scows, $3,108 each; Riverside Bridge Co., steel lock gates, 5.33¢ lb., **07,** 1788–89.

1908. Dixie Towing Co., hire of towboat, $24 per day; Virginia Portland Cement Co., cement, prices given, **09,** 1845. The Marion Steam Shovel Co., dipper dr., $6,545; Kanawha Dock Co., 2 barges, $4,300; Dixie Towing Co., hire of barge, $4 per day, **08,** 1857–58. T. W. Disken & Co., hire of towboat, $29.50 per day; Kentucky River Poplar Co., hire of towboat, $20 per day; Kenny Bros., hire of barge, $3 per day; Virginia Portland Cement Co., cement, $1.50 bbl., **09,** 1845–46.

1909. Kosmos Portland Cement Co., cement, $1.56 bbl.; Capital Lumber & Mfg. Co., yellow pine timber, $25.30 M f. b. m.; The Kentucky & Ohio Trans. Co., sand, 98¢ c. y., and gravel, $1.32 c. y., **09,** 1848. Penn Bridge Co., steel lock gates, 5.33¢ lb., **09,** 1849. M. A. Sweeney Shipyard & Foundry Co., wooden hull towboat, $16,915; E. A. Bogie, constr. dwelling above foundation, $2,200 (Lock No. 2), **09,** 1847. Howard Ship Yards Co. (3 con.), docking and repairing floating plant (prices given), constr. and installing ice making and refrigerating plant on U. S. S. *Kentucky*, $2,478.50, and constr. wooden hull towboat, $24,600, **09,** 1845–46. Kenney Bros. Co., hire of barge, $3 per day, **10,** 2006. Lewis Tanner, hire of towboat and crew, $19.50 per day, **10,** 2007. The Kentucky & Ohio Trans. Co., gravel at Lock No. 4, $1.42 c. y.; Kosmos Portland Cement Co., cement, $1.56 bbl., **10,** 2007.

1910. The Ohio River Cont. Co., removing r. ledge, unit prices given, **10,** 2205. J. B. Blanton & Co., furn. sand, $1.40 c. y.; Penn-Allen Cement Co., Portland cement, $1.84 bbl.; Kosmos Portland Cement Co., cement, $1.90 bbl., **11,** 2208.

[1] Expend. under permanent-indefinite app. for operating and keeping in repair canals and other public works provided by act July 5, 1884, and act Mar. 3, 1909.

The Ohio River Cont. Co., hire of 2 barges, $3 and $5 per day; J. F. Butts (2), furn. gravel, $1.45 c. y.; hire of derrick boat, $3 per day; Devil's Hollow Stone Co., 900 c. y. crushed st., $1.10 c. y.; The Kentucky & Ohio Trans. Co., hire of 2 barges, $4 per day each, **11,** 2207.

1911. Universal Portland Cement Co., Portland cement, $1.70 bbl.; Ed. J. Howard, repairing barges, prices given, and constr. 2 wooden-hull dump scows, $3,220 each, **11,** 2208. J. F. Butts, sand and gravel, $2,037.50; Lehigh Portland Cement Co., Portland cement, $1.60 bbl., **12,** 2402.

1912. Kanawha Dock Co., repairs to floating plant, $3,891.50, **12,** 2402. Des Moines Bridge & Iron Works, constr. 1 steel derrick boat hull, $4,398, **12,** 2405. American Bridge Co., constr. 2 steel barges, $9,800, **12,** 2402. Des Moines Bridge & Iron Works, constr. 1 open steel barge, $1,990, **12,** 2405. Chas. Armstrong, hire of barge, $3.50 per day, **12,** 2402. J. B. Blanton Co., sand and gravel, **12,** 2406. Lehigh Portland Cement Co., Portland cement, $1.60 bbl., **12,** 2404. Lehigh Portland Cement Co., Portland cement, prices given, **12,** 2406.

ENGINEERS.

Chief of Engineers. R., 93, 332; **94,** 304; **95,** 339; **96,** 296; **97,** 375; **98,** 356; **99,** 439; **00,** 502; **01,** 494; **02,** 421; **03,** 451; **04,** 483; **05,** 493; **06,** 543; **07,** 569; **08,** 611; **09,** 643; **10,** 717; **11,** 772; **12,** 927.

In charge:

Maj. D. W. Lockwood, 1888–95. **R., 93,** 2622; **94,** 1983; **95,** 2489.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2292; **97,** 2519.

Capt. J. G. Warren, 1898–99. **R., 98,** 2024.

Capt. G. A. Zinn, 1899.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 3523; **00,** 3369.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2746; **02,** 1955; (Lt. Col.) **03,** 1753; **04,** 2648; **05,** 1918.

Maj. J. G. Warren, 1905–10. **R., 06,** 1655; **07,** 1785; (Lt. Col.) **08,** 1853; **09,** 1836.

Maj. J. C. Oakes, 1910–. **R., 10,** 1996; **11,** 2198; **12,** 2395.

Assistants:

Lt. H. E. Waterman. **R., 93,** 2625; **94,** 1986; (Capt.) **95,** 2492.

Lt. W. W. Harts. **R., 96,** 2296; **97,** 2519.

J. M. G. Watt. **R., 98,** 2030; **99,** 2536; **00,** 3383.

C. H. Rumbold. **R., 02,** 1759.

Lt. P. S. Bond, **05,** 486; **06,** 536; **07,** 564; (Capt.) **08,** 602.

1st Lt. E. D. Peek, **06,** 536.

1st Lt. A. Williams, **07,** 564; **08,** 602; **09,** 636.

LEGAL PROCEEDINGS.

Leases and collections, **93,** 2623; **94,** 1984; **95,** 2490; **96,** 2294; **97,** 2526; **09,** 1854; **12,** 2403.

OBSTRUCTIONS.

In 1893 plans were approved by the Sec. of War for raising the height of the Louisville & Nashville RR. br. and a highway br., both at Frankfort, Ky., and preparations made for the completion of the work by the proper parties, **93,** 2625; **94,** 1989; **95,** 2492; **96,** 2296. The pool at that locality was lowered several times to permit the removal of 3 br. piers to depth 7′ below the pool, **95,** 2492; **96,** 2296.

Brs. obstr. navigation required to be lighted in accordance with the regulations of the Lighthouse Dept., **96,** 2296.

OPERATIONS.

1892-93. In this year and subsequent years the same general work was performed, consisting generally of repairs of locks and dams, dr., snagging. (See each an. report.)

1897-98. Lock and Dam No. 7 opened to navigation on Dec. 11, 1897, **98,** 2030–2034.

1900-01. New dr. hull constr. and general repairs to works, **01,** 2747. Lock No. 8 opened Oct. 15, 1900, **01,** 2748.

1901-02. General repairs to works, **02,** 1957.

1902-03. 92,432 c. y. dr.; minor repairs to works; snags and other obstr. removed from Pool No. 1; extensive repairs to Lock No. 1, **03,** 1754.

1903-04. Dr., minor repairs to structures, progress of repair work at Locks Nos. 1 and 2; Lock No. 9 opened Dec. 3, 1903, **04,** 2649.

1904-05. 51,300 c. y. dr.; general repairs to works; Lock No. 10 opened Jan. 12, 1905, **05,** 1918

1905-06. 50,132 c. y. dr. by U. S.; general repairs made to works and floating plant; extensive repairs to Locks Nos. 9 and 10, **06,** 1657.

1906-07. 46,350 c. y. dr. by U. S.; work of repairs to Locks Nos. 9 and 10 completed; many minor repairs to works and floating plant, **07,** 1786.

1907-08. 51,427 c. y. dr. by U. S.; repairs to works and floating plant; Lock No. 11 opened Jan. 1, 1907, **08,** 1855.

1908-09. 66,145 c. y. dr.; general repairs to works; new towboat built and put in use; extensive repairs made to floating plant; lockmaster's dwelling erected, **09,** 1844.

1909-10. Lock No. 12 opened Jan. 13, 1910; U. S. S. *Gregory* placed in commission; 55,963 c. y. dr.; repairs made to locks and dams and to floating plant, **10,** 1996.

1910-11. 78,425 c. y. dr.; general repairs to locks and dams and to floating plant, **11,** 2198.

1911-12. 89,160 c. y. dr.; repairs to locks, dams, and their appurtenances, **12,** 2395.

PHYSICAL CHARACTERISTICS.

Gauge readings, **93,** 2626–2628; **94,** 1987–1989; **95,** 2493–2499; **96,** 2296–2298; **97,** 2520–2522; **98,** 2031–2033; **99,** 2538; **00,** 3386.

Washouts, **95,** 2489; **96,** 2293; **05,** 1919.

Description of sites of locks located, **99,** 2523.

Experience with logs at Dam No. 9, **04,** 2650.

PRIVATE WORK.

Description of work constr. before acquirement of control by the U. S., **95,** 2490; **96,** 2292.

List of permits issued by Sec. of War to private persons and corporations, **06,** 1655.

SURVEYS.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 927.

Maps. New abutment, Dam No. 1, **02,** 1761.

DD-195 LICKING RIVER, KY.

APPROPRIATIONS.

1888,	$3,000,	**89,** 1983.
1890,	3,000,	**90,** 2273.
1899,	10,000,	**00,** 3155 (sur.).
Total,	16,000	

COMMERCE.

Important, **72,** 424, 425; **79,** 1422.

Utility as a H. of refuge from ice questioned, **72,** 425.

Damage sustained from ice floes of Licking R., 1856, **72,** 421, 424.

Description of. Mostly lumber. Unimportant, **93,** 2646; **95,** 2516.

ENGINEERS.

Chief of Engineers R., 71, 60; **72,** 57; **78,** 109; **79,** 147; **81.** 265; **82,** 260; **85,** 285; **87,** 249; **88,** 227; **89,** 264; **90,** 238; **91,** 306; **92,** 292; **93,** 332, 335; **94,** 304, 343; **95,** 340; **00,** 476; **01,** 476.

In charge:
Sylvester Welch, chief State engineer, 1836–37. **R., 79,** 1432.
Maj. W. E. Merrill, 1871–79. **R., 71,** 392; **72,** 420; **79,** 1422.
Maj. J. W. Cuyler. **R., 82,** 1964.
Lt. Col. W. E. Merrill. **R., 85,** 1843.
Maj. J. C. Post. **R., 87,** 1902.
Maj. D. W. Lockwood, 1889–99. **R., 89,** 1983; **90,** 2273; **91,** 2462; **92,** 2097; **93,** 2630, 2644; **94,** 1992; **95,** 2498, 2513.
Maj. W. H. Bixby, 1900–01. **R., 00,** 3155; **01,** 2670.

Assistants:
N. B. Buford, asst. State engineer, 1836–37. **R., 79,** 1434.
C. Schenk. **R., 79,** 1423; **00,** 3163.
B. F. Thomas. **R., 90,** 2274; **91,** 2462.

LEGISLATION.

Act of general assembly of Kentucky incorporating the "Licking River Lumber & Mining Co.," stating privileges, etc., **79,** 1436. Amendment, **79,** 1437.

OPERATIONS.

1888–89. 133 snags removed from chan. and trees from banks, **89,** 1983.
1889–90. 236 trees, 430 snags, 324 stumps, 4,679 c. y. solid r., and 4,172 c. y. loose r. removed, **90,** 2273.
1890–91. 5,875 c. y. solid and 2,145 c. y. loose r. and 80 snags removed from chan., **91,** 2462.
1891–92. 911 snags, trees, and stumps, 798 c. y. loose r., and 2,001 c. y. solid r. removed, **92,** 2097.

PHYSICAL CHARACTERISTICS.

General, **72,** 420, 421; **79,** 1422, 1424, 1426, 1435; **93,** 2645; **95,** 2514; **00,** 3159, 3164.
Rise and fall of R, and tributaries, **79,** 1425, 1426, 1430.
Coal and iron mines; quarries in vicinity, **79,** 1427–1429, 1431.
R. lies wholly in Kentucky, empties into the Ohio, with uncertain water supply; parts of it are narrow and tortuous in the upper part. Has been sur. for 297 m. from its mouth, **93,** 2645, 2646.
Water supply irregular. **95,** 2515.
The entire drainage basin of the Licking R. about 4,925 sq. m., **00,** 3159.
Gauge readings, **00,** 3181.
Under the proj. of 1888 the R. not susceptible of permanent imp. Each h. w. producing a large number of snags and other obstr., **93,** 2631; **94,** 1992; **95,** 2498.

PLANS.

By Maj. Merrill, H. of refuge from ice floes, at Newport, Ky. (mouth of Licking R.), by constr. a lateral basin, having an area of from 5.8 to 11.2 acres, according to various plans; and for the excavation of a chan. through the r. bar at the mouth of Licking R., to 4′ or 6′, and with either a straight or curved chan.; est., $518,513 to $1,624,794, **72,** 423, 424, 425.
By Sylvester Welch, 1837, locks and dams, for slack-water navigation, mouth to West Liberty; est., $1,539,591 to $2,036,000, **79,** 1433, 1434.
By Maj. Merrill, locks and dams to imp. navigation, mouth to the confluence with Elk Fork; est., $2,002,947. For slack-water navigation, mouth to Slate Creek; est., $1,424,184, **79,** 1423.
In 1882 Maj. Cuyler considered that radical imp. could only be accomplished by locks and dams; est., $684,000, **82,** 1965.
By Lt. Col. Merrill, 1885, connection of navigation of the Licking with that of the Ohio R. by the removal of the bar at the mouth of the former; est., $75,000, **85,** 1844.
By Maj. Post, 1887, imp., from Farmers to West Liberty, by removal of snags and similar obstr.; est., $17,680; **87,** 1903.

PRIVATE (STATE) WORK.

1837–42. State of Kentucky undertook constr. of locks and dams at a useless expend. of $372,520. Work was stopped before completion, **72,** 421; **79,** 1423, 1431.
1837. Chan. 100′ x 1,250′ excavated through the r. bar at mouth of Licking R., at cost of $5,383.47, **79,** 1431.
1868. Commission appointed by Kentucky to ascertain cost of removing the milldams and other obstr., **79,** 1432.
Description of work done before acquirement of control by the U. S., **93,** 2645; **95,** 2514.

PROJECTS.

By Maj. Post, 1887, imp. extending from Farmers to West Liberty by removal of snags and similar obstr.; est., $17,680, **87,** 1903.
Maj. Bixby est., 1900, $3,475,000 to obtain 6′ navigation up to Falmouth, and $47,000 an. for mainten.; and $270,000 or $307,000 for lock and dam at or near Threemile Ripple, but such work not recom.; and removal of Threemile Ripple and adjoining shoals, $100,000, recom., **00,** 3156.

SURVEYS.

By Lts. Turnbull and Grayson, 1829, **72,** 420; **79,** 1422, 1423.
By N. B. Buford, 1837, under direction of S. Welch, chief State engineer. **R., 79,** 1432, 1434.
By Maj. Merrill, 1871, sur. of mouth of Licking R. to ascertain its adaptability for an ice H. **R., 72,** 420
By C. Schenk, 1878, of the R. in general. **R., 79,** 1423.
Ex. au. act June 14, 1880; made by Maj. Cuyler, **82,** 1964.
Previous sur., **82,** 1964.
Of bar at mouth of the R. au. act July 5, 1884; made by Lt. Col. Merrill, **85,** 1843.
From Farmers to West Liberty au. act Aug. 5, 1886; made by Maj. Post, **87,** 1902.
Ex. for slack-water navigation au. act July 13, 1892; made, 1892, by Maj. Lockwood (**R.** unfav.), **93,** 2644.
Ex. of the mouth au. act Aug. 17, 1894, for ice H., incl. a lock and dam; made, 1894, by Maj. Lockwood (**R.** unfav.), **95,** 2513.
Sur. Licking R., Ky., from its mouth, opposite Cincinnati, Ohio, to Falmouth, Ky., with view to its imp., incl. est. of cost of a lock and dam at or near Threemile Ripple, about 3 m. above its mouth, au. act Mar. 3, 1899; made, 1900, by Maj. Bixby (see Projects). **00,** 3156.
Plotting of detail maps of sur. of 1900 completed. Congress not having taken any further action as to results of sur., the completion of maps terminates the work, **01,** 476, 2670.

DD-209 LIMESTONE CREEK, KY.

ENGINEERS.

Chief of Engineers. **R., 87,** 244.
In charge. Lt. Col. W. E. Merrill, 1887. **R., 87,** 1834.
Assistant. Lt. L. H. Beach. **R., 87,** 1834.

SURVEY.

Ex. of bar at mouth au. act Aug. 5, 1886; made, 1887, by Lt. Col. Merrill (**R.** unfav.), **87,** 1834.

DD-213 BIG SANDY RIVER, KY. AND W. VA.

Part.	Title.	Period.	Appropriations.
a	Appropriations	See below.	See below.
b	Big Sandy, including forks	1875–1912	$1,659,811.96
c	Levisa Fork, Ky	1894–1912	28,750.00
d	Tug Fork, Ky	1894–1912	29,250.00
e	Big Sandy R., operating and care of locks and dams	1898–1912	204,664.47
	Total		1,922,476.43

Part (a), DD-213 Appropriations.

Big Sandy River:

1878,	$12,000.00,	**78,** 108.
1879,	12,000.00,	**79,** 146, 1355.
1880,	50,000.00,	**80,** 1829.
1881,	46,000.00,	**81,** 1982.
1882,	15,000.00,	**82,** 259.
1884,	40,000.00,	**84,** 1751.
1886,	22,500.00,	**86,** 1619.
1888,	31,500.00,	**88,** 1788.
1890,	31,000.00,	**90,** 2275.
1892,	50,000.00,	**92,** 2100.
1894,	40,000.00,	**95,** 2500.
1896,	17,811.96,	act May 1, 1896.
1896,	30,000.00,	**96,** 2302.
1899,	50,000.00,	**99,** 2502.
1900,	280,000.00,	**00,** 3348.
1900,	1,000.00,	**00,** 491, 498.
1901,	140,000.00,	**01,** 2738.
1902,	178,000.00,	**02,** 1949.
1903,	50,000.00,	**03,** 1744.
1905,	43,000.00,	**05,** 1905.
	85,000.00,	**05,** 1905.
1906,	40,000.00,	**06,** 1647.
1907,	107,000.00,	**07,** 1773.
1908,	85,000.00,	**08,** 1845.
1909,	50,000.00,	**09,** 1827.
1910,	[1] 153,000.00,	**10,** 1986.
Total,	1,659,811.96 [2]	

APPROPRIATIONS. (See part a.)

1898,	$1,936.54	H. D. 248, 55th, 1st.
1899,	3,231.80	
1900,	3,615.94	
1901,	3,477.21,	**01,** 2741.
1902,	3,351.87,	**02,** 1952.
1903,	4,170.97,	**03,** 1748.
1904,	3,255.68,	**04,** 2643.
1905,	3,822.88,	**05,** 1912.
1906,	11,645.23,	**06,** 1651.
1907,	20,491.88,	**07,** 1778.

Levisa Fork:

1880,	$2,500.00,	**80,** 1829.
1881,	2,000.00,	**81,** 1982.
1882,	5,000.00,	**82,** 259.
1884,	5,000.00,	**84,** 1751.
1886,	3,750.00,	**86,** 1619.
1890,	2,500.00,	**91,** 2466.
1892,	2,500.00,	**92,** 2109.
1894,	2,500.00,	**95,** 2504.
1896,	1,000.00,	**96,** 2321.
1899,	1,000.00,	**99,** 2511.
1900,	1,000.00,	**00,** 3360.
Total,	28,750.00	

Tug Fork:

1880,	$2,500.00,	**80,** 1829.
1881,	2,000.00,	**81,** 1982.
1882,	5,000.00,	**82,** 259.
1884,	5,000.00,	**84,** 1751.
1886,	3,750.00,	**86,** 1619.
1890,	2,500.00,	**91,** 2468.
1892,	2,500.00,	**92,** 2111.
1894,	2,500.00,	**95,** 2506.
1896,	2,000.00,	**96,** 2324.
1899,	1,500.00,	**99,** 2509.
Total,	29,250.0	

1908,	22,734.53,	**08,** 1849.
1909,	42,152.51,	**09,** 1831.
1910,	15,048.32,	**10,** 1990.
1911,	19,608.30,	**11,** 2191.
1912,	46,120.81,	**12,** 2389.
Total [3],	204,644.47	(total allotted, $228,055.93; misc. receipts, $7.35; total given, **12,** 2389, is $228,063.28).

Part (b), DD-213 Big Sandy River, Ky. and W. Va.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Products of valley, **75,** 761, 763; **76,** ii, 143. C. of Levisa Fork unimportant, **76,** ii, 140. C. limited to rafting, **76,** ii, 142.

Description of, **96,** 2301; **01,** 2755, 2761, 2769.

Since the U. S. began imp. of the R. and its forks, C., 1896, had doubled; value, $39,910,000, **96,** 2301.

In 1898, the great natural resources of the country with its enormous coal deposits awaited development by transportation facilities, **98,** 2160; **01,** 491, 2769.

R. by Prof. C. Newton Brown on mineral wealth, Big Sandy Valley, Levisa to head of navigation, **00,** 3413.

Whether the coal adjacent to the R. will seek outlet by water, after 4 dams have been au. above Louisa, depends justification for continuation of the imp., **11,** 2736, 2752, 2769.

Existing C. decreasing, **01,** 2740.

Imp. exerting no material effect on rates, **06,** 539; **09,** 641; **10,** 715; **11,** 771.

Diagram exhibiting, **11,** 2192.

Traffic, 1911–12, 180,000± t., **12,** 2390.

[1] $50,000 of this amount to be applied to completion of Lock No. 1, Levisa and Tug Forks; $3,000 to constr. of steel service br. at Lock No. 1, Big Sandy R., and $100,000 to completion of Lock No. 2, Levisa and Tug Forks.

[2] Total given, **12,** 2384, $1,701,700.47, incl. $1,700.47 ("receipts"), but omits item of 1896, act May 1.

[3] Expend. under the permanent-indefinite app. provided by act of July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

CONTRACTS.

1883. D. B. Shipley, delivery of st. for lock, **84,** 1749.

1891. Marting, Mittendorf & Duis, oak timber, $10,977, **91,** 2464. G. Kinsey & Co., ironwork, $963.44, **91,** 2464.

1893. G. Kinsey & Co., ironwork: Cast iron, 2¾¢ lb.; wrought iron, 3 $\frac{9}{10}$¢ lb., **93,** 2633.

1896. J. P. McGuire, furnishing and delivering about 31 steel trestles, 35,250 lbs., at 4¾¢ lb., **97,** 2532.

1900. Foltz & Jonte, constr. Lock No. 1, unit prices listed; The Evansville Contract Co., constr. Lock No. 2, unit prices listed; Joseph M. Neil, constr. frame dwelling, etc., prices listed **01,** 2738.

1901. Virginia Portland Cement Co. cement, unit prices listed; Lehigh Portland Cement Co., cement, unit prices listed; Chas. Hegewald Co., valves for Locks Nos. 1 and 2, 4 pairs, automatic, $734; 4 pairs, nonautomatic, $689, **01,** 2739.

1902. William Newman and Robert Crawford, cement sheds at Locks Nos. 1 and 2; Robert Crawford, recovering roof of cement shed at Lock No. 1, **02,** 1950, 1951.

1903. Sheridan-Kirk Contract Co., constr. Dam No. 1, unit prices given; Atlas Portland Cement Co., cement, $2.46 bbl., **03,** 1745, 1746.

1904. E. Brown Baker, constr. Dam No. 2, unit prices given; Virginia Portland Cement Co., cement, $1.75 bbl., **04,** 2641, 2642.

1906. Baker Contract Co., constr. guide and retaining walls, and paving, at Lock No. 1, unit prices given, **07,** 1775.

1908. J. C. Thomas, raising crest of Lock and Dam No. 3, unit prices given, **08,** 1846.

1910. New Jersey Foundry & Machine Co., constr. steel service br. at Lock No. 1, unit prices given, **11,** 2189.

ENGINEERS.

Chief of Engineers. R., 75, 73; **76,** 90; **78,** 108; **79,** 145; **80,** 196; **81,** 264; **82,** 258; **83,** 266; **84,** 265, 267; **85,** 290; **86,** 284; **87,** 241, 249; **88,** 227, 229; **89,** 265, 267; **90,** 239; **91,** 307, 308, 310; **92,** 293, 294, 2101; **93,** 332, 336; **94,** 305; **95,** 340; **96,** 297; **97,** 377; **98,** 369, 373; **99,** 433; **00,** 496, 503; **01,** 490, 496; **02,** 417; **03,** 448, 449; **04,** 479; **05,** 488; **06,** 507, 538; **07,** 565; **08,** 604; **09,** 638; **10,** 713; **11,** 768; **12,** 922.

Boards:

Convened, Louisa, Ky., Nov., 1891, to report on dam to be built, Big Sandy R., near Louisa, Ky. **R., 92,** 2102. (Col. Craighill, Maj. Lockwood, and Capt. Turtle.)

Convened, Cincinnati, Ohio, Apr., 1896, to report on proposed modifications in details constr. of movable dam, Louisa, Ky. **R., 96,** 2302. (Lt. Col. A. Stickney, Maj. J. F. Gregory, Capt. H. M. Chittenden, and Lt. W. W. Harts.) Minority report, **96,** 2306. (Maj. D. W. Lockwood and Lt. W. E. Craighill.)

In charge:

Maj. W. E. Merrill, 1875–80; **75,** 73; **76,** i, 90. **R., 75,** 756; **76,** ii, 140; **79,** 1353; (Lt. Col.) **80,** 195.

Maj. J. W. Cuyler, 1880–83. **R., 80,** 1827; **81,** 1979; **82,** 1952; **84,** 1755.

Capt. J. C. Post, 1883–87. **R., 83,** 1564; **84,** 1749; **85,** 1884; **86,** 1618; **87,** 1902.

Lt. Col. W. E. Merrill, 1887. **R., 87,** 1823.

Maj. D. W. Lockwood, 1888–95. **R., 88,** 1786, 1795, 1796; **89,** 1983; **90,** 2274; **91,** 2463, 2466, 2467; 2476; **92,** 2098, 2108, 2109; **93,** 2631, 2647; **94,** 1992, **95,** 2498.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2300; **97,** 2530.

Maj. W. H. Heuer, 1897.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2143, 2159.

Capt. H. F. Hodges, 1899–1900. **R., 99,** 2501; **00,** 3347, 3403.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2735–40, 2759; **02,** 1946; (Lt. Col.) **03,** 1742; **04,** 2636; **05,** 1901.

Maj. J. G. Warren, 1906–09. **R., 06,** 1645; **07,** 1771; (Lt. Col.) **08,** 1842; **09,** 1825.

Maj. John C. Oakes, 1910–. **R., 10,** 1984; **11,** 2185; **12,** 2382.

Assistants:

J. E. Bell, **75,** 756; **76,** ii, 140. **R., 75,** 760; **76,** ii. 140.

E. A. Chase. **R., 80,** 1829; **81,** 1982; **82,** 1953; **83,** 1567.

B. C. Howell. **R., 84,** 1751.

B. F. Thomas. **R., 85,** 1886; **87,** 1824; **88,** 1789; **89,** 1985; **90,** 2276; **91,** 2465, 2467, 2468, 2478; **92,** 2100; **93,** 2633; **94,** 1994; **95,** 2500; **96,** 2318; **97,** 2532; **98,** 2149, 2164; **99,** 2504; **00,** 3351, 3403.

History of work; proposed modifications in constr. of dam, **96,** 2310.

Details, lock and needle dam near Louisa, Ky., history, cost, and methods employed to operate it, **97,** 2534.

M. W. Venable. **R., 88,** 1797.

Est., lock and dam, had it been constr. under fav. conditions, **97,** 2559.

D. A. Watt. Calculations, trestles and needles of dam, **97,** 2558.

B. F. Thomas. **R., 01,** 2756–81.

OPERATIONS.

1878–79. Imp. bet. Louisa and Catlettsburg, and on forks. Above Louisa, removal of 6,758 snags, 4,257 fallen trees, 4,098 cords of drift, and 4,013 c. y. r. removed from chan., **79,** 146, 1353.

1879–80. Logs, snags, fallen trees, loose and solid r. removed, **80,** 1827, 1830.

1880–83. Obstr. removed, **81,** 1984; **82,** 1954; **83,** 1564, 1569; summary of results, **83,** 1655. Imp. of natural chan. resulting in chan. 2′ x 50′ from Louisa, 100 m. up Levisa Fork, and similar chan. in Tug Fork for 108 m., **83,** 1565.

1883–84. Obstr. removed from 36 m. of Levisa Fork; 2,768 c. y. of st. for lock delivered; 2,132 c. y. r. and 1,623 c. y. earth removed from foundation of lock, **84,** 1750, 1751.

1884–85. Obstr. removed from 26 m. of the Big Sandy, 87 m. of Levisa Fork, and 58 m. on Tug Fork; excavation of lock site and completion of nearly two-thirds of the lock masonry, **85,** 1885.

1885–86. Completion of masonry for lock, **86,** 1618.

1886–87. Progress on foundation for abutment and excavation of the approaches to the lock; 1,603 trees and snags and 6,608 c. y. r. removed from Levisa and Tug Forks, **87,** 1823, 1825.

1887–88. Abutment for dam at Louisa completed and upstream lock entrance blasted out; 1,050 l. f. of protection wall built at Big White House Shoal on Levisa Fork; 455 trees and snags and 57 c. y. r. cleared from the chan. below Louisa; 880 snags and 1,744 c. y. r. removed from Levisa Fork; 150 snags and 2,533 c. y. r. cleared from Tug Fork, **88,** 1789, 1790.

1888–89. 2,000 c. y. r. excavated from lock site at Louisa; 372 snags, 88 trees, 142 c. y. solid and 376 c. y. loose r. removed from R. below Louisa, **89,** 1985.

1889–90. Lock at Louisa completed, **90,** 2275.

1890–91. Abutment graded and portion of dam next the abutment completed, **91,** 2463; 550 trees, snags, and stumps, 230 c. y. solid and 1,523 c. y. loose r. removed from Levisa Fork, **91,** 2466; 70 c. y. r. and 463 snags cleared from chan., and 625 trees and stumps topped and removed from banks of Tug Fork, **91,** 2469.

1891–92. Work on dam in Big Sandy R. suspended, pending a decision in regard to the style of dam; 375 snags, logs, and trees cleared from the chans. and 120 c. y. r. blasted from points in the R., **92,** 2,100; 320 c. y. solid and 1,310 c. y. loose r. and 816 snags, logs, and trees removed from Levisa Fork, **92,** 2109; 80 c. y. solid and 2,147 c. y. loose r. and 1,134 snags and stumps removed from Tug Fork, **92,** 2111.

1892–93. Lock modified to suit the change from a fixed to a movable dam; entrance to lock deepened; shore cribs constr. above and below the lock; Kentucky bank protected by riprapping; and cofferdam partly constr. to inclose the site of the pass and part of the movable dam, **93,** 2632.

1893–94. Cofferdam completed; masonry of pass completed ready to receive trestles; and pier partly constr. and part of old abutment removed, **94,** 1994, 1998.

1894-95. Masonry foundations of needle dam, pier, and abutment completed; banks on both sides of the R. graded, riprapped, and paved; and old waste piles in bed of R. removed, **95,** 2500–2502.

1895-96. Two lock houses in course of completion; banks about lock and dam riprapped and paved; and designing of movable parts of dam in progress, **96,** 2318, 2319.

1896-97. Lock gates constr. and placed in position; trestles placed in position in weir and navigation pass; means for lowering and raising the dam provided; and dam operated for the first time on Jan. 1, 1897, **97,** 2532–2534.

1897-98. Work of minor importance performed, **98,** 2149.

1898-99. Lock grounds drained, gauges placed, old crib removed and replaced by a st. wall, and minor work done, **99,** 2501.

1899-00. Misc. work done, **00,** 3352.

1900-01. Preliminary work on Locks Nos. 1 and 2 at Catlettsburg and Wrights Station, Ky., and obstr. removed from R., **01,** 2736.

1901-02. Constr. of locks and dams continued, **02,** 1946–48.

1902-03. Work continued on Lock and Dam No. 1, Catlettsburg, Ky., and Lock No. 2, Kavanaugh, Ky., **03,** 1742–43.

1903-04. Lock No. 1 completed, and work on Dam No. 1 in progress; Lock No. 2 completed, and work on Dam No. 2 in progress, **04,** 2636–37.

1904-05. Locks and Dams Nos. 1 and 2 completed, **05,** 1901–02.

1905-06. General repairs to Locks Nos. 1 and 2, **06,** 1645.

1906-07. Placing concrete in guide and retaining walls, **07,** 1771.

1907-08. Work on regulating works below Lock No. 1 was delayed by continued high water and practically no work was done; Lock No. 3, excavation work completed and piles driven, **08,** 1842–43. Plans for a steel service br. at Lock No. 1 were made and bids for constr. rejected, built later by contract, **08,** 1842.

1908-09. Regulating works below Lock No. 1 completed; raising crest of Lock and Dam No. 3 completed, **09,** 1825.

1910-11. Plant delivered and material received and stored, for constr. service br. at Lock No. 1, **11,** 2185. Flatboats purchased and maneuvering boats and flats under constr. for use in the forks, **11,** 2187.

1911-12. Operations begun for constr. of service br.; summary of work given, **12,** 2383. Maneuvering boats and pushboats for use at imp. works completed, **12,** 2384.

PHYSICAL CHARACTERISTICS.

Length of R. and tributaries, **75,** 756, 760, 762; **76,** ii, 140, 142.

Description of R. and valley, **75,** 760; **76,** ii, 141.

Fall of R., **75,** 756, 760, 766; **76,** ii, 140, 142, 145. Width of, **75,** 761; **76,** ii, 141. Discharge of, **75,** 761; **76,** ii, 142. (See Operations. 1880–83.)

Geology of basin, **75,** 763.

Description of, **88,** 1787; **89,** 1990; **93,** 2631; **94,** 1992; **95,** 2498; **96,** 2300, 2304; **97,** 2537, 2541; **01,** 2750, 2760; **11,** 769, 770.

Description of. Formed by confluence of Levisa and Tug Forks, 26 m. from its mouth. Flows through a narrow valley bet. rocky hills, and empties into the Ohio at Catlettsburg. The Ohio is so low at times that it is unable to carry away the material brought down by the Big Sandy, which causes the formation of this material into a bar at the mouth of the latter stream, **93,** 2647, 2648. Its bottom lands not generally subject to overflow; its banks are composed of fine sand generally. Its many tributaries are sediment-bearing in rainy weather, **98,** 2160.

Description of, Big Sandy R., Levisa Fork, and Tug Fork, **00,** 3407, 3409, 3411; **01,** 2750, 2760.

Description of, Levisa Fork, **88,** 1796.

Description of, Tug Fork, **91,** 2467.

Description of, Russel Fork, **91,** 2478.

Character of the material excavated for the dam, some of it being coal, such that additional work was required, **94,** 1993, 2000; **97,** 2543.

Bed of the R. slowly rising, due to the influx into it of material from various sources, **95,** 2499; **96,** 2301, 2312.

Freshets, **96,** 2312.

Gauge readings, **96,** 2318; **01,** 2770.

Discharge and velocity observations, **97,** 2539; **01,** 2757.

Large quantities of drift a menace to the trestles, **98,** 2145.

Description of sites of Locks Nos. 1 and 2, **00,** 3347.

Max. draft at m. l. w. over shoalest part, 20″, **01,** 491.

Scarcity of water during dry season hindrance to works of regulation, **01,** 2751, 2781.

Shoals, **01,** 2770.

PLANS. (See Estimates and Projects.)

By Maj. Merrill, 1875, imp. to 4′, by slack-water navigation—locks and dams—mouth to Levisa Fork, 26 m.; thence by Levisa Fork to Pikeville, 86½ m. Also imp. of Tug Fork, Louisa to Warfield, 35 m., requiring 22 locks and dams; locks 45′ x 200′, lift about 10′; dams of timber cribs filled with st.; est., $1,922,536, **75,** 757, 759. Temporary imp. from removal of obstr., $15,000, **75,** 759.

Ex., 1876, unfav. to imp. of Levisa Fork by locks and dams, **76,** ii, 140, 144.

By Lt. Col. Merrill, 1878, imp. of the natural chans.; to better the raft and push-boat navigation, to be followed by a slack-water navigation; to afford a permanent 5′ navigation with locks and dams; est., $1,937,536, **75,** 757; **79,** 1355.

In 1880 Maj. Cuyler proposed constr. of first lock and dam at Louisa, Ky.; est., $110,000, **80,** 1828; **81,** 1981. In 1883 est. increased to $213,237.39, **83,** 1565.

In 1887 Maj. Post reported that at a cost of $5,750 the Levisa Fork could be imp. from Va. line to Dismal Creek; imp. the rafting facilities by the removal of snags and rs., **87,** 1902.

By Maj. Lockwood, 1889, slack-water navigation from l. w. in Ohio to Pikeville, on the Levisa Fork, and to mouth of Pond, on the Tug Fork, involving const. of 18 locks and dams est., $3,396,557, **89,** 1992.

By Lt. Col. Merrill, 1887, imp. of Levisa Fork by removal of snags and bowlders; est., $5,750, **88,** 1797.

Capt. Hodges, 1900, recom. regulating works from lower lock to Ohio R.; est., $40,000; and 2 dams instead of 3 up to Louisa, **01,** 2750; **04,** 2637.

By district officer for small dr. plant to aid in operating and mainten., $17,500, **08,** 1844; $20,000, **09,** 1827.

PRIVATE (STATE) WORK.

Work done by Kentucky, **81,** 1980.

PROJECTS. (See Estimates and Plans.)

Temporary imp. of R., 1875, by removal of obstr. **75,** 759; **76,** ii, 140, 144; **79,** 146, 1353.

Permanent imp., 1879, by locks and dams; dams of timber to be replaced by movable dams; first lock and dam to be built at Louisa, **79,** 145, 1355.

By Lt. Col. Merrill, 1878, for imp. of natural chan., for better raft and push-boat navigation; est., $15,000, **80,** 1828.

In 1880 modified by constr. of lock and dam, Louisa, Ky.; est., $60,000, **80,** 1828.

Increased by Capt. Cuyler, 1881, to $110,000, **81,** 1981. Increased by Capt. Post, 1883, to $213,237.39, **83,** 1566. (See Operations, 1880–83.)

At 1887 est. $62,645.31 required to complete the proj., **87,** 1824.

In 1891 the BE. proposed movable dam of needles, supported by trestles, Poiree's system, Big Sandy R. near Louisa, Ky.; est., $93,029.25, **92,** 2102.

The proj., Levisa Fork, Big Sandy R., comprised, 1891, facilitating rafting and push-boat navigation by removal of r., snags. stumps, and similar obstr.; est., an. $2,500, **91,** 2466.

The proj. for imp. Tug Fork, Big Sandy R., comprised, 1891, clearing chan. of r., snags, and stumps, and excavating chans. through ripples

and shoals, to facilitate log rafting in upper stream, and provided l.-w. push-boat chan.; an. est., $2,500, **91,** 2468.

Approved plan, 1893, contemplated navigable pass 130′ l. and weir 140′ l. separated from pass by pier, **93,** 2632.

In 1893 Maj. Lockwood est. it would cost $70,151.58 to complete needle dam near Louisa, Ky. Increase caused by conditions not in view when proj. was made, **94,** 2000.

By Maj. Gregory, 1896, with the approval of a BE., for substitution of size of iron then manufactured for size orig. adopted; and for change in the form of trestle of navigable pass so that, when lying down, the trestles would rest within, and not upon, each other, **96,** 2301.

By Maj. Gregory, 1897, for boom 800′ l., located above lock, for diversion of drift, **97,** 2531.

In 1897 Maj. Gregory est., had the lock and dam been constr. under fav. conditions, cost might have been $198,152. Actual cost, $349,155.82, **97,** 2552, 2555, 2559.

By Maj. Bixby, 1898, for carrying slack water, Ohio R. to Pikeville, on Levisa Fork, and mouth of Pond Creek on Tug Fork, by 21 locks and movable dams, in addition to the one built below Louisa, 10 for Levisa Fork, 8 for Tug Fork, and 3 for main R.; est. of addl. work, $4,725,000, **98,** 2163; **99,** 434; **00,** 3401. R. and H. act Mar. 3, 1899, adopted portion of imp. recom., and au. the letting of contracts for completion of 2 locks and dams bet. Louisa and mouth, cost not to exceed $450,000, **01,** 491.

Maj. Ruffner recom., 1901, elevation of existing dam at Louisa, to cost $35,000, before definitely fixing location of the 2 dams above that point, **01,** 2737.

Act June 13, 1902, au. $350,000 for completion of locks and dams, Big Sandy R.; and also raising crest of dam, Louisa, Ky., **02,** 418.

Act Mar. 3, 1905, provided for imp. mouth Big Sandy R. and Tug and Levisa Forks; $40,000, **04,** 2637–38; **05,** 1902; for mainten., $43,000, **05,** 488.

Description of 3 locks and dams done by 1905, **05,** 1903; effect of, **05,** 489.

Act Mar. 2, 1907, au. steel service br., Lock No. 1; est., $7,000, **06,** 538; **07,** 566.

Outline of history of projects, **09,** 638.

Act June 25, 1910, app. $50,000 for Lock and Dam No. 2, Levisa Fork, and $50,000 for Lock and Dam No. 2, Tug Fork, **10,** 1986; revision of proj. rec., **11,** 768.

Economy of small dr. plant urged for mainten., **10,** 1986.

SURVEYS. (See Plans.)

From mouth, via Levisa Fork, to Pikeville, 112½ m.; also of Tug Fork from Louisa to Warfield, **75,** 73, 756, 760; **76,** ii, 140.

Of localities imp., **81,** 1980.

Ex. upper part of Levisa Fork; made, 1883; Maj. Cuyler (**R.** unfav.), **84,** 1755.

Ex. Levisa Fork au. act Aug. 5, 1886; Capt. Post, **87,** 1902.

Ex., Catlettsburg to Pikeville, Levisa Fork, and to mouth of Pond Creek on Tug Fork, au. act Aug. 11, 1888; **R.,** 1889, Maj. Lockwood, **89,** 1990.

Sur. Levisa Fork au. act Aug. 5, 1886; **R.,** 1887, Lt. Col. Merrill, **88,** 1796.

Ex. Russel Fork au. act Sept. 19, 1890; **R.,** 1890, Maj. Lockwood (unfav.), **91,** 2476.

Ex. Big Sandy, at its junction with the Ohio, au. act July 13, 1892, to ascertain if bar existed, and if it could be moved by confinement of chan. of Big Sandy; **R.,** 1892, Maj. Lockwood (unfav.), **93,** 2647.

Congress, 1898, by concurrent resol., called for plans and ests. of cost for imp. the R. **R.,** 1898, Maj. Bixby (see Projects), **98,** 2159.

Sur. Big Sandy R., W. Va. and Ky., incl. Levisa and Tug Forks, au. act Mar. 3, 1899; pre. **R.,** 1900, Capt. Hodges (see Projects), **00,** 3401.

Levels, **00,** 3405.

Final report of sur. made under act Mar. 3, 1899, Big Sandy R., incl. Levisa and Tug Forks, Capt. Hodges, Nov. 26, 1900,[1] **01,** 496, 2750.

Pre. ex. of Big Sandy R. with view to imp. headwaters, incl. Pound R. and Russel Fork, Va. and Ky., ordered by R. and H. act Mar. 2, 1907; **R.** (unfav.), **08,** 612.[2]

Ex. and sur. au. act July 25, 1912, of Tug and Levisa Forks, **12,** 924.

Maps.

(Photographs etc.) **97,** 2560; (photographs), **98,** 2144.

General drawing, Lock No. 2, Wrights Sta., Ky., **02,** 1948.

Of R., and plans of Lock No. 1, Tug and Levisa Forks, **11,** 2186.

Diagram, statistics of commerce and navigation, **11,** 2192.

List of Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 491, 2736, 2753; **02,** 418; **03,** 449; **05,** 488; **08,** 612; **11,** 769; **12,** 923.

Part (c), DD-213 Big Sandy River, Levisa Fork, Ky.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Description of, **93,** 2635; **94,** 2001.

Large quantities of coal shipped, **93,** 2635; **94,** 2001.

Imp. effected by the U. S. had increased, 1896, C. 100%, to value of $23,890,000, **96,** 2321.

CONTRACTS.

1905. Baker Contract Co., constr. Lock No. 1, prices given; Alma Cement Co., cement, prices given, **05,** 1908.

1907. Contractors for the constr. of Lock No. 1, the Baker Contract Co., in the hands of a receiver, The Colonial Trust Co., of Pittsburgh, Pa., completing the work, **07,** 1772.

1908. James Skene & Sons. constr. dam, guide walls, buildings, etc., $113,627.85, **09,** 1829.

1910. Augustus Snyder, emergency, constr. dwellings. outbuildings, and cisterns at Lock No. 1, unit prices given, **11,** 2188. Ironton Portland Cement Co., cement, $1.53 bbl., **11,** 2189.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 333; **94,** 305; **95,** 341; **96,** 298; **97,** 376. **98,** 371: **99,** 436; **00,** 499, 503; **01.** 493; **02,** 417; **03,** 448; **04,** 479: **05,** 488; **06,** 538; **07,** 565; **08,** 604; **09,** 638; **10,** 713; **11,** 768; **12,** 922.

In charge:

Maj. D. W. Lockwood, 1893–95. **R.,** **93,** 2635; **94,** 2001; **95,** 2503.

Maj. J. F. Gregory, 1896–97. **R.,** **96,** 2320; **97,** 2529.

Maj. W. H. Bixby, 1898–99. **R.,** **98,** 2155.

Capt. H. F. Hodges, 1899–1900. **R.,** **99,** 2511; **00,** 3360, 3400.

Maj. E. H. Ruffner, 1901–05. **R.,** **01,** 2742; **02,** 1949; (Lt. Col.) **03,** 1744; **04,** 2638; **05,** 1903.

Maj. J. G. Warren, 1906–09. **R.,** **06,** 1646; **07,** 1772; (Lt. Col.) **08,** 1843; **09,** 1826.

Maj. John C. Oakes, 1910–. **R.,** **10,** 1984; **11,** 2186; **12,** 2383.

Assistant. B. F. Thomas. **R.,** **93,** 2636; **94,** 2002; **95,** 2504; **96,** 2321; **97,** 2530; **98,** 2156; **99,** 2512; **00,** 3361.

[1] H. D. 235, 56th, 2d.

[2] H. D. 222, 60th, 1st.

LEGISLATION.

Acquiring title to sites for proposed dam through courts necessary, owing to exorbitant prices demanded by owners of land, **04,** 2638.

OPERATIONS.

1892-93. About 2,000 c. y. r. and about 500 snags and other obstr. removed, **93,** 2636.

1893-94. About 1,500 c. y. r. and about 300 snags and other obstr. removed, **94,** 2002.

1894-95. Over 6,000 c. y. r. and about 400 snags and other obstr. removed, **95,** 2504, 2505.

1895-96. Over 3,000 c. y. r. and about 200 snags and other obstr. removed, **96,** 2321, 2322.

1896-97. About 6,000 c. y. r. and about 300 snags and other obstr. removed, **97,** 2530.

1899-00. 267 c. y. r. and 137 snags removed from R., **00,** 3362.

1900-01. Obstr. removed, Louisa to Pikeville, **01,** 494, 2743.

1902-03. 280 snags, 82 overhanging trees, 31 stumps, 770 c. y. loose r., and 80 c. y. solid r. removed, **03,** 1744.

1903-04. 110 trees, 87 snags, 14 stumps, 20 c. y. solid r., 69 c. y. loose r. removed, **04,** 2638.

1904-05. Site cleared for constr. of lock, **05,** 1904.

1905-06. Concrete work for lock about half completed; 27 trees and 2,265 snags removed, **06,** 1646.

1906-07. Lock No. 1 completed, and specifications and plans for dam prepared, **07,** 1772.

1908-09. Abutment of Dam No. 1 and 2 dwellings completed; about 75% of gate reinforcement done and lower approach to lock excavated; 177 trees and 620 c. f. r. removed, **09,** 1826.

1909-10. Reinforcement of lock gates for Dam No. 1, and reinforced concrete paving done; items of work omitted through lack of funds, **10,** 1985.

1910-11. 1 lockman's cottage, 1 outbuilding, and 1 cistern completed, **11,** 2186. Nature and quantities of work done by hired labor at Lock No. 1, **11,** 2187.

1911-12. Upper guide wall constr., rear of lock and guide wall paved, walk and steps built about lockmaster's dwelling, 1,050 c. y. sand and r. dr., round and sheet piles driven, and drain tile laid at Lock No. 1 by hired labor, **12,** 2383.

PHYSICAL CHARACTERISTICS.

Levisa is the w. of the 2 forks of the Big Sandy R., uniting with it at Louisa. It possesses all the characteristics of mountain streams, **93,** 2635; **98,** 2156.

At or near the mouth of Georges Creek, 15 m. above Louisa, the R. had shoaled and w. for some years prior to 1896. At that time ground over which it used to flow was being cultivated, **96,** 2321.

Quicksand encountered in excavation work for dam at Lock No. 1; materially increasing est.; additional app. of $25,000 recom., **09,** 639.

PROJECTS.

By Maj. Bixby, 1898, extending slack water up the Levisa Fork to Pikeville as part of the imp. of the Big Sandy R., **00,** 499.

Act June 13, 1902, au. constr. of a lock and dam in each (Tug and Levisa) fork, next above their junction with Big Sandy R., **02,** 418.

SURVEYS.

Ex. made, and snags and overhanging trees reported, **05,** 1904.

Sur. made at site of proposed dam for Lock No. 1, and discharge observations taken, **07,** 1772.

Soundings and borings made to determine location of proposed lock, **11,** 2187.

Part(d), DD-213 Big Sandy River, Tug Fork, Ky.

APPROPRIATIONS. (See Part a.)

COMMERCE.

Description of, **96,** 2323.

Imp. by U. S. had, 1896, increased the C. 100%, to total value of $8,472,000, **96,** 2323.

CONTRACTS.

1905. Hollerbach & May Contracting Co., constr. lock, prices given; Alma Cement Co., 16,800 bbls. cement, prices given, **05,** 1908.

1908. Ohio River Contract Co., constr. dam, guide walls, and buildings at Lock No. 1, $97,782, **09,** 1829.

1910. Augustus Snyder, emergency, constr. dwellings, outbuildings, and cisterns at Lock No. 1, unit prices given, **11,** 2188.

ENGINEERS.

Chief of Engineers. R., 93, 333; **94,** 306; **95,** 341; **96,** 298; **97,** 375; **98,** 371; **99,** 436; **00,** 498, 503; **01,** 493; **02,** 417; **03,** 448; **04,** 479; **05,** 488; **06,** 538; **07,** 565; **08,** 604, 612; **09,** 638; **10,** 713; **11,** 768; **12,** 922.

In charge:

Maj. D. W. Lockwood, 1893–95. **R., 93,** 2637; **94,** 2002; **95,** 2505.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2323; **97,** 2528.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2152.

Capt. H. F. Hodges, 1899–1900. **R., 99,** 2508; **00,** 3357, 3400.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2742; **02,** 1949; (Lt. Col.) **03,** 1744; **04,** 2638; **05,** 1903.

Maj. J. G. Warren, 1906–09. **R., 06,** 602, 1645; **07,** 1771; (Lt. Col.) **08,** 1843; **09,** 1825.

Maj. John C. Oakes, 1910–. **R., 10,** 1984; **11,** 2185; **12,** 2383.

Assistant. B. F. Thomas. **R., 93,** 2638; **94,** 2004; **95,** 2506; **96,** 2324; **97,** 2528; **98,** 2153; **99,** 2509; **00,** 3358.

LEGAL PROCEEDINGS.

Norfolk & Western RR. et al., 1891, perpetually enjoined from causing obstr. in the R. by dumping, etc., **93,** 2637; **94,** 2003.

OBSTRUCTIONS.

Complaints made that the Norfolk & Western RR. had not removed the obstr. from the R., due to the constr. of its road along the right bank, as ordered by injunction of 1891, **93,** 2637; **94,** 2003.

OPERATIONS.

1892-93. Over 4,000 c. y. r. and over 200 snags and other obstr. removed, **93,** 2638.

1893-94. Over 2,000 c. y. r. and about 300 snags and other obstr. removed, **94,** 2004.

1894-95. Over 6,000 c. y. r. and about 400 snags and other obstr. removed, **95,** 2508.

1895-96. Over 3,000 c. y. r. and about 200 snags, etc., removed, **96,** 2324.

1896-97. Over 5,000 c. y. r. and about 100 snags, etc., removed, **97,** 2529.

1897-98. Walls at Yoces Sluice repaired and rebuilt: about 1,500 c. y. r. and over 100 snags, etc., removed, **98,** 2152.

1899-1900. About 1,800 c. y. r. and 145 snags removed from R., **00,** 3359.

1901-02. Until slack water is instituted, no operations required except occasional mainten. dr., at an est. yearly expend. of $1,000, **02,** 1949.

1902-03. 237 snags, 88 overhanging trees, 11 stumps, 18 c. y. loose r., and 20 c. y. solid r. removed, **03,** 1744.

1903-04. 90 trees, 353 snags, 19 stumps, 8 c. y. solid r., and 9 c. y. loose r. removed, **04,** 2639.

1904-05. Lock, cofferdam, and protection works completed, **05,** 1903.

1905-06. Lock No. 1 practically completed with exception of steel lock gates, **06,** 1645.

1906-07. Lock completed Feb. 19, 1907, **07,** 1772.

1908-09. Abutment, guide walls, guard walls, gate reinforcement, and 1 dwelling at Dam No. 1 completed, **09,** 1825.

1909-10. Lower guide wall, lock gates, and concrete work at Dam No. 1 completed; items of work omitted in contract through lack of funds, **10,** 1984, 1985.

1910-11. Dwelling, lockmaster's cottage and outbuilding completed at Lock No. 1; nature and quantity of work done by hired labor at Lock No. 1. **11,** 2186.

1911-12. Work on protection of foundations of guard and guide walls and abutment with sheet piles, together with necessary work at dwellings and outbuildings done at Lock No. 1 by hired labor, **12,** 2382.

PHYSICAL CHARACTERISTICS.

Tug Fork is the e. of the 2 forks which unite at the town of Louisa to form Big Sandy R. It has all the characteristics of a mountain stream, **93,** 2637; **96,** 2323.

Quicksand encountered in excavation for dam at Lock No. 1, increasing est.; addl. app. of $25,000 recom., **09,** 639.

PROJECTS.

By Maj. Bixby, 1898, extending slack water up the Tug Fork to mouth of Pond Creek, as a part of the imp. of Big Sandy R., **99,** 436.

Act June 13, 1902, au. constr. of lock and dam in each (Tug and Levisa) fork, next above their junction with Big Sandy R., **02,** 418.

SURVEYS.

Sur. made, by Maj. Warren, at site of proposed dam, and discharge observations taken, **07,** 1772.

Soundings and borings made to determine location of proposed lock, **11,** 2187.

Part (e), DD-213 Big Sandy River, Ky. (Including Forks) and W. Va. (Lock and dam, operating and care of.)

APPROPRIATIONS. (See Part a.)

COMMERCE.

Description, **11,** 771.
Diagram showing C. by decades, **11,** 2192.
181,770 t. in 1911–12, **12,** 925.

CONTRACTS.

1906. The Cincinnati Forging & Smithing Co., iron and steel, **06,** 1652.

1907. Lawrence D. Weaning, steel valves and journal bearings; McKay & Runyon, st., $1.70 t.; J. W. Harris, timber, $22 M f., **07,** 1779.

1908. Augustus Snyder, constr. storehouse, $750, **08,** 1850. Pioneer Boat & Pattern Co., gasoline boat, $1,975, **09,** 1831.

1909. Augustus Snyder, constr. dwelling, $2,000, **09,** 1832.

1910. Evans & Justice, push boat, $124.50, **10,** 1990.

1911. New Jersey Foundry & Machine Co., constr. guide wall at Lock No. 1, prices given, **11,** 2192.

1912. Chas. Hegewald Co., 2 steel hulls for maneuvering boats, $8,496.99, **12,** 2390.

ENGINEERS.

Chief of Engineers. R., 98, 370; **99,** 435; **00,** 498; **01,** 492; **02,** 419; **03,** 450; **04,** 481; **05,** 490; **06,** 540; **07,** 568; **08,** 607; **09,** 640; **10,** 715; **11,** 770; **12,** 924.

In charge:

Maj. W. H. Bixby, 1898–99. **R., 98,** 2150.

Capt. H. F. Hodges, 1899–1900. **R., 99,** 2505; **00,** 3353.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2741; **02,** 1952; (Lt. Col.) **03,** 1747; **04,** 2643; **05,** 1910.

Maj. J. G. Warren, 1906–09. **R., 06,** 1649; **07,** 1775; (Lt. Col.) **08,** 1846; **09,** 1829.

Maj. John C. Oakes, 1910–. **R., 10,** 1988; **11,** 2189; **12,** 2385.

Assistant. B. F. Thomas. **R., 98,** 2152, 2164; **99,** 2507; **00,** 3356.

OPERATIONS.

For misc. work done each year, see references to Engineers in Charge.

PROJECTS.

Operating and care of lock and dam placed under indefinite app. July 1, 1897, **98,** 2150.

DD-341 MUSKINGUM RIVER, OHIO.

Part.	Title.	Period.	Appropriations.
a	Muskingum R.	1884–1912	$307,300.00
b	Muskingum R., operating and care	1888–1912	1,966,375.79
	Total		2,273,675.79

Part (a), DD-341 Muskingum River, Ohio.

APPROPRIATIONS.

1886,	$20,000,	**86,** 1548.
1888,	102,000,	**88,** 217.
1898,	6,000,	**99,** 2455.
1902,	10,300,	**02,** 1936.
1905,	118,000,	**05,** 1890.
1907,	48,000,	**07,** 1758.
1910,	3,000,	**11,** 2173.
Total,	307,300	(incl. misc., $308,039.08, **12,** 2370).

COMMERCE.

In 1895, 6,000 t., **95,** 2391.
Mostly local; not increasing, **04,** 2657.
See Locks and Dams of Muskingum R., operating and care.

CONTRACTS.

1888. E. M. Ayres, dimension st., $2.69 c. y.; Griffith & Wedge Co., gate anchorages, $48 set; J. W. Dickinson, Portland cement, $2.75 bbl.; J. B. Speed, natural cement, $1.30 bbl.; Griffith &

Wedge Co., 2 hoisting engines, $555 and $1,050; G. S. Wormer, 1 hoisting engine, $700; M. Lautz & Son, iron driftbolts, $1,275; J. R. King, timber, $19 M f., **88,** 1689–1691.

1889. A. J. Jolly & Sons, lock constr., $61,340, **89,** 1891. E. B. Henderson & Son, dimension and backing st., $3.67 c. y., **89,** 1899.

1899. E. G. Pettit, lockmaster's house at Dam No. 1, $2,975, **99,** 2455.

1903. Cayuga Lake Cement Co., Portland cement, $2.35 bbl.; Rechsteiner Bros., building dwelling, Lock No. 3, $1,592.20; C. O. Waxler, building dwelling, Lock No. 9, $1,137; Castalia Portland Cement Co., Portland cement, $2.20 bbl., **04,** 2623.

1904. Rechsteiner Bros., building dwelling, Lock No. 4, $1,347.87, **04,** 2624.

1905. W. S. Gregg & Co., timber, Dam No. 3, $1,357, **05,** 1891.

1907. Edward J. Landor, building Lock and Dam No. 11, unit prices given, **07,** 1759. C. O. Waxler, building combined dwelling and storehouse, Lock No. 10, $4,719, **07,** 1759.

ENGINEERS.

Chief of Engineers. R., 85, 285; **86,** 274, 275; **87,** 240; **88,** 217, 1699; **89,** 253, 254; **90,** 228; **91,** 293; **92,** 281, 282; **93,** 317; **94,** 288; **95,** 321, 323; **96,** 277; **97,** 358; **98,** 361; **99,** 423; **00,** 487; **01,** 485; **02,** 415; **03,** 446; **04,** 477, 483, 2654; **05,** 486; **06,** 536; **07,** 564; **08,** 602; **09,** 636; **10,** 711; **11,** 765; **12,** 920.

Boards. BE. reported, 1903, imp. to Coshocton inadvisable, and that to Dresden also, unless side cut canal be d. by other interests, **04,** 2658.

In charge:

Lt. Col. W. E. Merrill, 1886–92. **R., 86,** 1547, 1548, 1551, 1552; **87,** 1815; **88,** 1684, 1701, 1708, 1710; **89,** 1890, 1892, 1909; **90,** 2200, 2201; **91,** 2369.

Maj. A. Stickney, 1892–95. **R., 92,** 1999, 2000; (Lt. Col.) **93,** 2504; **94,** 1875; **95,** 2370, 2390.

Maj. W. H. Heuer, 1896–97. **R., 96,** 2104; **97,** 2363, 2378.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2094.

Capt. H. F. Hodges, 1899–1900. **R., 99,** 2454; **00,** 3297.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2714; **02,** 1935; **03,** 1731; **04,** 2622, 2655; (Lt. Col.) **05,** 1890.

Maj. J. G. Warren, 1906–09. **R., 06,** 1633; **07,** 1757; (Lt. Col.) **08,** 1825; **09,** 1809.

Maj. John C. Oakes, 1910–. **R., 10,** 1971; **11,** 2171; **12,** 2369.

Assistants:

J. B. Gregory. **R., 86,** 1556.

Lt. L. H. Beach. **R., 87,** 1820; **88,** 1691, 1704, 1712; **89,** 1900, 1911.

E. J. Carpenter. **R., 88,** 1695.

Lt. C. E. Gillette. **R., 90,** 2208; **91,** 2377.

E. Moeser. **R., 92,** 1999, 2001; **93,** 2505; **94** 1875; **95,** 2370; **96,** 2105; **97,** 2364, 2378; **98,** 2095 **99,** 2456; **00,** 3299.

LEGAL PROCEEDINGS.

Title to land for lock house, Dam No. 1, acquired 1899, **99,** 424.

Easements needed for extension of the Zanesville Levee obtained, 1900, **99,** 2454; **00,** 487.

LEGISLATION.

Act of Ohio, ceding to U. S. the locks and dams on the Muskingum R., **86,** 1564.

Act Aug. 5, 1886, au. acceptance from Ohio of the locks and dams on the Muskingum R. built by the State, **86,** 1547; **87,** 1815.

OBSTRUCTIONS.

Drawless county br. a hindrance to the operation of the Taylorsville Lock, **94,** 1875. (See Operations and Projects.)

Commissioners of Muskingum County ordered by court to alter br. bet. Taylorsville and Duncans Falls. U. S. Supreme Court reversed decision of lower court, but before this decision was rendered the br. was put in a satisfactory condition, **00,** 3298.

OPERATIONS.

1885-86. Sur. of R. made, **86,** 1547, 1548.

1886-87. Locks and dams ceded to US. and taken possession of Apr. 7, 1887; progress on repair of works, **87,** 1817, 1818, 1820.

1887-88. Extensive repairs to Dams 1, 2, 4, 5, and 6; Lock No. 9 rebuilt; 420 snags, stumps, and obstr. removed; 156,934 c. y. dr. at lock entrance and at Bear Creek, Stones Ripple, and Blue Rock Bars, **88,** 1684, 1685. Operation and care of locks and dams, **88,** 1685.

1888-89. Cofferdam completed, and excavation for foundation begun for new lock at Taylorsville, **89,** 1891. Operation and care of locks and dams, **89,** 1892.

1889-90. Lock at Taylorsville completed, **90,** 2200. Operation and care of locks and dams, **90,** 2201, 2208.

1890-91. Work of opening out the chan. below Lock No. 9 begun; 7,500 c. y. material and 1,600 c. y. r. excavated; operation and care of locks and dams, **91,** 2369.

1891-92. 13,443 c. y. r. and 10,062 c. y. earth excavated; repairs to existing works; operation and care of locks and dams, **92,** 1999, 2008.

1892-93. Taylorsville Locks almost completed, **93,** 2505.

1895-96. Taylorsville Lock completed and opened to navigation on Apr. 20. Alterations of county br. (see Obstructions) made, **96,** 2104.

1896-97. Ice H. at mouth of R. completed, **97,** 2364.

1898-99. Constr. of lockmaster's house in progress, **99,** 2454.

1899-00. Lockmaster's house completed, and levee at Zanesville repaired and extended, **00,** 3298.

1900-01. 800 sq. f. concrete pavement laid at Lock No. 1, **01,** 2714.

1903-04. Dwellings at Locks 3 and 9 completed and 1 at Lock 4 commenced; 686 c. y. concrete laid over crest of Dam No. 9, **04,** 2622.

1904-05. Dwelling at Lock No. 4 completed, at cost of $2,209.62, **05,** 1890.

1905-06. Crest of Dam No. 3 raised 1′, **06,** 1634.

1906-07. Work begun on constr. of Lock and Dam No. 11; foundations built for house at Lock No. 10; work of raising crest of Dam No. 3 1′ completed, **07,** 1758.

1907-08. Combined dwelling and storehouse at Lock No. 10 completed, **08,** 1825. Office, dwelling, and outbuildings at Lock and Dam No. 11 completed; 50% of excavation in lock pit finished, 60% pile foundation driven, upper wing wall completed, and 57 l. f. lock floor laid, **08,** 1826.

1908-09. Lock, upper guide wall, lower guide and wing walls at Lock and Dam No. 11 completed and gates hung, 40% of pile foundation driven and superstr. begun; 80% embankment at locks completed, **09,** 1809.

1909-10. 181′ dam, metal work for movable top, concrete abutment, lock embankment, and paving at Lock and Dam No. 11 completed, **10,** 1972.

1910-11. Constr. of Lock and Dam No. 11 completed Nov., 1910; repairs made to break in levee, Dam No. 10, **11,** 2171.

1911-12. 120 l. f. caving bank below lock protected with 4,450 sq. f. wire-woven willow mattress covered with riprap; constr. of gravel bed for 3,820 sq. f. walks on lock grounds completed, **12,** 2369.

PHYSICAL CHARACTERISTICS.

Description of, Zanesville to Dresden, **89,** 1911.

Description of, vicinity of Zanesville, **93,** 2505.

Description of, sur. of 1895. Borings. (Maps.) **95,** 2391.

Gauge readings, **97,** 2378.

PRIVATE (STATE) WORK.

Locks and dams, Zanesville to Dresden, built by Ohio; cost, $1,500,000, **86,** 1552, 1554, 1557, 1561; **87,** 240.

Condition of work when turned over to the U. S., **87,** 1817, 1820.

PROJECTS.

Locks and dams on the Muskingum R. ceded to the U. S. by act of Ohio Legislature, **86,** 1564; accepted by the U. S. by act of Aug. 5, 1886, **86,** 1547; **87,** 1815, 1817.

In 1886 Lt. Col. Merrill est. $200,000 to repair the State locks and dams, Zanesville to Marietta, **86,** 1553.

In 1887 a more detailed ex. indicated that the locks and dams would require more extensive repairs than expected, 1886, **87,** 1817, 1820.

By Lt, Col. Merrill, 1887, reconstr. and repair of 10 locks and dams, Marietta to Zanesville; cost, $268,218; also for lock to take the place of the lateral canal at Taylorsville; cost, $102,000, **88,** 1700, 1701, 1702.

By Lt. Col. Merrill, 1889, slack-water navigation, Zanesville to Dresden, with lock and dam at Ellis; est., $139,000, **89,** 1910, 1911.

Act of 1894 au. alteration of county br. (see Obstructions), the U. S. to do all the work except that relating to the superstr., the cost to be paid from the fund for care and mainten. of public works; and devoted the funds for the alterations of the Zanesville Lock to making a sur. from Zanesville to Dresden, to completing ice H. at R. mouth, and to completing Taylorsville Lock, **95,** 2370.

In 1895 Lt. Col. Stickney est. $110,000 to constr. lock and dam about 8 m. above Zanesville, **95,** 2390.

By Capt. Hodges, 1899, expend. $6,000 to extend the levee at Zanesville; Ohio (work suspended 1899, see Legal Proceedings), **99,** 2454.

Capt. Hodges est., 1899, $14,000 to constr. 5 buildings for lock tenders, and to raise the crests o Dams 3 and 9, **99,** 424; **00,** 487.

By Maj. Ruffner, 1902, expend. of $10,300, app. June 13, 1902, and unexpend. balance in building 4 lockmasters' dwellings and raising crest of Dam No. 9, **03,** 1731. This proj. was enlarged to provide for building combined storehouse and dwelling at Lock No. 10, and raising crest of Dam No. 3; est., $8,000 addl., **03,** 1732.

Act of Mar. 3, 1905, app. $110,000 for rebuilding Lock and Dam No. 11 above Zanesville, and provided that no part of this should be expend. until assured that the State of Ohio or other agency would spend $200,000 upon Ohio canal system bet. above lock and Lake Erie, **05,** 486.

By Maj. Warren, 1906, for Lock and Dam No. 11; est. increased to $158,000, and act Mar. 2, 1907, app. addl. $48,000, **07,** 564.

SURVEYS.

Au. act July 5, 1884; made by Lt. Col. Merrill, **86,** 1551.

Sur., Marietta to Dresden, made, 1888, by Lt. Col. Merrill, **89,** 1894.

Ex., Zanesville to Dresden, Ohio, au. act Aug. 11, 1888; made, 1889, by Lt. Col. Merrill, **89,** 1909.

Sur. for 4,400′ in the vicinity of canal head at Zanesville to determine best method of reconstr. locks at that point; made, 1892, by Lt. Col. Stickney, **93,** 2505.

Sur. from Zanesville to Dresden au. act Aug. 17, 1894; made, 1895, by Lt. Col. Stickney (see Projects), **95,** 2390.

(The Chief of Engineers allotted $700, 1895, to obtain data on this R. upon the form of the surface of water when backed up by a dam in a running stream. Gauge readings were made in 1895–96 under direction of Maj. Heuer, **97,** 2378.)

Pre. ex., Zanesville to Coshocton, au. act June 13, 1902, for d. of 6′; **R.,** Maj. Ruffner (unfav.),[1] **04,** 2655.

R. by BERH., Jan. 19, 1905, requested by R. and H. Com. whether it would be advisable to extend imp. of Muskingum R. from Zanesville to Dresden, at cost est. of $110,000, conditioned upon expend. by State of Ohio of a considerably larger sum. Board recom. such imp.[2]

Of site for new Lock and Dam No. 11, made, 1906, by Maj. Warren, **06,** 1633.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 921.

Maps. **88,** 1701; **95,** 2392.

Part (b), DD-341 Muskingum River, Ohio, Locks and Dams. (Operating and care.)

APPROPRIATIONS.[3]

1888,	$175,657.16	
1889,	128,524.64	
1890,	210,460.84	
1891,	219,744.56	
1892,	235,732.19	
1893,	43,202.71	
1894,	51,386.77	H. D. 421, 57th, 2d.
1895,	43,460.55	
1896,	35,904.88	
1897,	37,901.57	
1898,	41,323.92	
1899,	39,747.66	
1900,	39,537.55	
1901,	35,147.83,	**01,** 2717.
1902,	48,070.11,	**02,** 1939.
1903,	43,448.89,	**03,** 1736.
1904,	48,345.61,	**04,** 2629.
1905,	55,048.57,	**05,** 1895.
1905,	[4] 17,934.80,	**05,** 1893.
1906,	39,377.35,	**06,** 1637.
1907,	68,505.37,	**07,** 1762.
1908,	82,657.57,	**08,** 1832.
1909,	52,824.79,	**09,** 1817.
1910,	50,130.25,	**10,** 1978.
1911,	49,521.45,	**11,** 2179.
1912,	72,778.20,	**12,** 2375.
Total,	1,966,375.79	

COMMERCE.

1898, 83,077 t.; 1899, 70,206 t., **99,** 425; **00,** 489.
Imp. has had no material effect on C., **10,** 713.
1911, 72,000 t., **12,** 2379.

CONTRACTS.

1896. J. Garrett and Cowell & Hickman, coal, $415, **96,** 2112.

1899. Muskingum & Ohio River Transportation Co., towboat tender to the U. S. dr. *Malta*, $23 per day, and 50¢ per meal for employees, **99,** 2459.

1900. Muskingum & Ohio River Transportation Co., towboat as tender to U. S. dr. *Malta*, $2 per day, and 50¢ per meal for employees, **00,** 3303.

1901. Edward J. Howard, wooden hull, stern, wheel towboat, complete, $9,805; Muskingum & Ohio River Transportation Co., hire of towboat, $24 per day, and 50¢ per meal for U. S. employees, **01,** 2717. E. A. Patterson, rubble st.; Gregg & Dutro, white oak timber; Clifton Bros., derrick st.; Joseph Oliver, rebuilding lockmaster's house at Lock No. 2, **02,** 1938, 1939.

1902. Winfield S. Gregg, lock-gate timber, **02,** 1938. J. W. Leake, rubble st., 37¢ c. y.; New Jersey Foundry & Machine Co., driftbolts, 2.85¢ lb.; Milton Fouts, timber, unit prices given; E. J. Landor, reconstr. abutments and miter sills for guard gates at head of canal, and repairs to dam at Lock and Dam No. 7, unit prices given, **03,** 1735.

[1] H. D. 241, 58th, 2d.
[2] R. and H. 38, 61st, 2d.
[3] Expend. under the permanent-indefinite app., act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.
[4] For special works.

1903. Union Machine Co., locomotive-type boiler for dr. *Malta*, **03,** 1736. Milton Fouts, timber, $17.65 and $29.50 M f. b. m., **04,** 2627. E. A. Kinsey Co., planing machine and feed-roll attachment, $1,183 and $202.50, resp.; New Jersey Foundry & Machine Co., driftbolts, 2½¢ lb.; Muskingum River Stone Co., st., 44¢ c. y., **04,** 2628.

1904. The Hayward Co., dr. bucket, $502; The Union Machine Co., metal work for dump scows, $2,227.75; J. G. Newbegin, timber for dump scows, $10.90 M, **04,** 2628, 2629. C. O. Waxler, building quarterboat, except hull, $943; Roe & Woodrow, lock-gate timbers, $27.50 M.; J. L. Sutter, white oak timber, $16.90 M, **05,** 1894. Clifton Bros., repairing Dam No. 9, and guide cribs at Nos. 5 and 9, unit prices given, **05,** 1895.

1905. Milton Fouts, timber, $24.95 M; W. S. Gregg Co., timber, $15.90 M; Rechsteiner Bros., lockmaster's dwelling, $1,658, **06,** 1638.

1906. Clifton Bros., reconstr. about 617′ Dam No. 9, unit prices given, **06,** 1639. Lewis Pope & Sons, services of towboat, $30 per day; James Ramsey, constr. cement sidewalk at Lock No. 3, 13¾¢ sq. ft.; Clifton Bros., reconstr. conduit and guide and guard crib at Lock No. 4, unit prices given, **07,** 1764.

1907. Clifton Bros., reconstr. revet. of canal embankment at Locks 9 and 10, and guard cribs at Locks 6 and 9, unit prices given, **07,** 1764. Howard Shipyards Co., constr. wooden-hull towboat, $14,400, **07,** 1765. Clifton Bros., rebuilding guide and guard cribs, Locks 4, 6, 10; Parkersburg Dock Co., repairing SS. *Vega*, unit prices given, **08,** 1835.

1908. S. W. Hoffman, reconstr. storehouse and waiting room at Lock No. 4, $498; S. W. Hoffman, building revet. at Lock No. 3, unit prices given, **08,** 1834. S. W. Hoffman, constr. conduit at Lock No. 7, unit prices given, **09,** 1817. Clifton Bros., repair work at Locks Nos. 2, 3, 5, and 10, unit prices given, **09,** 1818.

1909. Clifton Bros., repairing canal embankment at Lock No. 7, unit prices given, **09,** 1818. Clifton Bros., repairs at Locks Nos. 1, 2, 3, 5, and 8, unit prices given; Alonzo Hanson, constr. concrete pavements at Lock No. 4, 12¢ c. y., and at Lock No. 8, 13¢ c. y.; S. W. Hoffman, constr. roadway at Lock No. 10; paving, 14¢ sq. ft.; ballast, $1.10 c. y., **10,** 1980.

1910. Alonzo Hanson, constr. core wall, etc., at Lock No. 7, unit prices given, **10,** 1981. Clifton Bros., reconstr. revet., guide walls, etc., Locks Nos. 1, 3, 4, 5, 6, and 9, unit prices listed, **11,** 2180.

1911. Clifton Bros., furnishing and driving 12 guard piles above R. wall, Lock No. 8, price listed, **11,** 2180. J. A. Swingle & Co., concrete work, top of Dam No. 5, prices listed, **11,** 2181.

1912. Clifton Bros., repairs to Locks Nos. 2, 3, 9, and 10, prices listed, **12,** 2377, 2378. Clifton Bros., reconstr. of top of Dam No. 8, prices listed; Walter Ellis, raising and reconstr. lockmaster's dwelling, Lock No. 6, $1,442.83, **12,** 2378.

ENGINEERS.

Chief of Engineers. **R., 93,** 317; **94,** 289; **95,** 322; **96,** 278; **97,** 358; **98,** 361; **99,** 424; **00,** 488; **01,** 485; **02,** 416; **03,** 447; **04,** 478; **05,** 487; **06,** 537; **07,** 565; **08,** 603; **09,** 637; **10,** 712; **11,** 766; **12,** 921.

In charge:

Lt. Col. A. Stickney, 1892–95. **R., 93,** 2506; **94,** 1876; **95,** 2371.

Maj. W. H. Heuer, 1896–97. **R., 96,** 2106; **97,** 2364.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2095.

Capt. H. F. Hodges, 1899–1900. **R., 99,** 2457; **00,** 3300.

Maj. E. H. Ruffner, 1901–05. **R., 01,** 2714; **02,** 1936; **03,** 1732; **04,** 2624; (Lt. Col.) **05,** 1891.

Maj. J. G. Warren, 1906–09. **R., 06,** 1634; **07,** 1759; (Lt. Col.) **08,** 1827; **09,** 1811.

Maj. John C. Oakes, 1910–. **R., 10,** 1973; **11,** 2174; **12,** 2370.

Assistant. E. Moeser. **R., 93,** 2507; **94,** 1877; **95,** 2372; **96,** 2113; **97,** 2375; **98,** 2109; **99,** 2471; **00,** 3313.

LEGAL PROCEEDINGS.

Leases (water power, land, and rental), **93,** 2510; **94,** 1881; **95,** 2376; **96,** 2112, 2115; **97,** 2370, 2378; **98,** 2104, 2105, 2112; **99,** 2467; **00,** 3301, 3309; **12,** 2381.

OBSTRUCTIONS.

List of br. over the R. requiring alterations, **93,** 2509; **94,** 1880; **95,** 2375.

Under au. of Sec. of War, the old wooden draw in the br. of the Cincinnati & Muskingum Valley Ry. Co., at Zanesville, Ohio, displaced with an iron br., **97,** 2365.

Structures by private persons in and over the R. au. by Sec. of War, **99,** 2457; **00,** 3301.

OPERATIONS.

1892–93. About 60,000 c. y. dr.; locks, dams, buildings, and plant repaired, **93,** 2507.

(For detailed statement of dr. done at each locality, see end of each an. report.)

1893–94. Over 80,000 c. y. dr.; and work similar to that of the preceding year done, **94,** 1877.

1894–95. Over 70,000 c. y. dr., and work like that of 1892–93 done, **95,** 2373.

1895–96. Nearly 90,000 c. y. dr., and (see preceding year), **96,** 2111.

1896–97. Nearly 90,000 c. y. dr., and (see preceding year), **97,** 2365.

1897–98. Nearly 70,000 c. y. dr., and (see preceding year), **98,** 2095.

1898–99. 98,816 c. y. dr., and minor repairs made to dams and locks, **99,** 2457, 2458.

1899–00. 99,233 c. y. dr., and 219 snags and other obstr. removed; and misc. repairs made to locks and dams, **00,** 3301, 3315.

1900–01. Permits granted for brs., pipe lines, waterpower, etc., **01,** 2714. Repairs made at various locks; dr. hull rebuilt; repairs to floating plant, **01,** 2715, 2716. About 66,000 c. y. dr., **01,** 2718.

1901–02. Repairs made at various locks, **02,** 1936. New towboat received; 85,510 c. y. dr., **02,** 1937. Lists of leases, rents, etc., **02,** 1940, 1941.

1902–03. Repairs made at various locks, **03,** 1732. Timber floors, sills, copings, guide walls, abutments, etc., replaced with concrete, and other imp. made, **03,** 1733. Dr., snagging, etc., **03,** 1736. Lists of leases, rents, etc., **03,** 1737.

1903–04. Repairs to various locks; renovation of Lock and Dam No. 9 completed; imp. made at shop, **04,** 2624. Additions made to floating plant, **04,** 2626. Dr., snagging, etc., **04,** 2629. Leases, rents, etc., **04,** 2630.

1904–05. Repairs and imp. at various locks, **05,** 1891. Dr., snagging, etc., **05,** 1895. Leases, rents, etc., **05,** 1896.

1905–06. Permits and leases granted; new lockman's dwelling built at Lock No. 1, and repairs and imp. made at Locks Nos. 1 to 10, **06,** 1635. Conduit rebuilt in concrete at Lock No. 9; 85,400 c. y. dr., **06,** 1636. Leases, rents, etc., **06,** 1639.

1906–07. Permits granted; repairs and imp. made at Locks Nos. 1 to 10; reconstr. of conduit and guide and guard cribs in concrete at Lock No. 4 begun, **07,** 1760. 617′ Dam No. 9 reconstr. in concrete, and reconstr. of revet. on canal embankment commenced, **07,** 1761. 58,798 c. y. dr., **07,** 1762. Leases, rents, etc., **07,** 1765, 1766.

1907–08. Repairs and imp. made at various locks, **08,** 1827. 100′ concrete revet. built along R. bank at Lock No. 3; reconstr. of conduit, lower and upper guide and guard cribs and storehouse at Lock No. 4 completed, **08,** 1828, 1829. Reconstr. of 2 upper guard cribs and lower guide crib at Lock No. 6 completed, **08,** 1829. Reconstr. of 215′ canal embankment and upper guard crib at Lock No. 9 completed, **08,** 1830. Upper guide and guard cribs, lower guide cribs, and 257 l. f. revet. reconstr. at Lock No. 10, **08,** 1831. 78,947 c. y. dr.; repairs made to SS. *Vega;* new towboat delivered, **08,** 1832. Leases, rents, etc., **08,** 1840, 1841.

1908–09. Repairs and imp. made at Locks Nos. 1 to 10; new retaining wall and guard wall

built and dam repaired at Lock No. 2, **09,** 1811. Guide piles replaced and guard crib rebuilt at Lock No. 3, and new storehouse built, **09,** 1812. Lower guide crib replaced with concrete retaining wall, and dam repaired at Lock No. 5, **09,** 1813. New conduits, with gates, built at Lock No. 7, and 726′ bank repaired with piling, **09,** 1814. 1,840 l. f. eroded embankment at Lock No. 9 refilled; about 100′ new concrete revet. built above Lock No. 10, **09,** 1815. 88,998 c. y. dr.; repairs to floating plant, **09,** 1816. Leases, rents, etc., **09,** 1824.

1909-10. Repairs and imp. made at Locks Nos. 1 to 10; 60′ concrete revet. built at Lock No. 2, **10,** 1973. 100′ concrete revet. built at Lock No. 3, and 1,552 s. f. pavement at Lock No. 4 built, **10,** 1974. Lower guard crib at Lock No. 5 reconstr.; old conduit at Lock No. 7 removed and 726′ bank repaired, **10,** 1975. 60′ crib at Lock No. 8 rebuilt and 1,620 s. f. pavement laid, **10,** 1976. Roadway built at Lock No. 10, **10,** 1977. 112,650 c. y. dr., and repairs made to floating plant, **10,** 1978. Leases and rents, **10,** 1983, 1984. 6.42 m. H. line, approv. June 25, 1909, laid out, **10,** 1978.

1910-11. Lock No. 1: Abutment protected by 90 c. y. riprap. Lock No. 2: Reconstr. cribwork of upper step of dam over 157′ of its l.; renewed 20′ sheathing on lower apron; minor repairs to lock wall and lockmaster's dwelling. Lock No. 3: Concrete revet. on R. bank extended to lock; concrete pavements laid. Lock No. 4: Minor repairs, and repainting lockmaster's dwelling. Lock No. 5: Wooden guide crib replaced with reinforced concrete wall 97′ l., and 38′ wooden guide crib above R. wall reconstr. with reinforced concrete, **11,** 2175. Top of dam reconstr. in concrete; 2,000 sq. ft. concrete paving placed; well at lock house repaired. Lock No. 6: Reinforced concrete guide wall completed; minor repairs. Lock No. 7: Reconstr. with concrete and riprap 100 l. f. of revet., left bank of canal, **11,** 2176. Lock No. 8: 12 guard piles driven above wall of lock; replaced old woodwork and raised 245 l. f. of guide crib below land wall by 22″; concrete stairway built; dam repaired by placing splashboards on crest and raising crest permanently with timber; minor repairs to lockmaster's dwelling, **11,** 2177. Lock No. 9: Concrete pavement laid over terreplein of lock, extending back at both ends of lock wall; flood-damaged portion of canal embankment restored; 120 c. y. riprap on side slopes replaced, **11,** 2177. Lock No. 10: Gate machinery repaired. Lock No. 11: Replacing 3 walk plates of movable dam; U. S. dr. *Malta* removed 91,763 c. y. from canal, approaches to locks, and also removed bars and other obstr.; floating plant repaired, **11,** 2178.

1911-12. Lock No. 1: U. S. dr. removed 13,215 c. y. deposit from chamber, and 4 snags and 2 rs.; reinforced concrete revet. completed, **12,** 2370. Lock No. 2: New machinery for operating gates installed; replacing wooden guard cribs with concrete, 60% completed. Lock No. 3: 177 c. y. gravel back of dam placed to stop leakage; concrete extension of right abutment of dam 290′ l. completed; replacing guide and guard cribs above lock with reinforced concrete walls 80% completed, **12,** 2371. Lock No. 4: Decayed sheathing on lower slope of dam replaced; machinery repaired; 4 reinforced concrete guide walls for guard abutment at head of canal completed. Lock No. 5: Concrete guard crib above R. wall of lock completed; reconstr. of top of dam in concrete completed. Lock No. 6: Lockmaster's dwelling raised 11′ 3″, and foundation and cellar walls 25% completed. Lock No. 7: Oil storehouse constr.; machinery repaired; U. S. drawbr. over lateral canal repaired; repairs to lock gates, scows, etc. Lock No. 8: Cement shed constr., **12,** 2373. Lock No. 9: Embankment bet. canal and basin above old lock reconstr. by placing 3,910 c. y. earth filling; lower lock gate and gate-opening machinery repaired; unserviceable wooden guard crib below R. wall of lock removed and replaced by reinforced concrete crib, **12,** 2373. Lock No. 10: Repairs to handrails on upper gate of lock and on guard gate at head of canal. Lock No. 11: Lock houses repaired, 1 house repainted; walk plates of Boule Dam repaired; overhanging trees removed and trimmed back; U. S. dr. *Malta* removed 77,343 c. y. material; repairs to floating plant, **12,** 2374–75.

PHYSICAL CHARACTERISTICS.

For occasional floods, periods of l. w., and ice, all more or less damaging works and suspending navigation, see references to Engineers in charge.

Navigation suspended on account of ice, **11,** 2174.

Description and shoaling, **12,** 2370.

PRIVATE WORK. (See Obstructions.)

About seven-eighths of the débris of the Taylorsville Br. removed by the owner, **99,** 3301.

PROJECTS.

At 1893 there were bet. Ohio R. and Zanesville 10 dams, 11 locks, and 5 lateral canals, **93,** 2506.

Congress, 1895, allotted, from funds for care and mainten. of public works, for constr. of protection wall at Zanesville, $1,651; for constr. of RR. br. pier at Marietta, $10,449.60; and for pier of the county br. at Taylorsville, $5,834.20, **95,** 2371. (See Muskingum River and Muskingum River Ice Harbor.)

Accident to floor of chamber of Lock No. 1 suspending navigation for 29 days, **97,** 2365.

DD-442 BIG HOCKING RIVER, OHIO.

ENGINEERS.

Chief of Engineers. **R., 87,** 244; **88,** 218; **92,** 277.

In charge:
Lt. Col. W. E. Merrill, 1887–88. **R., 87,** 1835; **88,** 1719, 1720.
Maj. A. Stickney, 1892. **R., 92,** 1964.

Assistants:
Lt. L. H. Beach. **R., 87,** 1835; **88,** 1720, 1721.
E. Moeser. **R., 92,** 1964.

OPERATIONS.

1891-92. 627 c. y. st. and 48 logs removed from chan., **92,** 1964.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1720.

PLANS.

By Lt. Col. Merrill, 1887, for imp. R., mouth to Coolville, 5 m., securing a navigation for light-draft boats during the medium and higher stages, by removing overhanging trees and similar obst.; est., $5,000, **88,** 1720.

SURVEYS.

Ex., mouth to Coolville, au. act Aug. 5, 1886; made, 1887, by Lt. Col. Merrill (**R.** fav.), **87,** 1835; **88,** 1720.

DD-444 RACCOON RIVER, OHIO.

COMMERCE.

None, 1892, but country believed to be rich in natural resources, **93,** 2531.

ENGINEERS.

Chief of Engineers. **R., 93,** 319.
In charge. Lt. Col. A. Stickney, 1892–93. **R., 93,** 2530.
Assistant. Lt. H. F. Hodges. **R., 93,** 2531.

PHYSICAL CHARACTERISTICS.

Description of. Small stream with steep slope. Several dams on the stream for power, **93,** 2531.

SURVEY.

Ex. of 50 m. of R. from junction with Ohio, au. act July 13, 1892; made, 1892, by Lt. Col. Stickney (**R.** unfav.), **93,** 2530.

DD-446 SCIOTO RIVER, OHIO.

ENGINEERS.

Chief of Engineers. **R., 85,** 285.

In charge. Lt. Col. W. E. Merrill. **R., 85,** 1832.

Assistant. Lt. G. W. Goethals. **R., 85,** 1832

PHYSICAL CHARACTERISTICS.

Description of, **85,** 1834.
Necessity for protection against ice, **85,** 1833.

PLANS.

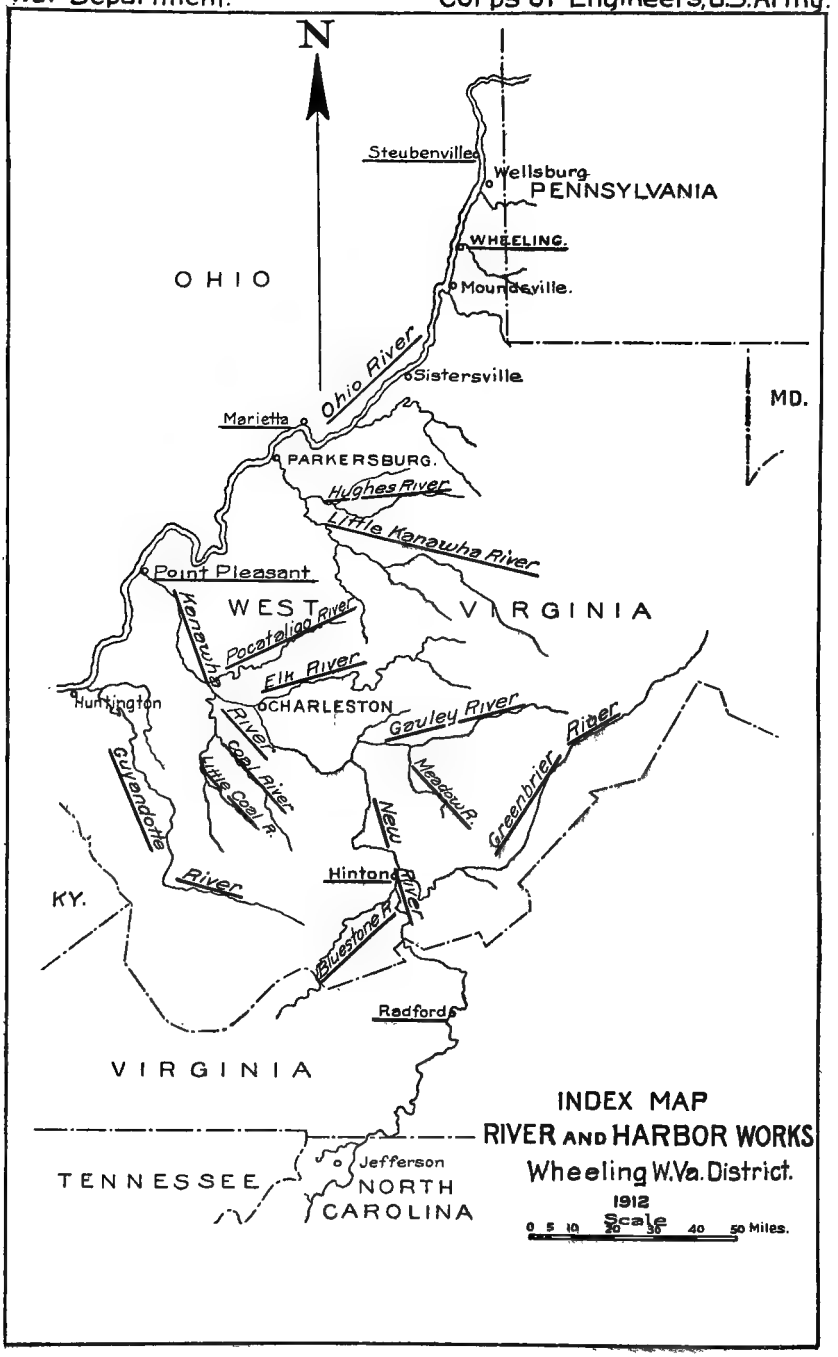
By Lt. Col. Merrill, 1885, dr. bar at mouth, and forming ice H. opposite Portsmouth; est., $47,000, **85,** 1836, 1839.

SURVEY.

Au. act July 5, 1884; made by Lt. Col. Merrill. **85,** 1832.

RIVER AND HARBOR WORKS—OHIO RIVER SYSTEM.

EE.—WHEELING, W. VA., DISTRICT.


War Department.
Corps of Engineers, U.S. Army.
N
Steubenville
Wellsburg
PENNSYLVANIA
WHEELING.
OHIO
Moundsville.
Ohio River
Sistersville
MD.
Marietta
PARKERSBURG.
Hughes River
Little Kanawha River
Point Pleasant
WEST
VIRGINIA
Kanawha River
Pocatalico River
Elk River
Huntington
CHARLESTON
Gauley River
Greenbrier River
Guyandotte River
Little Coal R.
Coal River
Meadow R.
New River
Hinton
KY.
Bluestone R.
Radford
VIRGINIA
INDEX MAP
RIVER AND HARBOR WORKS
Wheeling W.Va. District.
1912
Scale
0 5 10 20 30 40 50 Miles.
Jefferson
TENNESSEE
NORTH
CAROLINA

EE.—WHEELING, W. VA., DISTRICT.

In charge of U. S. Engineer Office,
Wheeling, W. Va.

NOTE.—Embraces portion of the Ohio R. (see Dist. CC) and the tributaries on the left bank from Big Sandy R., Ky.-W. Va., to vicinity of Wheeling, W. Va.

EE 1 Ohio R. at Big Sandy R.
EE 2 Twelve-Pole Cr., W. Va. (1)
EE 3 Buffalo Cr., W. Va. (2)
EE 4 Greenbrier Cr., W. Va. (2)
EE 5 Moses Cr., W. Va. (2)
EE 6 East Fork, T. P. Cr., W. Va. (2)
EE 7 Beech Fork, W. Va. (2)
EE 8 Ohio R.
EE 9 Four-Pole Cr., W. Va. (1)
EE 10 Ohio R., Lock and Dam 28.
EE 11 Guyandotte R., W. Va. (1)
EE 12 Fourmile Cr., W. Va. (11)
EE 13 Tenmile Cr., W. Va. (11)
EE 14 Fourteenmile Cr., W. Va. (11)
EE 15 Crawley Cr., W. Va. (11)
EE 16 Island Cr., W. Va. (11)
EE 17 Mud Fork, W. Va. (16)
EE 18 Copperas Mine Fork, W. Va. (16)
EE 19 Cow Cr., W. Va. (16)
EE 20 Little Cr., W. Va. (16)
EE 21 Middle Fork, W. Va. (16)
EE 22 Rich Cr., W. Va. (11)
EE 23 Gilbert Cr., W. Va. (11)
EE 24 Little Huff Cr., W. Va. (11)
EE 25 Indian Cr., W. Va. (11)
EE 26 Pinnacle Cr., W. Va. (11)
EE 27 Barker Cr., W. Va. (11)
EE 28 Winding Gulf, W. Va. (11)
EE 29 Devils Fork, W. Va. (28)
EE 30 Tommys Cr., W. Va. (28)
EE 31 Stone Coal Cr., W. Va. (28)
EE 32 Allen Cr., W. Va. (28)
EE 33 Slab Fork, W. Va. (11)
EE 34 Cabin Fork, W. Va. (11)
EE 35 Bear Hole Fork, W. Va. (11)
EE 36 Rock Castle Cr., W. Va. (11)
EE 37 Clear Fork, W. Va. (11)
EE 38 Glen Fork, W. Va. (37)
EE 39 Toney Fork, W. Va. (37)
EE 40 Big Cub Cr., W. Va. (11)
EE 41 Elk Cr., W. Va. (11)
EE 42 Big Huff Cr., W. Va. (11)
EE 43 Buffalo Cr., W. Va. (11)
EE 44 Rum Cr., W. Va. (11)
EE 45 Dingus Run, W. Va. (11)
EE 46 Big Run, W. Va. (11)
EE 47 Big Ugly Cr., W. Va. (11)
EE 48 Ninemile Cr., W. Va. (11)
EE 49 Mud R., W. Va. (11)
EE 50 Fudges Cr., W. Va. (49)
EE 51 Big Cr., W. Va. (49)
EE 52 Left Fork (M. R.), W. Va. (49)
EE 53 Laurel Cr., W. Va. (49)
EE 54 Middle Fork (M. R.), W. Va. (49)
EE 55 Trace Fork (M. R.), W. Va. (49)
EE 56 Charley Cr., W. Va. (49)
EE 57 Kilgore Cr., W. Va. (49)
EE 58 Mill Cr., W. Va. (49)
EE 59 Cabell Cr., W. Va. (49)
EE 60 Ohio R., Dams 27 and 26 (see Dist. CC)
EE 61 Little Guyandotte R., W. Va. (1)
EE 62 Kanawha R., W. Va. and Va. (1)
EE 63 Little Sixteenmile Cr., W. Va. (62)
EE 64 Sixteenmile Cr., W. Va. (62)
EE 65 Five and Twentymile Cr., W. Va. (62)
EE 66 Big Hurricane Cr., W. Va. (62)
EE 67 Little Hurricane Cr., W. Va. (62)
EE 68 Coal R., W. Va. (62)
EE 69 Little Coal R., W. Va. (68)
EE 70 (Headwaters), W. Va. (68)
EE 71 Big Coal R., W. Va. (68)
EE 72 Davis Cr., W. Va. (62)
EE 73 Cabin Cr., W. Va. (62)
EE 74 Paint Cr., W. Va. (62)
EE 75 Armstrong Cr., W. Va. (62)
EE 76 Loop Cr., W. Va. (62)
EE 77 New R., W. Va. and N. C. (62)
EE 78 Laurel Cr., W. Va. (77)
EE 79 Dunloup Cr., W. Va. (77)
EE 80 Piney Cr., W. Va. (77)
EE 81 Glade Cr., W. Va. (77)
EE 82 Blue Stone R., Va. and W. Va. (77)
EE 83 Island Cr., W. Va. (77)
EE 84 East R., W. Va. and Va. (77)
EE 85 Wolf Cr., Va. (77)
EE 86 Walker Cr., Va. (77)
EE 87 Kimberling Cr., Va. (86)
EE 88 Little Walker Cr., Va. (86)
EE 89 Back Cr., Va. (77)
EE 90 Peak Cr., Va. (77)
EE 91 Reed Cr., Va. (77)
EE 92 Cripple Cr., Va. (77)
EE 93 Elk Cr., Va. (77)
EE 94 Peach Bottom Cr., Va. (77)
EE 95 Fox Cr., Va. (77)
EE 96 Wilson Cr., Va. (77)
EE 97 North Fork, N. C. and Va. (77)
EE 98 South Fork, N. C. (77)
EE 99 Little R., N. C. and Va. (77)

EE 100 Chestnut Cr., Va. (77)
EE 101 Crooked Cr., Va. (77)
EE 102 Big Reed Island Cr., Va. (77)
EE 103 Little R., Va. (77)
EE 104 Sinking Cr., Va. (77)
EE 105 Stone Cr., Va. (77)
EE 106 Rich Cr., W. Va. (77)
EE 107 Indian Cr., W. Va. (77)
EE 108 Greenbrier R., W. Va. (77)
EE 109 Second Cr., W. Va. (108)
EE 110 Howards Cr., W. Va. (108)
EE 111 Dry Cr., W. Va. (110)
EE 112 Anthonys Cr., W. Va. (108)
EE 113 Muddy Cr., W. Va. (108)
EE 114 Gauley R., W. Va. (62)
EE 115 Rich Cr., W. Va. (114)
EE 116 Meadow R., W. Va. (114)
EE 117 Hominy Cr., W. Va. (114)
EE 118 Cherry R., W. Va. (114)
EE 119 Cranberry R., W. Va. (114)
EE 120 Williams R., W. Va. (114)
EE 121 Middle Cr., W. Va. (114)
EE 122 Peters Cr., W. Va. (114)
EE 123 Little Elk Cr., W. Va. (114)
EE 124 Twentymile Cr., W. Va. (114)
EE 125 Bells Cr., W. Va. (124)
EE 126 Smithers Cr., W. Va. (62)
EE 127 Hughes Cr., W. Va. (62)
EE 128 Kelly Cr., W. Va. (62)
EE 129 Hurricane Fork, W. Va. (128)
EE 130 Witcher Cr., W. Va. (62)
EE 131 Georges Cr., W. Va. (62)
EE 132 Campbell Cr., W. Va. (62)
EE 133 Elk R., W. Va. (62)
EE 134 Elk Cr., W. Va. (133)
EE 135 Blue Cr., W. Va. (133)
EE 136 Falling Rock Cr., W. Va. (133)
EE 137 Porter Cr., W. Va. (133)
EE 138 Sycamore Cr., W. Va. (133)
EE 139 Middle Cr., W. Va. (133)
EE 140 Leatherwood Cr., W. Va. (133)
EE 141 Buffalo Cr., W. Va. (133)
EE 142 Strange Cr., W. Va. (133)
EE 143 Birch R., W. Va. (133)
EE 144 Little Birch R., W. Va. (143)
EE 145 Laurel Cr., W. Va. (133)
EE 146 Holly R., W. Va. (133)
EE 147 Right Fork, W. Va. (146)
EE 148 Left Fork, W. Va. (146)
EE 149 Otter Cr., W. Va. (133)
EE 150 Little Sandy Cr., W. Va. (133)
EE 151 Cooper Cr., W. Va. (133)
EE 152 Pocatalico R., W. Va. (62)
EE 153 Big Guana Cr., W. Va. (62)
EE 154 Eighteenmile Cr., W. Va. (62)
EE 155 Thirteenmile Cr., W. Va. (62)
EE 156 Ohio R., Dams 25, 24, 23, 21, 20, 19 (see Dist. CC)
EE 157 Little Kanawha R., W. Va. (1)
EE 158 Tygart Cr., W. Va. (157)
EE 159 Slate Cr., W. Va. (157)
EE 160 Tucker Cr., W. Va. (157)
EE 161 Reedy Cr., W. Va. (157)
EE 162 Spring Cr., W. Va. (157)
EE 163 West Fork of Little Kanawha R., W. Va. (157)
EE 164 Steer Cr., W. Va. (157)
EE 165 Right Fork, W. Va. (164)
EE 166 Left Fork, W. Va. (164)
EE 167 Cedar Cr., W. Va. (157)
EE 168 Saltlick Cr., W. Va. (157)
EE 169 Knawl Cr., W. Va. (157)
EE 170 Oil Cr., W. Va. (157)
EE 171 Sand Fork Cr., W. Va. (157)
EE 172 Stewart Cr., W. Va. (157)
EE 173 Leading Cr., W. Va. (157)
EE 174 Tanner Cr., W. Va. (157)
EE 175 Laurel Cr., W. Va. (157)
EE 176 Yellow Cr., W. Va. (157)
EE 177 Lower Leading Cr., W. Va. (157)
EE 178 Straight Cr., W. Va. (157)
EE 179 Standing Stone Cr., W. Va. (157)
EE 180 Hughes R., W. Va. (157)
EE 181 South Fork of Hughes R., W. Va. (180)
EE 182 North Fork of Hughes R., W. Va. (180)
EE 183 Goose Cr., W. Va. (180)
EE 184 Walker Cr., W. Va. (157)
EE 185 Stillwell Cr., W. Va. (157)
EE 186 Worthington Cr., W. Va. (157)
EE 187 Ohio R., Dams 18, 17, 16, 15, 14, 13 (see Dist. CC)
EE 188 Middle Cr., W. Va. (1)
EE 189 Fishing Cr., W. Va. (1)
EE 190 Fish Cr., W. Va. (1)
EE 191 Big Grave Cr., W. Va. and Pa. (1)
EE 192 Wheeling Cr., W. Va. (1)
EE 193 Ohio R., Dams 12, 11, 10 (see Dist. CC) (1)

EE-2 TWELVE-POLE RIVER, W. VA.

COMMERCE.
Important, **75**, 749, 755.

ENGINEERS.
Chief of Engineers. **R., 75,** 73.
In charge. Maj. W. E. Merrill. **R., 75,** 747, 749.
Assistant. A. L. Cox. **R., 75,** 750.

PHYSICAL CHARACTERISTICS.
Described, **75,** 749, 754, 755.
Obstr., **75,** 754.

PLANS.
By Maj. Merrill, 1875. 8 locks and dams; locks to be 10′ x 60′ x 160′ lift; dams, 100′ l.; est., $648,000. To reach the coal fields would require 2 more dams; total est., $810,000; not recom., **75,** 749, 750. Imp. by removing obstr.; est., $50,000; recom., **75,** 750, 754.

SURVEY.
Ex. below Wayne Courthouse, by A. L. Cox, 1874, **75,** 73, 753.

EE-11 GUYANDOT (Guyandotte) RIVER, W. VA.

APPROPRIATIONS.

1878,	$2,000,	**78,** 108.
1879,	1,000,	**79,** 145.
1880,	2,000,	**80,** 1831.
1881,	3,500,	**81,** 1987.
1882,	2,000,	**82,** 1957.
1884,	[1]2,000,	**84,** 1754.
1888,	2,000,	**88,** 1792.
1890,	2,000,	**90,** 2277.
1892,	2,000,	**92,** 2112.
1894,	2,000,	**95,** 2509.
1896,	1,000,	**96,** 2326.
1899,	1,000,	**99,** 2498.
1910,	5,000,	**10,** 2012.

Total, 27,500 (incl. misc., $27,690.70, **12,** 2409).

COMMERCE.

Minerals, timber, and coal tributary to R., **75,** 748, 752, 753; **79,** 1348.

Description of, **95,** 2510; **96,** 2325.

Imp. effected up to 1896 by the US. had increased the C. 100%; total value $11,340,000, **96,** 2325.

Timber interests of greatest value, but the rafts, etc., constant menace to navigation, **97,** 2563.

RR. under constr. in Guyandot Valley likely to destroy the small existing boating trade on R., which would then be used only for floating logs and ties, **01,** 2734.

Increase in shipment of logs, etc., 1891 to 1901 **02,** 417.

ENGINEERS.

Chief of Engineers. **R., 75,** 73; **78,** 108; **79,** 145; **80,** 196; **81,** 264; **82,** 259; **83,** 267; **84,** 266; **85,** 290; **86,** 285; **87,** 242; **88,** 228; **89,** 265; **90,** 239; **91,** 308; **92,** 294; **93,** 334; **94,** 306; **95,** 342, 343; **96,** 298; **97,** 378; **98,** 368; **99,** 432, 440; **00,** 495, 503; **01,** 489; **02,** 417; **03,** 448; **04,** 478; **08,** 612; **10,** 718; **11,** 774; **12,** 928.

In charge:

Maj. W. E. Merrill, 1874–79. **R., 75,** 747; **79,** 1347.

Maj. J. W. Cuyler, 1880–83. **R., 80,** 1830; **81,** 1986; **82,** 1955.

Capt. J. C. Post, 1883–87. **R., 83,** 1570; **84,** 1753; **85,** 1889; **86,** 1622.

Lt. Col. W. E. Merrill, 1887. **R., 87,** 1827.

Maj. D. W. Lockwood, 1888–95. **R., 88,** 1791; **89,** 1986; **90,** 2276; **91,** 2469; **92,** 2111; **93,** 2639; **94,** 2004; **95,** 2508, 2517.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2324; **97,** 2562.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2140.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 2499; **00,** 3343, 3396.

Maj. E. H. Ruffner, 1901–04. **R., 01,** 2734; **02,** 1945; (Lt. Col.) **03,** 1741; **04,** 2635.

Lt. Col. J. G. Warren, 1907–10; **08,** 602.

Maj. J. C. Oakes, 1910–. **R., 10,** 2011; **11,** 2213; **12,** 2409.

Assistants:

A. L. Cox. **R., 75,** 750.

J. N. Caldwell, jr. **R., 79,** 1348.

E. A. Chase. **R., 80,** 1831; **81,** 1987.

B. F. Thomas. **R., 90,** 2277; **91,** 2470; **92,** 2112; **93,** 2640; **95,** 2509; **96,** 2324; **97,** 2562; **98,** 2142; **99,** 2500; **00,** 3344.

OBSTRUCTIONS.

Description of, **79,** 1348.

2 milldams, 1 at Pecks and the other at Lamberts, constr. under au. of circuit court, a nuisance and constant danger to the R. interests, **93,** 2639; **94,** 2005; **95,** 2508; **96,** 2325; **97,** 2562; **98,** 2140; **00,** 495.

In 1897 difficult to keep the lower 4 or 5 m. of R. open to SS. traffic, because of the numerous rafts awaiting a rise in the Ohio, **97,** 2562.

OPERATIONS.

1878–79. 110 cords of drift, 1,058 c. y. r. filling, 2,257 c. y. earth, and 3,378 c. f. timber removed from dams near Barboursville. At Falls, 417 c. y. r. filling, 161 c. y. earth, and 122 c. f. timber removed; also 34 snags were removed from the R., **79,** 145, 1348.

1879–80. 800 c. y. sand dr.; 300 c. y. solid r. removed; 3,348 snags, stumps, and trees cut and removed, **80,** 1831.

1880–81. 1,345 snags removed; 965 c. y. r. removed, **81,** 1987.

1881–82. Imp. of chan. continued, **82,** 1956.

1882–83. 600 c. y. solid r. removed; 122 stumps and trees removed; 1,030 l. f. brush and r. dams built, **83,** 1571.

1883–84. 426 c. y. solid r. and 85 c. y. loose r. and gravel removed, **84,** 1753.

1886–87. Removal of Rogers's milldam, **87,** 1827.

1889–90. 1,197 c. y. solid r., 1,209 c. y. loose r., and 300 snags, stumps, and trees removed, **90,** 2277.

1890–91. Rock bar removed near Big Creek, 300 logs and a quantity of loose r. removed at mouth of Big Huff Creek, **91,** 2470.

1891–92. 424 c. y. solid and 4,280 c. y. loose r., 347 snags and logs, and 7 drifts removed from chan., **92,** 2113.

1892–93. About 2,300 c. y. r. and over 1,600 snags and other obstr. removed, **93,** 2640.

1894–95. About 3,000 c. y. r. and about 200 snags and other obstr. removed, **95,** 2510.

1895–96. About 3,500 l. f. bank wall built, 2,000 c. y. r. and over 100 snags and other obstr. removed, **96,** 2326.

1896–97. Over 4,000 c. y. r. and about 200 snags and other obstr. removed, **97,** 2563.

1897–98. About 500 c. y. r. removed, **98,** 2140.

1899–1900. 153 snags and other obstr. and 1,367 c. y. r. removed, **00,** 3345.

1910–11. Chan. cleared and bank revetted with riprap at Barboursville, W. Va., **11,** 2213.

1911–12. Revet. work finished; addl. protection of 1,500 willow sprouts planted; repairs to cribs damaged by h. w., **12,** 2409.

PHYSICAL CHARACTERISTICS.

Description of, **75,** 747, 748, 750, 752; **79,** 1348; **95,** 2518; **99,** 2500; **00,** 3344, 3397.

Large mineral and timber wealth, **75,** 748, 752, 753.

Discharge, **75,** 751; **95,** 2519.

List of obstr., **75,** 751; **79,** 1348–1351.

Table of distances and levels, **75,** 753.

Rises in the sw. part of W. Va. and empties into Ohio R., 12 m. above mouth of Big Sandy R. and 39 m. below mouth of Great Kanawha R., **93,** 2639.

Floods previous to 1893 carried away the works constr. under au. of Va., **93,** 2639.

Max. draft, m. l. w., 1901, at shoalest part of imp., 20± inches, **01,** 490.

Erosion of banks, **11,** 2213.

Damage to cribs by h. w. during winter, 1911–12, **12,** 2409.

PLANS.

By Maj. Merrill, 1875, slack-water navigation, locks 60′ x 160′, with 10′ lift; dams 300′ l., with 10′ lift; est., $1,420,500, **75,** 748, 749, 751, 752.

PRIVATE (STATE) WORK.

Imp. by State of Va. by means of locks and dams (destroyed), **75,** 747.

Description of work performed under au. of State of Va. before U. S. undertook imp., **93,** 2639; **94,** 2005; **95,** 2508, 2518; **96,** 2325; **00,** 3399.

[1] Reapp., act 1886, **86,** 1622.

PROJECTS.

By Maj. Merrill, 1878, removal of snags, r., and other obstr.; est., $10,000, **75,** 749; **78,** 108; **79,** 1352; **80,** 196.

By Capt. Post, 1884, removal of snags, r., and obstr, mouth to Logan Courthouse, 81 m.; also purchase and removal of Roger's and Peck's mill-dams; est., $10,000, **84,** 1753; **89,** 1986; **92,** 2111.

Au. act June 25, 1910, continuing imp. in accordance with plan, H. Doc. No. 558, 60th Cong., 1st sess.; not more than $2,000 of $5,000 app. to be expend. in revetting banks, **10,** 719.

SURVEYS.

By A. L. Cox, of R. below Logan Courthouse, 1874, **75,** 73, 750.

Ex. for imp. by means of locks and dams au. act Aug. 17, 1894; made, 1894, by Maj. Lockwood (**R.** unfav.), **95,** 2517.

Ex., mouth to a point 50 m. above, au. act Mar. 3, 1899; made, 1899, by Capt. Hodges (**R.** unfav. except to snag removal), **00,** 3393.

Ex. au. act Mar. 2, 1907. **R.,** Lt. Col. Warren, June 14, 1907[1] (unworthy of supple. imp.), **08,** 612.

EE-62 KANAWHA RIVER, W. VA.

Part.	Title.	Period.	Appropriations.
a	Kanawha R.	1838–1912	$4,296,949.45
b	Kanawha R., operating and care of locks and dams	1885–1912	1,264,697.58
c	Kanawha R., ice harbor at mouth	1880–1881	
d	Kanawha R., "James R. and Kanawha Canal"	1871–1874	
	Total		5,561,647.03

Part (a), EE-62 Kanawha River, W. Va.

APPROPRIATIONS.

1873,	[2] $25,000.00,	**73,** 59, 505; **76,** 91, ii, 154; **77,** 297.
1874,	[2] 25,000.00,	**74,** 66, 485; **76,** 91, ii, 154; **77,** 297.
1875,	300,000.00,	**75,** 89, ii, 87; **76,** 91, ii, 154; **77,** 297. 676.
1876,	270,000.00,	**76,** 91, ii, 154; **77,** 61, 297, 676.
1878,	222,000.00,	**78,** 68, 469.
1879,	150,000.00,	**79,** 80, 550.
1880,	200,000.00,	**80,** 683.
1881,	200,000.00,	**81,** 911.
1882,	200,000.00,	**82,** 920.
1884,	200,000.00,	**84,** 928.
1886,	187,500.00,	**86,** 1590.
1888,	350,000.00,	**88,** 1750.
	64,749.45,	**88,** 2825.
1890,	300,000.00,	**90,** 2238.
1892,	225,000.00,	**92,** 2045.
1893,	500,000.00,	**93,** 2578.
1895,	580,700.00,	**95,** 2448.
1897,	273,000.00,	**97,** 2568.
1910,	24,000.00,	**10,** 1965.
Total,	4,296,949.45	(less $1,086.31 carried to surplus fund, and incl. misc., $4,299,292.82, **12,** 2362).

COMMERCE.

Importance of imp., **73,** 508, 835; **75,** ii, 90, 95; **77,** 304; **79,** 548; as part of line of water communication bet. Ohio R. and tide water, **71,** 625, 627, 629, 644, 646; **74,** ii, 91, 102, 114, 123.

Requirements of coal trade, **73,** 507; **74,** ii, 91, 95; **75,** ii, 96.

Distances from Ohio R., via Kanawha and Richmond to tide water, **71,** 635, 650; **73,** 830, 833, 837; **77,** 677, 679.

Tows, w. of, **75,** ii, 96.

Appalachian coal fields, resources of, **77,** 306.

Salt deposits of W. Va., resources of, **77,** 320.

Objections to movable dams considered, **77,** 745.

Advantages of the several locks and dams, **79,** 548.

Transportation companies of W. Va., **77,** 326.

Increasing with R. imp., **93,** 2578; **94,** 1952; **95,** 2448; **96,** 2248.

Description of, **04,** 2589, 92.

Difficult to determine effect on rates, **05,** 485.

Diagram of tonnage and value of and app., **10,** 2164.

The imp. of R. has been gradual, hence it is hard to give exact effect imp. has had on rates; no doubt, however, rates, where transportation by R. is available, have been affected favorably, **12,** 918.

1911, 1,393,000± t. (coal, 1,347,000± t.; timber, 21,500± t.), **12,** 919.

CONTRACTS.[3]

1873. J. Roach, dams and dikes on Cabin Creek, Elk, and Twomile Shoals, **73,** 507; completion of, except Cabin Creek, **74,** 66.

1875. D. M. & C. P. Dull, building Lock No. 5 (for dam near Brownstown), **76,** 91, ii, 153, 155; **77,** 61, 296. Delay from improper management, **76,** ii, 158. C. McCafferty, building Lock No. 4 (for dam near foot of Cabin Creek Shoals), **76,** 91, ii, 153, 156; **77,** 61, 296. Delay from lack of capital, **76,** ii, 159; **78,** 467, 470.

1876. Schultz & Jolliffe, building dam, abutment p., and floor of navigable pass adjoining Lock No. 5, **76,** 91, ii, 153, 157; **77,** 296. Work abandoned by contractor Oct., 1878, **79,** 549, 554.

1877. Freeman, Richards & Frazer, building dam, abutment p., and floor of navigable pass adjoining Lock No. 4, **77,** 61, 296, 298. Contract annulled Jan. 31, 1878, **78,** 467, 470. W. M. Archer,

[1] H. D. 558, 60th, 1st.
[2] Temporary imp.
[3] Proposals:
1873. For temporary imp., by dams and dikes, on Cabin Creek, Elk, and Twomile Shoals, **73,** 506.
1875. Permanent imp., for building Locks Nos. 4 and 5, **76,** ii, 155.
1876. For building dam, etc., to Lock No. 5, **76,** ii, 157. For culvert pipes and lock gates rejected, **77,** 297. For ironwork for movable Dam No. 5, **77,** 299.
1877. For building dam adjoining Lock No. 4, **77,** 298.
1878. For ironwork at Dam No. 4 and iron gates for Lock No. 5, **78,** 469.

ironwork for navigable pass and weir on dam adjoining Lock No. 5, **77,** 61, 296, 299. Work contracted at prices less than est. cost, **76,** ii, 165; **77,** 297.

1878. Ramsey & Latrobe, ironwork in pass and weir at Dam No. 4, **78,** 467, 469, 471. Edge Moor Iron Co., iron gates for Lock No. 5, **78,** 468, 469, 472.

1880. W. D. Lewis, timber, **80,** 683. H. L. Fearing, proof chain, 7.94¢ lb., **80,** 684. Harris & Black, materials and labor for Lock No. 6, **81,** 916.

1881. J. E. Thayer, tugboat hull, **81,** 916. J. Gilliland, constr. of houses and Locks 3 and 5, **82,** 924. J. Morgan, constr. of house at Lock No. 4, **82,** 924.

1882. J. E. Thayer, side-dumping scow, **82,** 925.

1883. F. Hefright, part constr. of Lock No. 2, **83,** 708. D. Eagan, lock-house constr., **83,** 709. D. Eagan, lock-house constr., **84,** 930.

1884. Harold, McDonald & Co., foundation, p., and abutment constr., **85,** 1848. O. A. & W. T. Thayer, iron, **85,** 1848.

1885. C. H. Strong & Son, lock constr., **85,** 1849. Snead & Co. Iron Works, iron, **85,** 1850. Martz, Kulp, McWilliams & Co., gate and wickets, **86,** 1592.

1886. Ainslie, Cochran & Co., lock gates, **86,** 1592. West Lebanon Rolling Mill Co., chain, **86,** 1593. T. W. Farley, telephone poles, 75¢, **87,** 1914. H. Crawford, lock-house constr., **87,** 1914. Layten & F. C. Williams, crane-boat constr., **87,** 1915. J. E. Thayer, fuel-boat constr., **87,** 1915.

1887. Ainslie, Cochran & Co., ironwork, $4,184, **88,** 1750. W. D. Lewis, timber, $26 M f., **88,** 1751.

1888. D. Egan, completing lock house No. 2, $516, **88,** 1751. D. Egan, lock house and outbuildings, $2,606, **89,** 1942. L. Williams, guard cribs at Lock No. 2, $4,328, **89,** 1943. Carkin, Stickney & Cram, Lock No. 7, $136,095, **89,** 1944.

1889. L. Williams, dump boat, $1,405.50, **89,** 1944. C. I. McDonald, Lock No. 8, $123,935, **90,** 2239. Queen City Bridge & Steam Forging Co., lock ironwork, $3,751, **90,** 2239.

1890. Mumford & Reynolds, Dam No. 7, $113,515, **91,** 2415.

1891. Russell Wheel & Foundry Co., ironwork for anchorage and fixed parts of movable Dams Nos. 7 and 8, $11,750.50, **91,** 2416.

1892. F. J. Myers Mfg. Co., ironwork, $29,025.85, **92,** 2045. H. T. Morrison & Co., ironwork for lock gates Nos. 7 and 8, $7,363.60, **93,** 2579.

1893. Zimmerman, Truax & Sheridan, Lock and Dam No. 9, $283,344, **93,** 2580; Lock and Dam No. 10, $232,441, **93,** 2584. L. Williams, dump boat, $1,690, **93,** 2583. J. M. Mays, 2 lock houses and outbuildings, $5,672.50, **93,** 2583. West End Rolling Mill Co., chains for Dams Nos. 7 and 8, $1,558.95, **93,** 2583. T. Munford, Lock and Dam No. 11, $526,895, **93,** 2585. M. V. Smith, lock house No. 11, $1,624, **94,** 1952.

1894. D. Egan, 5 houses for lock hands at Locks Nos. 7 and 8, $3,655.75, **95,** 2449.

1895. Youngstown Bridge Co., ironwork for Dams Nos. 9, 10, and 11, $20,371.40, **96,** 2250. G. M. Donaldson, timber for gates and wickets of Locks and Dams Nos. 9, 10, and 11, $6,312.88, **96,** 2250.

1896. Fort Pitt Bridge Works, ironwork for gates of Locks Nos. 9, 10, and 11, $9,250.42, **97,** 2570.

1897. H. B. Newhall, chains and clevises for movable dams, $1,300.69, **98,** 2121.

1898. H. Dilcher, 6 lock houses, Locks Nos. 9 and 10, $4,169.64, **98,** 2120. Calderwood & Hanna, 3 service boats, $1,230, **98,** 2121.

1899. W. H. Hanna, crane boat. $1,250; W. L. Alderson and T. S. Neil, lock house at Lock No. 11, $817.50; Neil & Hamm, lock houses and outbuildings at Locks Nos. 2, 3, 4, 5, and 6. $6,601.70, **99,** 2480, 2481.

1910. Clifton Bros., building guide walls at Locks Nos. 4 to 11; prices given, **10,** 1965. J. M. Hammitt, constr. quarter boat, $1,700, and hull for snag boat, $3,400; Pfaff & Smith Co., constr. ice piers near Pt. Pleasant, W. Va., $22,536 (prices given), **11,** 2164.

1911. Thos. Carlins Sons Co., derrick irons, $827; Lidgerwood Mfg. Co., engines for snag boat $2,040, **11,** 2165.

1912. Kanawha Dock Co., furn. deck flat, $1,050 for lot, **12,** 2362.

DOCUMENTS. (Not printed in reports.) S. Doc. 25, 42d Cong., 3d sess., **73,** 508.

ENGINEERS.

Chief of Engineers. R., 72, 74; **73,** 59; **74,** 66; **75,** 89; **76,** 91; **77,** 61; **78,** 67; **79,** 79; **80,** 108, 684; **81,** 145; **82,** 142, 930; **83,** 146; **84,** 149; **85,** 285; **86,** 279; **87,** 249; **88,** 222, 223; **89,** 258, 260; **90,** 232, 233; **91,** 299, 300; **92,** 286, 287; **93,** 324; **94,** 297; **95,** 332; **96,** 289; **97,** 381; **98,** 363; **99,** 427; **00,** 490; **01,** 487; **02,** 413; **03,** 444; **04,** 475, 476; **05,** 485; **06,** 535; **07,** 562; **08,** 601; **09,** 635; **10,** 709; **11,** 763; **12,** 918.

Boards:

1875. On the proj. submitted by Maj. W. P. Craighill for imp. from mouth to Great Falls. B. recom. slack-water imp. by means of 9 movable dams (with locks) from mouth to Paint Creek Shoals and 3 permanent dams at and above Paint Creek Shoals (unless it be deemed advisable to make the whole or a part of the latter movable). Dimensions of locks from 285′ to 300′ l., from 48′ to 50′ w. In the movable dams the Chanoine wicket to be used at first, with navigable pass 300′ w. App. of 1875 ($300,000) to be applied to the constr. of 2 locks (dams to be movable and constr. with future app.), 1 at or near Brownstown, the other bet. that point and Paint Creek Shoals, **75,** 89, ii, 95; **76,** ii, 164; **77,** 676; **79,** 551. (Lt. Col. H. G. Wright and Majs. W. P. Craighill and O. M. Poe, **75,** 89, ii, 95.)

Convened at Detroit, Mich., June 21, 1882, by S. O. No. 24, to **R.** upon work of imp. completed, in progress, and proposed, **82,** 926. (Lt. Col. Comstock, Majs. Weitzel and Merrill, and Capt. Turtle.)

BERH., 1903, review reports of Capt. Craighill and Maj. Zinn[1] (see Surveys), **04,** 2591.

In charge:

Maj. W. E. Merrill, 1873–74; **73,** 58. **R., 73,** 505; **74,** 483.

Maj. W. P. Craighill, 1874–95; **74,** 66, 483; **75,** 89, ii, 87, 633. **R., 73,** 835; **75,** ii, 87, 90, 631; **76,** ii, 153; **77,** 296; **78,** 467; **79,** 545; (Col.) **80,** 681, 685; **81,** 911; **82,** 919; **83,** 706; **84,** 928; **85,** 1845; **86,** 1589; **87,** 1911; **88,** 1749, 1756; **90,** 2237, 2246; **91,** 2413, 2425; **92,** 2041, 2062; **93,** 2577; **94,** 1951; **95,** 2447 (Brig. Gen.).

Capt. T. Turtle, 1889. **R., 89,** 1941, 1954.

Lt. Col. P. C. Hains, 1895–96. **R., 95,** 2447; **96,** 2247.

Maj. J. F. Gregory, 1897. **R., 97,** 2566.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2118.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 2479; **00,** 3322.

Maj. E. H. Ruffner, 1901–02. **R., 01,** 2726.

Capt. W. E. Craighill, 1902–03. **R., 02,** 1927; **04,** 2588.

Maj. G. A. Zinn, 1903–07. **R., 03,** 1721; **04,** 2575, 2594; **05,** 1882; **06,** 1625.

Capt. F. C. Boggs, 1907–08. **R., 07,** 1749.

Capt. F. W. Altstaetter, 1908–. **R., 08,** 1818; **09,** 1801; **10,** 1964; (Maj.) **11,** 2164; **12,** 2361.

Assistants:

E. Lorraine. **R., 73,** 835.

A. M. Scott, **74,** 483; **75,** ii, 87, 634; **76,** ii, 154; **77,** 296; **78,** 468. **R., 73,** 507; **75,** ii, 88; **76,** ii, 157; **77,** 303, 684, 709.

H. Bacon, **75,** ii, 87.

W. R. Hutton, **77,** 296, 675; **78,** 468. **R. 76,** ii, 163; **77,** 727, 749.

Lt. T. Turtle, **77,** 675. **R., 77,** 299, 709; **78,** 469; **79,** 548, 550; **80,** 686.

Capt. E. H. Ruffner. **R., 81,** 911; **82,** 920.

A. M. Scott. **R., 83,** 710; **84,** 930; **85,** 1850, 1855; **86,** 1594; **87,** 1915; **88,** 1751; **89,** 1945, 1952;

[1] H. D. 305, 58th, 2d.

90, 2240; **91,** 2417; **92,** 2045; **93,** 2586; **94,** 1953; **95,** 2450; **96,** 2250; **97,** 2570; **98,** 2121; **99,** 2483; **00,** 3324.
Thos. E. Jeffries. **R., 04,** 2592.
1st Lt. Max C. Tyler, **10,** 701.
1st Lt. L. M. Adams, **10,** 701.

ESTIMATES. (See Plans and Projects.)

J. A. Byers, 1868, mouth to Great Falls, masonry, dams, and locks, $1,867,072; or timber crib dams and masonry locks, $1,494,544; or timber crib dams and locks, $1,335,280, **77,** 803, 806; or side canal, with locks, from mouth to Brownstown; thence slack-water navigation, by masonry locks and dams, $2,048,580, **77,** 803; or by masonry locks and dams at Lykens, Paint Creek, and Cabin Creek Shoals, with sluice dams at other points, $743,820, **77,** 803.

W. R. Hutton, 1871, mouth to and above Lykens Shoals (85 m.), sluice dams, openings 7′ x 100′ aiding l. w. by discharge from meadow reservoir; est., $973,900, **71,** 627, 642, 650.

E. Lorraine, 1872, mouth to Paint Creek Shoals, .-w. sluice dams; thence to Great Falls by locks and dams; est., $1,979,172, **73,** 836, 841; **74,** ii, 101; or by locks and dams throughout, $2,918,453, **75,** ii, 637.

A. M. Scott, 1873, est. cost of lock and dam at Paint Creek Shoals, lock 50′, x 255′ st. lock with timber dam, $224,000; st. lock with st. dam, $261,-000, **73,** 508. **R.,** Maj. Craighill, as too low, **73,** 509.

A. M. Scott, revising est. of Lorraine, 1872, mouth to foot of Paint Creek Shoals, sluice dams, aided by reservoir discharge; thence to Great Falls by 4 st. locks and dams, $2,350,000, **77,** 746; or by locks and dams throughout, $3,077,113, **75,** ii, 91, 93, 638; **77,** 747; or by 7 movable dams, with locks, mouth to Brownstown; thence to Great Falls by 5 permanent dams with locks, $3,894,183, **77,** 748.

Maj. W. P. Craighill, 1875, mouth to foot of Great Falls, 12 permanent dams with locks, $3,077,113; or by 9 permanent dams with locks, $2,739,440; or 9 movable dams and 3 permanent dams, $4,071,216, **75,** ii, 91, 93, 94, 638. For permanent dam, lock 14′ lift, at or near Brownstown, $237,000, **75,** ii, 92, 94; or movable dam, lock 8′ lift, $286,000, **75,** ii, 92, 94.

Revised est. of proj. approved by BE., 1875, for 9 movable and 3 permanent dams, with locks, $4,152,500, **76,** 91, ii, 154, 165; **77,** 297, 676, 747, 751; **78,** 469. Est. prices in excess of contracts, **76,** ii, 165; **77,** 297, 751.

Est. reduced $600,000, 1879, by reduction of locks and dams near Charleston and omission of Lock No. 1. Amount required to complete existing proj., $2,610,000, **79,** 80, 550.

LEGAL PROCEEDINGS.

Additional purchases of land at Locks Nos. 4 and 5, **94,** 1961.

The sum of $2,214 awarded in the Court of Claims to M. Alfred Pasqueau, for use of his patented hurter in certain dams, **00,** 3323.

Suits were filed by contractors, for Locks 7, 9, and 10, for certain sums due for extra work on contracts, **00,** 3323.

LEGISLATION.

Suggested, concerning Great Kanawha, **77,** 678.

Act of legislature (1869) defining and enlarging powers of Kanawha Board, **77,** 808.

Act of Congress (1872) providing for transfer to US. of certain rights, franchises, etc., by W. Va., **77,** 813.

Act of legislature (1875) giving consent to, **77,** 814.

Act of Congress (1875) providing for condemnation of land for public use, **77,** 815.

Act proposed by Col. Craighill to provide for the operation, mainten., and repairs of the locks and dams, **80,** 685. Rejected by Congress, **81,** 147.

Proposal of W. Va. to abandon jurisdiction of R. to U. S. refused by Sec. of War, **82,** 919.

OPERATIONS. (See Great Kanawha River, Operating and Care.)

Previous to 1873 carried on by Kanawha Board and Kanawha R. Imp. Co., and consisted in dr. narrow chutes through shoals, aided by constr. of short wing dams, **73,** 505, 507, 839; **77,** 807. Insufficiency of work done, **73,** 507, 839.

1873-74. Temporary imp. by constr. of wing dams at Elk and Twomile Shoals, by contract, w. chute at Elk Shoals, and removing obstr. in lower R., by hired labor, **73,** 507; **74,** 66, 483.

1874-75. Temporary imp. by constr. of wing dams at Bousemans Isld., Elk, Twomile, Johnson, and Knob Shoals by hired labor; removal of obstr. by U. S. crane boat; dr. on bars by State dr., **75,** 89. ii, 87, 88.

1875-76. Temporary imp. by work on Charleston, Elk, Twomile, and Red-House Shoals by hired labor; removal of obstr. by U. S. crane boat; dr. on bars by State dr., **76,** i, 91; **76,** ii, 154, 162; **77,** 303. Permanent imp., constr. of Dams (movable) Nos. 4 and 5, also Lock No. 4, by contract, **76,** 91, ii, 154, 158, 162; **77,** 303.

1876-77. Temporary imp. by work at Red-House Shoals, **77,** 61, 296, 299, 300. Permanent imp., progress on Locks and Dams (movable) Nos. 4 and 5 by contract, **77,** 61, 296, 299, 303.

1877-78. Temporary imp. by removal of bowlders from shallows of lower R. by hired labor and use of crane boat, **78,** 472. Permanent imp., commencement of work by hired labor on Lock and Dam No. 3, **78,** 67, 467, 470. Progress at Locks Nos. 4 and 5 by contract, **78,** 67, 467, 470, 471. Failure of contractor at Dam No. 4 and prosecution of work by hired labor, **78,** 67, 467.

1878-79. Temporary imp. by repair of Twomile Dam, **79,** 554. Permanent imp.; progress on Lock and Dam No. 3 delayed by labor strikes, **79,** 79, 549, 552. Completion of Lock No. 4; progress on Dam No. 4, **79,** 79, 549, 552. Completion of Lock No. 5; abandonment of Dam No. 5 by contractor and progress by hired labor, **79,** 79, 549, 551, 553. History of previous operations, **79,** 550.

1879-80. Lock and Dam No. 3: St. prepared; cofferdam placed; excavation and masonry commenced for lock; 12,839 c. y. masonry built. Lock and Dam No. 4: Lock ready for gates; 120 l. f. of retaining crib built; pass, p., and R. walls completed; cofferdam nearly finished. Dr. Lock and Dam No. 5; dr. of lock approaches; bulkheads built across ends of lock; masonry work completed, **80,** 686, 687, 688.

1880-81. Lock and Dam No. 3: Masonry work on R. wall completed; 2,200 y. paving on land and land wall laid; cribs at foot of lock completed. Lock and Dam No. 4 completed and in working order. Lock and Dam No. 5 completed and in working order, **81,** 911, 912, 913.

1881-82. Lock and Dam No. 3: Land wall bolted to foundation r.; 280 l. f. of foundation cribwork for dam constr.; 560 l. f. of foundation trench dr.; 10,000 c. y. st. placed in dam. Locks and Dams 4 and 5 in operation. Lock and Dam No. 6: 3,441 c. y. masonry placed, **82,** 920, 921, 922, 923.

1882-83. Lock No. 2 (for stationary dam): Work commenced under contract. Locks 3, 4, and 5 in operation, and Lock 6 nearly finished; dr., **83,** 710, 711, 712, 713.

1883-84. Lock No. 2: 17,500 c. y. dr.; cofferdam built; masonry bed rock prepared and lock house built. Lock No. 6 completed and dam for same commenced, **84,** 930, 931, 933.

1884-85. Lock No. 2: Constr. advanced by 9,922 c. y. masonry placed and 9,180 c. y. excavation. Dam No. 6: Masonry work and second section of cofferdam completed, **85,** 1850, 1851, 1853.

1885-86. Lock No. 2 and Dam No. 6 nearly completed; dr., **86,** 1595, 1597.

1886-87. Lock and Dam No. 6 completed and put in operation, **87,** 1912.

1887-88. Lock and Dam No. 2 completed and put in operation; banks riprapped at Lock No. 3; repairs to lock; 2 sunken barges in the Charleston Pool and 1 near Lock No. 3 removed; repairs to plant, **88,** 1751, 1755.

Operation and care of locks and dams, **88,** 1756.

1888-89. 2,180 c. y. riprap used in repair of banks at Lock and Dam No. 2; cribs built at head of Lock No. 2, and lock house completed; minor repairs to movable dams; lock house built, and constr. of Lock No. 7 begun; dr. at Lock No. 2, Harveys Shoal, Witchers Creek Shoal, Scary Shoal, **89,** 1945, 1949.

Operation and care of locks and dams, **89,** 1954.

1889-90. Cofferdams, excavation, and foundation for Lock No. 7 completed, and main walls begun; constr. of Lock No. 8 begun; lock house built; 2,813 c. y. riprap placed in repair of Lock No. 2; new lower gates placed in Lock No. 3, and repairs to Locks 4, 5, and 6 of the movable dams; dr. and snag removal, **90,** 2240–2245.

Operation and care of locks and dams, **90,** 2246.

1890-91. Excavation for foundations; 528 c. y. concrete and 104 c. y. masonry laid; preparation of material for dam at Lock and Dam No. 7; 4,500 c. y. masonry laid in constr. of Lock and Dam No. 8.

Operation and repair of locks and dams, **91,** 2417–2425.

1891-92. Locks Nos. 7 and 8 completed (except gates), and foundations for Dams Nos. 7 and 8 in progress; repairs to Locks Nos. 4 and 5; dr. and repairs to plant, **92,** 2045, 2052.

Operation and care of locks and dams, **92,** 2062.

1892-93. Constr. of masonry and foundations of Locks and Dams Nos. 7 and 8; preparations for work on Nos. 9, 10, and 11; completed works operated; some dr. done; plant repaired and additions made thereto; snags and other obstr. removed; and lock houses under constr., **93,** 2586–2593.

1893-94. Locks and Dams Nos. 7 and 8 completed; constr. of Nos. 9 and 10 commenced; completed works operated; about 35,000 c. y. dr.; telephone line extended; misc. work done, **94,** 1953–1961.

1894-95. Constr. of foundations and masonry of Locks and Dams Nos. 9, 10, and 11; completed works operated and cared for; 27,000 c. y. dr., and snags and other obstr. removed; misc. work done, **95,** 2450–2457.

1895-96. Constr. of foundations and masonry of Locks and Dams Nos. 9, 10, and 11 (photographs); completed works operated; 38,500 c. y. dr.; snags and other obstr. removed; misc. work done, **96,** 2250–2259.

1896-97. Constr. of foundations and masonry of Locks and Dams Nos. 9, 10, and 11 (photographs); about 12,000 c. y. dr.; some obstr. removed, **97,** 2568–2574.

1897-98. Locks and Dams Nos. 9, 10, and 11 almost completed (photographs); misc. work done; 52,470 c. y. dr.; some obstr. removed, **98,** 2119.

1898-99. Locks and Dams Nos. 9, 10, and (maps) 11 finished, completing the entire system of locks and dams; lock houses, tool houses, and shops, etc., built and 25,500 c. y. dr.; 750 c. y. bowlders and some snags removed from R., **99,** 2483.

1899-00. 16,760 c. y. dr. and 1,585 c. y. bowlders removed; new crane boat and new houses for lock tenders built, and minor repairs made to plant, **00,** 3322.

1900-01. 29,860 c. y. dr.; 285 c. y. r. and 23 trees and snags removed; lock house, wells, cisterns, and boats built, **01,** 2726.

1901-02. 47,986 c. y. dr.; 58 snags and trees removed; work on lock houses, cisterns, boats, etc., **02,** 1928.

1902-03. Towboat completed; additions to lock houses built, 14,166 c. y. dr., **03,** 1722.

1903-04. 31,840 c. y. dr.; 52 c. y. st. removed; sewers built; additions to lock houses built, grading, etc., **04,** 2576.

1904-05. Grading, building sewers, walks, guide cribs, etc.; 15,640 c. y. dr., **05,** 1882.

1905-06. 13,270 c. y. dr., grading, building, etc., **06,** 1626.

1906-07. Building sewers, grading. etc., **07,** 1749.

1907-08. Guide crib at Lock No. 1 completed; operating machinery installed, **08,** 1819.

1908-09. Preparing plans for new work, **09,** 1801.

1909-10. Preparing plans, **10,** 1964.

1910-11. Constr. guide walls, Locks 4-11, and rebuilding ice piers in progress, **11,** 2164.

1911-12. Constr. of pile and guide walls completed; work on rebuilding ice piers 78% completed; snag and quarter boat completed; work on deck flatboat 60% completed, **12,** 2361.

PHYSICAL CHARACTERISTICS.

Fall of R., **71,** 642; **73,** 837; **75,** ii, 91, 95; **76,** ii, 159, 163; **77,** 744, 749.

Discharge of, **71,** 641; **73,** 839; **75,** ii, 92; **76,** ii, 160, 163; **77,** 745, 749, 802, 807; **78,** 473.

Comparison of l.-w. slope and discharges of, with Seine, **76,** ii, 163; **77,** 749.

Floods on, **76,** ii, 163; **77,** 749, 802; **78,** 473.

Width and character of bed, **73,** 839; **75,** ii, 91; **76,** ii, 163.

Regimen, as affected by floods in New R., **77,** 296, 303.

Character of r. at lock foundations, **77,** 300.

Geology of coal basins on, **77,** 306.

Salt deposits of W. Va., **77,** 320.

Kanawha R. begins at junction of Gauley and New Rs., **73,** 837, 844; **74,** ii, 93; 94½ m. l. from Kanawha Falls to Pt. Pleasant, W. Va., where it empties into Ohio R., **12,** 918.

Compressive strength, specific gravity, and ratio of absorption of Great Kanawha sandstones, **89,** 1951.

Quicksand hindering work on Dam No. 11, **98,** 2119.

Description of, **04,** 2588, 2592, 2594.

Condition of works, d. of w., etc., **05,** 485; **11,** 764.

PLANS. (See Estimates and Projects.)

1817–19. For a connection bet. the Ohio and James Rs. via Kanawha, **71,** 625, 636.

By Capt. McNeil, U. S. T. E., 1826–28, for a connection bet. the Ohio and James Rs., via Kanawha, **71,** 625, 636; **77,** 677, 762.

By James River & Kanawha Canal Co., 1832, for connection bet. the Ohio and James Rs., via Kanawha R., **71,** 625, 650.

By E. H. Gill, 1838–41, imp. Kanawha with system of locks from pool to pool, **71,** 636, 640; **77,** 803.

By Mr. Fish 1855, system of dams at pools provided with sluices—dams at intervals of about ½ m.—grading the R. to a nearly uniform slope, **71,** 637, 642; **73,** 839; **77,** 745.

By C. Ellet, 1860, system of sluice dams, aiding l.-w. d. by reservoir discharge, **71,** 637; **73,** 839; **77,** 745.

By J. A. Byers, 1868, mouth to Loup Creek Shoals, 5 m. below Great Falls, to 5′ d. l. w., by 12 locks and dams, slack-water locks 40′ x 200′; or combination of locks and dams, slack water, with side canals to pass most difficult points, with locks at foot of shoals and dams at head; or by locks and dams at Paint Creek, Lykens, and Cabin Creek Shoals, together with l.-w. dams provided with sluice opening 110′ w.; grading the R. slope not exceeding 3′ fall per m., **77,** 803, 806.

By E. Lorraine, 1872, mouth to Great Falls, slack-water navigation, 12 locks and dams, locks 7′ x 40′ x 240′, **73,** 840; **75,** ii, 91, 93, 638; **77,** 746; **79,** 550. Objections to sluice system of navigation, **73,** 507, 509, 839; **77,** 748.

By A. M. Scott, 1875, revising plan of E. Lorraine (1872), locks increased to 7′ x 40′ x 280′, **75,** ii, 91, 93, 638; **77,** 746; or 7 movable dams, with locks, mouth to Brownstown; thence by 5 permanent dams, with locks, to foot of Great Falls; movable dams, with navigable pass 250′ w.; all locks 7′ x 50′ x 280′, **77,** 747.

PRIVATE (STATE AND CORPORATE) WORK.

In 1832 the James & Kanawha River Canal Co. was formed, **71,** 625, 635, at which time the Kanawha R. was a part of their property.

In 1858 the Kanawha Board was created for the imp. of Kanawha R. from mouth to Loup Creek Shoals, subject to instructions of the James & Kanawha River Canal Co.

In 1869 W. Va. annulled all rights of the canal company to Kanawha R. and placed it entirely under control of Kanawha Board.

In 1875 W. Va. transferred to the U. S. all rights, etc., on Kanawha R. and its tributaries to mouth of Howard and Anthony Creeks (see Legislation), **77,** 807, 813.

Work done by Kanawha Board, **73,** 839; **75,** ii, 89; **77,** 303.

PROJECTS. (See Estimates and Plans.)

By W. R. Hutton, 1871, mouth to Lykens Shoals, 85 m. (as a part of third division "Central route" of transportation routes to seaboard) to a l.-w. d. of 7′ by sluice dams; grading the R., with openings 100′ x 7′; aiding l.-w. discharge by reservoir on Meadow Creek, **71,** 627, 642; est., $973,900, **71,** 627, 642, 650.

By E. Lorraine, 1872, mouth to Great Falls, to 7′ d. at l. w., as follows: Mouth to foot of Paint Creek Shoals by timber crib, l.-w. dams, provided with sluice openings 6½′ x 120′, and arranged to grade surface of R. to slope of 2′ per m.; l.-w. discharge of R. to be increased by reservoirs; foot of Paint Creek Shoals to Great Falls by slack-water navigation, with 4 locks and dams, locks 40′ x 240′, **73,** 836, 840; **75,** ii, 91, 93, 638; **77,** 746; **79,** 550. Adoption of, recom. by Maj. Craighill, **73,** 836; est., $1,979,172, **73,** 836, 841; **74,** ii, 101. Revised by A. M. Scott, 1875, increasing dimensions of locks to 280′ x 50′, **77,** 745; est., $2,350,000, **77,** 746.

By Maj. Merrill, 1873, proposes lock and dam at foot of Paint Creek Shoals, lock 13′ x 50′ x 225 lift′; indorsed the proj. for imp. above Paint Creek Shoals with locks and dams, **73,** 508.

By Maj. Merrill, 1874, temporary imp. below Paint Creek Shoals with riprap dams; removing obstr., in connection with dr. by the Kanawha Board; work to be done by hired labor largely, **73,** 59, 506.

By Maj. Craighill, 1875, mouth to Great Falls, 94.2 m., l.-w. d. of 7′: 1st, with locks with permanent dams; 2d, with locks with movable dams; 3d, by a combination of the two. By the first plan 9 or 12 locks and dams would be required, with an aggregate lift of 108′; locks from 285′ to 300′ l. and from 48′ to 50′ w.; est., $2,739,440 to $3,077,113. If movable dams be used, the lift should be limited to 8′. By the third, or a combination of permanent and movable dams, the arrangement would be: 9 movable dams bet. mouth and Paint Creek Shoals and 3 permanent dams. bet. Paint Creek and foot of falls; est., $4,071,216. Movable dams provided with a navigable pass of from 250′ to 300′ and closed with the Chanoine wicket; the first dam built to be movable and located at or near Brownstown, **75,** 89, ii, 90, 95.

BE. (1875) recom. adoption of movable dams from mouth to Paint Creek and permanent dams above that point, unless best to make whole or part movable; est., $4,152,500. Further recom. dimensions, suggested by Maj. Craighill, together with the adoption of Chanoine wicket (see Board of Engineers), **75,** 89, ii, 90, 95; **76,** ii, 158, 163, 164; **77,** 303, 676.

Objections to movable dams considered, **77,** 745.

Dimensions of locks and dams in progress, **79,** 547.

Omission of Lock and Dam No. 1, **79,** 550.

Recom. of BE. of 1882, **82,** 928, 929.

In 1886 Locks and Dams Nos. 3, 4, and 5 were completed, and Lock and Dam No. 6, with No. 2 nearly completed, **86,** 280.

Amount app. for permanent imp., $1,929,500; amount required to complete proj., $1,670,000, **86,** 281.

In 1889 the amount est. for completion was reduced to $970,000, **89,** 1942.

In 1892 Col. Craighill est. the cost of completing the slack-water imp. on the Great Kanawha, by completion of Locks and Dams Nos. 7 and 8, constr. of 3 addl. locks and dams, constr. of lock houses, and dr., at $1,305,700, **92,** 2043, 2056.

Constr. of works under continuous contract sanctioned by act of 1892, **93,** 2588.

Description of proposed locks and dams, **93,** 2588.

In 1896 Lt. Col. Hains est. that, largely because of the 8-hour law, $273,000 addl. would be required for the completion of Locks and Dams Nos. 9, 10, and 11, **97,** 2568, 2569.

Description of projs., general work, and condition of R., **00,** 490.

New proj. au. provides for grading land, constr. sewers, buildings, shops, purchasing addl. land, etc., **04,** 2575.

By Capt. Altstaetter, 1909, expend. of balance of app., provides for constr. guide walls, building boats, etc., **09,** 1801.

Act June 25, 1910, au. restoration of ice piers at Pt. Pleasant, W. Va.; est., $24,000, **10,** 710.

SECRETARY OF WAR.

R., 80, 648.

SURVEYS.

By C. Ellet, 1838, **71,** 625, 636; **77,** 743, 749.

By J. A. Byers, 1856, **76,** ii, 163; **77,** 743, 749.

By A. M. Scott, 1873, **74,** 485; **76,** ii, 163.

By A. M. Scott, 1874, **75,** ii, 634.

By A. M. Scott, 1875–76, to determine exact location of locks and dams recom. by BE., 1874, **76,** ii, 154, 157, 163; **77,** 296, 303, 676.

To determine effects of freshets in New R. on regimen of Kanawha, **77,** 61, 296, 303. Profile of R. from mouth to Great Falls, **76,** ii, 164.

To determine location of lock and dam sites, **78,** 473.

Completion below Charleston, **79,** 554.

For location of Dams Nos. 6 and 7, **80,** 689.

For location of Lock and Dam No. 2, **81,** 915.

Pre. ex. and sur. from Lock No. 2 to the falls au. act June 13, 1902. **R.,** Capt. Craighill and Maj. Zinn, Feb. 6 and Nov. 21, 1903, resp.; est., $1,777,730.[1] BERH. considered imp. not warranted at "present" time, **04,** 476, 2588, 2590, 2591, 2594.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 918.

Maps. (See Operations.) **80,** 682; **89,** 1951; (photographs) **96,** 2260; **97,** 2568; **98,** 2119; **99,** 2483.

Part (b), EE-62 Kanawha River Locks and Dams. (Operating and care.)

APPROPRIATIONS.[2]

1885,	$5,811.51
1886,	8,241.77
1887,	11,336.69
1888,	13,955.84
1889,	19,629.59
1890,	19,981.77
1891,	25,355.20
1892,	21,554.66
1893,	19,564.91
1894,	28,745.60
1895,	29,983.04
1896,	30,713.95
1897,	26,868.30
1898,	23,322.19
1899,	34,547.44
1900,	45,215.73
1901,	44,157.03

[1] H. D. 305, 58th, 2d.

[2] For expend., under permanent-indefinite app. au. act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

1902,	47,000.94
1903,	74,389.63
1904,	64,731.59
1905,	61,873.12
1906,	54,823.95
1907,	66,149.57
1908,	96,823.60
1909,	100,915.32
1910,	84,315.60
1911,	85,502.29
1912,	119,180.75

Total, 1,264,697.58 (allotted, net, $1,284,933.40, **12,** 2364).

COMMERCE. (See Physical characteristics.)

Coal trade greatly assisted by pools in Kanawha R., **00,** 3325.

Shipment of coal more than quadrupled since 1880, when first locks and dams were completed, **01,** 488.

In 1911, 1,392,788 t., mostly coal, **12,** 920. (See Kanawha R.)

Table, comparative rates, Charleston, W. Va.—Kanawha R. points, 1911, **12,** 2367.

CONTRACTS.

1901. Charles Ward, building towboat, $28,000, **01,** 2729.

1902. J. M. Neil, additions to lock houses, prices given; W. H. Wiseman, lumber and posts, prices given; New Jersey Foundry & Machine Co., iron for Dams Nos. 4 and 5, prices given; Benj. T. Flesher, dump boat, service boat, and 2 push boats, prices given, **02,** 1930. Riley E. and Frank C. Williams, guard cribs at Lock No. 3, prices given; W. H. Wiseman, white oak timber, $29.95 M, and lumber and posts (prices given), **03,** 1725.

1903. B. Wallis & Co., steel trestles for Dam No. 5, 6.5¢ lb., **03,** 1725.

1904. York Bridge Co., steel trestles for Dam No. 4, 3.84¢ lb.; Robert Shore and Bennett Murrell, 2 lock houses at Lock No. 6, $2,950 each, **04,** 2579. W. H. Hanna, buildings, fences, etc., prices given, **05,** 1885. R. B. Cassady & W. H. Hanna, guide cribs at Locks 2, 3, and 11, prices given, **05,** 1886.

1905. Triple-State Electric Co., electric-light plant for towboat, $994.75; A. J. Ferrell, telephone poles, prices given; Miller Supply Co., telephone supplies, prices given, **05,** 1886. Champion Iron Co., steel trestles, 3.67¢ lb., **06,** 1629.

1906. Interstate Lumber Co., timber and lumber, prices given; Newhall Chain, Forge & Iron Co., chain and clevises, prices given; W. F. Shawver Co., tinwork, prices given; Kanawha Valley Mch. Works, ironwork for Lock No. 8, prices given, **06,** 1629. Frank Woodman, steel horses for Dams Nos. 4 and 5, 5¼¢ lb., **07,** 1752.

1907. Charleston Lumber Co., timber, lumber, etc., prices given; Volney E. Taylor, lock houses, etc., prices given, **07,** 1752.

1909. Thomas Y. Keeney, st., $1.70 c. y., **09,** 1805.

1910. W. M. Ritter Lumber Co., white oak timber, prices given; Charles Hegewald Co., ironwork for lock gates, prices given, **10,** 1968.

1911. Vulcan Iron Works, lock-gate valves and rods, prices given; Finley Bros. Co., lockmasters' houses, $2,973 each, **11,** 2167. Perry Wright, service boat for Lock No. 7, $920; C. Crane & Co., white oak timber, prices given, **11,** 2168. Thos. Y. Keeney, st. for Locks Nos. 9 and 10, $2.25 c. y., **12,** 2365.

1912. Perry Wright, 2 service boats, $900 each; Kanawha Dock Co., deck flat, fuel flat, and hull for crane boat, $3,900 lot, **12,** 2365.

ENGINEERS.

Chief of Engineers. R., 93, 326; **94,** 299; **95,** 334; **96,** 290; **97,** 383; **98,** 365; **99,** 429; **00,** 492; **01,** 488; **02,** 414; **03,** 445; **04,** 475; **05,** 486; **06,** 536; **07,** 563; **08,** 601; **09,** 635; **10,** 710; **11,** 764; **12,** 919.

In charge:

Col. Wm. P. Craighill, 1874–95. **R., 93,** 2594; **94,** 1962; **95,** 2458 (Brig. Gen.).

Lt. Col. P. C. Hains, 1895–96. **R., 95,** 2458; **96,** 2260.

Maj. J. F. Gregory, 1897. **R., 97,** 2575.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2129.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 2485; **00,** 3325.

Maj. E. H. Ruffner, 1901–02. **R., 01,** 2727.

Capt. W. E. Craighill, 1902–03. **R., 02,** 1928.

Maj. G. A. Zinn, 1903–07. **R., 03,** 1723; **04,** 2577; **05,** 1883; **06,** 1627.

Capt. F. C. Boggs, 1907–08. **R., 07,** 1750.

Capt. F. W. Altstaetter, 1908–. **R., 08,** 1820; **09,** 1802; **10,** 1964; (Maj.) **11,** 2165; **12,** 2362.

Assistants:

A. M. Scott. **R., 97,** 2575; **98,** 2135; **99,** 2493; **00,** 3334.

T. E. Jeffries. **R., 00,** 3337.

1st Lt. Max C. Tyler, **10,** 701.

1st Lt. L. M. Adams, **10,** 701.

OPERATIONS.

For details of routine work, see references to Engineers in charge.

1897–98. 3 wrecks removed and 1,240 c. y. dr., **98,** 2129.

1898–99. About 8,700 c. y. dr. and some snags removed, and minor repairs made to locks and dams, **99,** 2494.

1899–00. 29,640 c. y. dr., 1 wreck and some snags removed, and repairs made to Lock No. 4 and Dam No. 6, **00,** 3325.

1900–12. For detailed report of operations, all similar to details previously given, see report of engineer in charge for each year, **01,** 2727; **02,** 1928; **03,** 1723; **04,** 2577; **05,** 1883; **06,** 1627; **07,** 1750; **08,** 1820; **09,** 1802; **10,** 1965; **11,** 2165; **12,** 2362.

PHYSICAL CHARACTERISTICS.

Ice suspending navigation, **98,** 2129.

Small rises in Ohio R. augmented by water from Kanawha R. pools sufficiently to move waiting coal craft to market, **00,** 3325.

Table of important features of locks and dams, giving dimensions, etc., **03,** 1724.

Unusual fluctuation of water levels in 1907, **08,** 1820.

PROJECTS.

List of dams, **98,** 2129; location of locks and dams and year completed, **99,** 428.

Part (c), EE-62 Point Pleasant, W. Va. (Ice harbor.)

ENGINEERS.

Chief of Engineers. R., 80, 195; **81,** 263.

In charge. Maj. W. E. Merrill. **R., 81,** 1954.

Assistant. J. H. Harlow. **R., 81,** 1956.

PLAN.

By Maj. Merrill, 1881, H. of refuge from ice at the mouth of the Great Kanawha R. with 4 crib piers filled with st.; est., $22,000, **81,** 1955, 1957.

SURVEY.

Au. act June 14, 1880; made, 1880, by Maj. Merrill, **81,** 1954.

Part (d), EE-62 James River and Kanawha Canal, Va. and W. Va. (Survey for extension of.)[1]

COMMERCE.

Importance of imp., **71,** 625, 626, 629, 636, 644, 646; **73,** 832; **74,** ii, 91, 102; 114, 123.

Superiority of canals as great freight highways, **71,** 628, 630, 632, 644, 647; **73,** 832, 834; **74,** ii, 123; **75,** ii, 637; cost of transportation by, **71,** 630, 632, 639, 644; **73,** 833; **74,** ii, 111, 123; application of steam on, **73,** 833.

Distances from Richmond to Ohio R., **71,** 635, 650; **73,** 830, 833; **77,** 677.

Comparison of route with Chesapeake and Ohio Canal, **77,** 677, 682.

ENGINEERS.

Chief of Engineers. R., 70, 69; **71,** 76; **72,** 74; **73,** 78; **74,** 89.

Boards:

1874. To determine and **R.,** in the proj. for connecting the navigable waters of the James and Ohio Rs., as to practicability, plan, cost, and probable time of execution, and benefits to C. to be derived therefrom, **74,** 89, ii, 86, 124. Conclusions: Entirely practicable to connect said Rs. by water navigation 7′ d., involving the enlargement of existing canal on James R. and its extension to the Greenbrier R., together with the constr. of summit tunnel, and water supply for summit level, and the extension of water communication from Greenbrier R. to the mouth of the Great Kanawha R., **74,** ii, 89, 94, 115, 121, 129; **77,** 677. Concerning the plan, minor differences of opinion exist as to dimensions and arrangement of locks on that portion which shall be canal, i. e., from Richmond to Greenbrier R., majority favoring increased lock dimensions both on canal and slack-water imp.; suggest further ex. for location of tunnel, **74,** ii, 90, 93, 111, 117, 129; **75,** ii, 630, 632; **77,** 675. Unanimously recom. single tunnel 34′ x 34′ with recesses for passing boats, **74,** ii, 90, 100, 128; **77,** 685. Concerning imp. of Greenbrier, New, and Kanawha Rs. by locks and dams, a difference of opinion exists as to its applicability, requiring further surs. to finally adjust, **74,** ii, 91, 93, 97, 112, 117, 119, 121, 128; **75,** ii, 632. Cost and probable time of execution: In the opinion of the majority, a water communication, with a d. of 7′, can be obtained at a cost not exceeding $60,000,000 in about 6 years, **74,** ii, 91, 92, 101, 113, 120, 122, 129; **75,** ii, 637; **77,** 677. Benefits to C.: In general terms, the route presents extraordinary claims as a measure of relief to the Western States and as a means of developing immense mineral resources now neglected, **74,** ii, 91, 95, 102, 109, 113, 114, 123, 128. (See Projects.)

(Col. Barnard, Majs. Craighill and Weitzel, B. H. Latrobe, and Lt. Turtle, **74,** ii, 92, 124.)

Supplementary **Rs.:** Col. Barnard, **74,** ii, 91, 97; B. H. Latrobe, **74,** ii, 97, 102; Lt. Col. Gillmore, **74,** ii, 102, 114; Maj. Craighill, **74,** ii, 114, 121; Maj. Weitzel, **74,** ii, 121, 134.

In charge. Maj. W. P. Craighill, 1870–74; **70,** 68. **R., 71,** 620, 624; **73,** 828; **74,** ii, 114.

Assistants:

W. R. Hutton, **71,** 76, 620, 624; **75,** ii, 633. **R., 71,** 634.

W. G. Turpin, **71,** 76, 620, 624. **R., 71,** 650.

E. Lorraine, **71,** 620, 634; **73,** 78, 828.

J. M. Harris. **R., 73,** 828.

R. B. Pegram, **73,** 828.

Lt. T. Turtle, **75,** ii, 632.

ESTIMATES. (See Plans and Projects.)

For enlargement of existing canal from Richmond to Buchanan, and extension to mouth of Fork Run, $14,781,644, **71,** 627; **73,** 830; **74,** ii, 101, 654; **77,** 676. From Fork Run to tunnel, $2,383,447, **71,** 627, 648. Tunnel, $13,253,310, **71,** 627, 648. Greenbrier and New Rs., $13,243,541, **71,** 627, 648. Kanawha R., $973,900, **71,** 627, 642, 650. Contingencies, 10%, $2,986,420, **71,** 627, 650. Aggregate, $47,622,262, **71,** 627; **73,** 830; stated at $50,000,000, **71,** 628; **73,** 829; **74,** ii, 120.

Revised est., 1873, $50,960,636, **73,** 830.

BE., 1874, consider that the connection bet. James and Ohio Rs. would not exceed $60,000,000, **74,** ii, 91, 92, 101, 113, 120, 122, 129; **75,** ii, 636; **77,** 677.

By B. H. Latrobe, after modifying tunnel section and adjusting prices therefor, $49,626,845, **74,** ii, 101.

PHYSICAL CHARACTERISTICS.

Of New R., **71,** 640; discharge of, **71,** 641; h. w. on, **71,** 641; **73,** 831; **74,** ii, 94.

Of Greenbrier R., **71,** 641; discharge of, **71,** 641; **73,** 831; h. w. on, **71,** 641; **73,** 831; **74,** ii, 94.

PLANS. (See Estimates.)

Early plans, 1817–19, contemplated a navigation of Rs., e. and w. of the Alleghanies, by batteaux of 2 or 3′ draft, and passage of mountains by turnpike road, **71,** 625, 636.

Capt. McNeil, 1826–28, submitted to board of internal imp. plan for imp. James, Jackson, Greenbrier, New, and Kanawha Rs., by slack-water navigation and canal, passing the Alleghanies by tunnel 2.6 m. l., **71,** 625, 634, 637; **74,** ii, 87; **77,** 677, 762.

The James River & Kanawha Canal Co., 1832–36, began constr. of works, looking to the connection bet. James and Ohio Rs. (See Private and corporate work.)

For further plans, see Kanawha R.

PRIVATE (CORPORATE) WORK.

1785. A company was organized for imp. of James R., which, in 1832, transferred all its rights and franchises to the James & Kanawha River Canal Co., who, in 1836, began the constr. of the James River & Kanawha Canal, the proposed route of which was as follows: From Richmond up valleys of James and Jackson Rs. to Covington; thence via Dunlaps Creek and Fork Run to summit level; thence by tunnel 2.6 m.; thence via valleys of Howard Creek, Greenbrier, New, and Kanawha Rs. to the Ohio; total distance, 486 m. In 1872 the portion from Richmond to Buchanan had been completed, of which 159.7 m. was canal and 36.7 m. slack water; canal dimensions, 5′ x 50′; locks, 5′ x 15′ x 100′ **71,** 625, 635, 650, 651.

1868. E. Lorraine advised new line for tunnel, reducing summit level 216′, but increasing l. of tunnel to 9 m., **71,** 626. Legislation concerning duties, rights, and franchises of company, **77,** 808. Kanawha R. Improvement Co. (See Kanawha River.) Chesapeake & Ohio RR.; the location of, adds greatly to est. cost of water communication, **71,** 643; **73,** 829; **77,** 677.

PROJECTS.

By Maj. Craighill, 1871–73, connecting the James and Ohio Rs. by a water navigation 7′ d., as follows: By enlargement of existing works of the James River & Kanawha Canal Co., Richmond to Buchanan, 196½ m.; thence via valleys of James and Jackson Rs., Dunlap Creek, and Fork Run to summit level, passing summit, 1,700′ above tide, by tunnel 7.8 m. l. (tunnel section double 34.5′ x 52′); thence down Howard Creek to Greenbrier R., or 77.6 m. from Buchanan (canal section 7′ x 70′ locks 7′ x 20′ x 120′); thence via Greenbrier, New and Kanawha Rs. to Paint Creek Shoals, 123 m., by slack-water navigation, with occasional short reaches of canal, to avoid expensive locations for dams (locks and dams of masonry, locks 40′ x 240′);

[1] Sur.—**R.** Mar. 24, 1828, H. D. 482, 55th, 2d.

thence via Kanawha to its mouth, 79 m., by open navigation of l.-w. dams provided with sluices, l.-w. d. to be aided by reservoirs on Anthony Creek and Meadow R.; est., $50,000,000 (see Estimates), **71,** 625, 635, 637, 650; **73,** 829; **74,** ii, 88, 100, 117, 128; **77,** 754.

Projs. submitted, 1874, to BE. for conclusions and recom. concerning. (See Board of Engineers.)

Part (e), EE-62 Ohio River, Connecting with James River Survey.[1]

("Transportation Routes to Seaboard.")

COMMERCE. (See James River and Kanawha Canal, and James River and Kanawha River.)

Comparison of horizontal and equated distances by Central Route and Chesapeake and Ohio Canal, **77,** 677, 682.

Objections to navigable dams considered, **76,** ii, 14; **77,** 637, 645, 677, 745.

ENGINEERS.

Chief of Engineers. **R., 75,** 37; **76,** 92; **77,** 95.

Boards. (See James River and Kanawha Canal; Kanawha River.)

In charge. Maj. W. P. Craighill. **R., 75,** ii, 631; **77,** 675.

Assistants:

Lt. T. Turtle, **75,** ii, 632; **77,** 675. **R., 77,** 684, 709.

W. R. Hutton, **75,** ii, 633; **77,** 675. **R., 77,** 727, 749.

A. M. Scott, **75,** ii, 634; **77,** 675. **R., 77,** 743.

H. D. Whitcomb, **75,** ii, 634; **77,** 675. **R., 75,** ii, 639.

C. P. Manning, **75,** ii, 635; **77,** 675. **R., 75,** ii, 653.

R. H. Temple, **75,** ii, 636. **R., 75,** ii, 650.

C. R. Howard, **75,** ii, 636. **R., 75,** ii, 643.

A. Marbury, **75,** ii, 636.

E. Lorraine. **R., 77,** 754, 759.

Lt. Maguire, **77,** 675.

R. H. Talcott, **77,** 684, 709.

J. M. Harris. **R., 77,** 742.

ESTIMATES. (See Plans and Projects.)

For water navigation, 1871–74, to d. 7′ bet. James and Ohio Rs. (See James River and Kanawha Canal; Kanawha River.)

For enlargement and extension, 1877, of James R. Canal, Richmond to mouth of Fork R. (Assistant Turpin), $13,481,000, **71,** 627; **73,** 830; **74,** ii, 101; **77,** 676.

Summit division from mouth of Fork R. to Greenbrier R., incl. summit tunnel (Assistant Turtle), $16,387,000, **77,** 676, 699, 706, 708, 709.

Anthony Creek reservoir (Assistant Lorraine), $300,000, **71,** 649; **77,** 676.

Greenbrier division, slack-water proj. (Assistant Turtle), $6,251,000, **77,** 676, 710, 717.

New R. division, slack-water proj. (Assistant Hutton), $11,427,000, **77,** 676, 737.

Removing bowlders in New R., $260,000, **77,** 676, 743.

Great Kanawha R., by movable and permanent dams, $4,000,000, **76,** 91, ii, 154, 165; **77,** 297, 676, 748, 751.

Aggregate, $52,106,000, **77,** 676.

If by independent canal from Richmond to Greenbrier R., as before, $30,168,000, **77,** 677.

Greenbrier division (Assistant Turtle), $4,765,000, **77,** 677, 727.

New R. division (Assistant Hutton), $20,650,000, **77,** 677, 741.

Kanawha division, as before, $4,000,000, **76,** 91, ii, 154; **77,** 297, 676, 751.

Aggregate, $59,583,000, **77,** 677.

Establishes correctness of opinion of BE., 1874, **74,** ii, 91; **77,** 677.

For double-track freight RR., 1874, according to details of plan (see Plans), Charleston, on Kanawha R., to Norfolk, 454.8 m., $36,364,136, **75,** ii, 642, 646, 656.

To Newport News, 449½ m., $36,167,279, **75,** ii, 642, 646, 656.

To Newport News via James Valley, 476.3 m., $36,627,725, **75,** ii, 642, 646, 656.

To Alexandria, 384.6 m., $31,704,336, **75,** ii, 642, 646, 656.

Maj. Craighill est. cost from Ohio to tide water at $45,000,000, or $75,000,000 inclusive of terminal facilities, equipment, etc., **75,** ii, 636.

LEGISLATION. (See Kanawha River.)

PHYSICAL CHARACTERISTICS.

Summit level; rainfall on, **77,** 757, 759, 769.

Anthony Creek; discharge of, **77,** 760, 769, 794.

Greenbrier R.; general characteristics of, **71,** 641; **77,** 754, 788, 801; floods on, **71,** 641; **73,** 831; **74,** ii, 94; discharge of, **71,** 641; **73,** 831.

New R.; general characteristics of, **71,** 640; **77,** 728, 788, 802; floods on, **71,** 641; **73,** 831; **74,** ii, 94; discharge of, **71,** 641.

PLANS. (See Estimates and Projects.)

For a double-track freight RR. from Charleston on the Kanawha to tide water in Virginia; gauge, 4′ 8½″; excavation, 30′ w.; embankments, 28′; steel rails, 68½ lbs. per yard, **75,** ii, 641, 644. Limiting grades facing westward to 30′ per m.; facing e., 60′, **75,** ii, 640, 643, 650, 652; by one of the following routes, viz: From Charleston, thence up valleys of Kanawha, New, and Greenbrier Rs. and Howard Creek to summit, passing summit by tunnel 9,050′ l.; thence down valleys of Dunlap Creek and Jackson R. to Clifton Forge; thence along valleys of Jackson and James Rs. to Norfolk, 454.8 m., **75,** ii, 635, 639, 640, 643. Or following above route to Clifton Forge; thence via Richmond and Yorktown to Newport News, 449½ m., **75,** ii, 635, 639, 641, 643. Or last-named route via valley of James R. to Newport News, 476.3 m., **75,** ii, 635, 639, 641, 643. Or by above-named route to Clifton Forge; thence via Gordonsville to Alexandria, 384.6 m., **75,** ii, 635, 639, 641, 653. (See James River and Kanawha Canal; also Kanawha River.)

PRIVATE AND CORPORATE WORK. (See James River and Kanawha Canal; also Kanawha River.)

PROJECTS. (See Estimates and Plans.)

By Maj. W. P. Craighill, 1874–77, water navigation 7′ d. connecting James and Ohio Rs., as follows: By enlargement of existing canal from Richmond to Buchanan; its extension therefrom via valleys of James and Jackson Rs., Fork Run, and Brush Creek; thence by tunnel 41,505′ l., single tunnel with turnouts for passing boats; elevation of tunnel 1,713′ above tide; thence via s. fork of Howard Creek to Greenbrier R.; canal section

[1] Being a connection by canal or freight railroad from the Ohio or Kanawha R. near Charleston by the most practicable route through Western Virginia to tidewater in Virginia, **71,** 625, 655; **75,** ii, 631; **76,** 91; **77,** 675.

7′ x 70′; locks 7′ x 24′ x 120′; canal section proper ends at w. debouché of tunnel, at which point slack-water navigation begins; thence by locks and dams, with short reaches of canal to avoid expensive location of locks and dams, via Greenbrier; New, and Kanawha Rs. to Paint Creek Shoals, locks 48′ x 250′; from Paint Creek Shoals to mouth of Kanawha by locks and movable dams; locks 50′ x 300′; navigable pass adjoining lock 250′ w. (see Projects, James River and Kanawha Canal), **74,** ii, 88, 100, 117, 128; **75,** ii, 90, 95; **76,** ii, 158, 163, 164; **77,** 676, 684, 696, 697, 703, 709, 718, 727, 743, 747, 749.

Suggested use of planes in place of locks, **77,** 682.

SURVEYS. (See also Kanawha River.)

By Capt. McNeil, 1827, connecting James and Ohio Rs., **71,** 625, 636, 637; **74,** ii, 87; **77,** 677, 762.

To determine practicability and cost of connecting James and Ohio Rs. by water navigation, 1870–74, **71,** 76, 624, 650; **73,** 829; **75,** ii, 632; **77,** 676.

EE-68 COAL RIVER, W. VA.

ENGINEERS.

Chief of Engineers. **R., 87,** 253.

In charge. Lt. Col. W. P. Craighill. **R., 87,** 1929.

Assistant. W. C. Reynolds. **R., 87,** 1929.

PHYSICAL CHARACTERISTICS.

Description, **87,** 1929.

SURVEY.

Ex. au. act Oct. 4, 1886; made, 1887, by Lt. Col. Craighill (**R.** unfav.), **87,** 1929.

EE-68(a) BIG COAL AND LITTLE COAL RIVERS, W. VA.

COMMERCE.

Unimportant, **95,** 2466.

ENGINEERS.

Chief of Engineers. **R., 87,** 253; **95,** 336.

In charge:

Lt. Col. W. P. Craighill, 1887–94. **R., 87,** 1929; (Col.) **95,** 2465.

Lt. Col. P. C. Hains, 1895. **R., 95,** 2465.

Assistant. W. C. Reynolds. **R., 87,** 1929.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1929.

Little Coal R. a branch, **95,** 2465.

SURVEYS.

Ex. au. act Oct. 4, 1886; made, 1887, by Lt. Col. Craighill (**R.** unfav.), **87,** 1929.

Ex. au. act Aug. 17, 1894; made, 1894, by Col. Craighill (**R.** unfav.), **95,** 2465.

EE-77 NEW RIVER, VA. AND W. VA.

APPROPRIATIONS.

1876,	$15,000,	**76,** 91; **77,** 62, 332.
1878,	15,000,	**78,** 69, 499.
1879,	12,000,	**79,** 79, 531.
1880,	24,000,	**80,** 677.
1881,	24,000,	**81,** 909.
1882,	12,000,	**82,** 919.
1886,	10,000,	**86,** 1600.
Total,	112,000	

COMMERCE.

Mineral and agricultural resources of country tributary to, **73,** 78, 843, 848; **75,** ii, 134, 138.

Requirements of, **73,** 78, 843, 848.

Necessity of imp. from Lead Mines to Virginia & Tennessee RR., **73,** 78, 848, 854; **77,** 62, 332; **79,** 535.

ENGINEERS.

Chief of Engineers. **R., 73,** 78; **75,** 95; **76,** 91; **77,** 62; **78,** 69; **79,** 79, 81; **80,** 107; **81,** 144; **82,** 140; **83,** 144; **84,** 149; **85,** 287; **86,** 281; **87,** 251; **88,** 225; **89,** 261; **90,** 235; **91,** 302; **92,** 289; **93,** 328; **94,** 301; **95,** 335; **96,** 292; **97,** 379; **98,** 367; **99,** 431; **04,** 477, 2617.

Boards. BERH. **R., 04,** 2619.

In charge:

Maj. W. P. Craighill, 1873–94. **R., 73,** 842; **77,** 331; **78,** 495; **79,** 530, 538; (Col.) **80,** 676; **81,** 904, 909; **82,** 912; **83,** 699; **84,** 928; **85,** 1859; **86,** 1599; **87,** 1925; **88,** 1760; **90,** 2249; **91,** 2430; **92,** 2071; **93,** 2603; **94,** 1965.

S. T. Abert, U. S. C. E., ex. of R. **R., 75,** ii, 133.

Capt. T. Turtle, 1889. **R., 89,** 1961.

Lt. Col. P. C. Hains, 1895–97. **R., 95,** 2465; **96,** 2264.

Maj. J. F. Gregory, 1897. **R., 97,** 2563.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2140.

Capt. H. F. Hodges, 1899. **R., 99,** 2498.

Capt. W. E. Craighill, 1904. **R., 04,** 2617.

Assistants:

N. H. Hutton, **73,** 842. **R., 73,** 844.

C. R. Boyd, **73,** 842. **R., 73,** 849.

Capt. J. W. Cuyler, **77,** 332. **R., 78,** 495; **79,** 531.

A. M. Scott. **R., 79,** 536.

W. P. Smith. **R., 79,** 538; **80,** 678; **81,** 904; **82,** 912; **83,** 700; **86,** 1600; **87,** 1926; **89,** 1961; **90,** 2249.

Capt. T. Turtle. **R., 83,** 704.

ESTIMATES. (See Plans and Projects.)

For keel-boat imp., 1872, to a d. of 2′ from mouth of Greenbrier R. to Lead Mines, in Wythe Co., 128 m., $100,000, **73,** 843, 848, 852, 853; **76,** 91; **77,** 62, 331. Increased to $156,100, **79,** 531, 532. Or for a SS. navigation to d. of 3′, $750,000, **73,** 843, 848. Revised, 1873, to $1,017,000, **73,** 78, 853, 854; **76,** 91; **77,** 62, 331. If last imp. extend only from Lead Mines to crossing of Virginia & Tennessee, RR., 40 m., $350,000, **73,** 78, 848, 854; **77,** 62. Or for SS. imp. to 5½′ from mouth of Greenbrier R. to Lead Mines by locks and dams, $2,500,000, **73,** 854; **76,** 91.

By W. P. Smith, 1879, imp. from Lead Mines, in Wythe Co., to mouth of Wilson Creek, Grayson Co., for keel-boat navigation, with chan. 2′ x 30′, $115,000, **79,** 539, 543. Or for SS. navigation by chan. 3′ x 90′, obtained by grading R., to slope not exceeding 1 in 400, and also by use of locks and dams, $1,200,000, **79,** 539, 544. Or for a SS. navigation with 5′, by locks and dams, $1,600,000, **79,** 539, 544.

Amount required, 1879, for completion of existing proj., $114,160, **79,** 531.

OPERATIONS.

1877-78. Removal by hired labor of r. and bowlders from chan., and constr. of wing dams and training walls; details of r. removal, **78,** 69, 496, 499.

1878-79. Continuation of operations of previous year; details of r. removal, **79,** 79, 531, 533, 535, 537.

1879-80. Chan. 2′ x 50′ l. w. excavated from Blue Stone R. to War Ford Shoals, **80,** 678.

1880-81. Chan. 2′ x 50′ l. w. excavated from Hinton Landing to Harveys Falls, 18 m., **81,** 907.

1881-82. Chan. of above dimensions excavated for 26 m.; also 2½ m. of wing dam and training wall built, **82,** 913–918.

1882-83. 2,000 c. y. r. and gravel removed, forming a chan. of former dimensions for 8 m., **83,** 702, 703.

1885-86. 1,371 c. y. dr. in continuation of chan. already formed; 1,863 l. f. wing dams and sustaining walls built, **86,** 1600.

1888-89. Drilling, blasting, and r. removal begun, **89,** 1962.

1889-90. 2,204 c. y. excavated and built into training and wing walls, **90,** 2250.

PHYSICAL CHARACTERISTICS.

Description of; joins Greenbrier R.; rises in N. C. and flows n. through Va. into W. Va., **73,** 844; **75,** ii, 133; **78,** 496; **79,** 539.

Discharge of, **73,** 845; **78,** 497; **79,** 540; fall of, **73,** 845; **78,** 497; **79,** 540.

Iron, copper, lead, and zinc deposits, **73,** 848; **75,** ii, 135; **79,** 545.

Geology of basin, **73,** 849; **75,** ii, 133; **78,** 498. (See James and Kanawha River Water Line.)

Erosion not caused by former U. S. work, but by high water, **04,** 2618.

PLANS. (See Estimates and Projects.)

From mouth of Greenbrier R. to Lead Mines, 128 m. For keel-boat navigation to d. of 2′, by excavation of sluices 30′ w. through shoals and ledges, aided in places by slight brush and st. dam deflectors; cost, $100,000, **73,** 78, 843, 848, 852; **76,** 91; **77,** 62, 331. For SS. navigation, to 3′, by excavation of sluices 90′ w. through shoals and ledges, with grade not exceeding 1′ in 400′, and at points with excessive fall, locks and dams, and short lateral canals, locks 25′ x 90′; cost, $1,017,000, **73,** 78, 843, 848, 853; **76,** 91; **77,** 62, 332. Portion of R. bet. Lead Mines and crossing of Virginia & Tennessee RR. should be first imp., **73,** 78, 848, 854; **77,** 62. For SS. navigation, to 5½′, by locks and dams; cost, $2,500,000, **73,** 854; **76,** 91.

Possibility of imp. R. above Lead Mines, by locks and dams, **75,** ii, 134, 138.

By W. P. Smith, 1879, imp. R. from Lead Mines, in Wythe Co., to mouth of Wilson Creek, Grayson Co.: 1st, By a 2′ navigation for keel boats, chan. 30′ w., with towpaths at falls and rapids; cost, $115,000, **79,** 539, 543, 544. 2d, For SS. navigation with chan. 3′ x 90′, aided by 28 locks and dams; cost, $1,200,000, **79,** 539, 544. 3d, For SS. navigation with chan. 5′ x 90′; cost, $1,600,000, **79,** 539, 544.

PROJECTS. (See Estimates and Plans.)

For imp. from mouth of Greenbrier R. to Lead Mines, for keel-boat navigation to d. of 2′ and w. of 30′, with a view to its utilization and adaptation at some future time, when the imp. to d. of 5′ shall be made—first imp. to be made near New R. Br., so as to facilitate communication with Virginia & Tennessee RR.; est., $156,160, **77,** 62, 332; **78,** 69, 495; **79,** 530.

In 1880, $66,000 having been app. since 1876, the proj. was modified to embrace part of the R. bet. mouth of Wilsons R. and Lead Mines; est., $205,000, **80,** 677.

SURVEYS.

By Moore & Briggs, 1819, for State of Virginia, from mouth of Greenbrier R. to Sinking Creek, **73,** 843, 844.

By Maj. Craighill, 1872, from Greenbrier R. to Lead Mines, in Wythe Co., 128 m., **73,** 78, 842, 844; **77,** 331.

Ex. by S. T. Abert, U. S. C. E., 1874, from Lead-Mines, in Wythe Co., to mouth of Wilson, in Grayson Co., Va., **75,** 95, ii, 133. Instrumental sur. recom., **75,** ii, 138; ordered, 1878, **78,** 70; made, **79,** 538.

Ex. at its confluence with Greenbrier R., au. act June 13, 1902, to ascertain cause of erosion of bank in front of Avis, or Upper Hinton; made, 1903, by Capt. Craighill (**R.** unfav.),[1] **04,** 2617.

Maps:
At Ingles Falls, **78,** 498.
At Falls Branch, **78,** 498.

EE-108 GREENBRIAR (Greenbrier) RIVER, W. VA.

ENGINEERS.

Chief of Engineers. **R., 85,** 288.

In charge. Lt. Col. W. P. Craighill. **R., 77,** 709; **85,** 1866.

Assistants:
Lt. T. Turtle. **R., 77,** 709.
W. P. Smith. **R., 85,** 1867.

PHYSICAL CHARACTERISTICS.

R. described, **85,** 1867.

SURVEYS.

Ex. au. act July 5, 1884; made by Lt. Col. Craighill (**R.** unfav.), **85,** 1866.

EE-114 GAULEY RIVER, W. VA.

APPROPRIATIONS.

1888,	$3,000,	**88,** 224.
1890,	3,000,	**90,** 2248.
1892,	3,000,	**92,** 2068.
1894,	3,000,	**95,** 2462.
1896,	3,000,	**96,** 2263.
Total,	15,000	

COMMERCE.

First attempt since 1889 to drive logs through "The Roughs," made, 1898; 2,000,000′ b. m., cut and put in the R. to be rafted down to the mills, **99,** 2498.

ENGINEERS.

Chief of Engineers. **R., 88,** 224, 226; **89,** 260; **90,** 234; **91,** 301; **92,** 288; **93,** 327; **94,** 300; **95,** 334; **96,** 291; **97,** 380; **98,** 366; **99,** 431; **00,** 494; **01,** 489; **02,** 415; **03,** 446.

In charge:
Col. W. P. Craighill, 1886–89. **R., 88,** 1761.
Capt. T. Turtle, 1889–90. **R., 89,** 1959.
Col. W. P. Craighill, 1890–95. **R., 90,** 2248; **91,** 2428; **92,** 2067; **93,** 2598; **94,** 1964.
Lt. Col. P. C. Hains, 1895–97. **R., 95,** 2462; **96,** 2263.
Maj. J. F. Gregory, 1897. **R., 97,** 2564.

[1] H. D. 176, 58th, 2d.

Maj. W. H. Bixby, 1898. **R., 98,** 2138.
Capt. H. F. Hodges, 1899–1901. **R., 99,** 2496; **00,** 3340.
Maj. E. H. Ruffner, 1901. **R., 01,** 2733.
Capt. W. E. Craighill, 1901–03. **R., 02,** 1933.
Maj. G. A. Zinn, 1903. **R., 03,** 1728.

Assistants:
N. H. Hutton. **R., 88,** 1762.
W. P. Smith. **R., 89,** 1959; **91,** 2429; **92,** 2068; **93,** 2599; **95,** 2462.
A. M. Scott. **R., 98,** 2139; **99,** 2498; **00,** 3341.

OPERATIONS.

1888-89. 52 c. y. r. blasted and removed, **89,** 1960.
1890-91. 212 c. y. solid and 2,070 c. y. loose r. removed, **91,** 2430.
1891-92. 3,184 c. y. r. removed and 6,980 l. f. of training wall built, **92,** 2067.
1892-93. 5,034 l. f. new walls built; nearly 5,000 c. y. loose r. and bowlders removed, **93,** 2601.
1894-95. 729 c. y. loose r. and 918 c. y. bowlders blasted and removed, **95,** 2463.

PHYSICAL CHARACTERISTICS.
Description of, **88,** 1761.

PROJECTS.
By Col. Craighill, 1887, mouth to "The Roughs," 12 m., removal of r. ledges and obstr., giving a chan. 2′ x 20′ at l. w.; est., $10,000, **88,** 1761. At and above "The Roughs," r. removal and constr. of training walls; est., $65,000. Total est., $75,000, **88,** 1761; **89,** 1959; **92,** 2067.
By Capt. Hodges, 1899, for expend. available funds to blast down large r. on the shoals and to cut trees to facilitate the floating of logs over "The Roughs," **99,** 2498.

SURVEYS.
Ex. au. act Aug. 5, 1886; made, 1887, by Col. Craighill, **87,** 253; **88,** 1761.
Maps. **88,** 1762.

EE-116 MEADOW RIVER, W. VA.

ENGINEERS.
Chief of Engineers. **R., 87,** 253; **88,** 226.

In charge. Col. W. P. Craighill, 1886. **R., 88,** 1761.

Assistant. N. H. Hutton. **R., 88,** 1762.

PHYSICAL CHARACTERISTICS.
Description of, **88,** 1761.

PLANS.
By Col. Craighill, 1887, clearing Meadow R. to facilitate rafting; est., $45,000, **88,** 1762.

SURVEYS.
Ex. au. act Aug. 5, 1886, **87,** 253; made, 1887, by Col. Craighill, **88,** 1762.
Maps. **88,** 1762.

EE-133 ELK RIVER, W. VA.

APPROPRIATIONS.

1875,	*$500, sur., **76,** ii, 166.
1878,	5,000, **79,** 80, 556.
1880,	5,000, **80,** 691.
1881,	5,000, **81,** 917.
1882,	2,000, **82,** 931.
1886,	1,500, **86,** 1598.
1888,	3,000, **88,** 1760.
1890,	2,500, **90,** 2248.
1892,	2,500, **92,** 2064.
1894,	2,000, **95,** 2460.
1896,	2,000, **96,** 2262.
Total,	31,000

COMMERCE.
Mineral products of valley, **76,** ii, 171, 173, 175, 176.
C. of R. mostly logs, **79,** 555.
Description of C. possibilities, **95,** 2468.
C. entirely in timber and timber products, diminished from 139,800 t. in 1892 to 55,500 t. in 1898, **99,** 2496.
1901, 96,940 t., **01,** 489.
Large coal fields underlie watershed of R., **04,** 2585.

ENGINEERS.
Chief of Engineers. **R., 76,** 91; **79,** 80; **80,** 108; **81,** 147; **82,** 143; **83,** 147; **84,** 150; **85,** 286; **86,** 281; **87,** 251; **88,** 224; **89,** 260; **90,** 234; **91,** 300; **92,** 287; **93,** 326; **94,** 299; **95,** 334, 336; **96,** 290; **97,** 380; **98,** 365; **99,** 429, 440; **00,** 493, 503; **01,** 489; **02,** 415; **03,** 446; **04,** 476, 2582.

Boards. BERH. **R.,** "Inadvisable to undertake imp.," **04,** 2585.

In charge:
Maj. W. P. Craighill, 1876–95; **76,** 91. **R., 76,** ii, 166; **79,** 555; (Lt. Col.) **80,** 690; **81,** 917; **82,** 931; **83,** 716; **84,** 936; **85,** 1857; **86,** 1598; **87,** 1923; (Col.) **88,** 1760; **90,** 2247; **91,** 2427; **92,** 2064; **93,** 2595; **94,** 1963.
Capt. T. Turtle, 1889. **R., 89,** 1955.
Lt. Col. P. C. Hains, 1895–97. **R., 95,** 2460, 2466; **96,** 2262.
Maj. J. F. Gregory, 1897. **R., 97,** 2565.
Maj. W. H. Bixby, 1898. **R., 98,** 2137.
Capt. H. F. Hodges, 1899–1900. **R., 99,** 2495; **00,** 3337, 3392.
Maj. E. H. Ruffner, 1901. **R., 01,** 2732.
Capt. W. E. Craighill, 1902. **R., 02,** 1933.
Maj. Geo. A. Zinn, 1903–04. **R., 03,** 1729; **04,** 2582.

Assistants:
N. H. Hutton, **76,** ii, 166. **R., 76,** ii, 167.
C. Humphries, **76,** ii, 166, 171.
Lt. T. Turtle. **R., 80,** 692, 695.
Capt. E. H. Ruffner. **R., 81,** 917; **82,** 931.
A. M. Scott. **R., 84,** 936; **85,** 1858; **86,** 1599; **92,** 2064; **93,** 2595; **95,** 2460; **97,** 2565; **98,** 2137; **99,** 2495; **00,** 3339.
W. A. Porter. **R., 89,** 1956.

ESTIMATES. (See Plans and Projects.)
For an open navigation by sluices through shoals, $100,000, **76,** ii, 166, 171. For slack-water navigation, by 22 locks and dams; if of masonry, $1,543,080; if of timber and masonry, $1,000,000, **76,** ii, 167, 170; **79,** 555.

LEGAL PROCEEDINGS.
Toward removal of obstr. lock and dam near Charleston, **84,** 937; **85,** 1858; **86,** 1599.
Two dams obstr. navigation. Condemnation proceedings instituted against one; suit dismissed. Commissioner's price regarded as excessive. Indictment brought against the owner of the other dam, **99,** 2495.

* Allotment.

LEGISLATION.

Act of State legislature providing for removal of dams, **87,** 1923.

OBSTRUCTIONS.

R. obstr. by milldams, **80,** 692. Dilapidated condition of corporate lock and dam near Charleston makes it an obstr. to navigation, **82,** 143, 931, 933; **83,** 716; **84,** 937. Recom. by DO. that all operations be suspended until this obstr. is remedied, **82,** 934; **83,** 716; **85,** 1858.

Several small grist and saw mill dams obstr., **94,** 1963. Proceedings to be instituted for their removal, **95,** 2460. Progress of the proceedings (see Legal proceedings), **96,** 2262; **97,** 2565; **98,** 2137.

OPERATIONS.

1879-80. Removal of rs., trees, and gravel bars, **80,** 109, 693.

1880-81. Removal of r. and constr. of gravel and st. dikes at shoals, **81,** 147, 917.

1881-82. Formation of chutes and dikes at shoals, **82,** 931.

1883-84. Removal of r. from chan., **84,** 936.

1884-85. Removal of obstr. from chan., **85,** 1858.

1888-89. 5,471 c. y. r. blasted and removed from chan., **89,** 1958.

1890-91. 153 snags and 18 r. removed from chan., **91,** 2427.

1891-92. 4,418 c. y. r. blasted and removed in the upper R.; 2,460 c. y. r. and 7,670 l. f. of round timber used in dike constr. at points below Clay Courthouse, **92,** 2065, 2066.

1892-93. Chutes cleared and w.; chute walls built and repaired; passageways opened through 4 abandoned dams; some snags and other obstr. removed, **93,** 2595.

1897-98. Some obstr. removed; dikes at Queens Shoal chute raised from 3½′ to 4′ for 500′, **98,** 2137.

1899-00. 3,000 c. y. r. blasted and scattered and some snags removed, **00,** 3339.

1902-03. Work closed Sept., 1902; property transferred to Kanawha imp.; unexpend. balance returned to Treas., **03,** 1729.

PHYSICAL CHARACTERISTICS.

Pools, character of; w. of R.; fall of; discharge of; freshets on. **76,** ii, 166, 168.

Geological formation of valley of, **76,** ii, 172.

Mineral springs, **76,** ii, 173, 176.

Cement r., **76,** ii, 176.

One of the principal tributaries of the Great Kanawha R., and a tortuous stream with an average w. of 200′ bet. banks, **00,** 3393.

Max. draft carried, 1901, 2′, **01,** 489.

PLANS. (See Estimates and Projects.)

Inadequate navigation from mouth to Braxton Courthouse, 100 m., for a d. of 1′ x 10′, by cutting sluices through shoals, **76,** ii, 166, 169. Slackwater navigation to d. of 4′, mouth to Braxton Courthouse, 100 m., by means of 22 locks and dams; locks, 24′ x 120′; average lift, 8′, **76,** ii, 167, 169, 170. Small need of imp., **79,** 555.

PRIVATE (STATE) WORK.

Poorly built and badly located dam and lock, built by State, 2½ m. above mouth; should be removed, **76,** ii, 167, 169, 170.

PROJECTS. (See Estimates and Plans.)

By Maj. Craighill, 1875, imp. chans. through shoals to a d. of 10 or 12″ at l. w. by cutting sluiceways 12′ w.; also the removal of rs., snags, and overhanging trees; est., $100,000, **76,** ii, 166, 171; **79,** 555; **80,** 691; **81,** 147; **85,** 286.

By Maj. Craighill, 1879, expend. of app. of 1878 ($5,000) in removing obstr.; small occasion for imp., **79,** 80, 555.

SURVEYS.

Mouth to Braxton Courthouse, 1875, 100 m., **76,** 91, ii, 166, 167.

Notes from previous civil surs., **76,** ii, 166, 167, 171.

Value of level and micrometer attachment to transits for rapid sur., **76,** ii, 171.

Ex. for locking and damming, au. act Aug. 17, 1894. **R.** (unfav.), Col. Craighill, 1894, **95,** 2466.

Ex. Elk R., mouth to Sutton, au. act Mar. 3, 1899; made, 1899, by Capt. Hodges (**R.** unfav.), **00,** 3393.

Ex. au. act June 13, 1902. **R.,** Capt. Craighill, Feb. 5, 1903 (unfav.),[1] **04,** 476, 2583.

EE-157 LITTLE KANAWHA RIVER, W. VA.

Part.	Title.	Period.	Appropriations.
a	Little Kanawha R.	1874-1912	$494,418.00
b	Little Kanawha R., operating and care of locks and dams	1892-1912	101,523.86
c	Little Kanawha R. (mouth) ice harbor		
	Total		595,941.86

Part (a), EE-157 Little Kanawha River, W. Va.

APPROPRIATIONS.

1876, $7,300, **77,** 94, 663, 665.
1878, 18,000, **78,** 108, 810, 813.
1879, 18,000, **79,** 145, 1347.
1880, 15,000, **80,** 1833.
1881, 40,000, **81,** 1990.
1882, 31,000, **82,** 1958.
1886, 16,875, **86,** 1624.
1888, 25,000, **88,** 1793.
1890, 40,000, **90,** 2278.
1896, 1,500, **96,** 2328.
1899, 743, **99,** 2474.
1902, 1,000, **02,** 1925.
1905, 1,000, **05,** 1879.
1905, 163,000, **05,** 1880.
1907, 81,000, **07,** 1743.
1909, 30,000, **09,** 1796.
1910, 5,000, **10,** 1960.

Total, 494,418 (incl. misc., $496,663.60, **12,** 2358).

[1] H. D. 81, 58th, 2d.

COMMERCE.

Probable C., **75,** 743.
Navigation only during h. w., **75,** 744.
C. of 1877 passing lock of Little Kanawha Navigation Co., **77,** 664.
Tolls collected by Little Kanawha Navigation Co., for 1881, **81,** 1990.
Country rich in resources, 1894, **95,** 2523.
Not largely increased by R. imp., **96,** 2328; **99,** 426.
Rates, through purchase of Locks 1–4, reduced amount of former tolls, **07,** 561.
Boats engaged on R., **10,** 707.
Rates lowered, **12,** 917.

CONTRACTS.

1877. Removal of r. at Beaver Rocks and Nailor Bend, **77,** 663.
1882. T. B. Townsend, dimension and rubble st., $4.50 and $3.50 c. y., **82,** 1959.
1885. Portsmouth Foundry & Machine Works, boilers and machinery for lock constr., **85,** 1891. S. M. Hamilton & Co., cement, $1.40 bbl. A. J. Mitchell, sawed lumber, **85,** 1891; timber, **85,** 1892. Morris & Co., coal, 8½¢ bushel, **85,** 1892.
1891. T. W. Moore, oak timber, $6,332, **91,** 2472. Pattin, Hall & Pattin, ironwork, $2,118, **91,** 2472. G. Kinsey & Co., ironwork, $684.95, **91,** 2472.
1906. The Parkersburg Mill Co., white oak timber, $29.50 M; H. A. Douglass, st., 98¢ c. y.; The Atlas Portland Cement Co., cement, prices given; H. A. Douglass, sand, 75¢ c. y.; Municipal Eng. & Con. Co., concrete mixer, $495; The Queen City Supply Co., boiler, hoisting engines, prices given; Thos. Carlin's Sons Co., derrick irons, ropes, etc., prices given; Pittsburgh Industrial Iron Works, pumps, etc., prices given, **06,** 1622–23.
1907. G. Elias & Bro., timber, prices given; Parkersburg Mill Co., timber, $34 M; Parkersburg & Marietta Sand Co., sand and gravel, 50¢ c. y. G. W. Righter, timber, $30 M, **07,** 1745–46.
1908. Nicolette Lumber Co., timber, prices given, **08,** 1816.
1909. The Parkersburg Mill Co., timber, $4,643.02, **09,** 1797.
1910. The Superior Portland Cement Co., cement, $744, **10,** 1961. Stephen Davidson, constr. lockkeeper's house, etc., prices given; The Guy Johnston Cont. Co., constr. office and wareroom, $1,813, **11,** 2160.
1911. The Pattin Bros. Co., iron, steel, etc., $1,065.83; Cantrel Cons. Co., constr. lock house, etc., $2,740, **11,** 2161.
1912. Rippley Hdw. Co., gasoline boat, $2,500, **12,** 2358.

ENGINEERS.

Chief of Engineers. **R., 75,** 73; **77,** 94; **78,** 107; **79,** 145; **80,** 197; **81,** 265; **82,** 259; **83,** 267; **84,** 266; **85,** 291; **86,** 285; **87,** 242; **88,** 228; **89,** 266; **90,** 240; **91,** 308; **92,** 295; **93,** 334; **94,** 307; **95,** 342, 343; **96,** 299; **97,** 384; **98,** 362; **99,** 425; **00,** 489; **01,** 486; **02,** 413; **03,** 443; **04,** 473, 476; **05,** 483; **06,** 533; **07,** 560; **08,** 598, 602; **09,** 631; **10,** 706; **11,** 760; **12,** 915, 920.

Boards:
BERH. reviews Maj. Zinn's **R.,** 1903, and recom. purchasing locks and dams from present owners, at $75,000, and repair of same, at $88,000, **04,** 2613.
BERH. reviews Capt. Craighill's **R.,** 1903, and concurs in his opinion to defer any imp. until question of purchasing locks and dams from Little Kanawha Nav. Co. is settled, **04,** 2600.

In charge:
Maj. W. E. Merrill, 1875–79; **75,** 73. **R., 75,** 740; **77,** 663; **78,** 806, 813; **79,** 1346.
Maj. J. W. Cuyler, 1880–83. **R., 80,** 1831; **81,** 1988; **82,** 1957.
Capt. J. C. Post, 1883–87. **R., 83,** 1572; **84,** 1754; **85,** 1890; **86,** 1623.
Lt. Col. W. E. Merrill, 1887. **R., 87,** 1828.
Maj. D. W. Lockwood, 1888–95. **R., 88,** 1792; **89,** 1987; **90,** 2278; **91,** 2471; **92,** 2114, 2117; **93,** 2641; **94,** 2006; **95,** 2510, 2520.
Maj. J. F. Gregory, 1896–97. **R., 96,** 2327; **97,** 2582.
Maj. W. H. Bixby, 1898–99. **R., 98,** 2113.
Capt. H. F. Hodges, 1899–1901. **R., 99,** 2474; **00,** 3317.
Maj. E. H. Ruffner, 1901–02. **R., 01,** 2723.
Capt. W. E. Craighill, 1902–03. **R., 02,** 1925; **04,** 2598.
Maj. G. A. Zinn, 1903–07. **R., 03,** 1718; **04,** 2572, 2607; **05,** 1878; **06,** 1620.
Capt. F. C. Boggs, 1907–08. **R., 07,** 1743.
Capt. F. W. Altstaetter, 1908–. **R., 08,** 1814; **09,** 1796; **10,** 1960; (Maj.) **11,** 2160; **12,** 2357.

Assistants:
E. J. Carpenter. **R., 75,** 742.
J. E. Bell, **77,** 663. **R., 78,** 807.
W. E. Strong. **R., 79,** 1346; **80,** 1833.
M. W. Venable. **R., 87,** 1830.
B. F. Thomas. **R., 88,** 1793; **89,** 1988; **90,** 2279; **91,** 2472; **92,** 2115, 2119; **98,** 2114.
E. Moeser. **R., 98,** 2113; **99,** 2475; **00,** 3317.
W. M. Hall. **R., 04,** 2601.

ESTIMATES. (See Projects.)

Maj. Merrill, 1875, imp. from Spring Creek to Bulltown, by slack-water navigation, 12 locks and dams, $758,400, **75,** 740; **77,** 665; will be largely increased if r. foundations are not found, **75,** 742; same work est. by E. J. Carpenter at $480,000, **75,** 744; considered too low by Maj. Merrill, **75,** 740. For temporary imp. by removal of r. and obstr., $7,300, **75,** 742.
Maj. Merrill, 1878, lock and dam at Burning Springs, $84,200, **78,** 813. Cause of increase from est. of 1875, **78,** 813; **79,** 145, 1347.

LEGAL PROCEEDINGS.

Transfer of Little Kanawha Nav. Co. property to US., **05,** 1879.

OPERATIONS.

1876–77. Temporary imp. by removal of r., sand, gravel, and other obstr. by hired labor, **77,** 664.
1877–78. Removal of r. by contract, **78,** 107, 808. Constr. of wing dams and removal of obstr. by hired labor, **78,** 108, 808.
1878–79. Removal of r. and obstr. and constr. of wing dams by hired labor, **79,** 145, 1346.
1879–80. 27,378 trees and 11,925 snags cut and removed; 11,133 l. f. crib dams and 3,712 l. f. brush dams built, **80,** 1835.
1882–83. St. for lock and dam received and repaired, **83,** 1572.
1883–84. Preparations of st. continued, **84,** 1754.
1884–85. Machinery placed and cofferdam half finished, **85,** 1890.
1885–86. Cofferdam completed; foundation of miter and R. walls excavated and walls partially built upon concrete foundation, **86,** 1623.
1886–87. Constr. of lock; R. and head walls commenced, **87,** 1829.
1887–88. 1,090 c. y. dimension and backing st. quarried and delivered at lock site; 460 c. y. cut st. and 230 c. y. backing placed in constr. of Lock and Dam No. 5; repairs to chute at Glenville, **88,** 1794.
1888–89. R. wall of lock completed; constr. of land wall, cofferdam, and lockkeeper's house begun, **89,** 1987.
1889–90. Lockkeeper's house and entire lock masonry completed; lock floor laid; 238 c. y. st. cut; 2,392 c. y. masonry laid; 4,116 c. y. earth excavated; 2,638 l. f. piles driven, and 148 c. y. concrete laid, **90,** 2278.
1890–91. Framing of lock gates completed; constr. of dam begun; 130 c. y. st. cut, 550 c. y. laid, and 4,029 c. y. quarried, **91,** 2473.
1891–92. 16,700 c. y. dr. at and below dam site; 250 l. f. cribwork sunk and filled in constr. of the dam; protection crib, guide crib, and cribwork for protection of the R. bank built; lock gates, wickets, and maneuvering apparatus put in place; lock floor paved; constr. and repair of plant, **92,** 2115. Operation and repair of lock and dam, **92,** 2118.

1892-93. Dike of dam completed; shore crib below lock constr.; misc. work done, **93,** 2641.
1897-98. Over 1,000 obstr. removed, **98,** 2113.
1898-99. About 700 snags and 520 c. y. r. removed, **99,** 2474.
1899-00. About 2,500 snags and other obstr. and 1,138 c. y. r. removed, **00,** 3318.
1903-04. Snags, stumps, logs, fallen trees, etc., removed; fire extinguishers placed in U. S. buildings, **04,** 2572.
1905-06. Stumps, trees, snags, etc., removed; on Nov. 1, 1905, US. took charge of Locks and Dams Nos. 1–4, **06,** 1620.
1906-07. Repairs to works, **07,** 1743.
1907-08. Extensive repairs made to locks recently purchased, **08,** 1814.
1908-09. Snags, logs, trees, etc., removed; repairs to Locks 1–4 completed, **09,** 1796.
1909-10. Obstr. removed from chan.; sur. made of R., **10,** 1960.
1910-11. Lock keepers' houses, offices, etc., erected at Locks Nos. 1 and 2; foundations placed at Lock No. 3; office and wareroom erected at Lock No. 4; milldam at Stouts Mill removed; obstr. removed from chan., **11,** 760, 2160.
1911-12. Buildings constr. at Lock No. 3; gates for Lock No. 1 built; extensive repairs made at Lock and Dam No. 5, **12,** 2357.

PHYSICAL CHARACTERISTICS.

Description of R., **75,** 742, 744; **78,** 806.
Falls, **75,** 740, 744, 745.
High water, **75,** 744.
Discharge, **75,** 745.
Area of water shed, **78,** 806.
Description of, 1894. Glenville, 55 m. from head of navigation, West Fork, has an elevation of 80′, which would require 7 addl. locks to give 4′ d., **95,** 2522.
Freshets and washouts damaging works of navigation company, and making navigation expensive and difficult, **96,** 2327.
Description of locks and dams owned by Little Kanawha Nav. Co., **04,** 2608.
Extent of slack-water navigation, water stages, etc., **09,** 632.
Empties into Ohio R. at Parkersburg, W. Va. General course, nw.; is very crooked and full of sharp turns. About 158 m. l., **12,** 915.

PRIVATE (CORPORATE) WORK.

Little Kanawha Navigation Co. began in 1867 and completed in 1874 the slack-water navigation to d. of 4′ from mouth to Spring Creek, 43 m., by 4 locks and dams; locks 23′ x 143′, **75,** 740, 744; **77,** 664.
Condition of the works of the canal company, 1894. Valued by the company at $250,000, **95,** 2520.
Leaky dams of navigation company lessening value of U. S. works, **94,** 2006; **95,** 2511; **96,** 2328.

PROJECTS.

Maj. Merrill, 1875, temporary imp. by removing r. and other obstr., **75,** 742, 744; **77,** 663, 665. For permanent imp., to 4′ from head of slack-water navigation, Spring Creek to Bulltown, 87¾ m., by slack-water navigation, 12 locks and dams; locks 143′ x 23′, with an average lift of 12¾′, **75,** 740; **77,** 664; **78,** 813. First dam and lock proposed at Burning Springs, **78,** 813.
The proj. of 1876 proposed the constr. of a lock and dam near Burning Springs, to extend slack-water navigation, for 4′, a distance of 12 m., and the imp. of the natural chan. for an addl. distance of 80 m., by the removal of obstr. to obtain 40′ w. and at least 2′ d. during 4 months of the year. Est., lock and dam, $62,000, **75,** 741. In 1878 dimensions of the lock increased; est., $84,200, **78,** 813; **81,** 1989; **82,** 1958. In 1883, est. increased to $135,672.47, **83,** 1573. Of the $129,300 app. previous to 1883, $43,300 was for the removal of obstr., **83,** 1574. Increased cost of work due to the small app., **86,** 1623. In 1888, $51,800 est. for completion, **88,** 1793.
Act Mar. 3, 1905, au. purchase of locks and dams from Little Kanawha Nav. Co., according to Maj. Zinn's **R.**[1] (see Surveys), **05,** 484.

SURVEYS.

From Bulltown to mouth, 1874, **75,** 73, 740, 742.
Ex., 1884, of previous works of imp. upon the R., **84,** 1754.
Ex. for locks and dams, report to contain probable price for which the U. S. could obtain possession of locks and dams, au. act Aug. 17, 1894; made, 1894, by Maj. Lockwood (**R.** unfav.), **95,** 2520.
Pre. ex. bet. Lock No. 5 and Burnsville, au. act June 13, 1902. **R.,** Capt. Craighill, Feb. 14, 1903; not advisable to undertake any imp. until U. S. acts on question of purchasing locks and dams below Lock No. 5,[2] **04,** 476, 2597.
Est. of probable cost of locks and dams in Little Kanawha R., present condition, cost of repairs, etc., au. act June 13, 1902. **R.,** Maj. Zinn, Aug. 3, 1903; considered it desirable for U. S. to purchase property and rights at cost of $75,000, and repair same at cost of $88,000,[3] **04,** 476, 2607.
Sur. for a lock and dam above Lock No. 5, au. act Mar. 2, 1907. **R.,** Capt. Boggs, Jan. 31, 1908 (unfav.),[4] **08,** 602.
Pre. ex. and sur. au. act Mar. 3, 1909, for modification of existing system of locks and dams, and further imp. **R.,** Maj. Altstaetter, June 8, 1909, Jan. 31, 1910, and May 23, 1911 (not considered immediately advisable),[5] **12,** 920.
Maps.[5]

Part (b), EE 157 Little Kanawha River, W. Va. (Locks and dams, operating and care.)

APPROPRIATIONS.[6]

1892,	$611.65
1893,	4,797.97
1894,	2,445.32
1895,	3,864.13
1896,	3,230.47
1897,	2,349.03
1898,	1,723.53
1899,	2,496.58
1900,	2,421.61
1901,	2,355.63
1902,	3,130.46
1903,	2,083.97
1904,	3,385.05
1905,	3,792.06
1906,	4,217.40
1907,	7,950.67
1908,	11,442.43
1909,	10,338.43
1910,	8,040.03
1911,	11,069.06
1912	9,778.38
Total,	101,523.86

(allotted $115,434.72, **12,** 2359).

[1] H. D. 309, 58th, 2d.
[2] H. D. 217, 58th, 2d.
[3] H. D. 309, 58th, 2d.
[4] H. D. 917, 60th, 1st.
[5] H. D. 480, 62d, 2d.
[6] Expend. under permanent-indefinite app. au. act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

COMMERCE.

Description of. Value of, at 1896, that had passed through since opening of the canal and lock, est. at $5,271,276, **96,** 2329; during 1898, 122,405 t., valued at about $2,176,352; 1899, 138,664 t., valued at about $1,795,000, **99,** 2478; **00,** 3320.

Owing to U. S. assuming control of Locks Nos. 1 to 4, no tolls being charged, a great increase in traffic, **06,** 1623.

1911, 120,000 t., principally oil-well supplies, saw logs, RR. ties, **12,** 2360.

Comparison of boat and rail rates, **12,** 2361.

CONTRACTS.

1904. Stephen Davidson, frame storehouse, Lock No. 5, $1,675, **04,** 2574.

1911. J. & J. B. Milholland Co., iron and steel for Lock No. 4, $612.93, **11,** 2162.

ENGINEERS.

Chief of Engineers. R., 93, 335; **94,** 307; **95,** 342; **96,** 300; **97,** 384; **98,** 363; **99,** 426; **00,** 490; **01,** 487; **02,** 413; **03,** 444; **04,** 474; **05,** 484; **06,** 534; **07,** 562; **08,** 600; **09,** 634; **10,** 709; **11,** 763; **12,** 917.

In charge:

Maj. D. W. Lockwood, 1888–95. **R., 93,** 2642; **94,** 2007; **95,** 2511.

Maj. J. F. Gregory, 1896–97. **R., 96,** 2328; **97,** 2582.

Maj. W. H. Bixby, 1898–99. **R., 98,** 2115.

Capt. H. F. Hodges, 1899–1901. **R., 99,** 2476; **00,** 3319.

Maj. E. H. Ruffner, 1901–02. **R., 01,** 2724.

Capt. W. E. Craighill, 1902–03. **R., 02,** 1926.

Maj. G. A. Zinn, 1903–07. **R., 03,** 1719; **04,** 2573; **05,** 1880; **06,** 1623.

Capt. F. C. Boggs, 1907–08. **R., 07,** 1746.

Capt. F. W. Altstaetter, 1908–. **R., 08,** 1816; **09,** 1798; **10,** 1962; (Maj.) **11,** 2161; **12,** 2359.

Assistants:

B. F. Thomas. **R., 96,** 2330; **97,** 2583.

E. Moeser. **R., 98,** 2117; **99,** 2479; **00,** 3321.

OPERATIONS.[1]

1894–95. New timber and concrete floor put in lock, **95,** 2512.

1895–96. Upper shore crib extended; bank below lock riprapped, and misc. work done, **96,** 2329.

1896–97. Minor repairs made to lock and dam, **97,** 2583.

1897–98. Minor repairs made to lock and dam, **98,** 2115.

1898–99. Emptying valve repaired, gates resheeted and repairs made to guide crib and dam, **99,** 2479.

1899–00. Necessary repairs made to lock and dam and about 1,750 s. f. of terreplein paved, **00,** 3320.

1900–01. Rebuilding guide crib to Lock No. 5, and general repairs, **01,** 2724.

1901–02. Minor repairs to works, **02,** 1926.

1902–03. Necessary repairs to lock and dam, **03,** 1719.

1903–04. Repairs to works, **04,** 2573.

1904–05. General repairs to structures, **05,** 1880.

1905–06. Locks Nos. 1 to 4, owned by Little Kanawha Nav. Co., purchased by U. S., and on Nov. 1, 1905, placed under U. S. control; general repairs made to all locks and dams, **06,** 1623.

1906–07. Repairs to structures, **07,** 1747.

1907–08. Mainten. and repair of works, **08,** 1816.

1908–09. Repairs to works, **09,** 1798.

1909–10. Minor repairs to works, **10,** 1962.

1910–11. Lockmaster's shelter house constr.; general repairs to works, **11,** 2161.

1911–12. Minor repairs to locks and dams, **12,** 2359.

PHYSICAL CHARACTERISTICS.

Leakage of works of Little Kanawha Navigation Co. lessening usefulness of U. S. work, **93,** 2642; **94,** 2007; **95,** 2512.

Table of important features of Locks and Dams Nos. 1 to 5, giving complete description of structures, **03,** 1720.

Stoppage of navigation, 1904, due to leaky condition of Locks Nos. 1–4, **04,** 2573.

Ice interferes with navigation, **12,** 918.

SURVEYS.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 919.

Part (c), EE 157 Little Kanawha River (Mouth), W. Va. (Ice harbor.)

ENGINEERS.

Chief of Engineers. R., 79, 147; **80,** 195.
In charge. Maj. W. E. Merrill. **R., 80,** 1790.
Assistant. W. E. Strong. **R., 80,** 1793.

PRIVATE (CORPORATE) WORK.

Petition of Little Kanawha Bridge Co. with reference to the disposal of their br. as an obstr. in R., **80,** 1797.

PLANS.

By Maj. Merrill, 1880, 2 ice breakers of timber and st. below RR. br. across the Ohio; est., $6,000, **80,** 1796.

By Maj. Merrill, 1880, raising wagon br. near mouth of Little Kanawha R. 32′ and constr. of approaches thereto; est., $80,000, **80,** 1795.

Modification of above plan; est., $60,000, **80,** 1795.

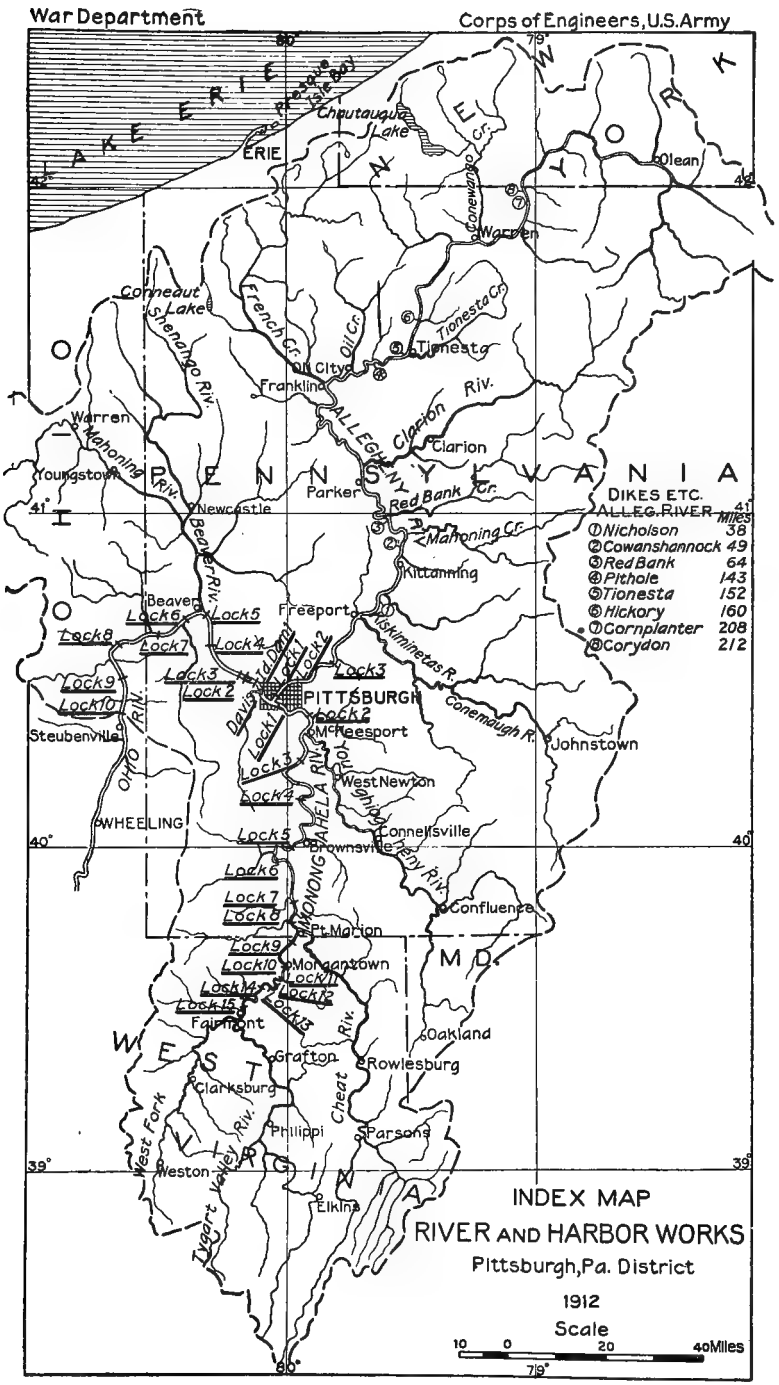
SURVEY.

Au. act Mar. 3, 1879; made, 1880, by Maj. Merrill, **80,** 1790.

[1] See references to Engineers in charge for minor misc. work performed each year.

RIVER AND HARBOR WORKS—OHIO RIVER SYSTEM.

FF.—PITTSBURGH, PA., DISTRICT.


War Department
Corps of Engineers, U.S. Army
LAKE ERIE
Presque Isle Bay
ERIE
Chautauqua Lake
NEW YORK
Olean
Conewango Cr.
Warren
Conneaut Lake
Shenango Riv.
French Cr.
Oil Cr.
Tionesta Cr.
Tionesta
Oil City
Franklin
ALLEGHENY RIV.
Clarion Riv.
Clarion
Warren
Mahoning Riv.
Youngstown
PENNSYLVANIA
Parker
Red Bank Cr.
Newcastle
Beaver Riv.
Mahoning Cr.
Kittanning
Beaver
Lock6
Lock5
Freeport
Lock8
Lock7
Lock4
Lock3
Lock2
Lock1
Davis Id. Dam
Lock1
Lock2
Lock3
Lock9
Lock10
PITTSBURGH
Lock2
McKeesport
Steubenville
OHIO RIV.
Lock3
Lock4
West Newton
Youghiogheny Riv.
Johnstown
Conemaugh R.
Kiskiminetas R.
WHEELING
Lock5
Connellsville
Brownsville
Lock6
Lock7
Lock8
Confluence
Pt. Marion
Lock9
Lock10
Morgantown
Lock11
Lock14
Lock12
Lock15
Lock13
Fairmont
MD.
Oakland
Rowlesburg
Grafton
Clarksburg
Cheat Riv.
Philippi
Parsons
West Fork
Tygart Valley Riv.
Weston
Elkins
WEST VIRGINIA
OHIO
DIKES ETC.
ALLEG. RIVER
Miles
① Nicholson 38
② Cowanshannock 49
③ Red Bank 64
④ Pithole 143
⑤ Tionesta 152
⑥ Hickory 160
⑦ Cornplanter 208
⑧ Corydon 212
INDEX MAP
RIVER AND HARBOR WORKS
Pittsburgh, Pa. District
1912
Scale
10 0 20 40 Miles
80°
79°
42°
41°
40°
39°

FF.—PITTSBURGH, PA., DISTRICT.

In charge of U. S. Engineer Office,
Pittsburgh, Pa.

NOTE—This group begins on left bank of Ohio R., vicinity of Wheeling, W. Va., at Dam No. 10; list of waterways proceeds to Pittsburgh, Pa., thence by tributaries thereof, returning by right bank of Ohio R. to vicinity of Dam No. 10, at Steubenville, Ohio.

FF 1 Ohio R. (see Dist. CC)
FF 2 Ohio R., Locks and Dams Nos. 10 to 1 (see Dist. CC)
FF 3 Raccoon Cr., Pa. (1)
FF 4 Chartiers Cr., Pa. (1)
FF 5 Ohio R., junction, at Pittsburgh, Pa., of Allegheny and Monongahela Rs. (1)
FF 6 Monongahela R., Pa. (1)
FF 7 Tenmile Cr., Pa. (6)
FF 8 Dunkard Cr., Pa. and W. Va. (6)
FF 9 Buffalo Cr., W. Va. (6)
FF 10 Junction of W. Fork and Tygarts Valley Rs., W. Va. (6)
FF 11 West Fork R., W. Va. (6)
FF 12 Tygarts Valley R., W. Va. (6)
FF 13 Buckhannon R., W. Va. (12)
FF 14 Cheat R., Pa. and W. Va. (6)
FF 15 Youghiogheny R., Pa. and Md. (6)
FF 16 Castleman R., Pa. and Md. (15)
FF 17 Indian Cr., Pa. (15)
FF 18 Turtle Cr., Pa. (6)
FF 19 Pittsburgh, Pa. (1) (6) (20)
FF 20 Allegheny R., Pa. (1) (19)
FF 21 Kiskiminetas R., Pa. (20)
FF 22 Loyalhanna Cr., Pa. (21)
FF 23 Black Lick Cr., Pa. (21)
FF 24 Conemaugh R., Pa. (21)
FF 25 Stony Cr., Pa. (24)
FF 26 Crooked Cr., Pa. (20)
FF 27 Mahoning Cr., Pa. (20)
FF 28 Red Bank Cr., Pa. (20)
FF 29 Clarion R., Pa. (20)
FF 30 Tionesta R., Pa. (20)
FF 31 Tuna Cr., Pa. (20)
FF 32 Oswayo Cr., N. Y. and Pa. (20)
FF 33 Conewango Cr., N. Y. and Pa. (20)
FF 34 Broken Straw Cr., N. Y. and Pa (20)
FF 35 Oil Cr., Pa. (20)
FF 36 French Cr., Pa. and N. Y. (20)
FF 37 Buffalo Cr., Pa. (20)
FF 38 Beaver R., Ohio and Pa. (1)
FF 39 Connoquenessing Cr., Pa. (38)
FF 40 Shenango R., Ohio and Pa. (38)
FF 41 Mahoning R., Ohio and Pa. (38)
FF 42 Little Beaver R., Ohio and Pa. (1)

FF-6 MONONGAHELA RIVER, PA. AND W. VA.

Part.	Title.	Period.	Appropriations.
a	List of notable points—mouth to headwaters		
b	Monongahela R., Pa. and W. Va.	1825–1900	$1,257,900.00
c	Monongahela R., Lock and Dam No. 7	1888	[1] 166,733.13
d	Monongahela R., Lock and Dam No. 6	1890–1897	[1] 167,000.00
e	Monongahela R., purchase of canal system	1896–1898	3,766,615.46
f	Monongahela R., Pa.	1898–1912	2,237,605.00
g	Monongahela R., W. Va.	1898–1912	450,000.00
h	Monongahela R., operating and care of locks and dams	1885–1912	3,541,231.08
	Total		1,587,084.67

Part (a), FF-6 Notable Points, Mouth to Headwaters.

Ohio R., Pa.
Pittsburgh, Pa.
Locks and Dams 1, 2.
McKeesport, Pa.
Youghiogheny R., Pa.
Lock and Dam 3.
Monongahela City, Pa.
Lock and Dam 4.
Charleroi, Pa.
Brownsville, Pa.
Locks and Dams 5, 6, 7, 8.
Cheat R., Pa. and W. Va.
Lock and Dam 9.
Morgantown, W. Va.
Deckers Cr., W. Va.
Locks and Dams 10, 11, 12, 13, 14, 15.
Fairmont, W. Va.
Tygarts Valley R., W. Va.
West Fork R., W. Va.

[1] Only $5,301.36 expended; full purchase price included in Part e.

Part (b), FF-6 Monongahela River, Pa. and W. Va.

APPROPRIATIONS.[1]

1872,	$25,000,	**73,** 503.
1873,	66,000,	**73,** 503.
1874,	25,000,	**74,** 66, 482.
1875,	22,000,	**75,** 72, 738.
1878,	25,000,	**78,** 806.
1879,	24,000,	**79,** 145, 1346.
1880,	25,000,	**80,** 1764.
1881,	25,000,	**81,** 1945.
1882,	25,000,	**82,** 1931.
1884,	45,000,	**84,** 1701.
1886,	90,900,	**86,** 1542.
1888,	35,000,	**88,** 1677.
1892,	25,000,	**92,** 1985.
1894,	20,000,	**95,** 2398.
1896,	30,000,	**96,** 2136.
1897,	350,000,	**97,** 2385.
1898,	400,000,	**98,** 2175.
Total,	1,257,900	

COMMERCE.

Important, **72,** 417, 418; **76,** ii, 132, 135, 139.

Value of coal formation reached by, **76,** ii, 133, 139.

Method and cost of transportation of, **76,** ii, 133, 134.

Value and importance of works of Monongahela Navigation Co., **87,** 1802, 1805.

C. movement on the Lower Monongahela, 1884 to 1891, **92,** 1986.

Great natural resources of the adjacent country depend on the navigability of the R. for development, **95,** 2397.

C. accommodated at Lock No. 9 during 1898, 33,543 t.; 1899, 41,503 t.; and 1900, 57,211 t., **00,** 478.

CONTRACTS. (See Projects.)

1873. Smith, Hawkins & Davis, lock (except lift and miter walls) at Hoards Rocks, $54,641.75, to be completed Dec., 1874, **73,** 503. Time extended to Dec., 1875, **75,** 72, 735. Extended to June 20, 1876, and completed, **76,** ii, 54.

1876. Smith & Hawkins. st. dam at Hoards Rocks. In July, 1876, for lack of reasonable progress, contract was annulled and work prosecuted with hired labor, **76,** ii, 55.

1881. Shipman & Carmody, st., **81,** 1944.

1888. Mapel Bros. & Titus. white oak timber, $39.97 1,000′ b. m., **89,** 1880.

1889. C. T. McDonald, lock and dam constr., $38,727; Lambert Bros. & Co., furnishing operating machinery for Lock No. 8, $3,889, **89,** 1881.

1897. C. I. McDonald, Locks and Dams Nos. 10 to 15, $600,814, **98,** 2181. Annulled May 31, 1900, **00,** 3226.

ENGINEERS.

Chief of Engineers. R., 71, 60; **72,** 57; **73,** 59; **74,** 65; **75,** 72, 73; **76,** 89; **77,** 94; **78,** 107; **79,** 144; **80,** 193; **81,** 261; **82,** 256; **83,** 263; **84,** 262; **85,** 282; **86,** 273; **87,** 238, 239; **88,** 215; **89,** 251, 254; **90,** 226; **91,** 290, 291; **92,** 278, 279; **93,** 313; **94,** 290; **95,** 323; **96,** 279; **97,** 359; **98,** 373; **99,** 417; **00,** 477.

Boards:

1874. Recom. trial of movable dams with hydraulic gates in connection with navigable chute on Dam No. 1 of the Monongahela Navigation Co.; US. to pay half the cost of experiment, and if successful the company to become owners of the dam, **74,** 480. (See Ohio River. Board of Engineers.)

Convened, Pittsburgh, Dec. 21, 1886, by S. O. No. 112, C. of E., to report upon C. value and importance of works of Monongahela Navigation Co. **R., 87,** 1802. (Majs. King, Stickney, and Mackenzie.)

In charge:

Maj. W. E. Merrill, 1872–92. **R., 72,** 412; **73,** 503, 504; **74,** 481; **75,** 735; **76,** ii, 54, 129; **77,** 662; **78,** 805; **79,** 1344; (Lt. Col.) **80,** 1763; **81,** 1943; **82,** 1929; **83,** 1548; **84,** 1699, 1701; **85,** 1813, 1817; **86,** 1542, 1543; **87,** 1800–1809; **88,** 1676, 1678; **89,** 1879, 1882, 1904; **90,** 2190, 2192, 2193; **91,** 2355, 2357, 2359, 2360.

Maj. A. Stickney, 1892–93. **R., 92,** 1984, 1986, 1989; (Lt. Col.) **93,** 2488.

Capt. R. L. Hoxie, 1894–96. **R., 94,** 1903; **95,** 2396; (Maj.) **96,** 2134.

Maj. C. F. Powell, 1897–. **R., 97,** 2383; **98,** 2173; **99,** 2373; **00,** 3225.

Assistants:

C. Reichspfarr, **72,** 414.

E. A. Chase, **72,** 414.

J. F. Wilson, **72,** 414.

S. Petitdidier, **75,** 735; **76,** ii, 131.

J. E. Bell, **76,** ii, 54.

T. P. Roberts, **76,** ii, 129. **R., 76,** ii, 131.

W. Weston, **79,** 1344.

L. M. Petitdidier. **R., 85,** 1816.

P. J. Schopp. **R., 88,** 1677; **89,** 1881, 1884.

P. Golay. **R., 91,** 2358; **92,** 1987; **93,** 2489; **94,** 1905; **95,** 2397.

J. W. Arras. **R., 92,** 1988; **93,** 2489; **94,** 1905; **95,** 2397; **96,** 2135.

ESTIMATES. (See Projects.)

By Maj. Merrill, 1872. Extending slack-water navigation, Jacobs Creek to Morgantown, 18½ m., with 3 locks and dams, $270,000. less obligation of canal company, $160,000, leaving cost of Lock and Dam No. 9 to US. $110,000, **72,** 417. Revised, 1873, for change in location, $137,000, **73,** 505.

Change in proj., 1874, by which U. S. assumed cost of constr. of Lock and Dam No. 8; est. of lock, $110,000, **74,** 482; **75,** 737. Revised for extra d. of foundation and difficulty of obtaining st., $115,000; cost of lock and dam, $189,000, **75,** 72, 737; **77,** 663. Constr. of Dam No. 9 exceeded est.; cause, **76,** ii, 56; **77,** 662; **78,** 806.

Proj. of 1874 increased, 1875, by extension of slack-water navigation from Morgantown to Fairmont, 25 m., with 6 locks and dams; est., $780,000, **76,** ii, 131.

LEGAL PROCEEDINGS. (See Obstructions.)

Purchase of land, **98,** 2174.

LEGISLATION.

Charter granted by Pa. to Monongahela Navigation Co., 1836; subsequently modified, **72,** 413.

Act Aug. 11, 1888, au. purchase of Lock and Dam No. 7, **90,** 2193.

OBSTRUCTIONS.

Encroachments upon Pittsburgh H. (list of persons or firms stopped from dumping in the R.), **93,** 2490; **94,** 1905; **95,** 2397; **96,** 2135; **97,** 2384.

List of brs. au., under constr., and completed, **93,** 2490; **94,** 1907; **95,** 2399, 2400; **96,** 2137, 2138; **97,** 2407, 2408.

OPERATIONS.

1874–75. Lock No. 9 at Hoards Rocks; completion of, delayed, and time extended, **75,** 735. Quarrying st. for dam commenced, **75,** 72, 735.

1875–76. Lock No. 9 completed June 20, 1876, **76,** ii, 54. After unsatisfactory attempts to build dam by hired labor a contract awarded; after a month's operations work resumed with hired labor, **76,** 89, ii, 55.

1876–77. Timber for lock gates and machinery ready, but not in place; dam about one-third completed when exhaustion of funds caused suspension of work, **77,** 94. 662.

1878–79. Resumption of work on Lock No. 9 (Hoards Rocks); no work done since 1876, **79,** 1344.

1879–80. Lock and Dam No. 9 completed, **80,** 1763.

1882–83. Cofferdam built for Lock No. 8, foundations for lock wall, cross wall at lock head, and 32 l. f. of wing wall built, **83,** 1548.

[1] Partial app. increase the cost of the work, **73,** 505.

1883-84. Care and operation of Lock and Dam No. 9, **84,** 1701.

1884-85. 5,460 c. y. masonry placed in Lock No. 8, completing the lock, with the exception of lower wing wall. **85,** 1813.

Care and operation of Lock and Dam No. 9, **85,** 1817.

1885-86. Care and operation of Lock and Dam No. 9, **86,** 1543.

1886-87. Wing wall of Lock No. 9 completed to 14′ above lower miter sill, **87,** 1800.

Care and operation of Dam No. 9, **87,** 1809.

1887-88. R. and wing walls completed; 3,791 c. y. masonry laid; retaining wall and abutment finished, **88,** 1678.

Operation and care of Lock and Dam No. 9, **88,** 1678.

1888-89. Land wall and lock chamber completed, **89,** 1881.

Operation and care of Lock and Dam No. 9. **89,** 1882.

1889-90. Lock and Dam No. 8 completed.

Operation and care of Locks and Dams Nos. 8 and 9, **90,** 2190, 2192.

1890-91. Two lock-keepers' houses built at Lock No. 8, and guiding crib below land wall raised and extended into the bank.

Operation and care of Locks and Dams Nos. 8 and 9.

Purchase of Locks and Dams Nos. 6 and 7, **91,** 2355–2360.

1891-92. Operation and care of locks and dams, **92,** 1986.

1896-97. 2,000 c. y. dr. at Smithfield St. Br., **97,** 2385.

1897-98. Work commenced on Lock No. 10, **98,** 2174.

1898-99. Work on Locks Nos. 10 and 11 in progress, and 181 addl. borings made at sites for Locks and Dams Nos. 13 to 15. **99,** 2374.

1899-00. Work on Locks Nos. 10 and 11 continued till Nov., 1899, when contractor stopped work. (See Contracts.) Irons for Locks Nos. 11 and 12 prepared, **00,** 3226.

PHYSICAL CHARACTERISTICS.

Description of R. Distances from Pittsburgh; tributaries, **72,** 413; **76,** ii, 138; **76,** ii, 131.

Slope of water surface, **72,** 414; **76,** ii, 131–138.

Thickness of coal beds in valley of, **72,** 418; **74,** 545; **76,** ii, 131, 138.

Height of h. w. at Morgantown, **76,** ii, 137.

Divide bet. n. branch of Potomac R. and Monongahela, **74,** 494, 500, 513, 545.

Rainfall in valley of the Ohio and its tributaries, **74,** 507, 520, 523, 532; **76,** ii, 100.

Description of, vicinity of proposed Lock and Dam No. 10, **93,** 2489; **94,** 1905.

Description of, part formerly controlled by navigation company, **97,** 2384.

Shoaling of chans. and formation of bars helped by material dumped into the stream at Pittsburgh and vicinity, **97,** 2384.

PRIVATE (CORPORATE) WORK.

1836. Monongahela Navigation Co. chartered by Pa. for purpose of extending slack-water navigation from mouth of the Monongahela R. to State line of Va., 92½ m.

1872. Monongahela Navigation Co. had extended a 4′—and partly 6′—d. from mouth of R. to 84 m. above, with 6 dams and 8 locks, locks being 50′ x 190′, and 56′ x 250′, lifting 62′, **72,** 413.

Obligation of the Monongahela Navigation Co. to extend the imp. to Va. line, **72,** 413, 415; **73,** 503. Company proposed to build but 1 dam in place of 2, as recom. by Maj. Merrill (see Projects), with lift of 16′, **73,** 504.

Use of Dam No. 1 tendered to the U. S. by the Monongahela Navigation Co. for experiments with movable dams with navigable sluices; acceptance of the same recom. by BE. See Board of Engineers Ohio R., **74,** 480; **75,** 686. Obligation of company to continue imp., **73,** 504; **79,** 1345.

Company chartered by Va. to extend slack-water navigation from the State line to Clarksburg; nothing done, **72,** 417.

1835. $30,000 expend. by lumber interest in erecting log dams on the West Fork of R. **76,** ii, 131.

Works built by the Monongahela Navigation Co., statements and est. of their value, **87,** 1802.

PROJECTS. (See Estimates.)

By Maj. Merrill, 1872, continuing slack-water navigation to 6′ from Jacobs Creek, limit of the Monongahela Navigation Co. (see Private work) to Morgantown, 18¼ m., to wit: The Monongahela Navigation Co. to constr. Dams and Locks Nos. 7 and 8 of 10½′ lift each, thereby continuing imp. to the Va. line as required by their charter, the U. S. to constr. Lock and Dam No. 9 at Collins Ripple, 4.7 m. above State line, **72,** 416. Subsequent ex. locates Lock and Dam No. 9 at Hoards Rocks, 3½ m. below previous location, **73,** 504. Dams to be of timber, filled with st.; locks to be 50′ x 250′ x 6′, **73,** 505.

Monongahela Navigation Co., 1873, proposed to constr. but a single dam and lock (in place of 2 as above proposed) with lift of 16′, **73,** 503; **79,** 1345.

In view of proposed action of the Monongahela Navigation Co., 1874, Maj. Merrill recom. that U. S. waive obligation of the company to extend the imp. to State line, and as a matter of expediency that the U. S. build Lock and Dam No. 8, but required the company to relinquish control of the R. bet. proposed Dam No. 8 and the State line, and further agreeing to build Lock and Dam No. 7 with 6′ of water over lower miter sill, **74,** 482; **75,** 736; **79,** 1345.

Dam No. 9, 1875, changed from timber to st., and the work done with hired labor, **75,** 735, 736.

Reasons for permanent dams in place of movable, **76,** ii, 130.

Foregoing proj. modified by extension of slack-water navigation from Morgantown to Fairmont, 25 m., by means of 6 locks and dams, lifting 64′, similar to those proposed and in process of constr., viz, Nos. 8 and 9, **76,** ii, 130, 136, 138. (See Estimates.)

From 1872 to 1886, incl., $397,900 app., when cost to complete was est. at $30,376, **86,** 1542. **R.** by BE., 1886, upon the commercial value and importance of the works built by the Monongahela Navigation Co., **87,** 1802, 1808.

Act 1892 app. $25,000 for addl. lock and dam, No. 10, **93,** 2489; the first in a series of 6 proposed by Lt. Col. Merrill, 1889, for completion of slack-water navigation from Morgantown to above Fairmont, 25 m., at an est. of $1,320,000, or an average cost of $220,000 each, **94,** 1904.

Site for No. 10 selected at Falling Run, below Morgantown, after local opposition, **95,** 2396; **97,** 2384. Changed from below Morgantown to site 3,000′ above it, **98,** 2174.

Act 1896 app. $10,000 for location and purchase of sites of 6 locks and dams to be built under continuous contract at a total cost not to exceed $1,200,000, **96,** 2134, 2135.

By Maj. Hoxie, 1896–97, constr. of locks and dams. The lifts for overcoming the 64′ from Fairmont to Pool No. 9 to be 10 and 12′; locks and dams to be of concrete; lock chambers to be 56′ x 177′, with 7′ of water on the lower sills at pool levels and 8′ at upper sills, **97,** 2384.

In 1896–97 small allotment made for dr. shoal at Smithfield St. Br., **97,** 2385.

SURVEYS.

1825. By "Board of internal improvement," in connection with extension of the Chesapeake & Ohio Canal, **74,** 525.

1871. Au. act Congress, Jacobs Creek to Morgantown, 18 m., **71,** 60; **72,** 412, 414. Completed in 1871, **72,** 414.

1875. Ordered, Morgantown to Fairmont, 25 m., **76,** ii, 129.

Ex. above upper dam, W. Va., for slack-water navigation, Morgantown to Fremont; made, 1889, by Lt. Col. Merrill, **89,** 1904.

Minor surs. (See references to reports of Engineers in charge.)

H. lines at Pittsburgh estab. by Sec. of War on recom. of a H.-line board in 1894–95, **95,** 2397; **97,** 2384. (See also Obstructions.)

Bench marks, leveling of 1896, Pool No. 9, to Hoults Mill, **97,** 2407; leveling of 1897, Hoults Mill to near head of R., **98,** 2182.

Part (c), FF-6 Monongahela River, Pa.; Lock and Dam No. 7, Purchase of.

APPROPRIATIONS.

1888, [1] $166,733.13, **88,** 1677.

Part (d), FF-6 Monongahela River; Lock and Dam No. 6, Purchase of.

APPROPRIATIONS.

1890, [2] $167,000, **91,** 2360.

ENGINEERS. (See Part c.)

PROJECTS.

Purchase of this work dependent on acquirement of Lock and Dam No. 7. (See Part c.)

In 1897 Maj. Powell recom., since whole system of locks and dams of which this work is a part had been purchased by U. S., the money app. for the purchase of this lock and dam be turned into the Treas., **97,** 2411.

LEGAL PROCEEDINGS.

Condemnation proceedings (U. S. v. Monongahela Navigation Co.) for purchase of lock and dam. Value of work fixed at $209,000, excl. of value of franchise of company in 1890. Judgment reversed by higher court in 1892 and new trial granted, **93,** 2496.

ENGINEERS.

Chief of Engineers. R., 93, 314; **94,** 291; **95,** 324; **96,** 280; **97,** 361.

In charge:

Lt. Col. A. Stickney, 1892–93. **R., 93,** 2495.

Capt. R. L. Hoxie, 1894–96. **R., 94,** 1911; **95,** 2403; (Maj.) **96,** 2141.

Maj. C. F. Powell, 1897–98. **R., 97,** 2411.

Part (e), FF-6 Monongahela River, W. Va. and Pa. (Purchase of slack-water system of Monongahela Navigation Co.)

APPROPRIATIONS.

1896, [3] $3,766,615.46, **98,** 2188.

COMMERCE.

Description of, part affected by works of the company, and great C. importance of free navigation for part affected, **96,** 2150.

R. shown to have traffic next in order to that of St. Marys Falls Canal, in the interior waterways of the US., **97,** 2420.

ENGINEERS.

Chief of Engineers. R., 95, 325; **96,** 280, 281; **97,** 361; **98,** 374.

In charge:

Maj. R. L. Hoxie, 1895–96. **R., 96,** 2141.

Maj. C. F. Powell, 1897. **R., 97,** 2411.

LEGAL PROCEEDINGS.

Condemnation proceedings, 1896–97. Award of $3,761,615.46 made, and final judgment entered for $3,601,615.46, remainder of award to be retained by U. S. as security for the cancellation of outstanding bonds issued by the company, **97,** 2411.

PROJECTS.

Act 1896 au. acquirement of property, and the taking of written, sworn testimony as to its value. The latter est. at from $3,634,720 to $5,000,000, excl. of bonded indebtedness of company, **96,** 2142, 2196.

Description of property, **96,** 2144; **97,** 2412.

Comparative statement of approx. cost and tonnage of certain canals and slack-water imps. in US., incl. also Suez Canal, **96,** 2144.

Maj. Powell, 1897, est. $1,820,797.67 for necessary enlargements and imp. of the system purchased **97,** 2422.

SURVEYS. (See Projects.)

Part (f), FF-6 Monongahela River, Pa.

APPROPRIATIONS.

1899,	[4] $50,000,	**99,** 2376.
1900,	135,556,	**00,** 3230.
1902,	200,000,	**02,** 1884.
1903,	455,961,	**03,** 1659.
1905	7,850	**05,** 1830.
1905	200,000	
1906,	389,196,	**06,** 1576.
1907,	256,042,	**07,** 1683.
1908,	300,000,	**08,** 1764.
1909,	200,000,	**09,** 1757.
1910,	43,000,	**10,** 1920.
Total,	2,237,605	

COMMERCE.

Traffic delayed and restricted by insufficient capacity and conveniences of the locks, and in the pool channels. T. of R. about 7,000,000, **99,** 2376.

Hindered by the inadequate capacity of Locks 1, 3, 4, and 5, **04,** 2543.

Effect of imp. on rates, **06,** 516.

CONTRACTS.

1902. M. A. Sweeney Shipyard & Foundry Co., building dr. hull and furnishing and installing machinery, $19,740; Oscar F. Barrett, 2 wooden side-dump scows, $7,200 for 2, **02,** 1884. Thomas

[1] $5,000 was app. in 1888 for expenses of condemnation. Only part of this was used, but the whole amount is included in the above sum. See footnote on p. 1003.

[2] $5,000 for condemnation expenses included in this sum. See footnote on p. 1003.

[3] $5,000 of this sum was for condemnation expenses, and only part of it was used; $120,000 of the sum was to be retained as security for cancellation of certain outstanding bonds of the navigation company.

[4] Imp. Locks 3 and 6 and for floating plant.

M. Rees, building steel single-hull repair steamer with snagging appliances, $51,800, **03,** 1659.

1904. Dravo Contracting Co., building a lock below Turtle Creek, **04,** 2501. Sterrit-Thomas Foundry Co., iron, steel, and bronze work for Lock No. 2, **05,** 1830. American Bridge Co., building and erecting 4 pairs of lock gates and anchorages, **05,** 1831.

1905. James Rees & Sons Co., 4 windlass and 2 capstan engines, $6,340; Dravo Contracting Co., building lock with 2 chambers, 2 guide walls, and guard wall, near Elizabeth, Pa., **05,** 1831. Penn Bridge Co., steel movable top for Dam No. 2; James Rees & Sons Co., 4 Otis capstan engines, $3,460 for 4; James Rees & Sons Co., 6 Otis windlass engines, $6,720; Dravo, Doyle & Co., furnishing and installing system of air-compressing machinery, $14,717; T. J. Williams, power house at new Lock No. 2, $5,558, **06,** 1577.

1906. N. D. Yant & Co., steel lock gates and anchorages, **06,** 1577. N. D. Yant & Co., lock gates and anchorages; Rodgers Sand Co., sand and gravel, 2¢ and 1¼¢ bu., resp.; Runkle & Wright, piles, 12½¢ l. f.; McClure Timber Co., oak timber, $30 M f.; T. D. Collins, beech timber, 20′ l., $19.50 M; 30′ l., $25.50 M f., **06,** 1578. D. J. Kennedy Co., cement, 40¢ sack of 95 lbs.; J. & J. B. Milholland Co., 2 right-hand air engines, $2,020; J. & J. B. Milholland Co., 2 left-hand air engines, $2,020, **06,** 1579. Bair & Gazzam Mfg. Co., 8 cylindrical valves, $4,032.05; B. F. Jacobs Lumber Co., building 2 lock-keepers' houses at new Lock No. 3, $6,700 each; Hall Steam Pump Co., compressed-air machinery, $11,349; Dravo Contracting Co., concrete foundation and floor for power house at new Lock No. 3; Joseph Moscarelli, power house at new Lock No. 3, $7,657, **07,** 1686. J. & J. B. Milholland Co., 8 sets gate-opening machinery, $5,400, **07,** 1687.

1907. Penn Bridge Co., steel movable top for dam at new Lock No. 3, **07,** 1687. H. E. Talbott & Co., building lock, 2 guide walls, and 2 guard walls at Brownsville (new Lock No. 5), **08,** 1765.

1909. J. & J. B. Milholland Co., lock-operating machinery for Lock No. 5, $14,938.66; Pittsburgh Bridge & Iron Works, 5 pairs steel lock gates, $20,894, **09,** 1758. Hall Steam Pump Co., furnishing and installing water-power air-compressor plant at Lock No. 5, $5,120, **10,** 1921.

1910. H. R. Norman, building 2 lock houses at Lock No. 5, $5,967.54 each, **11,** 2107.

ENGINEERS.

Chief of Engineers. R., 99, 418; **00,** 478; **01,** 478; **02,** 402; **03,** 429; **04,** 458, 470, 2540; **05,** 468; **06,** 514; **07,** 543; **08,** 579; **09,** 613; **10,** 686; **11,** 739; **12,** 890.

Boards. Convened, Pittsburgh, Pa., Feb. 19, 1903, by S. O. No. 23, to select suitable site for lock and dam; recom. site at Carnegie Steel Co.'s landing, **03,** 1658.

In charge:

Maj. C. F. Powell, 1899–1901. **R., 99,** 2375; **00,** 3228; **01,** 2683.

Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1883; **03,** 1658; (Maj.) **04,** 2499, 2541, 2545; **05,** 1827; **06,** 1573.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1681; **08,** 1761; **09,** 1754; (Lt. Col.) **10,** 1916; **11,** 2105; **12,** 2297.

LEGAL PROCEEDINGS.

Negotiations pending for R. frontage, the purchase of which is necessary before building the guide wall and extension of No. 6 lock walls, **00,** 479.

OPERATIONS.

1899–00. Enlarging and imp. Lock No. 6; at Lock No. 3 in progress; some work done on foundation for the guide-wall extension and on crib-deflecting dike, **00,** 3228, 3229.

1900–01. Enlargement and imp. of Lock No. 6 almost completed; lock walls extended at lower ends, lower gates rebuilt and hung in new position, concrete guide wall constr. below lock; rock bottom in and out of lock chamber excavated to new d.; old crib outside R. wall replaced by new crib, and wall strengthened with concrete, **01,** 2683. At Lock No. 3, deflecting dike and fender-crib extension completed, **01,** 2683. Difficulties encountered, **01,** 2684.

1901–02. Guide wall at Lock No. 6 completed, **02,** 1883.

1902–03. 2 dump scows and dr. completed, **03,** 1658.

1903–04. Snagging steamer completed: temporary water intake built at Carnegie Steel Works, **04,** 2499. Excavation started for new Lock and Dam No. 2, **04,** 2500.

1904–05. At new Lock No. 2, pile foundation completed; middle and R. walls completed and land wall almost completed; crib protection to R. wall placed; part of upper guard wall built and piles driven for foundation of upper guide wall, **05,** 1827. Abutment wall and core walls completed; crib protection placed along lower abutment wall; a 390′ section of dam foundation and 21′ superstr. completed; temporary intake at Carnegie Steel Works extended; land secured for Locks Nos. 3, 5, and 6, and work begun on No. 3, **05,** 1828.

1905–06. New Lock No. 2 completed, and opened to navigation in spring of 1906; 2 unfinished 20′ sections of dam closed by temporary timber bulkheads, and removal of old Lock No. 2 begun, **06,** 1573. Land wall of new Lock No. 3 completed and middle wall commenced; unexpected difficulties in foundations for R. wall; abutments and core walls completed; 246′ section of apron crib placed and concrete work started; imp. at Locks Nos. 3, 6, etc., completed, **06,** 1574, 1575.

1906–07. New Lock and Dam No. 2, with adjustable top, completed, **07,** 1681. New lock, guide and guard walls completed at Lock No. 3; 2 lock houses and power house built and machinery installed; foundation for dam partly completed, **07,** 1681. 4 pairs lock gates erected and machinery installed for operating gates, valves, and movable top; upper and lower entrances dr., **07,** 1682.

1907–08. Dam at new Lock No. 3 completed, except steel movable top, **08,** 1761. Excavation for new Lock No. 5, and work on dam abutments commenced, **08,** 1762. Loss of SS. *Stella Moren* and tow at Lock No. 2 attributed to shortness of upper guide wall, **08,** 1762, 1767.

1908–09. Adjustable steel top placed on dam at Lock No. 3, **09,** 1754. At new Lock No. 5, lower guide wall, land wall, middle wall, 5 miter walls, and 2 core walls completed, and upper guide wall, guard wall, and R. wall almost completed; abutment wall finished and considerable work done on dam; 220′ section of apron crib built and placed, **09,** 1755.

1909–10. Concrete work on locks at new Lock and Dam No. 5 completed and gates hung; power house built and machinery installed; approaches dr.; R. lock opened to navigation Dec., 1909, **10,** 1916. Dam almost completed and slopes above abutment walls paved, **10,** 1919.

1910–11. Extension of upper guide wall completed and work on downstream extension of middle wall in progress at Lock and Dam No. 2; land lock placed in operation July 29, 1910; work on dwellings in progress at Lock and Dam No. 5; work on abutment, Lock No. 6, completed, **11,** 2105–06.

1911–12. Downstream extension of middle wall of Lock and Dam No. 2 completed; 2 lock-keepers' dwellings completed at Lock and Dam No. 5, **12,** 2297–98. Condition of works June 30, 1912, **12,** 892.

PHYSICAL CHARACTERISTICS.

Cause of excessive heights of floods at Turtle Creek, **03,** 1658.

PROJECTS.

By Maj. Powell, 1899, to remove the lower gates back 6′ at Lock No. 6, lowering the sill 12″, or as much thereof as practicable, and lengthening the gate walls 8′ by concrete constr.; to build a short concrete guide wall below the lock in prolongation of land chamber face; to rebuild upper miter sill, floor in head bay, and placing new filling valves and lowering the upper sills 1.6′; to lengthen the

dam 7′; to build a 2½′ high movable dam on fixed dam, and to make other but smaller imps. at the lock and dam; to extend at Lock No. 3, upper guide and mooring crib 300′ by a concrete wall on timber-floored piling, and to build a timber-crib deflecting dike about 133′ l. above lock; to build a repair steamer with snagging appliances and dipper dr., and 2 dump scows; est., $185,556, **00,** 479.

Maj. Powell est., 1900, $12,500 to purchase a shallow R. lot below Lock No. 1, and about $30,000 to purchase shore strips, **00,** 3230.

Act June 13, 1902, au. rebuilding Lock and Dam No. 2; est., $655,961,[1] **03,** 430.

Owing to increase in C. traffic, Lock No. 4 inadequate; should be rebuilt, **11,** 740.

SURVEYS.

Bench marks, **00,** 3231.

By Capt. Sibert, 1902, for new lock and dam at site below old Lock No. 2, **03,** 1658.

Ex. of Locks and Dams Nos. 1, 3, 4, and 5, made au. act June 13, 1902, by Maj. Sibert; and plan and est. of $2,118,791 presented (see Monongahela River, Pa. and W. Va., operating and care of locks and dams), **04,** 470, 2540.

Reference to ex. and sur. reports, etc., **12,** 891.

Part (g), FF-6 Monongahela River, W. Va.

APPROPRIATIONS.

1902, $350,000, **02,** 1878.
1904, 100,000, **04,** 2494.

Total, 450,000

COMMERCE.

Effect of imp. on., **06,** 514.

CONTRACTS.

1901. T. A. Gillespie, building Locks and Dams Nos. 12 and 13; Baker & Judson, completing Locks and Dams Nos. 10 and 11, **01,** 2682. T. A. Gillespie Co., building Locks and Dams Nos. 14 and 15, **02,** 1878.

1902. Rosedale Foundry Co., furnishing 5 sets valve-operating gear and cover plates for Locks 11 to 15; Chas. Hegewald Co., furnishing 3 sets lock-gate irons for Locks 13, 14, and 15; Chas. Hegewald Co., 6 sets gate-maneuvering gear for Locks 10 to 15; Joseph J. Wharton, building 2 lock-tenders' dwellings at Lock No. 10, **02,** 1879. Baker & Judson, supple. contract for broken st. for Lock No. 11, $2 c. y.; T. A. Gillespie Co., supple., broken st. at Locks Nos. 12 and 13, $2 c. y.; T. A. Gillespie Co., broken st. at Locks Nos. 14 and 15, $2 c. y.; T. J. Williams, building a dwelling at each of Locks Nos. 11, 12, and 13, $2,890 each, **03,** 1653.

1903. T. J. Williams, building dwelling at Lock No. 15, $3,000, **03,** 1653. Kammerer & Kern, building office building at Lock No. 14, $885; J. J. Wharton, building office building at Lock No. 10, $800, **03,** 1654. Kammerer & Kern, building dwelling at Lock No. 14, $2,982, **04,** 2496.

1904. Kammerer & Kern, building storehouse, shop, and coal house at each of Locks Nos. 10, 12, 13, and 15, and an office at each of Locks Nos. 12, 13, and 15—Lock No. 10, $1,254; Locks Nos. 12 and 13, $2,056 each; Lock No. 15, $2,040, **05,** 1826. Kammerer & Kern, building dwelling and privy at each of Locks Nos. 12, 13, 14, and 15—Locks Nos. 12 and 13, $2,673 each; Lock No. 14, $2,654; Lock No. 15, $2,642, **05,** 1826. Charles G. Lutes, building dwelling and privy at Lock No. 11, $2,650, **05,** 1826. Brady Construction Co., building storehouse, shop, and coal house at each of Locks Nos. 11 and 14, $1,259 each, **05,** 1826. Morgantown Cement Building Block Co., building concrete walks, floors, and steps at Locks Nos. 10 to 15; walks, $1.60 s. y.; floors, 60¢ s. y.; steps, $8 c. y., **05,** 1826.

ENGINEERS.

Chief of Engineers. **R., 01,** 477; **02,** 401; **03,** 427; **04,** 457; **05,** 466; **06,** 513; **07,** 542; **08,** 578; **09,** 612; **10,** 685.

In charge:

Maj. Chas. F. Powell 1901. **R., 01,** 2679.

Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1877; **03,** 1651; (Maj.) **04,** 2494; **05,** 1824; **06,** 1571.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1679; **08,** 1759; **09,** 1753; (Lt. Col.) **10,** 1915.

Assistant. J. L. Callard. **R., 02,** 1880; **03,** 1654; **04,** 2496.

OBSTRUCTIONS.

Obstr. of navigation by Baltimore & Ohio RR. br. at Fairmont, **04,** 457.

OPERATIONS.

1900-01. Extensive repairs and imp. at the unfinished Lock and Dam No. 10; extension built to land crib; protection crib built above locks; lock grounds cleared and graded; wall built across ravine above locks, and 30″ pipe laid to carry off storm water; masonry retaining wall built at foot of hill opposite lock; 4′ concrete core wall built at dam abutment and slope graded and paved, **01,** 2680. Work started at Lock and Dam No. 12, **01,** 2681.

1901-02. Upper and lower guard and guide cribs at Lock No. 10 completed by contractor; right bank of R. above and below dam graded and paved or riprapped; slopes and terrepleins protected by st. paving or grass sodding, and other imp. made, **02,** 1880. Work on Lock No. 11 recommenced and carried on by new contractors; 6,120 c. y. earth, hardpan, and r. excavated, and 4,479 c. y. concrete laid, **02,** 1881. Work on Lock No. 12 continued by contractor; 7,001 c. y. earth, hardpan, and r. excavated; 2,390 c. y. placed in embankments; 10,112 c. y. concrete laid; 1,829 c. y. st. ballast laid; 31 s. y. paving laid; 28,570′ lumber and 1,322 lbs. driftbolts used, **02,** 1882. Work at Lock No. 13 commenced and carried on by contractor; 7,961 c. y. earth, hardpan, and r. excavated; 2,495 c. y. placed in embankment; 6,030 c. y. concrete laid; 495 c. y. st. ballast laid; 26,700′ timber and 1,545 lbs. driftbolts used, **02,** 1882. Work at Lock No. 15 commenced and carried on by contractor; 7,425 c. y. earth and r. excavated; 2,925 c. y. placed in embankment, and 200 c. y. concrete laid, **02,** 1882.

1902-03. At Lock No. 10, pile foundation for upper guide wall, 2 dwellings, and office building completed; left bank below lock riprapped and paving of slopes completed; lower chan. approach dr.; lock gates built and hung; maneuvering gear placed, **03,** 1654. At Lock No. 11, lock walls, lower and upper guide walls, upper guard crib, 317 l. f. dam, and 30 l. f. addl. of foundation completed; retaining wall built along right bank of R. below dam, and bank above partly graded and paved; st. drain completed and gates hung, **03,** 1654. At Lock No. 12, 52 l. f. lock wall, 321 l. f. dam, and foundation for remaining 104′ dam, built; grading and paving of lock grounds and protection of right bank below dam practically completed; lower guide wall built and upper guard crib completed; upper gates built and hung; needle dam fails and gate is wrecked; foundation of dwelling built, **03,** 1655, 1656. At Lock No. 13, lock walls, lower guide walls, and upper guard crib and dam completed; right bank above and below protected by paving and riprap; grading of lock ground and building of gate continued; ledge of r. removed from right bank below dam to avoid washing down bank; foundation of dwelling built, **03,** 1656. Work commenced on Lock No. 14; excavation for lock foundations and grading of

[1] See Monongahela River, Pa. and W. Va., operating and care of locks and dams.

lock grounds about three-fourths completed; upper guide wall, 204 l. f. lock wall, and 60 l. f. dam built; gates partly framed; office building completed and foundations of dwelling built, **03,** 1657. At Lock No. 15, lock walls, lower guide walls, 40 l. f. dam, upper guard crib, and st. drain completed; grading lock grounds two-thirds completed; gates partly framed; dwelling 70% completed, **03,** 1657.

1903-04. At Lock No. 10, dam and fenders for recesses for intermediate gates completed; filling placed in back of upper guide wall, and left bank above dam graded and partly riprapped, **04,** 2496. Lock No. 11, dam completed; right bank of R. protected; lock grounds graded and st. paving partly laid; 1 dwelling completed and the other commenced, **04,** 2497. Lock No. 12, dam and upper guide wall completed; lower gates assembled and hung; fenders for intermediate gates completed; grading of lock grounds and protection of right bank near dam and left bank below dam completed; dwelling completed and sites for remaining buildings cleared and graded, **04,** 2497. Lock No. 13, upper gate hung; lower gates framed and placed in position; grading of lock grounds, st. paving, and protection of right bank of R. near dam completed; dwelling completed and sites for remaining buildings cleared and excavations made for foundations, **04,** 2498. Lock No. 14, lock and dam practically completed; dwelling completed, **04,** 2498. Lock No. 15, work on lock and dam completed; grading and st. paving completed; dwelling completed, **04,** 2499.

1904-05. Various imp. made at Locks 10 to 15, incl. concrete and brick paving, protection to banks and walls, wells, sewers, etc.; dwellings, offices, walks, etc., completed except office at Lock No. 14, **05,** 1824.

1905-06. Various minor imp. by grading, paving, and protecting banks at Locks Nos. 10 to 15, incl., **06,** 1571.

1906-07. Lower guide cribs and walls at Locks Nos. 10, 11, 13, and 15 raised 6′, and lengthened, **07,** 1679.

1909-10. Core wall at Lock No. 12 raised and upper guide wall at Lock No. 13 built, **10,** 1915.

SURVEYS.

Record of elevations along R. from Morgantown to Lock No. 9, **02,** 1880.

Part (h), FF-6 Monongahela River, Pa. and W. Va., Locks and Dams on. (Operating and care.)

APPROPRIATIONS.[1]

1885,	$10,091.78	H. D. 421, 57th, 2d.
1886,	1,008.22	
1887,	2,293.34	
1888,	10,800.14	
1889,	8,804.10	
1890,	4,352.43	
1891,	11,556.57	
1892,	22,415.15	
1893,	20,835.54	
1894,	33,252.75	
1895,	16,636.71	
1896,	14,842.79	
1897,	24,851.71	
1898,	105,986.72	
1899,	148,755.13	
1900,	141,558.00	
1901,	159,496.37, **01,** 2694.	
1902,	191,916.23, **02,** 1886.	
1903	238,816.16, **03,** 1664.	
1904,	292,149.13, **04,** 2506.	
1905,	234,070.41, **05,** 1832.	
1906,	249,625.71, **06,** 1583.	
1907,	242,365.62, **07,** 1693.	
1908,	253,701.36, **08,** 1770.	
1909,	231,966.81, **09,** 1764.	
1910,	191,298.57, **10,** 1926.	
1911,	376,302.72, **11,** 2114.	
1912,	301,480.91, **12,** 2305.	
Total,	3,541,231.08	

COMMERCE.

After the abolition of the tolls on the lock and dam system acquired in 1897, there was a marked increase in traffic, **98,** 2182.

Description of and effect on rates, **10,** 690.

1911, 10,747,041 t., **12,** 2308.

Effect on f. rates very great. By water on Monongahela R. coal is carried at 10¢ t., hauls not exceeding 7 m., and on the Allegheny R., which is unimp., about 35¢ t., **12,** 894.

CONTRACTS.

1893. J. M. Deffenbaugh, 2 frame houses, $6,500, **93,** 2495.

1902. Inland Marine Construction Co., hull and upper work of stern-wheel repair boat, $9,200, **02,** 1886. W. C. Jutte, dr., in Pool No. 1, 13.6¢; Pool No. 2, 14.5¢; Pools Nos. 3, 4, and 5, 15.5¢ c. y.; Pittsburgh Dredging & Construction Co., dr., 11¢ c. y., **02,** 1887. Charleroi Lumber Co., building office building and dwelling at Lock No. 4; office, $1,170; dwelling, $2,950, **03,** 1664.

1903. Darrah Bros., building office at each of Locks Nos. 8 and 9, $800 each; additions, $987; George B. Darrah, building dwelling at Lock No. 7, and additions to dwellings at Lock No. 8; dwelling, $2,500; additions, $1,000; James Rees & Sons Co., 2 boilers and placing same on US. repair boat *Slackwater*, $2,650, **03,** 1665.

1904. American Bridge Co., steel lock gate and anchorages, **04,** 2507. Lawrence D. Weaning, steel lock gate and anchorage, **05,** 1832.

1906. J. M. Hammit, wooden hull towboat, $17,370, **06,** 1582.

1909. Johnson & Anderson, building 2 lock houses at Lock No. 2, **09,** 1768. J. & J. B. Milholland Co., lock-gate operating machinery for Lock No. 1, $4,379.35, **10,** 1929. W. N. Kratzer & Co., furnishing and erecting lock gates at Lock No. 1, $10,000, **10,** 1930. American Compressor & Pump Co., furnishing and installing air-compressor plant at Lock No. 1, $2,981, **10,** 1930.

1911. Hall Steam Pump Co., water-power air-compressor plant, $3,412.75, **11,** 2117.

ENGINEERS.

Chief of Engineers. R., 93, 314; **94,** 291; **95,** 324; **96,** 280; **97,** 360; **98,** 374; **99,** 419; **00,** 480; **01,** 479; **02,** 404; **03,** 431; **04,** 460, 2540; **05,** 471; **06,** 517; **07,** 546; **08,** 583; **09,** 616; **10,** 689; **11,** 742; **12,** 893.

Boards. BERH. **R., 04,** 2544.

In charge:

Lt. Col. A. Stickney, 1892–93. **R., 93,** 2492.

Capt. R. L. Hoxie, 1894–96. **R., 94,** 1908; (Maj.) **95,** 2400; **96,** 2138.

Maj. C. F. Powell, 1897–1901. **R., 97,** 2409; **98,** 2182; **99,** 2376; **00,** 3233; **01,** 2686.

Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1884; **03,** 1660; (Maj.) **04,** 2502; **05,** 1831; **06,** 1579.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1687; **08,** 1765; **09,** 1758; (Lt. Col.) **10,** 1921; **11,** 2107; **12,** 2298.

Assistants:

P. Golay. **R., 93,** 2493; **94,** 1909; **95,** 2401; **96,** 2139; **97,** 2409.

Thomas P. Roberts. **R., 02,** 1890; **05,** 1835.

J. L. Callard. **R., 05,** 1837.

[1] Expend. under permanent-indefinite app. provided by act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

LEGAL PROCEEDINGS.

By decision of Feb. 21, 1910, Supreme Court of U. S. sustained War Dept. in controversy with owners of highway br. at Brownsville, Pa., **10,** 1925.

OBSTRUCTIONS.

List of brs. across the R. and its tributaries au. and constr., **98,** 2200.

Monongahela Bridge Co. removed br. over R. at Brownsville, Pa., by orders of Sec. of War and Supreme Court, **11,** 2113.

OPERATIONS.

1892-93. Misc. repairs made; over 10,000 c. y. dr., and some buildings erected, **93,** 2493.

1893-94. About 335 t. snags, etc., removed; 9,560 c. y. dr.; buildings and machinery repaired, and other misc. work done, **94,** 1908, 1909.

1894-95. 2,437 t. snags, etc., removed, and repairs made to machinery, etc., **95,** 2401.

1895-96. Misc. work done, **96,** 2139.

1896-97. Misc. repairs made, and a small amount of dr. done, **97,** 2409.

1897-98. Locks 1 to 7, incl., operated by the US. from July 7. Repairs made to Locks and Dams Nos. 1 to 9, incl.; 7,900 c. y. dr.; 368 snags removed, and 19 wrecks removed, **98,** 2183, 2187.

1898-99. Repairs made to Locks and Dams Nos. 1 to 9, incl.; 7 new lock gates and a derrick boat built; 68,082 c. y. dr.; 59 snags, 10 wrecks, and part of a large floating dry dock removed, **99,** 2382.

1899-00. Repairs made to Locks and Dams Nos. 1 to 9, incl.; 8 new lock gates constr.; timber shed and a warehouse built; 45,510 c. y. dr.; 9 wrecks removed, and 169 snags and other obstr. removed, **00,** 3238.

1900-01. Extensive repairs and imp. at and about Locks and Dams Nos. 1 to 9 incl., except No. 6, **01,** 2687. Old shore guide crib protected by extensive pile work, **01,** 2688. At Lock No. 4, upper guard crib removed and old lower shore guide crib removed and partly replaced with new cribwork, **01,** 2689. At Lock No. 7, 4 new lock gates built and hung, new guide wall below locks, and masonry retaining wall opposite lock built, and abutment slopes protected with riprap and riprap paving, **01,** 2690. At Lock No. 9, both banks below dam protected with riprap; lower gates repaired, **01,** 2691. 32,223 c. y. dr.; 229 snags and stumps, and 25 wrecks, coal tipples, etc., removed; list of permits granted, **01,** 2692.

1901-02. List of brs. au., **02,** 1890. Extensive repairs and imp. at and about Locks and Dams Nos. 1 to 9, incl., except No. 6, **02,** 1891. Beacons built, **02,** 1894. 77,275 c. y. dr., **02,** 1894. 639 snags, trees and stumps, and 4 wrecks removed, **02,** 1895.

1902-03. Extensive repairs and imp. at and about Locks and Dams Nos. 1 to 9, incl.; at Lock No. 1, shore guide crib and engine house reconstr.; at No. 4, section of guide crib reconstr., roadway graded, concrete wall built, old dwelling razed and new one erected, **03,** 1660. R. wall of Lock No. 9 strengthened with concrete, **03,** 1661. Derrick boat and quarterboat built, repairs made to floating plant, and additions made to shop, **03,** 1662. 40,824 c. y. dr., 213 snags, trees, and stumps, and 5 wrecks removed, **03,** 1663.

1903-04. Minor repairs and imp. at Locks Nos. 1 to 3; serious leaks in Nos. 2 and 3 repaired, **04,** 2502. Dam at Lock No. 4 raised 18″ and lengthened 100′; bank further protected by concrete wall; damages caused by SS. *Edgar Cherry;* 3,000 c. y. r, and 4,000 c. y. sand and gravel removed from chan.; minor repairs and imp. at Locks Nos. 4 to 6, **04,** 2503. New dwelling and guard crib at Lock No. 7 completed; upper guide crib built and upper guard crib rebuilt at Lock No. 8; office and addition to dwelling completed; minor repairs and imp. to Locks Nos. 8 and 9, **04,** 2504. Locks Nos. 10 to 15, incl., opened to navigation Jan., 1904, **04,** 2504. 70,120 c. y. dr., 431 snags, trees, and stumps, and 4 wrecks removed, **04,** 2505.

1904-05. Minor repairs and imp. at Locks Nos. 1 to 15, incl., **05,** 1835. Damage done by SS. *Edgar Cherry* at Lock No. 4 repaired; several boats and flats for floating plant built, **05,** 1836. 75 snags and 5 wrecks removed, **05,** 1837. 24,000 c. y. dr., **05,** 1839.

1905-06. Repairs and imp. at Locks Nos. 1 to 15, incl., **06,** 1579. Removal of old Lock No. 2 commenced and damage done by flood at Lock No. 5 repaired, **06,** 1580. 4 wrecks and 9 snags removed; new towboat completed, **06,** 1581. 36,875 c. y. dr., **06,** 1586.

1906-07. Repairs and imp. at Locks Nos. 1 to 15, incl., **07,** 1687. Damage done by flood to dam at Lock No. 8 repaired, **07,** 1688. 57 snags removed; 16,500 c. y. dr., **07,** 1690. Dimensions and other data of locks and dams, **07,** 1691.

1907-08. Repairs and imp. at Locks Nos. 1 to 15, incl.; repairs made to middle wall of Lock No. 1, **08,** 1765. Removal of old Lock and Dam No. 2 completed, **08,** 1767. Removal of old Lock No. 3 commenced, **08,** 1768. Additions and repairs to floating plant; 68 snags removed, **08,** 1769.

1908-09. New system of lock lights estab.; damage done by landslide at Lock No. 1 repaired by dr., and cribwork built for protection; large lock closed to navigation for nearly a month, owing to accident to gates; work commenced on the partial reconstr. of Lock and Dam No. 1, **09,** 1759. Minor repairs and imp. at Locks Nos. 1 to 15, incl., **09,** 1759. Extension made to upper guard wall at Lock No. 2, and building of lock houses commenced, **09,** 1761. Floating plant repaired and added to, **09,** 1762. 33,255 c. y. dr., **09,** 1763.

1909-10. New R. lock at No. 1 completed and opened to navigation in June; work on new shore lock commenced; work on dam interfered with by storms, etc.; power house built and machinery installed; guard crib built, **10,** 1921. Minor repairs and imp. at Locks Nos. 1 to 15, incl., **10,** 1923. Two dwellings built at Lock No. 2, **10,** 1924.

1910-11. Work continued on reconstr. of Lock and Dam No. 1, practically completed; general repair and mainten. work continued at Locks and Dams Nos. 1 to 15; various additions made to floating plant at boat yard and shops at Lock No. 4; dr., removing shoals and remains of abandoned coal tipples done by U. S. dr. and snag boats, **11,** 2107.

1911-12. Lock and Dam No. 1: New inner lock placed in operation June 1, 1912; power house completed and plant installed; work of placing concrete top on old timber crib dam in progress; necessary repairs made to locks and dams and floating plant, and locks operated throughout year, except when closed for repairs or on account of ice; U. S. dr. removed 31,650 c. y. material, **12,** 2299.

PHYSICAL CHARACTERISTICS.

Closing of locks; repairs, same due to unusual weather conditions, **01,** 2686; **02,** 1885; **03,** 1664.

Highest recorded flood occurred Mar. 13 and 14, 1907, **07,** 1690.

Acid in R. water, **09,** 1761.

Freshet of June, 1910, caused considerable damage to work in progress, **11,** 2108.

Flood in Jan., 1911, covered lock walls for several feet and damaged fixtures in turbine power house, Lock No. 5, **11,** 2111.

Scour of left bank below abutment, Lock No. 5 **11,** 2111.

Rise of 6′, end of Aug.; unprecedented weather conditions, **12,** 2299. Ice of unusual thickness, **12,** 2299.

PRIVATE WORK.

Concrete wall along H. line built by National Tube Co., **08,** 1766.

Eighteen permits for structures in advance of H. lines granted, **12,** 2305.

PROJECTS.

App. for condemnation and purchase of imp. of R. amounted, 1898, to $4,100,348.59, **98,** 2188.

On July 7, 1897, Locks and Dams Nos. 1 to 7, incl., trans. by purchase from Monongahela River Navigation Co. to US., act 1896. These works make slack-water navigation from near the mouth of R. at Pittsburgh to Lock No. 8. Nos. 1, 2, 3, and 4 double locks, each consisting of one large and one small lock; all the others single and small locks, **98,** 2182.

By Capt. Sibert, remodeling Locks and Dams Nos. 1 and 4 and replacing Locks and Dams Nos. 3 and 5 with new structures in new locations; in each case to be double locks 56′ x 360′; est., No. 1, $443,184; No. 3, $589,196; No. 4, $428,983; No. 5, $657,428, **04,** 2547.

Act June 13, 1902, au. rebuilding of Lock and Dam No. 2; limiting cost, $655,961, **06,** 515.

Act Mar. 3, 1905, au. rebuilding Lock and Dam No. 3 (limiting cost, $589,196) and acquisition of R. front at, and certain imp. to Locks and Dams Nos. 5 and 6, at est. of $7,850, **06,** 515. Est. for Locks and Dams Nos. 1 and 4 increased, 1908, by Maj. Newcomer to $502,000 and $527,000, resp., **08,** 1762. Act Mar. 3, 1909, made special allotment of $329,045, for partial reconstr. of Lock and Dam No. 1, this being the est. cost of rebuilding the outer lock chamber, with new power plant, and putting new concrete top on old crib dam, **09,** 1759.

SURVEYS.

H. lines, Homestead to McKeesport, extension of, **98,** 2182.

Ex. and sur., 1902 and 1903, of Locks and Dams Nos. 1, 3, 4, and 5,[1] by Maj. Sibert, **04,** 2541, 2545.

H.-line sur., Elizabeth to Brownsville, by Maj. Sibert, **05,** 1837.

H.-line sur., 1905, Brownsville to Lock No. 6, by Maj. Sibert, **06,** 1581.

FF-11 WEST FORK RIVER, W. VA.

COMMERCE.

Description of; unimportant, **00,** 3275.

ENGINEERS.

Chief of Engineers. **R., 99,** 423; **00,** 486.

In charge. Maj. C. F. Powell, 1899–1900. **R., 00,** 3267.

Assistant. G. M. Lehman. **R., 00,** 3272.

OBSTRUCTION.

Description of brs. that would obstr. navigation if imp. were made, **00,** 3270, 3281.

PHYSICAL CHARACTERISTICS.

Description of. West Fork R. and the Tygarts Valley R. unite 1½ m. above Fairmont, W. Va., to form Monongahela R.; geology, hydrography, **00,** 3268.

PROJECT.

Maj. Powell est., 1899, $996,000 to imp. stream **00,** 3272.

SURVEYS.

Sur. of West Fork R., W. Va., mouth to Clarksburg, au. act Mar. 3, 1899; made, 1899, by Maj. Powell (**R.** unfav.; see Projects), **00,** 3268.

Bench marks, **00,** 3281.

FF-12 TYGARTS VALLEY RIVER, W. VA.

ENGINEERS.

Chief of Engineers. **R., 84,** 263.

In charge. Maj. W. E. Merrill, 1883. **R., 84,** 1718.

Assistant. J. B. Holbrook, **84,** 1719.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1718.

SURVEY.

Ex. au. act Aug. 2, 1882; made, 1883, by Maj. Merrill (**R.** fav., but work not a necessity), **84,** 1718.

FF-13 BUCKHANNON RIVER, W. VA.

APPROPRIATIONS.

1884,	$1,500,	**85,** 1893.
1886,	1,500,	**86,** 1625.
1888,	1,500,	**88,** 1795.
1890,	1,000,	**90,** 2280.
Total,	5,500	

COMMERCE.

Justification of a limited expend. for imp. of R., **84,** 1719; **86,** 1624.

Increase in lumber output due to imp., **88,** 1794.

In 1893 the constr. of a logging road was looked on as a cause for the probable disuse of the stream in the future, **93,** 2644.

ENGINEERS.

Chief of Engineers. **R., 84,** 263; **85,** 291; **86,** 286; **87,** 243; **88,** 229; **89,** 266; **90,** 240; **91,** 309; **92,** 295; **93,** 335.

In charge:

Maj. W. E. Merrill, 1884–87. **R., 84,** 1718; (Lt. Col.) **87,** 1832.

Capt. J. C. Post, 1885–87. **R., 85,** 1892; **86,** 1624.

Maj. D. W. Lockwood, 1888–93. **R., 88,** 1794; **89,** 1989; **90,** 2279; **91,** 2474; **92,** 2119; **93,** 2644.

Assistant. J. B. Holbrook. **R., 84,** 1719.

OPERATIONS.

1884–85. 7 m. of R. cleared of obstr., **85,** 1893.

1886–87. Chan. opened to Tenmile Creek, **87,** 1832.

1888–89. 3,000 c. y. r. removed from chan., **89,** 1989.

1889–90. 1,106 c. y. r. and 5 log jams removed from chan., **90,** 2280.

1891–92. 3,510 c. y. st. and 160 snags and logs removed from chan., **92,** 2119.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1718, 1720.

Tributary of the Tygart Valley R. about 57 m. l., **93,** 2644.

PLANS.

In 1883 Maj. Merrill reported a comparatively small expend. would be justified for the imp. of the R., **84,** 1719.

PROJECTS.

Proj. of 1884 contemplated a rafting chan. from Three Forks to Buckhannon, 24½ m., with a w. of 30′ and a d. of 2′ during 4 months of each year, **85,** 291. After an expend. of $4,500, it was est., 1888, that $20,955 was necessary for completion, **88,** 1795.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Maj. Merrill (see Plans), **84,** 1718.

[1] H. D. 209, 58th, 2d.

FF-13(a) DECKERS CREEK, W. VA.

ENGINEERS.

Chief of Engineers. R., 06, 529; **08,** 593; **11,** 754.

In charge:
Maj. W. L. Sibert, **06,** 529.
Maj. H. C. Newcomer, **08,** 578; (Lt. Col.) **11,** 739.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905, mouth of Deckers Creek, W. Va., at its confluence with Monongahela R., a chan. 1,600′ l. with same d. as in Monongahela R., and for restoring and imp. H. destroyed by flood; **R.,** Maj. Sibert, 1905 (unfav.),[1] **06,** 529.

Pre. ex. au. act Mar. 2, 1907; **R.,** Maj. Newcomer, 1907 (unfav.),[2] **08,** 593.

Pre. ex. au. act June 25, 1910, for chan. and H. for 2,500′ up from mouth with same d. as in Monongahela R.; **R.,** Lt. Col. Newcomer, 1910 (unfav.),[3] **11,** 754.

FF-14 CHEAT RIVER, W. VA.

APPROPRIATION.

1890, $13,000, **91,** 2361.

COMMERCE.

Tonnage, 1902, 3,000 t.

ENGINEERS.

Chief of Engineers. R., 89, 254; **91,** 291; **92,** 279; **93,** 315; **94,** 291; **95,** 326; **04,** 470, 2538; **08,** 593.

Boards. BERH. **R., 04,** 2540.

In charge:
Lt. Col. W. E. Merrill, 1888–92. **R., 89,** 1905; **91,** 2361.
Maj. A. Stickney, 1892–93. **R., 92,** 1991; (Lt. Col.) **93,** 2496.
Capt. R. L. Hoxie, 1894–95. **R., 94,** 1911; (Maj.) **95,** 2404.
Capt. W. L. Sibert, 1904. **R., 04,** 2538.
Maj. H. C. Newcomer, 1908, **08,** 593.

Assistants:
C. E. Rees. **R., 89,** 1906.
P. Golay. **R., 91,** 2361; **92,** 1991; **93,** 2497; **95,** 2405.

OPERATIONS.

1890–91. 5,626 c. y. r. cleared from chan., **91,** 2361.

1891–92. 8,221 c. y. r. blasted and removed from chan., **92,** 1991.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1905.

One of principal trib. of Monongahela R. Expensive to imp. R. because of excessive fall, requiring locks and dams. 140 m. l., **04,** 2538.

PROJECTS.

By Lt. Col. Merrill, 1889, mouth at Pt. Marion to Rowlesburg, W. Va., 49 m., blasting and removing r. obstr. to give a raft navigation; est., $13,000, **89,** 1906; **91,** 2361.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Lt. Col. Merrill, **89,** 1905.

Pre. ex. au. act June 13, 1902; Capt. Sibert's **R.** unfav. to immediate imp.,[4] **04,** 470, 2538.

Pre. ex. au. act Mar. 2, 1907; district officer's **R.** unfav.,[5] **08,** 593.

FF-15 YOUGHIOGHENY RIVER, PA.

APPROPRIATIONS.

1875,	$10,000, act Mar. 3.	
1910,	100,000, **10,** 1948.	
Total,	110,000	

COMMERCE.

Iron and coal interests require slack-water navigation on R. as far up as Connellsville, **76,** ii, 84. Coal barges; requirements of, **76,** ii, 85.

Description of, **00,** 3286–3288.

Several industrial plants near mouth of R. report 185,000 t. in 1911, **12,** 908.

ENGINEERS.

Chief of Engineers. R., 73, 60; **74,** 67; **80,** 195; **81,** 263; **84,** 263; **99,** 423; **00,** 486; **08,** 593; **10,** 699; **11,** 752; **12,** 907.

In charge:
Maj. W. E. Merrill, 1874–84. **R., 74,** 558; (Lt. Col.) **81,** 1957; **84,** 1716.
Maj. C. F. Powell, 1899–1900. **R., 00,** 3283.
Maj. H. C. Newcomer, 1908–. **R.** (Lt. Col.), **10,** 1948; **11,** 2146; **12,** 2341.

Assistant. Lt. F. A. Mahan. **R., 74,** 559.

ESTIMATES. (See Plans and Projects.)

Of proj., 1874, slack-water navigation to 6′, McKeesport (mouth of Youghiogheny) to West Newton, 18.8 m., by permanent dams with locks, $688,023, **74,** 559, 563, 566. Same, by plan of movable dams with locks, $1,308,406, **74,** 566.

In connection with proj. for extension of Chesapeake & Ohio Canal (which see) for slack-water navigation, McKeesport to Connellsville, 45.3 m., to 7′, $1,254,040, **76,** ii, 87.

OPERATIONS.

1911–12. Borings made to determine locations for proposed locks and dams, **12,** 2342.

PHYSICAL CHARACTERISTICS.

Distances from Pittsburgh, **74,** 527, 560; **76,** ii, 114, 123.

Elevation above Ohio, **74,** 521, 560; **76,** ii, 86, 114, 123.

Tributaries of the Ohio; rainfall in valleys of, **74,** 507, 520, 523, 532; **76,** ii, 100.

Discharge of R., **74,** 561.

Lack of water supply on, **74,** 497, 559, 561.

Coal deposits of valley, **74,** 512; **76,** ii, 84.

Description of R. and resources of adjacent country, **81,** 1958; **00,** 3283, 3289.

[1] H. D. 193, 59th, 1st.
[2] H. D. 57, 60th, 1st.
[3] H. D. 14, 62d, 1st.
[4] H. D. 248, 58th, 2d.
[5] H. D. 216, 60th, 1st.

The Youghiogheny R., the largest tributary of the Monongahela R., **00,** 3283.

Geology, **00,** 3291.

Heavy ice gorge causes much damage to RR. tracks, highways, and wrecked telegraph poles, bridges, etc., **12,** 2342.

PLANS. (See Estimates and Projects.)

By Lt. Mahan, 1874, movable instead of permanent dams; in the proj. for slack-water navigation to 6′, McKeesport to West Newton Dam, to consist of navigable pass 150′ w., closed with Chanoine wickets 13′ h.; adjacent weir with sill 6′ above sill of pass; lock 7′ x 56′ x 250′; plan involves use of 5 locks and dams, **74,** 564; est., $1,308,406; comparison with permanent dams, and plan rejected for excess of cost of, **74,** 566.

By Maj. Merrill, 1874, extension of proposed Chesapeake & Ohio Canal down the valley of the Youghiogheny to McKeesport, **74,** 497; **76,** ii, 85. Modified in 1876 by terminating canal at Connellsville (see Projects), **76,** ii, 83. (See Chesapeake & Ohio Canal, Board of Engineers.)

By Lt. Col. Merrill, lock and dam on the Lower Youghiogheny R.; est., $230,000, **81,** 1958.

PROJECTS. (See Estimates and Plans.)

By Maj. Merrill, 1874, slack-water imp. to 6′ from McKeesport, at confluence of Youghiogheny with the Monongahela, to West Newton, 18.8 m., by 3 locks and dams of 10′ lift each; dams to consist of timber cribs filled with st., and locks of masonry 56′ x 250′; est., $688,023, **74,** 559, 563. Compared with plan of movable dams, and the adoption of permanent dams recom., **74,** 559, 566.

Considered by Maj. Merrill, 1876, in connection with proj. for extension of Chesapeake & Ohio Canal (q. v.); the foregoing proj. becomes slack-water navigation from McKeesport to Connellsville (proposed terminus of Chesapeake & Ohio Canal), 45.3 m., by means of 15 locks and dams of about 10′ lift; upper 12 locks to be 26′ x 146′, and lower 3 locks 56′ x 250′; d. of imp. to be 7′; dams of st., **76,** ii, 83, 86; est., $1,254,040, **76,** ii, 87.

Maj. Powell est., 1899, $599,106 to make slack-water imp., **00,** 3286.

Act June 25, 1910, au. canalization of R. from mouth to West Newton by constr. of 3 locks and dams; est., $1,050,000,[1] **10,** 700.

SURVEYS.

1873. Au. by Cong., **73,** 60; **74,** 558. Completed, **74,** 67. Indefinite instructions as to limits of, **74,** 559. Distances on R. from Pittsburgh, **74,** 560. Elevation and location of benches, **74,** 561. (See Chesapeake & Ohio Canal.)

Au. act June 14, 1880; made, 1880, by Lt. Col. Merrill, **81,** 1957.

Au. act Aug. 2, 1882; made, 1882, by Lt. Col. Merrill, **84,** 1716.

Ex. of Youghiogheny R., West Newton to mouth at McKeesport, Pa., au. act Mar. 3, 1899; made, 1899, by Maj. Powell (**R.** fav.; see Projects), **00,** 3283.

Pre. ex. au. act Mar. 2, 1907, to Connellsville, Pa. **R.** by Maj. Newcomer, Oct. 10, 1907[2] (unfav.), **08,** 593.

Sur. from mouth to West Newton, **11,** 2146.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 908.

FF-19 PITTSBURGH HARBOR, PA.

(Can be considered as a part of the O. R. improvement—See No. 105 on p. 908.)

APPROPRIATIONS.

1899,	$110,662.90,	**99,** 2398.
1902	10,000.00,	**02,** 1896.
	*5,000.00,	**04,** 2511.
1905,	10,000.00,	**05,** 1839.
1907	[3] 4,000.00,	**07,** 1733.
	10,000.00,	**07,** 1733.
1909,	*4,000.00,	**09,** 1786.
1910,	5,000.00,	**10,** 1947.
1911,	5,000.00,	**11,** 2146.
1912,	5,000.00,	**12,** 2340.
Total,	168,662.90 (incl. misc., $168,770.49, **12,** 2340).	

COMMERCE.

Pittsburgh H. the terminus of 4 Ohio R., 4 Monongahela R., and 1 Allegheny R. packet lines; and besides harboring coal fleets waiting to descend the Ohio R., a large local C. is accommodated at times with inconvenience, **99,** 420, 2400.

Average yearly t. of coal boated down the Ohio R. from Pittsburgh, for the 10 years ending 1897, 2,836,390; 1896, nearly 4,000,000 t.; total water-borne t. at the H., 1896, about 7,500,000 t.; 1899, about 8,813,000 t., **99,** 2399, 2400; **00,** 483.

Description of, **10,** 698.

1911, 12,519,776 t.; 682,807 passengers, **12,** 2341.

H. used principally for mooring of coal fleets awaiting rise in Ohio R. to proceed downstream, mooring of timber rafts and boat bottoms coming down Allegheny R., delivery of coal and other materials to mills, and accommodation of packet lines whose routes terminate at H., **12,** 907.

CONTRACTS.

1902. Monongahela & Western Dredging Co., dr. and removing obstr., **03,** 1670.

ENGINEERS.

Chief of Engineers. **R., 99,** 419; **00,** 481; **01,** 480; **02,** 405; **03,** 432; **04,** 461; **05,** 472; **06,** 518; **07,** 554; **08,** 590; **09,** 625; **10,** 697; **11,** 750; **12,** 905.

In charge:

Maj. C. F. Powell, 1899–1901. **R., 99,** 2397; **00,** 3254; **01,** 2697.

Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1895; **03,** 1667; (Maj.) **04,** 2510; **05,** 1839; **06,** 1587.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1731; **08,** 1802; **09,** 1785; (Lt. Col.) **10,** 1946; **11,** 2144; **12,** 2338.

Assistant. H. C. Gould. **R., 04,** 2511; **05,** 1840.

LEGAL PROCEEDINGS.

Decision of the U. S. Supreme Court in favor of U. S. in controversy over Union Br., **07,** 1732.

OBSTRUCTIONS.

Encroachments on H. by fillings and structures, **99,** 2400.

36 applications for approval of br. plans and changes of H. lines, and for permits for projecting structures, reported upon, **00,** 3255.

140 old pile stubs removed from R. by Baltimore & Ohio RR. Co., **01,** 2698.

Unau. timber structure removed by Duquesne Forge Co., **02,** 1895.

Agreement with Jones & Laughlin concerning change of H. line, incl. removal by them of some 25,000 or 30,000 c. y. slag fill, **02,** 1895.

Union Br. declared to be an obstr. to navigation; complaints against other brs., **03,** 1669.

* Allotment.
[1] R. and H. Com. D. 9, 61st, 2d.
[2] H. D. 330, 60th, 1st.
[3] Received by Treas. certificate of transfer settlement.

Action against dredging company for deposit of waste in chan., **08,** 1802.

Waste piles left by sand dr. removed; action to prevent such obstr., **10,** 1946.

Complaints regarding "scraping" of landings obstr. chan.; circulars issued to interested parties; work in future to be done under supervision of U. S. Permits for structures granted, **11,** 2145.

OPERATIONS.

1899-00. 30,565 c. y. dr.; 27 large st. removed; Brunot Isld. Dam raised; arrangements made for removal of abandoned structures in Monongahela R.; systematic location and permanent marking of estab. H. lines in progress; prevention or stoppage of deposits over the banks; improper dumping in Rs., and encroachments of unau. structures beyond H. lines accomplished by thorough patrol and inspection, **00,** 3254.

1900-01. 80,075 c. y. dr.; work on Brunot Isld. Dam completed, **01,** 2697. H. lines marked and extended, **01,** 2698. List of applications for permits reported; brs. and vessels measured, **01,** 2699.

1901-02. 22,437 c. y. dr.; marking of H. lines continued, **02,** 1895, 1896.

1902-03. Marking of H. lines continued; 89,776 c. y. dr., **03,** 1667. Changes made in H. line and H. lines extended, **03,** 1668. Public hearings of proposed changes in H. lines, **03,** 1669.

1903-04. Marking of H. lines completed, **04,** 2511. Changes in H. lines, **04,** 2512.

1904-05. Changes in H. lines and public hearings on proposed changes; 22 applications for permits for structures in R. beyond H. lines reported on, **05,** 1840.

1905-06. Changes in H. lines, **06,** 1587. Public hearings; reports made on 21 applications for permits, **06,** 1588.

1906-07. 4 wrecks removed, **07,** 1731. Changes in H. lines; removal of Union Br. started; ex. and reports made on 8 applications for permits; existing H. lines approved by Sec. of War, **07,** 1732.

1907-08. 4,000 c. y. dr.; wreck removed, **08,** 1802. Changes in H. lines; removal of Union Br. completed; ex. and reports made on 7 applications for permits, **08,** 1803.

1908-09. Changes in H. lines, **09,** 1786.

1909-10. 8 permits granted, **10,** 1946. Public hearings of proposed plans of br. imp., **10,** 1947.

1910-11. 14,000 c. y. removed; abandoned tipples and ice breakers removed; chan. inspected and patrolled; public hearings held; U. S. removed wreck, **11,** 2144, 2145.

1911-12. 123,447 c. y. dr. by U. S. plant; removal of wrecks, inspection of Rs., surs., soundings and mainten. of H. lines, **12,** 2338, 2339.

PHYSICAL CHARACTERISTICS.

Pittsburgh H. extends from Davis Isld. Dam in the Ohio R. to site of Allegheny R. Dam No. 2, and on the Monongahela R. to McKeesport, at mouth of Youghiogheny R., **99,** 2399.

Monongahela R. part of the H. serves as a refuge from Allegheny R. ice, **99,** 420.

Description of, **05,** 472.

Measurement of R. discharge, **08,** 1803; **09,** 1786.

Report of estab. and modification of H. lines, **12,** 906.

PRIVATE (STATE) WORK.

In 1858 Pa., through a board of commissioners and at an expense of $40,000, had a complete sur. and detailed maps made of the Rs. at and near Pittsburgh, **99,** 2401.

Point near Hazelwood removed by Jones & Laughlin Steel Co., **05,** 1840.

10,000 c. y. dr. from H. by Pittsburgh & Lake Erie RR. Co., **10,** 1946.

P. & L. E. Ry. Co. dr. 6,000 c. y.; city of Pittsburgh, 32,000 c. y.; local company, 4,000 c. y.; and B. & O. Ry. Co., 7,000 c. y., **11,** 2144.

46,020 c. y. dr. by various parties; driveway on wharf constr., about 2,000′ l., **12,** 2339.

PROJECTS.

By Maj. Powell, 1897, dr. chan. throughout lower H., where needed, 10′ d. at pool level and 500′ w. below Smithfield St. Br., Monongahela R., and above this br. and in the Allegheny R. of a less w., and 1 limited by lines from ends of chan. spans of adjoining brs.; to raise the old riprap st. dam across Brunot Isld. chan., Ohio R., and protect its surface by large and flat pieces of st., but leaving a channel way of 5′ d. at pool surface; to remove abandoned structures and unau. and obstr. fillings projecting from bank beyond the H. line in cases where it is impossible to secure removal except at expense of U. S.; to mark H. lines and conduct inspection and patrol for execution of law to protect and preserve Hs.; to an. maintain works; make local surs. and measurements, and prepare H.-line plats; est., $110,662.90, and $10,000 an. inspection and patrol, **99,** 420.

Orig. proj. modified, 1902, to w. dr. chan. at Try St., owing to changes in RR. br. there, **03,** 1667.

Existing proj. provides for mainten. of H. at an est. of $5,000, **10,** 698; **12,** 906.

SURVEYS.

Ex. of Pittsburgh H., with view to preserving it from unau. encroachments and other damage; dr., marking H. lines, and patroling H., au. by Senate's resol. June 25, 1897; **R.** submitted, 1897, by Maj. Powell (see Projects), **99,** 2399.

FF-20 ALLEGHENY RIVER, PA.[1]

Part.	Title.	Period.	Appropriations.
a	List of notable points, mouth to headwaters		
b	Allegheny R.	1832–1892	$352,500.00
c	do	1893–1912	66,000.00
d	Allegheny R., building locks and dams	1893–1912	1,863,959.63
e	Allegheny R., operating and care of locks and dams	1903–1912	369,165.05
	Total		2,651,624.68

[1] To French Creek (Franklin): Sur.—**R.,** May 20, 1832. To Olean: Sur.—**R.,** Mar. 17, 1838; est., $877,466. (H. D. 482, 55th, 2d.)

Part (a), FF-20 List of Notable Points, Mouth to Headwaters.

Ohio R., Pa.
Pittsburgh, Pa.
Locks and Dams 1, 2, 3.
Tarentum, Pa.
Freeport, Pa.
Kiskiminetas R., Pa.
Kittanning, Pa.
Mahoning Cr., Pa.
Red Bank Cr., Pa.
Clarion R., Pa.
Franklin, Pa.
French Cr., Pa.
Oil City, Pa.
Oil Cr., Pa.
Tionesta Cr., Pa.
Tionesta, Pa.
Warren, Pa.
Conewango Cr., Pa. and N. Y.
Chautauqua Lake, N. Y.

Part (b), FF-20 Allegheny River, Pa.

APPROPRIATIONS.

1879,	$10,000, **79,** 144.
1880,	20,000, **80,** 1767.
1881,	25,000, **81,** 1947.
1882,	15,000, **82,** 1934.
1884,	35,000, **85,** 1818.
1886	30,000, **86,** 1545.
	[1] 37,500, **86,** 1546.
1888	25,000, **88,** 1680.
	[1] 35,000, **88,** 1683.
1890	20,000, **90,** 2195.
	[1] 35,000, **90,** 2198.
1892	25,000, **92,** 1995.
	[1] 40,000, **92,** 1996.
Total,	352,500

COMMERCE.

C. above Pittsburgh confined to lumber and oil; requirements for, **76,** ii, 147, 151, 152; **79,** 1374.

Oil, amount of, brought to Pittsburgh, **76,** ii, 152; **79,** 1374. Transportation of, by pipes, **76,** ii, 148, 151; **79,** 1374. Cost of, **76,** ii, 151.

Imp. of R., above Pittsburgh, not justified, **76,** ii, 147, 148.

Injury to C. by brs., **79,** 1372.

Necessity for imp. of R. at Pittsburgh, **76,** ii, 149; **80,** 1767; **84,** 1702; **86,** 1545.

CONTRACTS.

1889. J. J. Shipman, dike constr., $13,784, **89,** 1886.

ENGINEERS.

Chief of Engineers. R., 76, 90; **78,** 109; **79,** 144, 147; **80,** 193, 195; **81,** 261; **82,** 256; **83,** 264; **84,** 262; **85,** 283; **86,** 273; **87,** 239; **88,** 216; **89,** 251, 252; **90,** 227; **91,** 292; **92,** 280.

In charge:

Maj. W. E. Merrill, 1876–91; **76,** 90. **R., 76,** ii; 147; **79,** 1371; (Lt. Col.) **80,** 1764, 1767; **81,** 1945, **82,** 1931; **83,** 1550; **84,** 1702; **85,** 1818; **86,** 1544; **87,** 1810, 1811; **88,** 1680, 1682; **89,** 1885, 1887; **90,** 2194, 2198; **91,** 2363, 2366.

Maj. A. Stickney, 1892–93. **R., 92,** 1992, 1996.

Assistants:

Lt. F. A. Mahan. **R., 76,** ii, 149.

I. V. Hoag, **76,** ii, 147; **81,** 1945. **R., 82,** 1931; **83,** 1551.

T. P. Roberts. **R., 79,** 1372; **80,** 1765, 1768.

J. B. Dougherty, **80,** 1767.

J. W. Arras. **R., 88,** 1681; **89,** 1886, 1888; **90,** 2196; **91,** 2364, 2367; **92,** 1992.

LEGAL PROCEEDINGS. (See Projects, 2d par.)

Work at Cornplanter Islds. stopped by injunction, **90,** 2195; removal of injunction secured by modification of plan, **91,** 2364.

Commencement of operations on Herrs Isld. Dam delayed by suit brought by riparian owners, **92,** 1996.

LEGISLATION.

Required by Pa. giving U.S. jurisdiction over land for lock and dam at Pittsburgh, **86,** 274, 1545; **87,** 1812.

OBSTRUCTIONS. (See Commerce.)

List of obstr., **79,** 1377.

OPERATIONS.

1879-80. Constr. of dams at Sixmile Isld., Nicholsons Rapids, and Garrisons Ripple; dr. at mouth of R. and purchase of snag boat, **80,** 1765.

1880-81. Repairs to dams at Sixmile Isld. and Nicholsons Rapids; removal of snags and r., **81,** 1945.

1881-82. Repairs to dams at Sixmile Isld. and Nicholsons Rapids; removal of r. and snags, **82,** 1931.

1882-83. Removal of 301 snags and 28,513 c. y. r., **83,** 1551.

1884-85. Repairs to dam at Nicholsons Rapids; removal of 70,649 c. y. r., 3,555 c. y. gravel, and 848 snags, **85,** 1819.

1886-87. Removal of r. from R. chan. and preparation for constr. of inclined plane at Corydon Dam, **87,** 1810.

1887-88. Dam at Corydon partly rebuilt, repairs to Sixmile and Nicholsons Dams, and 540 t. r. removed from R. bed, **88,** 1680.

1889-90. Repairs to dams at Sixmile and Nicholsons Islds.; 1,739 l. f. timber and st. dike completed under contract at Red Bank, **90,** 2194.

1890-91. Dam at Cornplanter Islds. completed; 50 l. f. dam at Pithole built; 236 c. y. r. used in repair of dike at Red Bank, **91,** 2363. Site prepared for lockkeeper's house at Herrs Isld., **91,** 2366.

1891-92. Dams at Hickory and Pithole completed; repairs to dike at Red Bank and dam at Nicholsons Isld.; 500 c. y. r. removed from bar at foot of Pithole Ripple; 621 c. y. r. and 11 snags removed bet. Kittanning and Pittsburgh, **92,** 1993, 1994.

PHYSICAL CHARACTERISTICS.

Fall of R., Freeport to mouth, **76,** ii, 147. Tributaries, **76,** ii, 150. R. consists of alternate pools and shoals, **76,** ii, 150. Conformation of bottom, **76,** ii, 147, 152. General description, **79,** 1373; **80,** 1767, 1769. Floods, slope, **80,** 1769.

PLANS. (See Projects.)

By Maj. Merrill, mouth to Freeport, 30 m., slackwater navigation, consisting of 5 dams and locks; average lift, 11′; locks, 50′ x 200′; est., $765,132, **76,** ii, 149.

[1] For dam at Herr Isld., **86,** 1546; **87,** 1812; **92,** 1996.

By Lt. Col. Merrill, 1876, imp. at Pittsburgh by lock and dam at Garrisons Ripple; est., $153,000, **76,** ii, 149; **80,** 1767; **82,** 1933. Probability that further consideration would increase est., **86,** 1545; est., $400,000, **87,** 1812.

PRIVATE (CORPORATE) WORK. (See Projects, 2d par.)

Pipe lines laid by natural-gas companies across bed of R., **85,** 1820.

PROJECTS. (See Plans.)

By Maj. Merrill, imp. of R., mouth to upper limits of city of Pittsburgh, 8.3 m., to a min. d. of 6′, by lock, with movable dam; navigable pass of dam, 200′ w.; lock, 6′ x 50′ x 200′; approx. est., $269,564, **76,** ii, 148, 149.

Maj. Merrill, 1876, proposed imp. of Garrisons Ripple at head of Herrs Isld., about 2 m. above confluence of Allegheny and Monongahela Rs., with lock and fixed dam at head of Allegheny arm of the pool formed by Davis Isld. Dam; est., $153,000, **76,** ii, 148; **80,** 1766; **86,** 1545. In 1891 the au. of Allegheny City gave necessary land on the right bank on condition that dam be made movable. Plans changed, increasing est. to $600,000, **91,** 2366.

By Maj. Merrill, 1879, temporary imp. by r. removal (est., $51,425), constr. of wing dams, closing l.-w. chutes behind islds., erection of log chute in dam at Corydon Isld., and repairs to dams at Nicholsons and Sixmile Islds., **79,** 144, 1371, 1376; **86,** 273; **88,** 1681.

SURVEYS.

In vicinity of Pittsburgh, 1875, **76,** 90, ii, 147, 149; and ex. from Pittsburgh to Freeport, **76,** ii, 147, 149. From Pittsburgh to French Creek, **78,** 109; **79,** 1371.

By T. P. Roberts, 1879, from French Creek, Pa., to Olean, N. Y., **80,** 1767.

Sur. for location of Herr Isld. Lock and Dam; made, 1889, by Lt. Col. Merrill, **89,** 1888.

Part (c), FF-20 Allegheny River, Pa.

APPROPRIATIONS.[1]

1894,	$12,500,	**95,** 2407.
1896,	12,500,	**96,** 2198.
1899,	15,000,	**99,** 2410.
1900,	*5,000,	**01,** 2708, 2709.
1902,	10,000,	**02,** 1911.
1902,	*5,000,	**04,** 2528.
1909,	*1,000,	**09,** 1769.
1910,	5,000,	**10,** 1931.
Total,	66,000	

COMMERCE.

Navigation should be extended 30 m. farther upstream to provide for traffic from extensive sawmills and boat yard estab. at Warren, **01,** 2708.

No apparent effect on freight rates from imp., **12,** 897.

Traffic, 346,000+ t., 1912, above slack water, **12,** 897; general traffic, 1,720,000 t., **12,** 2311.

ENGINEERS.

Chief of Engineers. **R., 93,** 315, 319; **94,** 292; **95,** 326, 328; **96,** 281, 284; **97,** 362; **98,** 375, 377, 378; **99,** 422, 423; **00,** 485; **01,** 483; **02,** 409; **03,** 439; **04,** 469; **05,** 480; **06,** 528; **07,** 547; **08,** 583; **09,** 617; **10,** 690; **11,** 742; **12,** 895.

In charge:

Lt. Col. A. Stickney, 1892–93. **R., 93,** 2498, 2535, 2538, 2540.

Capt. R. L. Hoxie, 1894–96. **R., 94,** 1913; (Maj.) **95,** 2406; **96,** 2196, 2212.

Maj. C. F. Powell, 1897–1901. **R., 97,** 2424; **98,** 2202, 2211; **99,** 2410, 2411; **00,** 3263; **01,** 2707.

Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1910; **03,** 1686; (Maj.) **04,** 2528; **05,** 1860; **06,** 1613.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1697; **08,** 1774; **09,** 1768; (Lt. Col.) **10,** 1930; **11,** 2118; **12,** 2309.

Assistants:

Lt. H. F. Hodges. **R., 93,** 2537, 2540, 2542.

J. W. Arras. **R., 93,** 2498; **94,** 1914; **95,** 2406; **96,** 2197; **97,** 2425; **98,** 2202; **04,** 2529; **05,** 1861.

G. M. Lehman. **R., 99,** 2420.

LEGAL PROCEEDINGS.

Encroachments, **93,** 2499.

OBSTRUCTIONS.

Break in Corydon Milldam an obstr., **94,** 1915; **95,** 2407.

List of brs. over R. bet. Olean, N. Y., and Pittsburgh, Pa., au. and constr., **94,** 1917; **95,** 2409; **96,** 2199; **97,** 2427, 2428; **98,** 2205, 2206. List of brs. over R. above Tarentum, **99,** 2448.

Br. of Venango Co., at Franklin, Pa., **03,** 651. Big Rock Br., near Franklin, Pa., **03,** 651.

OPERATIONS.[2]

1892-93. Minor repairs to existing works; 3,240 c. y. r. and bowlders forming a bar removed at Pithole Ripple, **93,** 2498, 2499.

1893-94. Existing works repaired; dam below Tionesta Creek built and repaired; dam at Cowanshannock built, and dike in course of constr.; 3,311 c. y. r. and other obstr. removed, **94,** 1913.

1894-95. Dike at Cowanshannock completed 6,645 t. r. and other obstr. removed, **95,** 2406.

1895-96. Dike built at Cowanshannock; existing works repaired, **96,** 2196.

1896-97. Some dams and dikes repaired; 1,373 c. y. bowlders and some snags removed, **97,** 2425.

1897-98. Red Bank Dike extended; banks at Hickory Isld. protected; misc. repairs made to works; over 3,000 c. y. bowlders and other obstr. removed, **98,** 2202, 2203.

1899-00. Red Bank dike repaired and paving laid; Nicholson Dam repaired; minor repairs mad; to other works; some snags and nearly 5,000 c. y. r., etc., removed, **00,** 3264, 3265.

1900-01. Repairs made to Nicholson Dam and Red Bank Dike, Corydon log chute, Hickory and Pithole Dams and upper Cowanshannock Dike; about 2,700 c. y. bowlders, 350 c. y. gravel, and 14 snags removed bet. Hickory and New Kensington, **01,** 2707.

1901-02. Repairs made to Nicholson Dam and Red Bank Dike, **02,** 1910.

1902-03. Repairs made to Red Bank Dike; 200 c. y. st. placed on Nicholson Isld. Dam; slight repairs made to Hickory Dam; 536 c. y. bowlders, 350 c. y. gravel, and 6 snags removed from chan., **03,** 1686.

1903-04. Repairs made to Hickory Dam, Nicholsons Isld. Dam, Red Bank Dike, **04,** 2529.

1904-05. Repairs made to dams at Hickory, Pithole, Nicholsons Isld., and dikes at Red Bank and Cowanshannock; obstr. removed bet. Warren and head of Pool No. 3, consisting of 609 c. y. bowlders, 390 c. y. gravel, and 30 snags, **05,** 1861.

1905-06. Repairs made to dam at Hickory, and dikes at Pithole, Red Bank, and Cowanshannock; obstr. removed from chan. bet. Warren and Kennerdell, consisting of 27 c. y. bowlders, 23 c. y. gravel, and 5 snags, **06,** 1613.

1906-07. Repairs made to dams at Hickory, Pithole, and Nicholsons Isld.; 160 c. y. st., 70 c. y. bowlders, and 25 trees and snags removed, **07,** 1697.

* Allotment.

[1] See Part b.

[2] List of structures erected 1879–97, **97,** 2426.

1907-08. Repairs made to dams at Hickory, Pithole, and Nicholsons Isld., and Red Bank Dike, **08,** 1774.

1908-09. Repairs made to dams at Hickory and Nicholsons Isld., and to upper dike at Cowanshannock, **09,** 1768. Corydon Milldam, an obstr., dynamited and partly removed, **09,** 1769.

1909-10. Repairs made to dikes at Nicholsons Isld. and Red Bank; 35 c. y. gravel, 249 c. y. bowlders, and 10 snags removed from chan., **10,** 1930.

1910-11. Corydon Milldam completely removed; repairs made to dikes at Cowanshannock and Red Bank, and dam at Hickory, **11,** 2118.

1911-12. 136 c. y. bowlders, 215 c. y. gravel, and 4 snags removed, **12,** 2309.

PHYSICAL CHARACTERISTICS.

Description of, Tarentum to Herrs Isld., **93,** 2537; **96,** 2213.

Description of, at or near Tarentum, **93,** 2539, 2540; **96,** 2213.

Description of, Olean to Warren. Chan. exceedingly shallow with a steep slope, **93,** 2542.

Distances, various points, bet. Pittsburgh and Oil City, **98,** 2204.

Description of, Tarentum to Pa. State line, **99,** 2413. Hydrography, towns, and ripples, **99,** 2421. Geology, **99,** 2439. Probable route for canal connecting the R. and Lake Erie, **99,** 2443. Distances on the stream, **99,** 2445.

PRIVATE WORK.

St. dike constr. by Venango Motor Boat & Canoe Club, **12,** 2310.

PROJECTS.

After ex., 1892, Lt. Col. Stickney est. $2,000 for sur. bet. Tarentum and Herrs Isld., and $500 for sur. at or near Tarentum, **93,** 2536, 2539.

Maj. Hoxie, 1895, est. $500,000 to secure slackwater navigation from Herrs Isld. to Tarentum, Pa., with 2 locks and dams (see Allegheny River, Part c), **96,** 2214.

Maj. Powell, 1897, est. $897.50 to remove Corydon Dam to 4′ below l.-w. level, **98,** 2211; $2,400 to remove dams sur. in Conewango Creek, 1897, excl. of damages for destroying or diminishing water power, **98,** 2211; and $90,000 for removal of Waterboro Rapids, **98,** 2212.

Maj. Powell, 1899, est. $2,499,384.14 for 8 locks and dams from Natrona to Monterey (the part of imp. probably to be recom.), **99,** 2416. Est., locks and dams for whole R., $13,704,391.25, **99,** 2419.

By Maj. Powell, 1900, applying app. of 1899 to reconstr. Nicholsons Isld. Dam, completing Red Bank Dike and repairing it, making minor repairs at other places, removing obstr., and continuing sur., **00,** 3263.

Proj. for open-chan. work, 1912, that embraced in acts 1879 and 1882, removal of obstr., building low dams, etc., to close secondary chans., **12,** 895.

SURVEYS.

Exs. for lock and dam bet. Tarentum and Herrs Isld. Dam, and one at or near Tarentum, au. act July 13, 1892; Lt. Col. Stickney's **R.,** 1892, fav., **93,** 2535, 2538. Sur. au. act Aug. 17, 1894; made by Maj. Hoxie (see Projects), **96,** 2212.

Ex., Olean, N. Y., to Warren, Pa., au. act July 13, 1892; Lt. Col. Stickney's **R.** unfav., **93,** 2540.

Sur., removal of dam near Corydon, Pa., of all the dams on Conewango Creek, and the rapids at or near Waterboro in the creek (a tributary of the Allegheny), au. act June 3, 1896; Maj. Powell's **R.,** 1897, unfav., **98,** 2211.

Sur. for determining what reaches could be made navigable and the number, location, and cost of the necessary locks and dams, au. act June 3, 1896; Maj. Powell's **R.,** 1898, partly fav. (see Projects), **99,** 2411. Bench marks, **99,** 2446.

Maps. **98,** 2206.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 895.

Part (d), FF-20 Allegheny River, Pa. (Building locks and dams.)

APPROPRIATIONS.[1]

1894,	$40,000.00,	**95,** 2416.
1896,	50,000.00,	**96,** 2207.
1897,	350,000.00,	**97,** 2433.
1898,	300,000.00,	**98,** 2210.
1901,	126,000.00,	**01,** 2704.
1902,	118,500.00,	**02,** 1901.
1905,	*10,000.00,	**06,** 1608.
1906,	281,226.63,	**06,** 1608.
1907,	235,000.00,	**07,** 1701.
1909,	*[2] 5,000.00,	**10,** 1932.
1910,	48,233.00,	**10,** 1932.
1912,	300,000.00,	**12,** 2312.
Total,	1,863,959.63	

COMMERCE. (See Allegheny River, operating and care.)

CONTRACTS.

1894. Lawrence Cement Co., cement, $14,400; Drake & Stratton Co. (Ltd.), dr., 14¢ c. y., p. m., $8,820, **95,** 2416, 2417.

1895. Patton & Gibson, st., $1,823.28, **95,** 2417.

1896. Atlas Cement Co., Portland cement, $6,300, **96,** 2207.

1897. Sloan, McIlvain & Ott Bros., constr. Lock No. 2, $220,492.68; No. 3, $175,932.02, **97,** 2433, 2436.

1898. W. W. Hegeman & Co., constr. cofferdam and part of a Chanoine movable dam, Herrs Isld., $57,375.10, **99,** 2408.

1900. E. J. Hingston and O. R. Pihl, cofferdam, foundation, piers, and abutments for part of movable dam and guide cribs, and erecting Chanoine wickets at Herrs Isld. Lock and Dam, $101,594.82; T. Marshall, 2 bear-trap gates at Herrs Isld., $40,149.53, **00,** 3261, 3262.

1902. Charles Hegewald Co., 2 sets gate-maneuvering gears, Locks 1 and 3; James Rees & Sons Co., valve gearing, Dam No. 1, and operating machinery, Dam No. 3, and screens, shutters, and cover plates for Locks Nos. 1 and 3, **02,** 1908.

1903. Samuel H. McCain, lock-master's dwelling, $6,806; Dravo Contracting Co., constr. Lock No. 2 and abut. for dam, with prices, excavating, $1.10 c. y.; concrete, $7.10 c. y.; oak, $62 M b. m.; hemlock, $46.50 M b. m.; st. ballast, $3.10 c. y.; paving, $4.65 s. y.; and driftbolts, 5¢ lb., **03,** 1681.

1905. James H. McQuade Co., building Dam No. 2, unit prices given; Penn Bridge Co., 2 pairs of steel lock gates and anchorages for Lock No. 2; Gloster R. Morrell, lock-master's dwelling at Lock No. 2, $3,350, and supple. contract for replacing foundation, etc., $550, **05,** 1855.

1906. Joseph Heidenkamp, 20,000 t. riprap, at $1.05 t., **06,** 1610.

1907. Pihl & Miller, building power conduit, excavation, 60¢ c. y.; concrete, $7.85 c. y.; steel, 4¢ lb.; New Kensington Lumber Co., lock-master's dwelling, $3,595.70, **07,** 1702, 1703.

1908. James H. McQuade Co. (supple.), building Dam No. 2, unit prices given, **08,** 1779.

ENGINEERS.

Chief of Engineers. R., 93, 316; **94,** 292; **95,** 326; **96,** 282; **97,** 363; **98,** 376; **99,** 421; **00,** 483; **01,** 482; **02,** 408; **03,** 438; **04,** 467; **05,** 478; **06,** 526; **07,** 548; **08,** 585; **09,** 618; **10,** 691; **11,** 744; **12,** 897.

* Allotment.

[1] See Part b.

[2] Amount trans. from operating and care of Ohio R., Aug. 31, 1908.

Boards. Convened, Pittsburgh, Pa., May 3, 1894, under S. O. No. 20, dated Apr. 24, 1894, to report upon proposed plans for lock and dam below Herr Isld. **R., 94,** 1924. (Col. W. P. Craighill, Maj. D. W. Lockwood, Maj. T. Turtle.)

In charge:
Lt. Col. A. Stickney, 1892–93. **R., 93,** 2501.
Capt. R. L. Hoxie, 1894–96. **R., 94,** 1918; (Maj.) **95,** 2410; **96,** 2200.
Maj. C. F Powell, 1897–1901. **R., 97,** 2428; **98,** 2206; **99,** 2404; **00,** 3257; **01,** 2701.
Capt. Wm. L. Sibert, 1902–06. **R., 02,** 1900, 1902; **03,** 1680; (Maj.) **04,** 2522; **05,** 1854; **06,** 1607.
Maj. H. C. Newcomer, 1907–. **R., 07,** 1699; **08,** 1775; **09,** 1770; (Lt. Col.) **10,** 1931; **11,** 2120; **12,** 2311.

Assistant. J. W. Arras. **R., 93,** 2501; **94,** 1919; **95,** 2414; **96,** 2205; **97,** 2429; **98,** 2207; **01,** 2702; **02,** 1908; **03,** 1681; **04,** 2524; **05,** 1855.

LEGAL PROCEEDINGS. (See Projects.)

Purchases of land for Locks and Dams Nos. 2 and 3, **97,** 2432; **98,** 2209; the last reference including condemnation proceedings for land at No. 3.

Title to the lock ground adjacent to Sixmile Isld. Lock not obtained to 1900, no satisfactory reply having been received from the Pittsburgh city au. to the offers from the U. S., **00,** 3260.

LEGISLATION.

City councils of Pittsburgh passed ordinance in Feb., 1902, granting to the U.S. land required for site of lock at head of Sixmile Isld., **C2,** 1900.

OPERATIONS.

1892-94. Preparations made for constr. of Herr Isld. work, **93,** 2501; **94,** 1919.

1894-95. Constr. of lock foundations in progress. **95,** 2413.

1895-96. Work of preceding year continued, **96,** 2200. (Unit prices of materials, labor, etc.) **96,** 2204.

1896-97. Lock and head walls completed, and foundation of the miter walls partly laid, **97,** 2429. (Summary of work performed and materials expended) **97,** 2432.

1897-98. Lock and fixed part of dam at Herr Isld. works under constr.; Lock No. 3, Springdale, begun, **98,** 2206, 2210. (Summary of work performed and materials expended) **98,** 2209.

1898-99. Accessory lock structures, a part of the movable dam at Herr Isld., and the Springdale Lock, incl. its dam, under constr. during year, **99,** 2405.

1899-00. Lock at Herr Isld. and some accessories completed, the Chanoine wickets and irons for the navigable pass obtained, and building of the foundation of the pass commenced. **00,** 3258.

1900-01. Work continued on Herr Isld. Lock and Dam; navigable pass and concrete pier and cribs nearly completed; work continued on Springdale Lock and Dam, and cribs and lower guide wall nearly completed, **01,** 2701.

1901-02. Work on locks and dams at Herr Isld. and Springdale continued, **02,** 1900.

1902-03. Lock and dam at Herr Isld. and lock-master's house completed; cofferdam of Lock and Dam No. 2 practically finished and 5,659 c. y. gravel and r. excavated for foundation of lock and lock floor; concrete core wall of Lock and Dam No. 3 completed, embankment made and concrete paving placed; numerous freshets prevented completion, **03,** 1681, 1682, 1683.

1903-04. Excavation for foundation of Lock and Dam No. 2 completed and all irons set, concrete return wall completed and gravel cofferdams constr.; sheeting on upper face of Lock and Dam No. 3 completed, cribwork raised, and st. and gravel filling placed, **04,** 2524.

1904-05. Lock and abutment for Dam No. 2 finished; Pennsylvania RR. Co. deposited 8,000 c. y. of ashes and slag behind lock; timber cribwork of dam of Lock No. 3 completed, piles driven on upstream face of dam and lock-master's house practically completed, **05,** 1856, 1857.

1905-06. Work of Locks and Dams Nos. 2 and 3 continued; excavation, pile, st., and concrete work in progress on Lock and Dam No. 2, and gate completed; Lock and Dam No. 3 nearly completed; lock master's dwelling completed, **06,** 1607, 1608.

1906-07. Lock gates of Lock and Dam No. 2 erected, power conduit begun, and 41,409 c. y. slag placed by Pennsylvania RR. Co.; lock master's house erected at Lock and Dam No. 3, abutment of dam failed and dam dynamited, **07,** 1699, 1700.

1907-08. Work on Lock and Dam No. 2 continued, power conduit completed and filling of lock grounds by Pennsylvania RR. Co. practically completed; reconstr. of abutment of Dam No. 3 begun, land washed away restored, and work on dam continued, **08,** 1775–78.

1908-09. Lock and Dam No. 2 and abutment completed; Lock and Dam No. 3 completed and 76,358 c. y. slag and refuse placed behind abutment, **09,** 1770, 1771.

1909-10. 25,000 c. y. ashes, slag, etc., and 450 c. y. large st. placed for bank protection, **10,** 1931.

1910-11. Bank-protection work completed at Dam No. 2; 88,598 c. y. material placed in embankment during year at Springdale, **11,** 2120.

1911-12. 46,864 c. y. deposited in embankment at Dam No. 3, Springdale, Pa., to restore bank, **12,** 2311.

PHYSICAL CHARACTERISTICS.

R. bottom at Herr Isld. Dam treacherous, **94,** 1919.

Floods and ice damaging works, **94,** 1919; **95,** 2413.

PRIVATE WORK.

City of Pittsburgh let contract to extend 9′ sewer so as to have it empty below instead of above the dam, **04,** 2525; **05,** 1856.

PROJECTS.

Herr Isld. By Lt. Col. Stickney, 1892–93, for changing the position of works to provide a passageway 55′ w. at the bank, settling all legal opposition of riparian owners to lock location, **93,** 2501.

By Capt. Hoxie, 1894, modified by B., 1894, for lock 55′ x 330′, and for dam, pass, and weir of Chanoine type; est. of lock, $225,147; of dam, $373,963.24, **94,** 1924. Modified by Maj. Powell, 1898, by providing navigable pass 500′ w. instead of one 250′; for substitution of 2 bear-trap dams 94′ l. each for 2 Chanoine wicket weirs; and for fixed masonry dam with 3 4½′ valve culverts for a Boulé dam 20′ w. in the 55′ passageway above mentioned, **98,** 2206, 2207.

After failure of cofferdam, 1894, Maj. Hoxie proposed dr. out foundation of lock to 30′ below pool level, deposit of stratum of concrete at this d. under water in concrete form of piles; redeposit of dr. material, after starting foundations on the concrete stratum, for a certain distance, and completion by means of a cofferdam (drawing of details), **95,** 2412. Est., $82,644; completed for $22,203.16 less, **96,** 2202, 2205.

Nos. 2 and 3. Act 1896 au. beginning work at Sixmile Isld. and at Springdale under continuous contract. General proj. prepared and approved, 1896–97, for timber dams and concrete locks, the lift of the locks to be 11′ and 12′, resp.; the useful dimensions of the lock chambers to be 56′ x 289.5′, **97,** 2432.

By Capt. Sibert, completion of Locks and Dams Nos. 1, 2, and 3; est., $178,000, **02,** 1902.

Est., by Maj. Sibert, of cost of work required to complete proj. for locks and dams, required by act June 13, 1902, $256,521.50,[1] **05,** 480, 1862.

Maj. Newcomer est., 1908, amount necessary to pay for damages to private property and restore land washed away by failure of abutment of dam, at $110,300, **08,** 1778.

Orig. proj. lock and dam work, adopted 1886, extended 1896, called for 3 locks and dams (built

[1] H. D. 167, 58th, 3d.

at 1912), extending slack water mouth to Natrona, 24 m.

Act 1912 au. 5 addl. locks and dams, extending slack water upstream, to 61 m. from mouth; est., $2,788,000. The act app. $300,000 contingent on local interests contributing same sum. Dam 1 movable; others, fixed type. Dam 3 of cribwork, Nos. 2 and 4 to 8 of concrete on pile foundation. Dimen.: No. 1, 55′ x 286′ plus; 2 and 3, 56′ x 289′ plus; 4, 8, 56′ x 360′ (see Surveys), **12,** 897.

SURVEYS.

Triangulation from Pittsburgh to Natrona, Pa., for estab. of H. lines, **07,** 1700.

Ex. au. act Feb. 27, 1911, with view to constr. of addl. locks and dams, made by Lt. Col. H. C. Newcomer (see Projects); plan of imp. submitted; est., $2,788,000, and $25,000 to $60,000 an. for maintenance.[1] **12,** 909.

Maps. (See projects, 3d par., drawings.)

Part (e), FF-20 Allegheny River, Pa., Locks and Dams on. (Operating and care.)

APPROPRIATIONS.

1903,	$5,233.62	**03,** 1685. **04,** 2526.
1904,	16,204.93	**05,** 1858.
1905,	27,235.94	**05,** 1858.
1906,	26,462.52	**06,** 1612. **07,** 1705.
1907,	82,998.35	**07,** 1706.
1908,	61,574.93	**08,** 1762.
1909,	37,839.51	**09,** 1775.
1910,	46,639.83	**10,** 1935.
1911,	30,874.84	**11,** 2123.
1912,	34,100.58	**12,** 2317.
Total,	369,165.05	**12,** 899.

COMMERCE.

Through the constr. of locks and dams a saving in rates will be effected, **11,** 746.

Traffic, 1911, on slack-water section, 1,375,000 t., 24,300+ passengers; marked by cheap R. rates, hindered by low brs. on Lower Allegheny R., **12,** 899.

CONTRACTS.

Johnson & Anderson, for 2 lock houses at Lock No. 2, $4,522 each, **09,** 1776.

ENGINEERS.

Chief of Engineers. R., 03, 439; **04,** 468; **05,** 479; **06,** 528; **07,** 549; **08,** 586; **09,** 620; **10,** 692; **11,** 745; **12,** 899.

In charge:

Capt. Wm. L. Sibert, 1903–06. **R., 03,** 1683; (Maj.) **04,** 2526; **05,** 1857; **06,** 1610.

Maj. H. C. Newcomer, 1907–. **R., 07,** 1703; **08,** 1780; **09,** 1772; (Lt. Col.) **10,** 1932; **11,** 2120; **12,** 2312.

Assistants:

J. W. Arras. **R., 04,** 2527; **05,** 1858.

Capt. R. C. Moore, 2d Lt. P. B. Fleming, J. W. Stewart, J. C. Mehaffy, and P. S. Reinecke, **12,** 890.

OBSTRUCTION. (See Commerce.)

OPERATIONS.

1903. Lock and Dam No. 1 assigned to "Operating and care of canals, etc.," in January; slight alterations made to valves and culvert intakes; experiments and tests made, **03,** 1683–85.

1903–04. Minor repairs made to Lock No. 1; about 350 c. y. st. and gravel placed in front of wall and 1,000 c. y. deposited in depression below large bear trap, **04,** 2527.

1904–05. Minor repairs to Lock No. 1; 800 t. st. placed at bottom of foundations of piers; Lock and Dam No. 3 assigned to "Operating and care of canals, etc.," Nov. 29, 1904; repairs and betterments made where needed, 800 c. y. st. placed below and at end of return wall of Lock No. 3; deposit of ashes and slag continued by Pennsylvania RR. Co., 15,000 c. y. placed along bank, **05,** 1858–60.

1905–06. Minor repairs made to gates, new retaining wall started and maneuvering boat constr. at Lock and Dam No. 1; imp. made to abutments, 2,000 t. st. deposited, and 40,000 c. y. slag placed by Pennsylvania RR. Co. at Lock and Dam No. 3, **06,** 1610–12.

1906–07. 5,200 c. y. st. placed below bear-trap weirs of Lock and Dam No. 1, and retaining wall completed; abutment of Lock and Dam No. 3 failed and carried away 9 dwellings and 5.3 acres of land; 560 l. f. of top of dam blasted off, **07,** 1703–05.

1907–08. Repairs made to Lock and Dam No. 1, and 300 c. y. small st. and 575 c. y. large st. placed above bear-trap foundations; 1,000 c. y. dr. from lower entrance of Lock and Dam No. 2, and 11,610 c. y. dr. from below lower entrance; 1,500 c. y. dr. from upper entrance to Lock No. 3, and 2,865 c. y. dr. from above dam, **08,** 1780–82.

1908–09. Minor repairs made to Lock and Dam No. 1; 19,850 c. y. dr. from below Lock No. 2, 1,875 c. y. removed from lock chamber and 1,362 c. y. r. bottom blasted and dr.; 2 lock houses under constr.; minor repairs made to Lock and Dam No. 3, **09,** 1772–74.

1909–10. General repairs made and 7,023 c. y. dr. from lock entrance of Lock and Dam No. 1; lock houses nearly completed at Lock and Dam No. 2, 54,300 c. y. ashes, etc., placed at abutment of dam to protect eroded bank; minor repairs made at Lock and Dam No. 3, **10,** 1932–35.

1910–11. Lock and Dam No. 1: Repairs to machinery and structures made and 810 sq. ft. concrete walk constr., **11,** 2121. Lock and Dam No. 2: 225 c. y. riprap and 700 c. y. large derrick st. placed along lower edge of protection crib of dam; downstream face of concrete dam repaired; 30 l. f. of head of upper guard crib was reconstr.; 24,233 c. y. dr. at Fourteenmile Isld., **11,** 2122. Lock and Dam No. 3: Minor repairs, incl. dr. of lock chamber and approaches, and repairs to lock walls were made, **11,** 2122.

1911–12. Lock and Dam No. 1: 86,037 c. y. dr., 1 large snag and 2 bowlders removed from Pool No. 2 at Twelve and Fourteenmile Islds., resp., **12,** 2313. Lock and Dam No. 2: Repairs to lock machinery and structures, **12,** 2315. Lock and Dam No. 3: Small amount of sheathing replaced on downstream slope of dam, **12,** 2316.

PHYSICAL CHARACTERISTICS.

Unusual heavy rains, producing flood, prevented the use of maneuvering boat; ramming ineffectual; general idea that it is unsafe to permit a Chanoine wicket dam to stand over a considerable rise proved erroneous; dam withstood severe test; less damage done than from ramming, **12,** 2313, 2314.

PRIVATE WORK.

Pittsburgh Plate Glass Co. removed 500 c. y. gravel from entrance to Lock No. 3 for its own convenience, **06,** 1612.

J. K. Davison & Bro. placed 2,240 c. y. slag and gravel along upstream side of the dam, without cost to U. S., **12,** 2315.

Sand and gravel dr. firm removed about 500 c. y. sand and gravel from chan. opposite Verona, and placed it along the bank for protection against wash, **12,** 2316.

[1] H. D. 540, 62d, 2d.

FF-21(a) CONEMAUGH AND KISKIMINETAS RIVERS, PA.

COMMERCE.

Description, **79,** 1394.

ENGINEERS.

Chief of Engineers. R., 78, 109; **79,** 147.
In charge. Maj. W. E. Merrill, 1878; **78,** 109. **R., 79,** 1388.
Assistant. J. Worrall. **R., 79,** 1390.

PHYSICAL CHARACTERISTICS.

Fall of Conemaugh and Kiskiminetas Rs., bet. Johnstown and the Allegheny R., **79,** 1389.

Water supply by means of reservoirs sufficient, **79,** 1391.

PLANS.

By J. Worrall, water communication Havre de Grace, Md., to Pittsburgh, Pa., having vertical lockage of 2,700′, divided into 3 sections: Eastern division, from mouth of the Susquehanna, along that and the Juniata Rs., to Frankstown, with a canal and slack-water navigation, requiring 912′ of lockage; est., $10,720,000; difficulties in damming the Susquehanna R., **79,** 1392, 1393, 1397. Middle or mountainous division, from Frankstown, on the Juniata, to Johnstown, on the Conemaugh, by independent canals and partial slack-water navigation on the Conemaugh R., requiring 1,339′ of lockage, by tunneling through the mountains, water supply by feeders from reservoirs; est., $15,607,000, **79,** 1392, 1393, 1397. Western division, from Johnstown, via Conemaugh, Kiskiminetas, and Allegheny Rs., to Pittsburgh, by slack-water navigation, requiring 449′ of lockage; est., $4,518,700, **79,** 1393, 1396, 1397. Total est. for single locks, $30,845,700; for double locks, $40,000,000, **79,** 1397.

List of reservoirs, **79,** 1395, 1397.

Discussion of advantages and disadvantages of slack-water navigation, **79,** 1392.

Discussion of possibility of surmounting all engineering difficulties, **79,** 1388, 1391.

PRIVATE (STATE AND CORPORATE) WORK.

The "main line of Pennsylvania's public works," running from Philadelphia to Pittsburgh, consisted of railway from Philadelphia to Columbia, canals from Columbia to the foot of the Allegheny Mtns., portage railway across the Alleghenies, and canal and slack-water navigation from Johnstown to Pittsburgh, about 409 m., **79,** 1390.

SURVEYS.

Under direction of Maj. Merrill, 1878–79, by J. Worrall, reconnoissance of Conemaugh and Kiskiminetas Rs.; also a sur. for water communication from Ohio R. at Pittsburgh, Pa., to the Chesapeake B. at Havre de Grace, Md., via Allegheny, Kiskiminetas, Conemaugh, Juniata, and the Susquehanna Rs. **R., 79,** 1388, 1390.

FF-28 RED BANK (Sandy Lick) CREEK, PA.

ENGINEERS.

Chief of Engineers. R., 81, 263.
In charge. Maj. W. E. Merrill. **R., 81,** 1959.
Assistant. J. Worrall. **R., 81,** 1961.

PHYSICAL CHARACTERISTICS.

Description of the Appalachian region; trib. to Allegheny R.; flows bet. Armstrong and Clarion Co., **81,** 1962.

PLANS.

In 1881 Maj. Merrill reported inadvisable to use bear-trap dams, **81,** 1961.

SURVEYS.

Ex. au. act June 14, 1880; made by Maj. Merrill (see Plans), **81,** 1959.

FF-29 CLARION RIVER, PA.

COMMERCE.

Lumber statistics, **82,** 1938, 1944.

Description of: This stream first in C. importance of the Allegheny tributaries; an. t., 125,000 t., **96,** 2209.

ENGINEERS.

Chief of Engineers. R., 81, 263; **82,** 257; **95,** 328; **96,** 283.

In charge:
Maj. W. E. Merrill. **R., 82,** 1938.
Maj. R. L. Hoxie, 1896. **R., 96,** 2208.

Assistants:
J. Worrall. **R., 82,** 1939.
J. W. Arras. **R., 96,** 2210.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1938, 1939, 1942.

Description of: Second in the order of area drained by Allegheny R. tributaries. Navigability of the R. dependent on h. w., **96,** 2209.

PLAN.

Maj. Merrill reported, 1881, that until the Allegheny R. had been radically imp. there was but small need of imp. of its tributaries except to keep open navigation by the removal of r. and similar obstr., which could be done on Clarion R. at an est. of $40,000, **82,** 1938, 1941.

SURVEYS.

Au. act Mar. 3, 1881; made by Maj. Merrill, 1881, **82,** 1938.

Ex. au. act Aug. 17, 1894; made, 1895, by Maj. Hoxie (**R.** fav. only to obstr. removal), **96,** 2208.

FF-30 TIONESTA (River) CREEK, PA.

COMMERCE.

Description of, **95,** 2418.

An. output of 40,000,000 c. f. lumber, at 1895, that would probably continue for 25 years, **95,** 2417.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 263; **91,** 294; **95,** 327.

In charge:

Maj. W. E. Merrill, 1884–91. **R.,** **84,** 1704; (Lt. Col.) **91,** 2381.

Maj. R. L. Hoxie, 1895. **R.,** **95,** 2417.

Assistant. I. V. Hoag, jr. **R.,** **84,** 1704; **95,** 2419.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2381.

PLANS.

Maj. Merrill, 1883, est. $1,000 as cost of removal of boom piers at lower portion of creek, but does not consider imp. as one of public necessity, **84,** 1704.

By Lt. Col. Merrill, removal of obstr. to such an extent as to enable the creek to be used for rafting purposes; est., $2,000, **91,** 2381.

PRIVATE WORK.

Obstr. from over 7 m. of stream removed at various times by business firms, **95,** 2419.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1883, by Maj. Merrill (see Plans), **84,** 1704.

Ex. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Merrill (see Plans), **91,** 2381.

Ex. au. act Aug. 17, 1894; made by Capt. Hoxie, 1894 (**R.** fav.; opinion of the Chief of Engineers unfav.), **95,** 2417.

FF-38 BEAVER RIVER, PA.

COMMERCE.

No traffic "at present"; many large iron and steel industries in vicinity, **04,** 2534.

ENGINEERS.

Chief of Engineers. **R.,** **04,** 470.

Boards. BERH. Concurs in unfav. **R.,** **04,** 2533.

In charge. Maj. W. L. Sibert, 1904. **R.,** **04,** 2531

Assistant. Wm. Martin. **R.,** **04,** 2534, 2535, 2537.

OBSTRUCTIONS.

8 brs. in 6 m.—2 RR. brs., and none would give proper clearance after R. imp.; 4 stationary dams for power.

PHYSICAL CHARACTERISTICS.

Details, **04,** 2531.

Discharge not enough for power and navigation, **04,** 2530.

PLANS.

Imp. would probably cost from $5,000,000 to $7,000,000. **04,** 2531.

SURVEYS.

Pre. ex. au. act June 13, 1902, Ohio R. to n. end Beaver Falls Borough, with view to slack-water navigation; **R.** by Maj. Sibert, Apr. 16, 1903 (unfav.),[1] **04,** 470, 2529.

FF-38(a) OHIO CANAL TO BIG BEAVER RIVER, PA. (For canal.)[2]

FF-41 MAHONING RIVER, OHIO.

ENGINEERS.

Chief of Engineers. **R.,** **10,** 700.

In charge. Lt. Col. H. C. Newcomer, **10,** 685.

SURVEY.

Pre. ex. au. act Mar. 3, 1909, from Girard Dam to Warren. **R.,** Lt. Col. Newcomer, Aug. 5, 1909[3] (unfav.), **10,** 700.

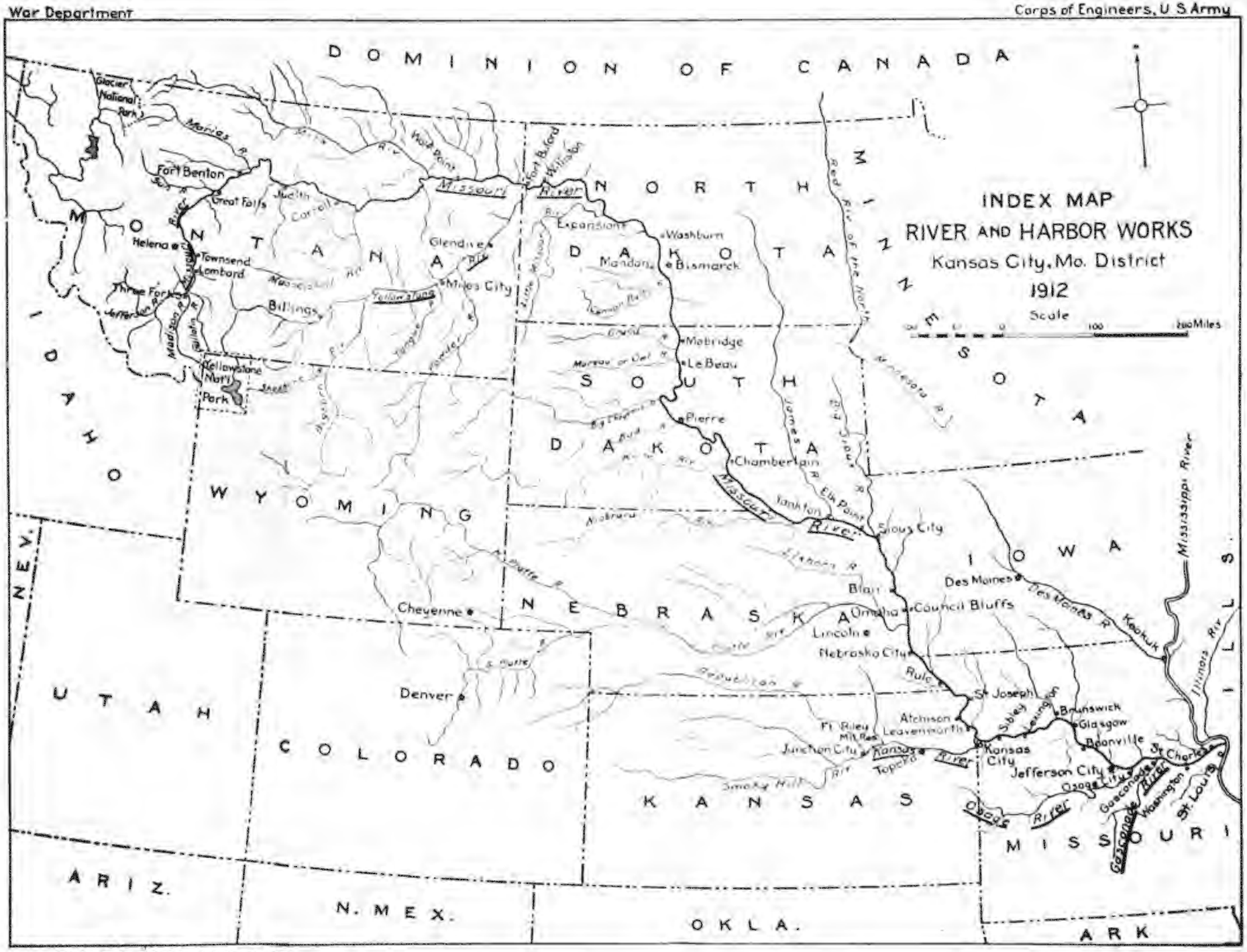
[1] H. D. 225, 58th, 2d. [2] Sur.—**R.,** May 4, 1832. (H. D. 482, 55th, 2d.) [3] H. D. 211, 61st, 2d.

RIVER AND HARBOR WORKS.

MISSISSIPPI RIVER SYSTEM.

MISSOURI RIVER BRANCH.

GG.—KANSAS CITY, MO., DISTRICT.


INDEX MAP
RIVER AND HARBOR WORKS
Kansas City, Mo. District
1912
Scale
100
200 Miles
DOMINION OF CANADA
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WYOMING
NEBRASKA
IOWA
ILLINOIS
MISSOURI
KANSAS
COLORADO
UTAH
ARIZ.
N. MEX.
OKLA.
ARK
IDAHO
NEV.
Glacier National Park
Fort Benton
Great Falls
Helena
Townsend
Lombard
Three Forks
Billings
Yellowstone Nat'l Park
Miles City
Glendive
Fort Buford
Williston
Expansion
Washburn
Mandan
Bismarck
Mobridge
Le Beau
Pierre
Chamberlain
Yankton
Sioux City
Des Moines
Keokuk
Blair
Omaha
Council Bluffs
Lincoln
Nebraska City
Rulo
St. Joseph
Brunswick
Glasgow
Boonville
St. Charles
St. Louis
Atchison
Leavenworth
Kansas City
Jefferson City
Osage City
Gasconade
Washington
Ft. Riley
Junction City
Topeka
Cheyenne
Denver
Missouri River
Mississippi River
Illinois River
Kansas River
Osage River
Gasconade River
Red River of the North
James River
Big Sioux R.
Elk Point
Niobrara R.
Platte R.
Republican R.
Smoky Hill R.
Cottonwood R.
Big Horn R.
Bad R.
Cheyenne R.
Moreau or Cut R.
Grand R.
Cannon Ball R.
Little Missouri R.
Yellowstone R.
Musselshell R.
Milk R.
Marias R.
Sun R.
Dearborn R.
Jefferson R.
Madison R.
Gallatin R.
Big Hole R.
Bitterroot R.
Clark Fork
Kootenai R.
Flathead R.
Milk Rapids
Mill Rec.

GG.—KANSAS CITY, MO., DISTRICT.

(Comprising the Missouri River System.)

In charge of U. S. Engineer Office,
Kansas City, Mo.

GG 1 Mississippi R., Mo.
GG 2 Missouri R. (1)
GG 3 Taylors Branch, Mo. (2)
GG 4 Little Duckett Cr., Mo. (2)
GG 5 Big Duckett Cr., Mo. (2)
GG 6 Femme Osage Cr., Mo. (2)
GG 7 Little Femme Osage Cr., Mo. (6)
GG 8 Callaway Branch, Mo. (6)
GG 9 Bigelow Cr., Mo. (2)
GG 10 Sehrt Cr., Mo. (9)
GG 11 Tuque Cr., Mo. (2)
GG 12 College Cr., Mo. (11)
GG 13 Wolf Cr., Mo. (11)
GG 14 Charrette Cr., Mo. (2)
GG 15 Dry Fork, Mo. (14)
GG 16 Howard Branch, Mo. (15)
GG 17 Smith Cr., Mo. (2)
GG 18 Water Run, Mo. (17)
GG 19 Lost Cr., Mo. (2)
GG 20 Little Lost Cr., Mo. (19)
GG 21 Massas Cr., Mo. (2)
GG 22 Loutre R., Mo. (2)
GG 23 Bear Cr., Mo. (22)
GG 24 Little Bear Cr., Mo. (23)
GG 25 Mill Branch, Mo. (22)
GG 26 Clear Cr., Mo. (22)
GG 27 Smiths Branch, Mo. (22)
GG 28 Cave Branch, Mo. (27)
GG 29 Clear Cr., Mo. (27)
GG 30 Bates Branch, Mo. (27)
GG 31 Lick Branch, Mo. (22)
GG 32 McIntosh Branch, Mo. (31)
GG 33 Little Loutre Cr., Mo. (22)
GG 34 Bachelor Cr., Mo. (22)
GG 35 Whetstone Cr., Mo. (22)
GG 36 Heat Spring Cr., Mo. (35)
GG 37 Clarks Branch, Mo. (35)
GG 38 Massy Branch, Mo. (22)
GG 39 Davis Branch, Mo. (38)
GG 40 Simpsons Branch, Mo. (22)
GG 41 Prairie Fork, Mo. (22)
GG 42 Martins Branch, Mo. (41)
GG 43 Cole Cr., Mo. (41)
GG 44 Dry Fork of Loutre R., Mo. (22)
GG 45 Wardens Branch, Mo. (22)
GG 46 Modoc Cr., Mo. (2)
GG 47 Quick Cr., Mo. (46)
GG 48 Little Tavern Cr., Mo. (2)
GG 49 Big Tavern Cr., Mo. (2)
GG 50 Myers Branch, Mo. (49)
GG 51 Logan Cr., Mo. (2)
GG 52 Auxvasse Cr., Mo. (2)
GG 53 Cow Cr., Mo. (52)
GG 54 Harrison Branch, Mo. (52)
GG 55 Rocky Branch, Mo. (52)
GG 56 Byhume Cr., Mo. (52)
GG 57 Craghead Branch, Mo. (52)
GG 58 Crow Cr., Mo. (52)
GG 59 Dyers Branch, Mo. (58)
GG 60 Allen Branch., Mo. (58)
GG 61 McKinney Branch, Mo. (58)
GG 62 Houts Branch, Mo. (58)
GG 63 Richland Cr., Mo. (58)
GG 64 Dunlaps Cr., Mo. (58)
GG 65 Stinson Cr., Mo. (58)
GG 66 Ewings Cr., Mo. (2)
GG 67 East Wing Cr., Mo. (66)
GG 68 Middle R., Mo. (2)
GG 69 Craghead Cr., Mo. (68)
GG 70 Midde Cr., Mo. (68)
GG 71 Gallons Cr., Mo. (68)
GG 72 Little Auxvasse Cr., Mo. (68)
GG 73 Rivaux Cr., Mo. (2)
GG 74 Cedar Cr., Mo. (2)
GG 75 Turkey Cr., Mo. (74)
GG 76 Smiths Cr., Mo. (74)
GG 77 Millers Cr., Mo. (74)
GG 78 Fowler Cr., Mo. (74)
GG 79 Bonne Femme Cr., Mo. (2)
GG 80 Turkey Cr., Mo. (79)
GG 81 Gans Cr., Mo. (79)
GG 82 Little Bonne Femme Cr., Mo. (2)
GG 83 Rochee Perchee Cr., Mo. (2)
GG 84 Grindstone Cr., Mo. (83)
GG 85 Hinkson Cr., Mo. (83)
GG 86 Hominy Branch, Mo. (85)
GG 87 Flat Branch, Mo. (85)
GG 88 Bear Cr., Mo. (83)
GG 89 Rocky Cr., Mo. (83)
GG 90 Slacks Branch, Mo. (83)
GG 91 Silver Cr., Mo. (83)
GG 92 Little Cr., Mo. (91)
GG 93 Long Branch, Mo. (91)
GG 94 Thompsons Branch, Mo. (91)
GG 95 Grindstone Branch, Mo. (91)
GG 96 Lick Cr., Mo. (83)
GG 97 Stocktons Branch, Mo. (83)
GG 98 Callahan Cr., Mo. (83)
GG 99 Barclay Branch, Mo. (98)
GG 100 Sugar Cr., Mo. (83)
GG 101 Sinking Cr., Mo. (2)
GG 102 Moniteau Cr., Mo. (2)

GG 103 McGill Branch, Mo. (102)
GG 104 Prairie Fork, Mo. (102)
GG 105 Braggs Branch, Mo. (102)
GG 106 Cole Cr., Mo. (102)
GG 107 Hungry Mother Cr., Mo. (102)
GG 108 Salt Cr., Mo. (2)
GG 109 Bonne Femme Cr., Mo. (2)
GG 110 Salt Fork, Mo. (109)
GG 111 Sugar Tree Branch, Mo. (109)
GG 112 Adams Branch, Mo. (109)
GG 113 Sulphur Cr., Mo. (109)
GG 114 Boones Branch, Mo. (2)
GG 115 Richland Cr., Mo. (2)
GG 116 Hurricane Cr., Mo. (2)
GG 117 Greggs Cr., Mo. (2)
GG 118 Chariton R., Iowa and Mo. (2)
GG 119 Batts Cr., Mo. (118)
GG 120 Doxies Cr., Mo. (119)
GG 121 East Fork, Mo. (118)
GG 122 Silver Cr., Mo. (121)
GG 123 Sweet Springs Cr., Mo. (121)
GG 124 Sugar Cr., Mo. (121)
GG 125 Dark Cr., Mo. (121)
GG 126 Middle Fork, Mo. (118)
GG 127 Muncas Cr., Mo. (126)
GG 128 Puzzle Cr., Iowa and Mo. (118)
GG 129 Long Branch, Iowa and Mo. (118)
GG 130 Muscle Cr., Mo. (118)
GG 131 Palmer Cr., Mo. (2)
GG 132 Lake Cr., Mo. (131)
GG 133 Grand R., Iowa and Mo. (2)
GG 134 Brush Cr., Mo. (133)
GG 135 Salt Cr., Mo. (133)
GG 136 Yellow Cr., Mo. (133)
GG 137 Locust Cr., Iowa and Mo. (133)
GG 138 Thomsons Fork, Iowa and Mo. (133)
GG 139 Big R., Iowa and Mo. (133)
GG 140 East Fork, Iowa and Mo. (133)
GG 141 West Fork, Iowa and Mo. (133)
GG 142 Grindstone Cr., Mo. (133)
GG 143 Shoal Cr., Mo. (133)
GG 144 Big Cr., Mo. (133)
GG 145 Parker Branch, Mo. (144)
GG 146 Snow Cr., Mo. (144)
GG 147 Mud Branch, Mo. (144)
GG 148 Turkey Branch, Mo. (144)
GG 149 Wolf Branch, Mo. (144)
GG 150 Shoatman Cr., Mo. (144)
GG 151 Parker Branch, Mo. (144)
GG 152 Darr Branch, Mo. (144)
GG 153 Peavine Branch, Mo. (144)
GG 154 Wakenda Cr., Mo. (2)
GG 155 Little Wakenda Cr., Mo. (154)
GG 156 Brush Cr., Mo. (154)
GG 157 McGill Cr., Mo. (154)
GG 158 McCreskie Cr., Mo. (154)
GG 159 Plum Branch, Mo. (158)
GG 160 Turkey Cr., Mo. (154)
GG 161 Bee Branch, Mo. (160)
GG 162 Hickory Cr., Mo. (160)
GG 163 Burr Oak Cr., Mo. (160)
GG 164 East Fork, Mo. (154)
GG 165 Pedee Cr., Mo. (164)
GG 166 Crabapple Cr., Mo. (164)
GG 167 West Fork, Mo. (154)
GG 168 Moss Cr., Mo. (154)
GG 169 Crooked R., Mo. (2)
GG 170 East Fork, Mo. (169)
GG 171 Middle Fork, Mo. (169)
GG 172 West Fork, Mo. (169)
GG 173 Cottonwood Branch, Mo. (172)
GG 174 Willow Cr., Mo. (2)
GG 175 Cravens Cr., Mo. (2)
GG 176 Fishing R., Mo. (2)
GG 177 Keeney Branch, Mo. (176)
GG 178 Bogart Cr., Mo. (176)
GG 179 Schackelford Branch, Mo. (176)
GG 180 Lick Cr., Mo. (176)
GG 181 East Fork, Mo. (176)
GG 182 Dry Fork, Mo. (181)
GG 183 Williams Cr., Mo. (176)
GG 184 Clear Cr., Mo. (176)
GG 185 Carroll Cr., Mo. (184)
GG 186 Muddy Cr., Mo. (184)
GG 187 Rock Cr., Mo. (176)
GG 188 Holmes Cr., Mo. (176)
GG 189 Crocketts Cr., Mo. (176)
GG 190 Rush Cr., Mo. (2)
GG 191 Town Branch, Mo. (2)
GG 192 Shoal Cr., Mo. (2)
GG 193 Little Shoal Cr., Mo. (192)
GG 194 Dougherty Branch, Mo. (192)
GG 195 Thornton Mill Cr., Mo. (192)
GG 196 Buckeye Cr., Mo. (2)
GG 197 Searey Branch, Mo. (196)
GG 198 Rock Cr., Mo. (2)
GG 199 Line Cr., Mo. (2)
GG 200 Little Platte R., Iowa and Mo. (2)
GG 201 Rush Cr., Mo. (200)
GG 202 Brush Cr., Mo. (200)
GG 203 Hayes Cr., Mo. (202)
GG 204 Ellis Branch, Mo. (200)
GG 205 Prairie Cr., Mo. (200)
GG 206 Sand Branch, Mo. (205)
GG 207 Big Cr., Mo. (205)
GG 208 Clear Branch, Mo. (200)
GG 209 Smith Cr., Mo. (200)
GG 210 Todds Cr., Mo. (209)
GG 211 First Cr., Mo. (209)
GG 212 Wilkerson Branch, Mo. (209)
GG 213 Crows Branch, Mo. (209)
GG 214 Camp Cr., Mo. (209)
GG 215 Roberts Branch, Mo. (209)
GG 216 Owen Branch, Mo. (209)
GG 217 Dicks Cr., Mo. (200)
GG 218 Owl Cr., Mo. (217)
GG 219 Castle Cr., Mo. (200)
GG 220 Mauldins Cr., Mo. (200)
GG 221 One Hundred and Two R., Iowa and Mo. (200)
GG 222 White Coal Cr., Mo. (200)
GG 223 Shanks Branch, Mo. (200)
GG 224 Jowler Cr., Mo. (200)
GG 225 Bee Cr., Mo. (2)
GG 226 Owl Cr., Mo. (225)
GG 227 Jordan Branch, Mo. (225)
GG 228 Little Jordan Branch, Mo. (227)
GG 229 Pedee Cr., Mo. (2)
GG 230 Brills Cr., Mo. (229)
GG 231 Bear Cr., Mo. (2)
GG 232 Mud Lake, Mo. (outlet) (2)
GG 233 Lake Contrary, Mo., discharge from (2)

GG 234 Liniment Cr., Mo. (2)
GG 235 Dillon Cr., Mo. (2)
GG 236 Nodaway R., Iowa and Mo. (2)
GG 237 East Nodaway R., Iowa (236)
GG 238 Middle Nodaway R., Iowa (236)
GG 239 West Nodaway R., Iowa (236)
GG 240 Mile Cr., Iowa (239)
GG 241 Little Tarkio Cr., Mo. (2)
GG 242 Square Cr., Mo. (241)
GG 243 Big Tarkio Cr., Iowa and Mo. (2)
GG 244 Rock Cr., Mo. (2)
GG 245 Nishnabotna R., Iowa and Mo. (2)
GG 246 East Nishnabotna R., Iowa (245)
GG 247 Turkey Cr., Iowa (246)
GG 248 Crooked Cr., Iowa (246)
GG 249 Divide Cr., Iowa (246)
GG 250 Buck Cr., Iowa (246)
GG 251 West Nishnabotna R., Iowa (245)
GG 252 Silver Cr., Iowa (251)
GG 253 Key Cr., Iowa (2)
GG 254 Mosquito Cr., Iowa (2)
GG 255 Indian Cr., Iowa (2)
GG 256 Iowa Lake, Iowa, outlet to (2)
GG 257 Pigeon Cr., Iowa (2)
GG 258 Boyer Cr., Iowa (2)
GG 259 Lone Tree Lake, Iowa (2)
GG 260 Willow R., Iowa (2)
GG 261 Soldier R., Iowa (2)
GG 262 East Soldier Cr., Iowa (261)
GG 263 Beaver Cr., Iowa (261)
GG 264 Little Sioux R., Iowa (261)
GG 265 Mill Cr., Iowa (261)
GG 266 West Fork, Iowa (261)
GG 267 Big Whiskey Cr., Iowa (266)
GG 268 Sand Hill Lake, Iowa (2)
GG 269 Floyd R., Iowa (2)
GG 270 Deep Cr., Iowa (269)
GG 271 Willow Cr., Iowa (270)
GG 272 Beaver Cr., Iowa (269)
GG 273 Perry Cr., Iowa (2)
GG 274 Big Sioux R., Iowa and S. Dak. (2)
GG 275 Broken Kettle Cr., Iowa (274)
GG 276 Indian Cr., Iowa (274)
GG 277 Ford Cr., Iowa (274)
GG 278 Sixmile Cr., Iowa (274)
GG 279 Dry Cr., Iowa (274)
GG 280 Rock R., Minn. and Iowa (274)
GG 281 East Rock R., Iowa and Minn. (280)
GG 282 Little Rock R., Iowa (280)
GG 283 Champepelon Cr., Iowa and Minn. (280)
GG 284 Tom Cr., Minn. (280)
GG 285 Mud Cr., Iowa (280)
GG 286 Bachelor Cr., Iowa (274)
GG 287 Silver Cr., Iowa (274)
GG 288 Skunk Cr., Iowa (287)
GG 289 Beaver Cr., S. Dak. (274)
GG 290 South Beaver Cr., S. Dak. (289)
GG 291 Little Beaver Cr., S. Dak. (274)
GG 292 Brule Cr., S. Dak. (274)
GG 293 Vermillion R., S. Dak. (2)
GG 294 Long Cr., S. Dak. (293)
GG 295 Saddle Cr., S. Dak. (294)
GG 296 East Fork, S. Dak. (293)
GG 297 Little Vermillion, S. Dak. (293)
GG 298 West Fork, S. Dak. (293)
GG 299 Turkey Ridge Cr., S. Dak. (293)
GG 300 Olay Cr., S. Dak. (293)
GG 301 James or Dakota R., S. Dak. and N. Dak. (2)
GG 302 Furlong Cr., S. Dak. (301)
GG 303 Wolf Cr., S. Dak. (301)
GG 304 Pierre Cr., S. Dak. (301)
GG 305 Rock Cr., S. Dak. (301)
GG 306 Redstone Cr., S. Dak. (301
GG 307 Marsh Cr., S. Dak. (301)
GG 308 Pearl Cr., S. Dak. (301)
GG 309 Shoe Cr., S. Dak. (301)
GG 310 Foster Cr., S. Dak. (301)
GG 311 Timber Cr., S. Dak. (301)
GG 312 Dry Run, S. Dak. (301)
GG 313 Mud Cr., S. Dak. (301)
GG 314 Bear Cr., N. Dak. (301)
GG 315 Kelly Cr., N. Dak. (301)
GG 316 Beaver Cr., N. Dak. (301)
GG 317 Pipestem Cr., N. Dak. (301)
GG 318 Bone Hill Cr., N. Dak. (301)
GG 319 Cottonwood Cr., N. Dak. (301)
GG 320 Elm R., S. Dak. (301)
GG 321 Maple Cr., S. Dak. and N. Dak. (320)
GG 322 Willow Cr., S. Dak. (320)
GG 323 Moccasin Cr., S. Dak. (301)
GG 324 Foot Cr., S. Dak. (323)
GG 325 Snake R., S. Dak. (301)
GG 326 North Fork of Snake R., S. Dak. (325)
GG 327 South Fork of Snake R., S. Dak. (325)
GG 328 Turtle R., S. Dak. (301)
GG 329 Ree Cr., S. Dak. (328)
GG 330 Wolf Cr., S. Dak. (328)
GG 331 Cain Cr., S. Dak. (301)
GG 332 Silver Cr., S. Dak. (301)
GG 333 Sand Hill Cr., S. Dak. (332)
GG 334 Morris Cr., S. Dak. (301)
GG 335 Firesteel Cr., S. Dak. (301)
GG 336 West Firesteel Cr., S. Dak. (335)
GG 337 Enemy Cr., S. Dak. (301)
GG 338 Twelvemile Cr., S. Dak. (301)
GG 339 Coffee Cr., S. Dak. (338)
GG 340 Pony Cr., S. Dak. (338)
GG 341 Dry Cr., S. Dak. (301)
GG 342 North Branch Dry Cr., S. Dak. (341)
GG 343 South Branch Dry Cr., S. Dak. (341)
GG 344 Lone Tree Cr., S. Dak. (301)
GG 345 South Branch Lone Tree Cr., S. Dak. (344)
GG 346 Beaver Cr., S. Dak. (301)
GG 347 The Rhine, S. Dak. (2)
GG 348 Silver Cr., S. Dak. (2)
GG 349 Snatch Cr., S. Dak. (2)
GG 350 Emanuel Cr., S. Dak. (2)
GG 351 Hoyts Cr., S. Dak. (2)
GG 352 Plum Cr., S. Dak. (2)
GG 353 Choteau Cr., S. Dak. (2)
GG 354 Mosquito Cr., S. Dak. (2)
GG 355 Ansons Cr., S. Dak. (2)
GG 356 Spring Cr., S. Dak. (2)
GG 357 Camel Cr., S. Dak. (2)
GG 358 Guibert Cr., S. Dak. (2)

GG 359 Cedar Cr., S. Dak. (2)
GG 360 Platte Cr., S. Dak. (2)
GG 361 Fivemile Cr., S. Dak. (2)
GG 362 Snake Cr., S. Dak. (2)
GG 363 Le Compte Cr., S. Dak. (2)
GG 364 Elm Cr., S. Dak. (2)
GG 365 Petersons Cr., S. Dak. (2)
GG 366 American Cr., S. Dak. (2)
GG 367 Crow Cr., S. Dak. (2)
GG 368 Smith Cr., S. Dak. (367)
GG 369 Boxelder Cr., S. Dak. (367)
GG 370 Elm or Wolf Cr., S. Dak. (2)
GG 371 Camel Cr., S. Dak. (2)
GG 372 Crow or Soldier Cr., S. Dak. (2)
GG 373 Reynolds Cr., S. Dak. (2)
GG 374 Chapelle Cr., S. Dak. (2)
GG 375 Little Medicine Cr., S. Dak. (2)
GG 376 Hackberry Cr., S. Dak. (2)
GG 377 Okobojo Cr., S. Dak. (2)
GG 378 Bloody Run Cr., S. Dak. (2)
GG 379 Little Cheyenne R., S. Dak. (2)
GG 380 Pole Cr., S. Dak. (2)
GG 381 Stage Cr., S. Dak. (2)
GG 382 Steamboat Cr., S. Dak. (2)
GG 383 Otter Cr., S. Dak. (2)
GG 384 Blue Blanket Cr., S. Dak. (2)
GG 385 Swan Cr., S. Dak. (2)
GG 386 Olson Cr., S. Dak. (2)
GG 387 Spring or Hermaphrodite Cr., S. Dak. (2)
GG 388 Cat Tail Cr., N. Dak. (2)
GG 389 Beaver Cr., N. Dak. (2)
GG 390 Horse Head Cr., N. Dak. (2)
GG 391 Long Lake Cr., N. Dak. (2)
GG 392 Long Knife Cr., N. Dak. (2)
GG 393 Apple Cr., N. Dak. (2)
GG 394 East Branch, N. Dak. (393)
GG 395 West Branch, N. Dak. (393)
GG 396 Painted Woods Cr., N. Dak. (2)
GG 397 Turtle Cr., N. Dak. (2)
GG 398 Spring Cr., N. Dak. (2)
GG 399 Wolf Cr., N. Dak. (2)
GG 400 Swan Cr., N. Dak. (2)
GG 401 Douglas Cr., N. Dak. (2)
GG 402 Rising Water or Pride Cr., N. Dak. (2)
GG 403 Shell Cr., N. Dak. (2)
GG 404 Little Knife R., N. Dak. (2)
GG 405 White Earth Cr., N. Dak. (2)
GG 406 Beaver Cr., N. Dak. (2)
GG 407 Tobacco Garden Cr., N. Dak. (2)
GG 408 Muddy Cr., N. Dak. (2)
GG 409 Sandy Cr., N. Dak. (408)
GG 410 Red Bank Cr., N. Dak. (408)
GG 411 Little Muddy Cr., Mont. (2)
GG 412 Big Muddy R., Mont. (2)
GG 413 East Fork, Mont. (412)
GG 414 Cherry Cr., Mont. (413)
GG 415 Poplar R., Mont. (2)
GG 416 Quaking Asp Cr., Mont. (415)
GG 417 East Branch, Mont. (415)
GG 418 West Branch, Mont. (415)
GG 419 Poplar Cr., Mont. (418)
GG 420 Tulle Cr., Mont. (2)
GG 421 Wolf Cr., Mont. (2)
GG 422 Little Porcupine Cr., Mont. (2)
GG 423 Milk R., Mont. (2)
GG 424 Porcupine Cr., Mont. (423)
GG 425 Buggy Cr., Mont. (423)
GG 426 Rocky Cr., Mont. (423)
GG 427 Frenchmans Cr., Mont. (423)
GG 428 White Cr., Mont. (423)
GG 429 Cottonwood Cr., Mont. (423)
GG 430 Woody Island Cr., Mont. (423)
GG 431 Assinniboine Cr., Mont. (423)
GG 432 West Fork, Mont. (431)
GG 433 Mud Cr., Mont. (423)
GG 434 Twelvemile Cr., Mont. (423)
GG 435 Black Cr., Mont. (423)
GG 436 Thirtymile Cr., Mont. (423)
GG 437 Noon Cr., Mont. (423)
GG 438 Battle Cr., Mont. (423)
GG 439 North Fork, Mont. (438)
GG 440 West Fork, Mont. (438)
GG 441 Red Rock Cr., Mont. (423)
GG 442 Coulee Cr., Mont. (441)
GG 443 Many Berries Cr., Mont. (423)
GG 444 North Branch of Milk R., Mont. (423)
GG 445 South Branch of Milk R., Mont. (423)
GG 446 Big Sandy Cr., Mont. (423)
GG 447 Sage Cr., Mont. (446)
GG 448 Box Elder Cr., Mont. (423)
GG 449 Clear Cr., Mont. (423)
GG 450 Snake Cr., Mont. (423)
GG 451 Water Cr., Mont. (423)
GG 452 Ninemile Cr., Mont. (423)
GG 453 Peoples Cr., Mont. (423)
GG 454 White Horse Cr., Mont. (423)
GG 455 Beaver Cr., Mont. (423)
GG 456 Antelope Cr., Mont. (455)
GG 457 Willow Cr., Mont. (455)
GG 458 Skunk Cr., Mont. (2)
GG 459 Champaign Cr., Mont. (2)
GG 460 Wolf Cr., Mont. (2)
GG 461 Gibson Cr., Mont. (2)
GG 462 Timber Cr., Mont. (2)
GG 463 Killed Woman Cr., Mont. (2)
GG 464 Fourchett Cr., Mont. (2)
GG 465 Kanuck Cr., Mont. (2)
GG 466 Beauchamp Cr., Mont. (2)
GG 467 Little Rock Cr., Mont. (2)
GG 468 Warm Spring Cr., Mont. (2)
GG 469 Calf Cr., Mont. (2)
GG 470 Cow Cr., Mont. (2)
GG 471 Birch Cr., Mont. (2)
GG 472 Sage Cr., Mont. (2)
GG 473 Eagle Cr., Mont. (2)
GG 474 Little Sandy Cr., Mont. (2)
GG 475 Twenty-fourmile Cr., Mont. (2)
GG 476 Marias R., Mont. (2)
GG 477 O'Briens Coulee, Mont. (476)
GG 478 Cottonwood Cr., Mont. (476)
GG 479 Willow Cr., Mont. (476)
GG 480 North Fork, Mont. (479)
GG 481 West Fork, Mont. (479)
GG 482 Cut Bank Cr., Mont. (476)
GG 483 Snake Cr., Mont. (482)
GG 484 Two Medicine Cr., Mont. (476)
GG 485 Badger Cr., Mont. (484)
GG 486 Birch Cr., Mont. (476)
GG 487 Dupuyer Cr., Mont. (486)
GG 488 Schultz Cr., Mont. (476)

GG 489 Piser Cr., Mont. (476)
GG 490 Antelope Cr., Mont. (489)
GG 491 Breast or Teton R., Mont. (2)
GG 492 Muddy Cr., Mont. (491)
GG 493 Gravel Bottom Cr., Mont. (491)
GG 494 Sun R., Mont. (2)
GG 495 Big Muddy Cr., Mont. (494)
GG 496 North Fork, Mont. (494)
GG 497 Little Willow Cr., Mont. (494)
GG 498 South Fork, Mont. (494)
GG 499 Willow Cr., Mont. (498)
GG 500 Little Muddy Cr., Mont. (2)
GG 501 Bird Tail Cr., Mont. (500)
GG 502 Rock Gap Cr., Mont. (500)
GG 503 Trout Cr., Mont. (2)
GG 504 Dearborn R., Mont. (2)
GG 505 Wolf Cr., Mont. (2)
GG 506 Dog Cr., Mont. (2)
GG 507 Rock Cr., Mont. (2)
GG 508 Little Prickly Pear Cr., Mont. (2)
GG 509 Beaver Cr., Mont. (2)
GG 510 Crow Cr., Mont. (2)
GG 511 Hot Springs Cr., Mont. (2)
GG 512 Jefferson R., Mont. (2)
GG 513 Wisdom R., Mont. (512)
GG 514 North Fork, Mont. (513)
GG 515 South Fork, Mont. (513)
GG 516 Wise R., Mont. (513)
GG 517 Beaver Head R., Mont. (512)
GG 518 Rattlesnake Cr., Mont. (517)
GG 519 Grasshopper Cr., Mont. (517)
GG 520 Horse Prairie Cr., Mont. (517)
GG 521 Red Rock Cr., Mont. (517)
GG 522 Blacktail Deer Cr., Mont. (517)
GG 523 Ruby R., Mont. (517)
GG 524 Willow Cr., Mont. (512)
GG 525 Madison R., Mont. and Wyo. (2)
GG 526 West Fork, Mont. (525)
GG 527 Firehole R., Wyo. (525)
GG 528 Gardner R., Wyo. (525)
GG 529 Gallatin R., Mont. (2)
GG 530 West Gallatin R., Mont. (529)
GG 531 Sixteenmile Cr., Mont. (2)
GG 532 Sixmile Cr., Mont. (2)
GG 533 Greyson Cr., Mont. (2)
GG 534 Deep Cr., Mont. (2)
GG 535 Duck Cr., Mont. (2)
GG 536 Confederate Cr., Mont. (2)
GG 537 White Gulch Cr., Mont. (2)
GG 538 Snipe Cr., Mont. (2)
GG 539 Cottonwood Cr., Mont. (2)
GG 540 Wegner Cr., Mont. (2)
GG 541 Sheep Cr., Mont. (2)
GG 542 Bird Cr., Mont. (2)
GG 543 Deep R., Mont. (2)
GG 544 Encampment Cr., Mont. (543)
GG 545 Hound Cr., Mont. (543)
GG 546 Smith R., Mont. (543)
GG 547 Sand Coulee Cr., Mont. (2)
GG 548 Box Elder Cr., Mont. (2)
GG 549 Bell Cr., Mont. (2)
GG 550 Otter Cr., Mont. (549)
GG 551 Highwood Cr., Mont. (2)
GG 552 Spring Cr., Mont. (2)
GG 553 Shonkin Cr., Mont. (2)
GG 554 Shallow Cr., Mont. (2)
GG 555 Crow Cr., Mont. (2)
GG 556 Arrow Cr., Mont. (2)
GG 557 Pine Cr., Mont. (556)
GG 558 Judith R., Mont. (2)
GG 559 Wolf Cr., Mont. (558)
GG 560 Skull Cr., Mont. (558)
GG 561 Wiltons Cr., Mont. (558)
GG 562 Beaver Cr., Mont. (558)
GG 563 Big Trout Cr., Mont. (558)
GG 564 Warren Spring Cr., Mont. (558)
GG 565 Salt Cr., Mont. (558)
GG 566 Dog Cr., Mont. (2)
GG 567 Snake Cr., Mont. (2)
GG 568 Armells Cr., Mont. (2)
GG 569 Musselshell R., Mont. (2)
GG 570 Crooked Cr., Mont. (569)
GG 571 Dovetail Cr., Mont. (569)
GG 572 Cat Cr., Mont. (569)
GG 573 Blood Cr., Mont. (569)
GG 574 Wood Cr., Mont. (569)
GG 575 Big Box Elder Cr., Mont. (569)
GG 576 Fords Cr., Mont. (575)
GG 577 McDonald Cr., Mont. (575)
GG 578 Yellow Water Cr., Mont. (569)
GG 579 Elk Cr., Mont. (578)
GG 580 Lawrence Cr., Mont. (578)
GG 581 Willow Cr., Mont. (569)
GG 582 Cameron Cr., Mont. (569)
GG 583 Pole Cr., Mont. (582)
GG 584 Womans Pocket Cr., Mont. (569)
GG 585 Elk Cr., Mont. (569)
GG 586 Hapleys Cr., Mont. (569)
GG 587 North Fork, Mont. (569)
GG 588 Lost Horse Cr., Mont. (587)
GG 589 Big Elk Cr., Mont. (587)
GG 590 American Fork, Mont. (569
GG 591 Lebo Cr., Mont. (590)
GG 592 Fish Cr., Mont. (569)
GG 593 Big Coulee Cr., Mont. (569
GG 594 Dean Cr., Mont. (569)
GG 595 Goulden Cr., Mont. (569)
GG 596 Half Breed Cr., Mont. (569)
GG 597 Fattio Cr., Mont. (569)
GG 598 Sage Hen Cr., Mont. (569)
GG 599 Lodge Pole Cr., Mont. (569)
GG 600 Squaw Cr., Mont. (2)
GG 601 Devil or Rattlesnake Cr., Mont. (2)
GG 602 Quarrel Cr., Mont. (2)
GG 603 Seven Blackfeet Cr., Mont. (2)
GG 604 Stick Lodge Cr., Mont. (2)
GG 605 Paradise or Little Snow Cr., Mont. (2)
GG 606 Flirt Cr., Mont. (2)
GG 607 Little Dry Fork, Mont. (2)
GG 608 Catamount Cr., Mont. (2)
GG 609 Big Dry Cr., Mont. (2)
GG 610 Big Timber Cr., Mont. (609)
GG 611 Cached Cr., Mont. (609)
GG 612 Crow Rock Cr., Mont. (609)
GG 613 Bridge Cr., Mont. (609)
GG 614 Brow Cr., Mont. (609)
GG 615 East Branch, Mont. (614)
GG 616 Ada Cr., Mont. (609)
GG 617 Carter Cr., Mont. (609)
GG 618 Elk R., Mont. (2)
GG 619 Sand Cr., Mont. (2)
GG 620 Elk Prairie Cr., Mont. (2)
GG 621 Antelope Cr., Mont. (2)

GG 622 Red Water Cr., Mont. (2)
GG 623 Shadow Cr., Mont. (2)
GG 624 Elk Horn Cr., Mont. (2)
GG 625 Hardscrabble Cr., Mont. (2)
GG 626 Yellowstone R., N. Dak., Mont., and Wyo. (2)
GG 627 Lone Tree Cr., Mont. (626)
GG 628 Fox Cr., Mont. (626)
GG 629 Crain Cr., Mont. (626)
GG 630 White Clay Cr., Mont. (626)
GG 631 Burns Cr., Mont. (626)
GG 632 Thirteenmile Cr., Mont. (626)
GG 633 Clear Cr., Mont. (626)
GG 634 Red Route Cr., Mont. (626)
GG 635 Mayradiers Cr., Mont. (626)
GG 636 Cedar Cr., Mont. (635)
GG 637 Cherry Cr., Mont. (635)
GG 638 Custer Cr., Mont. (626)
GG 639 Muster Cr., Mont. (626)
GG 640 Sunday Cr., Mont. (626)
GG 641 Sand Cr., Mont. (626)
GG 642 Horse Cr., Mont. (626)
GG 643 Little Porcupine Cr., Mont. (626)
GG 644 Short Cr., Mont. (626)
GG 645 Great Porcupine Cr., Mont. (626)
GG 646 Starved to Death Cr., Mont. (626)
GG 647 Froze to Death Cr., Mont. (626)
GG 648 Van Horn or Pease Cr., Mont. (626)
GG 649 Alkali Cr., Mont. (626)
GG 650 Buffalo Cr., Mont. (626)
GG 651 Pompeys Pillar Cr., Mont. (626)
GG 652 Razor Cr., Mont. (626)
GG 653 Crooked Cr., Mont. (626)
GG 654 Butter Cr., Mont. (626)
GG 655 Canon Cr., Mont. (626)
GG 656 Valley Cr., Mont. (626)
GG 657 Keyser Cr., Mont. (626)
GG 658 Sweet Grass Cr., Mont. (626)
GG 659 Big Timber Cr., Mont. (626)
GG 660 Little Timber Cr., Mont. (626)
GG 661 Pelican Cr., Mont. (626)
GG 662 Lamar R., Wyo. (626)
GG 663 Buffalo Cr., Wyo. and Mont. (662)
GG 664 Hell Roaring Cr., Wyo. and Mont. (626)
GG 665 Mill Cr., Mont. (626)
GG 666 Boulder Cr., Mont. (626)
GG 667 Upper Deer Cr., Mont. (626)
GG 668 Lower Deer Cr., Mont. (626)
GG 669 Bridge Cr., Mont. (626)
GG 670 Stillwater R., Mont. (626)
GG 671 Big Rosebud R., Mont. (670)
GG 672 Clarkes Fork, Mont. and Wyo. (626)
GG 673 Red Lodge Cr., Mont. (672)
GG 674 Blue Water Cr., Mont. (672)
GG 675 Pryor Cr., Mont. (626)
GG 676 West Fork, Mont. (675)
GG 677 East Fork, Mont. (675)
GG 678 Big Horn R., Mont. and Wyo. (626)
GG 679 Beauvais Fork, Mont. (678)
GG 680 Stinking R., Wyo. (678)
GG 681 Grey Bull R., Wyo. (678)
GG 682 Shoshone R., Wyo. (678)
GG 683 Cottonwood Cr., Wyo. (678)
GG 684 Gooseberry Cr., Wyo. (678)
GG 685 Mu-ye-ro Cr., Wyo. (678)
GG 686 Owl Cr., Wyo. (678)
GG 687 Muddy Cr., Wyo. (678)
GG 688 Wind R., Wyo. (678)
GG 689 Little Wind R., Wyo. (678)
GG 690 Agel R., Wyo. (678)
GG 691 Beaver Cr., Wyo. (678)
GG 692 Porson Cr., Wyo. (678)
GG 693 Kirby Cr., Wyo. (678)
GG 694 No Water Cr., Wyo. (678)
GG 695 No Wood Cr., Wyo. (678)
GG 696 Shell Cr., Wyo. (678)
GG 697 Salt Cr., Wyo. (678)
GG 698 Spring Cr., Wyo. (678)
GG 699 Trout Cr., Wyo. (678)
GG 700 No Mouth Cr., Wyo. (678)
GG 701 Soap Cr., Mont. (678)
GG 702 Rotten Grass Cr., Mont. (678)
GG 703 Little Big Horn or Greasy Grass R., Mont. (678)
GG 704 Tullocks Fork, Mont. (626)
GG 705 Sarpy Cr., Mont. (626)
GG 706 Armells Cr., Mont. (626)
GG 707 West Fork, Mont. (706)
GG 708 East Fork, Mont. (706)
GG 709 Rosebud R., Mont. (626)
GG 710 Muddy Cr., Mont. (709)
GG 711 Sweeney Cr., Mont. (626)
GG 712 Graveyard Cr., Mont. (626)
GG 713 Tongue R., Mont. and Wyo. (626)
GG 714 Hanging Woman Cr., Mont. and Wyo. (713)
GG 715 O'Dell Cr., Mont. (713)
GG 716 Otter Cr., Mont. (713)
GG 717 Beaver Cr., Mont. (713)
GG 718 Pumpkin Cr., Mont. (713)
GG 719 Squaw Cr., Mont. (713)
GG 720 Cottonwood Cr., Mont. (626)
GG 721 Powder R., Mont. and Wyo. (626)
GG 722 Mizpah R., Mont. (721)
GG 723 Cache Cr., Mont. (721)
GG 724 Balloon Cr., Mont. (721)
GG 725 Spring Cr., Mont. (721)
GG 726 Clear Cr., Wyo. (721)
GG 727 Crazy Woman Fork, Wyo. (721)
GG 728 Ninemile Cr., Wyo. (721)
GG 729 North Fork, Wyo. (721)
GG 730 Buffalo Cr., Wyo. (721)
GG 731 South Fork, Wyo. (721)
GG 732 Salt Cr., Wyo. (721)
GG 733 Pumpkin Cr., Wyo. (721)
GG 734 Wild Horse Cr., Wyo. (721)
GG 735 Buffalo Cr., Mont. and Wyo. (721)
GG 736 Bay Horse Cr., Mont. and Wyo. (721)
GG 737 Little Powder R., Mont. and Wyo. (721)
GG 738 Crow Cr., Mont. and Wyo. (721)
GG 739 Sheep Cr., Mont. (721)
GG 740 O'Fallons Cr., Mont. (626)
GG 741 East Fork, Mont. (740)
GG 742 Cabin Cr., Mont. (626)
GG 743 Cedar Cr., Mont. (626)
GG 744 Glendive Cr., Mont. (626)
GG 745 Box Elder Cr., Mont. (626)
GG 746 Smith Cr., Mont. (626)

GG 747 Shadwell Cr., Mont. (626)
GG 748 Charbonneau Cr., N. Dak. (626)
GG 749 Squaw Cr., N. Dak. (2)
GG 750 Tobacco Cr., N. Dak. (2)
GG 751 Pebble Cr., N. Dak. (2)
GG 752 Clark Cr., N. Dak. (2)
GG 753 Indian Cr., N. Dak. (2)
GG 754 Little Missouri R., N. Dak., Mont., and Wyo. (2)
GG 755 Beaver Cr., N. Dak. and Mont., (754)
GG 756 Cannon Ball Cr., N. Dak. and Mont. (754)
GG 757 Corral Cr., N. Dak. and Mont. (754)
GG 758 Little Beaver Cr., N. Dak. and Mont. (754)
GG 759 Tie Cr., Mont. (754)
GG 760 Blacktail Cr., Mont. (754)
GG 761 Cottonwood Cr., Mont. (754)
GG 762 Willow Cr., Mont. (754)
GG 763 Thompsons Cr., N. Dak. (754)
GG 764 Deep Cr., N. Dak. (754)
GG 765 Sand Cr., N. Dak. (754)
GG 766 Blacktail Cr., N. Dak. (754)
GG 767 Whitetail Cr., N. Dak. (754)
GG 768 Beiceger Cr., N. Dak. (754)
GG 769 Little Beaver or Pretty Cr., N. Dak. (2)
GG 770 Emmanuel Cr., N. Dak. (2)
GG 771 Knife R., N. Dak. (2)
GG 772 Mandan Lake, N. Dak. (2)
GG 773 Square Butte Cr., N. Dak. (2)
GG 774 Heart R., N. Dak. (2)
GG 775 Sweet Briar Cr., N. Dak. (774)
GG 776 Curlew Cr., N. Dak. (774)
GG 777 Antelope Cr., N. Dak. (774)
GG 778 Little Heart R., N. Dak. (2)
GG 779 Cannon Ball R., N. Dak. (2)
GG 780 Dogtooth Cr., N. Dak. (779)
GG 781 Louse Cr., N. Dak. (780)
GG 782 North Fork, N. Dak. (779)
GG 783 Thirtymile Cr., N. Dak. (782)
GG 784 South Fork, N. Dak. (779)
GG 785 Willow Cr., N. Dak. (2)
GG 786 Pointer Cr., N. Dak. (2)
GG 787 Battle or La Barge Cr., N. Dak. (2)
GG 788 Long Soldier Cr., N. Dak. (2)
GG 789 Fourmile Cr., N. Dak. (2)
GG 790 Blackfeet Cr., S. Dak. (2)
GG 791 Eagle Feather Cr., S. Dak. (2)
GG 792 Kunkpapa Cr., S Dak. (2)
GG 793 Cathead Cr., S Dak. (2)
GG 794 Rampart or Oak Cr., S. Dak. (2)
GG 795 Grand R., S. Dak. (2)
GG 796 North Fork, S. Dak. (795)
GG 797 South Fork, S. Dak. (795)
GG 798 Highbank Cr., S. Dak. (795)
GG 799 Bellsman Cr., S. Dak. (2)
GG 800 Green Timber Cr., S. Dak. (2)
GG 801 Le Compte Cr., S. Dak. (2)
GG 802 Owl or Moreau R., S. Dak. (2)
GG 803 Little Moreau R., S. Dak. (802)
GG 804 Red Water Cr., S. Dak. (802)
GG 805 Meadow Cr., S. Dak. (802)
GG 806 Red Earth Cr., S. Dak. (802)
GG 807 Worthless Cr., S. Dak. (802)
GG 808 Thunder Cr., S. Dak. (802)
GG 809 Antelope Cr., S. Dak. (802)
GG 810 Rabbit Cr., S. Dak. (809)
GG 811 North Fork, S. Dak. (802)
GG 812 South Fork, S. Dak. (802)
GG 813 Sand Ledge Cr., S. Dak. (802)
GG 814 Flint Rock Cr., S. Dak. (802)
GG 815 Four Bears Cr., S. Dak. (2)
GG 816 Buffalo Cr., S. Dak. (2)
GG 817 White Brant Cr., S. Dak. (2)
GG 818 Stove or Cherry Cr., S. Dak. (2)
GG 819 Pascal Cr., S. Dak. (2)
GG 820 No Heart Cr., S. Dak. (2)
GG 821 McKenzie Cr., S. Dak. (2)
GG 822 Fox Cr., S. Dak. (2)
GG 823 Big Cheyenne R., S. Dak. (2)
GG 824 Cherry Cr., S. Dak. (823)
GG 825 Sulphur Cr., S. Dak. (824)
GG 826 Owl Feather Cr., S. Dak. (824)
GG 827 Big Timber Cr., S. Dak. (823)
GG 828 North Fork, S. Dak. and Wyo. (823)
GG 829 East Elm Cr., S. Dak. (828)
GG 830 Elm or Eightmile Cr., S. Dak. (828)
GG 831 Willow Cr., S. Dak. (828)
GG 832 Dead Horse Cr., S. Dak. (828)
GG 833 Crow Cr., S. Dak. (828)
GG 834 Spear Fish Cr., S. Dak. (828)
GG 835 White Wood Cr., S. Dak. (828)
GG 836 Bear Butte Cr., S. Dak. (828)
GG 837 Warren Cr., S. Dak. (828)
GG 838 South Fork, S. Dak. (823)
GG 839 South Fork, Wyo. (838)
GG 840 Elk Cr., S. Dak. (838)
GG 841 Box Elder Cr., S. Dak. (838)
GG 842 Rapid Cr., S. Dak. (838)
GG 843 Spring Cr., S. Dak. (838)
GG 844 Battle Cr., S. Dak. (838)
GG 845 Beaver Cr., S. Dak. (838)
GG 846 Sage Cr., S. Dak. (838)
GG 847 Sage Cr., Wyo. (846)
GG 848 Cottonwood Cr., S. Dak. (838)
GG 849 Hat Cr., S. Dak. (838)
GG 850 Horse Head Cr., S. Dak. (838)
GG 851 Squaw Cr., S. Dak. (823)
GG 852 Mexican Cr., S. Dak. (823)
GG 853 Beaver Cr., S. Dak. (823)
GG 854 Snake Cr., S. Dak. (823)
GG 855 Missouri Cr., S. Dak. (2)
GG 856 Chantier Cr., S. Dak. (2)
GG 857 Bad R., S. Dak. (2)
GG 858 Willow Cr., S. Dak. (857)
GG 859 Lance Cr., S. Dak. (857)
GG 860 Plum Cr., S. Dak. (857)
GG 861 Mitchell Cr., S. Dak. (857)
GG 862 Medicine Cr., S. Dak. (857)
GG 863 Grindstone Cr., S. Dak. (857)
GG 864 North Fork, S. Dak. (857)
GG 865 Poeno Cr., S. Dak. (864)
GG 866 Cottonwood Cr., S. Dak. (857)
GG 867 White Willow Cr., S. Dak. (857)
GG 868 Indian Cr., S. Dak. (857)
GG 869 Brave Bill Cr., S. Dak. (857)
GG 870 Pass Cr., S. Dak. (857)
GG 871 Fort George Cr., S. Dak. (2)
GG 872 Loiselle Cr., S. Dak. (2)

GG 873 Cedar Cr., S. Dak. (2)
GG 874 Dry Cr., S. Dak. (2)
GG 875 Medicine Cr., S. Dak. (2)
GG 876 Fish Cr., S. Dak. (2)
GG 877 Camel Cr., S. Dak. (2)
GG 878 Badger Cr., S. Dak. (2)
GG 879 Laurel or Zephyr Cr., S. Dak. (2)
GG 880 American Crow Cr., S. Dak. (2)
GG 881 White R., S. Dak. and Nebr. (2)
GG 882 Bull Cr., S. Dak. (881)
GG 883 White Clay Cr., S. Dak. (881)
GG 884 Wounded Knee Cr., S. Dak. (881)
GG 885 Porcupine Cr., S. Dak. (881)
GG 886 Yellow Medicine Cr., S. Dak. (881)
GG 887 Pumpkin Cr., S. Dak. (881)
GG 888 Corn Cr., S. Dak. (881)
GG 889 Bear in the Lodge Cr., S. Dak. (881)
GG 890 Eagles Nest Cr., S. Dak. (881)
GG 891 Pass Cr., S. Dak. (881)
GG 892 Black Pipe Cr., S. Dak. (881)
GG 893 Bad Land Cr., S. Dak. (881)
GG 894 South Fork, S. Dak. (881)
GG 895 Rosebud Cr., S. Dak. (894)
GG 896 Oak Cr., S. Dak. (881)
GG 897 Two Tail Cr., S. Dak. (881)
GG 898 Dog Ears Cr., S. Dak. (881)
GG 899 Ball Cr., S. Dak. (2)
GG 900 Whetstone Cr., S. Dak. (2)
GG 901 Scalp Cr., S. Dak. (2)
GG 902 Garden Cr., S. Dak. (2)
GG 903 Waterholes Cr., S. Dak. (2)
GG 904 Bull Cr., S. Dak. (903)
GG 905 Ponca Cr., Nebr. and S. Dak. (2)
GG 906 Niobrara R., Nebr. and Wyo. (2)
GG 907 Keya Paha R., Nebr. and S. Dak. (906)
GG 908 Antelope Cr., S. Dak. (907)
GG 909 Rock Cr., S. Dak. (907)
GG 910 Sand Cr., S. Dak. (907)
GG 911 Minnechaduga Cr., Nebr. and S. Dak. (906)
GG 912 Bear Cr., Nebr. (906)
GG 913 Antelope Cr., Nebr. (906)
GG 914 Rush Cr., Nebr. (906)
GG 915 Pepper Cr., Nebr. (906)
GG 916 Leau Que Court R., Nebr. (906)
GG 917 Niobrara Cr., Wyo. (906)
GG 918 Silver Cr., Wyo. (906)
GG 919 Weasel Cr., Nebr. (906)
GG 920 Butte Cr., Nebr. (906)
GG 921 Pine Cr., Nebr. (906)
GG 922 Deer Cr., Nebr. (906)
GG 923 Snake R., Nebr. (906)
GG 924 Eureka Cr., Nebr. (923)
GG 925 Gordons Cr., Nebr. (906)
GG 926 Schlegels Cr., Nebr. (906)
GG 927 Plum Cr., Nebr. (906)
GG 928 Evergreen Cr., Nebr. (927)
GG 929 Long Pine Cr., Nebr. (906)
GG 930 Boone Cr., Nebr. (929)
GG 931 Eagle Cr., Nebr. (906)
GG 932 Verdigris R., Nebr. (906)
GG 933 Bazile Cr., Nebr. (2)
GG 934 Bozzie Cr., Nebr. (933)
GG 935 Little Bazile Cr., Nebr. (933)
GG 936 Beaver Cr., Nebr. (2)
GG 937 Bow Cr., Nebr. (2)
GG 938 West Bow Cr., Nebr. (937)
GG 939 Aowa Cr., Nebr. (2)
GG 940 Elk Cr., Nebr. (2)
GG 941 Omaha Cr., Nebr. (2)
GG 942 Spring Cr., Nebr. (2)
GG 943 Blackbird Cr., Nebr. (2)
GG 944 Fish Cr., Nebr. (2)
GG 945 Ponca Cr., Nebr. (2)
GG 946 Mill Cr., Nebr. (2)
GG 947 Florence Lake, Nebr. (2)
GG 948 Otoe Cr., Nebr. (2)
GG 949 Papillon R., Nebr. (2)
GG 950 Platte R., Nebr. (2)
GG 951 Elkhorn R., Nebr. (950)
GG 952 Cummings Cr., Nebr. (951)
GG 953 Plum Cr., Nebr. (951)
GG 954 Humbug Cr., Nebr. (951)
GG 955 North Fork, Nebr. (951)
GG 956 Willow Cr., Nebr. (951)
GG 957 South Fork, Nebr. (951)
GG 958 Cache Cr., Nebr. (951)
GG 959 Cedar Cr., Nebr. (951)
GG 960 Buffalo Cr., Nebr. (951)
GG 961 Battle Cr., Nebr. (951)
GG 962 Taylor Cr., Nebr. (951)
GG 963 Rock Cr., Nebr. (951)
GG 964 Maple Cr., Nebr. (951)
GG 965 Rawhide Cr., Nebr. (950)
GG 966 Shell Cr., Nebr. (950)
GG 967 Lasker Cr., Nebr. (966)
GG 968 Loup R., Nebr. (950)
GG 969 Beaver Cr., Nebr. (968)
GG 970 Cedar Cr., Nebr. (968)
GG 971 Horse Cr., Nebr. (968)
GG 972 Cottonwood Cr., Nebr. (968)
GG 973 North Loup R., Nebr. (968)
GG 974 Middle Loup R., Nebr. (968)
GG 975 Mud Cr., Nebr. (968)
GG 976 South Loup R., Nebr. (968)
GG 977 Prairie Cr., Nebr. (950)
GG 978 Wood R., Nebr. (950)
GG 979 Big Buffalo Cr., Nebr. (950)
GG 980 Pawnee Cr., Nebr. (950)
GG 981 Spring Cr., Nebr. (950)
GG 982 White Horse Cr., Nebr. (950)
GG 983 North Platte R., Nebr., Wyo., and Colo. (950)
GG 984 Birchwood Cr., Nebr. (983)
GG 985 White Tail Cr., Nebr. (983)
GG 986 Lonergan Cr., Nebr. (983)
GG 987 Cold Water Cr., Nebr. (983)
GG 988 Brown Cr., Nebr. (983)
GG 989 Springs Cr., Nebr. (983)
GG 990 Lower Dugout Cr., Nebr. (983)
GG 991 White Clay Cr., Nebr. (983)
GG 992 Otter Cr., Nebr. (983)
GG 993 Blue R., Nebr. (983)
GG 994 Willow Cr., Nebr. (983)
GG 995 Spoonhill Cr., Nebr. (983)
GG 996 Rawhide Cr., Wyo. (983)
GG 997 Muskrat Cr., Wyo. (983)
GG 998 Broom Cr., Wyo. (983)
GG 999 Spring Cr., Wyo. (983)
GG 1000 Willow Cr., Wyo. (983)
GG 1001 Muddy Cr., Wyo. (983)
GG 1002 Casper Cr., Wyo. (983)

GG 1003 Poison Spider Cr., Wyo. (983)
GG 1004 Sweetwater R., Wyo. (983)
GG 1005 Sage Hen Cr., Wyo. (983)
GG 1006 Longs Cr., Wyo. (983)
GG 1007 Rock Cr., Wyo. (983)
GG 1008 Willow Cr., Wyo. (983)
GG 1009 Sulphur Cr., Wyo. (983)
GG 1010 Crooks Cr., Wyo. (983)
GG 1011 Cottonwood Cr., Wyo. (983)
GG 1012 Muddy Cr., Wyo. (983)
GG 1013 Whiskey Gap Cr., Wyo. (983)
GG 1014 Cherry Cr., Wyo. (983)
GG 1015 Arkansas Cr., Wyo. (983)
GG 1016 Sand Cr., Wyo. (983)
GG 1017 Deweese Cr., Wyo. (983)
GG 1018 Bear Cr., Wyo. (983)
GG 1019 Big Sage Cr., Wyo. (983)
GG 1020 Little Sage Cr., Wyo. (983)
GG 1021 Common Sage Cr., Wyo. (983)
GG 1022 Jack Cr., Wyo. (983)
GG 1023 Spring Cr., Wyo. (983)
GG 1024 Cow Cr., Wyo. (983)
GG 1025 Grand Encampment Cr., Wyo. and Colo. (983)
GG 1026 Beaver Cr., Wyo. and Colo. (983)
GG 1027 Big Beaver Cr., Wyo. and Colo. (983)
GG 1028 Roaring Fork, Colo. (983)
GG 1029 Raspberry Cr., Colo. (983)
GG 1030 Beaver Cr., Colo. (983)
GG 1031 Grizzly Cr., Colo. (983)
GG 1032 Colorado Cr., Colo. (983)
GG 1033 Arapahoe Cr., Colo. (983)
GG 1034 Coyote Cr., Colo. (983)
GG 1035 Buffalo Cr., Colo. (983)
GG 1036 Illinois Cr., Colo. (983)
GG 1037 Willow Cr., Colo. (983)
GG 1038 Pony Cr., Colo. (983)
GG 1039 Jack Cr., Colo. (983)
GG 1040 Michigan R., Colo. (983)
GG 1041 Owl Cr., Colo. (983)
GG 1042 East Fork Canadian R., Colo. (983)
GG 1043 Pinkham Cr., Colo. (983)
GG 1044 Beaver Cr., Wyo. (983)
GG 1045 Lake Cr., Wyo. (983)
GG 1046 Douglas Cr., Wyo. (983)
GG 1047 French Cr., Wyo. (983)
GG 1048 Brush Cr., Wyo. (983)
GG 1049 Cedar Cr., Wyo. (983)
GG 1050 Pass Cr., Wyo. (983)
GG 1051 Medicine Bow R., Wyo. (983)
GG 1052 Little Medicine Bow R., Wyo. (983)
GG 1053 Sheep Cr., Wyo. (983)
GG 1054 Mule Cr., Wyo. (983)
GG 1055 Muddy Cr., Wyo. (983)
GG 1056 Cottonwood Cr., Wyo. (983)
GG 1057 Lost Cr., Wyo. (983)
GG 1058 Sage Cr., Wyo. (983)
GG 1059 Canon Cr., Wyo. (983)
GG 1060 Camp Cr., Wyo. (983)
GG 1061 Pates Cr., Wyo. (983)
GG 1062 Deer Cr., Wyo. (983)
GG 1063 Box Elder Cr., Wyo. (983)
GG 1064 La Prele Cr., Wyo. (983)
GG 1065 Red Tick Cr., Wyo. (983)
GG 1066 Wagon Hound Cr., Wyo. (983)
GG 1067 La Bonte Cr., Wyo. (983)
GG 1068 Indian Cr., Wyo. (983)
GG 1069 Elkhorn Cr., Wyo. (983)
GG 1070 Horseshoe Cr., Wyo. (983)
GG 1071 Laramie R., Wyo. and Colo. (983)
GG 1072 Chugwater Cr., Wyo. (983)
GG 1073 Horse Cr., Nebr. and Wyo. (983)
GG 1074 Pumpkin Seed Cr., Nebr. and Wyo. (983)
GG 1075 Smith Branch, Nebr. and Wyo. (983)
GG 1076 Ash Cr., Nebr. and Wyo. (983)
GG 1077 South Platte R., Nebr. and Colo. (950)
GG 1078 Lodge Pole Cr., Colo., Nebr., and Wyo. (1077)
GG 1079 Moores Cr., Colo. and Wyo. (1077)
GG 1080 Lewis Cr., Colo. (1077)
GG 1081 Horsetail or Clear Cr., Colo. (1077)
GG 1082 Pawnee Cr., Colo. (1077)
GG 1083 Wild Cat Cr., Colo. (1077)
GG 1084 Crow Cr., Colo. and Wyo. (1077)
GG 1085 Cache La Poudre R., Colo. (1077)
GG 1086 Big Thompson Cr., Colo. (1077)
GG 1087 St. Vrains Cr., Colo. (1077)
GG 1088 Dry Cr., Colo. (1077)
GG 1089 Clear Cr., Colo. (1077)
GG 1090 Bear Cr., Colo. (1077).
GG 1091 Deer Cr., Colo. (1077)
GG 1092 North Fork, Colo. (1077)
GG 1093 Goose or Lost Park Cr., Colo. (1077)
GG 1094 Tarryall Cr., Colo. (1077)
GG 1095 Trout Cr., Colo. (1077)
GG 1096 Fourmile Cr., Colo. (1077)
GG 1097 South Fork, Colo. (1077)
GG 1098 Buffalo Slough, Colo. (1077)
GG 1099 Threemile Cr., Colo. (1077)
GG 1100 Douglas Cr., Colo. (1077)
GG 1101 Trout Cr., Colo. (1077)
GG 1102 Pine Cr., Colo. (1077)
GG 1103 Willow Cr., Colo. (1077)
GG 1104 Plum Cr., Colo. (1077)
GG 1105 Willow Cr., Colo. (1077)
GG 1106 Cherry Cr., Colo. (1077)
GG 1107 Coal Cr., Colo. (1077)
GG 1108 Terrapin or Box Elder Cr., Colo. (1077)
GG 1109 Kiowa Cr., Colo. (1077)
GG 1110 Bijou Cr., Colo. (1077)
GG 1111 Badger Cr., Colo. (1077)
GG 1112 Sand Cr., Nebr. (950)
GG 1113 Clear Cr., Nebr. (950)
GG 1114 Bone Cr., Nebr. (950)
GG 1115 Skull Cr., Nebr. (950)
GG 1116 Wahoo Cr., Nebr. (950)
GG 1117 Silver Cr., Nebr. (950)
GG 1118 Sand Cr., Nebr. (950)
GG 1119 Cottonwood Cr., Nebr. (950)
GG 1120 Weeping Water Cr., Nebr. (2)
GG 1121 Spring Branch Cr., Nebr. (2)
GG 1122 Squaw Cr., Nebr. (2)
GG 1123 Walnut Cr., Nebr. (2)
GG 1124 Buck Cr., Nebr. (2)
GG 1125 Honey Cr., Nebr. (2)
GG 1126 Little Nemaha R., Nebr. (2)
GG 1127 North Fork, Nebr. (1126)

GG 1128 Wilson Cr., Nebr. (1127)
GG 1129 Deer Cr., Nebr. (1127)
GG 1130 Brownell Cr., Nebr. (1127)
GG 1131 Owl Cr., Nebr. (1127)
GG 1132 Wolf Run Cr., Nebr. (1127)
GG 1133 Hooper Cr., Nebr. (1127)
GG 1134 Silver Cr., Nebr. (1126)
GG 1135 Russell Cr., Nebr. (1126)
GG 1136 Muddy Cr., Nebr. (1126)
GG 1137 South Fork, Nebr. (1126)
GG 1138 Silver Cr., Nebr. (1137)
GG 1139 Sand Cr., Nebr. (1137)
GG 1140 Jones Cr., Nebr. (2)
GG 1141 Big Nemaha R., Nebr. and Kans. (2)
GG 1142 Muddy Cr., Nebr. (1141)
GG 1143 Long Branch, Nebr. (1141)
GG 1144 Winnebago Cr., Nebr. (1141)
GG 1145 Squaw Cr., Nebr. and Kans. (2)
GG 1146 Walnut Cr., Nebr. and Kans. (2)
GG 1147 North Table Cr., Nebr. and Kans. (2)
GG 1148 Fox Cr., Nebr. and Kans. (2)
GG 1149 South Table Cr., Nebr. and Kans. (2)
GG 1150 Fourmile Cr., Nebr. and Kans. (2)
GG 1151 Camp Cr., Nebr. and Kans. (2)
GG 1152 Noharts Cr., Nebr. and Kans. (2)
GG 1153 Roys Cr., Nebr. and Kans. (2)
GG 1154 Cedar Cr., Kans. (2)
GG 1155 Mill Cr., Kans. (2)
GG 1156 Wolf Cr., Kans. (2)
GG 1157 Mosquito Cr., Kans. (2)
GG 1158 Charlestown Cr., Kans. (2)
GG 1159 Peters Cr., Kans. (2)
GG 1160 Rock Cr., Kans. (2)
GG 1161 Brush Cr., Kans. (2)
GG 1162 Independence Cr., Kans. (2)
GG 1163 Whiskey Cr., Kans. (2)
GG 1164 Walnut Cr., Kans. (2)
GG 1165 Plum Cr., Kans. (2)
GG 1166 Salt Cr., Kans. (2)
GG 1167 Onemile Cr., Kans. (2)
GG 1168 Corral Cr., Kans. (2)
GG 1169 Threemile Cr., Kans. (2)
GG 1170 Fivemile Cr., Kans. (2)
GG 1171 Sevenmile Cr., Kans. (2)
GG 1172 Ninemile Cr., Kans. (2)
GG 1173 Honey Cr., Kans. (2)
GG 1174 Island Cr., Kans. (2)
GG 1175 Conner Cr., Kans. (2)
GG 1176 Marshall Cr., Kans. (2)
GG 1177 Big Eddy Cr., Kans. (2)
GG 1178 Kansas R., Colo. and Kans. (2)
GG 1179 Muncie Cr., Kans. (1178)
GG 1180 Mill Cr., Kans. (1178)
GG 1181 Little Turkey Cr., Kans. (1178)
GG 1182 Belt Cr., Kans. (1178)
GG 1183 East Missouri Cr., Kans. (1178)
GG 1184 West Missouri Cr., Kans. (1178)
GG 1185 Spring Cr., Kans. (1178)
GG 1186 Wolf Cr., Kans. (1178)
GG 1187 Little Paw Cr., Kans. (1178)
GG 1188 Big Stranger Cr., Kans. (1178)
GG 1189 Rock Cr., Kans. (1188)
GG 1190 Kramer Cr., Kans. (1188)
GG 1191 Buckham Cr., Kans. (1188)
GG 1192 Ashby Cr., Kans. (1188)
GG 1193 Austin Cr., Kans. (1188)
GG 1194 Walnut Cr., Kans. (1188)
GG 1195 Fall Cr., Kans. (1188)
GG 1196 Jarbolo Cr., Kans. (1188)
GG 1197 Tonganoxie Cr., Kans. (1178)
GG 1198 Ninemile Cr., Kans. (1178)
GG 1199 Crow Cr., Kans. (1178)
GG 1200 Wild Horse Cr., Kans. (1178)
GG 1201 Mud Cr., Kans. (1178)
GG 1202 Buck Cr., Kans. (1178)
GG 1203 Stone House Cr., Kans. (1178)
GG 1204 Grasshopper Cr., Kans. (1178)
GG 1205 Wild Horse Cr., Kans. (1204)
GG 1206 Big Slough Cr., Kans. (1204)
GG 1207 Little Slough Cr., Kans. (1204)
GG 1208 Fish Pond Cr., Kans. (1204)
GG 1209 Rock Cr., Kans. (1204)
GG 1210 Brush Cr., Kans. (1204)
GG 1211 Walnut Cr., Kans. (1204)
GG 1212 Spring Cr., Kans. (1204)
GG 1213 Coal Cr., Kans. (1204)
GG 1214 Cedar Cr., Kans. (1204)
GG 1215 Websters Cr., Kans. (1204)
GG 1216 Craig Cr., Kans. (1204)
GG 1217 Mud Cr., Kans. (1178)
GG 1218 Lock Lane Cr., Kans. (1178)
GG 1219 Wolfly Cr., Kans. (1178)
GG 1220 Spring Cr., Kans. (1178)
GG 1221 Mosquito Cr., Kans. (1178)
GG 1222 Straight Cr., Kans. (1178)
GG 1223 Elk Cr., Kans. (1178)
GG 1224 Catamount Cr., Kans. (1178)
GG 1225 Cedar Cr., Kans. (1178)
GG 1226 Peter Cr., Kans. (1178)
GG 1227 Duck Cr., Kans. (1178)
GG 1228 Rock Cr., Kans. (1178)
GG 1229 Muddy Cr., Kans. (1178)
GG 1230 Little Muddy Cr., Kans. (1229)
GG 1231 Indian Cr., Kans. (1229)
GG 1232 Big Soldier Cr., Kans. (1178)
GG 1233 Half Dry Cr., Kans. (1232)
GG 1234 Little Soldier Cr., Kans. (1232)
GG 1235 Walnut Cr., Kans. (1232)
GG 1236 Cross Cr., Kans. (1178)
GG 1237 Salt Cr., Kans. (1236)
GG 1238 Sullivan Cr., Kans. (1236)
GG 1239 Illinois Cr., Kans. (1236)
GG 1240 Little Cross Cr., Kans. (1236)
GG 1241 Mayano Cr., Kans. (1236)
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GG 1244 Red Vermillion Cr., Kans. (1242)
GG 1245 Rock Cr., Kans. (1242)
GG 1246 Rush Cr., Kans. (1178)
GG 1247 Camp Cr., Kans. (1178)
GG 1248 Big Blue R., Nebr. and Kans. (1178)
GG 1249 Cedar Cr., Kans. (1248)
GG 1250 McIntyre Cr., Kans. (1248)
GG 1251 Carnahan Cr., Kans. (1248)
GG 1252 Fourmile Cr., Kans. (1248)
GG 1253 Bluff Cr., Nebr. (1248)
GG 1254 Black Vermillion R., Nebr. (1248)
GG 1255 Mosquito Cr., Nebr. (1248)
GG 1256 Spring Cr., Nebr. (1248)
GG 1257 Lilly Cr., Nebr. (1248)

GG 1258 Elk Cr., Nebr. (1248)
GG 1259 Horseshoe Cr., Nebr. (1248)
GG 1260 Mountain Cr., Nebr. (1248)
GG 1261 Remer Cr., Nebr. (1248)
GG 1262 Little Blue R., Nebr. and Kans. (1248)
GG 1263 Camp Cr., Kans. (1248)
GG 1264 Sulphur Cr., Kans. (1248)
GG 1265 Swede Cr., Kans. (1248)
GG 1266 Fancy Cr., Kans. (1248)
GG 1267 Otter Cr., Kans. (1248)
GG 1268 Crooked Cr., Kans. (1178)
GG 1269 Walnut Cr., Kans. (1178)
GG 1270 Mill Cr., Kans. (1178)
GG 1271 Tuttle Cr., Kans. (1178)
GG 1272 Wildcat Cr., Kans. (1178)
GG 1273 Sevenmile Cr., Kans. (1178)
GG 1274 Threemile Cr., Kans. (1178)
GG 1275 Onemile Cr., Kans. (1178)
GG 1276 Republican R., Colo., Nebr., and Kans. (1178)
GG 1277 Fourmile Cr., Kans. (1276)
GG 1278 Mill Cr., Kans. (1276)
GG 1279 Peat Cr., Kans. (1276)
GG 1280 Gar Cr., Kans. (1276)
GG 1281 Scribner Cr., Kans. (1276)
GG 1282 Dry Cr., Kans. (1276)
GG 1283 Salt Cr., Kans. (1276)
GG 1284 Camp Cr., Kans. (1276)
GG 1285 School Cr., Kans. (1276)
GG 1286 Dry Cr., Kans. (1276)
GG 1287 Otter Cr., Kans. (1276)
GG 1288 Blakely Cr., Kans. (1276)
GG 1289 Lost Cr., Nebr. (1276)
GG 1290 Beaver Cr., Nebr. (1276)
GG 1291 Willow Cr., Nebr. (1276)
GG 1292 Farmers Cr., Nebr. (1276)
GG 1293 Thompsons Cr., Nebr. (1276)
GG 1294 Sawsanes Cr., Nebr. (1276)
GG 1295 Lovely Cr., Nebr. (1276)
GG 1296 Wasp Cr., Nebr. (1276)
GG 1297 Walnut R., Nebr. (1276)
GG 1298 Center Cr., Nebr. (1276)
GG 1299 Turkey Cr., Nebr. (1276)
GG 1300 Rope Cr., Nebr. (1276)
GG 1301 Flag Cr., Nebr. (1276)
GG 1302 Elk Cr., Nebr. (1276)
GG 1303 Muddy Cr., Nebr. (1276)
GG 1304 Beaver Cr., Colo., Kans., and Nebr. (1276)
GG 1305 Sappa Cr., Kans. and Nebr. (1276)
GG 1306 Crow Cr., Kans. and Nebr. (1276)
GG 1307 Crystal Cr., Kans. and Nebr. (1276)
GG 1308 Rebecca Cr., Kans. and Nebr. (1276)
GG 1309 Lachiel Cr., Kans. and Nebr. (1276)
GG 1310 Calumet Cr., Kans. and Nebr. (1276)
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GG 1312 Lohff Cr., Kans. and Nebr. (1276)
GG 1313 White Rock Cr., Kans. (1276)
GG 1314 Beaver Cr., Kans. (1276)
GG 1315 Buffalo Cr., Kans. (1276)
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GG 1321 Chapmans Cr., Kans. (1320)
GG 1322 Abilene Cr., Kans. (1320)
GG 1323 Solomon R., Kans. (1320)
GG 1324 Clear Cr., Kans. (1320)
GG 1325 Spring Cr., Kans. (1320)
GG 1326 Oak Cr., Kans. (1320)
GG 1327 Buffalo Cr., Kans. (1320)
GG 1328 Cow Cr., Kans. (1320)
GG 1329 Fossil Cr., Kans. (1320)
GG 1330 Big Cr., Kans. (1320)
GG 1331 Downer Cr., Kans. (1320)
GG 1332 Sand Cr., Kans. (1320)
GG 1333 Page Cr., Kans. (1320)
GG 1334 Hackberry Cr., Kans. (1320)
GG 1335 Indian Cr., Kans. (1320)
GG 1336 Plum Cr., Kans. (1320)
GG 1337 Turtle Cr., Kans. (1320)
GG 1338 Pond Cr., Kans. (1320)
GG 1339 Goose Cr., Kans. (1320)
GG 1340 Rose Cr., Kans. (1320)
GG 1341 Twin View Cr., Kans. (1320)
GG 1342 Ladder Cr., Kans. (1320)
GG 1343 Wild Horse Cr., Kans. (1320)
GG 1344 Elm Cr., Kans. (1320)
GG 1345 Big Timber Cr., Kans. (1320)
GG 1346 Shelter Cr., Kans. (1320)
GG 1347 Langdons Cr., Kans. (1320)
GG 1348 Sellers Cr., Kans. (1320)
GG 1349 Wright Cr., Kans. (1320)
GG 1350 Beaver Cr., Kans. (1320)
GG 1351 Pole Cr., Kans. (1320)
GG 1352 Wolf Cr., Kans. (1320)
GG 1353 Oxide Cr., Kans. (1320)
GG 1354 Mud Cr., Kans. (1320)
GG 1355 Ash Cr., Kans. (1320)
GG 1356 Thompson Cr., Kans. (1320)
GG 1357 Bluff Cr., Kans. (1320)
GG 1358 Wolf Cr., Kans. (1320)
GG 1359 Hoover Cr., Kans. (1320)
GG 1360 Sharks Cr., Kans. (1320)
GG 1361 Gypsum Cr., Kans. (1320)
GG 1362 Stag Cr., Kans. (1320)
GG 1363 Harvey Cr., Kans. (1320)
GG 1364 Hobbs Cr., Kans. (1320)
GG 1365 McAllister Cr., Kans. (1320)
GG 1366 Holland Cr., Kans. (1320)
GG 1367 Turkey Cr., Kans. (1320)
GG 1368 Lyons Cr., Kans. (1320)
GG 1369 Coe Cr., Kans. (1320)
GG 1370 Lime Cr., Kans. (1320)
GG 1371 Clarks Cr., Kans. (1320)
GG 1372 McDowell Cr., Kans. (1320)
GG 1373 Deep Cr., Kans. (1178)
GG 1374 Antelope Cr., Kans. (1178)
GG 1375 Wells Cr., Kans. (1178)
GG 1376 Roberts Cr., Kans. (1178)
GG 1377 Turkey Cr., Kans. (1178)
GG 1378 Mill Cr., Kans. (1178)
GG 1379 Mulberry Cr., Kans. (1178)
GG 1380 Paw Paw Cr., Kans. (1178)
GG 1381 Pretty Cr., Kans. (1178)
GG 1382 Hendrix Cr., Kans. (1178)
GG 1383 Kinsley Cr., Kans. (1178)
GG 1384 Nokomo Cr., Kans. (1178)
GG 1385 Dog Cr., Kans. (1178)

GG 1386 Post Cr., Kans. (1178)
GG 1387 Vassar Cr., Kans. (1178)
GG 1388 Mission Cr., Kans. (1178)
GG 1389 Blacksmith Cr., Kans. (1178)
GG 1390 Shonganunga Cr., Kans. (1178)
GG 1391 Deer Cr., Kans. (1178)
GG 1392 Tecumseh Cr., Kans. (1178)
GG 1393 Martin Cr., Kans. (1178)
GG 1394 Wakruska Cr., Kans. (1178)
GG 1395 Coon Cr., Kans. (1394)
GG 1396 Deer Cr., Kans. (1394)
GG 1397 Dog Cr., Kans. (1394)
GG 1398 Rock Cr., Kans. (1394)
GG 1399 Washington Cr., Kans. (1394)
GG 1400 Spring Cr., Kans. (1178)
GG 1401 Kill Cr., Kans. (1178)
GG 1402 Cedar Cr., Kans. (1178)
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GG 1404 Mill Cr., Kans. (1178)
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GG 1407 Round Grove Cr., Mo. (2)
GG 1408 Wolf Cr., Mo. (2)
GG 1409 Coffee Cr., Mo. (2)
GG 1410 Tomahawk Cr., Mo. (2)
GG 1411 Indian Cr., Mo. (2)
GG 1412 Big Blue R., Mo. and Kans. (2)
GG 1413 Brush Cr., Mo. (1412)
GG 1414 Rock Cr., Mo. (2)
GG 1415 Sugar Cr., Mo. (2)
GG 1416 Little Blue R., Mo. (2)
GG 1417 Sleepy Branch, Mo. (1416)
GG 1418 Mill Cr., Mo. (1416)
GG 1419 Sugar Cr., Mo. (2)
GG 1420 Prairie Cr., Mo. (2)
GG 1421 Sniabar Cr., Mo. (2)
GG 1422 Little Sniabar Cr., Mo. (1421)
GG 1423 Owl Cr., M. (1421)
GG 1424 Tabo Cr., Mo. (2)
GG 1425 Brush Cr., Mo. (1424)
GG 1426 Little Tabo Cr., Mo. (1424)
GG 1427 Graves Cr., Mo. (2)
GG 1428 Buck Cr., Mo. (2)
GG 1429 Bear Cr., Mo. (2)
GG 1430 Fish Cr., Mo. (2)
GG 1431 Moon Cr., Mo. (2)
GG 1432 Lamine R., Mo. (2)
GG 1433 Blackwater R., Mo. (1432)
GG 1434 Flat Cr., Mo. (1433)
GG 1435 Camp Cr., Mo. (1433)
GG 1436 Rock Cr., Mo. (1433)
GG 1437 Salt Fork, Mo. (1433)
GG 1438 Lamine Cr., Mo. (1432)
GG 1439 Thomas Branch, Mo. (2)
GG 1440 Petite Saline Cr., Mo. (2)
GG 1441 Stevens Cr., Mo. (1440)
GG 1442 Clarks Fork, Mo. (1440)
GG 1443 Cave Cr., Mo. (1440)
GG 1444 Wolf Cr., Mo. (1440)
GG 1445 Big Splice Cr., Mo. (2)
GG 1446 Little Splice Cr., Mo. (2)
GG 1447 Factory Cr., Mo. (2)
GG 1448 Moniteau Cr., Mo. (2)
GG 1449 Little Moniteau Cr., Mo. (1448)
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GG 1451 Rock Cr., Mo. (2)
GG 1452 Meadow Cr., Mo. (2)
GG 1453 Gray Cr., Mo. (2)
GG 1454 Sones Cr., Mo. (2)
GG 1455 Moreau R., Mo. (2)
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GG 1461 Jim Henry Cr., Mo. (1457)
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GG 1470 Little Monegaw Cr., Mo. (1465)
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GG 1477 Hushpuckney Cr., Mo. (1457)
GG 1478 Elm Cr., Mo. (1457)
GG 1479 Big Sugar Cr., Mo. (1457)
GG 1480 Richland Cr., Mo. (1457)
GG 1481 Turkey Cr., Mo. (1457)
GG 1482 Davis Cr., Mo. (1457)
GG 1483 Little Sugar Cr., Mo. (1457)
GG 1484 Mine Cr., Mo. (1457)
GG 1485 Walnut Cr., Mo. (1457)
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GG 1487 Muddy Cr., Mo. (1457)
GG 1488 Little Osage R., Mo. and Kans. (1457)
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GG 1490 Pryors Cr., Mo. (1488)
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GG 1492 Dry Wood Cr., Kans. and Mo. (1491)
GG 1493 Peshaw Cr., Mo. (1491)
GG 1494 Sac R., Mo. (1457)
GG 1495 Pomme de Terre R., Mo. (1457)
GG 1496 Turkey Cr., Mo. (1495)
GG 1497 Deer Cr., Mo. (1495)
GG 1498 Indian Cr., Mo. (1495)
GG 1499 Rainey Cr., Mo. (1495)
GG 1500 Coon Cr., Mo. (1495)
GG 1501 Dog Cr., Mo. (1495)
GG 1502 Cat Tail Cr., Mo. (1495)
GG 1503 Panther Cr., Mo. (1495)
GG 1504 Big Tavern Cr., Mo. (1457)
GG 1505 Little Tavern Cr., Mo. (1457)
GG 1506 Sugar Cr., Mo. (1457)
GG 1507 Profis Cr., Mo. (1457)
GG 1508 Niangua R., Mo. (1457)
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GG 1510 Marais Cr., Mo. (1457)
GG 1511 Loose Cr., Mo. (2)
GG 1512 Cedar Cr., Mo. (1511)
GG 1513 Beris Branch, Mo. (1512)
GG 1514 Deer Cr., Mo. (2)
GG 1515 Greasy Cr., Mo. (2)
GG 1516 Baileys Cr., Mo. (2)

GG 1517 Gasconade R., Mo. (2)
GG 1518 Duncan Cr., Mo. (1517)
GG 1519 Tavern Cr., Mo. (1517)
GG 1520 Osage Fork, Mo. (1517)
GG 1521 Lock Fork, Mo. (1517)
GG 1522 Parks Cr., Mo. (1517)
GG 1523 Steins Cr., Mo. (1517)
GG 1524 Clarks Cr., Mo. (1517)
GG 1525 Beaver Cr., Mo. (1517)
GG 1526 Roubidoux Cr., Mo. (1517)
GG 1527 Piney Cr., Mo. (1517)
GG 1528 Hamilton Cr., Mo. (1517)
GG 1529 Little Piney Cr., Mo. (1517)
GG 1530 Williams Cr., Mo. (1517)
GG 1531 Beaver Cr., Mo. (1517)
GG 1532 Wolf Cr., Mo. (1517)
GG 1533 Second Cr., Mo. (1517)
GG 1534 Turkey Cr., Mo. (1533)
GG 1535 Puncheop Camp Cr., Mo. (1533)
GG 1536 First Cr., Mo. (1517)
GG 1537 Libbie Branch, Mo. (1536)
GG 1538 Cole Cr., Mo. (2)
GG 1539 Frene Cr., Mo. (2)
GG 1540 Little Berger Cr., Mo. (2)
GG 1541 Big Berger Cr., Mo. (2)
GG 1542 Cliftie Cr., Mo. (1541)
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GG 1544 Buck Lick Cr., Mo. (1543)
GG 1545 Little Boeuf Cr., Mo. (1543)
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GG 1547 Brushie Cr., Mo. (1546)
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GG 1549 Dunn Spring Cr., Mo. (2)
GG 1550 Labadie Cr., Mo. (2)
GG 1551 Fiddle Cr., Mo. (2)
GG 1552 Little Tavern Cr., Mo. (2)
GG 1553 Big Tavern Cr., Mo. (2)
GG 1554 Wild Horse Cr., Mo. (2)
GG 1555 Bon Homme Cr., Mo. (2)
GG 1556 Cold Water Cr., Mo. (2)

GG-2 MISSOURI RIVER, MO., KANS., NEBR., IOWA, S. DAK., N. DAK., AND MONT.

Part.	Title.	Period.
a	List of notable points, mouth to headwaters	
b	Index to points named in these parts	
c	General data	
d	Appropriations	1852–1912
e	Missouri R. (except snagging)	1868–1879
f	Missouri R., general imp	1903–1912
g	Missouri R., mouth to Fort Benton	1880–1887
h	Missouri R., mouth to Sioux City	1880–1902
i	Missouri R., snagging, mouth to Kansas City	1880–1887
j	Missouri R., above Sioux City	1880–1902
k	Missouri R., snagging, above Sioux City	1893–1902
l	Missouri R., above Great Falls	1892–1894

Part (a), GG-2 List of Notable Points, Mouth to Headwaters.

Mississippi R. (above St. Louis, Mo.).
St. Charles, Mo.
Washington, Mo.
Gasconade R., Mo.
Osage R., Mo.
Jefferson City, Mo.
Grand R., Mo.
Sibley, Mo.
Kansas City, Mo.
Kansas R., Kans.
Leavenworth, Kans.
Atchison, Kans.
St. Joseph, Mo.
Nebraska City, Nebr.
Platte R., Nebr.
Omaha, Nebr.
Council Bluffs, Iowa.
Sioux City, Iowa.
Big Sioux R., Iowa and S. Dak.
James R., S. Dak. and N. Dak.
Yankton, S. Dak.
Niobrara R., Nebr.
Chamberlain, S. Dak.
Pierre, S. Dak.
Lebeau, S. Dak.
Owl R., S. Dak.
Cannon Ball R., N. Dak.
Bismarck, N. Dak.
Little Missouri R., N. Dak.
Williston, N. Dak.
Yellowstone R., N. Dak., Mont., and Wyo.
Milk R., Mont.
Musselshell R., Mont.
Marias R., Mont.
Ft. Benton, Mont.
Great Falls, Mont.
Helena, Mont.
Three Forks, Mont.
Yellowstone National Park, Idaho, Wyo., and Mont.

Part (b), GG-2 Index to Places Named in GG-2 (Missouri River Data).

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Part (c), GG-2 Missouri R.—General Data.

APPROPRIATIONS. (See p. 1041.)

One or two small app. had been made prior to 1878, for general imp. App. on a larger scale began with the act of June 18, 1878. **03,** 406.

COMMERCE.

Mouth to Sioux City: 1897, 391,000 t.; 1902, 410,527 t.; 1907, 843,863 t.; 1911, 359,721 t.; **12,** 839.

Above Sioux City: 1887, 14,000 t.; 1892, 17,000 t.; 1897, 17,000 t.; 1902, 31,000 t.; 1907, 45,000 t.; 1911, 11,000 t.; **12,** 839.

The Kansas City-Missouri River Navigation Co. had been organized, 1912, with capital of about $1,200,000. The first boats of the company were run 1911. Extensive terminal facilities had been constr. at Kansas City, with probably the most complete inland river transfer wharf in the U. S. Related terminals were being estab. at other points. The effect of this revival of traffic not apparent at 1912, but as the boat rates were one-third less than RR. rates, the latter expected to decline. **12,** 839.

PHYSICAL CHARACTERISTICS.

The Mo. R. formed by the junction of the Jefferson, Madison, and Gallatin Rs. in sw. Montana, flows se. to entrance into Miss. R. in e. part of Mo., about 18 m. above St. Louis. From Three Forks to mouth is 2,551 m.

From Fort Benton to Great Falls, 49 m., there are dams and rapids, the aggregate fall being 695′. Some portions above Great Falls are navigable also, but not continuously because of several power dams.

There has been navigation on the R. since 1819.

The elevations above sea level are: Three Forks, 3,045′; Ft. Benton, 2,671′; Sioux City, 1,085′; Kansas City, 723′; and mouth of Mo. R., 386′.

The general condition of the R. is one of alternate pools and bars. The l.-w. d. over bars is 3′ generally, and w. thereat from one-third to 1 m.; in the d. reaches the w. from 800′ to 1,500′, and the l.-w. d. in such places is often over 12′. Snagging operations since work of imp. has lessened what was once a great hindrance to navigation. **12,** 839.

PROJECTS.

The U. S. began removal of snags as early as 1838, with funds usually app. for several Rs. jointly, i. e., for the Ohio, Mississippi, Missouri, and sometimes the Arkansas, **03,** 406.

Up to 1884, the work of imp. was conducted on the separate-district plan. From 1884 to 1890 the work on the entire R. was under the Missouri R. Commission. After 1890, however, the portion from Sioux City, Iowa, upward and inclusive, was a separate district until 1902.

At 1902 no proj. for the imp. of the R. as a whole had been adopted. Whatever work was done was of a more or less local or detached character. **03,** 406.

On the upper portion of the R. the work originally consisted, mainly, in imp. the shoals and rapids on the so-called "Rocky River," from Ft. Benton downstream for 150 m. In "more recent times" the work has been limited largely to chan. regulation and bank protection. Two ice Hs. were constr. Some minor work has been done above Ft. Benton. **03,** 406.

Capt. Chittenden, 1903, recom. that the arbitrary division of the R. into 2 districts, with the dividing point at Sioux City, should be abolished, and that the R. should be treated as a whole; also, that the app. should be in a lump sum, providing elasticity to cover emergencies constantly arising from the unstable character of the R., **03,** 1553.

The commission was constituted by act July 5, 1884, and abolished by act June 13, 1902; thereupon the entire R. was consolidated into one district, **03,** 406.

The effort of the commission was to accomplish a continuous, progressive control of the R., contracting it where necessary, giving the chan. proper direction, and securely holding it in place. Imp., on this plan, was carried out in the vicinity of Kansas City, and on the first reach of the R., extending from near Jefferson City to the mouth. On 45 m. of this reach a continuous chan. of not less than 6′ was obtained, and this location was originally one of the worst parts. In addition, new land was formed, and much land protected from damage by the R. The greater part of the funds app. for expend. under the commission was not applicable to the comprehensive plans of the commission, the acts of app. diverting specific amounts for specific localities. **03,** 406.

The following work was being done at period of transfer:

1902–03. Lower R.: Mainly mainten. and repairs. Revet. repair at St. Joseph; dikes resreened at Nebraska City, protection of Chamois bankhead, and work was in progress at Little Blue when suspended by floods. Snagging. Property accumulated during 19 years of the Missouri Commission transferred. Records sent to Sioux City; some of the boatyard plant at Gasconade auctioned.

Upper R.: Snagging; repair work at Pierre, S. Dak., and Sioux City, Iowa; revet. constr. at Elk Pt., S. Dak., and revet. extension above Combination Br., Sioux City; repair and extension of dikes at Yankton; **03,** 1552.

A complete sur. of the R. had been made, and a fleet of snag boats had been kept in steady operation, directly benefiting navigation, **03,** 406.

Snagging. Orig. proj. adopted 1890 an. obstr. removal, and temporary imp. of worst shoals; est., $50,000 an. Work was begun 1891.

Act of 1902 consolidated app. for snagging with that for general imp. of R., **03,** 407.

For condensed description of works executed under the Mo. R. Commission, see Supplement to An. Rs., 1902.

For condensed description of works above Great Falls, see **99,** 385–386, and later An. Rs.—between Ft. Benton and Sioux City, **02,** 382–385, **12,** 837.

At 1912, the projs. were as follows:

Mouth to Kansas City: Act July 25, 1912, 392 m.; act July 25, 1912, au. efforts to gain a permanent 6′ chan., by means of regulating works, contracting the chan. with revet. and dikes, together with the removal of snags; est., $20,000,000; time of completion, est. at 10 years; **12,** 839.

Kansas City to Ft. Benton (1894 m.): At 1912 there was no approv. proj. for the section from Kansas City to Sioux City. Act July 25, 1912, app. $75,000 for imp. and mainten. for Kansas City to Sioux City, and $150,000 for imp. and mainten. Sioux City to Ft. Benton. The work thus au. is regulation and control of the R., incl. snagging and r. removal, mainten., and augmentation of urgent work near cities and important landings. Est. for this work, indefinite. Time of completion, indefinite. **12,** 839.

Opposite Sioux City: Act May 9, 1912, app. $50,000 for protection of the Nebraska shore, **12**, 839.

At Achison, Kans.: Act June 25, 1910, au. system of longitudinal and wing dikes on left bank, Mo., just above Atchison R.R. br.; est., $180,000, with $4,500 an. mainten., but local au. to contribute $90,000 before U. S. begins work, **12**, 839.

At St. Joseph, Mo.: Act June 25, 1910, au. revet. on the left bank near Lake Contrary; est., $150,000, and $3,000 an. mainten. No work to be undertaken until St. Joseph or other agency shall furnish $75,000 for cooperation. Action had not been taken on this latter fact at 1912. **12**, 839.

SURVEYS.

Complete sur. of the R. made, and published in 83 maps, scale 1" to m., **12**, 839.

Cong. docs., etc., **12**, 836, 842.

Part (d), GG-2 Missouri R.—Appropriations.

NOTE.—As is the rule in the case of other waterways, only the money set aside for the Missouri R. by Congress, directly or indirectly, is listed below. The classification is that given by H. D. 421, 57th Cong., 2d sess., and the annual report of 1912, **12**, 2218–20; and the items are from the same sources.

Summary of the Tables 1-17.

Table.	Title.	Period.	Total.
1	General improvement	1852–1892	$65,000.28
2	Above mouth of Yellowstone R., N. Dak.-Mont	1876–1881	160,000.00
3	Mouth to Sioux City, Iowa	1878–1910	8,510,078.07
4	Removal of obstructions	1878–1899	317,500.00
5	Sioux City to Ft. Benton, Mont	1878–1886	352,500.00
6	Mouth to Ft. Benton, Mont	1879–1888	1,100,000.00
7	Above Ft. Benton, Mont	1884	15,000.00
8	Sioux City, Iowa, to Great Falls, Mont	1890–1896	465,000.00
9	Three Forks to Canyon Ferry, Mont	1892	2,500.00
10	Sioux City, Iowa, to Stubbs Ferry, Mont	1894–1899	535,000.00
11	Upper Missouri R., except snagging	1902–1907	280,000.00
12	Mouth to Ft. Benton—mainten., etc	1909	555,000.00
13	Kansas City, Mo., to mouth	1910–1912	2,400,000.00
14	North and south of Le Beau, S. Dak	1910–1912	525,000.00
15	At St. Joseph, Mo	1910	75,000.00
16	At Atchison, Kans	1910	90,000.00
17	Dakota Co., Nebr.—banks	1912	50,000.00
	Grand total		15,497,578.35

Table 1. General improvement:

Aug. 30, 1852	$40,000.00	
July 25, 1868	25,000.00	
July 28, 1892	.28	
		$65,000.28

Table 2. Above mouth of Yellowstone R.:

Aug. 14, 1876	$20,000.00	
June 18, 1878	30,000.00	
Mar. 3, 1879	45,000.00	
June 14, 1880	25,000.00	
Mar. 3, 1881	40,000.00	
		160,000.00

Table 3. Missouri R., mouth to Sioux City, Iowa:

June 18, 1878	[1] $265,000.00
Mar. 3, 1879	174,000.00
June 14, 1880	232,000.00
Mar. 3, 1881	233,000.00
Aug. 2, 1882	850,000.00
July 5, 1884	500,000.00
Aug. 5, 1886	375,000.00

Table 3. Missouri R., mouth to Sioux City, Iowa—Con.

Mar. 2, 1889 (claims)	$62,060.00
Sept. 19, 1890	800,000.00
July 13, 1892	600,000.00
Mar. 3, 1893	[2] 750,000.00
Aug. 18, 1894	[2] 750,000.00
Mar. 2, 1895	[3] 750,000.00
June 3, 1896 [4]	300,000.00
June 4, 1897	300,000.00
July 1, 1898	[5] 300,000.00
Jan. 5, 1899	100,000.00
Mar. 3, 1899	200,000.00
June 6, 1900	250,000.00
June 13, 1902	175,000.00
Feb. 18, 1904	19.35
Apr. 28, 1904	50,000.00
Mar. 3, 1905	150,000.00
Mar. 2, 1907	300,000.00
Mar. 3, 1905	[6] 10,000.00
Mar. 2, 1907	[6] 998.72
Mar. 3, 1909	[7] 20,000.00

[1] Includes money for special places in these limits.
[2] $50,000 of this for snagging "above" Sioux City.
[3] $40,000 of this for work "at" Sioux City.
[4] As amended by act Jan. 5, 1899.
[5] $20,000 for Kaw R. mouth.
[6] Emergencies allotted Apr. 22, 1908.
[7] Emergencies allotted Dec. 13, 1909.

Table 3. Missouri R., Mouth to Sioux City, Iowa—Con.

Mar. 3, 1909	[1] $4,000.00	
June 25, 1910	[2] 1,500.00	
June 25, 1910	[3] 7,500.00	
		[4] $8,510,078.07

Table 4. Removal of obstructions:[5]

June 18, 1878	$70,000.00	
July 5, 1884	50,000.00	
Aug. 5, 1886	22,500.00	
Feb. 22, 1890	75,000.00	
June 3, 1896	[6] 50,000.00	
Mar. 3, 1899	[6] 50,000.00	
		[7] 317,500.00

Table 5. Sioux City to Ft. Benton:[8]

June 18, 1878	$12,500.00	
Mar. 3, 1879	15,000.00	
June 14, 1880	18,000.00	
Mar. 3, 1881	22,000.00	
Aug. 2, 1882	100,000.00	
July 5, 1884	[9] 125,000.00	
Aug. 5, 1886	60,000.00	
		[10] 352,500.00

Table 6. Mouth to Ft. Benton:

Mar. 3, 1879 (sur.)	$30,000.00	
Mar. 3, 1881 (sur.)	30,000.00	
Aug. 2, 1882 (sur.)	40,000.00	
Aug. 11, 1888	[11] 1,000,000.00	
		1,100,000.00

Table 7. Above Ft. Benton:

July 5, 1884 (sur.)	$15,000.00	
		15,000.00

Table 8. Sioux City to Great Falls:

Sept. 19, 1890	$300,000.00	
July 13, 1892	150,000.00	
June 3, 1896	15,000.00	
		465,000.00

Table 9. Three Forks to Canyon Ferry:

July 13, 1892 (ex. for water power)	$2,500.00	
		2,500.00

Table 10. Sioux City to Stubbs Ferry:[12]

Aug. 18, 1894	$110,000.00	
June 3, 1896	220,000.00	
Mar. 3, 1899	[13] 205,000.00	
		$535,000.00

Table 11. Upper Missouri (except snagging):

June 13, 1902	$100,000.00	
Mar. 3, 1905	75,000.00	
Mar. 3, 1907	100,000.00	
Mar. 4, 1907	[14] 5,000.00	
		280,000.00

Table 12. Missouri R., mouth to Ft. Benton, Mont.—Preservation, maintenance, act of Mar. 3, 1909:

Plant and boat yards	$155,000.00	
Dikes and revetment	400,000.00	
		555,000.00

Table 13. Missouri R., Kansas City to mouth:

June 25, 1910	$1,000,000.00	
July 25, 1912	800,000.00	
Aug. 24, 1912	600,000.00	
		2,400,000.00

Table 14. Missouri R., north and south of Lebeau:

June 25, 1910	$300,000.00	
July 25, 1912	225,000.00	
		525,000.00

Table 15. At St. Joseph:

1910, $75,000, **10**, 1832	75,000.00

Table 16. At Atchison:

1910, $90,000, **10**, 1833	90,000.00

Table 17. Protecting banks, Dakota Co., Nebr.:

1912 (special act)	$50,000.00	
		50,000.00
Grand total		15,497,578.35

[1] Emergencies allotted Apr. 13, 1912.
[2] Emergencies allotted Apr. 29, 1912.
[3] Emergencies allotted May 6, 1912.
[4] The total appropriations and receipts from other sources for the Missouri R. from mouth to Sioux City, Iowa (taken from **12**, 2220), are:

Act of Aug. 2, 1882, applied to works above Sioux City, Iowa	$4,000.00	
Survey of Missouri R. from mouth to Ft. Benton, act of Aug. 2, 1882	8,844.39	
Act of Aug. 5, 1886, to removing obstructions from Missouri R	1,982.80	
		$14,827.19
Funds contributed by railroad companies		50,000.00
Funds contributed by citizens of St. Joseph		50,000.00
Funds contributed by citizens of Hartsburg, Mo		10,000.00
Funds contributed by Sioux City Stock Yards Co		2,000.00
Funds contributed by citizens of Craig, Mo		4,491.73
Funds contributed by citizens of Sioux City, Iowa		15,342.00
Funds contributed by Union Terminal Ry. Co		3,000.00
Funds contributed by Chicago & Alton Ry. Co		4,500.00
Refunded on account of overpayments, etc		3,578.16
Received from transfer of materials		5,021.59
Received from transfer of surplus property		7,556.15
Received from sale of condemned and surplus property		12,954.32
Received from sale of maps		95.52
Received from deposit by Isthmian Canal Commission		423.15
Received for services of snag boats		394.49
Received for delay to snag boat		100.63

[5] See also "Sioux City to Stubbs Ferry."
[6] Snagging upper R.
[7] Total for "snagging" given as $393,073.53, **03**, 1555; **12**, 2219; but this total includes items app. under other general titles. Does not include 2 allotments of $50,000 each for removing snags, etc., above Sioux City, from money for "below" Sioux City, 1893 and 1894.
[8] Includes sums for special parts.
[9] Includes $15,000 for snag boat to work between Sioux City and on Yellowstone R.
[10] In addition, $40,000 allotted for bank protection vicinity of Sioux City from money for imp. "below" Sioux City, act Mar. 2, 1895.
[11] Of this sum, $775,000 allotted for specific localities.
[12] Includes sums for special places in these limits.
[13] As amended by act June 6, 1900.
[14] Deficiency act, destruction of ice gorge, Mo. R., S. Dak.

The annual report of the Chief of Engineers, **12,** 2220 gives the total for Missouri R. as $15,451,432.07. This total is arrived at after adding contributions or quotas from private sources, receipts from sales, reimbursements, etc., and then deducting refunds, etc. It does not include, however, all the sums provided for the R. according to H. D. 421, 57th Cong., 2d sess., these sums being considered in the 1912 reports, to the extent of $10,841,000. The complete total in H. D. 421, 57th Cong., 2d sess., is $11,078,560.28. The difference, $237,560.28, added to $15,451,432.07, equals $15,688,992.35, which, after considering the receipts and deductions shown at **12,** 2220, makes a reasonable correspondence with the total given in this work, as above, $15,497,578.35.

As an example of what is meant by "contributions, quotas," etc., in the foregoing paragraph, see the various footnotes to the tables of appropriations, and particularly the footnotes to table No. 3.

Part (e), GG-2 Missouri River. (Except removing snags.)

APPROPRIATIONS. (See p. 1041.)

ENGINEERS.

Chief of Engineers. Rs.—
Upper Missouri, **68,** 59; **75,** 68; **77,** 82; **78,** 95; **79,** 127.
St. Joseph, **76,** 80; **77,** 79; **78,** 90; **79,** 123.
Nebraska City, **77,** 79; **78,** 90; **79,** 124.
Ft. Leavenworth, **78,** 90; **79,** 122.
Atchison, **78,** 90; **79,** 123.
Omaha and Council Bluffs, **78,** 91; **79,** 124.
Sioux City, **78,** 91; **79,** 124.
Sur., mouth to Sioux City, **78,** 92; **79,** 126.
Cedar City, **79,** 121.
Glasgow, **79,** 121.
Kansas City, **79,** 122.
Vermillion, **79,** 125.
St. Charles, **79,** 127.

In charge:

Col. J. N. Macomb, 1868—
Upper Missouri, **68,** 622.

Maj. C. R. Suter, 1875–79. **Rs.—**
Ex. above mouth of Yellowstone, **75,** 517.
Near St. Joseph, **76,** 627; **77,** 498; **78,** 652; **79,** 1065.
Near Nebraska City, **77,** 499; **78,** 653; **79,** 1066.
Near Atchison, **78,** 652, 668; **79,** 1063.
Near Ft. Leavenworth, **78,** 652; **79,** 1063.
Near Omaha and Council Bluffs, **78,** 657, 665; **79,** 1076.
Near Sioux City, **78,** 657, 674; **79,** 1078.
Near Cedar City, **79,** 1053, 1054.
Near Glasgow, **79,** 1055, 1056.
Near Kansas City, **79,** 1059.
Near St. Charles, **79,** 1083.
Near Vermilion, **79,** 1079.
Sur., mouth to Sioux City, **78,** 658; **79,** 1082.
Sur. at Omaha, Atchison, and Plattsmouth, **78,** 663, 671, 673.

Lt. E. Maguire, 1877–79. **Rs.,** above mouth of Yellowstone, **77,** 519; **78,** 689; **79,** 1095.

Assistants:
Capt. C. W. Howell. **R., 68,** 622.
T. P. Roberts. **R., 75,** 517.
M. Boehmer. **R., 76,** 630, 632; **78,** 654, 666, 668, 675.
A. H. Blaisdell. **R., 78,** 671, 673.
H. E. Stevenson. **R., 78,** 699.
L. E. Cooley. **R., 79,** 1067.
S. H. Yonge. **R., 79,** 1080.
Capt. T. H. Handbury. **R., 79,** 1054, 1056, 1060, 1084.

ESTIMATES. (See Plans and Projects.)

By Capt. Howell, 1868, light-draft boat, upper Missouri, $29,000, **68,** 621, 633.

By Maj. Suter, 1875, light-draft snag boat, upper Missouri, $50,000, **75,** 519.

By Maj. Suter, 1875, imp. near St. Joseph, $150,000, **76,** 630; **77,** 499. To complete, $84,000, **79,** 1066.

By Maj. Suter, 1877, near Nebraska City, $150,000, **77,** 499; **78,** 653. To complete, $55,000, **79,** 1067.

By Maj. Suter, 1877, near Atchison, $56,000, **78,** 669. Modified in 1878 to $120,000, **79,** 1063. To complete, $80,000, **79,** 1064.

By Maj. Suter, 1878, near Ft. Leavenworth, $70,000, **79,** 1063. To complete, $35,000, **79,** 1063.

By Maj. Suter, 1878, near Omaha, $210,000, **79,** 1076. To complete, $80,000, **79,** 1077.

By Maj. Suter, 1878, near Sioux City, $46,300, **79,** 1078. To complete, $23,800, **79,** 1079.

By Capt. Handbury, 1879, near Glasgow, $133,000, **79,** 1058. To complete, $118,000, **79,** 1055.

By Capt. Handbury, 1879, near Kansas City, $92,810, **79,** 1062. To complete, $62,810, **79,** 1059.

By Maj. Suter, 1879, near Vermilion, $75,000, **79,** 1079. To complete, $70,000, **79,** 1079.

By Capt. Handbury, 1879, near St. Charles, $80,000, **79,** 1085. To complete, $80,000, **79,** 1083.

OPERATIONS.

1877–78. Strengthening dikes near St. Joseph; constr. floating dike at Nebraska City, **78,** 90, 652, 653, 656. Removal of r. and constr. wing dams on upper Missouri, **78,** 95, 695, 700.

1878–79. Imp. of R. with shore protection (brush mats); and R. rectification, with floating dikes (Brownlow weeds) at Glasgow, Kansas City, Ft. Leavenworth, Atchison, St. Joseph, Nebraska City, Omaha and Council Bluffs, Sioux City, and Vermillion, **79,** 1055, 1059, 1063, 1064, 1065, 1066, 1067, 1076, 1078, 1079. Removal of r. and constr. of wing dams in upper Missouri, **79,** 1096.

PHYSICAL CHARACTERISTICS.

Of upper Missouri, **68,** 623; **75,** 517.
Erosion of banks, **76,** 628, 632; **78,** 655, 666, 669, 671, 673, 675; **79,** 1054, 1057.
Slope, upper Missouri, **75,** 518; **78,** 699.
Slope, lower Missouri, **76,** 632; **78,** 666, 670.
Discharge, upper Missouri, **78,** 699.
Discharge, lower Missouri, **76,** 632; **78,** 667, 670.
Cut-offs at Omaha, **78,** 665, 666.
Cut-offs at Atchison, **78,** 670.

PLANS. (See Estimates and Projects.)

By M. Boehmer, 1875, protection of shore near St. Joseph with spur dikes, **76,** 631, 633. Plan considered uncertain, **76,** 629.

By M. Boehmer, 1877, shore protection with riprap, **78,** 668.

PROJECTS. (See estimates and Plans.)

By Capt. Howell, 1868, Missouri above mouth of Yellowstone, removing obstr. and constr. wing dams, **68,** 621, 624.

By Maj. Suter, 1875, repetition of foregoing, **75,** 518.

By Lt. Maguire, repetition of foregoing, **77,** 520; **78,** 694; **79,** 1096.

By Maj. Suter, 1876, protection of shore on Kansas side above St. Joseph with brush mats, **76,** 629, 630; **77,** 499.

Protection of banks near Nebraska City with brush and st. dikes, **77,** 499; small app. required a

modification of plan to obtain immediate protection; use of floating dikes (Brownlow weeds) suggested, **77,** 500; **78,** 653; success of, **78,** 654; cost of, **79,** 1067.
Protection of banks at Omaha with brush and st. revet., **78,** 664, 666.
Rectification of chan. and protection of banks at Atchison with floating dikes and brush protection, **78,** 664, 669.
Shore protection at Sioux City with brush revet., **78,** 675.
Rectification of chan. with floating dikes (Brownlow weeds), and shore protection with brush mats at Sioux City, **79,** 1079; Cedar City, **79,** 1054, 1055; Glasgow, **79,** 1056, 1058; Kansas City, **79,** 1059, 1062; Ft. Leavenworth, **79,** 1063; Atchison, **79,** 1064; Omaha and Council Bluffs, **79,** 1077; Vermillion, **79,** 1079.

SURVEYS.
Exploration of upper Missouri, **68,** 59, 621; **75,** 517.
St. Joseph, **76,** 80, 630.
Omaha and Council Bluffs, Plattsmouth, Brownville, and Atchison, **78,** 93, 652, 663, 666, 671.
Mouth to Sioux City, **78,** 658; **79,** 1082.
Glasgow, **79,** 1056.
Kansas City, **79,** 1059.
St. Charles, **79,** 1083.

Maps:
Near St. Joseph, **76,** 632; **79,** 1065.
Near Nebraska City, **78,** 654; **79,** 1066, 1071, 1074.
Near Omaha, **78,** 664; **79,** 1076.
Near mouth of Platte R., **78,** 672.
Near Brownville, **78,** 672.
Vermillion, **79,** 1080.

Part (f), GG-2 Missouri River. (General improvement.)

APPROPRIATIONS. (See p. 1041.)

COMMERCE.
Small, bet. St. Louis and Kansas City, **04,** 2301.
Letter of Commercial Club of Kansas City, **04,** 2310.
Indications of renewed C. activity, **07,** 1597.
Increase in C., **08,** 1671.
Tables of freight carried from mouth to Sioux City, 1897 to 1911, incl.; and above Sioux City, 1897 to 1911, incl., **12,** 845.
Local, at Atchison, small, **11,** 699; **12,** 848.
Local, at St. Joseph, small, **11,** 699; **12,** 847.
In 1910, 762,720 t., Kansas City to mouth, **11,** 695.

CONTRACTS.
1909. R. O. Shobe, revet., $8.90 l. f.; A. W. Farney, pile dikes, 3-row dikes, $11.75 and $13.25 f., and 2-row dikes, $6.77 f.; Swift & Rust, 3-row pile dike, $15 f.; Swift & Rust, pile dike, $15 f., **10,** 1829. R. O. Shobe, pile dikes ($12.20, $12.40, and $12.75 f.) and revet. ($7.90 l. f.); R. O. Shobe, pile dikes ($12.75 f.) and revet. ($8.25 f.), **10,** 1830.

1910. DeWitt & Shobe, pile dike ($5.50 f.) and revet. ($8.90 l. f.); H. W. Kolkmeyer & Co., levee, 13.75¢ c. y.; slope paving, 42¢ s. y., **10,** 1829. Dubuque Boat & Boiler Works, 3 steel towboats, $104,205, **11,** 1999, 2000, 2004.

1911. Missouri Valley Bridge & Iron Co., 8 barges, $41,672, **11,** 2000, 2005. Rust, Swift & Co., standard revet. 13,000′ l., $8.29 l. f., **11,** 2005. DeWitt & Shobe, standard revet. 11,000′ in St. Charles Bend, $7.74 l. f., **11,** 2005.

1912. J. W. McMurry Contracting Co., standard revet., $10.85 l. f.; Rust, Swift & Co., standard revet., $8.09 l. f.; DeWitt & Shobe, standard revet., $8.37 l. f.; McGuire & Stanton Contracting Co., and Edward Jones, standard revet., $9.32 l. f., **12,** 2205.

ENGINEERS.
Chief of Engineers. **R., 03,** 405; **04,** 431, 436, 2328; **05,** 442; **06,** 483; **07,** 511; **08,** 543, 550, 551; **09,** 573, 582; **10,** 644, 656, 657; **11,** 688; **12,** 831.

Boards:
Appointed, S. O. No. 39, Oct. 31, 1903, to consider H. lines for Kansas City., Mo., and to report on flood conditions and obstr. in Kaw R. **R.** on flood conditions, S. Doc. 160, 58th Cong., 2d sess., **04,** 2300.
BERH. reported, 1904, that imp. by dr. impracticable, and that imp. at West Glasgow, Wilhoite Bend, Lexington or St. Joseph not advisable; recom. app. of $50,000 per year for 2 years and $35,000 per year thereafter, for snagging, and $10,000 for certain imp. at Hermann, Mo., **04,** 2332.

In charge:
Capt. H. M. Chittenden, 1903–05. **R., 03,** 1551; (Maj.) **04,** 2300, 2328; **05,** 1689.
Col. James B. Quinn, 1906. **R., 06,** 1481.
Capt. Edward H. Schulz, 1907–. **R., 07,** 1595; **08,** 1663; (Maj.) **09,** 1655; **10,** 1813; **11,** 1987; **12,** 2193.

Assistants:
S. Waters Fox. **R.,** Sioux City to mouth, **03,** 1560.
Bathurst Smith. **R.,** above Sioux City, **03,** 1566.
W. R. DeWitt. **R.,** Sioux City to mouth, **04,** 2311; **05,** 1696. Above Sioux City, **05,** 1702.
E. D. Vincent. **R.,** above Sioux City, **04,** 2316; **05,** 1701.

LEGAL PROCEEDINGS.
Purchase of land for boat yard at Gasconade, **10,** 1816.

OBSTRUCTIONS.
Complaints against slow opening of Jefferson City, Mo., drawbr. Notice served on owners to imp. operation of br., **08,** 1667. Public hearing regarding br. at Atchison, Kans.; notice served on owners to alter br. by constr. addl. draw or to dr. chan., **08,** 1669.

OPERATIONS.
1902–03. Repairs and additions, **03,** 1560. 4,137′ revet. repaired and 3,396′ built at and near St. Joseph, **03,** 1552, 1562. 205′ revet. built, 700′ rebuilt and other repairs made at Pierre and Ft. Pierre; 1,800′ revet. built at Elk Pt.; 1,982′ revet. built, and extensive repairs made at Sioux City, **03,** 1566. Work and property of Missouri River Commission trans. to U. S. Engineer office, **03,** 1552. 465 snags and 88 other obstr. removed, and 356 trees felled, **03,** 1563, 1567.

1903–04. Work on yard and floating plant. **04,** 2311. Repairs and imp. to dikes and revet, near mouth of Little Blue, at Lexington, Mo. Wilhoite Bend, in the several bends of the First Reach, and near Jefferson City, Mo., **04,** 2312. 775′ revet. built at Ft. Benton; 500′ dike built at Pierre, and Dike No. 7 at Yankton extended 1,020′, **04,** 2316. Repairs to revet. at Elk Pt., Sioux City, Iowa, and Sioux City, Nebr., **04,** 2317. 215 snags, 183 trees, and 4 other obstr. removed from lower R., **04,** 2314. 454 snags and 160 trees removed from upper R., **04,** 2317.

1904–05. Repairs to plant, etc., **05,** 1697, 1700, 1702. Repairs and imp. to dikes and revet. at Omaha, Nebraska City, Nearman Bend, mouth of Little Blue, Lexington, Miami, Cambridge Bend, Nigger Bend, Murray Bend, and Jefferson City, **05,** 1698. Revet. at Kansas City extended 523′, **05,** 1698. Two dikes built at Wilhoite Bend, **05,** 1698. Fascine dike built at Cedar Isld. Chute; 6 pile dikes built and repairs made at Chamois; 2 pile dikes built and repairs made at St. Aubert Isld.; 4 pile dikes built and repairs made at Portland Isld.; fascine dike built and bank protected at Heckman Isld., and brush and st. dike built

See p. 1037. **MISSOURI RIVER.** See special index, p. 1038.

and repairs made at Pelican Bend, **05,** 1699. Repairs made to works at Sioux City, Elk Pt., Yankton, Pierre, and Bismarck, **05,** 1701. 1,059 snags and other obstr. removed, and 2,767 trees felled **05,** 1700, 1702, 1703.

1905-06. Repairs and additions to plant, **06,** 1483, 1488. Plant damaged by flood, **06,** 1488. 90 pile dikes constr. and repairs made below Little Blue; 2 pile dikes, aggregating 100′, constr., and repairs made at Lexington, **06,** 1483. Two 80′ dikes built, and repairs made at Wilhoite Bend; 3 dikes averaging 100′ each built, and 1 rebuilt at Portland Isld.; 14 spur dikes, 70′ to 90′ each, built, and repairs made at Murray Bend, **06,** 1484. Longitudinal dike 4,338′ l., and 7 spur dikes aggregating 1,562′ built at St. Joseph, **06,** 1484. 502′ dike built at Hermann, **06,** 1487. 1,350′ revet. and 920′ longitudinal dike built at Sioux City, Iowa, **06,** 1488. 1,500′ longitudinal dike and 740′ cross dikes built at Bismarck, **06,** 1489. 371 snags and other obstr. removed, and 345 trees felled, **06,** 1484, 1489.

1906-07. Repairs to plant, **07,** 1596. Five short spur dikes built by local interests with U. S. plant at Wilhoite Bend; expedition for the destruction of ice gorge, **07,** 1597.

1907-08. Repairs to plant, **08,** 1666, 1667. 700′ pile dike built below Miami, **08,** 1666. 2,050′ longitudinal dike and 2,036′ cross dikes built at Elwood, **08,** 1668. 1,853 snags and other obstr. removed, and 2,113 trees felled, **08,** 1665, 1667, 1669. 2,000′ revet. built at Bismarck, **08,** 1670.

1908-09. Repairs, etc., to plant, **09,** 1657, 1660, 1664. 1,145′ longitudinal pile dike and 3 short buttress dikes built in Little Blue Reach, **09,** 1657. 3,100′ earth levee built (in conjunction with Farmers Assn.) at Wilhoite Bend; 1,000′ revet. and 120′ dike built at St. Aubert Bend, **09,** 1658. 1,187′ dike and 666′ of cross dike built at Belmont Bend, above and below St. Joseph; two 300′ pile dikes, and 1 wood and concrete pile dike built, and extensive repairs made to old dike (one-half cost paid by RRs.), 1,050′ longitudinal dike and 1,252′ cross dikes built at Elwood, **09,** 1661. Repairs made at Sioux City ,**09,** 1662. Bank at Expansion protected, **09,** 1663. Dangerous bowlders, etc., removed bet. Ft. Benton and Ft. Buford, **09,** 1664. 3,075′ revet. and 100′ pile dike built at Williston, **09,** 1665. 2,421 snags and other obstr. removed and 1,736 trees felled, **09,** 1656, 1657, 1660, 1663.

1909-10. Repairs and additions to plant, **10,** 1814, 1815, 1822, 1827. 2,122 l. f. dikes and 1,792 l. f. revet. built, and repairs made at 21 places along first reach, **10,** 1816. 500 l. f. dikes built at Fishing River Bend; 200 l. f. dike built near head of Blue Mills Isld.; 1,430 l. f. dikes built and 2,260 l. f. bank protected opposite Lexington, **10,** 1818. 250 l. f. dike built at head of Prunty Isld.; 650 l. f. dikes built and 3,550 l. f. bank protected at Waverly Bend; 460 l. f. dikes built and 2,350 l. f. bank protected at Baltimore Bend; work begun on 200′ dike at Wilhoite Bend; 500 l. f. dike built at New Frankfort; 3,365 l. f. revet. built at Nigger Bend, **10,** 1819. 1,640 l. f. dikes built and 9,950 l. f. bank protected at Hartsburg ($10,000 paid by citizens of Hartsburg); 250 l. f. dike built below St. Charles; 500 l. f. dike built at Howard Bend; 1,060 l. f. revet. work at Pelican Bend completed; 36,602 c. y. earth placed in levee at Wilhoite Bend; 50 l. f. revet. work above Glasgow completed, **10,** 1820. 193 l. f. bank paved, 1,145 l. f. revet. and 547 l. f. dikes rebuilt at Belmont Bend; 347 l. f. revet. built and 6,554 l. f. concrete piles cast for dike at Bonton Bend, **10,** 1822. 350 l. f. dikes built near Craig; 1,040 l. f. revet. rebuilt at Council Bluffs, and 200 l. f. dike built at Sioux City, and 400 l. f. at Decatur, **10,** 1823. 750 l. f. revet. built at Sioux City (material furnished by Chicago, Milwaukee & St. Paul Ry. Co.); 500 l. f. dike built at Pierre, **10,** 1825. 500 l. f. dikes built at Ft. Pierre; 2,500 l. f. revet. built at Williston (material furnished by city of Williston and Great Northern Ry. Co.), **10,** 1826. 500 l. f. bank paved at Ft. Benton, **10,** 1827. 2,137 snags and other obstr. removed, and 3,149 trees felled, **10,** 1814, 1815, 1822, 1825.

1910-11. Mouth to Kansas City: 1,127 snags and other obstr., 1,862 c. y. r., and 2 wrecks removed, **11,** 1988. Repairs made to plant and tools at Gasconade boat yard; quarterboat made; air-compressor plant purchased; plant assembled for filling yard; snag boat repaired, and dikes and revet. completed by hired labor, **11,** 1989, 1990. Unfinished contract work at Wilhoite and Pelican Bends completed, **11,** 1991. Constr. of 3 steel towboats in progress; dikes and revet. at Heckmann Isld. and Howard Bend completed by hired labor, **11,** 2000. Revet. by contract at Howard Bend 30% completed, **11,** 696, 2000. Work on revet. at St. Charles Bend 7% completed, **11,** 696, 2000, 2001. Cottonwood pile dike at Nigger Bend completed, **11,** 696, 2001.

Kansas City to Sioux City: Additions and minor repairs made to fleet; 1,527 snags and other obstr. removed, **11,** 1991; wooden braces of concrete pile dike at Elwood Bend removed; concrete dike at Bonton Bend near St. Joseph completed; 3 standard 3-row pile dikes constr., and 3 old dikes repaired at Nebraska City, **11,** 1992. Standard 3-row pile dike constr. at Sioux City, **11,** 1993. Steel-hull towboat *Lieut. Lewis* launched and half completed, **11,** 2007. Material assembled to replace 1,000′ revet. below Grand Isld. Br. at St. Joseph, Mo.; 725 l. f. revet. and 4 dikes, 330 l. f. in all, constr. immediately below concrete dike in Bonton Bend at St. Joseph; 3 dikes repaired and 4 addl. dikes aggregating 790 l. f. built at Craig, Mo. (local interests paid for part of work); 2 dikes maintained, and 2 addl. dikes built at Decatur, Nebr., **11,** 698, 2007.

Sioux City to Ft. Benton: Boat and supply yard maintained, **11,** 1993. Pile driver and 4 barges recalked, tools overhauled and unserviceable property condemned and sold at Sioux Ice H.; 2 barges recalked, pile driver barge rebuilt, machinery repaired, and 3 old barges sold at Rock Haven, **11,** 1994. Material assembled at Sioux City for revetting 7,000 l. f. bank at Sioux Pt. in cooperation with local interests, **11,** 698, 2007. Repairs to dike system made at Elk Pt., S. Dak.; lower 5 of system of 7 dikes above br. at Bismarck, N. Dak., repaired; revet. below br. maintained and extended 2,000′ downstream; total of system, 5,400′, **11,** 698, 2008. Local interests failed to furnish funds, and it was not practicable to do the work at Washburn, N. Dak., **11,** 2008. Revet. system at Williston, N. Dak., maintained and extended downstream 1,000′; total of system, 6,575′, **11,** 698, 2008. 700 l. f. paving and 200 l. f. mattress 30′ w. constr. at Judith, Mont. **11,** 698, 2009.

Snagging: Snag boat *Mandan* removed 812 snags and other obstr. from various points above Kansas City, **11,** 1994.

Dikes repaired at Yankton, S. Dak.; 230 l. f. standard dike completed and 250 l. f. crib dike built to close remaining chute at Pierre, S. Dak.; dikes at Bismarck and Mandan, above Northern Pacific RR. br., repaired with piles, mattresses, and rebracing; 610 l. f. of right bank at Deapolis, N. Dak., paved with native bowlders; 604 l. f. right bank at Expansion, N. Dak., paved; city river front, Ft. Benton, paved and other repairs made, **11,** 1995. Revet. work done at Judith and Williston, N. Dak., and bowlders and snags removed from Rocky R. chan. with dynamite, **11,** 1996.

1911-12. Kansas City to Ft. Benton: Paving of left bank, water front of Ft. Benton, extended downstream 200′; revet. extended 580′ and slide 240′ l. in revet. bank repaired at Williston, N. Dak.; repair of damage by ice to work on Mandan side of R. in progress; 202 piles driven, **12,** 2208. Revet. extended upstream 500 l. f. and 3 deflection dikes, 270′ in all, constr. above new revet. protecting 1,500 l. f. of bank at Pierre, **12,** 2208, 2209. Materials received for repairing dikes at Elk Pt., S. Dak. (local interests contributed $160); U. S. cooperated

with local interests in constr. 7,100 l. f. revet. and pile dike 100′ l. above mouth of Big Sioux R., **12,** 2209. Temporary repairs made to training dike at Council Bluffs, Iowa; crib raised and rescreened at Dike No. 4, Bonton Bend, near St. Joseph; U. S. cooperated with Union Terminal Ry. Co. in reinforcing dike at St. Joseph; repairs made to training dike below St. Joseph and Grand Isld. Ry. br.; 1,000 l. f. revet. built to repair old work at St. Joseph, **12,** 2211. Bowlders and snags destroyed by dynamite in Rocky R.; summary of work given, **12,** 2212. Towboat *Lieut. Lewis* delivered; dike fleet laid up; SS. *Arethusa* repaired; boat and supply yards maintained; materials purchased for constr. of quarterboat, pile driver, and 3 barges, **12,** 2211, 2212. Minor repairs made to pile driver No. 5, kitchen boat No. 99, and 8 barges calked; pile driver and 2 barges repaired at Rockhaven, N. Dak., **12,** 2212. Snag boat *Mandan* removed 2,039 snags and other obstr. bet. Miners Bend and mouth of Yellowstone R., **12,** 2213. Snag boat *James B. McPherson* removed 1,557 snags and other obstr. from below and above Sioux City, **12,** 2214. 13 snags and other obstr. removed by dynamite, operating through ice, **12,** 2214–15.

At Atchison: No work; cooperation of local interests not yet obtained, **12,** 2218.

At. St. Joseph: No work; cooperation of local interests not yet obtained, **12,** 2218.

Kansas City to mouth: 13,068 l. f. revet. completed at Randolph Bend; 15,000 l. f. revet. completed at Wayne City Bend; 12,000 l. f. revet. completed at Liberty Bend; assembling material and plant for constr. of 12,000 l. f. revet. at Missouri City Bend; 4,025 of the 5,000 l. f. of revet. completed by day labor and U. S. plant at EurekaBend; 1,000 l. f. willow mattress and concrete revet. completed by hired labor and U. S. plant at Gasconade, Mo., **12,** 2196. Work on 12,000 l. f. willow mattress and concrete revet. in progress at Bates Isld. Bend; work on 11,000 l. f. revet. in progress at St. Charles Bend; work on 4,500 l. f. concrete dike in progress at Pelican Bend, **12,** 2197. Status of work June 30, 1912, and mainten., **12,** 2195. One 3-row dike, 100 l. f., completed at Waverly Bend; three 3-row dikes, 620 l. f. in all, completed by hired labor at Glasgow, Mo., Chicago & Alton Ry. Co. paying half the cost; 3 dikes, 230 l. f. in all, built for protection of system of 9 dikes constr. in Eureka Bend; dike extension, 300 l. f., completed at First Reach (below Jefferson City, Mo.); 260 l. f. revet. built as repair to old revet. at Gasconade, **12,** 2198. New plant—2 steel-hull towboats, *Lieut. Gurney* and *Lieut. Augustin,* delivered at Gasconade, **12,** 2198. 8 steel barges delivered at Gasconade; material and machinery for survey boat *Katherine* received, and keel and framing in place; 2 quarter boats completed and launched; 2 mattress barges completed and launched; propelling machinery of snag boat *Missouri* overhauled and general repairs made; mattress barge completed and launched; pile driver completed; boat yard raised 1′ above flood line of 1908, 15,000 c. y. sand deposited, **12,** 2199. Snag boat *Missouri* repaired and assisted in floating the sunken lighthouse tender *Lily,* **12,** 2199, 2200. Snag boat *McPherson* removed 1,553 snags and other obstr., **12,** 2200.

NOTE.—Various detailed tabular statements of localities, amounts, and cost of work found each year in reports of engineers in charge, and assistants.

PHYSICAL CHARACTERISTICS.

Disastrous flood, **08,** 1671.

Gauge readings and discharge observations, **09,** 1666.

Description of, **11,** 695; **12,** 831, 832, 841.

At Atchison, orig. and "present" conditions, **11,** 699; **12,** 848.

At St. Joseph, orig. and "present" conditions, **11,** 699; **12,** 847.

PRIVATE WORK.

640 l. f. dike and 400 l. f. revet. built and more work under constr. by Chicago & Alton Ry. Co., **10,** 1821.

Atchison, Topeka & Kansas Ry. Co. and the Wabash RR. Co. constr. revet. and dikes, **11,** 2001.

Current deflectors and dikes built by assn. of farmers, **11,** 2001, 2002.

Atchison: 600′ pile dike built to force current through draw opening of their br. by Atchison & Eastern Bridge Co., **08,** 1672.

Bellefontaine: 1,200 l. f. revet. built by Chicago, Burlington & Quincy RR. Co., **10,** 1821.

Belmont Bend and St. Joseph: One-half cost of dike work at Belmont Bend and repair work on dikes at St. Joseph paid by C., R. I. & P. and St. Joseph & Grand Island Ry. Cos., **09,** 1661.

Blair (see Marion Island and St. Joseph): 800 l. f. revet. built, by Chicago & North Western Ry. Co., **09,** 1666; **11,** 1993. C. & N. W. Ry. Co., constr. 600′ new revet., **12,** 2216.

Boles: 5 mud-cell dikes built by the Labadie Bottom Land Protection Assn., **08,** 1671.

Boonville: 5,000′ revet. built by M., K. & T. RR. Co., **08,** 1671.

Council Bluffs: 210′ revet. built by Illinois Central RR. Co., **10,** 1824.

Craig: 6 pile dikes, aggregating 1,200 l. f., built by Farmers Assn., **09,** 1666.

Decatur. (See Sioux City.)

DeWitt (see Randolph): 1,100′ revet. and 500′ dikes near DeWitt, and 7,250′ revet. and 750′ dikes at Hull Pt. built by Wabash RR. Co., **10,** 1821.

Fishing River: 500′ revet., 400′ dikes built by Prairie Oil & Gas Co., **10,** 1821.

Floyd River: 210′ dike built by Sioux City Stock Yards Co., with U. S. plant, **10,** 1824.

Folsom, Iowa: 70 old cars loaded with r. run into break, 1,900 cars of r. thrown along RR. embankment, and 3,900′ revet. constr., **12,** 2216.

Hartsburg: $10,000 contrib. by Farmers Assn. toward work, **10,** 1821.

Herman: $1,300 contrib. by citizens toward work opposite Wilhoite Bend, **09,** 1660.

Hulls Pt. (see DeWitt): Wabash RR. Co. repaired existing revet. at Hulls Pt., 1,000 l. f., **12,** 2201.

Kansas City: Corporation of Kansas City, Mo., completing revet. and pile dike above Quindaro, **11,** 1993. Levee built opposite Kansas City, and levee and revet. work in progress in Kaw Valley drainage district, **11,** 2002. Kansas City, Mo., completed revet. and dike work, **12,** 2215.

Kaw Valley. (See Kansas City.)

Leavenworth (see Pomeroy): Missouri Pacific Ry. Co. rebuilt 1,500 l. f. revet. at Leavenworth Junction, **12,** 2216.

Lupus: Missouri Pacific Ry. Co. constr. 2,000′ revet. at Lupus, Mo., and repaired revet. at Woolridge and Sandy Hook, **12,** 2201.

Marion (see Myrick): 5 mud-cell dikes built by Missouri Pacific Ry. Co., **08,** 1672.

Marion Island and Blair: 650′ revet. built on Marion Isld., and repairs made at Blair by Chicago & North Western Ry. Co., **08,** 1672.

Myrick (see Petite Saline Creek): 5 mud-cell dikes built by Missouri Pacific Ry. Co., **08,** 1672.

Napoleon: 10 pile dikes, aggregating 1,700′, built by Farmers Assn., **09,** 1666. Two 200′ dikes built by Prairie Oil & Gas Co., **09,** 1666.

Omaha: Illinois Central RR. constr. mattress on east bank, **11,** 1993.

Parkville: 800′ revet. built and 3,000′ bank protected with r., by C., B. & Q. RR. Co., **08,** 1672.

See p. 1037. **MISSOURI RIVER.** See special index, p, 1038.

12,000′ revet. built below Parkville by C., B. & Q. RR. Co., **10,** 1824.

Petite Saline Creek: 3,700 l. f. revet. reinforced by dikes above Petite Saline Creek, and 2,200 l. f. revet. at Myrick built by Missouri Pacific Ry. Co., **10,** 1821.

Plattsmouth. (See Rulo and St. Joseph.)

Quindaro. (See Kansas City.)

Rulo (see St. Joseph): 600 l. f. longitudinal dike, reinforced by 150 l. f. cross dikes, and 700 l. f. mattress built at Rulo; 500 l. f. revet. 5 m. above, and extensive repairs made at Plattsmouth, by C., B. & Q. RR. Co., **09,** 1666.

Pope. (See Pomeroy.)

Pomeroy: Missouri Pacific Ry. Co. constr. bank protection at Pomeroy and Pope, Kansas, Leavenworth Junction, and Ft. Leavenworth, **11,** 1993.

Randolph: 2,500 l. f. revet. built and 4,800 l. f. at DeWitt by Wabash RR. Co., **09,** 1666.

St. Joseph (see Belmont Bend): $50,000 contrib. by au. toward imp., **05,** 1690. C., B. & Q. RR. Co. constr. revet. at St. Joseph, Mo., pile dike at Rulo, Nebr., and bank protection at White Cloud and Plattsmouth, Nebr., **11,** 1993. Union Terminal Ry. Co. paved bank back of dike at St. Joseph water front, **12,** 2216.

Sandy Hook. (See Lupus.)

Sioux City: 1,700 l. f. revet. built above by C., M. & St. P. Ry. Co., **09,** 1666. 975′ revet. built at Sioux City by C., M. & St. P. Ry. Co., **10,** 1825. Fascines made and anchored entire length of eroded bank above Sioux City by RR. cos. and other interests at cost of $13,000; work taken over by U. S.; local interests furn. brush for repair of dikes at Decatur, Nebr., **12,** 2210.

West Glasgow: 3,000′ revet. built, 2,000′ rebuilt, and 2 short dikes built by Chicago & Alton RR. Co., **08,** 1671.

White Cloud. (See St. Joseph.)

Wilhoite Bend: 5 short spur dikes built by local interests, with U. S. plant, **07,** 1597. Assistance by Farmers Assn., **09,** 1658.

Williston: Material (est. $25,000) furn. by citizens of Williston, and Great Northern Ry. Co., **09,** 1665.

Woolridge. (See Lupus.)

PROJECTS.

By Capt. Chittenden, 1902, expend. of app. of $175,000 and $100,000, for snagging and dike and revet. work, on lower and upper Rs., resp., **03,** 1552, 1553.

By Capt. Chittenden, 1903, imp. by removal of obstr., dr., dikes, and bank protection at the following places, with costs: Hermann, $60,000; Glasgow, $100,000; Wilhoite Bend, $75,000; St. Joseph, $200,000; and removal of obstr., $50,000 year for 2 years, **04,** 2328.

By Maj. Chittenden, expend. of following app., act Mar. 3, 1905: $50,000, provided a similar amount be contributed by au. of St. Joseph, for constr. of longitudinal dike and 7 cross dikes at that place, **05,** 1690, 1697; $10,000 for dike across Hermann Isld. Chute at Hermann, **05,** 1690, 1697; **06,** 1482; and $165,000 for snagging and mainten. of chan., $90,000 below, and $75,000 and balance of $13,000, above Sioux City, Iowa, **05,** 1690, 1696, 1702; **06,** 1482.

By Capt. Schulz, 1907, expend. of $400,000, act Mar. 2, 1907, as follows: $150,000 for snagging and necessary repairs bet. mouth and Kansas City; $150,000 for similar work bet. Kansas City and Sioux City; and $100,000 for similar work bet. Sioux City and Ft. Benton, and for imp. H. at Bismarck, **07,** 1596.

By Capt. Schulz, 1908, building pile dike to protect bankhead below Miami, **08,** 1666.

By Capt. Schulz, 1908, building longitudinal pile dike, strengthened by 4 short dikes, to protect bankhead opposite Atherton; est., $19,000, **08,** 1666.

By Capt. Schulz, 1908, rebuilding 1,000′, and repairing balance of revet. at St. Aubert Bend; est., $10,000, **08,** 1666.

By Capt. Schulz, 1907, building 3,100′ longitudinal dike and 3,436′ cross dike at Elwood, one-half of cost to be contributed by interested RRs.; est., $100,000, **08,** 546, 1668.

By Capt. Schulz, 1908, imp. R. bet. Sioux City and Kansas City; est., for 6′ d., $3,900,000, and $97,000 an. for mainten.; for 12′ d., $22,500,000, and $562,500 an. for mainten.; for snagging, $50,000 an.,[1] **08,** 1668.

By Maj. Schulz, 1909, expend. of $275,000, act Mar. 3, 1909, dike and revet. work bet. Kansas City, Mo., and mouth; approv. May 29, 1909, **09,** 1658.

By Maj. Schulz, 1909, expend. of $75,000, act Mar. 3, 1909, for dike and revet. work bet. Kansas City, Mo., and Sioux City, Iowa, **09,** 1662.

By Maj. Schulz, 1909, expend. of $50,000, act Mar. 3, 1909, for dike and revet. work bet. Sioux City and Ft. Benton, **09,** 1665.

By Maj. Schulz, 1908, protecting bank at Williston, material to be furn. by citizens of Williston, and Great Northern Ry. Co.; est., material, $25,000; labor, $12,000, **09,** 1665.

By Maj. Schulz, 1909, bank protection by dike and revet. work above Glasgow, one-half of work to be paid for by Chicago & Alton Ry. Co.; est., $38,000; approv. Dec. 16, 1909, **10,** 1818.

By Maj. Schulz, 1909, preventing undesirable cut-off of R. at Wilhoite Bend by 5,500′ levee; approv., **10,** 1818.

By Maj. Schulz 1910, imp. of R. at Atchison by constr. system of longitudinal and wing dikes on left bank above Atchison RR. br.; est., $180,000, and $4,500 an.; $90,000 app. act June 25, 1910, with provision that $90,000 be contributed by local interests,[2] **10,** 652, 656, 1833.

By Maj. Schulz, 1910, preventing a diversion of chan. at Lake Contrary, near St. Joseph, Mo., by constr. of 16,000′ standard revet. on left bank near Lake Contrary; est., $150,000, and $3,000 an.; $75,000 app. by act June 25, 1910, with provision that $75,000 be contributed by local interests,[3] **10,** 651, 657, 1832.

Various proj. for expend. of $300,000 app. June 25, 1910, **11,** 2006.

Existing projects, **12,** 834.

General considerations on R. imp., **11,** 2003, 2004.

Act July 25, 1912, au. proj. for 6′ chan.; est., $20,000,000; to be completed in 10 years, **12,** 2194.

Extent of works in force, and references to m. of R. sur., revet., pile dikes, and C., **12,** 2204.

SURVEYS.

Inspections, ex., and minor sur., **03,** 1563, 1567; **05,** 1700, 1703; **06,** 1487; **08,** 1667–70.

Ex. bet. mouth and Sioux City, incl. sections at and near Hermann, West Glasgow, Wilhoite Bend, and St. Joseph, Mo., au. act June 13, 1902; made, 1903, by Capt. Chittenden,[4] **04,** 2328.

[1] H. D. 1120, 60th, 2d. [2] H. D. 700, 61st, 2d. [3] H. D. 750, 61st, 2d. [4] H. D. 441, 58th, 2d.

At St. Joseph, Mo., au. act Mar. 2, 1907; made, 1907, by Capt. Schulz,[1] **08,** 550.

Soundings and location of caving banks bet. mouth and Kansas City, **09,** 1658.

From mouth to Sioux City, au. act Mar. 2, 1907; made, 1907–08, by Maj. Schulz,[2] **08,** 551, 1666; **09,** 582.

For estab. of H. lines at Omaha and Council Bluffs; made, 1907–08, by Maj. Schulz, **09,** 1662.

BERH., Apr. 12, 1909, state no ex. has been made of Parkville, in their knowledge.[3]

In vicinity of Lake Contrary, au. act Mar. 3, 1909; made, 1909–10, by Maj. Schulz,[4] **10,** 657. Supp. R. by BERH. recom. expend. of $75,000.[5]

At Atchison, au. act Mar. 3, 1909; made, 1909, by Maj. Schulz,[6] **10,** 656.

Ex. and sur. au. act Mar. 3, 1909, Sioux City to Ft. Benton. **R.** by Maj. Schulz, July 19, 1909, and Dec. 12, 1910, **11,**[7] 706.

Ex. bet. Omaha, Nebr., and mouth of Platte R., by special board, for trial of cable and sand plan, au. act June 25, 1910; made 1910; reviewed by BERH. (method not recom.),[8] **11,** 706.

Ex. by BE., for 6′ chan., au. act June 25, 1910; made 1910; plan and est. presented.[9] Resur. from Kansas City to mouth, and various local ones, **11,** 2001.

Sur. of R. near Omaha, South Omaha, Florence, and Dundee, with view to imp. of navigation and protection of banks in cooperation with local interests, au. act June 25, 1910; made by Maj. Schulz; review by BERH. (imp. not deemed advisable at "present" time),[10] **12,** 856,857.

Kansas City to mouth, and various local ones, **12,** 2200, 2201.

Ex. of banks to ascertain quantities of willow brush, **12,** 2201.

Of R., in vicinity of Ft. Benton; discharge measured; and sur. extending 1 to 2 m. made at 7 localities; names and depths given, **12,** 2212.

Tables showing quantities of brush, **12,** 2215.
References to ex. and sur. reports, **12,** 842.

Maps.[10,2,1,6] R. at Chamois, Ft. Benton, and Yankton, **04,** 2316; near Omaha and Council Bluffs; near Atchison; hydrographs at St. Charles, Kansas City, and Sioux City, **08,** 1674; **11,** 1987, 1992, 1995; **12,** 2209, 2196, 2202.
Photographs, **10,** 1826; **11,** 1992; **12,** 2196, 2202.

Part (g), GG-2 Missouri River, Mouth to Fort Benton (including survey from mouth to Sioux City).

APPROPRIATIONS. (See p. 1041.)

ENGINEERS.

Chief of Engineers. **R.,** **80,** 167; **81,** 229; **82,** 226; **83,** 233; **84,** 237; **85,** 258; **86,** 248; **87,** 341.

In charge:
Maj. C. R. Suter, 1878–84. **R.,** **80,** 1460; **81,** 1659; **82,** 1725; **83,** 1332; **84,** 1538; **85,** 1654.
Trans. Oct. 21, 1884, to Missouri River Commission. **R.,** **85,** 1654, 2994, 2996, 3001; **86,** 2167; **87,** 2913, 3031.

Assistants:
D. W. Wellman. **R.,** **82,** 1725; **83,** 1332; **84,** 1538; **87,** 2946, 3063.
O. B. Wheeler. **R.,** **87,** 2929, 2931, 2934, 2950 2955, 2958, 2963, 2966, 2983, 3074, 3079, 3124.
J. A. Seddon. **R.,** **87,** 2971, 3079.
A. H. Blaisdell. **R.,** **87,** 2974.
A. Warren. **R.,** **87,** 2984.

OPERATIONS.

1879–83. Sur. bet. mouth and Sioux City in progress, 80, 1460; **81,** 1659; **82,** 1725; **83,** 1332.
1883–84. Sur. completed and maps published for the R. from mouth to Ft. Pierre, 1,174 m., **84,** 1538.
1884–85. Secondary triangulation in progress below Glasgow, **85,** 2996, 3001. Sur. in progress bet. Ft. Benton and Sioux City, **85,** 3006.
1885–86. Sur. in progress on upper Missouri, **86,** 2167.
1886–87. Sur. in progress, **87,** 2913, 2922, 2927, 2942, 2946, 2950, 2981, 3031, 3032, 3043, 3079.

PHYSICAL CHARACTERISTICS.

L.-w. slope, **82,** 1729; **83,** 1337.
Table of distances, **82,** 1729; **83,** 1337; **84,** 1540.
Discharge observations, **87,** 3081.
Sediment observations, **87,** 3090, 3121.

SURVEYS.

Maps. Showing extent of secondary triangulation, **87,** 2934, 3052.

Part (h), GG-2 Missouri River Mouth to Sioux City.

APPROPRIATIONS. (See p. 1041.)

Continuing system of app. of great value, **95,** 3971.

COMMERCE

C. of the R., **81,** 1650; **85,** 2992; **87,** 2988, 2994, 3010, 3012, 3041; **88,** 2320; **90,** 3370; **91,** 3737; **92,** 3262.

Br. requirements, **87,** 3060.

Statistics. Method of collecting, and results obtained, **93,** 3932; **94,** 3116; **95,** 3987; **96,** 3784; **97,** 3860; **98,** 3485; **99,** 3676; **00,** 4956.

Mile-tons carried: Missouri R., 1899, 1,057,761, as against 1,929,561 in 1898; Osage R., 3,261,257, 1899, as against 4,175,054 in 1898; Gasconade R., 1,387,129, 1899, as against 1,832,263 in 1898, **00,** 4938.

That of Osage R. of sufficient importance, 1898, to justify continuous future imp. of the R., **98,** 3472; and likewise that of Gasconade R., **98,** 3472.

Practically none in vicinity of Huntsdale and Napoleon, **00,** 2849, 2856.

Small, due to difficulty of navigation, **02,** Sup. 177, 179.

CONTRACTS.

1894–95. Proposals for timber, piling, and for building misc. buildings at Osage R. Lock, **95,** 3979.

[1] H. Doc. 824, 60th, 1st.
[2] H. D. 1120, 60th, 2d.
[3] R. & H. C. 16, 61st, 2d.
[4] H. D. 750, 61st, 2d.
[5] R. & H. C. 5, 62d, 2d.
[6] H. D. 700, 61st, 2d.
[7] H. D. 91, 62d, 1st.
[8] H. D. 46, 62d, 1st.
[9] H. D. 1287, 61st, 3d.
[10] H. D. 862, 62d, 2d.

1895-96. Proposals for piling, etc., **96,** 3780. McGee, Kahman, lock building. Osage R.; contract terminated because of difficulty of setting a price for extra work, **96,** 3770. W. T. Berthelet, 3,000 bbls. cement, $1.02, **97,** 3856.

1897-98. Proposals for cement, **98,** 3482.

1898-99. J. S. Pollard and J. D. Wallace, l. and d. work (excavation, paving, ironwork, concrete work, etc.), $142,465, **99,** 3674.

Contract with Pollard & Wallace for l. and d. on Osage R. ended by agreement, **01,** Sup. 372.

ENGINEERS.

Chief of Engineers: R.—

Atchison, **80,** 164; **81,** 276; **82,** 223; **83,** 232; **84,** 237.

Brownville, **80,** 165; **81,** 227; **82,** 224; **83,** 232.

Cedar City, **80,** 163; **81,** 224; **82,** 222; **83,** 231.

Council Bluffs and Omaha, **80,** 166; **81,** 228; **82,** 224; **83,** 233.

Eastport and Nebraska City, **80,** 165; **81,** 227; **82,** 224; **83,** 232.

Ft. Leavenworth, **80,** 164; **81,** 226; **82,** 223; **83,** 232.

Glasgow, **80,** 163; **81,** 225; **82,** 222; **83,** 231.

Kansas City, **80,** 163; **81,** 225; **82,** 223; **83,** 231.

Lexington, **80,** 163; **81,** 225; **82,** 223; **83,** 231.

Plattsmouth, **80,** 165; **81,** 227; **82,** 224; **83,** 232.

St. Charles, **80,** 162; **81,** 224; **82,** 222; **83,** 231.

St. Joseph, **80,** 164; **81,** 226; **82,** 224; **83,** 232.

Sioux City, **80,** 166; **81,** 228; **82,** 225; **83,** 233.

Mouth to Sioux City, **81,** 229; **82,** 226; **84,** 237; **85,** 258; **86,** 248; **87,** 341; **88,** 307; **89,** 365; **90,** 331; **91,** 275, 423; **92,** 397; **93,** 460; **94,** 421; **95,** 469; **96,** 420; **97,** 527; **98,** 529; **99,** 617; **00,** 443, 695; **01,** 658, 2367, 2369; **02,** 579.

Boards:

Missouri R. Commission. **R., 85,** 2989; **86,** 2913; **87,** 3031; **88,** 2313; **89,** 2741; **90,** 3361; **91,** 3723; **92,** 3251; **93,** 3921; **94,** 3075; **95,** 3957; **96,** 3759; **97,** 3837; **98,** 3459; **99,** 3655; **00,** 4935; **01,** 2367, 2369, Sup. 365; **02,** 579, Sup. 175. Members: Maj. C. R. Suter, chairman, 1885, (Lt. Col.) 1888, (Col.) 1896; Maj. A. Mackenzie, 1885, (Lt. Col.) 1895; Maj. O. H. Ernst, 1885–93; G. C. Broadhead, 1885–; Wm. J. Broatch, 1885–90; R. S. Berlin, 1891–97; Maj. C. J. Allen, 1894–95; Lt. Col. A. Stickney, chairman, 1896–; Maj. W. H. Heuer, 1896–97; Maj. T. H. Handbury, 1896–; Maj. W. L. Marshall, 1897–; C. L. Chaffee, 1897–.

The BE., New York, N. Y., ex., 1897, proj. of Capt. Chittenden for l. and d. at Brenneke Shoals, Osage R. (Lock No. 1), approv. design of modified form of drum weir, **97,** 3953.

Act creating Missouri R. Commission repealed; commission ceased to exist, **02,** s175.

In charge. (See Boards.)

Maj. C. R. Suter, 1875–84. **R.—**

Atchison, **80,** 1417; **81,** 1619; **82,** 1694; **83,** 1305, 1329; **84,** 1535.

Brownville, **80,** 1423; **81,** 1625; **82,** 1701; **83,** 1303.

Cedar City, **80,** 1405; **81,** 1606; **82,** 1680; **83,** 1328.

Council Bluffs and Omaha, **80,** 1436; **81,** 1636; **82,** 1712; **83,** 1303, 1331.

Eastport and Nebraska City, **80,** 1425; **81,** 1629; **82,** 1705; **83,** 1303, 1330.

Ft. Leavenworth, **80,** 1413; **81,** 1617; **82,** 1691; **83,** 1329.

Glasgow, **80,** 1406; **81,** 1609; **82,** 1682; **83,** 1303, 1328.

Kansas City, **80,** 1410; **81,** 1614; **82,** 1689; **83,** 1305, 1329.

Lexington, **80,** 1409; **81,** 1613; **82,** 1687; **83,** 1329.

Plattsmouth, **80,** 1435; **81,** 1634; **82,** 1709; **83,** 1330.

St. Charles, **80,** 1404; **81,** 1604; **82,** 1676; **83,** 1302. 1328.

St. Joseph, **80,** 1421; **81,** 1622; **82,** 1698; **83,** 1305, 1330.

Sioux City, **80,** 1453; **81,** 1642; **82,** 1718; **83,** 1303, 1331.

From mouth to Sioux City, **81,** 1649, 1659; **82,** 1731; **83,** 1301; **84,** 1533; **85,** 1654, 3017. Trans. to Missouri R. Commission. **R., 84,** 237; **85,** 2989, 2999; **86,** 2167; **87,** 2419, 3026, 3097.

Sur., Arrow Rock, Mo., **82,** 1733; Boonville, Mo., **81,** 1661; Brunswick, Mo., **81,** 1668; Tuque Creek, Mo., **81,** 1667; **87,** 2914, 3026, 3097.

Leavenworth to Platte, **91,** 2229.

Lt. T. A. Bingham, 1885–90. **R., 85,** 3006; **87,** 2921, 3036; **88,** 2317; **89,** 2753; (Capt.) **90,** 3375.

Capt. H. M. Chittenden, 1889–99. **R., 89,** 2760; **90,** 3419; **97,** 3870; (Osage R. Lock and Dam), **97,** 3933; Osage and Gasconade Rs., **98,** 3539.

Lt. J. C. Sanford, 1890–96. **R., 90,** 3367; **91,** 3733; **92,** 3259; **93,** 3929; **95,** 3987; (Capt.) **96,** 3784.

Lt. J. F. McIndoe, 1894. **R., 94,** 3083.

Lt. Col. A. Stickney, 1899. **R.,** Huntsdale, Mo., and Napoleon, Mo., **00,** 2847, 2849, 2852, 2855.

Assistants:

S. W. Fox. **R.—**

Cedar City, **80,** 1405.

Glasgow, **80,** 1407; **81,** 1610; **82,** 1683.

Arrow Rock, **82,** 1734.

St. Charles, **83,** 1309; **85,** 3027.

St. Joseph, **87,** 3107; **88,** 2357; **89,** 2765; **90,** 3428; **91,** 3835; **92,** 3278.

Shore-line sur., **91,** 3804.

Omaha Division, **93,** 4223; **94,** 3125; **99,** 3701.

St. Joseph Division, **93,** 4228; **94,** 3128.

Kansas City Division, **93,** 4232; **94,** 3130; **98,** 3512; **99,** 3716; **00,** 4981.

Gasconade Division, **93,** 4258; **94,** 3152; **95,** 4031; **96,** 3838; **97,** 3919; **98,** 3527; **99,** 3705; **00,** 4973; **01,** s418.

Osage Division, **97,** 3908.

Huntsdale, Mo., **00,** 2849.

Napoleon, Mo., **00,** 2853.

Above Kansas City, **01,** s388; below Kansas City, **01,** s398; Osage and Gasconade Rs., **01,** s427; **02,** s208, 212, 213.

E. Jones. **R.,** Napoleon, Mo., **00,** 2854.

J. W. Nier. **R.,** Kansas City, **80,** 1410; **81,** 1615; **82,** 1690; **83,** 1315.

D. W. Church. **R.—**

Ft. Leavenworth, **80,** 1414.

Atchison, **80,** 1418; **83,** 1325.

St. Joseph, **80,** 1421; **81,** 1623; **82,** 1699; **83,** 1324.

Capt. Handbury. **R.,** Brownville, **80,** 1425; Plattsmouth **80,** 1450.

L. E. Cooley. **R.,** Eastport, **80,** 1426; St. Charles, **81,** 1604.

C. B. Davis. **R.,** Omaha, **80,** 1437.

C. S. Pease. **R.,** Omaha, **80,** 1637; **82,** 1712; **83,** 1303; **84,** 1536.

T. C. Bradley. **R.,** Cedar City, **81,** 1667.

G. T. Nelles. **R.,** Ft. Leavenworth, **81,** 1617; **82,** 1692.

W. H. Hammond. **R.,** Brownville, **81,** 1626.

A. S. Potter. **R.,** Eastport, **81,** 1630; **82,** 1706; **83,** 1311.

E. C. Shankland. **R.,** Lexington, **81,** 1613; **82,** 1688.

W. H. McKnew. **R.,** Plattsmouth, **81,** 1634; **82,** 1709.

T. M. Harris. **R.,** St. Charles, **82,** 1676; **83,** 1306.

I. W. Pearl. **R.,** Brownville, **82,** 1702.

S. H. Yonge. **R.**—
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1880-81. Brownville, closure of Sonora Chute with weed dike; preparation for constr. of wire net dike, **81,** 1626, 1628; **82,** 1702. Cedar City, wire screen dike placed at Cedar City Bend to replace the failing weed dike, **81,** 1606, 1608; **82,** 1680. Council Bluffs, operations confined to repairs of former work, **81,** 1636. Eastport, previous season's work swept away; 1,800′ brush fence placed on bar opposite Nelighs; 2,250′ brush dike placed near Copelands Bend, **81,** 1629, 1632; **82,** 1708. Ft. Leavenworth, operations confined to repairs of old work, **81,** 1617. Glasgow, 5,630′ of bank revet. in bend above city, **81,** 1609. Lexington, 5,000′ of shore revet. placed above city, **81,** 1613. St. Charles, closure of chute behind isld., constr. of dike at head of isld. and at Downings Pt., **81,** 1604. St. Joseph, repair of old work, **81,** 1622. Surs. made at Boonville, **81,** 1661; at Brunswick, **81,** 1668; and at Tuque Creek, **81,** 1667.

1881-82. Atchison, permeable dikes continued, **82,** 1691. Methods of constr., **82,** 1696. Brownville, completion of wire screen dike closing Sonora Chute; ultimate destruction of the wire, **82,** 1701, 1703. Cedar City, completion of wire screen dike at Cedar City Bend, **82,** 1680. Council Bluffs, repairs to Omaha revet.; dike and training wall constr. near Florence, **82,** 1712, 1714. Eastport, buoy and pile dike built above Copelands Bend, **82,** 1705, 1708. Ft. Leavenworth, repair work of previous year; destruction of works, **82,** 1694. Glasgow, shore revet. placed at Cambridge and Middle Bends, **82,** 1682. Kansas City, revet. of bank below Quindaro, **82,** 1689. Lexington, 3,160′ of st. protection placed opposite city, **82,** 1688. Plattsmouth, constr. of training dike at mouth of R., **82,** 1709, 1710. St. Charles, continuation of dike constr. at Downings Pt. and St. Charles Isld., **82,** 1676, 1678. St. Joseph, shore protection and dike work at Bonton Bend and revet. at Ellwood Pt., **82,** 1699. Sioux City, constr. of wire screen dike from right bank 12 m. below city, **82,** 1718. Sur. of Arrow Rock, Mo., **82,** 1733.

1882-83. Atchison, permeable training dikes constr. from left bank above br. for rectification of chan. approaching br., **83,** 1305, 1325. Council Bluffs, operations confined to repairs of Omaha revet. and discharge observations at Florence, **83,** 1303. Eastport, 5,160′ of revet. placed in bend above Eastport, **83,** 1303, 1311. Kansas City, 8,750′ of revet. placed in Kaw Bend, **83,** 1305. 1316. Lexington, 4,200′ of revet. placed on left bank opposite city, **83,** 1305, 1315. St. Charles, 2,250 of shore revet. placed at St. Charles Bend, **83,** 1302

1309. St. Joseph, Ellwood revet. repaired and extended, **83,** 1305, 1324. Sioux City, extension of training dike commenced in 1879–80 destroyed during winter, **83,** 1303, 1314.

1883-84. Completion of St. Charles Bend revet.; Omaha revet. extended 1,270′ and 2,500′ of old work repaired; constr. and repair of plant, **84,** 1534.

1884-85. Operations continued under direction of Missouri R. Commission; revet. placed at Parkville and Quindaro and Kaw Bends, **85,** 3002, 3018, 3021, 3024.

1885-86. Bank revet. placed in vicinity of St. Joseph and Kansas City, **86,** 2167.

1886-87. Progress on Ellwood revet. at St. Joseph and on protection of banks at Kaw and Quindaro Bends, **87,** 2914. Bank revet. at Bonton Bend; pile-dike constr. and shore revet. near Kansas City, **87,** 3031, 3097, 3098, 3107.

1887-88. Constr. and repair of plant; 557 c. y. r. used in completion of revet. in Lower Bonton Bend; 3,000 c. y. r. placed in Ellwood revet.; 2,960 l. f. of bank revet. completed at E. Bottoms; 4,500 l. f. of bank protected at Little Platte Bend; 20,261 c. y. r. quarried, and 5,956 cords brush cut; 1,400 l. f. of mattress built in repair of Kaw Bend revet., **88,** 2356–2367.

1888-89. 4,250 l. f. of pile and brush dike built at Sioux City, **89,** 2763. Repair and reconstr. of plant, **89,** 2765. 1,825 c. y. r. used in repair of Bonton revet., **89,** 2767. 318,080 sq. f. of mattress woven at Bonton revet. extension, **89,** 2767. 136,700 sq. f. of mattress woven and placed at Kaw Bend revet.; repair of plant, **89,** 2792.

1889-90. 1,575 snags removed and 1,048 trees cut, **90,** 3364. 13,004 l. f. of pile and mattress revet. built at Omaha, **90,** 3422. Repairs to plant, **90,** 3424. 200 c. y. r. used in completion of dike constr. at Sioux City, **90,** 3427. 4,810 l. f. of revet. bank protection built at Nebraska City, **90,** 3428. 5,153 l. f. of bank graded, and 4,922 l. f. of mattress woven at Rulo, **90,** 3431. Repairs to plant at Kansas City Division, **90,** 3435. 6,658 l. f. of revet. constr. at Bee Creek Bend, **90,** 3437. 3,935 l. f. of revet. laid at Nigger Bend, **90,** 3439. 1,918 l. f. of revet. laid at Kaw Pt., **90,** 3441. Repairs to Harlem and Kansas City dikes, **90,** 3442. Repairs to Kaw Bend at East Bottoms revet., **90,** 3441. 1,302 l. f. of pile dike built at Miami, **90,** 3445.

1890-91. Repairs to dikes in vicinity of Sioux City, **91,** 3832. Repairs to plant at Omaha, **91,** 3834. 940 l. f. of brush and r. bank revet. built at Nebraska City, **91,** 3835. Repair of plant at Nebraska City, **91,** 3837. Repair and constr. of plant at St. Joseph, **91,** 3839. 3,295 l. f. of pile dike built at St. Joseph, **91,** 3841, 3843. 1,240 l. f. of bank revet. completed at St. Joseph, **91,** 3845. 3,500 l. f. of willow curtains woven and placed upon dikes at Atchison, **91,** 3847. 700 l. f. of bank revet. built above Harlem Dikes, **91,** 3849. 630 l. f. of single and 856 l. f. of double row dike built at Kansas City, **91,** 3850. 836 cords of brush and 31,977 l. f. of cottonwood piling procured, **91,** 3851.

1891-92. 9,220 l. f. of bank revet. constr. vicinity of Council Bluffs, **92,** 3274. Repairs to plant at Nebraska City, **92,** 3279. 14,246 l. f. of bank revet. constr. at Belmont Bend, **92,** 3280. Repairs to break in Elwood revet., **92,** 3282. 3,000 l. f. of bank revet. constr. at Bonton Bend, **92,** 3283. Extension and repair of pile dikes in vicinity of St. Joseph, **92,** 3286. Repairs to Little Platte Bend and Kaw Bend revet. **92,** 3290. 431 l. f. of double-row and 993 l. f. of triple-row dike constr. in extension of Kansas City and Harlem dikes, **92,** 3293. 1,244 l. f. of single. 3,472 l. f. of double, and 4,760 l. f. of triple-row dike constr. in Group I, First Reach, **92,** 3301. 165 l. f. of double-row dike and 1,400 l. f. of triple-row dike built in Group II, First Reach, **92,** 3304. 120 l. f. of double-row dike and 4,001 l. f. of triple-row dike built in Group III, First Reach, **92,** 3306. 389 l. f. of double-row dike and 895 l. f. of triple-row dike built in Cedar Isld. Group, **92,** 3309.

1892-93. Council Bluffs, revet. on Iowa shore extended, 2 pile dikes built, revet. strengthened, and minor repairs made. St. Joseph, revet. repaired. Kansas City, revet. repaired and extended. In first reach 17,000 l. f. pile dike built, and about 8,000 l. f. revet. built, repaired, and extended. Over 2,000 obstr. removed, **93,** 3921. Gauges maintained, **93,** 4221.

1893-94. Council Bluffs, 2,600 l. f. bank protected where broken. 4,500 l. f. damaged revet. repaired at St. Joseph. Osage Division, revet. work, and 10,472 l. f. of permeable dike work built, and 1,525 l. f. dam built across Osage Chute. Gasconade Division, 10,175 l. f. of permeable dikes built; plant repaired; almost 1,000 snags and other obstr. removed, **94,** 3075. Gauges maintained, **94,** 3108.

1894-95. Omaha, dike building in progress. Dike repairs at St. Joseph. Considerable work done at Atchison to prevent erosion. Dike work begun at Leavenworth. 18,693 l. f. of dike work in progress in Osage Division. In Gasconade Division over 15,000 l. f. dike work; about 2,000 obstr. removed. Large number of snags, etc., removed from Osage R., and preparations made for beginning l. and d. Snags removed from Gasconade R., and nearly 1,000 l. f. bank revetted, **95,** 3960. Gauges maintained, **95,** 4000.

1895-96. Dike work at Omaha. Dikes repaired at St. Joseph. 2 dikes built at Leavenworth to relieve danger to approach of RR. br. Dikes built, revet. constr. and extended in Osage Division. An unusual amount of repair work in Gasconade Division, due to floods; dikes and revetments built and extended; nearly 2,000 snags and other obstr. removed. L. and d. building begun on Osage R. Obstr. removed from Gasconade R. and a series of dikes built, **96,** 3763. Gauges maintained, **96,** 3802.

1896-97. Omaha and Council Bluffs: A system of training and cross dikes built. Nebraska City: system of dikes built to protect revet. Work of bringing the Osage into the Missouri above Dodds Isld. and closing the chute s. of the isld. in progress; dikes extended and repaired, and new dikes built and revet. repaired. In Gasconade Division, revet., dike constr., and repairs; building of experimental bankhead designed as a substitute for revet.; care and repair of plant, etc. About 1,000 snags, etc., removed from Osage R.; cofferdam of lock excavated, and materials gathered for building dam. Snags, etc., removed from Gasconade R.; r. quarried, and over 1,000 l. f. dikes built. **97,** 3840. Gauges maintained, **97,** 3839, 3859.

1897-98. Nebraska City, riprapping, and several pile dikes built. System of 3 dikes built at Leavenworth. Below Kansas City, training and protecting work; bankheads built at several places. Gasconade Division: Earth excavation and embankment work for new junction of Osage and Missouri Rs.; experimental dike work; dikes repaired and built; extension of bankheads and much misc. work. About 500 obstr. removed. L. and d. building under way at Osage R., and model of dam built, and observed to work satisfactorily, **98,** 3462; gauges maintained, **98,** 3484.

1898-99. About 500 obstr. removed. Revet. built, repaired, and extended, and misc. work done at various places in Omaha Division. Dike constr. in Gasconade Division, and preparations made to control new junction of Missouri and Osage; revet. repaired and extended. Preparations for continuing work on l. and d. on Osage R., **99,** 3658; gauges maintained, **99,** 3675.

1899-00. About 1,000 obstr. removed. Revet. work, dike constr., etc., at various places in Omaha Division and at other places. Ice H. made for

plant at Musics Ferry. Dikes and revet. built in Gasconade Division, and some repaired. L. and d. almost completed on Osage R. Snags, etc., removed from Gasconade R., and dams constr. at several places, **00,** 4938; gauges maintained, **00,** 4955.

1900-01. 436 snags and other obstr. removed, and 569 trees cut, **01,** s366. Two pile dikes reinforced, and 1884 l. f. revet. built in Omaha Reach; repairs and imp. made to existing dikes, and new longitudinal dike built in Nebraska City Reach, **01,** s367. 5,280 l. f. revet. built in Rulo Reach; 2 short lines abattis, fascine work bet., and 330 l. f. longitudinal dike, built in St. Joseph Reach; dike repaired, 2 short dikes, revet. radial dike and pile extension built in Little Blue Reach, **01,** s368. T-dike built, and bankheads repaired and strengthened in Glasgow Reach; outer wall pilework extended upstream and protected by mattress, and fascine spur dike built in Rocheport Reach, **01,** s369. 393 l. f. stem and longitudinal dike and dike of pile clusters built in Howard Bend Reach; abattis and dike repaired opposite Jefferson City; revet. at Straubs Bend repaired, **01,** s370. Repairs made and 10 new barges added to plant, **01,** s371. Osage River: Work commenced with hired labor on completion of Lock and Dam No. 1; lock completed; work on dam hampered by high stage of R.; foundation piles driven, valve-operating engines installed, cistern built, etc., **01,** s372. Gasconade R.: Dam at Brown shanty repaired, cross dams and training walls built at Hensleys Shoals, Larkes Ferry, Stake Shoals, and Bakers Shoals, **01,** s373. Tabular statements of app. and expend., **01,** s377.

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L.-w. discharge. Tabulation of results, **96,** 3808.

Osage River: Good, navigable stage found to be possible, 1898, without recourse to costly system of l. and d., **98,** 3472.

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Description of country along R.; new land formed by imp., **02,** s177.

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By Maj. Suter, imp. R. at Arrow Rock, Boonville, Brunswick, and Tuque Creek, Mo., with permeable dikes and shore protection, **81,** 1661, 1667, 1668; **82,** 1733.

PRIVATE WORK.

Considerable work done at Atchison by RR. and br. companies to prevent destruction of their property by eroding bank, **95,** 3961.

Large break in revet. at Council Bluffs repaired by RR. company, **99,** 3663.

7,975 l. f. revet. built near Rulo by Chicago, Burlington & Quincy RR. Co., **02,** s211.

PROJECTS. (See Plans.)

By Maj. Suter, arrest of deposits at portions of the R. designed to be abandoned, causing the R. to build up new banks and excavate new chan. at portions requiring imp.; the holding of such new lines and the protection of banks against erosion by light mattress protection; est., $10,000 per m., **81,** 1658; **82,** 226, 1732; approv. by Missouri R. Commission, **85,** 2991, 2999, 3003.

Act Sept. 19, 1890, provided that, with certain specified exceptions, the app. of that year should be expend. on the R. below Sioux City in a systematic imp. of the R. from its mouth up, in reaches to be designated by the commission. R. divided into 6 reaches. The first reach divided into the Gasconade and Osage Divisions, **97,** 3841.

Osage River: By commission, 1894, for removing snags and other obstr. for l. and d. at Brenneke Shoal; est., $265,000, **95,** 3966. Reduction of ele-

vation of lower sill of lock by 5′, due to effect of dr. on adjacent water surfaces, **96,** 3770. By Capt. Chittenden, 1897, for concrete lock 42′ x 220′, and a dam in 10 75′ sections, separated by 9 piers 10′ x 13′ at the base, materials to be wood, iron, and st.; the foundations of both structures to be built on piling and timber grillage. Novel form of drum weir used. (See Boards of Engineers.) Final est. cost, $325,000, **97,** 3946. Est., and discussion of strains, **97,** 3953, 3956. Costly system of imp. R. with l. and d. considered unnecessary, 1898, **98,** 3472.

Probability that imp. of the first reach might be completed for less than bet. $3,000,000 and $3,500,000, **96,** 3772.

Specifications for dikes, **96,** 3841. Total cost of dike work, Gasconade Division, **96,** 3849.

All the works in the first reach united into one division, the Gasconade Division, **97,** 3846; **98,** 3466.

The results obtained by the commission, up to 1897, showed beyond question the practicability of controlling the R., holding its banks to give ample chan. for navigation; but the cost, the uncertainty of the permanency of the work, and the slowness of progress, discouraging to Congress. Congress yielding at "this" time to demands for applications of considerable portions of the reduced app. to isolated places where the only objects to be attained would be the protection of local, unimportant, and often private interests, **97,** 3847; **99,** 3666.

Filling and emptying of locks; general methods; study, **97,** 3936.

New system of bank protection promising large reduction in cost of protection work, **98,** 3472.

The work of the commission on the R. had not developed, up to 1900, so as to render the submission of an est. for an. mainten. possible, **00,** 4947.

Impossibility of carrying on work with any degree of efficiency under the system of app. in practice, **00,** 4947.

Completion of the plans of the commission in the first reach, opening the R. from its mouth to Jefferson City, would fully demonstrate the advisability or inadvisability of continuing the works of imp. in the upper parts of the district of the commission, **00,** 4947.

Lt. Col. Stickney, 1899, est. it would cost $185,250. for dikes and revet. to protect banks for 10 m. at Huntsdale, **00,** 2851; and $385,000 to rectify chan. at Napoleon, **00,** 2857.

Gasconade River: Commission recom. $15,000 per year for imp. of this stream, **00,** 4948.

By Lt. Col. Stickney, 1900, protecting R. front at St. Joseph by revet.; est., $75,000; and to prevent R. breaking through into Lake Contrary by dike extension and revet. work; est., $120,000, **01,** 2367.

By Missouri R. Commission, 1900, expend. of app. of $250,000 in continuing imp. bet. Sioux City and mouth, **01,** s365.

Capt. Keller est., 1900, $20,000 to complete Lock and Dam No. 1, Osage R., and recom. further app. of $25,000 for work above the lock **01,** 2371.

SURVEYS. (See Physical characteristics.)

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Bench marks. (See Physical characteristics, par. 13.)

At Boonville, Brunswick, and Tuque Creek, Mo., au. act June 14, 1880; made by Maj. Suter, 1880, **81,** 1661, 1667, 1668.

At Arrow Rock, Mo., au. act Mar. 3, 1881; made by Maj. Suter, 1881, **82,** 1733.

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Ex. and sur. at Huntsdale, to prevent bank erosion of n. side, au. act Mar. 3, 1899; made by Lt. Col. Stickney, 1899 (**R.** fav.), **00,** 2847.

Ex. and sur. at Napoleon to prevent bank erosion and cutting of new chan., au. act Mar. 3, 1899; made by Lt. Col. Stickney, 1899 (**R.** fav.), **00,** 2852.

Ex. old mouth of Platte R. to Leavenworth, and at Weston, for imp. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Suter (**R.** unfav.), **91,** 2229.

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Various ex. and sur., **01,** s371; **02,** s202, 208.

Maps (refs. to maps arranged alphabetically):

Accretions and dikes, **96,** 3860. Abatis work, Chamois Reach, **99,** 3712.

Bankhead constr. details, **97,** 3960; **98,** 3548; **99,** 3712; (photograph) **99,** 3744; **00,** 4973.

Chute, method of closing, **98,** 3548.

Cross sections: Osage Division, **95,** 4048; **96,** 3860; **97,** 3960. Gasconade Division, **95,** 4048; **96,** 3860; **97,** 3960. Omaha Division, **98,** 3548. Jefferson City, **00,** 4980.

Dams: Osage Chute Dam, **94,** 3150; **96,** 3860.

Discharge observations, 1895, **96,** 3860.

Dikes: Constr. details, **89,** 2778, 2790; **93,** 4256; **94,** 3150; **95,** 4048; **96,** 3860; **97,** 3960; **98,** 3548; **99,** 3700. Profiles, **94,** 3150; **96,** 3860; **97,** 3960. Dike and mattress work, **95,** 4048. Hydraulic grading for revet. **96,** 3860. Old dikes in good repair, Osage R., **98,** 3548. Dikes and curtain work, **99,** 3712. Kaw R. dikes, **99,** 3700. Leavenworth, **99,** 3700. Dike work and its effects in various reaches, **96,** 3860; **99,** 3744. Pigeon Creek dikes, **00,** 4972; longitudinal, **01,** s398.

Divisions: First Reach, **95,** 4048; Gasconade Division, **93,** 4264; **94,** 3158; **95,** 4048; **96,** 3860; **97,** 3960; **98,** 3548. Kansas City Division, **93,** 4235. Omaha Division, **92** (atlas), 168, 170; **93,** 4226; **94,** 3125; **95,** 4048. Omaha Division and isolated places, **96,** 3860. Omaha Division, **97,** 3960; **98,** 3548. Osage Division, **93,** 4256; **94,** 3150; **95,** 4048; **96,** 3860; **97,** 3960. St. Joseph Division, **93,** 4230; **94,** 3128.

Gabion construction, **99,** 3744.

Gauge bulletins, **93,** 4222.

Groin construction, **99,** 3744.

Hydrographs: Gasconade dikes, vicinity, **97,** 3960. Below Kansas City, **99,** 3744. Osage Division dikes, vicinity, **97,** 3960.

Ice: Works damaged by, **99,** 3744.

Locks: Diagrams showing time required to empty and fill locks, **97,** 3960. Osage R., showing construction, **98,** 3548.

Mattress work: Details, **89,** 2778; **96,** 3860; **99,** 3744.

Miscellaneous places:
96, 3860.
Atchison, **82,** 1694; **83,** 1328; **87,** 3118; **89,** 2782; **90,** 3434; **91,** 3847; **02,** s212.
Arrow Rock, **87,** 3118.
Bakers, Fontanelle, and Shonkin Bars, Evans Bend, Seigneurs Reach, and Crocondunez, **90,** 3420.
Boonville, **81,** 1662.
Brunswick, **81,** 1668.
Brownville, **82,** 1702; **87,** 3118.
Camden, **87,** 3119.
Cedar City, **82,** 1680.
Chamois, **99,** 3712.
Claysville to Isabell Stn., **02,** s212.
Council Bluffs, **82,** 1716; **87,** 3118; **92** (atlas), 161; **02,** s212.
East Bottoms, **88,** 2368.
Leavenworth, **82,** 1692; **84,** 1538; **87,** 3118; **02,** s212.
Glasgow, **80,** 1406; **82,** 1682.
Harlem dikes, **89,** 2794.
Howard Bend, **01,** s410; **02,** s212.
Huntsdale, **02,** s212.
Isabell Stn. to Rhineland Ldg., **02,** s212.
Jefferson City, **00,** 4980.
Kansas City, **82,** 1690; **83,** 1316; **84,** 1538; **87,** 3098, 3118; **90,** 3446; **91,** 3852; **98,** 3548; **99,** 3744; **02,** s212.
Kickapoo Isld. and Leavenworth, **98,** 3548.
Leavenworth to St. Louis, **87,** 3052.
Lexington, **82,** 1688; **83,** 1328; **84,** 1538; **02,** s212.
Little Blue Reach, **01,** s410; **02,** s212.
Little Missouri, **02,** s212.
Little Platte Bend, **88,** 2368; **89,** 2794.
Miami, **90,** 3446; **02,** s212.
Nebraska City, **80,** 1434; **82,** 1708; **83,** 1330; **87,** 3118; **89,** 2782; **90,** 3428; **91,** 3837; **97,** 3960; **00,** 4963; **01,** s398; **02,** s212.
Nigger Bend, **02,** s212.
Omaha, **89,** 2764; **90,** 3426; **00,** 4972; **02,** s212.
Platte R. to Leavenworth, **91,** 2230.
Plattsmouth, **82,** 1710; **87,** 3118.
Pelican Bend, **02,** s212.
Rulo, **90,** 3430; **91,** 3839; **01,** s398; **02,** s212.
Rocheport, Mo., **01,** s410; **02,** s212.
St. Charles, **82,** 1678; **83,** 1328.
St. Joseph, **82,** 1700; **83,** 1326; **87,** 3110, 3118; **88,** 2358; **89,** 2782; **90,** 3432; **91,** 3846; **92** (atlas), 166; **00,** 4972; **01,** s398; **02,** s212.
Sioux City, **82,** 1718; **89,** 2764; **90,** 3426; **91,** 3833; **92** (atlas), 158; **02,** s212.
Tuque Creek, **81,** 1668.
Upper Kaw Bend, **88,** 2368; **89,** 2794.
Wilhoite Bend, **01,** s410; **02,** s212.

Photographs, **01,** s410, s398.

Pilework: Plant, **89,** 2778; works below Kansas City, **89,** 2790; **00,** 4992.

Plane, change of, **96,** 3860.

Revetments: Details of constr., etc., **99,** 3700, 3744; **00,** 4992.

Rivers (tributaries, etc.): Osage R., **96,** 3860; **98,** 3548. Osage Pt., design for cut, **97,** 3960; details of constr., **98,** 3548; **99,** 3712. Kansas and Missouri Junction, **99,** 3700. Gasconade R. localities, **00,** 5006.

Shore-protection details, **98,** 3548.

Triangulation: Sketches of secondary triangulation of the R. from Three Forks to Leavenworth, **91,** 3802.

Velocity observations: Gasconade Division, **97,** 3960.

Winter H. for plant, Musics Ferry, **00,** 4992.

Wrecks on the R., list of, up to 1897, **97,** 3960.

Part (i), GG-2 Missouri River. (Removing snags, Kansas City to mouth.)

APPROPRIATIONS. (See p. 1041.)

CONTRACTS.

1885. J. Rees, hull of steel and iron snag boat, $51,500, **85,** 1635.
1886. J. D. Lavoisin, upper works of new snag boat, $13,000, **86,** 1395.

ENGINEERS.

Chief of Engineers. R., 80, 162; **81,** 223, 229; **82,** 222, 225; **83,** 229, 230; **84,** 236; **85,** 252; **86,** 244; **87,** 211; **88,** 192; **89,** 226.

In charge:
Maj. C. R. Suter, 1873–84. **R., 80,** 1402; **81,** 1599, 1647; **82,** 1675, 1724; **83,** 1297; **84,** 1531; **85,** 1653.
Maj. A. M. Miller, 1884–89. **R., 85,** 1634; **86,** 1394; **87,** 1555; **88,** 1421; **89,** 1673.

OPERATIONS.

1879–80. 792 snags and 6 drift piles removed, **80,** 1402.
1880–81. 1,022 snags and 25 drift piles removed, **81,** 1601.
1881–82. 1,716 snags and 12 drift piles removed, **82,** 1724.
1882–83. 1,262 snags and 11 drift piles removed, **83,** 1299, 1301.
1883–84. 901 snags and 17 drift piles removed, **84,** 1532.
1884–85. 1,041 snags and 11 drift piles removed; hull of new snag boat in process of constr., **85,** 1635, 1653.
1885–86. 546 snags removed, new snag boat in process of constr., **86,** 1394.
1886–87. New snag boat completed, description of; 624 snags removed. **87,** 1555.

Part (j), GG-2 Missouri River, above Sioux City, Iowa.

APPROPRIATIONS. (See p. 1041.)

COMMERCE.

Description of, **81,** 1674; **83,** 1361; **85,** 3032; **87,** 1601, 2988, 3010, 3012, 3021.

Early C., **83,** 1342.

List of boats navigating upper R., **83,** 1344; **87,** 2994, 3025.

C., 1887 and 1888, **89,** 2761.

C. importance of Missouri bet. Sioux City and Ft. Benton, **91,** 2243.

Trade to be encouraged considered small, **95,** 2220, 2221. In 1895 there was about 25,000 t. an. carried bet. Yellowstone and Sioux City, **95,** 2222. Demand for imp. coming more from those interested in bank protection to prevent flooding of bottom lands than from those interested in navigation, **95,** 2221.

Description of, opposite Sioux City, **95,** 2241.

Stubbs Ferry to Great Falls: This portion paralleled by Montana Central RR.; but if sufficient d. were in R. C. by it would be increased, **96,** 1866.

Ft. Benton to Carroll: No C. on this portion since 1890; taken away by RRs., **96,** 1867; **99,** 2219.

Bismarck: Small, **96,** 1869, 1870.

Pierre and Ft. Pierre: None, and none expected, **96,** 1871.

Yankton: Probably large in future, **97,** 2181.

Elk Pt., **97,** 2182. (See Projects.)

CONTRACTS.

1891. I. P. Baker, charter of towboat, $50 per day, **91,** 2234.

1894. Iowa Iron Works, altering and repairing snag boat, $4,375; E. A. Conway, coal, $2,597.30, **94,** 1747.

1895. J. H. Owen, lumber, $20.90, $29, $30 M; piling 35¢, 36.90¢ l. f.; C. B. Ingham, broken st., $1.07, $1.73 c. y., **95,** 2222. G. Adgate and F. D. Halm, broken st., $1.89 c. y.; Goodrich & Robson, piles, 33.4¢ l. f.; J. W. Smith, sawed lumber, $18.50 M; L. G. Everist, coal, $3,755, **95,** 2223.

1896. J. Reese & Sons Co., mooring posts, etc., $633.36, **96,** 1894.

1897. M. Naughton, bank grading, 54¢ c. y.; McNamara, Miller & Keefe, brush, $1.48 c. y.; J. C. Hayes, riprap st., 63¢ c. y.; brush, $1.27 c. y.; M. Naughton, brush, $1.45 cord, **97,** 2186. P. C. Miller, brush, $1.60; Smith & Betz, brush, $1.45; J. C. French, riprap st., 35¢ c. y.; Moser & Ekroth, brush, $1.35 cord; P. E. Byrne, brush, $1.99; Northern Pacific Ry. Co., riprap st., $1.25 c. y.; W. E. Martin, st., $1.25 and $1, **97,** 2187.

ENGINEERS.

Chief of Engineers: R.—

Above mouth of the Yellowstone, **80,** 169; **81,** 230; **82,** 227.

Niobrara, Nebr., **80,** 169; **81,** 230.

Vermillion, S. Dak., **80,** 167; **81,** 228; **82,** 225; **83,** 233.

Yankton, S. Dak., **80,** 169; **81,** 230.

Sioux City to Ft. Benton, **83,** 234; **84,** 237; **85,** 258; **86,** 248; **87,** 215, 341; **88,** 205; **89,** 366; **90,** 331; **91,** 275; **93,** 295; **94,** 270; **95,** 301, 304; **96,** 260; **97,** 333; **98,** 323; **99,** 385; **00,** 444.

Sioux City to Great Falls. **R., 91,** 275; **92,** 263.

Bismarck, N. Dak. **R., 89,** 241.

Rs., 01, 452; **02,** 381.

In charge:

Maj. C. R. Suter, 1875–82: **R.—**

Niobrara, Nebr. **R., 81,** 1665.

Vermillion, S. Dak. **R., 80,** 1456, 1458; **81,** 1645; **82,** 1722; **83,** 1331.

Yankton, S. Dak. **R., 81,** 1663.

Trans. to Capt. E. Maguire, Oct., 1882. **R., 83,** 1331.

Capt. E. Maguire, 1877–83—

Above mouth of Yellowstone. **R., 80,** 1471; **81,** 1671; **82,** 1741.

Bet. Sioux City and Ft. Benton. **R., 83,** 1339.

Capt. J. B. Quinn, 1883–86. **R., 83,** 1367; **84,** 1541; **85,** 3028.

Missouri R. Commission, 1884, **85,** 258, 2989. **R., 85,** 2989; **86,** 2167; **87,** 2914, 3026; **89,** 2743; **90,** 3362.

Capt. C. B. Sears. **R., 87,** 1597.

Maj. C. J. Allen, 1888–89. **R., 88,** 1556; **89,** 1810.

Lt. H. M. Chittenden, 1889–90. **R., 89,** 2760; **90,** 3419.

Capt. C. F. Powell, 1891–2. **R., 91,** 2232, 2242, 2245, 2248; **92,** 1875.

Col. O. M. Poe, 1890. **R., 91,** 2245, 2249.

Capt. H. F. Hodges, 1893–95. **R., 93,** 2297; **94,** 1739; **95,** 2213, 2240.

Lt. Col. W. A. Jones, 1896. **R., 96,** 1865.

Capt. J. C. Sanford, 1897–99. **R., 97,** 2177; **98,** 1841; **99,** 2217.

Capt. H. M. Chittenden, 1900–02. **R., 00,** 2859; **01,** 2373; **02,** 1687.

Assistants:

T. T. Johnston. **R., 81,** 1663, 1666.

W. H. Wood. **R., 83,** 1371; **97,** 2190; **98,** 1850; **99,** 2225; **00,** 2866; **01,** 2379.

F. M. Towar. **R., 93,** 2315; **95,** 2230; **96,** 1890; **97,** 2204.

H. C. Gould. **R., 91,** 2234; **92,** 1879; **93,** 2316; **94,** 1770; **95,** 2232; **96,** 1879, 1885; **97,** 2192; **98,** 1852.

List of assistants employed on general sur. of the R., **94,** 1754.

W. G. Price. **R., 94,** 1769; **95,** 2229; **96,** 1887.

E. D. Vincent. **R., 95,** 2224; **96,** 1874; **97,** 2197; **98,** 1854, 1855; **99,** 2226; **00,** 2870; **01,** 2381, 2387, 2388.

A. H. Weber. **R., 98,** 1859.

B. Smith. **R., 98,** 1861, 1862; **99,** 2227; **00,** 2875 2877, 2881; **01,** 2385.

S. F. Crecelius. **R., 00,** 2879.

LEGAL PROCEEDINGS.

Purchase of ice H. tract at Rockhaven, **94,** 1742; **95,** 2219; title secured, **96,** 1868.

LEGISLATION.

Cession of jurisdiction over land required for ice H. in Dakota, by legislature, **95,** 2219.

OPERATIONS.

1879–80. Repair of dam at Dauphins Rapids; removal of 1,064 c. y. of r. from 11 localities; 1,825 c. y. st. and 1,861 fascines placed in dams; sur. of R. from Dauphins to Birds Rapids and above Great Falls, **80,** 1472, 1473.

1880–81. 1,165 c. y. r. removed from chan.; 5,481 c. y. st. placed in dams; sur. from Dauphins to Gallatin Rapids and at Snake Pt., **81,** 230, 1673. Sur. at Niobrara, Nebr., **81,** 1665. At Yankton, S. Dak., **81,** 1663.

1881–82. Removal of r. from rapids and constr. of dams below Ft. Benton, **82,** 227, 1742. Below Vermillion, S. Dak., 8,000 l. f. of wire screen dike built, **82,** 1722.

1882–83. Removal of r. from rapids and constr. of dams bet. Ft. Benton and Bismarck, **83,** 234, 1371. Statement of work already accomplished, **83,** 1356.

1883–84. Removal of r. from chan. and constr. of dams bet. Ft. Benton and Bismarck, **84,** 238, 1541. Work trans. to Missouri R. Commission.

1884. Preparations for work of coming season, **85,** 3002, 3030.

1885-86. Removal of r. and constr. of dams above Carroll, **86,** 2167. Dam constr. at Grand Isld., Hammond Isld., and Dauphins Rapids, **87,** 3022.

1886-87. Repair of plant and care of property, **87,** 1598, 2914.

1887-88. 750 l. f. of brush and gravel dam built, and 1,720 c. y. gravel dr. at Shonkin Bar; 1,200 l. f. dam built, and 3,774 c. y. gravel dr. at Crocondunez; 308 l. f. dam built at Rowes Ranch, **88,** 1556, 1557.

1888-89. Dam constr. at Fontanelle and Bakers Bar, **89,** 2761.

1889-90. 23,688 c. y. material dr. at Bakers and Fontanelle Bars, at Evans Bend, Crocondunez, and Seigneurs Reach; 5,647 fascines, 889 c. y. r., and 8,051 c. y. gravel used in constr. of wing dams, **90,** 3420.

1890-91. Repairs to dams at Bakers, Evans, and Fontanelle Bars; repair and reconstr. of plant, **91,** 2233.

1891-92. Repairs and extension of dams at Bakers Bar, Crocondunez, and 3 dams of the Fontanelle system; wing dams built at Archers Bar and Norris Isld.; 31,326 c. y. material dr. at Archer, Churchill, and Crow Coulee Bars; 322 snags and 3 wrecks cleared from chan., **92,** 1876, 1877.

1892-93. Several bad bars sluiced; nearly 700 snags and other obstr. removed, and plant repaired, **93,** 2299.

1893-94. Snag boat enlarged and plant repaired; Rockhaven ice H. under constr., **94,** 1741, 1742.

1894-95. Stubbs Ferry to Great Falls: Plant constr.; obstr. bars removed; several chutes closed by dams and spur dikes built adjacent thereto, **95,** 2215.

Bismarck: Dike constr. in progress, **95,** 2216.

Pierre and Ft. Pierre: Dam constr. in progress, **95,** 2217.

Sioux City: 2 new spur dikes and 2 T-heads for old group built, **95,** 2218.

Ice harbors: Constr. at Rockhaven continued, **95,** 2219.

1895-96. Stubbs Ferry to Great Falls: Several dams and spur dikes built, **96,** 1867.

Ice Hs.: Constr. at Rockhaven continued, and work begun at Big Sioux R., **96,** 1868.

Bismarck: In connection with preceding year, 7 dikes built; repairs made, **96,** 1869.

Pierre and Ft. Pierre: In connection with preceding year, dam built; 5 dikes built, **96,** 1870.

Sioux City: In connection with preceding year, 16 brush and st. dikes built, **96,** 1871.

1896-97. Great Falls to Stubbs Ferry: Several dikes built; repairs made; small towboat built, **97,** 2178, 2179.

Bismarck: Dikes repaired; 2 barges built; plant repaired; banks revetted, and works damaged by ice rebuilt and repaired, **97,** 2180.

Pierre and Ft. Pierre: Revet. completed; dam repaired; dike constr. in progress; 2 barges built, **97,** 2181.

South Sioux City: Bank revetted; short pile dike built, **97,** 2182, 2183.

Sioux City: 4 barges built; dikes at upper limits of city partly repaired, **97,** 2183.

Ice Hs.: Completion of, Big Sioux R., **97,** 2184.

1897-98. Great Falls to Stubbs Ferry: Dam repaired; 6 dikes (3 short) built; 3 dikes repaired; 3 barges built; quarry opened; constr. materials prepared, **98,** 1841, 1842, 1843.

Bismarck: In connection with preceding year, 3 short dikes built; a few dikes repaired, **98,** 1843.

Pierre and Ft. Pierre: Several dikes built; revet. constr.; repairs to existing works, **98,** 1844.

Yankton: Plant procured; 6 dikes begun; repairs made, **98,** 1844, 1845.

South Sioux City: Plant constr., **98,** 1845.

Sioux City: Iowa bank revetted for 824′; 20 short dikes built and others in course of constr.; about 15 dikes repaired; storehouse built, **98,** 1846.

Ice Hs.: Work on shore maintained and chan. sluiced through bars at entrance to both places, **98,** 1846.

1898-99. Snags and obstr. removed from Carroll to Sioux City; at Bismarck H., dikes repaired, plant repaired; chan. cut through ice to lessen injury at break-up, banks protected; Marion Isld. revet. repaired; chan. cut through ice bet. Pierre and Ft. Pierre, revet. done to prevent erosion; dikes at Yankton protected from flanking and also repaired; plant increased and cared for, **99,** 2218.

1899-00. Obstr. removed bet. Carroll and Sioux City; bank protection constr. and repairs made at Bismarck H. (maps); head of Marion Isld. protected, and dam constr. 1895 extended (map); dikes protected from flanking at Yankton, plant repaired, etc. (map); plant gathered at Elk Pt. and banks revetted (map); bank revet. in progress opposite Sioux City to opposite Elk Pt. (map); permanent gauges maintained, **00,** 2860.

1900-01. 436′ bank at Ft. Benton protected by revet., **01,** 2373. 830′ bank at Judith protected by revet., **01,** 2374. Work of repairing, strengthening, and raising Marion Isld. dam, and constr. levee, completed, **01,** 2375. 3,440′ bank at Elk Pt. protected by revet., **01,** 2375. 1,600′ bank opposite Sioux City protected by revet.; 2,900 l. f. revet. constr. at Sioux City, **01,** 2376.

1901-02. Minor repairs, **02,** 1688.

PHYSICAL CHARACTERISTICS.

Formation of cut-off, Vermillion, S. Dak., in 1881 **81,** 1645.

Description of upper R., **83,** 1339, 1345; **85,** 2993.

Slope and discharge, upper R., **80,** 1474; **83,** 1340, 1351.

Rainfall, **83,** 1346.

Description of, Sioux City to Great Falls, **92,** 1886.

Dates of ice closing above Sioux City, **83,** 1348; **93,** 2303; **94,** 1748; **95,** 2237; **96,** 1895; **97,** 2189; **98,** 1850; **99,** 2225.

Table of distances, sur. of 1892, **93,** 2304; Sioux City to Ft. Benton, **94,** 1755.

Descriptive notes of the R. and adjacent country, Campbell, S. Dak., to Sioux City, Iowa, by chiefs of sur. of this part, in 1892, **93,** 2304.

Gauge readings, **93,** 2316; **94,** 1743, 1770; **95,** 2234; **97,** 2207.

L. w. discharge measurements, **94,** 1743, 1744.

Discharge measurements through ice. H. w. discharge measurements, **94,** 1745.

Discharge measurements, Great Falls to Stubbs Ferry, **94,** 1769.

Description of, Sioux City, after ex. of 1894, **95,** 2241. After a second sur. in 1896 marked changes evident in the chan. within the year, **97,** 2183.

Description of, Great Falls to Stubbs Ferry. List of obstr., **95,** 2214. Description of shoals bet., **98,** 1842.

Description of, ice H. at Big Sioux R., **96,** 1868.

Floods, etc., damaging works of imp., **96,** 1869; **97,** 2178, 2179, 2180, 2181; **98,** 1843, 1844, 1845; **99,** 2219.

Description of, at Bismarck, **96,** 1869. Tendency of R. to cut across neck of land near, **00,** 2860.

Description of, at Yankton. The R. of excessive w. here, and its chan. constantly changing, **97,** 2181.

Description of, at Elk Pt. Danger of R. reaching a town about 2 m. inland by erosion, and by cutting into and occupying an old bed which ran by the town, **97,** 2182.

Removal of bars in front of ice Hs. and at mouth of Big Sioux R. frequently necessary to permit access to Hs., **99,** 2223; bar at Big Sioux R. mouth increasing, **00,** 2864.

PRIVATE WORK.

Reference to map showing, done bet. Great Falls and Stubbs Ferry, **98,** 1844.

Work of RR. to aid in preventing cutting of R. near Bismarck, **00,** 2860.

PROJECTS.

Operations, except at Vermillion, S. Dak., confined to R. bet. mouth of Yellowstone and Ft. Benton, and consisted in imp. of chan. at rapids and shoals, by removal of r. and constr. of dams, **78,** 695–700; **79,** 1096; **83,** 1355; **84,** 1542.

At and below Vermillion, S. Dak., the proj. directed to the rectification of the R. by shore protection and permeable dikes, **79,** 1079; **82,** 1722.

In 1885 the Missouri R. Commission recom. that, for the time, work be mainly confined to dams and dr. of shoals on "the rocky river" above Carroll; below that point the snag boat should be kept at work and certain experimental dams constr. near Bismarck, **85,** 3003.

In 1888, there being no proj. for imp. of the R. below Carroll, except snagging, $250,000 was est. as required to complete proj. above that point, **88,** 1558.

By Capt. Powell, 1891, Missouri, mouth of Big Sioux R. to north line of S. Dak., snagging, removal of wrecks and similar obstr., and rectification of R. at Yankton and at Pierre, S. Dak.; est., incl. sur., $229,486, **91,** 2246.

By Capt. Powell, 1891, Missouri, Sioux City to Ft. Benton, completion of r. removal below Judith, Mont., an. operation of snag boats, temporary imp. at worst bars, mainten. of ice H. at Rockhaven, and rectification of R. at and near Pierre and Yankton, S. Dak.; est., $329,497, **91,** 2249.

Snag-boat service considered of more benefit than any other imp. works with the same expend., **93,** 2300.

Act Aug. 17, 1894, extended the limits of imp. up the R. 180 m. to Stubbs Ferry, Mont., **95,** 2213.

Ice Hs.: Capt. Hodges proposed in 1894–95 raising levee at mouth of Big Sioux R. above h. w., planting of mooring posts, grading of banks, and constr. of an incline for hauling out boats, to make a second H., at an est. cost of $9,000, **95,** 2219.

Great Falls to Stubbs Ferry: By Capt. Hodges, in 1894, constr. of small working plant, removal of obstr., waterway contraction by means of spur dikes and dams, to give an available l.-w. d. of 2½′ from Stubbs Ferry to Cascade and 3′ thence to Great Falls, in accordance with plan of Capt. Powell in 1892, at a total est. cost of $165,812.50 (Capt. Powell's est. was $115,000), and $4,500 an. for mainten.; $20,000 allotted, act Aug. 17, 1894, **95,** 2215; **96,** 1866; $16,000, act June 3, 1896, **97,** 2178. In 1898, Capt. Sanford, after sur. of 1897, proposed increasing est. cost of imp. to $213,646.50 to cover cost of imp. number of shoals below Cascade not hitherto provided for, **98,** 1842. No continuation provided, remainder of funds (about $70) turned into Treas., 1899, **99,** 2218.

Bismarck H.: $40,000 allotted act Aug. 17, 1894, for protection of this H. and rectification of R. to prevent bank erosion and cutting of a new chan. at or near this locality. Capt. Hodges proposed commencement of constr. of 8 spur dikes on right bank, **95,** 2216; $32,000 allotted by act June 3, 1896, **97,** 2179, 2180. Work at this locality forms part of a general plan for rectification of the R, from a point 5 m. above to 5 m. below Bismarck, at est. of $725,000, **97,** 2180. By Capt. Sanford, 1899, expend. of allotment of $40,000, app. of 1899, for continuing work (repairing works, constr. bank and revet. on right bank above br. and continuing downstream the left bank protection below the br.), **99,** 2219.

Pierre and Ft. Pierre: Act Aug. 17, 1894, allotted $40,000 for rectification of R. at this locality. Capt. Hodges proposed constr. of 5 dikes and a closing dam, part of a general scheme to confine the l.-w. flood to a 700′ w. chan., **95,** 2216; $40,000, allotted, act June 3, 1896, **97,** 2178, with which Capt. Sanford proposed repairs, bank revet., and completion of proj. works, **97,** 2180; est. cost of works for rectification of about 7 m. of the stream here, $360,000, **97,** 2181. By Capt. Sanford, 1899, applying allotment of $40,000, app. of 1899, for continuing imp. (protecting head of Marion Isld. and closing chute behind it, extension of revet. on isld., raising shore ends of dike at Pierre, and constr. some dikes of Group E on the Pierre side), **99,** 2220.

Sioux City: Act Aug. 17, 1894, allotted $10,000 for protection of and completion of works here, and act Mar. 2, 1895, allotted $40,000 from app. for R. bet. its mouth and Sioux City, for protection of banks in front of city on the Iowa side. Capt. Hodges proposed with the first allotment constr. of 2 spur dikes above the old system, and protection of the old dikes' ends, as far as funds would permit; with the second allotment he proposed constr. of 20 spur dikes, 200′ to 300′ apart and from 100′ to 500′ l., or as many as funds would permit, **95,** 2218; est. of rectifying 7 m. of the R. here, $40,000, **96,** 1871; $40,000 allotted, act June 3, 1896, **97,** 2193; $30,000 allotted from app. of 1899, **99,** 2221; act June 6, 1900, directed that not to exceed $20,000 of this should be expended here (see Elk Point), **00,** 2859, 2863; condition of work, 1900 (map), **00,** 2880.

In 1896 Lt. Col. Jones est. $50,000 to imp. Nebraska side of R. opposite Sioux City, Iowa, in accordance with plan submitted by Capt. Hodges (see Commerce and Surveys), **96,** 1874.

South Sioux City: By Lt. Col. Jones in 1896, expend. allotment of that year, $40,000, in revetting, protecting, and paving banks at this locality, and constr. of short pile dike, the work forming part of a general plan for R. imp. at this locality (see Sioux City, under Projects), **97,** 2182; au. given to consolidate this work with that opposite Sioux City to opposite Elk Pt., **99,** 2221.

In 1895 Capt. Hodges est. $38,500 per m. for general imp. of R., **95,** 2222.

Yankton: By Capt. Sanford, 1896, expend. allotment of 1896, $32,000, for fairing-out and protecting the left bank above the site of a proposed br. at this locality; part of a general scheme of rectification of about 6½ m. of R. in this vicinity, with view to restoration of a SS. landing and control of the R. in vicinity of the br., **97,** 2181; proj. revised in 1897 to provide for commencing constr. of a group of dikes first, constr. of br. having been deferred; est. cost of general plan of rectification, $296,800, **98,** 1845.

By Capt. Sanford, 1899, applying allotment of $40,000, app. of 1899, to continuing constr. of group of dikes begun 1897 for restoration of SS. landing, **99,** 2220.

Elk Pt.: By Capt. Sanford, 1897, expend. allotment of 1896, $20,000, in protecting left bank as far as funds would permit, a part of a general plan for protection of about 10,000′ of the left bank in front of Elk Pt., at est. of $87,300, with probable addl. cost of $34,500; funds held until larger app. would be made, **97,** 2182.

In 1897 Capt. Sanford believed that works of this character at Elk Pt., where "there is" no C., interfered with the general scheme for imp. of R. in interests of C., **97,** 2182.

By Capt. Sanford, 1899, applying allotment of $20,000, app. of 1899, and remainder from app. of 1896 ($19,610.76), to protection of cutting left bank opposite the town (revet., and, where necessary, permeable dikes), **99,** 2221; act June 6, 1900, directed that $10,000 addl. be applied to this work (see Sioux City), **00,** 2859, 2863.

Opposite Sioux City to opposite Elk Pt.: Allotment of $800, 1899, for sur., **99,** 2221 (see Sioux City); by Capt. Chittenden, 1899, for applying $25,000, act 1899, to protection of right bank from point in Jackson Chute as far downstream as would be permitted by funds, **00,** 2863.

Judith, Mont.: Act 1899 au. $5,000 for repair of s. bank of the R. at this place, **99,** 2217; **00,** 2860.

Sioux City, adopted July 2, 1900, for the expend. of allotment of $20,000 and small balance, in protecting bank downstream from combination br., by revet., **01,** 2376.

SURVEYS.

Ex. for ice H. at Bismarck, N. Dak., au. act Aug. 11, 1888; made, 1888, by Maj. Allen (**R.** unfav.), **89,** 1810.

At Yankton, S. Dak., and Niobrara, Nebr., au. act June 14, 1880, **80,** 169; made by Maj. Suter, 1880, **81,** 1663, 1665.

Misc., **95,** 2215; **96,** 1867; **97,** 2192, 2179, 2206; **98,** 1854, 1859.

Sur. of the Missouri R. bet. Great Falls, Mont., and Sioux City, Iowa, **92,** 1886.

General sur. of the upper R.:
Bench marks, primary leveling of 1892, from Cannonball, N. Dak., to Chamberlain, S. Dak., **93,** 2306; elevation and geographical position of, **93,** 2313. Printing of charts, **94,** 1742, 1743. Composition of parties, **94,** 1749. Secondary triangulation; tertiary triangulation, **94,** 1750. Levels; topography, **94,** 1751. Computations; platting, **94,** 1753. Elevations and geographical positions of bench marks, primary triangulation, 1885–93, from Ft. Benton, Mont., to Sioux City, Iowa, **94,** 1757. Description and location of bench marks, primary leveling, 1893, Chamberlain, S. Dak., to Sioux City, Iowa, **94,** 1765; **95,** 2219; **96,** 1868; **97,** 2184; **98,** 1846.

Act Aug. 17, 1894, au. ex. of Nebraska side of the R. opposite Sioux City, and up the R. to a point in Nebraska opposite the mouth of Big Sioux R. made in 1894 by Capt. Hodges, **95,** 2240. Joint resol. of Apr. 18, 1896, called for plan and est. for imp. of the Nebraska side of the R. opposite Sioux City, Iowa. Submitted in 1896 by Lt. Col. Jones, **96,** 1873.

Sur. of the R. from 9 m. above to 1½ m. below old SS. landing at Yankton made in 1896 by Capt. Sanford, **97,** 2181.

Sur. at Elk Pt. from 7 m. above to 3 m. below made in 1896 by Capt. Sanford, **97,** 2181.

Sur. at Sioux City Reach made in 1896 by Capt. Sanford, **97,** 2183.

Ex. of shoals bet. Stubbs Ferry and Great Falls made in 1897 by Capt. Sanford. Sur. were made later to determine effect of works of imp. in 1895–96, **98,** 1842.

Maps.
Vicinity of Yankton, S. Dak., **81,** 1664.
Vermillion, S. Dak., **82,** 1722.
Dauphins Rapids, Cow Isld., and Grand Isld., **82,** 1742.
Parts of R. imp. bet. 1877 and 1883, **84,** 1542.
Bakers Bar, Evans Bend, Fontanelle Bar, Seigneurs Reach, Crocondunez, and Shonkin Bar, **90,** 3420.
95, 2236; **96,** 1894; **97,** 2208; **00,** 2880. (See Operations, 1900.)

Part (k), GG-2 Missouri River, above Sioux City, Iowa. (Removing obstructions.)

APPROPRIATIONS. (See p. 1041.)

COMMERCE.

Work is most beneficial to navigation of any undertaken on the upper Missouri, **00,** 2883.

CONTRACTS.

1897. C. A. Burton, coal, $1.85 t.; Brown Coal Co., $4.59 t.; L. G. Everist, $2.58 t., **97,** 2211.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 296; **94,** 271; **95,** 303; **96,** 262; **97,** 337; **98,** 329; **99,** 393; **00,** 450; **01,** 457; **02,** 385.

In charge:
Capt. H. F. Hodges, 1893–95. **R.,** **93,** 2319; **94,** 1772; **95,** 2238.
Lt. Col. W. A. Jones, 1896. **R.,** **96,** 1895.
Capt. J. C. Sanford, 1897–99. **R.,** **97,** 2208; **98,** 1865; **99,** 2229.
Capt. H. M. Chittenden, 1900–02. **R.,** **00,** 2882; **01,** 2391; **02,** 1690.

OPERATIONS.[1]

1893–94. Plant repaired; nearly 3,000 snags and other obstr. removed, **94,** 1773, 1774.

1894–95. Nearly 3,000 snags, etc., and 454 r. removed, **95,** 2239.

1895–96. Nearly 1,500 snags, etc., removed, **96,** 1895.

1896–97. Plant repaired, and nearly 4,000 snags, etc., removed, **97,** 2209.

1897–98. Plant repaired, and over 1,000 snags, etc., removed, **98,** 1866.

1898–99. Snag boats repaired and about 1,400 snags and other obstr. removed from R., **99,** 2230.

1899–00. Repairs made to snag boats, and about 3,000 snags and other obstr. removed from R.; and a machine shop has been erected at the Sioux ice H., **00,** 2883.

1900–01. 228 snags removed, 330 trees felled, and 92 misc. obstr. removed, **01,** 2392.[1]

PHYSICAL CHARACTERISTICS.

The shifting character of the R. and high spring floods cause many changes of chan., **99,** 2230.

PROJECTS.

By Capt. Hodges, 1893. Removing obstr. above Sioux City where boats would be running and where most needed, maintc ı. of 3 snag boats, and for doing work with hired labor, **93,** 2319; **95,** 2238.

By Capt. Sanford, 1899. Continuing the work of removing snags and other like obstr. from Missouri R., bet. Stubbs Ferry, Mont., and Sioux City, incl. care and mainten. of plant employed on the R. above Great Falls, Mont., **99,** 2229.

[1] For history of operations after 1902 see Part f.

Part (1), GG-2 Missouri River, Mont. (Three Forks to Great Falls, Mont.; Great Falls to Canyon next below Stubbs Ferry.)

COMMERCE.

Demands of C., **92,** 1906.

No navigation, 1894. After ex. of 1893–94 it was recom. that should dams be constr. for power, provision should be made for locks to accommodate any future C., **94,** 1775.

ENGINEERS.

Chief of Engineers. **R., 91,** 278; **92,** 265; **93,** 297; **94,** 272.

In charge:

Capt. C. F. Powell, 1891. **R., 92,** 1904, 1908.

Capt. H. F. Hodges, 1893–94. **R., 93,** 2320; **94,** 1775.

Assistants:

Lt. J. C. Sanford. **R., 92,** 1905.

E. D. Vincent. **R., 94,** 1780.

PHYSICAL CHARACTERISTICS.

Description of; from Three Forks to Canyon Ferry is about 81 m. by chan.; w., 250′ to 600′; fall averaging 4.8′ a m. Description of 6 probably suitable sites for dam, **94,** 1775, 1776, 1777.

PLANS.

By Capt. Powell, 1892, for (1) removing snags from the "long pool" extending up from Great Falls 51 m.; (2) constr. of 2,000′ of dams and 3,500′ of bank protection, extending the 3′ chan. 4 m. farther to towns of Cascade and St. Clair; (3) constr. of 10,000′ of dams and removal of bowlders and r. on the next reach of 70 m., giving 2½′ chan. at l. w.; est., $115,837, **92,** 1909.

SURVEYS.

Ex., 1891, by Capt. Powell, **92,** 1905.

Special ex. of R. bet. Three Forks and Canyon Ferry, Mont., au. act July 13, 1892, with view to determining at what points, if any, the stream might be dammed for power without injuring navigation; made, 1893, by Capt. Hodges, **93,** 2320; **94,** 1775.

GG-133 GRAND RIVER, MO.

COMMERCE.

Local, **89,** 1711.

ENGINEERS.

Chief of Engineers. **R., 89,** 230.

In charge. Maj. A. M. Miller, 1888. **R., 89,** 1709.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Miller (**R.** unfav.), **89,** 1709.

GG-245 NISHNABOTANA (Nishnabotna) RIVER, MO. AND IOWA.

ENGINEERS.

Chief of Engineers. **R., 81,** 230; **82,** 227; **85,** 257.

In charge. Maj. C. R. Suter. **R., 82,** 1736; **85,** 1643.

Assistants:

J. W. Pearl. **R., 82,** 1737.

L. E. Cooley. **R., 85,** 1643.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 1737.

SURVEYS.

Au. acts June 14, 1880, and July 5, 1884; made by Maj. Suter (**Rs.** unfav.), **82,** 1736; **85,** 1643.

GG-274 BIG SIOUX RIVER, S. DAK. AND IOWA.

ENGINEERS.

Chief of Engineers. **R., 10,** 656.

In charge. Maj. E H. Schulz, 1910, **10,** 643.

PHYSICAL CHARACTERISTICS.

Empties into Missouri R. at Sioux City.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Schulz, May 31, 1909 (unfav.),[1] **10,** 656.

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[1] H. D. 408, 61st, 2d.

GG-274(b) SIOUX RIVER, S. DAK.

ENGINEERS.

Chief of Engineers. **R., 01,** 458, 2395.

In charge. Capt. H. M. Chittenden. **R., 01,** 2396.

SURVEYS.

Pre. ex. au. act June 6, 1900, with view to constr. of dam for storage of water of said stream in Lake Kampeska and Lake Ponsett, with est. of capacity of said reservoir and feasibility of utilizing same. **R.** by Capt. Chittenden, Nov. 15, 1900,[1] **01,** 458, 2396.

GG-301(a) JAMES (Dakota) RIVER, N. DAK. AND S. DAK.

COMMERCE.

Unimportant, 1893, **93,** 2321–2325.

DOCUMENTS. (Not printed in reports.)

H. Doc. 75, 43d Cong., 2d sess. **R.,** result of sur., **75,** 367.

ENGINEERS.

Chief of Engineers. **R., 75,** 63; **87,** 217; **93,** 297.

In charge:
Maj. F. U. Farquhar, 1874–75. **R., 75,** 367.
Capt. C. B. Sears, 1886–87. **R., 87,** 1603.
Capt. H. F. Hodges, 1892–93. **R., 93,** 2321.

Assistants:
M. Schmidt, **75,** 367.
D. H. Ainsworth, **75,** 367.
F. M. Towar. **R., 93,** 2325.

PHYSICAL CHARACTERISTICS.

Description, **75,** 367–369; **87,** 1603; **93,** 2321.
Chan. very tortuous, **87,** 1606.
Insufficient volume of water for light-draft SS., **75,** 369, 370; **87,** 1606; **93,** 2321.

PLANS.

Imp. very difficult on account of a lack of water, and only to be determined by a careful sur., **75,** 369, 370.
In 1886 Capt. Sears **R.** R. can not be made navigable by the ordinary means of imp. the natural chan. for the reasons that there is not a sufficiency of water and that the chan. is too tortuous, **87,** 1606.

SURVEYS.

1874. Ex., D. H. Ainsworth and M. Schmidt, from Northern Pacific RR. to Southern Dakota RR. (see Plans), **75,** 63, 367.
Ex. au. act Aug. 5, 1886; made, 1886, by Capt. Sears (see Plans), **87,** 1603.
Ex. au. act July 13, 1892; made by Capt. Hodges, 1893 (**R.** unfav.), **93,** 2321.

GG-626 YELLOWSTONE RIVER, N. DAK., MONT., AND WYO.

APPROPRIATIONS.

1879,	$25,000,	**79,** 128.
1880,	15,000,	**80,** 1475.
1881,	20,000,	**81,** 1676.
1882,	20,000,	**82,** 1746.
1884,	[2] 20,000,	**85,** 1660.
1886,	18,750,	**86,** 1402.
1896,	10,000,	**96,** 1896.
Total,	128,750	

COMMERCE.

Communication and transportation, **79,** 1098.
Natural products and mining interests tributary to R., **79,** 1099, 1100.
Increase in SS. business, **82,** 1746.
Insignificant C. of upper R., **87,** 1602.
Former brisk trade taken by the RR., **93,** 2321.

ENGINEERS.

Chief of Engineers. **R., 78,** 95; **79,** 128; **80,** 170; **81,** 231; **82,** 228; **83,** 234; **84,** 238; **85,** 259; **86,** 249; **87,** 216; **88,** 206; **89,** 240; **90,** 215; **91,** 276, 277; **92,** 264; **93,** 297; **94,** 272; **95,** 304; **96,** 263; **97,** 338; **98,** 329; **99,** 394; **00,** 450; **11,** 705.

In charge:
Lt. E. Maguire, 1879–84. **R., 79,** 1097; (Capt.) **80,** 1475; **81,** 1674; **82,** 1743; **83,** 1364, 1373.
Capt. J. B. Quinn, 1884–86. **R., 84,** 1543; **85,** 1659; **86,** 1399.
Capt. C. B. Sears, 1886–87. **R., 87,** 1601.
Maj. C. J. Allen, 1888–90. **R., 88,** 1559; **89,** 1809.
Maj. W. A. Jones, 1890–91. **R., 90,** 2098.
Capt. C. F. Powell, 1891–92. **R., 91,** 2236, 2239; **92,** 1903.
Capt. H. F. Hodges, 1893–95. **R., 93,** 2321; **94,** 1784; **95,** 2240.
Lt. Col. W. A. Jones, 1896. **R., 96,** 1896.
Capt. J. C. Sanford, 1897–99. **R., 97,** 2211; **98,** 1866; **99,** 2231.
Maj. E. H. Schulz, **11,** 689.

Assistants:
F. M. Towar. **R., 83,** 1373; **84,** 1544.
B. Smith. **R., 97,** 2212.

OPERATIONS.

1878–79. Work in progress on Buffalo Rapids, and sur. continued, **79,** 128.
1880–81. 519 c. y. r. taken out of chan., **81,** 1675.
1881–82. 3,162 l. f. of brush and st. dam and shore protection built; 433 c. y. r. removed, **82,** 1743–1746.
1882–83. 6,806 fascines and 565 mats made and laid; 4,536 c. y. r. and gravel placed in constr. of dams and shore protection, **83,** 1375.
1883–84. Repairs to dikes in vicinity of Glendive, **84,** 1543.
1884–85. 2,504 l. f. of brush and st. dike built **85,** 1659.
1885–86. Outlets from main chan. below Glendive closed by brush-dam constr., **86,** 1399.
1896–97. About one-half m. of bank protected at Glendive, **97,** 2211.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 128, 1097, 1098, 1099, **1101.**
Tables of distances, **79,** 1101, 1102.
Discharge of R., **79,** 1101.

[1] H. D. 93, 56th, 2d.
[2] Allotted by act, from app. for Missouri R. from Sioux City to Ft. Benton, for purchase of snag boat to be operated above Sioux City and on Yellowstone R.

PLANS. (See Projects.)

By Capt. Powell, 1891, imp. of R. below Glendive, giving 3′ l.-w. chan. by constr. of closing dams, revet., and dr.; est., $281,250, **91,** 2241.

In 1891 Col. Poe did not consider imp. of any portion of the Yellowstone R. warranted by existing needs of C., **91,** 2242.

PROJECTS. (See Plans.)

By Lt. Maguire, 1878, imp. by removal of r., snags, trees, and similar obstr., and constr. of wing dams and shore protection for unification of chan., cost indeterminate, **79,** 1098.

1879 to 1886, incl., $118,750 app.; est. to complete proj., 1887, $106,000, **87,** 1603; **88,** 1559.

Act 1896 au. app. of that year should be expend. at or near Glendive, Mont., **96,** 1896. Capt. Sanford proposed with this amount protection of right bank at this place from caving for a distance of about one-half m., **97,** 2211

Au. obtained to drop R. from list of works; no further reports to be submitted unless work is revived by further app., **99,** 2231.

SURVEYS.

Au. act June 18, 1878, **79,** 95; made, 1879, by Lt. Maguire (see Projects), **79,** 128, 1097 (history of sur., **79,** 1101, 1102); **80,** 1475.

Ex. mouth to mouth of Tongue R.; made, 1891, by Capt. Powell (see Plans), **91,** 2239.

Pre. ex. and sur., mouth to Billings, Mont., with view to 4′ stage of water, and building lock at U. S. dam, au. act Mar. 3, 1909. **R.** by Maj. Schulz, Aug. 12, 1909, and Dec. 30, 1910[2] (unfav.), **11,** 705.

Maps.[1] **82,** 1744, 1746; **83,** 1374; **97,** 2211.

GG-713 TONGUE RIVER, MONT.

COMMERCE.

None, and none looked for, 1894. Rectification desired would have no bearing on C. interests, **95,** 2244.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 277; **95,** 304.

In charge:
Capt. C. F. Powell, 1890. **R.,** **91,** 2237.
Capt. H. F. Hodges, 1895. **R.,** **95,** 2243.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2238; **95,** 2244.

Insignificant at l. w.; at h., volume considerable and current swift. A tributary of the Yellowstone, **95,** 2244.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Powell (**R.** unfav.), **91,** 2238.

Ex. with view to straightening chan. along e. edge of Fort Keogh Military Reservation au. act Sept. 27, 1894; made, 1894, by Capt. Hodges (**R.** unfav.), **95,** 2243.

GG-823 CHEYENNE RIVER, S. DAK.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 170.
In charge. Lt. E. Maguire, 1880. **R.,** **80,** 1478.

SURVEY.

Of Cheyenne R., au. act Mar. 3, 1879, **79,** 128; made, 1880, by Lt. Maguire (**R.** unfav.), **80,** 1478.

History of the work, **80,** 1479.

GG-1025(a) WYOMING AND COLORADO. (Arid regions.)

(Examination of sites for reservoirs.)

APPROPRIATION.

1898, *$5,000, **98,** 2819.

ENGINEERS.

Chief of Engineers. **R.,** **98,** 469.

In charge:
Lt. Col. A. M. Stickney. **R.,** **98,** 2816.
Capt. H. M. Chittenden. **R.,** **98,** 2817. Contents: Sites in the arid regions. Dam constr. Conclusions and recom. Functions of reservoirs. Natural and artificial reservoirs. Floods. Reservoir constr. Magnitude and cost. Summary. Index to the foregoing. **98,** 2917.

Assistants:
F. B. Maltby. **R.,** **98,** 2879.
F. Bond. **R.,** **98,** 2883.
J. A. Seddon. Monograph on Mississippi R. floods, **98,** 2887.
H. A. Sumner. Letter on constr. of reservoirs by Colorado, **98,** 2908.
E. Mead. Letter on percentage of stream flow required to be stored, **98,** 2910.
F. J. Mills. Letter on preceding, for Idaho, **98,** 2912.

PHYSICAL CHARACTERISTICS.

Diagram showing the percentage of water to be stored, **98,** 2873.

Diagram showing the comparison of the mean monthly discharges of the Niagara, Ohio, upper Mississippi, and Missouri Rs., **98,** 2847.

See Engineers in Charge.

PLANS.

Capt. Chittenden reported that the total extent of a reservoir system in the arid regions which would render available the entire flow of the streams would not exceed 1,161,600,000,000 c. f.; that if the constr. of such a system were to consume a century in time, it would represent an an. storage of about 11,600,000,000 c. f., or 266,300 acre-f. At $5.37 per acre f. this would cost $1,430,031 per annum. This amount, distributed among the 17 States and Territories of the arid section, would give an average an. expend. in each of $84,119. The an. value of the stored water would return the orig. cost and mainten. in an average period of 3 years. **98,** 2878.

SURVEYS.

Act June 3, 1896, provided for a pre. ex. of sites and for a report upon the practicability and desirability of building reservoirs and other hydraulic works for storage and utilization of water to prevent floods and overflows, erosion of R. banks and breaks in levees, and to reinforce the flow of streams

* Allotment.

[1] H. D. 83, 62d, 1st.

during drought and l.-w. seasons, at least 1 site each in Wyoming and Colorado. There were ex. in all, under the direction of Capt. Chittenden, 2 systems in Colorado and 3 in Wyoming. **R., 98,** 2818.

Maps:
Photographs of dams and reservoirs, **98,** 2818.
Map of the drainage basin of the River Rhone, France, **98,** 2855.

GG-1178 KANSAS RIVER, KANS.

APPROPRIATIONS.

1911, *$3,000, **12,** 2228.
1912, 4,000, **12,** 2228.

Total, 7,000

COMMERCE.

Description of, unimportant, **79,** 1092, 1093; **93,** 2295.
Insignificant, largely sand, **04,** 2327; **12,** 855.

ENGINEERS.

Chief of Engineers. **R., 78,** 93; **79,** 127; **93,** 294; **04,** 436; **11,** 706; **12,** 855.

Boards. BERH. reviews Capt. Chittenden's **R.** and believes it undesirable for U. S. to imp., **04,** 2327.
Mention of special b. **R.** made, 1904, by BE. on flood conditions, encroachments, etc., **12,** 856.

In charge:
Maj. C. R. Suter, 1879–93. **R., 79,** 1089; (Lt. Col.) **93,** 2293.
Capt. H. M. Chittenden, 1904. **R., 04,** 2326.
Maj. E. H. Schulz, 1912–. **R., 12,** 2228.

Assistant. J. D. McKown. **R., 79,** 1089.

LEGISLATION.

Kansas Legislature declared stream unnavigable in 1864, and au. constr. of brs. over it, etc. Law not sustained by U. S. courts, **93,** 2294.
Drainage district organized by Kans., after 1904, for R. regulation and control. Bonds to $1,750,000 voted for levees, revet., R. widening, right of way, etc.

OBSTRUCTIONS. (See Physical characteristics.)

Milldam and a number of low brs. obstr. line of navigation, **93,** 2294; **12,** 855.
Conditions, 1912—débris, wreckage, and general encroachment. **12,** 855.
See Legislation.

OPERATIONS.

1911-12. Supervision of levee and revet. work, br. reconstr., **12,** 855.

PHYSICAL CHARACTERISTICS.

Description, **79,** 1089–1091; **12,** 855.
Obstr., artificial and natural, **79,** 1089–1091.
Discharge, **79,** 1092; **12,** 855.
Description of. The Kansas, or Kaw, R. formed by junction of Republican and Smoky Hill Rs., 176± m. l., enters the Missouri, and is entirely within Kansas. Numerous obstr. of all kinds hinder or prevent navigation, **93,** 2293.
Traffic, 1912, confined to lower 10 m., **12,** 855.
In 1903 R. floods caused loss of $20,000,000 at Kansas City alone. 16 brs. were destroyed. Another flood, 1904, and again in 1908, **12,** 856.

PLANS.

By J. D. McKown, 1879, mouth to Topeka, l.-w. d. of 4½'; Topeka to Junction City, l.-w. d. of 3½' with wing dams, and by removal of obstr.; est., $450,000, **79,** 1092. Recom. reserved by Maj. Suter until determined by a detailed sur., **79,** 1089.

PRIVATE WORK.

See Legislation.

PROJECTS.

Act July 25, 1912, au. imp. R. up to Argentine (12 m.), Kans., work to embrace supervision of levee and revet. work, of br. reconstr., etc., and removal of débris and obstr. from R. bed, **12,** 855.

SURVEYS.

Ex. from mouth to Junction City, Kans., au., **78,** 93. Completed, 1879, by J. D. McKown, **79,** 127, 1089.
Ex. au. act July 13, 1892; **R.,** 1893, by Lt. Col. Suter, president Missouri R. Commission (**R.** unfav.), **93,** 2293.
Pre. ex. at or near its mouth, au. act June 13, 1902. **R.,** Capt. Chittenden, Feb. 17, 1903 (unfav.),[1] **04,** 436, 2325.
1909, Cong. au. H. lines on R., **12,** 856; estab. by Sec. of War June 24, 1910.
Pre. ex. and sur., up to Argentine, au. act Mar. 3, 1909. **R.,** Maj. Schulz, 1909 and 1910; recom. removal of dikes constr. by U. S.,[2] **11,** 706.
Act July 25, 1912, au. sur. from mouth to w. limits of Kansas City, Kans., with view to removing obstr., etc. (**R.** to come), **12,** 856.
Maps.[2]

GG-1276 (a) REPUBLICAN AND SMOKY HILL RIVERS (Fort Riley Military Reservation), KANS.

APPROPRIATIONS.

1909, $25,000, **09,** 1674.
1912, [3] 8,500, **12,** 2228.

Total, 33,500

CONTRACTS.

1910. H. A. Kepler, driving concrete piles, 31½¢ l. f., **10,** 1844. H. A. Kepler, driving concrete piles, 60¢ l. f., **11,** 2021.

ENGINEERS

Chief of Engineers. **R., 10,** 656; **11,** 704; **12,** 854.

In charge. Maj. E. H. Schulz, 1909–. **R., 09,** 1674; **10,** 1842; **11,** 2020; **12,** 2227.

OPERATIONS.

1909-10. 2-row concrete pile dikes 800' and 400', resp., built; 30' piles reinforced with steel rods and braced with concrete, **10,** 1842.

* Allotment from "Ex., sur., and conting. of R. and H."
[1] H. D. 82, 58th, 2d.
[2] H. D. 94, 62d, 2d.
[3] From app. "Roads, walks, wharves and drainage;" $2,750.97 returned.

1910-11. Minor repairs made to old dike; 300′ extension built to 800′ dike; flexible concrete blocks laid for 23′ at end, **11,** 2020–21.

1911-12. Preservation Republican R.: Revet. 300′ l. placed above upper end of 1,100′ dike, and 100 l. f. placed below lower end; some small washes refilled with brush and r.; 180′ 15″ sewer pipe laid, **12,** 2227.

Preservation Smoky Hill R.: 500 l. f. revet. and 4 brush and st. fills across and 5 pavings at head of gullies made, **12,** 2227.

PHYSICAL DATA.

Erosion damaged 800′ of dike, **11,** 2020.

PROJECTS.

Act Mar. 4, 1909, app. $25,000, protection of bank against erosion; ex. to be made and proj. submitted, **09,** 1674. Maj. Schulz, proj. for two 2-row concrete dikes; approv. (first complete permeable concrete dike constr. on American waters, **10,** 656), **10,** 1842.

Sec. of War, 1911, au. work on preservation of bank line at Smoky Hill and Republican Rs., from current funds for "Roads, walks, wharves, and drainage," **12,** 854.

SURVEYS:

Maps:
Republican R., **10,** 1844.
Photographs, **10,** 1842.

GG-1457 OSAGE RIVER, MO.

APPROPRIATIONS.

1871,	$25,000,	**71,** 333.
1872,	25,000,	**72,** 53.
1873,	25,000,	**73,** 55.
1874,	25,000,	**74,** 61.
1878,	20,000,	**78,** 94.
1879,	20,000,	**79,** 120.
1880,	30,000,	**80,** 1395.
1881,	20,000,	**81,** 1589.
1886,	10,000,	**86,** 1396.
1888,	5,000,	**88,** 1451.
1890,	55,000,	**90,** 1993.
1892,	50,000,	**92,** 1743.
1905,	80,000,	**05,** 1703.
1905,	*10,000	**07,** 1602.
1902,	*10,000	
1907,	78,000	
1908,	100,000,	**08,** 1678.
1909,	10,000,	**09,** 1671.
1909,	60,000,	**09,** 1671.
1910	35,000	**10,** 1837.
	*15,000	
1911,	15,000,	**11,** 2014.
1912,	15,000,	**12,** 2223.
Total,	738,000	(incl. misc., $1,035,871.95, **12,** 2223).
Osage R., Kans. and Mo. (in connection with Missouri R. works; see GG-2):		
Aug. 18, 1894,	46,000	
June 3, 1896,	50,000	
Mar. 3, 1899,	25,000	
June 6, 1900,	146,000	
June 13, 1906,	30,000	
	297,000	
Grand total,	1,035,000	

COMMERCE.

Real wealth of country adjacent to the R., $100,000,000, **71,** 328; C. of R., nothing.

Remarks by Capt. Allen, **74,** 348; by Col. Simpson, **75,** 489, 492.

C. importance of the Osage Valley described in detail, **75,** 495.

Reported by Col. Simpson as not sufficient to justify expense of the imp., **75,** 493.

Description, **74,** 341–45; **75,** 490.

SS. traffic upon R., **81,** 1593.

Lumber interests, **87,** 1592.

Resources of the locality, **90,** 1997, 2002.

List of SS. engaged on the R., 1891, **92,** 1745.

1902, 95,194 t., mostly grain, hay, live stock, lumber, gravel, sand, salt, produce, and general merchandise, **03,** 1572.

Imp. influences rates only by affording shippers regular means of transportation by boat, **09,** 580.

1911, 19,274 t., **12,** 2224.

CONTRACTS.

1872. Howard Cook, dr. on shoals, **73,** 458, 459; relieved therefrom, **74,** 338.

1910. Penn Bridge Co., constr. 2 pairs steel lock gates, $2,615 for upper gates and $3,350 for lower gates, **10,** 1837.

ENGINEERS.

Chief of Engineers. R. against further imp., **75,** 66. **R., 70,** 31; **71,** 59; **72,** 52; **73,** 55; **74,** 61; **75,** 66; **76,** 82; **78,** 94; **79,** 119; **80,** 161; **81,** 222; **82,** 220; **83,** 228; **84,** 235; **85,** 254, 259; **86,** 246; **87,** 214; **88,** 195; **89,** 229, 230; **90,** 205, 206; **91,** 262; **92,** 251; **93,** 283; **94,** 260; **03,** 408; **04,** 434; **05,** 445; **06,** 487; **07,** 514; **08,** 548, 551; **09,** 579; **10,** 652; **11,** 700; **12,** 848.

Boards. Special BE. convened July 19, 1906; submitted proj.; later approved, and carried out, **07,** 1601.

In charge:

Lt. Col. W. F. Raynolds, 1870–73. **R., 71,** 327, 333; **72,** 341.

Col. J. H. Simpson, 1873–80. **R., 73,** 458; **74,** 338; **75,** 488, 490; **76,** 649; **78,** 687; **79,** 1044; **80,** 1391.

Maj. O. H. Ernst, 1880–85. **R., 80,** 1391; **81,** 1586; **82,** 1656; **83,** 1293; **84,** 1529.

Maj. A. M. Miller, 1885–92. **R., 85,** 1636, 1657; **86,** 1395; **87,** 1591, 1593; **88,** 1450; **89,** 1705; **90,** 1992, 1996; **91,** 2114; **92,** 1742.

Maj C. J. Allen, 1893–94. **R., 93,** 2182; **94,** 1620.

Maj. H. M. Chittenden, 1903–05. **R., 03,** 1568; **04,** 2320; **05,** 1703.

Col. J. B. Quinn, 1906. **R., 06,** 1494.

Capt. E. H. Schulz, 1907–. **R., 07,** 1601; **08,** 1675; (Maj.) **09,** 1669; **10,** 1834; **11,** 2011; **12,** 2220.

Assistants:

D. Fitzgerald. **R., 71,** 328.
Capt. Allen, **71,** 334. **R., 74,** 345.
A. Livermore, **72,** 341.
A. H. Blaisdell, **73,** 459. **R., 03,** 1572.
G. R. Eichbaum, **73,** 459; **74,** 342.
W. S. Simpson. **R., 74,** 341.
W. M. Gordon. **R., 75,** 493.
W. S. Simpson. **R., 81,** 1589; **82,** 1657.
S. E. McGregory. **R., 82,** 1667.
K. Winston. **R., 83,** 1294.
J. W. Beaman. **R., 89,** 1706; **90,** 1993; **91,** 2115; **92,** 1743; **93,** 2183; **94,** 1622.
C. D. Lamb. **R., 90,** 1999.
W. R. De Witt. **R., 04,** 2321.
Robert Walker. **R., 06,** 1494.

ESTIMATES. (See Projects.)

By Lt. Col. Raynolds, 1870, dams, scraping, etc., $200,000, **71,** 328; **72,** 343.

By Capt. Allen, 1874, dams, scraping, etc., $500,000, **74,** 348.

By Col. Simpson, 1875, slack-water imp., 83,000,000, **75,** 489.

*Allotment.

LEGAL PROCEEDINGS.

Condemnation proceedings for land on both sides of the R. required for proposed lock at Brenneke Shoal brought to a close, **94,** 1621.

OBSTRUCTIONS.

Lock in an incompleted stage a menace to navigation; should either be completed or removed. The longer it is left in its "present" state, the more will be the expense for its completion, **04,** 2322.

OPERATIONS.

Begun with hired labor Sept., 1871, **71,** 333; **72,** 341.

1871-72. Scraping on bars; 12,800 c. y. removed, 25¢ to 60¢ y.; logs and stumps removed from chan.; repair of 4 wing dams built by State; list of shoals and work done thereon, **72,** 342.

1872-73. Training wall at Shipleys Shoal begun; quarrying st. and cutting timber, **73,** 458.

1873-74. 7,346 l. f. of dams and training walls built on 3 shoals; 100′ of old dam torn away; chans. scraped 2′ x 50′, two 500′ l. and one 1,300′; 120 trees cut from bank; 62 snags removed from chan., **74,** 338.

1874-75. Repairs at Burds Shoal; 2,075 l. f. of dams built; chans. scraped 2′ x 50′, two 300′ l. each, one 500′, one 1,500′; 112 trees cut from banks; 94 snags removed, **75,** 488, 490.

1875-76. Work abandoned and property sold, **76,** 649.

1878-79. Repairs made on 2 dams; 1,130 l. f. of dam built at Moores Flats, where chan. scraped 50′ x 450′; 906 trees cut from banks; 89 snags removed, **79,** 1044.

1879-80. R. and snag removal at Reynolds Shoal and Devils Elbow; dam strengthened, training wall repaired and extended, and snags removed at Moores Flats; dams and training walls built at Haskins and Burds Shoals, and breach at latter place repaired; chans. dr. at Kirkmans, Packs, and Clarks Isld. Shoals, also dam built at first-named locality; training wall extended and break in dam repaired at Shipleys Shoal, **80,** 1392, 1394.

1880-81. Training walls extended at Shipleys and Burds Shoals; dr. and snag removal at Musics, Saline, and Town Shoals, and dr. at Locketts Isld. Shoal; r. quarried and chan. excavating begun at Moores Flats; break in training wall repaired and bar removed at Kirkmans Shoal; chan. dr. at Rices Shoal; cross dam and training wall built, excavating of chan. begun, and snags removed at Berrys Shoal, **81,** 1586, 1587.

1881-82. Straightening of chute completed, dam and training wall extended, and dr. done at Moores Flats; training wall extended, raised, and repaired, and dr. done at Berrys Shoal; dr. done at Schieless, Clarks Isld., Haskins, and Kirkmans Shoals; 463 snags removed from chan. and 699 trees cut from banks bet. Grand R. and mouth of Osage, **82,** 1656.

1882-83. 313 snags removed, Big Gravois to mouth of Osage, **83,** 1293.

1886-87. 370 snags and 878 trees removed, **87,** 1592.

1888-89. 1,126 l. f. of cross dam and training wall repaired; 110 l. f. of new dam built; 29 snags and 53 r. removed from chan.; work done with hired labor, **89,** 1705, 1706.

1889-90. 12 snags and 3 wreck heaps removed from chan., **90,** 1992.

1891-92. 66 snags removed from chan. and 342 trees cleared from banks, **92,** 1743.

1892-93. About 3,000 snags and other obstr. removed, and 250 l. f. dams built, **93,** 2182, 2184.

1893-94. About 900 obstr. removed, **94,** 1621.

1903-04. Work of mainten. and repair, **04,** 2320.

1904-05. Repairs to plant; assembling material for work au. by approv. of new proj., **05,** 445, 1704.

1905-06. Plant overhauled, and gap left by disappearance of Pier 3 and 20′ of adjacent dam filled in with brush and r.; tops of weirs of dam repaired; roofs of 7 bldgs. recovered, and new cableway and tramway put in working order; cribs built up of 10″ x 10″ timber and filled with st. and clay, piles driven in lower side of each crib, 4,547 c. y. st. used; new cofferdam built to elevation of 114′, or 4′ above that of the old one; repairs to dam, **06,** 1494.

1906-07. Crib dam cut down to elevation of 105′ for 50′, the next 105′ to 106.5′, and the remaining 90′ to 108′; temporary brush dam cut down to 106.5′; R. lock wall strengthened; lower slope and apron, incl. decking and stringers, removed from below sec. 1 and 2, bottom leveled off and crib 120′ l. constr. and sunk in place below sec. 1; sheet piling driven against upper side of crib and st. placed to d. of 3′ therein; entire cofferdam removed; lock and chamber kept free from mud around gates, **07,** 1602.

1907-08. Work consisted in addl. protection to Lock and Pier 1. and to Weirs 6 and 10; barge under constr.; 2,700 c. y. material removed from lock chamber, and lock unwatered; crib dam repaired and plant overhauled; 1,200 c. y. gravel dr. from chan., **08,** 1676.

1908-09. Constr. of Lock and Dam No. 1 continued, as follows: Protection of outer lock wall and piers, dam reinforced throughout, air tanks installed, 36 l. f. Chanoine dam foundation completed, repairs and additions to plant, and numerous shoals dr., **09,** 1669.

1909-10. Constr. of Lock and Dam No. 1 continued by constr. of 664′ cofferdam and 222′ Chanoine dam; 150′ wing dams constr.; 4,787 l. f. wing dams and training walls repaired, 3,938 c. y. dr. from chan., 18 snags and obstr. removed, etc., and plant repaired, **10,** 1834.

1910-11. Plant repaired, and new plant au. under constr. At Lock and Dam No. 1, Chanoine dam practically completed, wickets in place, repairs to lock-keeper's house, building asst. lock-keeper's house, quarters for laborers, and shed for storing machinery; old wooden lock gates destroyed and new steel gates erected instead; snagging, dr., etc., **11,** 2011–13.

1911-12. Lock and Dam No. 1 completed; drum weirs cleaned and slight changes in weirs and wickets made. Lock and dam placed in operation July 1, 1912. Power house for dam completed; lockmaster's old building repainted and repaired, etc.; men's quarters and new storehouse, frame bldg. erected; 5,500 c. y. dr. from R. and placed around various buildings for filling, raising grade to elevation of 126′; water and sewer systems installed in bldgs.; power barge built for maneuvering dam; floating plant repaired, **12,** 2221–22. 80 snags and other obstr. removed from chan., **12,** 2223.

PHYSICAL CHARACTERISTICS.

Described, **73,** 458; **74,** 346; **75,** 494.

Table of shoals, **71,** 332.

Gauge records at Tuscumbia and Warsaw for 1881, **81,** 1593, 1594; **82,** 1661; **83,** 1295; **84,** 1530.

Description of the R., **90,** 1996.

Gauge record, at Tuscumbia, Mo., for 1891, **91,** 2117; 1892, **92,** 1744; **93,** 2185.

Damage by floods, **03,** 1569.

Sharp and unusually high rise of water, **04,** 2321.

New breach made by sudden disappearance of Pier No. 3, and 20′ of adjacent dam, **06,** 1494.

4 rises occurring bet. June 30 and Sept. 1, 1906, took away all work done "to date," and caused suspension of work for long periods, **06,** 1494.

Phenominally high stages of water; flood reaching 128′, or an average d. of over 3½′ over entire reservation, **06,** 1494.

Pier No. 2 totally destroyed by sudden sinking sec. of Dam No. 3, and partial destruction of sec. of Dam No. 2, by high floods, **07,** 1601.

Head of navigation is Warsaw, Mo., 172 m. above mouth. Boats, formerly impeded by shoals, can "now" ascend to head of navigation without interference, **09,** 580.

Several rises interfered with work in R., **10,** 1836.

Heavy rise, 1912, scoured away some r. fill in front of apron crib protection, **12,** 850.

PRIVATE (STATE) WORK.

Missouri built wing dams and dr. at several points, **74,** 339; at an expense of $175,000, with no valuable results, **74,** 345; **75,** 490; **77,** 331.

PROJECTS. (See Estimates.)

By D. Fitzgerald, dr. shoals to give 3′, Roscoe to mouth, 233 m.; cost, $180,000, **71,** 331. Remarks by Lt. Col. Raynolds, **71,** 328, 333; by Col. Simpson, **73,** 460; by Capt. Allen, **74,** 348.

By W. M. Gordon, slack-water navigation by 27 l. and d.; cost, $3,090,825, **75,** 496. Remarks by Col. Simpson, **75,** 491.

Orig. proj. 1871 proposed contracting w. of R. at shoals, by means of cross dams and training walls, dr. chan. by means of teams and scrapers, and removal of r. and snags from chan. and trees from banks, object being to obtain 2′ l.-w. navigation. Est., $230,000, **71,** 328; **86,** 1395.

In 1890 Maj. Miller proposed l. and d. near mouth of Osage, with lift of 10.5′ and w. of 52′; est., $200,000, **90,** 1995; **92,** 1742; making total cost of imp. of R. $430,000, **92,** 1742.

For completion of Lock and Dam No. 1, **05,** 1704.

To close gap with stationary timber dam; approv. by Chief of Engineers, Sept. 22, 1906, **06,** 1494.

Revised proj. for completing l. and d. approv. June 20, 1907, is identical with **R.** and recom. of special BE., Sept. 11, 1906; est., $228,000, as au. act Mar. 2, 1907, i. e.: "Provided that Sec. of War may enter into contract or contracts for such material and work as may be necessary for completion of said proj., to be paid for as app. are made from time to time, not to exceed in the aggregate $160,000, n addition to amounts app.," **08,** 1676.

SURVEYS.

By State Engineer W. M. Morrell, 1840, referred to, **75,** 489.

Au. act July 11, 1870, **70,** 31. Ex. made by D. Fitzgerald, Oct., 1870. **R.,** **71,** 328.

Instrumental sur. of 60 m. of R., 1872, **73,** 458.

For l. and d. imp., 1875, **75,** 489. **R.** of W. M. Gordon, **75,** 493; **R.** of Col. Simpson, **75,** 490.

Sur. of 196 m., Ottawa, Kans., to Osceola, Mo., 1878, **79,** 1044.

Of R., 1881, above Tuscumbia, **81,** 1588.

Of Osage R., Tuscumbia to mouth of Rainey Creek, 1881, **82,** 1662.

Ex. of R., mouth to Osceola, with view to slack-water navigation, by movable l. and d.; made, 1884, by Maj. Ernst (**R.** unfav.), **85,** 1657; and also in 1886 by Maj. Miller (**R.** unfav.), **87,** 1593.

Sur. au. act Aug. 11, 1888; made, 1890, by Maj. Miller, **90,** 1995.

Ex., 1894, pre. to constr. of l. at Brennike Shoal, **94,** 1621.

Pre. ex., with plan and est. of cost of imp. of Osage R., Mo., mouth to mouth of Niangua R., au. act Mar. 2, 1907. **R.** by Capt. Schulz, June 4, 1907, and Jan. 21, 1908; est., $305,000,[1] **08,** 551.

Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 702; **12,** 849.

Maps. **80,** 1394;[1] Chanoine wicket, **11,** 2012.

GG-1517 GASCONADE RIVER, MO.

APPROPRIATIONS.

1880,	$5,000,	**80,** 1461.
1881,	10,000,	**81,** 1660.
1882,	10,000,	**82,** 1731.
1884,	5,000,	**84,** 1540.
1886,	7,500,	**86,** 1397.
1888,	5,000,	**88,** 1448.
1890,	4,000,	**90,** 1990.
1892,	4,000,	**92,** 1740.
1902,	*1,000,	**04,** 2323.
1905,	15,000,	**05,** 1706.
1907,	10,000,	**07,** 1604.
1909,	15,000,	**09,** 1673.
1910,	20,000,	**10,** 1841.
1911,	10,000,	**11,** 2019.
1912	*5,500,	**12,** 2226.
	10,000,	**12,** 2226.
Total,	137,000	(incl. sales, $172,124.31, **12,** 2226).

Gasconade R. (in connection with Mo. R. work; see GG-2):	
Aug. 18, 1894,	5,000
June 3, 1896,	5,000
Mar. 3, 1899,	15,000
June 13, 1902,	10,000
	35,000
Grand total,	172,000

COMMERCE.

Not unimportant, **73,** 480–482.

Transportation by boat afforded shippers, **09,** 581.

In recent years, imp. extended to Gascondy, **11,** 703. C. varies; in 1911, 42,000± t., **12,** 853.

Imp. has influenced rates, by giving regular transportation; no rail facilities, **12,** 853.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 56; **73,** 56; **79,** 127; **80,** 168, 169; **81,** 229; **82,** 226; **83,** 233; **84,** 237; **85,** 254; **86,** 247; **87,** 214; **88,** 194; **89,** 229; **90,** 205; **91,** 261; **92,** 251; **93,** 283; **94,** 259; **03** 409; **04,** 435; **05,** 446; **06,** 488; **07,** 515; **08,** 549, 551; **09,** 580; **10,** 654; **11,** 702; **12,** 851.

In charge:

Lt. Col. W. F. Raynolds, 1872–73; **72,** 56.

Col. J. H. Simpson, 1873. **R.,** **73,** 479.

Maj. C. R. Suter, 1879–85. **R.,** **79,** 127; **80,** 1461; **81,** 1660; **82,** 1731; **83,** 1337; **84,** 1540.

Maj. A. M. Miller, 1885–93. **R.,** **85,** 1637, 1654; **86,** 1396; **87,** 1590; **88,** 1448; **89,** 1703; **90,** 1989; **91,** 2112; **92,** 1739.

Maj. C. J. Allen, 1893–94. **R.,** **93,** 2178; **94,** 1617.

Capt. H. M. Chittenden, 1903–05. **R.,** **03,** 1574; (Maj.) **04,** 2322; **05,** 1705.

Col. J. B. Quinn, 1906. **R.,** **06,** 1497.

Capt. E. H. Schulz, 1907. **R.,** **07,** 1603; **08,** 1679; (Maj.) **09,** 1672; **10,** 1838; **11,** 2016; **12,** 2224.

Assistants:

J. D. McKown. **R.,** **73,** 480.

T. T. Johnston. **R.,** **80,** 1462; **83,** 1338.

J. W. Beaman. **R.,** **88,** 1449; **89,** 1704; **90,** 1990; **91,** 2113; **92,** 1740; **93,** 2180; **94,** 1619.

S. W. Fox. **R.,** **03,** 1575.

W. C. Wrenshall. **R.,** **03,** 1576.

W. R. De Witt. **R.,** **04,** 2323; **05,** 1706; **06,** 1497.

OPERATIONS.

1880-81. Removal of snags and similar obstr. begun, **81,** 1660.

1881-82. Removal of snags continued, **82,** 1731.

1882-83. Removal of snags completed throughout 78 m., **83,** 1337.

1884-85. 194 snags removed; banks cleared; repairs to wing dam, **85,** 1637.

1886-87. 1,888 trees and snags removed, **87,** 1590.

1887-88. 943 l. f. of dam, or training wall, built by hired labor, **88,** 1448.

1888-89. 284 snags and stumps removed from chan. and 446 trees cut from banks, imp. 78 m.; work done by hired labor, **89,** 1703.

1889-90. 65 l. f. of bank revet. laid; 22 log cribs built; 522 l. f. of crib and st. dam built, and 150 snags removed from chan.; work done with hired labor, **90,** 1989.

1890-91. 276 c. y. st. quarried; repairs to plant, **91,** 2112.

* Allotment.

[1] H. D. 960, 60th, 1st.

1891-92. 419 snags removed from chan.; 2,153 trees cleared from banks, **92,** 1741.

1892-93. About 400 snags and other obstr. removed; 3 new dams built and 2 old ones repaired, **93,** 2179.

1893-94. About 1,000 obstr. removed, **94,** 1618.

1903-09. Building and repair of wing dams; wrecks and snags removed, **03,** 1574; **04,** 2322; **05,** 1705; **06,** 1497; **07,** 1603; **08,** 1679; **09,** 1672.

1909-10. Dam at Pryors Mill Chute constr.; general work of snagging, repairs to dams, etc., continued, **10,** 1839.

1910-11. Break in Pryors Mill Dam repaired; general repairs to dams; 2,500 c. y. dr.; 57 snags and other obstr. removed; repairs to floating plant, **11,** 2017.

1911-12. 1,900 c. y. dr.; 392 snags and other obstr. removed from chan. and shore; 667 l. f. extension to dams; 1,034 l. f. new dams built; 150 l. f. repairs to dams, **12,** 2224.

PHYSICAL CHARACTERISTICS. (See Projects.)

Description, **73,** 480–482; **80,** 1462.

Fall of R. bed, **73,** 480, 481; disappearance of water under the bed; remarkable "boiling spring," **73,** 481.

Total l. of R., with trib., about 200 m. Average slope, Gascondy to mouth (62 m.), 1.23′ per m. Navigable to Arlington (107 m.), and for tie and log rafting a considerable distance above. **12,** 851.

Empties into Mo. R. at Gasconade, about 32 m. below mouth of Osage R.

PLANS.

Imp. with l. and d. not considered advisable, **73,** 480–482.

PRIVATE WORK.

Au. granted to 3 interested farmers for driving piles for bank protection along their R. fronts, on left bank, in vicinity of Pryors Mill Bend. Piles braced, and filled in rear with brush and st., to prevent bank erosion and change of chan., **10,** 1839.

PROJECTS.

By J. D. McKown, removing snags, r., overhanging trees, and wing dams; est., $22,979.87. Approv. by Col. Simpson, **73,** 480–482.

By Maj. Suter, 1880, mouth to Vienna, 78 m., removing snags and similar obstr.; est., $50,000, **80,** 1466; **91,** 2112.

Proj. contemplates mainten. and relief from year to year and removal of obstr., the latter constantly forming, **12,** 852.

Farmers submitted petition to open Pryors Mill Chute, to make main chan. Informal public hearing held, **10,** 1839.

Prior to 1903 this work taken up by Mo. R. Comm., and indexed as Part G., Mo. R.

SURVEYS.

Sur. by J. D. McKown, **73,** 56, 479, 480.

Au. act Mar. 3, 1879; made, 1880, by Maj. Suter, **80,** 1461.

Pre. ex., mouth to Gascondy, au. act Mar. 2, 1907. **Rs.,** Col. Quinn, June 4, 1907, and Capt. Schulz, Feb. 24, 1908; est., $110,000,[1] **08,** 551.

Ex. and sur., Gascondy to Arlington, au. act June 25, 1910 (to be made), **12,** 857.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 852.

[1] H. D. 829, 60th, 1st.

RIVER AND HARBOR WORKS.

HH.—MISSISSIPPI RIVER.

INDEX TO REPORTS.

CHIEF OF ENGINEERS, UNITED STATES ARMY,
1866–1912.

HH.—MISSISSIPPI RIVER.

Part (a), HH-1 Plan of Presenting Data.

The works of improvement on the Mississippi River cover so many diverse points and stretches, in various engineering districts, and so many periods embraced in almost one hundred years, that, for the sake of affording a clear, connected, and comprehensive outline of the reports rendered by many engineers concerning the waterway system, all such reports are here brought together into one special group known as Group HH. This lettering corresponds to U. S. waterway groups in the vicinity of St. Louis, Mo., and this selection of grouping has been made in preference to a lettering corresponding to the mouths of the river, for the reason that St. Louis may be considered more or less central to the Mississippi system.

A list of the notable points on the river, both banks, is printed on p. 1097, running from the mouth toward the headwaters, and each of these points has received a number accordingly. The abstracts of data cover either points or stretches. An abstract concerning a point is, of course, given the number of that point in the list. An abstract concerning a stretch is given the number pertaining to the first point on the stretch (proceeding upstream).

A special finding list to all the points or locations and stretches named under HH is provided on p. 1071, and in addition, of course, these points are listed in the general finding list at the back of this index.

A special or general summary of data concerning the river is printed on p. 1081. This indicates also the pages of this index whereon may be found special data concerning commerce, contracts, legislation, operations, etc. There is a special list of engineers.

The funds set aside for the river by Congress are printed on p. 1089. Special care has been taken to classify these appropriations in a simple form, so far as that may be done.

The data abstracted concerning the various works of improvement are grouped generally under the following headings:

Appropriation.
Commerce.
Engineers.
Obstructions.
Operations (from year to year).
Physical characteristics.
Projects.
Surveys, etc.

(For a definition of the matter groupable under the foregoing subheads, see p. 21.)

HH-1.—MISSISSIPPI RIVER.

Part (b) Contents.

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HH 1...(b)	Contents		1069
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HH 1...(d)	General summary of fact concerning the Mississippi R		1081
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HH 1...(f)	List of notable points on the R., from mouths to headwaters—the abstracts of data concerning works on the R. being arranged according to this list, each abstract being printed in the list at the number belonging to it. The list following is of the abstracts so printed, with their numerical designation.		1097

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[1] Surveys of R. 1765, 1770, and 1826. See p. 1162 of this index and 93, 3708.
[2] Refers to pages of this index; not of An. Rs., Chief of Engineers.

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[1] Refers to pages of this index; not of An. Rs., Chief of Engineers.

HH-1.—MISSISSIPPI RIVER.

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HH-1.—MISSISSIPPI RIVER.

Part (d) General Data.

APPROPRIATIONS.

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COMMERCE.

The general effect of improvement of the river has been to aid commerce. At 1912 there was a marked increase in the tonnage reported for New Orleans (q. v.); at Vicksburg and Yazoo R. freight rates had been reduced markedly, in some cases as much as over 66%, the rates to inland points having no water competition indicating these savings also. The effect of the reservoir system on rates has been considerable. Without the reservoirs considerable steamboating would be impracticable. Also, railroad freight from St. Paul to St. Louis, 600 m., is only 5% higher than the rate from St. Paul to Chicago, 400 m.; in addition, steamboat freight rates to river points below St. Paul are in general about one-third lower than those of the railroads. Some portion of this reduction is directly attributable to the reservoir system. In portions of the headwater course there are no railroads, so that the adjacent communities are dependent upon the river for traffic movement. It is not claimed that river improvements are solely responsible for the lower rates on traffic, but there is clear evidence that if the waterway formed by the river did not exist the rail rates would be markedly higher.

Many large and important tributaries of the Mississippi R. are dependent on the latter for an outlet for considerable of their commercial traffics.

The works of improvement pertaining to levees and embankments have a large beneficial effect in developing and protecting a vast number of square miles of territory; without such works and their maintenance there would be a tremendous increase in the damage coming annually from floods.

See each abstract listed on p. 1069.

CONTRACTS.

See each abstract listed on p. 1069.

A considerable portion of the work on the river is done by the district offices with their own men and plant. At times, however, contracts are entered into for material and equipment.

DOCUMENTS.

See each abstract listed on p. 1069.

For important special reports see Surveys and also Engineers. Almost every important piece of river and harbor work on the Mississippi R. is reported on in the annual reports of the Chief of Engineers. Data contained in congressional reports, if not printed in the annual reports referred to, are mentioned in them.

ENGINEERS.

(**Offices.** War Department, Washington, D. C. New Orleans, La.; Vicksburg, Miss.; Memphis, Tenn.; St. Louis, Mo.; Rock Island, Ill.; and St. Paul, Minn.)

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LEGAL PROCEEDINGS.

See each abstract listed on p. 1069.

LEGISLATION.

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MAPS.

See each abstract listed on p. 1069.

OBSTRUCTIONS.

See each abstract listed on p. 1069.

OPERATIONS.

See each abstract listed on p. 1069.

It would be impracticable to give these in minute detail from year to year. The general nature of the operations are outlined and only the more important points are named.

PHYSICAL CHARACTERISTICS.

See each abstract on p. 1069.

The mouth has several outlets or passes. Prior to improvement these were obstructed by bars, allowing of depths of only 9′ or so at mean low Gulf level. The widths varied. The width of South Pass, 1912, was 530′ to 850′; of Southwest Pass, 1,200′ to 2,400′.

Above the Passes the river has a well-known character. It is susceptible to floods, which injure its natural and artificial banks or levees, permitting the flooding at times of the surrounding areas for miles. The channel is tortuous. There are many bends, and sometimes the channel cuts across these. Prior to the work of snagging and wreck removal operations, the river was seriously obstructed by numerous snags, logs, etc., and wrecked boats, of all kinds, menacing life and property. There are many islands and bars, helping to form chutes, sloughs, and secondary channels.

The river is navigable for steamboats in one stretch from its mouth to St. Paul, 1,940 m. This portion of the waterway, added to that above St. Paul, to the head or source in Lake Itasca, Minn., makes a total mileage of 2,440 m.

Various locks and dams have been constructed, notably at Des Moines Rapids, Rock Island Rapids, between St. Paul and Minneapolis, and at the headwater lakes, the latter for governing reservoir supply for the river.

A reservoir system, already mentioned, is in process of evolution, for the purpose of improving the navigable depths of the river, principally above Lake Pepin. In 1880 this called for the construction of 41 reservoirs in Winconsin and Minnesota. Through the dams already built commerce has been aided in low-water seasons and floods mitigated, this set of benefits being felt more directly on the stretches from St. Paul downward.

Changes in river bed: A great flood in the Mississippi River always brings out a variety of opinions as to the causes of the floods and suggestions as to how the disasters that attend them may be avoided. The cause of the floods is frequently attributed to the elevation of the river bed due to the construction of levees. The Mississippi River Commission has established the fact that there has been no progressive elevation of the bed of the river. **12,** 3717.

Outlets: The following is taken from **12,** 3717: "A popular solution of the flood problem is the 'outlet' plan. To any other system (than levees) for the protection of these alluvial lands there are objections, both theoretical and practical, which can not be overcome. Those of a theoretical character are connected with the hydraulic law that a reduction of flood discharge in a silt-formed channel will reduce its capacity below the point of outlet. This observation has been repeated in the many local comparative surveys of the river bed made by the commission before and after crevasses, or before and after rebuilding the levee made necessary by a crevasse. The difficulties of a practical nature consist of the necessity of continuing any outlet to the Gulf without return to the river at any intermediate point. Such return would merely transfer the danger from one locality to another lower down. The condition thus imposed upon any outlet involves great cost and danger. Any outlet intended to relieve the parts of the river where flood heights are now most dangerous would, in any case, be very long. To have an appreciable effect it would require an excavated channel of large width and depth. As it would traverse tracts of cultivated and valuable land, the cost of expropriation of a right of way would be very great. The cost of the levees which would be required to control it and prevent the permanent continuation of disaster and overflow while flowing through regions which will in a few years be placed under the sufficient protection of a levee system would be very much greater.

"When completed, there would be two or more rivers, each presenting the same dangers and requiring the same treatment as the present single channel. The cost of efficient outlets would be greater than the cost of completion of the levee system. When constructed they would either silt up, as do many island chutes, or would enlarge and assume the tortuous type of an alluvial stream with shifting bars and caving banks. Finally, conceived and executed in defiance of physical law, they would fail as a safe, cheap, or efficient method of abating overflow.

"After a review of the progress thus far made in the improvement of a levee system and of the facts developed by the continued surveys, gagings, and observations of the river, such as the entire absence of evidence of any rise of the bed of the river, the local tendency to shoal where volume is reduced, and the larger discharge now controlled between levees, with an increase of flood heights which does not affect the practicability of a levee system, the commission[1] expresses its continued confidence in the reclamation from overflow of the alluvial lands of the lower Mississippi Valley on the lines now proposed and in progress, as entirely practicable, at a cost which is amply justified by the importance of the undertaking.

"The experiences of late years do not justify any material departure from the views thus expressed.

"It is evident that an outlet to be effective must be such as to carry the outflow to the Gulf and not return the water to the main stream at some point lower down. The highest point that will satisfy this condition is the mouth of Red River, 765 miles below Cairo, and an outlet at that point would give no relief to the many miles above it. The damage by the flood wave would be done before the point of relief could be reached.

"Waste weirs have been suggested for the Mississippi below Red River to carry off a volume of the flood equal in depth to the height of the levees, with sufficient width to deliver a large percentage of the overbank flow. There is no available site for such a structure above Bonnet Carre. This is so far down toward the end of the delta that a comparatively small area would be benefited thereby, and the general objections to outlets cited in the commission[1] report quoted are largely applicable here as well."

PLANS.

See each abstract listed on p. 1069.

PRIVATE WORK.

See each abstract listed on p. 1069.

PROJECTS.

See each abstract listed on p. 1069.

At Southwest Pass, the project is for depth of 35′, m. l. w., and width of 1,000′, leading to the lower part of the river.

The lower part of the river, from Head of Passes to above Cairo, is under the special care of the Mississippi River Commission. The orig. project of the commission, Feb. 17, 1880, contemplated gaining and holding a 10′ chan. at extreme low water. After studies and experiments of years the proj. was modified to seek temporary imp. of the low-water chan. embracing not less than 9′ depth and a navigable chan. 250′ w. At 1912, the following was esteemed the work of the commission:

1. Continuation of surveys; preparation and publication of maps; maintenance of gauges; the recording, tabulation, and publication of gauge readings; the taking and recording of discharge measurements at high and low stages of the Mississippi River and its tributaries; examinations and investigations relative to proposed separation of the waters of Red and Atchafalaya Rivers from those of the Mississippi; and other observations.

2. The building, extension, and repair of levees.

3. The building, maintenance, and operation of dredge boats.

4. The repair and extension of existing works for the improvement of the channel, the preservation of harbors, the prevention of cut-offs, and the security of levees.

5. The maintenance of a low-water channel between the Mississippi, Red, and Atchafalaya Rivers.

6. Other miscellaneous details incident to the execution of the general project.

Levees: The following is taken from **12**, 3718: "For convenience in administration and the allotment of funds for levee purposes, the river front has been divided by the commission[1] into levee districts. The names and locations of these districts, as now established by the commission, are as follows:

"1. The district on the right bank from the vicinity of Cape Girardeau, Mo., 54.5 miles above Cairo, to New Madrid, Mo. (71),[2] called the upper St. Francis levee district.

"2. The district on the left bank from Hickman, Ky. (36), to Slough Landing, Tenn., (60), called Reelfoot levee district.

"3. The district on the right bank extending from the vicinity of New Madrid, Mo. (79), to the mouth of the St. Francis (298), called lower St. Francis levee district.

"4. The district on the left bank extending from just below Memphis (244) to the Bolivar-Coahoma County line (365), called upper Yazoo levee district.

"5. The district on the left bank extending from the Bolivar-Coahoma County line (365) to mouth of the Yazoo (599), called lower Yazoo levee district.

"6. The district on the right bank extending from Helena (306) to White River (385), called White River levee district.

"7. The district on the left bank from the mouth of Yazoo R. (599) to Baton Rouge (833), called the Homochitto levee district.

"8. The district on the right bank extending from Arkansas River (402) to opposite Warrenton, Miss. (606), called upper Tensas levee district.

"9. The district on the right bank extending from opposite Warrenton, Miss. (606), to mouth of Red River (764), including Palmyra Island, called lower Tensas levee district.

"10. The district on the right bank extending from Red River (764) to Bayou Lafourche (885), called Atchafalaya levee district.

"11. The district on the right bank extending from Bayou Lafourche (885) to Orleans levee district (968), called Lafourche levee district.

"12. The district on the right bank extending from Orleans levee district (982) to the Gulf (1060), called Barataria levee district.

[1] Mississippi River Commission.

[2] Numerals in parentheses are miles below Cairo.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

"13. The district on the left bank extending from Baton Rouge (833) to Orleans levee district (960), called Pontchartrain levee district.

"14. The district on the left bank extending from Orleans levee district (972) to the Gulf (1060), called Lake Borgne levee district.

"The following table * * * * * shows the 'present' condition of the levees * * *:

Levee district.	In system.	Built.	Contents, 1911.	Built since by United States.	Built since by local authorities.	Total built since 1911.
	Miles.	*Miles.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
Upper St. Francis	90.00	55.00	3,448,722	372,902	77,640	450,542
Lower St. Francis	212.00	207.50	26,016,396	484,333	583,601	1,067,934
White River	74.00	74.00	11,346,107	291,732	53,000	344,732
Reelfoot	21.00	21.00	1,713,458	12,826	None.	12,826
Upper Yazoo	98.50	98.50	30,634,397	None.	None.	None.
Lower Yazoo	207.60	188.00	44,703,267	420,260	391,008	811,268
Upper Tensas	192.90	189.01	39,321,789	325,542	1,328,738	1,654,280
Lower Tensas	157.54	150.10	24,647,388	489,705	173,448	663,153
Atchafalaya	127.22	126.50	22,362,015	265,188	483,600	748,788
Lafourche	82.23	81.47	9,772,443	None.	142,893	142,893
Barataria	71.88	71.88	3,715,665	130,770	34,700	165,470
Pontchartrain	125.78	125.78	18,942,560	None.	131,880	131,880
Lake Borgne	78.10	78.09	4,416,321	51,494	84,071	135,565
Total	1,538.75	1,466.83	241,040,518	2,844,752	3,484,579	6,329,331

Levee district.	Lost or abandoned during the year.	Contents, 1912.	Required to complete.	Estimated final contents.	Per cent now built.	Approximate area protected.
	Cu. yds.	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*		*Sq. mi.*
Upper St. Francis	170,850	3,728,414	7,270,690	10,999,104	33.9	700
Lower St. Francis	394,848	26,689,482	4,846,514	31,535,996	84.6	3,500
White River	140,100	11,550,739	5,319,504	16,870,243	68.5	910
Reelfoot	60,032	1,666,252	1,001,294	2,667,546	62.4	310
Upper Yazoo	None.	30,634,397	Completed.	30,634,397	100.0	3,281
Lower Yazoo	1,134,000	44,380,535	11,196,000	55,576,535	79.9	3,367
Upper Tensas	1,348,000	39,628,069	10,328,000	49,956,069	79.3	2,500
Lower Tensas	181,308	25,129,233	4,888,051	30,011,284	83.7	2,080
Atchafalaya	650,611	22,460,292	3,312,027	25,772,319	87.1	6,085
Lafourche	128,000	9,787,336	1,706,351	11,493,687	85.2	2,020
Barataria	54,230	3,826,905	1,194,034	5,020,939	76.2	
Pontchartrain	None.	19,074,430	2,445,991	21,520,421	88.6	1,816
Lake Borgne	41,800	4,510,086	1,291,953	5,802,039	77.7	
Total	4,303,679	243,066,170	54,794,409	297,860,579	81.6	26,569

"The 'estimated final contents' of the levees given above is based on grades and sections, as provisionally established by the commission.

"In addition to the levee districts given in the foregoing table, there is the Homochitto levee district, established by the commission in 1894, extending on the left bank from mouth of the Yazoo River to Baton Rouge. Surveys were made of portions of this district in 1895 and in 1910, but no levee work has ever been done in it by the commission.

"Under the joint resolution of Congress approved April 30, 1912, the commission contemplates closing crevasses in such levees as exist in this district.

"The commission established a provisional grade, based on previous high-water records, to which the levees should be built. The ultimate grade necessary to safely pass the maximum flood can only be reached by observing the effect of successive floods, as the levee system becomes more and more effective in flood control. The provisional-grade line has always been well above the flood line and also well in advance of the levee heights possible with the funds placed at the disposal of the commission. The flood of 1912 gives new data for fixing a standard high water and determining a higher provisional-grade line.

* * * * *

"The development of the levee system has been carried on by both the Government and the several levee boards as rapidly as available funds would permit, but the top of the levee is still below the provisional grade for 586 miles of its length and the levee is deficient in the cross section contemplated for a large part of the entire line.

Effect of flood of 1912 on levee system, etc.

Levee district.	Length of levee destroyed.	Areas of land overflowed.	Length of levee protected by sacks, etc.	Areas of land saved from overflow by levees.	Cost of high-water protection to United States.	Length of levee below commission grade.
	Linear feet.	*Sq. miles.*	*Miles.*	*Sq. miles.*		*Miles.*
Upper St. Francis	[1] 21,987	429	11.1	271		25
Lower St. Francis	[2] 15,695	2,790	38.6	710		84.95
White River	6,595	850	18.5	60	$121,482.42	60.40
Reelfoot	5,550	310	18.2	0		14.4
Upper Yazoo		0		3,281		None.
Upper Tensas	7,325	1,498	126.0	260	172,709.62	125.0
Lower Yazoo	3,200	2,270		644		109.5
Lower Tensas			16.1		40,732.52	43.38
Deer Park (722 R)	700					
Union Point to Point Breeze (742–755 R)	1,910					
Atchafalaya			3.1		15,235.96	5.84
Torras (763 R)	3,800	1,343		5,588		
Lafourche			.4		14,153.35	9.01
Hymelia (930 R)	4,000	1,320				
Barataria			4.6		16,432.36	49.20
Lake Borgne			3.1		15,207.99	58.88
Cannon (1020 L)	60	2				
Pontchartrain					21,395.03	1.12
Giles Bend					3,304.57	
Homochitto district					2,126.00	
Bayou Sara					3,250.43	
Atchafalaya River					3,921.78	
Bayou des Glaises					26,722.48	
	70,822	10,812	239.7	10,814	456,674.51	586.68

[1] Includes all damage to small levees north of Birds Point, Mo.
[2] Includes levee destroyed at Point Pleasant this year by further caving.

"In addition to the sums given in the above table of cost of high-water protection, large amounts were also expended by the several levee boards, the total of which is not available.

"The following statement shows the estimated damages to property and other losses, exclusive of evees, due to the flood of 1912:

First and second districts	$6,569,623
Third district	11,345,000
Fourth district	25,000,000
	42,914,623

"The estimate for the fourth district is lacking in detailed information and should be regarded as a rough approximation which is probably too high. Furthermore, the total damage cited is by no means all due to breaks in the controlling levee system, but also covers damages in localities not protected by such levees."

Ohio R. upward: In the section immediately above the mouth of the Ohio the effort is to gain and hold 8′ d. below St. Louis, and 6′ above that point, by confining the flow of the river to a single chan. about 2,500′ w. at bankful stage, by closing sloughs and secondary channels, and by building out new banks where the natural w. is excessive.

As mentioned under Physical Characteristics, a reservoir system is in progress of construction for collecting surplus water at various seasons, to be released systematically during low water.

Above Minneapolis the channel is obstructed at places by power dams, but at suitable stretches there is an effort to gain and hold a navigable depth of about 4′.

There is systematic removal of wrecks, snags, and other obstructions.

SURVEYS.

See each abstract listed on p. 1069.

See also the work of the Mississippi River Commission, above, in Projects.

MAPS.

See each abstract listed on p. 1069.

HH-1.—MISSISSIPPI RIVER.

Part (e) Appropriations.

The sums set aside by Congress for the Mississippi River have been specified in so many ways throughout a period of almost a hundred years that it has been deemed more practical to assemble all the items, so far as they can be found, into one group, as below, rather than to attempt to assign the appropriations to any particular part or parts of the abstracts pertaining to the river.

The amounts and classifications in the following tables have been obtained from three principal sources—Treas. Doc. 373, 1882; H. D. 421, 57th, 2d; and from the annual reports of the Chief of Engineers:

GRAND SUMMARY OF APPROPRIATIONS.

General improvement, 1819–1912	$10,271,488.01
Mouths to Ohio R., 1829–1912	91,723,542.57
Ohio R. to vicinity of St. Paul (Minneapolis, etc.), 1836–1912	44,064,858.10
Vicinity of St. Paul (Minneapolis, etc.), at and above, 1870–1912	2,933,067.13
Grand total, 1819–1912	148,992.955.81

RECAPITULATION—TABLES OF APPROPRIATIONS.

Table.	Title.	Period.	Total.
	GENERAL IMPROVEMENT. (See No. 43 below.)		
1	Western tributaries of Miss. R.	1819–1820	$11,000.00
2	Mississippi and Ohio Rs	1820–1838	644,040.68
3	Miss., Mo., and Ohio Rs	1832–1837	223,000.00
4	Miss. and Mo. Rs	1836–1838	100,000.00
5	General imp.	1837–1868	250,000.00
6	Miss., Mo., Ohio, and Ark. Rs	1842–1866	1,130,000.00
7	Snag boats and dredges, operation	1867–1912	1,123,975.00
8	Miss., Mo., and Ark. Rs	1870–1882	1,455,000.00
9	Gauging, including "at or near St. Paul"	1876–1912	240,716.67
10	Miss. and Ark. Rs	1878	170,000.00
11	Snags and wrecks	1884–1912	2,273,755.66
12	Experimental towboats	1912	500,000.00
13	Levees (Miss. R. and tributaries)	1912	650,000.00
14	Levees (Miss. R. and tributaries), flood repairs	1912	1,500,000.00
	Total		10,271,488.01
	MOUTHS TO OHIO RIVER.[1]		
15	Passes	1829–1902	2,510,681.00
16	Pass a Loutre and Southwest Pass	1856	330,000.00
17	Gulf of Mexico to Ohio R	1874	25,000.00
18	South Pass, Eads contract	1875–1901	8,000,000.00
19	South Pass, ex. and sur	1875–1912	377,336.48
20	Southwest Pass	1873–1912	8,739,988.53
21	Head of Passes to Ohio R. (and surs. to headwaters)	1878–1912	69,847,676.28
22	Pass a Loutre	1897	240,000.00
23	South Pass, mainten	1900–1912	1,562,860.28
24	Walnut Bend, Ark., levees	1902	90,000.00
	Total		91,723,542.57

[1] See p. 1166 for item of $10,000 for sur. "Transportation Routes, etc."; p. 1168, for Yazoo R.; p. 1186, allotment, 'Transportation Routes, etc."

RECAPITULATION—TABLES OF APPROPRIATIONS—Continued.

Table.	Title.	Period.	Total.
	OHIO RIVER TO MINNEAPOLIS, MINN.		
25	Ohio R. to Missouri R.	1836–1912	$9,221,599.99
26	Des Moines R. to St. Paul	1844–1899	3,149,250.00
27	Ohio R. to St. Paul	1852–1896	565,000.00
28	Ill. R. to Des Moines R	1856–1890	6,380,950.00
29	Mo. R. to Ill. R.	1872	25,000.00
30	Mo. R. to Meramec R.	1872	100,000.00
31	Des Moines R. to Minneapolis	1888–1890	1,100,000.00
32	St. Paul to Minneapolis	1873–1912	1,891,722.33
33	Ohio R. to Ill. R.	1874–1890	4,085,000.00
34	Ohio R. to Des Moines Rapids	1878	100,000.00
35	Des Moines Rapids, canal, dry dock, operating and care	1882–1912	1,348,103.88
36	Ohio R. to Minneapolis	1892–1895	5,900,000.00
37	Missouri R. to St. Paul	1897–1912	9,730,000.00
38	St. Louis to Lockport, Ill.	1902–1905	25,093.40
39	Moline H., Ill.	1905–1907	386,000.00
40	Moline, Ill., operating and care of locks	1908–1912	43,137.92
41	St. Paul to Minneapolis, locks and dams, operating and care	1908–1912	13,000.57
	Total		44,064,858.10
	MINNEAPOLIS, MINN., AT AND ABOVE.		
42	Falls of St. Anthonys, at and above	1870–1912	723,000.00
43	Reservoir system, headwaters (see N. 14)	1879–1912	1,762,699.04
44	Reservoir system, headwaters, operating and care	1895–1912	405,812.13
45	Brainerd to Grand Rapids	1910–1912	41,555.96
	Total		2,933,067.13
	Grand total		[1]148,992,955.81

APPROPRIATIONS—GENERAL IMPROVEMENT.

Table 1.—Western tributaries of the Mississippi R. and its tributaries nw. of Ohio R., sur. of:

Feb. 15, 1819,	$6,500.00	
Apr. 14, 1820,	4,500.00	
		$11,000.00

Table 2.—Mississippi and Ohio Rs.:

Apr. 14, 1820,	$5,000.00	
May 24, 1824,	75,000.00	
May 23, 1828,	50,000.00	
Mar. 3, 1829,	50,000.00	
Apr. 23, 1830,	50,000.00	
Mar. 2, 1831,	200,000.00	
June 30, 1834,	6,240.63	
July 2, 1836,	77,800.05	
Mar. 3, 1837,	60,000.00	
July 7, 1838,	70,000.00	
		644,040.68

Table 3.—Mississippi, Missouri, and Ohio Rs.:

July 3, 1832,	$50,000.00	
Mar. 2, 1833,	50,000.00	
June 28, 1834,	50,000.00	
Mar. 3, 1835,	50,000.00	
Mar. 3, 1837,	23,000.00	
		223,000.00

Table 4.—Mississippi and Missouri Rs.:

July 2, 1836,	$40,000.00	
Mar. 3, 1837,	40,000.00	
July 7, 1838,	20,000.00	
		100,000.00

Table 5.—General improvement:

Mar. 3, 1837,	$210,000.00	
July 25, 1868,	40,000.00	
		$250,000.00

Table 6.—Mississippi, Missouri, Ohio, and Arkansas Rs.:

Aug. 23, 1842,	$100,000.00	
Mar. 1, 1843,	150,000.00	
June 11, 1844,	180,000.00	
Aug. 30, 1852,	150,000.00	
June 23, 1866,	550,000.00	
		1,130,000.00

Table 7.—Snag boats and dredge boats on upper R., operation of:

Mar. 2, 1867,	$96,000.00
July 25, 1868,	26,000.00
Apr. 10, 1869,	35,640.00
July 11, 1870,	36,000.00
Mar. 3, 1871,	42,000.00
June 10, 1872,	42,000.00
Mar. 3, 1873,	25,000.00
June 23, 1874,	25,000.00
Mar. 3, 1875,	25,000.00
Aug. 14, 1876,	30,000.00
June 18, 1878,	41,500.00
Mar. 3, 1879,	20,000.00
June 14, 1880,	8,000.00
Mar. 3, 1881,	25,000.00
Aug. 2, 1882,	25,000.00
Aug. 5, 1886,	22,500.00
Aug. 11, 1888,	25,000.00

[1] See p. 1166 for $10,000 additional sur., "Transportation Routes, etc."; p. 1168 for $1,253,000, Yazoo R. mouth; allotment, p. 1186, "Transportation Routes, etc."

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Table 7.—Snag boats and dredge boats on upper R., operation of—Continued.

Fiscal year ending June 30 [1]—		
1890,	$25,000.00	
1891,	25,000.00	
1892,	25,000.00	
1893,	25,000.00	
1894,	25,000.00	
1895,	25,000.00	
1896,	25,000.00	
1897,	25,000.00	
1898,	25,000.00	
1899,	25,000.00	
1900,	24,944.00	
1901,	25,000.00, **01,** 2232	
1902,	25,000.00, **02,** 1610	
1903,	25,000.00, **03,** 1464	
1904,	25,000.00, **04,** 2156	
1905,	25,000.00, **05,** 1608	
1906,	25,000.00, **06,** 1414	
1907,	25,000.00, **07,** 1557	
1908,	25,000.00, **08,** 1628	
1909,	25,000.00, **09,** 1618	
1910,	25,000.00, **10,** 1774	
1911,	24,391.00, **11,** 1932	
1912,	25,000.00, **12,** 2142	
		$1,123,975.00

Table 8.—Mississippi,[2] Missouri, and Arkansas Rs.:

July 11, 1870,	$150,000.00	
Mar. 3, 1871,	150,000.00	
June 10, 1872,	90,000.00	
Mar. 3, 1873,	100,000.00	
June 23, 1874,	100,000.00	
Mar. 3, 1875,	100,000.00	
Aug. 14, 1876,	90,000.00	
Feb. 7, 1878,	40,000.00	
Mar. 3, 1879,	160,000.00	
June 14, 1880,	165,000.00	
Mar. 3, 1881,	160,000.00	
Aug. 2, 1882,	150,000.00	
		1,455,000.00

Table 9.—Gauging, including principal tributaries:[3] 12, 2731.

1871–1875,	*$25,000, **12,** 3731.	
Aug. 14, 1876,	5,000.00	
June 18, 1878,	5,000.00	
Mar. 3, 1879,	5,000.00	
June 14, 1880,	5,000.00	
Mar. 3, 1881,	5,000.00	
Aug. 2, 1882,	5,000.00	
Mar. 12, 1884,	2,100.00	
July 5, 1884,	5,000.00	
Aug. 5, 1886,	5,000.00	
Aug. 11, 1888,	*8,700.00	
Oct. 19, 1888,	3,600.00	
Fiscal year ending June 30—[4]		
1890,	8,323.53	
1891,	5,761.96	
1892,	6,269.23	
1893,	5,929.67	
1894,	6,092.22	
1895,	6,023.37	
1896,	5,854.19	
1897,	6,000.00	

Table 9.—Gauging, including principal tributaries—Continued.

1898,	$5,998.39	
1899,	6,001.61	
1900,	5,470.19	
1901,	5,265.96, **01,** S., 24	
1902,	5,885.82, **02,** S., 22	
1903,	7,878.64, **03,** S., 33	
1904,	6,987.94, **04,** S., 32	
1905,	9,749.99, **05,** S., 31	
1906,	7,750.86, **06,** 2489	
1907,	7,189.00, **07,** 2631	
1908,	8,609.26, **08,** 2663	
1909,	8,338.68, **09,** 2666	
1910,	8,735.60, **10,** 2945	
1911,	8,744.71, **11,** 3192	
1912,	8,456.45, **12,** 3732	
		[5] $240,716.67

Gauging at and near St. Paul, Minn., 12, 2192:

For fiscal year ending June 30 [6]—

Table 10.—Mississippi and Arkansas Rs.:

June 18, 1878,	$180,000.00 [7]	170,000.00

Table 11.—Snags and wrecks, removal of:

July 5, 1884,	$75,000.00	
Aug. 5, 1886,	56,250.00	
Aug. 11, 1888,	100,000.00	
Fiscal year ending June 30—		
1890,	49,089.17	
1891,	92,720.97	
1892,	98,250.00	
1893,	96,497.23	
1894,	88,252.46	
1895,	100,000.00	
1896,	80,496.26	
1897,	83,421.64	
1898,	88,915.27	
1899,	88,925.62	
1900,	86,355.29	
1901,	86,710.05, **01,** 2168	
1902,	92,639.67, **02,** 1596	
1902,	415.60, **03,** 1442	
1903,	72,587.48, **03,** 1443	
1904,	88,245.25, **04,** 2127	
1905,	81,822.81, **05,** 1586	
1906,	85,662.36 {**06,** 1402, **10,** 1754	
1907,	85,669.59, **07,** 1538	
1908,	97,889.35, **08,** 1613	
1909,	100,021.03, **09,** 1596	
1910,	96,782.04, **10,** 1754	
1911,	103,157.94, **11,** 1901	
1912,	97,978.58, **12,** 2110	
		2,273,755.66

Table 12.—Experimental towboats:

1910,	$500,000.00, **12,** 1290	500,000.00

* Allotments.

[1] From allotment from permanent app. under act Aug. 11, 1888.

[2] See Arkansas R., Ft. Smith, and obstructions, p. 819.

[3] Allotments amounting to $25,000 made 1871–1875 from general appn. for ex. sur. and contingencies of rivers and harbors. Gauge work trans. Feb. 11, 1901, to secretary of Miss. R. Commission au. Sec. of War, Jan. 25, 1901.

[4] Expenditures from allotment of $9,000 au. from permanent indefinite appn. sec. 6, R. and H. act Aug. 11, 1888. 1891–1902 these allotments governed by Treas. ruling that only $6,000 could be expended each fiscal year.

[5] Given as $246,681.66 at **12,** 3731, which includes $25,000 allotted 1871–1875 and other allotments.

[6] Paid from allotments of about $500 au. from $9,000 referred to in footnote 4 to table preceding.

[7] $10,000 of this included under Arkansas R., Ft. Smith. See p. 819.

Table 13.—Maintaining and protecting levees (Miss. R. and tributaries):

Apr. 3, 1912, $350,000.00 } Apr. 16, 1912, 300,000.00 } **12,** 3732		
	650,000.00	$650,000.00

Table 14.—Rebuilding levees of Miss. R. and tributaries; damaged by floods:

Apr. 30, 1912, $1,500,000.00, **12,** 3733		$1,500,000.00
Grand total,		10,271,488.01

APPROPRIATIONS—OHIO RIVER TO MOUTH.

Table 15.—Mouths or passes:

Mar. 2, 1829,	[1] $500.00	
July 4, 1836,	75,000.00	
Sept. 30, 1850,	[1] 50,000.00	
Aug. 30, 1852,	75,000.00	
Aug. 31, 1852,	[1] 50,000.00	
June 23, 1866,	75,000.00	
Mar. 2, 1867,	200,000.00	
July 25, 1868,	50,000.00	
Apr. 10, 1869,	85,181.00	
July 11, 1870,	300,000.00	
Mar. 3, 1871,	125,000.00	
June 10, 1872,	155,000.00	
Mar. 3, 1873,	125,000.00	
Apr. 3, 1874,	30,000.00	
June 23, 1874,	[2] 155,000.00	
Mar. 3, 1875,	250,000.00	
Aug. 14, 1876,	100,000.00	
Mar. 3, 1899,	[3] 200,000.00	
June 6, 1900,	[3] 300,000.00	
June 6, 1900,	[4] 25,000.00	
June 6, 1900,	[5] 10,000.00	
June 13, 1900,	[6] 75,000.00	
	2,510,681.00	$2,510,681.00

Table 16.—Pass a Loutre and Southwest Pass:

July 8, 1856, $330,000.00		330,000.00

Table 17.—Ohio R. to Gulf of Mexico:

June 22, 1874, [7] $25,000.00		25,000.00

Table 18.—South Pass, payments under contract with James B. Eads, in accordance with act Mar. 3, 1875, and amendatory acts, which contract expired Jan. 28, 1901:

	$8,000,000.00	8,000,000.00

Table 19.—South Pass, examinations and surveys at:

Mar. 3, 1875,	$5,000.00	
May 1, 1876,	2,100.28	
Aug. 14, 1876,	15,000.00	
June 18, 1878,	15,000.00	
1878,	[8] 9,400.00	

Table 19.—South Pass, examinations and surveys at—Continued.

Mar. 3, 1879,	$24,000.00	
June 14, 1880,	20,000.00	
Mar. 3, 1881,	10,000.00	
Aug. 2, 1882,	10,000.00	
Mar. 12, 1884,	6,000.00	
July 5, 1884,	10,000.00	
May 26, 1886,	6,492.00	
Aug. 5, 1886,	10,000.00	
Mar. 30, 1888,	8,800.00	
Aug. 11, 1888,	10,000.00	
July 19, 1897,	1,000.00	
Fiscal year ending June 30—		
1890,	10,000.00	
1891,	10,000.00	
1892,	9,200.90	
1893,	8,946.73	
1894,	10,699.40	
1895,	8,933.33	
1896,	11,085.00	
1897,	10,000.00	
1898,	9,709.57	
1899,	10,223.77	
1900,	9,107.87	
1901,	6,637.63, **01,** 1867	
1903,	10,000.00, **03,** 1279	
1904,	10,000.00, **04,** 1886	
1905,	10,000.00, **05,** 1435	
1906,	10,000.00, **07,** 1412	
1907,	10,000.00, **07,** 1412	
1908,	10,000.00, **08,** 1474	
1909,	10,000.00, **09,** 1460	
1910,	10,000.00, **10,** 1604	
1911,	10,000.00, **11,** 1745	
1912,	10,000.00, **12,** 651	
		[9] $377,336.48

Table 20.—Southwest Pass:

Mar. 3, 1873,	$34,988.53	
Feb. 26, 1897,	[10] 10,000.00	
Mar. 3, 1899,	20,000.00	
1902,	750,000.00, **02,** 1324	
1903,	1,000,000.00, **03,** 1278	
1905,	1,250,000.00, **05,** 1432	
1906,	500,000.00 **06,** 1297	
1907,	1,000,000.00, **07,** 1402	
1908,	1,170,000.00, **08,** 1460	
1909 {	[11] 275,000.00 } 330,000.00 } **09,** 1444	
1910,	750,000.00, **10,** 1596	
1911,	450,000.00, **11,** 1738	
1912,	450,000.00, **12,** 1953	
		8,739,988.53

[1] Survey.
[2] Includes $25,000 for survey.
[3] Sill across Pass a Loutre, and for dr. for imp. outlets.
[4] Altering dr.
[5] From allotment for emergency work at South Pass, $200,000 was, by sec. 3 of same act, app. for purchase of plant of Eads estate (not used, and so not listed above).
[6] Purchase of Eads property, and for oper. dr. at South Pass.
[7] Incl. allotments and app. by Congress for specific places in stretch.
[8] Allotted from ex., sur. and contingencies of rivers and harbors, 1878.
[9] Given as $377,288.17, **12,** 1961, equal to $10,000 a year, 1890–1912, less reversion to Treas.
[10] Allotted by joint resol. Feb. 27, 1898, from app. of $250,000 for Pass a Loutre, act Feb. 26, 1897, for survey.
[11] Allotted from app. for preser. and mainten. of R. and H. works.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Table 21.—Ohio R. to Head of Passes, including surveys from Head of Passes to headwaters: [1]

June 18, 1878,	$330,000.00	
Mar. 3, 1879,	187,000.00	
June 28, 1879,	175,000 00	
June 14, 1880,	150,000.00	
June 16, 1880,	150,000.00	
Mar. 3, 1881,	1,365,000.00	
Aug. 2, 1882,	4,123,000.00	
Aug. 7, 1882,	150,000.00	
Mar. 3, 1883,	150,000.00	
Jan. 19, 1884,	1,000,000.00	
July 5, 1884,	1,425,000.00	
July 7, 1884,	75,000.00	
Aug. 5, 1886,	2,030,000.00	
Apr. 2, 1888,	7,572.48	
Aug. 11, 1888,	2,920,000.00	
Oct. 2, 1888,	35,000.00	
Oct. 19, 1888,	25,000.00	
Sept. 19, 1890,	3,200,000.00	
Sept. 30, 1890,	5,625.00	
Mar. 3, 1891,	1,001,950.00	
July 13, 1892,	2,545,000.00	
July 28, 1892,	44.80	
Mar. 3, 1893,	2,665,000.00	
Aug. 18, 1894,	[2] 3,340,000.00	
Mar. 2, 1895,	2,665,000.00	
June 3, 1896,	[3] 909,000.00	
Mar. 31, 1897,	250,000.00	
June 4, 1897,	3,283,333.00	
July 19, 1897,	625,000.00	
July 1, 1898,	1,983,333.00	
Mar. 3, 1899,	2,583,333.00	
Mar. 3, 1899,	185,000.00	
June 6, 1900,	2,250,000.00	
Mar. 3, 1901,	510,000.00	
June 13, 1902,	2,200,000.00,	**02,** S., 20
Mar. 3, 1903,	2,000,000.00,	**03,** S., 31
Apr. 28, 1904,	2,000,000.00,	**04,** S., 30
	[4] 48,000.00	
Mar. 3, 1905,	3,000,000.00,	**05,** S., 29
	[5] 485.00	
June 30, 1906,	2,000,000.00,	**06,** 2847
Mar. 2, 1907,	3,000,000.00,	**07,** 2628
May 27, 1908,	2,000,000.00,	**08,** 2661
	[3] 10,000.00	

Table 21.—Ohio R. to Head of Passes, including surveys from Head of Passes to Headwaters [1]**—Continued.**

Mar. 4, 1909,	2,000,000.00,	**09,** 2664
June 25, 1910,	4,000,000.00,	**10,** 2942
Feb. 27, 1911,	3,000,000.00,	**11,** 3189
	[6] 69,847,676.28	$69,847,676.28

Table 22.—Pass a Loutre:

Feb. 26, 1897,	[7] $240,000.00	240,000.00

Table 23.—Maintenance of South Pass Chan.:

1900,	[8] $100,000.00,	**01,** 1883.
1900,	10,000.00,	**02,** 1326
1901,	[9] 7,860.28,	**01,** 1883
1902	75,000.00	**02,** 1326
	[8] 100,000.00	
1903,	[8] 100,000.00,	**03,** 1281
1904,	[8] 100,000.00,	**04,** 1888
1905,	[8] 100,000.00,	**05,** 1440
1906	[8] 100,000.00	**06,** 1301
	50,000.00	
1907	[8] 100,000.00	**07,** 1415
	50,000.00	
1908	[8] 100,000.00	**08,** 1476
	50,000.00	
1909	[8] 100,000.00	**09,** 1452
	80,000.00	
1910	[8] 100,000.00	**10,** 1600
	40,000.00	
1911,	[8] 100,000.00,	**11,** 1741
1912,	[8] 100,000.00,	**12,** 1958
		[10] 1,562 860.28

Table 24.—Walnut Bend, Ark., repairing U. S. levees:

June 13, 1902,	$90,000.00,	**02,** 520; **12,** 3732 — 90,000.00
	Grand total,	91,723,542.57

APPROPRIATIONS—CAIRO (OHIO RIVER) TO FALLS OF ST. ANTHONY.

Table 25.—Missouri R. to Ohio R.:

July 4, 1836,	$15,000.00	
Mar. 3, 1837,	35,000.00	
June 11, 1844,	25,000.00	
Mar. 3, 1873,	200,000.00	
Aug. 14, 1876,	29,600.00	
June 14, 1880,	70,000.00	
Mar. 3, 1881,	20,000.00	
Sept. 19, 1890,	182,000.00	
June 4, 1897,	773,333.33	
July 19, 1897,	325,000.00	
July 1, 1898,	673,333.33	
Mar. 3, 1899,	673,333.33	
June 6, 1900,	[11] 100,000.00	
1902,	650,000.00,	**02,** 1600
1903,	$650,000.00,	**03,** 1450
1904,	650,000.00,	**04,** 2139
1905,	650,000.00,	**05,** 1593
1907,	250,000.00,	**07,** 1548
1908,	250,000.00,	**08,** 1621
1909,	250,000.00,	**09,** 1610
1910	250,000.00	**10,** 1764
	500,000.00	
1911,	1,000,000.00,	**11,** 1920
1912,	1,000,000.00,	**12,** 2128
	9,221,599.99	$9,221,599.99

[1] Under this head are included app. provided by act of Congress for work at mouth of Yazoo R. and H. at Vicksburg, and app. and allotments for work at mouths of Red and Achafalaya Rs.
[2] Includes $2,500, which "may be used in improving Bayou des Glaises," La.
[3] Includes $35,000 for improving Wolf R., Tenn.
[4] Allotted from app. for emergencies, R. and H. work; $8,000 for Wolf R., and $40,000 for Giles Bend; $10,000 for Old R.
[5] Allotted from app. for ex., sur., and conting. of R. and H. for Ashport, Tenn.
[6] Total, less $5,000 of 1900 app. used for expenses in office C. of E.
Total given at **12,** 3728, "expended under the M. R. Commission to June 30, 1912," is $66,528,823.66, which omits two items, 1878 and 1879, and includes receipts, sales, etc.
[7] Does not include $10,000 for sur. S. W. Pass (q. v.).
[8] Indefinite app. act June 6, 1900.
[9] For altering dredges.
[10] Total, incl. misc. rects. and transfers, and less $85,426.50 reverted to Treas., $1,500 235.97, **01,** 1883, 1867; **12,** 1959.
[11] Part of $250,000 for Ohio R. to St. Paul. See Table 37.

Table 26.—St. Paul to Des Moines Rapids:

June 15, 1844,	$7,500.00	
Mar. 3, 1845,	7,000.00	
Aug. 30, 1852,	115,000.00	
June 23, 1866,	100,000.00	
Mar. 2, 1867,	200,000.00	
July 25, 1868,	156,000.00	
Apr. 10, 1869,	133,650.00	
July 11, 1870,	150,000.00	
Mar. 3, 1871,	150,000.00	
June 10, 1872,	50,000.00	
Mar. 3, 1873,	50,000.00	
June 23, 1874,	50,000.00	
Mar. 3, 1875,	50,000.00	
Aug. 14, 1876,	60,000.00	
June 18, 1878,	320,500.00	
Mar. 3, 1879,	126,100.00	
June 14, 1880,	183,500.00	
Mar. 3, 1881,	235,000.00	
Aug. 2, 1882,	300,500.00	
July 5, 1884,	300,000.00	
Aug. 5, 1886,	392,500.00	
Mar. 3, 1899,	[1] 12,000.00	
	3,149,250.00	$3,149,250.00

Table 27.—St. Paul to Ohio R.:

Aug. 30, 1852,	$90,000.00	
June 3, 1896,	475,000.00	
	565,000.00	565,000.00

Table 28.—Des Moines Rapids to Illinois R.:

Aug. 16, 1856,	$200,000.00	
June 23, 1866,	200,000.00	
Mar. 2, 1867,	500,000.00	
July 25, 1868,	300,000.00	
Apr. 10, 1869,	178,200.00	
Dec. 23, 1869,	200,000.00	
July 11, 1870,	400,000.00	
Jan. 18, 1871,	341,000.00	
Mar. 3, 1871,	250,000.00	
June 10, 1872,	400,000.00	
Mar. 3, 1873,	400,000.00	
June 23, 1874,	400,000.00	
Mar. 3, 1875,	480,000.00	
Aug. 14, 1876,	230,000.00	
Apr. 30, 1878,	7,500.00	
June 18, 1878,	95,000.00	
Mar. 3, 1879,	125,000.00	
June 14, 1880,	210,000.00	
Mar. 3, 1881,	246,000.00	
Aug. 2, 1882,	275,000.00	
July 5, 1884,	280,000.00	
Aug. 5, 1886,	225,000.00	
Aug. 11, 1888,	251,250.00	
Sept. 19, 1890,	187,000.00	
	6,380,950.00	6,380,950.00

Table 29.—Illinois R. to Missouri R.:

June 10, 1872,	$25,000.00	25,000.00

Table 30.—Missouri R. to Meramec R.:

June 10, 1872,	$100,000.00	100,000.00

Table 31.—Minneapolis to Des Moines Rapids:

Aug. 11, 1888,	$600,000.00	
Sept. 19, 1890,	500,000.00	
	1,100,000.00	1,100,000.00

Table 32.—Minneapolis to St. Paul:

Mar. 3, 1873,	$25,000.00	
Aug. 17, 1894,	51,000.00	
June 3, 1896,	100,000.00	
Mar. 3, 1899,	150,000.00	
June 6, 1900,	[2] 185,000.00	
1901,	157,000.00, **01,** 2302	
1902,	250,000.00, **02,** 1664.	
1903,	223,579.33, **03,** 1524	
1906,	30,000.00, **06,** 1436	
1907,	30,000.00, **07,** 1581	
1909,	180,000.00, **09,** 1642	
1910,	59,543.00, **10,** 1800	
1910,	600.00, **11,** 1974	
1911,	250,000.00, **11,** 1974	
1912,	200,000.00, **12,** 2181	
		[3] $1,891,722.33

Table 33.—Illinois R. to Ohio R.:

June 23, 1874,	$200,000.00	
Mar. 3, 1875,	200,000.00	
Aug. 14, 1876,	200,000.00	
June 18, 1878,	240,000.00	
Mar. 3, 1879,	200,000.00	
June 14, 1880,	250,000.00	
Mar. 3, 1881,	600,000.00	
Aug. 2, 1882,	600,000.00	
July 5, 1884,	520,000.00	
Aug. 5, 1886,	375,000.00	
Aug. 11, 1888,	300,000.00	
Sept. 19, 1890,	400,000.00	
		4,085,000.00

Table 34.—Des Moines Rapids to Ohio R.:

June 18, 1878,	$100,000.00	100,000.00

Table 35.—Des Moines Rapids Canal and Dry Dock, operating and care of: [4]

Fiscal year ending June 30—		
1882,	$41,771.17	
1883,	77,926.79	
1884,	43,283.42	
1885,	44,506.50	
1886,	43,009.53	
1887,	42,152.84	
1888,	42,802.35	
1889,	38,885.37	
1890,	43,995.80	
1891,	44,998.20	
1892,	43,968.92	
1893,	57,057.21	
1894,	55,356.48	
1895,	41,052.80	
1896,	37,555.21	
1897,	33,440.54	
1898,	38,504.95	
1899,	35,118.85	
1900,	39,120.73	
1901,	48,595.91, **01,** 2285	
1902,	41,805.50, **02,** 1652.	
1903,	40,623.37, **03,** 1493	
1904,	45,161.69, **04,** 2197	
1905,	43,668.83, **05,** 1648	
1906,	49,948.65, **06,** 1427	
1907,	37,698.97, **07,** 1569	
1908,	42,007.60, **08,** 1641	
1909,	43,185.70, **09,** 1634	
1910,	38,772.18, **10,** 1789	
1911,	36,909.31, **11,** 1959	
1912,	35,218.51, **12,** 2167	
	1,348,103.88	1,348,103.88

[1] La Crosse H., Wis.
[2] $100 to reimburse Loren Fletcher for expediting transfer of land, L. and D. 2.
[3] Total, incl. $49,877.67 allotted Aug. 17, 1894, and less $25,000 allotted in 1873, $1,916,600, **12,** 2181.
[4] Expend. under permanent-indefinite app. provided by acts Mar. 3, 1881, and July 5, 1884, for operating and keeping in repair canals and other public works. App. for this work prior to 1881 amounting to $110,000 are included in those for imp. Des Moines Rapids, which are given under the heading Des Moines Rapids to the mouth of Illinois R.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Table 36.—Minneapolis to Ohio R.:

July 13, 1892,	$1,125,000.00	
Mar. 3, 1893,	1,525,000.00	
Aug. 18, 1894,	1,625,000.00	
Mar. 2, 1895,	1,625,000.00	
	5,900,000.00	$5,900,000.00

Table 37.—St. Paul to Missouri R.:

June 4, 1897,	$826,666.67	
July 19, 1897,	200,000.00	
July 1, 1898,	826,666.67	
Mar. 3, 1899,	826,666.67	
June 6, 1900, [1]	150,000.00	
1902,	400,000.00, **02,** 1623	
1903,	400,000.00, **03,** 1473	
1904,	400,000.00, **04,** 2170	
1905,	400,000.00, **05,** 1619	
1906,	300,000.00, **06,** 1425	
1907,	500,000.00, **07,** 1567	
1908,	500,000.00, **08,** 1638	
1909,	500,000.00, **09,** 1631	
1910,	1,000,000.00, **10,** 1787	
1911,	1,250,000.00, **11,** 1956	
1912,	1,250,000.00, **12,** 2164	
	9,730,000.01	9,730,000.01

Table 38.—Waterway, Lockport, Ill., to St. Louis, Mo.:

June 13, 1902,	$25,000.00, **03,** S., 30	
1905,	[2] 1,093.40, **05,** S., 28	
	26,093.40, **12,** 3732	26,093.40

Table 39.—Moline Harbor, Ill.:

1905,	$100,000.00, **05,** 1653	
1906,	150,000.00, **06,** 1429	
1907,	136,000.00, **07,** 1571	
	386,000.00	$386,000.00

Table 40.—Moline, Ill., operation and care of locks at: [3]

1908,	$4,799.03, **09,** 1636	
1909,	10,000.00, **09,** 1636	
1910,	9,966.15, **10,** 1792	
1911,	5,166.58, **11,** 1960	
1912,	13,206.16, **12,** 2168	
	43,137.92	43,137.92

Table 41.—Minneapolis to St. Paul, operation and care of locks and dams: [3]

1908,	$5,578.45, **08,** 531	
1909,	1,826.83, **09,** 562	
1910,	1,697.82, **10,** 631	
1911,	1,520.35, **11,** 677	
1912,	2,377.12, **12,** 817	
		13,000.57
Grand total		44,064,858.10

APPROPRIATIONS—HEADWATERS SECTION.

Table 42.—Falls of St. Anthonys, Minn., at and above:

July 11, 1870,	$50,000.00	
Mar. 3, 1871,	50,000.00	
June 10, 1872,	50,000.00	
Mar. 3, 1873,	50,000.00	
June 23, 1874,	150,000.00	
Mar. 3, 1875,	100,000.00	
Aug. 14, 1876,	140,000.00	
Mar. 3, 1879,	10,000.00	
June 14, 1880,	25,000.00	
Mar. 3, 1881,	25,000.00	
Aug. 2, 1882,	35,000.00	
July 5, 1884,	10,000.00	
Aug. 11, 1888,	10,000.00	
Sept. 19, 1890,	18,000.00	
		$723,000.00

Table 43.—Reservoirs at headwaters:

Construction of—

Mar. 3, 1879, [4]	$25,000.00	
June 14, 1880,	75,000.00	
Mar. 3, 1881,	150,000.00	
Aug. 2, 1882,	300,000.00	
July 5, 1884,	60,000.00	
Aug. 5, 1886,	37,500.00	
Aug. 11, 1888,	12,000.00	
Sept. 19, 1890,	80,000.00	
July 13, 1892,	60,000.00	
Aug. 17, 1894,	51,000.00	
June 3, 1896,	80,000.00	
Mar. 3, 1899, [5]	210,000.00	
1902,	[6] 240,000.00, **02,** 1674	
1905,	[7] 150,999.04, **05,** 1673	
1907,	145,000.00, **07,** 1583	

[1] Part of $250,000 for O. R. to St. Paul. See Table 25.
[2] Allotment (transfer) from "Sur. Ill. and Des Plaines R."
[3] Expend. under the permanent-indefinite app. provided by act July 5, 1884, as amended by act Mar. 3, 1909, for operating and keeping in repair canals and other public works.
[4] Survey.
[5] $2,500 for damages, if any, to property, due to failure of Pine River reservoir.
[6] Part of an app. of $250,000; $10,000 to be for "Brainerd to Grand Rapids."
[7] Part of an app. of $16,000; $9,000,96 expend. for "Brainerd to Grand Rapids," included in Table 45.

Table 43.—Reservoirs at headwaters—Continued.

Construction of—Continued.

1910,	$61,200.00, **10,** 1804	
1911,	10,000.00, **11,** 1977	
1912,	15,000.00, **12,** 2183	
		[1] 1,762,699.04

Table 44.—Reservoir, headwaters—Operation and care.

Operating and care of,[2] fiscal year ending June 30—

1895,	$5,704.86	H. D. 421, 57th, 2d.
1896,	26,801.98	
1897,	37,155.73	
1898,	20,497.19	
1899,	13,925.92	
1900,	19,378.23	
1901,	16,655.78	
1902,	17,576.47, **02,** 375	
1903,	10,854.63, **03,** 399	
1904,	12,658.35, **04,** 424	
1905,	12,855.57, **05,** 434	

Table 44.—Reservoir, headwaters—Operation and care—Continued.

Operating and care of, fiscal year ending June 30— Contd.

1906,	$22,268.40, **06,** 475	
1907,	18,423.75, **07,** 502	
1908,	16,448.92, **08,** 534	
1909,	27,932.08, **09,** 566	
1910,	35,380.62, **10,** 635	
1911,	43,012.34, **11,** 680	
1912,	48,281.31, **12,** 821	
		$405,812.13

Table 45.—Brainerd to Grand Rapids, Minn.:

1902,	*$10,000.00, **10,** 1804	
1903,	9,000.96, **10,** 1804	
	05, 1673	
1910,	22,555.00, **10,** 1804	
	41,555.96, **12,** 2184	41,555.96
Grand total		2,933,067.13

* Allotted.

[1] Total, less $25,000 allot. for sur. in 1879 $1,737,699.04, **12,** 2183.

[2] Expend. under permanent-indefinite app. provided by act July 5, 1884, as amended by act Mar. 3, 1909, for operating and keeping in repair canals and other public works.

HH-1.—MISSISSIPPI RIVER.

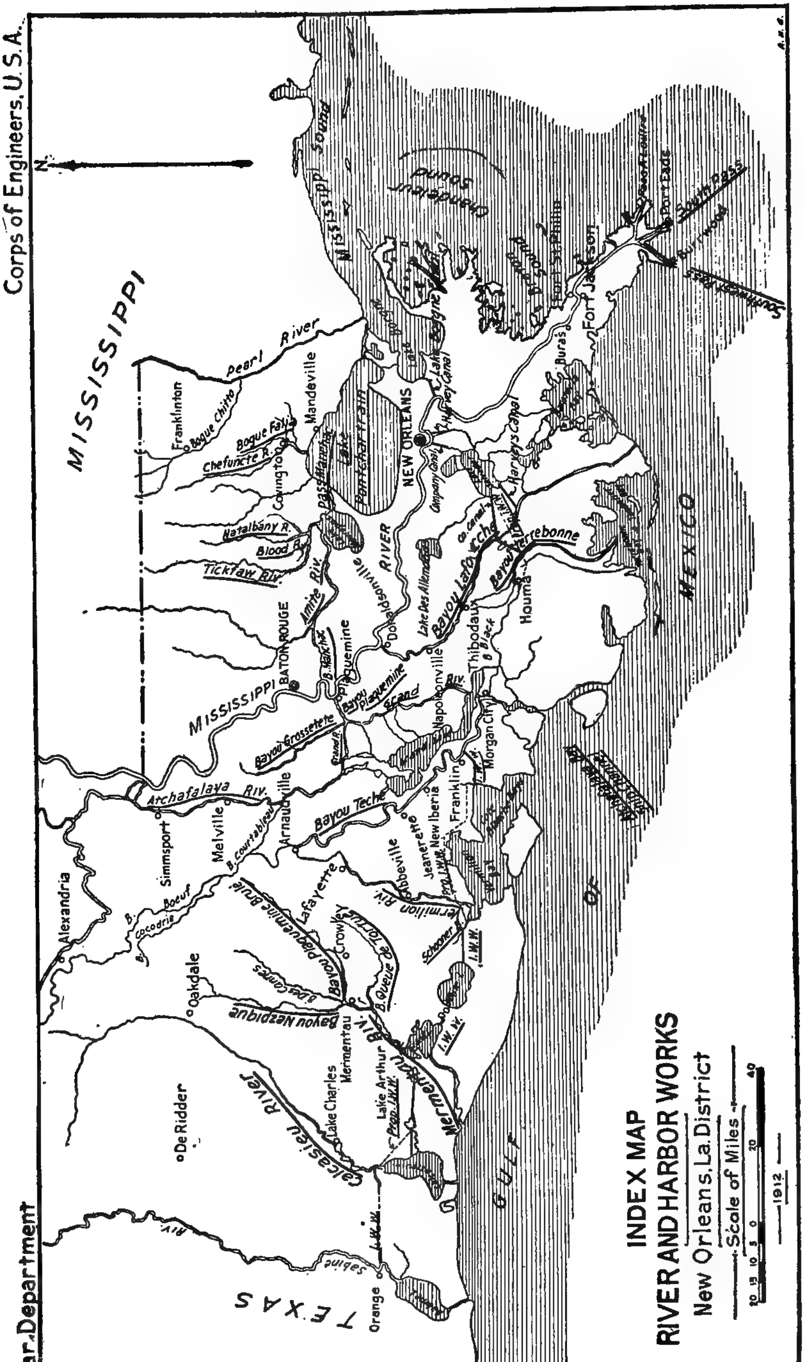
Part (f) Locations or Notable Points, Mouth to Headwaters.

PASSES TO VICKSBURG.

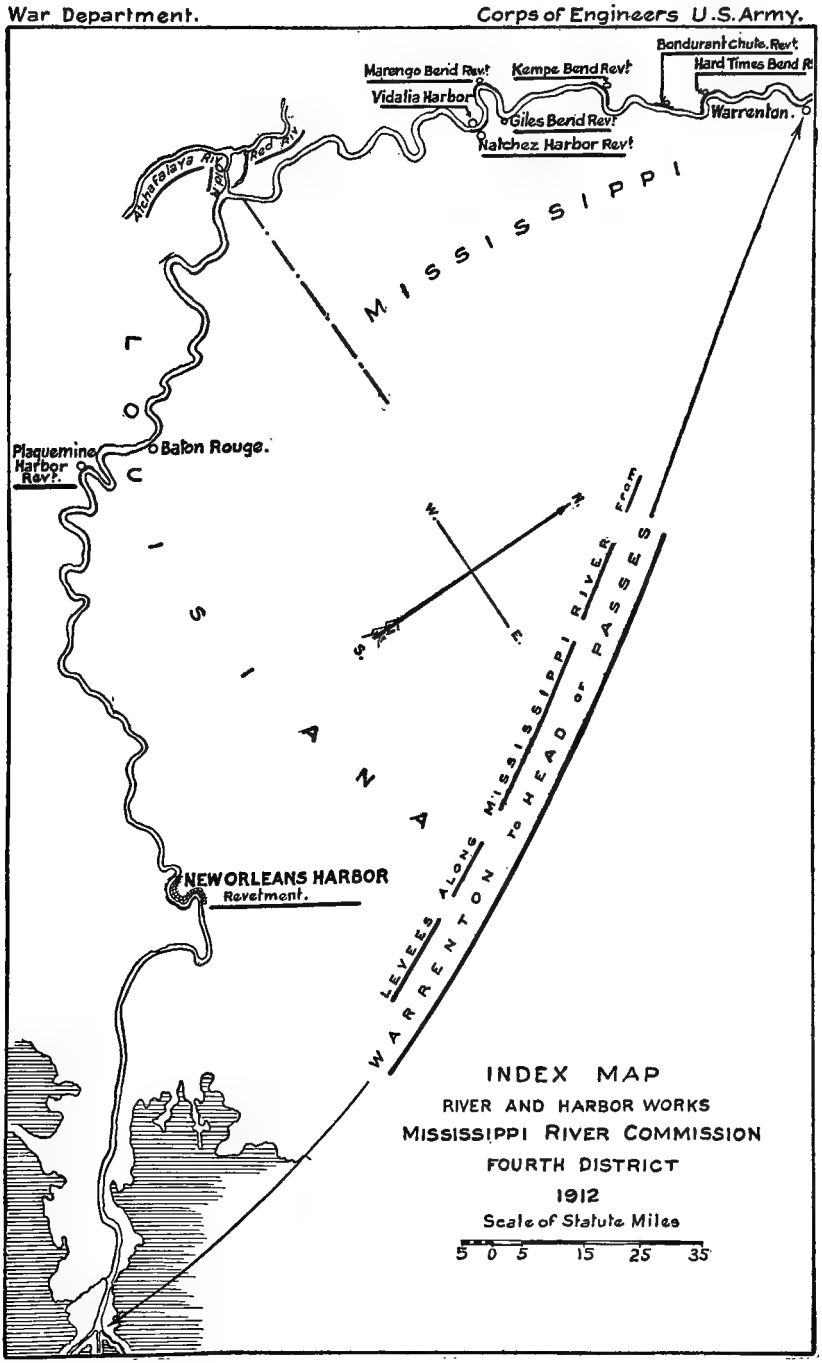
1	River in general, mouth to headwaters.	21	Edgard La.
2	Main Pass La.	22	Convent La.
3	Octave and Twenty-seven Pass La.	23	Donaldsonville La.
4	North Pass La.	24	Plaquemine La.
5	Pass a Loutre La.	25	Bayou Manchac La.
6	Northeast Pass La.	26	Baton Rouge La.
7	Southeast Pass La.	27	Pt. Allerton La.
8	South Pass La.	28	St. Francisville La.
9	Port Eads La.	29	Bayou Sara La.
10	Southwest Pass La.	30	Morganza La.
11	Williams Pass La.	31	Old R. La.
12	Grand Pass La.	32	Red R. La.
13	Tiger Pass La.	33	Angola La.
14	Reo Pass La.	34	Homochitto R. Miss.
15	Spanish Pass La.	35	Vidalia La.
16	Ft. Jackson La.	36	Natchez Miss.
17	Ft. St. Philip La.	37	Waterproof La.
18	Pt. A La Hache La.	38	St. Joseph La.
19	New Orleans (and Lake Pontchartrain) La.	39	Big Black R. Miss.
20	Hahnville La.	40	Grand Gulf Miss.
		41	Warrenton Miss.
		42	Vicksburg Miss.

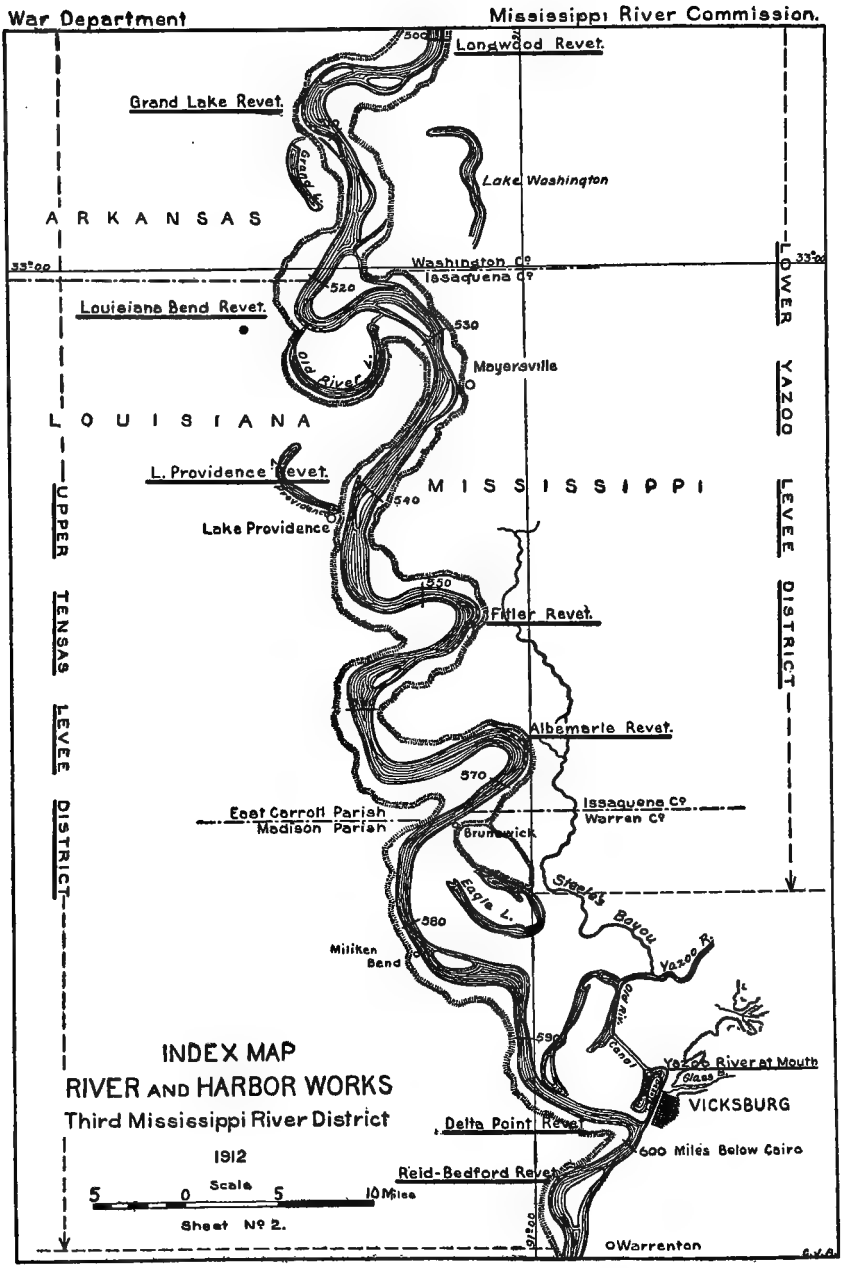
VICKSBURG, MISS., TO ARKANSAS RIVER, ARK.

43	Yazoo R. Miss.	61	Vaucluso Revetment Ark.
44	Delta Pt. La.	62	Mile 480 Ark. and Miss.
45	Mile 590 (below Cairo, Ill.), 580, 570 La. and Miss.	63	Greenville Miss.
46	Albemarle Revetment Miss.	64	Greenville Harbor Revetment Miss.
47	Mile 560 La. and Miss.	65	Mile 470 Ark. and Miss.
48	Fitler Revetment Miss.	66	Leland Neck Revetment Ark.
49	Mile 550 La. and Miss.	67	Mile 460 Ark. and Miss.
50	Lake Providence La.	68	Panther Forest Revet. Ark. and Miss.
51	Mile 540 La. and Miss.	69	Mile 450 Ark. and Miss.
52	Mayersville Miss.	70	Ashbrook Neck Revetment Miss.
53	Mile 530 La. and Miss.	71	Mile 440 Ark. and Miss.
54	Mile 520 Ark. and Miss.	72	Arkansas City Ark.
55	Mile 510 Ark. and Miss.	73	Mile 430 Ark. and Miss.
56	Grand Lake Revetment Ark.	74	Cypress Cr. Ark.
57	Longwood Revetment Miss.	75	Mile 420 Ark. and Miss.
58	Mile 500 Ark. and Miss.	76	Lake Bolivar Revetment Miss.
59	Lake Lee Miss.	77	Mile 410 Ark. and Miss.
60	Mile 490 Ark.	78	Beulah Lake Miss.
		79	Arkansas R. Ark.

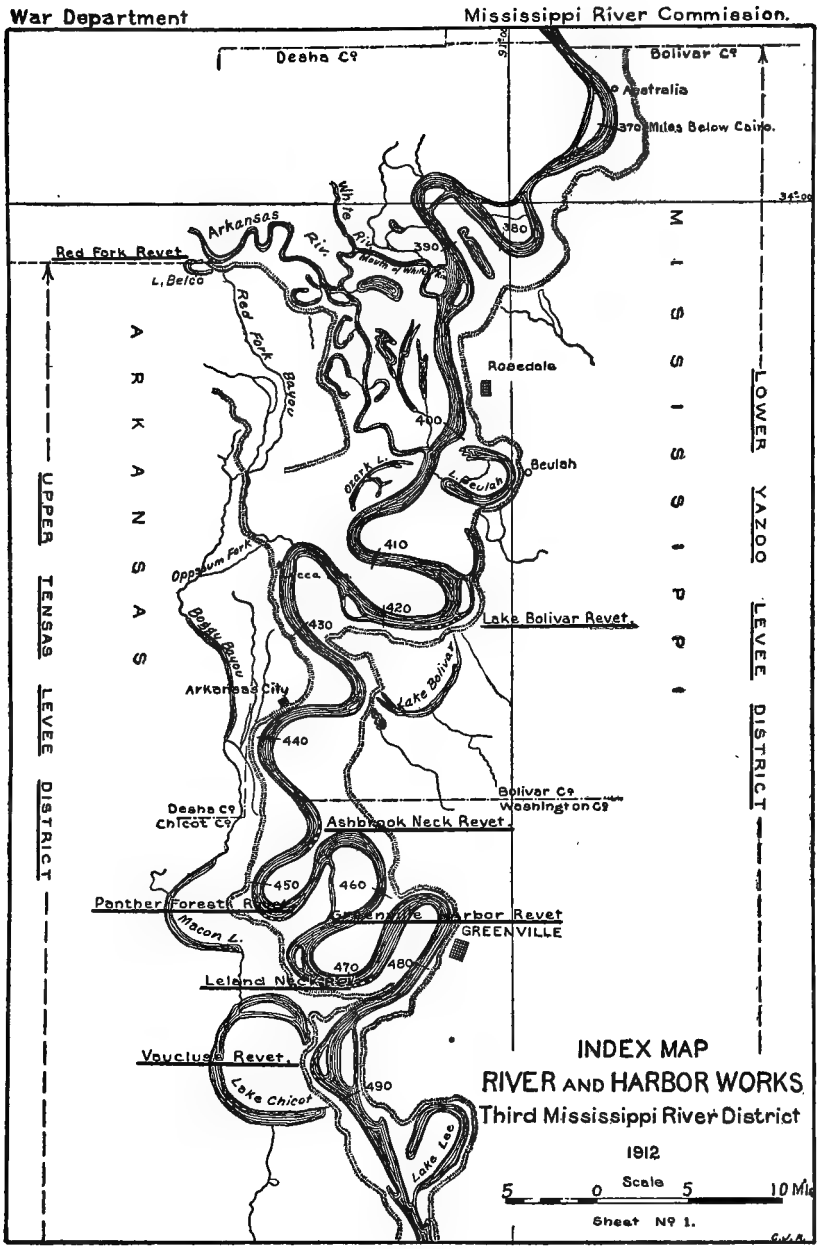

Corps of Engineers, U.S.A.
War Department
INDEX MAP
RIVER AND HARBOR WORKS
New Orleans, La. District
Scale of Miles
1912
MISSISSIPPI
TEXAS
GULF
OF
MEXICO
Mississippi Sound
Chandeleur Sound
Breton Sound
Lake Borgne
Lake Pontchartrain
Lake Maurepas
NEW ORLEANS
BATON ROUGE
MISSISSIPPI RIVER
Pearl River
Franklinton
Bogue Chitto
Bogue Falia
Chefuncte R.
Covington
Mandeville
Natalbany R.
Blood R.
Tickfaw Riv.
Amite Riv.
Donaldsonville
Plaquemine
Bayou Plaquemine
Bayou Grosse Tete
Grand R.
Atchafalaya Riv.
Simmsport
Melville
Arnaudville
Bayou Teche
Bayou Lafourche
Bayou Terrebonne
Houma
Thibodaux
Napoleonville
Lake Des Allemands
Company Canal
Harvey Canal
Harvey's Canal
Morgan City
Franklin
New Iberia
Jeanerette
Abbeville
Vermilion Riv.
Lafayette
Crowley
Bayou Plaquemine Brule
B. Queue De Tortue
Bayou Nezpique
B. Des Cannes
Mermentau
Mermentau Riv.
Lake Arthur
Lake Charles
Calcasieu River
Sabine Riv.
Orange
DeRidder
Oakdale
Alexandria
B. Boeuf
B. Cocodrie
B. Courtableau
Schooner B.
I.W.W.
Buras
Fort Jackson
Fort St. Philip
Port Eads
Burrwood
South Pass
Southwest Pass

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.




War Department
Mississippi River Commission.
Longwood Revet.
Grand Lake Revet.
Grand L.
Lake Washington
ARKANSAS
33°00
Washington Co
Issaquena Co
520
Louisiana Bend Revet.
530
Old River L.
Mayersville
LOUISIANA
L. Providence Revet.
MISSISSIPPI
540
Lake Providence
550
Fitler Revet.
Albemarle Revet.
570
East Carroll Parish
Madison Parish
Issaquena Co
Warren Co
Brunswick
Eagle L.
Steele's Bayou
580
Milliken Bend
Yazoo R.
Old Yazoo Canal
590
Yazoo River at Mouth
Glass St.
VICKSBURG
Delta Point Revet.
600 Miles Below Cairo
Reid-Bedford Revet.
INDEX MAP
RIVER AND HARBOR WORKS
Third Mississippi River District
1912
Scale
5 0 5 10 Miles
Sheet No 2.
Warrenton
UPPER TENSAS LEVEE DISTRICT
LOWER YAZOO LEVEE DISTRICT

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.



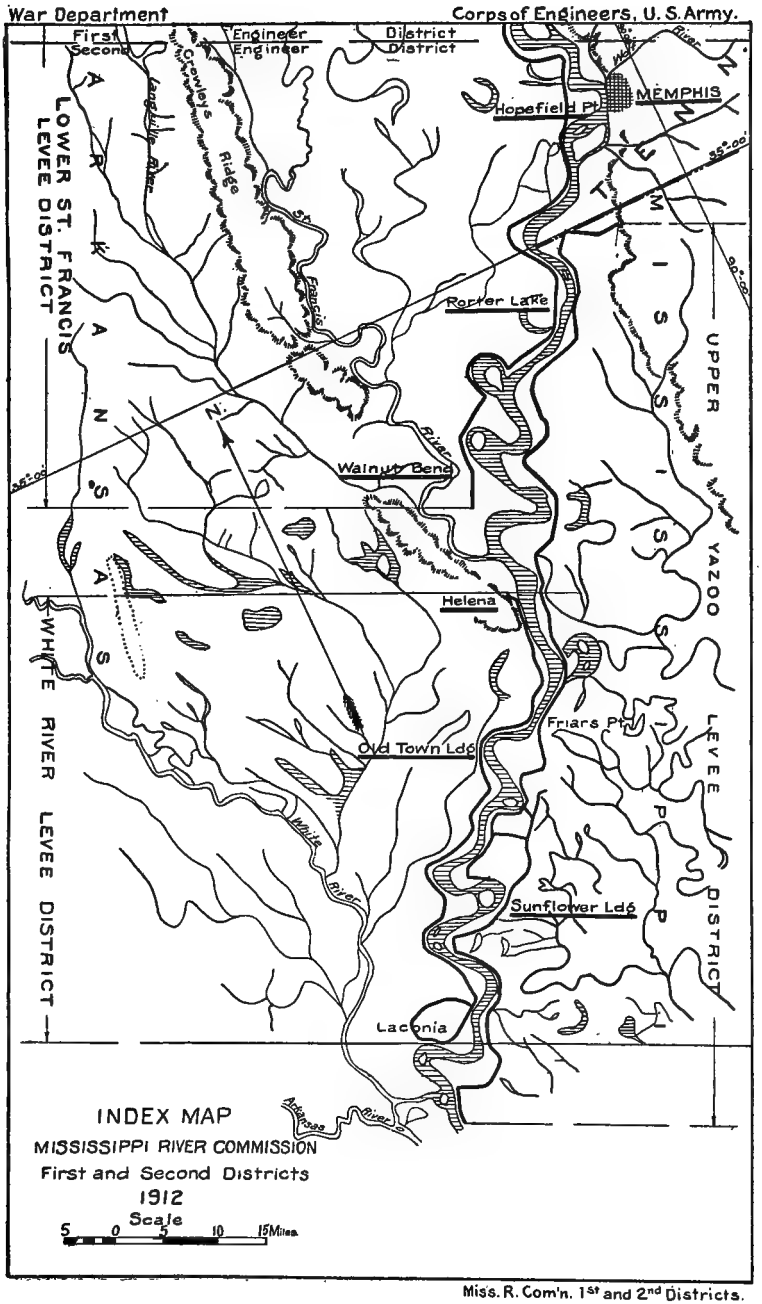
ARKANSAS R. TO CAIRO, ILL.

80	Mile 400 (below Cairo, Ill.).	
81	Rosedale	Miss.
82	White R.	Ark.
83	Mile 390	Ark. and Miss.
84	Mile 380	Ark. and Miss.
85	Mile 370	Ark. and Miss.
86	Sunflower Landing Revetment	Miss.
87	Old Town Landing	Ark.
88	Friars Pt.	Miss.
89	Lula	Miss.
90	Helena	Ark.
91	Tunica	Miss.
92	Porter Lake	Ark.
93	Miss.-Tenn. Line.	
94	President Isld.	Tenn.
95	Hopefield Pt.	Ark.
96	Memphis	Tenn.
97	Wolf R.	Tenn.
98	Island 40.	
99	Centennial Isld.	
100	Island 37.	
101	Deans Isld.	
102	Golden Lake Landing	Ark.
103	Island 35.	
104	Hatchee R.	Tenn.
105	Island 34.	
106	Fulton	Tenn.
107	Bullerton	Ark.
108	Plum Pt.	Tenn.
109	Osceola	Ark.
110	Luxora	Ark.
111	Ashport	Tenn.
112	Daniels Pt.	Ark.
113	Island 26.	
114	Forked Deer R.	Tenn.
115	Mo.-Ark. line.	
116	Cottonwood Pt.	Mo.
117	Caruthersville	Mo.
118	Reelfoot Lake	Tenn.
119	Tiptonville	Tenn.
120	Pt. Pleasant	Mo.
121	New Madrid	Mo.
122	Reelfoot Levee	Tenn. and Ky.
123	Island 8.	
124	Hickman Revetment	Ky.
125	Wolf Isld.	
126	Columbus	Ky.
127	Ohio R.	Ky. and Ill.
128	Cairo	Ill.

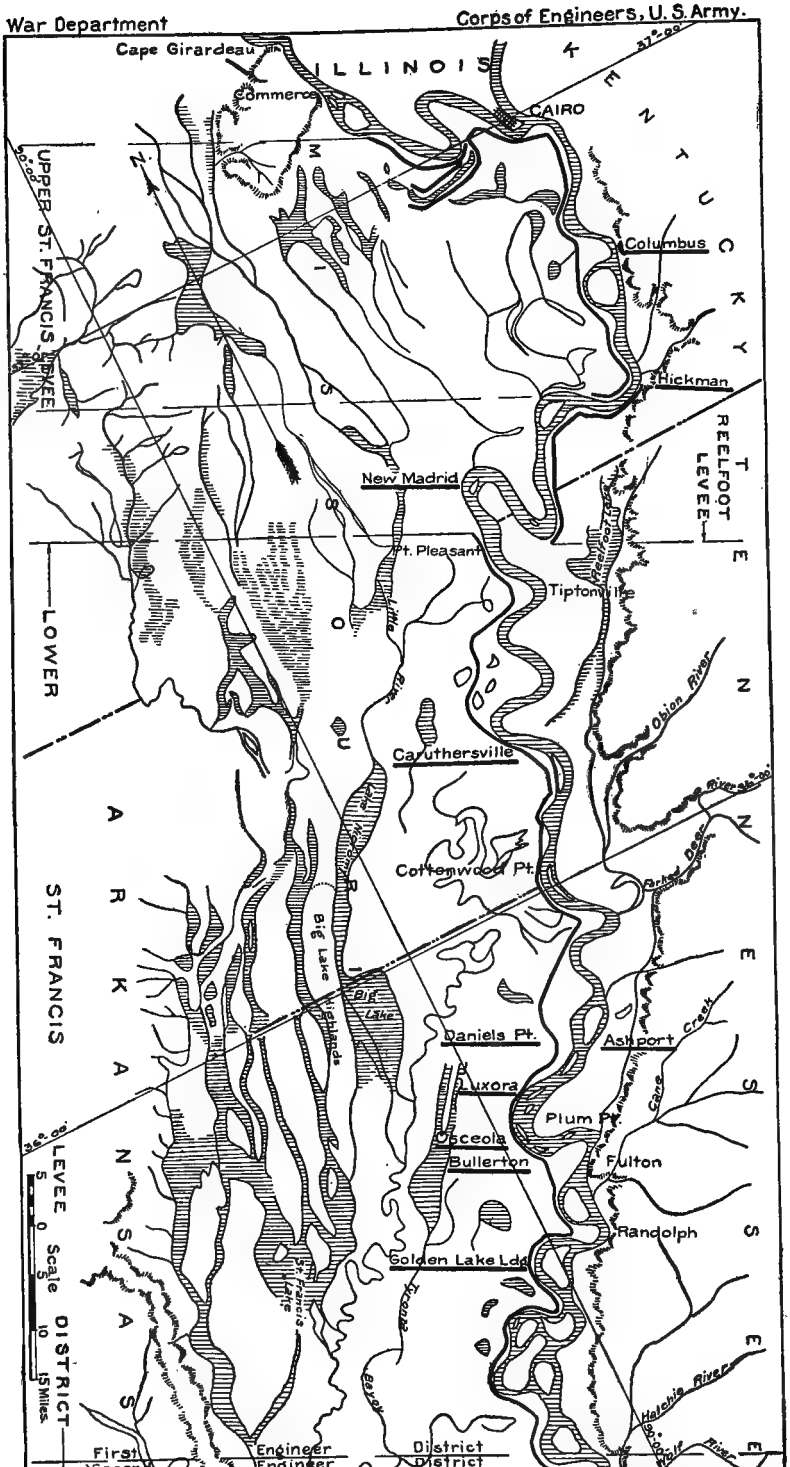
CAIRO, ILL., TO ST. LOUIS, MO.

129	Stevenson Bayou	Mo.
130	Brewers Pt.	Mo.
131	Dog Tooth Isld.	Ill.
132	Buffalo Isld.	Mo.
133	Prices Towhead	Ill.
134	Powers Isld.	Mo.
135	Commerce Isld.	Mo.
136	Burnham Isld.	Ill.
137	Commerce	Mo.
138	Thebes	Ill.
139	Grays Pt.	Mo.
140	Cape Girardeau	Mo.
141	Devils Isld.	Ill.
142	Hamburg Isld.	Ill.
143	Moccasin Springs	Mo.
144	Hanging Dog Isld.	Ill.
145	Neely Landing	Mo.
146	Apple Cr.	Mo.
147	Big Muddy R.	Ill.
148	Grand Tower Isld.	Ill.
149	Grand Tower	Ill.
150	Fountain Bluff	Ill.
151	Cape Cinque Hommes	Mo.
152	Wilkinson Isld.	Ill.
153	Cinque Hommes Cr.	Mo.
154	McLean Pt.	Ill.
155	Liberty Bend	Ill.
156	Liberty Isld.	Ill.
157	Crain Isld.	Ill.
158	Chester	Ill.
159	Kaskaskia Isld.	Ill.
160	Ft. Gage	Ill.
161	Kaskaskia R.	Ill.
162	St. Genevieve Isld	Ill.
163	St. Genevieve	Mo.
164	Turkey Isld.	Ill.
165	Frenchman Cr.	Mo.
166	Ft. Chartres, E. and W.	Ill. and Mo.
167	Brickeys	Mo.
168	Ames Isld.	Mo.
169	Isle de Bois Cr.	Mo.
170	Rush Towhead	Ill.
171	Perry Towhead	Mo.
172	Calico Isld.	Mo.
173	Plantin	Mo.
174	Crystal City	Mo.
175	Joachim Cr.	Mo.
176	Herculaneum	Mo.
177	Foster Isld.	Ill.
178	Fountain Cr.	Ill.
179	Kimmswick	Mo.
180	Chesley Isld.	Mo.
181	Meramec R.	Mo.
182	Beards Isld.	Ill.
183	Carrols Isld.	Ill.
184	Jefferson Barracks	Mo.
185	Prairie du Pont Cr.	Ill.
186	River des Peres	Mo.
187	Arsenal Isld.	Ill.
188	St. Louis	Mo.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

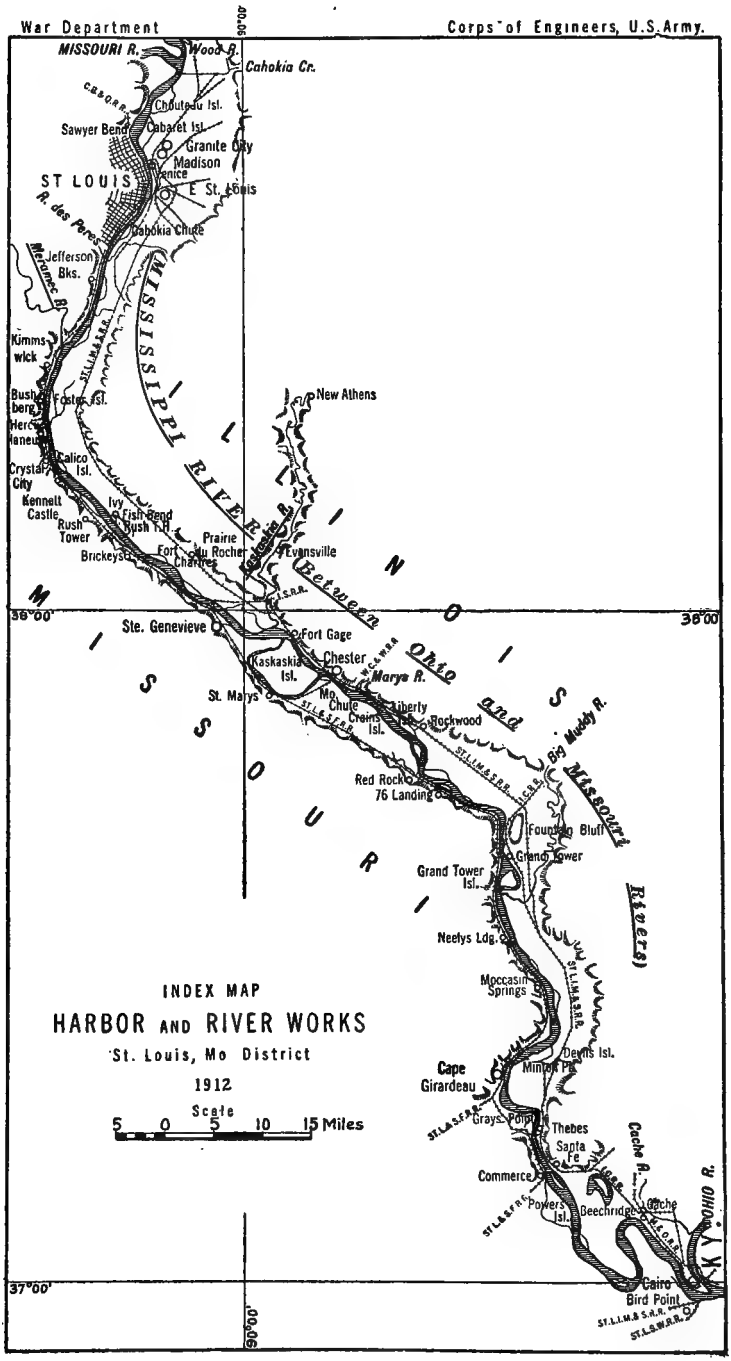


Miss. R. Com'n. 1st and 2nd Districts.
In two Sheets, Sheet 2.


War Department
Corps of Engineers, U. S. Army.
Cape Girardeau
ILLINOIS
KENTUCKY
Commerce
CAIRO
37°-00'
UPPER ST. FRANCIS LEVEE
90°-00'
MISSOURI
Columbus
Hickman
REELFOOT LEVEE
TENNESSEE
New Madrid
Pt. Pleasant
Tiptonville
Reelfoot Lake
Little River
LOWER
Obion River
Caruthersville
River
Cottonwood Pt.
Forked Deer
ARKANSAS
ST. FRANCIS
Big Lake Highlands
Big Lake
Daniels Pt.
Ashport
Cane Creek
Luxora
Plum Pt.
Osceola
Bullerton
Fulton
36°-00'
LEVEE
Scale
5 0 5 10 15 Miles
Randolph
Golden Lake Ldg
St. Francis Lake
Tyronza
Bayou
Hatchie River
90°-00'
Wolf River
First Engineer District
Second Engineer District
Miss. R. Com'n. 1st and 2nd Districts.
in two Sheets, Sheet 1.

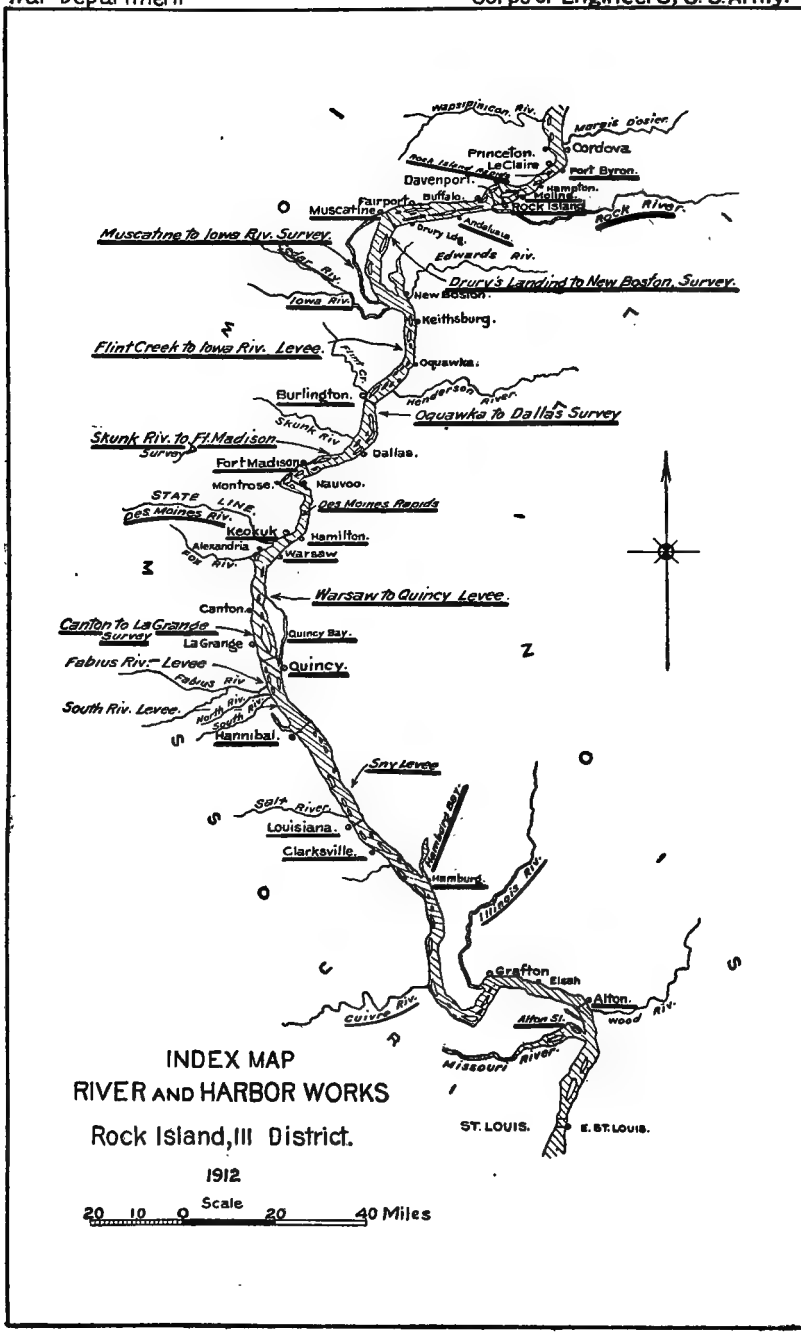
ST. LOUIS, MO., TO ST. PAUL, MINN.

189 East St. Louis	Ill.	250 Rapids City	Ill.
190 Venice	Ill.	251 Le Claire	Iowa.
191 Sawyer Bend	Mo.	252 Port Byron	Ill.
192 Cabaret Isld.	Ill.	253 Princeton	Iowa.
193 Chouteau Isld.	Ill.	254 Cordova	Ill.
194 Missouri R.	Mo.	255 Wapsipinicon R.	Iowa.
195 Wood R.	Ill.	256 Comanche	Iowa.
196 Alton	Ill.	257 Albany	Ill.
197 Portage	Mo.	258 Clinton	Iowa.
198 Grafton	Ill.	259 Fulton	Ill.
199 Illinois R.	Ill.	260 Lyons	Iowa.
200 Cuivre R.	Mo.	261 Elk R.	Iowa.
201 Cap Au Gris	Mo.	262 Sabula	Iowa.
202 Reds Landing	Ill.	263 Plum R.	Ill.
203 Hamburg	Ill.	264 Savanna	Ill.
204 Clarksville	Mo.	265 Apple R.	Ill.
205 Louisiana	Mo.	266 Maquoketa R.	Iowa.
206 Salt R.	Mo.	267 Bellevue	Iowa.
207 Mundys Landing	Mo.	268 Galena R.	Ill.
208 Cincinnati Landing	Ill.	269 E. Dubuque	Ill.
209 Saverton	Mo.	270 Dubuque	Iowa.
210 Ilasco	Mo.	271 Ill.-Wis. State line.	
211 Hannibal	Mo.	272 Platte R.	Wis.
212 South R.	Mo.	273 Grant R.	Wis.
213 North R.	Mo.	274 Spechts Ferry	Iowa.
214 Fabius R.	Mo.	275 Waupeton	Iowa.
215 Quincy	Ill.	276 Cassville	Wis.
216 La Grange	Mo.	277 Turkey R.	Iowa.
217 Canton	Mo.	278 Guttenberg	Iowa.
218 Gregory Landing	Mo.	279 Glen Haven	Wis.
219 Fox R.	Mo.	280 Clayton	Iowa.
220 Warsaw	Ill.	281 Wyalusing	Wis.
221 Alexandria	Mo.	282 Wisconsin R.	Wis.
222 Des Moines R.	Mo. and Iowa.	283 Prairie du Chien	Wis.
223 Keokuk	Iowa.	284 McGregor	Iowa.
224 Hamilton	Ill.	285 Lynxville	Iowa.
225 Montrose	Iowa.	286 Crooked Slough	Wis.
226 Nauvoo	Ill.	287 Lansing	Iowa.
227 Ft. Madison	Iowa.	288 De Soto	Wis.
228 Pontoosuc	Ill.	289 Upper Iowa R.	Wis.
229 Dallas	Ill.	290 Victory	Wis.
230 Skunk R.	Iowa.	291 Bad Axe R.	Wis.
231 Burlington	Iowa.	292 Minn.-Iowa line.	
232 Flint Cr.	Iowa.	293 Genoa	Wis.
233 Henderson Cr.	Ill.	294 Coon Sl.	Wis.
234 Oquawka	Ill.	295 Brownsville	Minn.
235 Keithsburg	Ill.	296 Root R.	Minn.
236 Edwards R.	Ill.	297 La Crosse	Wis.
237 New Boston	Ill.	298 La Crosse R.	Wis.
238 Iowa R.	Iowa.	299 Black R.	Wis.
239 Port Louisa	Iowa.	300 La Crescent	Minn.
240 Muscatine	Iowa.	301 Dresbach	Minn.
241 Fairport	Iowa.	302 Dakota	Minn.
242 Buffalo	Iowa.	303 Richmond	Minn.
243 Andalusia	Ill.	304 Trempeleau	Wis.
244 Ill. and Miss. Canal	Ill.	305 La Moille	Minn.
245 Rock Island.	Ill.	306 Homer	Minn.
246 Rock R.	Ill.	307 Winona	Minn.
247 Davenport	Iowa.	308 Fountain City	Wis.
248 Moline	Ill.	309 Minneiska	Minn.
249 Hampton	Ill.	310 White Water R.	Minn.

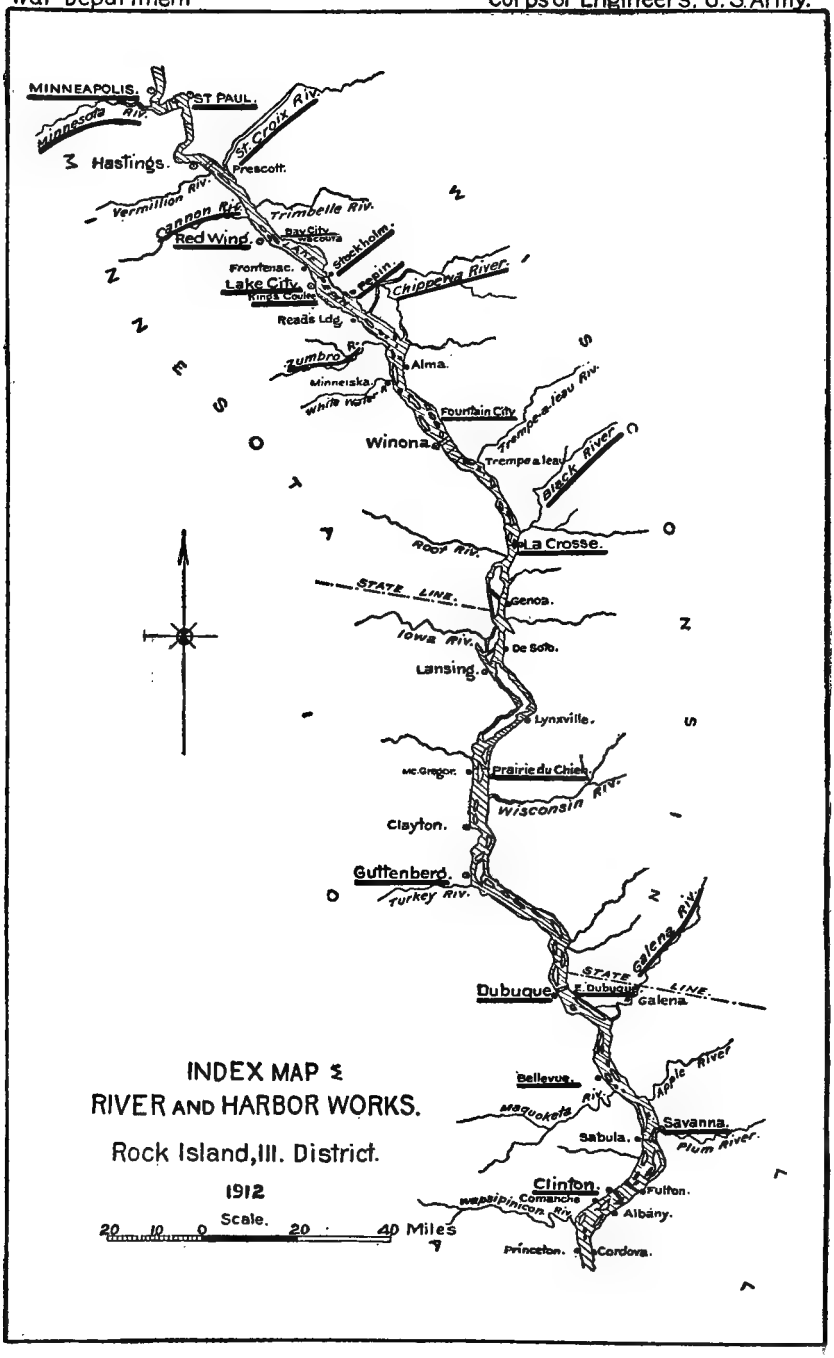

War Department
Corps of Engineers, U.S. Army.
MISSOURI R.
Wood R.
Cahokia Cr.
Chouteau Isl.
Sawyer Bend
Cabaret Isl.
Granite City
Madison
Venice
ST LOUIS
E St. Louis
R. des Peres
Cahokia Chute
Jefferson Bks.
Meramec R.
Kimmswick
Bushberg
Foster Isl.
Herculaneum
Calico Isl.
Crystal City
Kennett Castle
Ivy
Fish Bend
Rush Tower
Rush I.H.
Prairie du Rocher
Brickeys
Fort Chartres
Evansville
New Athens
MISSISSIPPI RIVER
Kaskaskia R.
Between Ohio and Missouri Rivers
Ste. Genevieve
Fort Gage
Chester
Kaskaskia Isl.
Marys R.
St. Marys
Mo. Chute
Liberty
Crains Isl.
Rockwood
Big Muddy R.
Red Rock
76 Landing
Fountain Bluff
Grand Tower
Grand Tower Isl.
Neelys Ldg.
Moccasin Springs
Devils Isl.
Minton Pt.
Cape Girardeau
Grays Point
Thebes
Santa Fe
Cache R.
Commerce
Powers Isl.
Beechridge
Cache
OHIO R.
KY.
Cairo
Bird Point
ILLINOIS
MISSOURI
INDEX MAP
HARBOR AND RIVER WORKS
St. Louis, Mo District
1912
Scale
5 0 5 10 15 Miles
38°00'
37°00'
90°00'

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

War Department Corps of Engineers, U. S. Army.

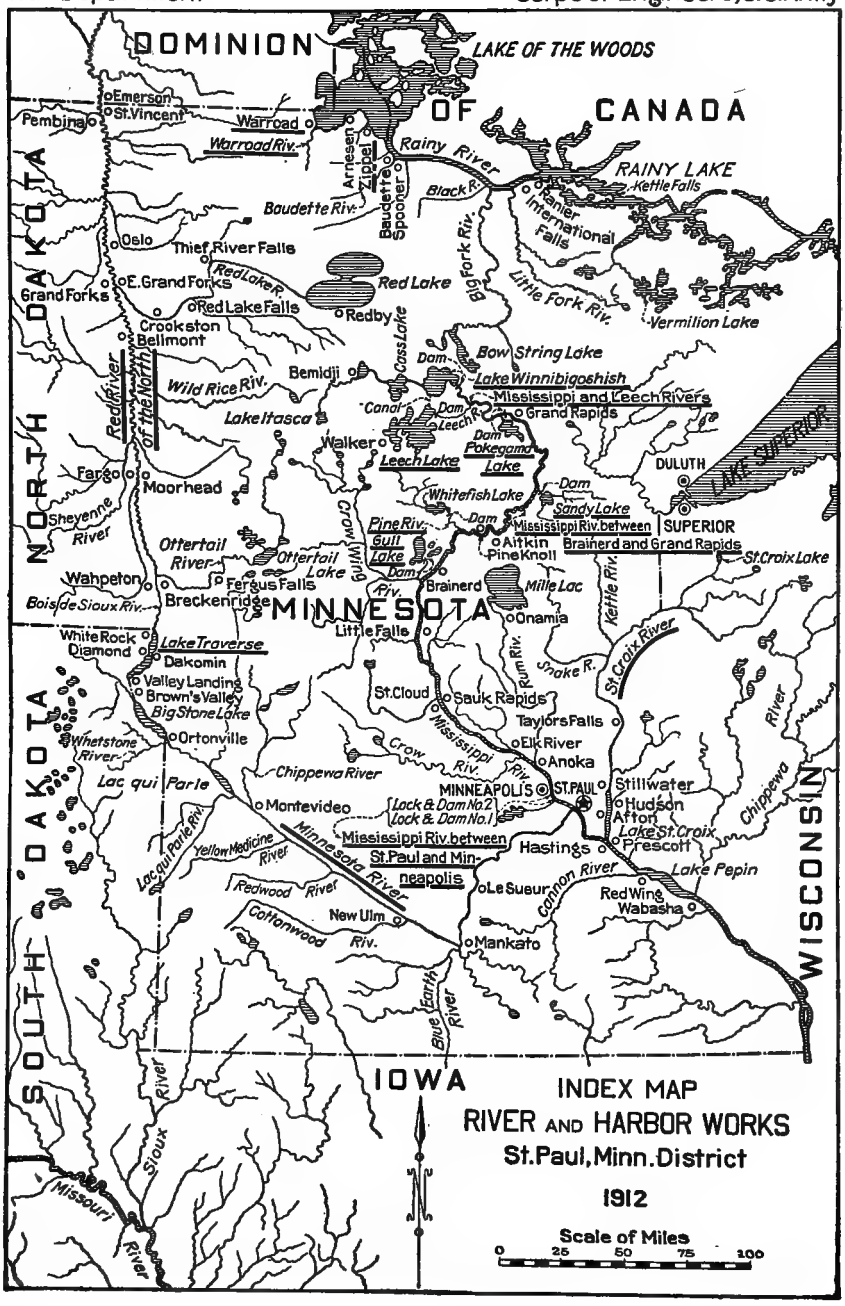


War Department Corps of Engineers, U. S. Army.



See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

War Department Corps of Engineers, U.S. Army



311 Alma	Wis.	322 Bay City	Wis.
312 Zumbro R.	Minn.	323 Red Wing	Minn.
313 Beef Slough	Wis.	324 Trenton	Wis.
314 Wabasha	Minn.	325 Cannon R.	Minn.
315 Reads Landing	Minn.	326 Diamond Bluff	Minn.
316 Chippewa R.	Wis.	327 Prescott	Wis.
317 Lake Pepin	Wis. and Minn.	328 St. Croix R.	Wis. and Minn.
318 Pepin	Wis.	329 Vermilion R.	Minn.
319 Lake City	Minn.	330 Hastings	Minn.
320 Frontenac	Minn.	331 Newport	Minn.
321 Stockholm	Wis.	332 St. Paul	Minn.

ST. PAUL TO HEADWATERS.

333 Minnesota R.	Minn.	345 Pine R.	Minn.
334 Locks and Dams 1 and 2	Minn.	346 Pine Knoll	Minn.
335 Minneapolis	Minn.	347 Aitkin	Minn.
336 Anoka	Minn.	348 Sandy Lake	Minn.
337 Rum R.	Minn.	349 Grand Rapids	Minn.
338 Crow R.	Minn.	350 Pokegama (dam and lake)	Minn.
339 Elk R.	Minn.	351 Leech R. (and lake)	Minn.
340 St. Cloud	Minn.	352 Lake Winnibigoshish (and dam)	Minn.
341 Sauk Rapids	Minn.	353 Cass Lake	Minn.
342 Little Falls	Minn.	354 Bemidji	Minn.
343 Crow Wing R.	Minn.	355 Lake Itasca	Minn.
344 Brainerd	Minn.		

HH.—MISSISSIPPI RIVER.

Part (g), HH-1 Western Rivers. (Dredging, removal of snags, wrecks, and other obstructions, including Arkansas, Mississippi, Missouri, and Ohio Rivers.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Amount to be benefited, **68,** 629; **72,** 340.

Imp. condition of R., **71,** 308.

List of SS. sunk bet. Cairo and Vicksburg, **67,** 387, 391; on lower Missouri, **68,** 654.

Obstr. to navigation by Kansas City Br., **69,** 305, 308.

Danger of cut-off at Vicksburg, **70,** 399.

CONTRACTS.[1]

1867. Marine Railway & Dock Co., constr. of snag boats, **67,** 382. Wm. Jones, snag boats, **67,** 382. C. T. Dumont, snag boats, **67,** 382. Neal Mfg. Co., snag boats, **67,** 382. D. Long, snag boats, **67,** 382. Morton & Stratzman, snag boats, **67,** 382. Hill, Hewitt & Co., snag boats, **67,** 382. Vance & Armstrong, snag boats, **67,** 382. J. J. Hair, snag boats, **67,** 382. D. J. Williams & Co., snag boats, **67,** 382. Swift's Iron & Steel Works, snag boats, **67,** 382. H. Wery, snag boats, **67,** 382. Hedrick & Laidley, snag boats, **67,** 382. Thomas Murdock, hire of snag boat, **67,** 385. Cincinnati Wrecking Boat Co., hire of snag boat, **67,** 385. Arkansas & White River Wrecking Co., hire of snag boat, **67,** 385.

1868. S. Cummings & Son, hire of snag boat, **68,** 610. J. Gominger, hire of snag boat, **68,** 610. J. De Camp, hire of snag boat, **68,** 610. Niles Work, hire of snag boat, **69,** 29.

1873. N. G. Thom, snag boat, **73,** 488.

ENGINEERS.

Chief of Engineers. **R., 66,** 4, ii, 41, iii, 37; **67,** 39; **68,** 58; **69,** 49; **70,** 65; **71,** 57; **72,** 52; **73,** 56; **74,** 62; **75,** 69; **76,** 79; **77,** 79; **78,** 89; **79,** 120.

In charge:

Col. J. N. Macomb, 1867–70. **R., 67,** 376, 389, 394; **68,** 589, 596, 604, 621; **69,** 285, 301, 307; **70,** 391, 398.

Lt. Col. W. F. Raynolds, 1870–73; **70,** 66, 394. **R., 71,** 307, 382; **72,** 335.

Col. J. H. Simpson, 1873; **73,** 56.

Maj. C. R. Suter, 1873–79; **73,** 56, 486. **R., 73,** 486; **74,** 368; **75,** 513; **76,** 618; **77,** 495; **78,** 649; **79,** 1049.

Assistants:

Capt. C. W. Howell. **R., 67,** 390; **68,** 605; **69,** 310.

Capt. C. R. Suter. **R., 69,** 303; **70,** 395; **71,** 383.

S. T. Abert, **69,** 50, 296, 301.

J. F. Richardson. **R., 68,** 594.

D. Hiner. **R., 68,** 597.

C. E. Pierce, **67,** 392; **68,** 602, 607.

E. M. Shield. **R., 68,** 602, 605, 632.

E. G. Hamlin. **R., 67,** 594.

ESTIMATES. (See Plans and Projects.)

Monthly cost of light-draft snag boat, $3,160, **68,** 609, 633.

By Capt. Howell, 1868, building light-draft snag boat, $29,000, **68,** 621, 633.

By Maj. Suter, 1875, iron-hull snag boat, $245,000, **73,** 490; **74,** 371; **75,** 516; **76,** 622; **77,** 79, 497.

LEGISLATION.

Act of Congress, July, 1866, au. constr. of br. over Missouri at Kansas City, **69,** 309.

OBSTRUCTIONS. (See Commerce.)

OPERATIONS.

1866–67. Constr. of snag boats, **67,** 39, 377. Removal of wrecks below St. Louis, **67,** 378, 392.

1867–68. Operation of snag boats, **68,** 58, 590, 610, 613. Removal of wrecks by hired labor, **68,** 591, 600. Constr. of snag boats *Long*, *De Russy*, and *Abert*, **68,** 602, 605.

[1] Difficulty of complying with regulations concerning contracts, **67,** 394; **68,** 605.

1868-69. Operation of snag boats, **69,** 50, 286. Completion of snag boat *Thayer*, **69,** 49. Purchase of dr. boat *Octavia*, **69,** 49. Description of snag boats, **69,** 292.

1869-72. Removal of obstr., and dr., **70,** 65, 391; **71,** 57, 308; **72,** 52, 337.

1872-73. Removal of obstr., **73,** 487. Loss of snag boat *Thayer*, **73,** 57, 486. Constr. of iron snag boats, **73,** 488.

1873-74. Removal of obstr., **74,** 62, 368. Completion of snag boat, **74,** 369.

1874-79. Removal of obstr., **75,** 67, 514; **76,** 79, 619; **77,** 495; **78,** 89, 649; **79,** 120, 1050.

Obstructions removed:

1867-68. Mississippi R., 158 snags; Missouri R., 222 snags; Arkansas R., 149 snags, **68,** 613.

1868-69. Mississippi R., 952 snags, 4,648 trees, and 7 logs; Missouri R., 1,695 snags, 8,516 trees, and 4 logs; Arkansas R., 50 snags and 1 tree, **69,** 289.

1869-70. Mississippi R., 813 snags, 22,504 trees, and 9 logs; Missouri R., 1,413 snags, 10,946 trees, and 56 logs; Arkansas R., 805 snags, 114 trees, and 3 logs, **70,** 394.

1870-71. Mississippi R., 1,200 snags, 6,000 trees, and 17 logs; Missouri R., 1,110 snags, 5,800 trees, and 16 logs; Arkansas R., 1,169 snags, 5,925 trees, and 16 logs, **71,** 58.

1871-72. Mississippi R., 1,365 snags, 2,621 trees, and 12 logs; Missouri R., 2,226 snags, 12,100 trees, and 72 logs; Arkansas R., 542 snags, 259 trees, and 2 logs, **72,** 339.

1872-73. Mississippi R., 1,365 snags, 1,713 trees, and 5 logs; Missouri R., 913 snags, 3,565 trees, and 23 logs; Arkansas R., 110 snags and 44 trees, **73,** 486, 487.

1873-74. Mississippi R., 630 snags, 515 trees, and 6 logs; Missouri R., 841 snags, 1,408 trees, and 14 logs, **74,** 368.

1874-75. Mississippi R., 1,461 snags, 2,984 trees, and 14 logs; Missouri R., 649 snags, 1,570 trees, and 23 logs; Arkansas R., 663 snags, 1,104 trees, and 9 logs, **75,** 515.

1875-76. Mississippi R., 1,213 snags, 1,589 trees, and 5 logs; Missouri R., 456 snags, 343 trees, and 8 logs; Arkansas R., 545 snags, 1,274 trees, and 5 logs, **76,** 620.

1876-77. Mississippi R., 696 snags, 402 trees, and 4 logs; Missouri R., 161 snags and 5 logs; Arkansas R., 193 snags, 234 trees, and 3 logs, **77,** 497.

1877-78. Mississippi R., 889 snags, 3,346 trees, and 1 log; Missouri R., 393 snags and 12 logs; Arkansas R., 430 snags, 1,177 trees, and 11 logs, **78,** 651.

1878-79. Mississippi R., 1,133 snags, 2,690 trees, and 5 logs; Missouri R., 876 snags, 258 trees, and 30 logs, **79,** 1050.

PHYSICAL CHARACTERISTICS.

Of lower Mississippi, **68,** 623; of Mississippi, **70,** 398, 402.

Floods on Arkansas, **69,** 299, 351.

Floods on Missouri, **69,** 351.

Current observations on Arkansas, **69,** 298.

Abrasion of banks on Mississippi, **70,** 398.

Danger of cut-off at Vicksburg, **70,** 399.

Formation of snags, **68,** 624; **73,** 489.

Formation of drift piles, **68,** 624.

PLANS. (See Estimates and Projects.)

By Capt. Howell, for R. channelers, **69,** 310, 311.

By J. A. Ragan, imp. of Mississippi by prevention of floods, **70,** 400; reported impracticable, **70,** 402.

PROJECTS. (See Estimates and Plans.)

Imp. of these Rs. not admitting permanent constr., **67,** 379; **68,** 621; **70,** 391; **73,** 489.

Removal of wrecks, **67,** 378, 390, 392.

Constr. of light-draft snag boats, **68,** 59, 597, 599.

Lighting reaches of Mississippi R., **68,** 594, 611.

Missouri, rectification of chan. and removal of obstr., **68,** 621, 624.

By Lt. Col. Raynolds, 1870, rebuilding snag boat, reducing draft from 4½′ to 2½′, **71,** 58, 382, 385. Requirements of snag boats, **71,** 310, 382, 385. Necessity for iron hulls, **72,** 340.

By Maj. Suter, 1873, removal of trees from banks, constr. of 4 iron-hull snag boats, and mainten. of R. free from snags for 6 years, $3,274,000, **73,** 57, 489; **75,** 67, 516; **76,** 622; **77,** 497; comparative merits of iron and wooden hull snag boats, **74,** 370; **75,** 516.

SURVEYS.

1867. Upper Missouri and Arkansas Rs., **68,** 59, 591; **69,** 50.

1868. Continuation of sur., **68,** 58.

1869. Lower Missouri, Mississippi, and Arkansas Rs., **69,** 50, 286, 297.

1870. Completed on Arkansas, **70,** 65, 391. Progress of, on Missouri and Mississippi, **70,** 65, 391.

1876. Of Missouri above St. Joseph, **76,** 627

Part (h), HH-1 Mississippi River Levees.

[Including "Railroad levee on the west side of the Mississippi," "Reclaiming waste lands of the lower Mississippi," "Repairing and perfecting present system of levees on the Mississippi River," "Reclamation of the alluvial basin of Mississippi," and "The establishment of gauges on the Mississippi and its principal tributaries," "Effects of a permanent levee system below mouth of the Ohio River."]

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Description of; important, **74,** 390; **75,** 563, 595, 629; **79,** 1015, 1019.

ENGINEERS.

Chief of Engineers:

Reports on RR. levee on the w. of Mississippi, **68,** 54, 468.

Reclaiming waste lands on lower Mississippi R., **69,** 51, 322, 323, 327.

Levees of Mississippi R. from Ohio to Gulf of Mexico, **70,** 405; **74,** 380; **79,** 1015.

Reclamation of alluvial basin of Mississippi, **75,** 536; **79,** 110, 853.

Estab. of gauges on Mississippi and principal tributaries, **70,** 402; **71,** 60; **72,** 57; **73,** 60; **74,** 60; **75,** 70; **76,** 79; **77,** 78; **78,** 88; **79,** 117.

Directing Maj. H. L. Abbot to report on repairing and perfecting levees, **69,** 328; **74,** 394.

Boards:

To investigate and report, 1874, on permanent plan for reclamation of alluvial basin of Mississippi subject to inundation. Reported resort to cut-offs dangerous and useless, **75,** 540, 564, 670. Diversion of tributaries impracticable, **75,** 540, 564, 670. Reservoirs for holding back floods also impracticable from lack of proper size, **75,** 540, 564, 670. Artificial outlets as dangerous and impracticable, **75,** 541, 545, 564, 670. Levees the only practicable plan, **75,** 550, 564, 600. Errors of system, **75,** 550. Section of levees, **75,** 552, 553, 562, 566, 587, 593, 596, 626, 664. Inspection and guarding of, **75,** 555. Location of, **75,** 557. Condition of, **75,** 588, 596, 599. **R., 75,** 539, 678. (Majs. Warren and Abbot, Capt. W. H. H. Benyaurd, and Messrs. J. E. Sickles and P. O. Herbert.)

For imp., 1878, of l.-w. navigation below Cairo, to report on "Effect of permanent leevee system * * * below mouth of Ohio." Board reported that a permanent system would develop a large addl. C., **79,** 1017; and, taken in connection with a l.-w. imp., would be an aid to l.-w. navigation, **79,** 1018. (Cols. Barnard and Tower, Lt. Col. Wright, and Majs. Comstock and Suter.)

In charge:

Maj. W. E. Merrill, 1872–74. **R., 72,** 426; **73,** 517; **74,** 487.

Capt. C. W. Howell, 1874–75. **R., 75,** 533.

Capt. W. H. H. Benyaurd, 1875–79. **R., 76,** 600; **77,** 493; **78,** 646; **79,** 982.

ESTIMATES. (See Plans and Projects.)

By Maj. H. L. Abbot, 1869, repairing and perfecting levees in Louisiana, $15,020,000; in Mississippi, $4,150,000; in Arkansas, $19,060,000, **69,** 328, 330, 332, 334, 344, 347; **70,** 405; **74,** 382, 387, 391.

By BE., 1875, to close breaks in levees in Louisiana, Mississippi, Missouri, and Arkansas, $3,459,450, **75,** 562; perfecting system in Louisiana, Mississippi, Missouri, and Arkansas, $45,909,600, **75,** 563, 593, 627; sur. of alluvial basin, $300,000, **75,** 537, 561.

OPERATIONS.

1871–72. List of gauges estab., **72,** 57, 426, 428.

1872–79. Estab. and repair of gauges, **73,** 517; **74,** 487; **75,** 533; **76,** 600; **77,** 494; **78,** 646; **79,** 982.

PHYSICAL CHARACTERISTICS.

Floods of Mississippi, **68,** 471; **69,** 321, 327, 335; **75,** 541, 553, 565, 594, 606, 676; **76,** 616; compared with Nile, **69,** 321, 327.

Floods of tributaries, **75,** 634.

Floods; effect on levees, **68,** 471; **74,** 382; **79,** 1017; effects on banks, **72,** 436.

Discharge of Mississippi, **69,** 325, 339; **75,** 574, 580.

Sediment in Mississippi **69,** 325; **72,** 439; **75,** 541.

Levees; breaks in, **74,** 382; **75,** 590, 612.

Levees on the Nile, **75,** 556.

Levees, caving of; rate, **75,** 608.

Levees, caving of; cause, **75,** 558; **79,** 1017.

Crevasses, effect of, **75,** 541.

Crevasses, table of, on Mississippi, **75,** 542, 572, 590, 612.

Cut-offs, action of, **75,** 540, 575.

R. bottom, character of, **75,** 546, 549.

Bottom lands, **68,** 468; **79,** 1016.

Physical geography of delta, **79,** 854.

Rainfall in lower valley, **75,** 571.

Mud lumps, formation of, **75,** 626.

Depth of alluvial beds, **75,** 626; **79,** 855.

Geology of alluvial beds, **79,** 855.

Description of gauges, **72,** 428; **73,** 523; **74,** 488.

PLANS. (See Estimates and Projects.)

By Gen. B. S. Roberts, 1866, reclaiming waste land of lower Mississippi with levees having waste weirs, to allow lowlands to be flooded, the sediment to raise the land, **69,** 51, 312. Also to increase l.-w. supply of Mississippi by draining Lake Michigan, **69,** 320. Reported impracticable, **69,** 323. (See Board of Engineers.)

Of the Memphis & St. Louis RR. Co., 1868, RR. levee on the w. bank, mouth of St. Francis R. to connect with Iron Mountain RR., **68,** 468; **74,** 382.

Description of levee from mouth of Ohio to mouth of Mississippi, **74,** 380, 393.

PRIVATE (STATE) WORK.

Louisiana expended in repair of levees, 1865–67, $2,661,516.13, **69,** 325.

Condition of State levees, **69,** 388; **74,** 380; **75,** 588, 596, 599.

Necessity of cooperation bet. State and U. S., **70,** 405; **75,** 565, 595, 600.

PROJECTS. (See Estimates and Plans.)

By Brig. Gen. A. A. Humphreys, 1868, levees, Cape Girardeau to mouth of Mississippi, to restrain max. flood discharge to chan., **69,** 335, 344; **72,** 438; **74,** 392.

By Maj. H. L. Abbot, 1870, gauges on western Rs. to perfect information concerning floods, **70,** 402.

By Maj. Merrill, 1872, telegraphic communication bet. gauges, **72,** 435.

By BE., 1874, to reclaim and protect alluvial region of the Mississippi: 1st, opening and maintaining Atchafalaya and La Fourche Rs.; 2d, by a general system of levees, Cape Girardeau to Gulf of Mexico, **75,** 564, 674.

SURVEYS.

Necessity for careful sur. before plan could be made; est., $300,000, **75,** 357, 360, 361.

Part (i), HH-1 Mississippi River, Upper. (Removal of snags and obstructions.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Statement, upper R., **80,** 1492.

Vessel accidents in 1879, **80,** 1492.

Advantages to C. from use of sheer booms at brs., **81,** 1678.

Necessity for lights and dams, **81,** 1679.

Necessity for ice Hs., **81,** 1680.

List of wrecks, **84,** 1548.

List of dimensions of SS. navigating the upper Mississippi in 1890, **90,** 2027.

Lumber interests, **90,** 2031.

Approx. t. of vessels using R. bet. Falls of St. Anthony and mouth of Missouri R., 1892, 4,500,000, **93,** 2190; 1899, 2,900,000; **00,** 2680.

List and dimensions of SS. navigating the R. bet. St. Louis and St. Paul, **04,** 2159.

An. t. bet. Falls of St. Anthony and mouth of Missouri R., 2,081,566 t. of logs, lumber, and U. S. material, **12,** 2142.

CONTRACTS.

1881. Howard & Co., light-draft snag boat, **82,** 1752.

ENGINEERS.

Chief of Engineers. **R., 80,** 171; **81,** 231; **82,** 228; **83,** 235; **84,** 238; **85,** 260, 265; **86,** 250; **87,** 218; **88,** 196; **89,** 231; **90,** 207; **91,** 264; **92,** 253; **93,** 285; **94,** 261; **95,** 291; **96,** 23, 253; **97,** 23, 321; **98,** 314; **99,** 38, 375; **00,** 431; **01,** 440; **02,** 370; **03,** 393; **04,** 415; **05,** 426; **06,** 464; **07,** 490; **08,** 523; **09,** 553; **10,** 622; **11,** 667; **12,** 807.

In charge:

Maj. A. Mackenzie, 1880–95. **R., 80,** 1481; **81,** 1677; **82,** 1750; **83,** 1377; **84,** 1245; **85,** 1662; **86,** 1403; **87,** 1617, 1623; **88,** 1471; **89,** 1726; **90,** 2021; **91,** 2137; **92,** 1749; **93,** 2189; **94,** 1627; **95,** 2095.

Lt. Col. W. R. King, 1896–97. **R., 96,** 1763; **97,** 2049.

Capt. C. McD. Townsend, 1898–1902. **R., 98,** 1733; **99,** 2091; (Maj.) **00,** 2679; **01,** 2231; **02,** 1609.

Maj. J. L. Lusk, 1903–04. **R., 03,** 1463; **04,** 2156.

Maj. C. S. Riché, 1905–09. **R., 05,** 1607; **06,** 1413; **07,** 1555; **08,** 1627; **09,** 1617.

Maj. Chas. Keller, 1910–12. **R., 10,** 1773; **11,** 1931; **12,** 2141.

Assistants:

C. W. Durham. **R., 80,** 1482; **81,** 1681; **82,** 1751; **83,** 1379; **84,** 1547; **85,** 1663; **87,** 1620; **88,** 1474, 1479; **89,** 1727; **90,** 2029; **91,** 2143; **92,** 1756; **93,** 2196; **94,** 1634; **95,** 2152; **96,** 1772; **97,** 2058; **98,** 1741; **99,** 2100; **00,** 2689; **01,** 2235; **02,** 1613 **03,** 1467; **04,** 2162; **05,** 1610.

Lt. C. Keller. **R., 95,** 2095.

OBSTRUCTIONS.

Injurious effect of sawdust deposits in upper R., **81,** 1679; **82,** 1750.

List of wrecks bet. St. Louis and St. Paul which have been, are, or may become obstr. to navigation, with approx. dates of sinking, **92,** 1764; **94,** 1635; **96,** 1774; **00,** 2691.

List of obstr. (r. and wrecks) to navigation, **02,** 1615.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

OPERATIONS.[1]

1879-87. Removing obstr. bet. St. Paul and mouth of Missouri R., **80,** 1483; **81,** 1681; **82,** 1751; **83,** 1380; **84,** 1548; **85,** 1644; **86,** 1409; **87,** 1620.

1887-88. 232 snags and 3 wrecks cleared from chan. and 833 leaning trees cut from banks, **88,** 1475.

1888-89. 361 snags removed from chan. and 2,034 trees cleared from banks; 31,500 c. y. dr. from chan., **89,** 1728.

1889-90. 400 snags removed from chan.; 1,183 c. y. r. placed in dams; 1,690 leaning trees cleared from banks; 8 wrecks and 11,160 c. y. gravel removed, **90,** 2030.

1890-91. 271 snags, 5 cribs, 1 wreck, and 36 dump loads of material removed from chan., and 2,200 leaning trees cleared from banks, **91,** 2144, 2145.

1891-92. 359 snags removed from chan. and 1,265 leaning trees cleared from banks, **92,** 1759.

1892-93. About 2,500 snags and other obstr. and 5 wrecks removed; dr. done, **93,** 2197, 2198.

1893-94. About 5,500 snags, etc., and 2 wrecks removed; plant repaired, **94,** 1635.

1894-95. About 5,200 snags and 5 wrecks removed; dr. done, **95,** 2103.

1895-96. About 13,600 snags, etc., and 1 wreck removed, **96,** 1773.

1896-97. Over 3,000 snags, etc., and 1 wreck removed; levees repaired and dr. done, **97,** 2058.

1897-98. Nearly 4,000 snags, etc., and 4 wrecks removed; 40,743 c. y. dr., about 1,500 c. y. solid r. broken, and 6,921 c. y. broken r., etc., taken up and removed, **98,** 1742.

1898-99. About 5,400 snags and other obstr.; 693 c. y. solid and 373 c. y. loose r., 1,060 c. y. sand, and 2 wrecks removed from chan., **00,** 2100.

1899-00. About 2,100 snags and other obstr.; 4,700 c. y. solid r., 9,400 c. y. loose r., 2,000 c. y. clay, 3,400 c. y. sand, and 2 wrecks removed from chan., **00,** 2690.

1900-01. 147 snags and 1 wreck removed, 295 trees pulled back, 1,770 trees felled, and 76 buoys placed, **01,** 2237. Snag boat *Gen. Barnard* replaced by snag boat *Gen. Mackenzie*, **01,** 440.

1901-02. 794 snags and stumps and 2 wrecks removed, 264 trees pulled back, 2,252 trees felled, and 44 buoys placed; 17,770 c. y. sand and 1,735 c. y. r. removed, **02,** 1614.

1902-03. 429 snags and stumps and 1 wreck removed, 212 trees pulled back and 1,869 felled, and 33 buoys placed; dr. at Fulton H., Wilds Landing, Beef Slough, Hamburg, Burlington, and Andalusia Slough, **03,** 1467.

1903-04. 474 snags and stumps removed, 196 trees pulled back, 2,050 trees felled, and 28 buoys placed; work by dr. at various places, **04,** 2162.

1904-05. 341 snags, stumps, and bowlders removed, 55 trees pulled back and 1,375 felled, and 17 buoys placed; work by dr. at various localities, **05,** 1611.

1905-06. 800 snags and stumps removed, 172 trees pulled back, 2,480 trees felled, and 15 buoys placed; dr. at various places, **06,** 1414.

1906-07. 937 snags, stumps, and wrecks removed, 370 trees pulled back, 3,877 trees felled, 12 buoys placed, and 81,856 c. y. dr., **07,** 1556.

1907-08. 319 snags and other obstr. removed, 272 trees pulled back, 3,495 trees felled, and 12,258 c. y. dr., **08,** 1628.

1908-09. 574 snags and other obstr. removed, 929 trees pulled back, 9,733 trees cut, and 2,973 c. y. dr., **09,** 1618.

1909-10. 412 snags and other obstr. removed, 650 trees pulled back, and 4,169 trees felled, **10,** 1774.

1910-11. 291 snags removed, 174 stumps destroyed, 136 trees pulled back, and 1,768 trees cut, **11,** 1932.

1911-12. 260 snags and stumps removed, 97 stumps destroyed, 179 trees pulled back, 1,492 trees cut, 4 buoys placed, 94 piles pulled, and 4 wrecks removed, **12,** 2142.

PHYSICAL CHARACTERISTICS.

List of bars and chan. d., **80,** 1484; **81,** 1682; **82,** 1752.

Description of, **93,** 2196; **94,** 1634; **95,** 2102; **96,** 1772; **97,** 2059; **98,** 1741.

Available chan. d. at worst bars at lowest stage, 1893, **94,** 1635; 1894, **95,** 2104; 1895, **96,** 1774; 1896, **97,** 2059; 1897, **98,** 1744; **99,** 2101; **00,** 2690; **01,** 2237; **02,** 1616.

List of r., obstr. or liable to become such, bet. St. Louis and St. Paul, **94,** 1636; **96,** 1775.

Gauge readings, **95,** 2103.

Extent of aid rendered navigation by reservoirs, **95,** 2104.

PROJECTS.

Act Aug. 11, 1888, au. uninterrupted work of snag and dr. boats on the upper R. under a permanent app. not to exceed $25,000 an., **12,** 807.

Act Mar. 2, 1907, au. snagging and dr. to include Illinois R., from mouth to Copperas Creek, **08,** 523.

Extended by act Mar. 3, 1909, to include Illinois R. up to La Salle, and the Minnesota, St. Croix, Chippewa, Wisconsin, Black, Galena, and Rock Rs. (i. e., all tributaries hitherto imp. by U. S.), **09,** 554.

SURVEYS.

Misc. sur. and ex., **93,** 2197; **97,** 2058; **98,** 1742; **99,** 2100; **00,** 2689.

Gauges estab., **94,** 1635; **93,** 2197.

[1] Summary of operations from 1868 to 1884, **85,** 1664. Comparative cost of constr. material from 1878 to 1885, **86,** 1405, 1407. Comparative cost of dr. from 1882 to 1885, **86,** 1408.

Part (j), HH-1 Obstructions—Lower Mississippi River.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

See "Ohio River to Missouri River," p. 1180.

CONTRACTS.

Detailed list of expend. for each year will be found at the end of each an. report.

1895. Iowa Iron Works, replating hull of snag boat, $22,900, **95,** 2046.

1902. New Jersey Foundry & Machine Co., 2 refrigerating plants, $3,550 each, **02,** 1596.

1906. A. B. Electric Co., electric-light plant, snag boat *H. G. Wright,* $1,453, **06,** 1402.

ENGINEERS.

Chief of Engineers. R., 80, 162; **81,** 223; **82,** 221; **83,** 229; **84,** 236; **85,** 252; **86,** 244; **87,** 210; **88,** 191; **89,** 225; **90,** 203; **91,** 258; **92,** 248; **93,** 280; **94,** 256; **95,** 287; **96,** 23, 249; **97,** 23, 317; **98,** 309; **99,** 38, 370; **00,** 425; **01,** 434; **02,** 366; **03,** 389; **04,** 412; **05,** 423; **06,** 461; **07,** 486; **08,** 519; **09,** 549; **10,** 618; **11,** 662; **12,** 802.

In charge:

Maj. C. R. Suter, 1873–84. **R., 80,** 1401; **81,** 1599; **82,** 1674; **83,** 1297; **84,** 1531; **85,** 1652.

Maj. A. M. Miller, 1884–92. **R., 85,** 1633; **86,** 1393; **87,** 1553; **88,** 1419; **89,** 1671; **90,** 1959; **91,** 2079; **92,** 1705.

Maj. C. J. Allen, 1893–95. **R., 93,** 2139; **94,** 1567; **95,** 2043.

Maj. T. H. Handbury, 1896–98. **R., 96,** 1707; **97,** 2001; **98,** 1687.

Capt. Edw. Burr, 1899–1901. **R., 99,** 2047; **00,** 2621; **01,** 2166.

Maj. Thos. L. Casey, 1902–06. **R., 02,** 1593; **03,** 1441; **04,** 2126; **05,** 1583; **06,** 1399.

Col. C. B. Sears, 1907. **R., 07,** 1535.

Capt. G. R. Lukesh, 1908. **R., 08,** 1609.

Col. W. H. Bixby, 1909. **R., 09,** 1593.

1st Lt. C. H. Knight, 1910. **R., 10,** 1751.

Lt. Col. Chas. L. Potter, 1911–. **R., 11,** 1897; **12,** 2107.

Assistant. Lt. C. Harding. **R., 95,** 2054.

OPERATIONS.

All operations with hired labor.

1879–80. 1,522 snags, 19 drift piles, and 600 trees removed, **80,** 1402. Constr. of new snag boats in progress, **80,** 1403.

1880–81. 1,057 snags, 6 drift piles, and 647 trees removed, **81,** 1600. Completion of new snag boats, **81,** 1602.

1881–82. 1,909 snags, 32 drift piles, and 4,983 trees removed, **82,** 1574.

1882–83. 2,775 snags, 31 drift piles, and 26,297 trees removed, **83,** 1298.

1883–84. 958 snags, 3 drift piles, and 4 trees removed, **84,** 1532.

1884–85. 1,692 snags and 16,900 trees removed, **85,** 1634.

1885–86. 693 snags and 567 trees removed, **86,** 1394.

1886–87. 2,030 snags, 10 drift piles, and 5,269 trees removed, **87,** 1554.

1887–88. 798 snags and 348 trees cleared from chan. and banks, **88,** 1420.

1888–89. 1,864 snags, 34 drift piles, and 8 wrecks removed from chan., and 9,102 trees cleared from banks, **89,** 1672.

1889–90. 2,861 snags, 23 drift piles, and 1 wreck removed from chan., and 12,112 trees cleared from banks, **90,** 1960.

1890–91. 3,450 snags pulled, 21,316 trees cut, and 30 drift piles removed, **92,** 1706.

1892–93. Over 11,000 snags, etc., removed, and plant repaired, **93,** 2140.

1893–94. 5 wrecks and nearly 26,000 snags, etc., removed; plant repaired, **94,** 1569.

1894–95. 3 wrecks and nearly 21,000 snags, etc., removed; plant repaired, **95,** 2045.

1895–96. Plant repaired, a wreck and nearly 23,000 snags, etc., removed, **96,** 1708.

1896–97. 1 wreck and about 34,000 snags, etc., removed; RR. wreckage removed at mouth of Big Muddy, expense borne by Chicago & Texas Ry. Co., **97,** 2003.

1897–98. 3 wrecks and about 17,000 snags, etc., removed, **98,** 1689.

1898–99. Boats repaired, and about 34,000 snags and other obstr. removed, **99,** 2049.

1899–00. Boats repaired and about 27,000 obstr. removed, **00,** 2623.

1900–01. 3,566 snags and 28 piles removed; 19,746 trees cut and 5 wrecks removed, **01,** 2167.

1901–02. 3,970 snags and 27 piles removed, 28,870 trees cut, and 7 wrecks removed, **02,** 1594.

1902–03. Ice and refrigerating plants installed on snag boats *Macomb* and *Wright;* 1,552 snags and 2 piles removed, and 6,895 trees cut, **03,** 1442.

1903–04. 4,654 snags and 18 drift piles removed, 17,034 trees cut and 2 wrecks removed, **04,** 2126.

1904–05. 4,118 snags and 19 drift piles removed, 15,241 trees cut, and 12 wrecks removed, **05,** 1584.

1905–06. 2,564 snags and 16 drift piles removed, and 14,478 trees cut, **06,** 1400.

1906–07. 3,339 snags, 23 drift piles, and 7 wrecks removed, and 2,772 trees cut, **07,** 1536.

1907–08. 3,744 snags, 19 drift piles, and 6 wrecks removed, and 5,175 trees cut, **08,** 1610.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Work begun of removal of Beaver Dam Rock and other obstructive r.; accident to plant, **08,** 1612.

1908-09. 4,526 snags, 27 drift piles, and 23 wrecks removed, and 2,406 trees cut, **09,** 1594; 710 c. y. r. blasted from Beaver Dam Rock, **09,** 1596.

1909-10. 3,245 snags, 17 drift piles, and 23 wrecks removed, and 2,571 trees cut, **10,** 1752; 250 c. y. r. blasted from Beaver Dam Rock, **10,** 1754.

1910-11. 3,823 snags, 6 drift piles, 21 wrecks removed; 734 trees cut, and work on removal of Beaver Dam Rock continued and practically completed, **11,** 1899.

1911-12. 1,517 snags, 11 drift piles, 14 wrecks removed, and 1,698 trees cut, **12,** 2108.

NOTE.—Itemized statement of expenses for operating snag boats, etc., printed each year, in reports of district engineers, and summary of amount and cost of work from 1868 to date, in 1905 and each year thereafter. **05,** 1585; **06,** 1401; **07,** 1537; **08,** 1611; **09,** 1595; **11,** 1753; **11,** 1900; **12,** 2110.

PHYSICAL CHARACTERISTICS.

Great value of snagging work, **03,** 1443.

PRIVATE (CORPORATE) WORK.

Expense of removal, by the U. S., of a wreck which occurred Mar. 3, 1897, at the br. near the mouth of Muddy R. borne by Chicago & Texas RR. Co., **97,** 2002.

PROJECTS.

Snagging operations of great benefit, **93,** 2140; **98,** 1688.

Jan. 29, 1902, au. granted to estab. ice-making and refrigerating plants on the 2 snag boats; cost, $7,100, **02,** 1594.

SURVEYS.

Of Beaver Dam Rock, **07,** 1612.

Part (k), HH-1 Mississippi River Gauges.

APPROPRIATIONS. (See p. 1089.)

CONTRACTS.

Itemized accounts of expend. each year. (See each an. report.)

ENGINEERS.

Chief of Engineers. **R., 80,** 158; **81,** 212; **82,** 210; **83,** 218; **84,** 226; **85,** 243; **86,** 237; **87,** 202; **88,** 184; **89,** 216; **90,** 194; **91,** 246; **92,** 239; **93,** 269; **94,** 250; **95,** 278; **96,** 22, 243; **97,** 23, 309; **98,** 301; **99,** 38, 360; **00,** 412; **01,** 425; **02,** 578; **03,** 639; **04,** 707; **05,** 716; **06,** 794; **07,** 812; **08,** 863; **09,** 909; **10,** 1015; **11,** 1074; **12,** 1288.

Boards. Mississippi R. Commission. **R., 02,** S., 52; **03,** S., 62, 97; **04,** S., 7 63; **05,** S., 8, 86; **06,** 2471, 2502, 2517; **07,** 2610, 2648; **08,** 2679, 2701; **09,** 2645, 2679, 2707; **10,** 2922, 2959, 2978 3001; **11,** 3168, 3209, 3216, 3231, 3259, 3308; **12,** 3751, 3758, 3772, 3776.

In charge:

Maj. W. H. H. Benyaurd, 1874–82. **R., 80,** 1342; **81,** 1436; **82,** 1561.

Maj. A. M. Miller, 1882–84. **R., 83,** 1162; **84,** 1341.

Capt. E. Bergland, 1884–86. **R., 85,** 1532; **86,** 1368.

Capt. J. H. Willard, 1886–99. **R., 87,** 1485; **88,** 1370; **89,** 1624; **90,** 1908; **91,** 2014; **92,** 1663; **93,** 2057; **94,** 1523; **95,** 1955; (Maj.) **96,** 1633; **97,** 1936; **98,** 1642; **99,** 2025.

Maj. T. L. Casey, 1900–01. **R., 00,** 2540; **01,** 2072.

Assistants:

H. B. Herr. **R., 81,** 1437.

Kivas Tully. **R., 02,** S., 52; **03,** S., 97; **04,** S., 63; **05,** S., 86.

LEGISLATION.

Laws relating to estab. of gauges on R., **98,** 1644.

OPERATIONS.

Observations of gauges each year; records furnished interested offices, and gauges inspected and repaired. (See references, Engineers.)

PHYSICAL CHARACTERISTICS.

List of water gauges, **81,** 1438; **85,** 1533; **87,** 1485.

Water-gauge records, **80,** 1342; **81,** 1439; **82,** 1562; **83,** 1163; **84,** 1341; **85,** 1532; **86,** 1369; **87,** 1485.

High and l. w. records, **81,** 1439, 1448.

Height of freshets, **81,** 1448; **82,** 1562; **83,** 1163; **84,** 1341; **85,** 1534; **86,** 1369.

Effect of tributaries on h. w. in Mississippi R., **81,** 1450.

Rate of progress of h.-w. wave, **81,** 1451.

Elevations of gauge zeros from St. Louis to Carrollton above Cairo datum, **89,** 1628.

Comparison of flood of 1890 with highest water previously recorded, **90,** 1912.

Chart showing limiting lines of h. and l. w. on Mississippi, St. Louis to Head of Passes, **91,** 2014.

Comparison of floods of 1891 and 1892 with highest water previously recorded, **91,** 2019; **92,** 1666,

Difficulty of determining zeros of gauges, which should be set so that there would not be any negative readings, to prevent errors in recording observations, **93,** 2060.

Comparison of h. w. yearly with highest water recorded since estab. of gauges, **93,** 2064; **94,** 1527; **95,** 1959; **96,** 1637; **97,** 1942; **98,** 1645; **99,** 2028; **00,** 2543.

Comparison of l. w., etc., **95,** 1959; **96,** 1637; **97,** 1943; **98,** 1645; **99,** 2029; **00,** 2544.

Highest and lowest gauge readings, **02,** S., 62; **03,** S., 103; **04,** S., 67; **05,** S., 92; **06,** 2517; **07,** 2664; **08,** 2698; **09,** 2702; **10,** 2978; **11,** 3231; **12,** 3772.

Highest guage readings, **02,** S., 65; **03,** S., 107; **04,** S., 71; **06,** 2522; **07,** 2667; **08,** 2701; **09,** 2707; **10,** 3001; **11,** 3259.

Meter readings, **03,** S., 122; **05,** S., 126.

List of water gauges, **02,** S., 53.

L.-w. readings, **11,** 3216; **12,** 3759.

L.-w. slope, **02,** S., 59; Aitken to Minneapolis, **02,** S., 61; Cairo to Ft. Jackson, **02,** S., 67; Cairo to Memphis, **09,** 2706.

Discharge observations, **02,** S., 59, 70; **03,** S., 101, 111; **04,** S., 65, 75; **05,** S., 88, 90, 115; **06,** 2502; **07,** 2648; **08,** 2642, 2681; **09,** 2646, 2680; **11,** 3168 3210; **12,** 3752.

Velocities, **05,** S., 89.

Comparison of max. heights with h. w. of 1903, **11,** 3235.

Gauge relations, third district, **11,** 3308.

Highest and lowest an. stages, referred to present gauges, **12,** 3776.

PROJECTS.

This work trans. to Mississippi R. Commission, 1901, **01,** 2072.

SURVEYS.

Search for benches of h.-w. elevations, **93,** 2061.

Maps. Hydrographic, Cairo Ill., to Ft. Jackson, La., **12,** 3752.

Part (1), HH-1 Mississippi River—Gauging at or near St. Paul, Minn.

APPROPRIATIONS.[1] (See p. 1089.)

ENGINEERS.

Chief of Engineers. **R., 90,** 215; **91,** 273; **92,** 261; **93,** 294; **94,** 269; **95,** 299; **96,** 259; **97,** 332; **98,** 322; **99,** 38, 384; **00,** 441; **01,** 449; **03,** 405; **04,** 430; **05,** 441; **06,** 482; **07,** 510; **08,** 541; **09,** 573; **10,** 642; **11,** 688; **12,** 830.

In charge:

Maj. W. A. Jones, 1890–97. **R., 90,** 2099; **91,** 2214; **92,** 1849; **93,** 2289; **94,** 1732; **95,** 2202; (Lt. Col.) **96,** 1859; **97,** 2164.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1831; Maj.) **99,** 2205; **00,** 2821.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2340.

Maj. R. L. Hoxie, 1901–1903. **R., 03,** 1549.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2296; (Lt. Col.) **06,** 1479.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1593.

Maj. F. R. Shunk, 1907–. **R., 08,** 1662; **09,** 1653; **10,** 1811; **11,** 1986; **12,** 2192.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

A. Johnson. **R., 90,** 2106.

A. O. Powell. **R., 90,** 2107.

OPERATIONS.

1892-93. 87 gaugings made, **93,** 2289.

1893-94. 159 gaugings made, **94,** 1733.

1894-95. 196 gaugings made, **95,** 2204.

1895-96. 130 gaugings made, **96,** 1861.

1896-97. 127 gaugings made n. of St. Paul, and 81 at mouth of Minnesota R., at Ft. Snelling, **97,** 2164, 2168.

1897-98. Gauging continued, **98,** 1831.

1899-00. Gaugings taken near site of Lock and Dam No. 2, **00,** 2821.

[1] Allotments:

1889–92,	$3,300, **93,** 2291.	1900, $500, **99,** 2205.	1909, $500, **09,**	1653.
1893,	$500, **93,** 2291.	1903, $500, **03,** 1550.	1910, $500, **12,**	2192.
1894,	$500, **94,** 1735.	1904, $500, **04,** 2297.	1912, $500, **12,**	2192.
1895,	$500, **94,** 1735.	1905, $500, **05,** 1687.		
1896,	$500, **95,** 2205.	1906, $500, **06,** 1497.	Total,	$11,300.
1897,	$500, **96,** 1863.	1907, $500, **07,** 1594.		
1898,	$500, **97,** 2170.	1908, $500, **08,** 1662.		

1901-12. Work of gauging continued each year. For operations, see each an. report of officer in charge.

1902-03. Gauges estab. bet. Lock and Dam No. 2 and mouth of Minnesota R., **03,** 1549.

PHYSICAL CHARACTERISTICS.

Gaugings made at St. Paul, Minn., during 1890, **90,** 2102; 1891 **91,** 2215, 2216; 1892, **92,** 1850, 1851.

Table of gaugings, **93,** 2289, and each yearly report thereafter.

Diagram showing volume of Mississippi R. at St. Paul, **94,** 1734; **95,** 2204.

Relation of run-off to rainfall on the Mississippi R. watershed above St. Paul, 1894–96, **96,** 1862; **97,** 2169.

Because of low stage of water during June, 1900, the taking of gaugings discontinued, **00,** 2821.

A rise in R. at St. Paul commences in 7 or 8 days following release of water from distributing reservoir at Pokegama Falls, and 5 days afterwards full effect is felt, **01,** 449.

On account of high stage of R., l.-w. gaugings only required, **05,** 442.

Tables of gauge readings, **06,** 2517; **08,** 2698.

PROJECTS.

This work is provided for by allotment from the permanent an. app. of $9,600 made by the R. and H. act of Aug. 11, 1888, as amended by sec. 9 of the R. and H. act of June 13, 1902, for the purpose of securing the uninterrupted gaugings of the waters of the Mississippi R. and its tributaries. No gaugings were made until the fall of 1899. Since then gaugings have been made as frequently as the funds available would permit and the conditions justified the expenditure, **12,** 830.

As it was useless to repeat the gaugings, because of the l. w. during June, 1900, the sum of $179.94 was returned to the Treas., **00,** 2821.

SURVEYS.

For location of gauges, see map facing p. 1832 **R.** of the Chief of Engineers for 1898.

Part (m), HH-1 Reservoirs—Mississippi, St. Croix, Chippewa, and Wisconsin Rivers.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Benefits arising from reservoir system, **80,** 1596, 1611.

Effect of dams already built on the l.-w. stages, **86,** 1503; **87,** 1669, 1691.

Probabilities of R. business, **04,** 2241.

No RRs. parallel upper R. for 190 m.; R. only means of transportation, **05,** 434.

Effect of proj. on freight rates far reaching, **06,** 474.

Expend. have resulted in benefit during l.-w. season to navigable portions of Mississippi R. from Cass Lake, Minn., to Lake Pepin, and mitigation of floods above St. Paul, **09,** 563.

CONTRACTS.

1898. Commercial Wood & Cement Co., 5,000 barrels cement, $1.64 barrel, **99,** 2187.

1899. H. W. Jack, 5 steel Tainter gates, **99,** 2187.

DOCUMENTS. (Not printed in reports.)

R. of Maj. Warren, 1867, H. Doc. 58, 39th Cong., 2d sess., **70,** 282, 1868; H. Doc. 247, 40th Cong., 2d sess., **70,** 283.

R. of Maj. Farquhar, 1875, **75,** ii, 441; **79,** 1195.

R. of Maj. Houston, 1878, **79,** 1195.

ENGINEERS.

Chief of Engineers. R., 69, 43; **70,** 59; **78,** 101; **79,** 136; **80,** 182; **81,** 245, 246; **82,** 241; **83,** 248, 249; **84,** 249; **85,** 272, 273; **86,** 263; **87,** 224, 1680; **88,** 202; **89,** 235, 240; **90,** 211, 215; **91,** 268; **92,** 257; **93,** 289; **94,** 264; **95,** 294; **96,** 255; **97,** 326, 332; **98,** 317; **99,** 379; **00,** 435; **01,** 444, 451; **02,** 374; **03,** 398; **04,** 422; **05,** 432; **06,** 472; **07,** 499; **08,** 532; **09,** 562; **10,** 632, 643; **11,** 677; **12,** 817.

Boards:

Constituted, S. O. No. 90, C. of E., 1880, to ex. and **R.** upon proj. of Maj. Allen for dam at outlet to Lake Winnibigoshish. **R., 81,** 1763–65. (Majs. Houston, Robert, and Lydecker, and Capt. Allen.)

Reconvened Sept., 1882, to consider modifications proposed by Maj. Allen for Winnibigoshish Dam. **R., 83,** 1471, 1472.

Mississippi R. Commission. **R., 81,** 2747, 2753. Convened, New York, May, 1887, to consider and **R.** upon effect of reservoir system on R. below St. Paul. **R., 87,** 1681–93.

Board did not favor extension of system to St. Croix, Chippewa, and Wisconsin Rs. "at present," **87,** 1680, 1692. (Cols. Casey and Abbot, Lt. Cols. Houston and McFarland and Maj. King.)

Constituted, S. O. No. 46, H. Q. C. E., Sept. 26, 1892, to consider and **R.** upon proj. for navigable pass through Sandy Lake Dam. Convened, St. Paul, Oct. 28, 1892, and thereafter, **93,** 2269. (Majs. Stickney and Mackenzie and Capt. Marshall.)

In charge:

Maj. G. K. Warren. **R., 69,** 189; **70,** 282, 283.

Maj. F. U. Farquhar, 1874–75. **R., 75,** ii, 434–441.

Capt. C. J. Allen, 1878–90. **R., 79,** 1193–1211; (Maj.) **80,** 1590, 1659; **81,** 1761, 1766, 1770, 1807; **82,** 1828, 1833; **83,** 1455, 1473, 1476; **84,** 1614; **85,** 1747, 1750; **86,** 1501, 1507; **87,** 1666; **88,** 1539; **89,** 1791, 1809.

Maj. W. A. Jones, 1890–97. **R., 90,** 2080, 2098; **91,** 2196, 2214; **92,** 1818, 1849; **93,** 2264, 2288; **94,** 1696, 1736; **95,** 2174, 2206; (Lt. Col.) **96,** 1829, 1863; **97,** 2137, 2170.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1812; (Maj.) **99,** 2182; **00,** 2786; **01,** 2344.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2309, 2343.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1672; **03,** 1529.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2235; **05,** 1670; (Lt. Col.) **06,** 1437.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1581.

Maj. F. R. Shunk, 1907–. **R., 08,** 1652; **09,** 1644; **10,** 1802; **11,** 1977; (Lt. Col.) **12,** 2182.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

F. Cook. **R., 70,** 285.

J. D. Skinner. **R., 75,** ii, 436, 441; **79,** 1212–1236; **80,** 1597.

J. P. Frizell. **R., 79,** 1236–1245; **81,** 1765, 1769, 1809; **82,** 1835.

J. McCalman, **79,** 1205, 1213, 1217.

R. Davenport, **79,** 1205, 1213, 1217; **81,** 1795; **84,** 1630, 1633, 1635; **99,** 2189, **00,** 2799; **01,** 2321; **02,** 1674; **03,** 1537; **04,** 2242.

H. S. Treherne, **79,** 1206, 1217, 1220.

G. R. Stunz, **79,** 1206, 1219.

M. L. Lum, **79,** 1206.

W. H. Fuller, **79,** 1206, 1220.

J. Allard, **79,** 1206.

J. H. Dager, **79,** 1208, 1220, 1221.

R. T. Parker, **79,** 1208, 1209, 1220.

W. W. Strong, **79,** 1208.

W. W. Redfield, **79,** 1208, 1220.

G. O. Foss, **79,** 1208, 1220; **81,** 1773, 1795.

C. Wanzer, **79,** 1209, 1222, 1223; **81,** 1802; **82** 1831; **83,** 1461.

V. D. Simar. **R., 80,** 1615.

A. Johnson. **R., 80,** 1624; **87,** 1673; **96,** 1833; **99,** 2187.

J. D. Raynolds. **R., 80,** 1632.

W. S. Morton. **R., 81,** 1783.

J. B. Parkinson. **R., 83,** 1465; **84,** 1619.

C. McClellan. **R., 84,** 1616.

W. C. Weeks. **R., 00,** 2792; **01,** 2315.

T. M. Fowble. **R., 01,** 2348.

John Wade. **R., 01,** 2348.

C. W. Raynor. **R., 01,** 2349.

Thos. Robinson. **R., 03,** 1534; **04,** 2239; **05,** 1673.

A. O. Powell. **R., 03,** 1536.

ESTIMATES. (See Plans and Projects.)

By Maj. Warren, 1870, dams, etc., for reservoirs, Pokegama Falls, $52,540; Pine R., $31,808; Mille Lacs, $30,000, **70,** 284, 286, 287.

By J. D. Skinner, 1875, dams, etc., for reservoirs, Winnibigoshish; dam 1,000′ long, $59,969.80; Leech Lake, dam 4,000′ long, $177,555.64; Mud Lake, dam 600′ long, $31,737.20; Vermilion R., dam 850′ long, $56,245.20; Pine R., dam 592′ long, $32,386.20; Gull R., dam 442′ long, $25,786.20; Mille Lacs, dam 600′ long, $29,537.20; Pokegama Falls, masonry and needle dam, $75,334. Maj. Farquhar **R.** further ex. would materially diminish these est., **75,** ii, 441.

By Capt. Allen, 1879, dams for reservoirs, $336,458.60, and $10,000 an. for repairs in first 10 years, $7,840 an. for operating, and $13,500 for telegraph lines, **79,** 1204, 1205, 1216. Test dam, Lake Winnibigoshish, $70,000, **79,** 1205, 1211.

Mississippi R., **80,** 1614; **81,** 1768, 1775, 1777, 1781, 1789, 1791, 1796; **83,** 1460.

St. Croix R., **80,** 1603, 1615, 1639, 1645; **81,** 1781.

Chippewa R., **80,** 1607, 1615, 1648; **81,** 1781.

Wisconsin R., **80,** 1609, 1615, 1638; **81,** 1781.

Rock R., **81,** 1807, 1812.

Cannon R., **84,** 1635.

Minnesota R., **84,** 1632.

Increasing height of Pokegama Dam, **86,** 1506.

LEGAL PROCEEDINGS.

Opinion of Atty. Gen. relative to lands to be overflowed by constr. of dams, **81,** 1781.

Action of U. S. Commission in appraisement of lands, **82,** 1828.

Action relating to overflowed lands, **84,** 1617.

Necessity for protective legislation, **87,** 1691.

Injurious effect on R. arising from improper impounding of water by private interests, **86,** 1504 **87,** 1669, 1670.

Acquirement of flowage rights in connection with Gull Lake Reservoir, **96,** 1832.

Proceedings commenced in U. S. District Court for condemnation of 4.71 acres at both ends of Pokegama Falls Reservoir Dam to obtain title resting in the U. S., **96,** 1831. Award made by commissioners considered exorbitant, and dismissal of proceedings recom., to which defendant objected, **97,** 2139. Efforts made to secure title to the lands, **98,** 1813; **99,** 2185; **00,** 2790.

Rules and regulations to control use and administration of the reservoirs issued by the Sec. of War in 1889, **96,** 1830.

Gull Lake land damages. (See Projects.)

Flowage. To properly adjust flowage easements, Maj. Abbot est., 1897–98, $30,000, and 2 years' time, for sur., **98,** 1813.

Break in Pine R. Reservoir cause of damages to extent of $2,500; est. by officer in charge, and accepted by owner of property damaged, **98,** 1813.

Acquisition of lands, **99,** 2189.

Flowage rights in Indian lands, **99,** 2184; **00,** 2787.

Acquisition of land, flowage rights and easements, and condemnation proceedings, **01,** 2310; **05,** 1670; **06,** 1437; **07,** 1582; **08,** 1653; **09,** 1645; **10,** 1803.

Payment of amount ($5,193.60) awarded by commissioners in Pokegama Falls condemnation proceedings, **02,** 1672.

OPERATIONS.

1881-82. Constr. with hired labor of Winnibigoshish Dam begun, **82,** 1829, 1831.

1882-83. Progress on Winnibigoshish Dam, beginning of Leach Lake Dam, and preparations for constr. of Pokegama Dam, **83,** 1455, 1456, 1461, 1464. Cost of materials and labor, **83,** 1463, 1465.

1883-84. Progress on Winnibigoshish, Leach Lake, and Pokegama Dams; commencement of Pine R. Dam at outlet of Cross Lake, **84,** 1614.

1884-85. Completion of Winnibigoshish, Leach Lake, and Pokegama Dams; Progress on Pine R. Dam; capacity of dams, **85,** 1747; **87,** 1668.

1885-86. Progress on Pine R. Dam; description and capacity of, **86,** 1502. Operation of Winnibigoshish, Leach Lake, and Pokegama Dams, **86,** 1503. Effect of dams on l.-w. stages, **86,** 1503.

1886-87. Completion of Pine R. Dam; description of dam and its capacity, **87,** 1667, 1668-1674.

1887-88. Increasing the lift of Pokegama Dam begun, **88,** 1540.

1888-89. Work of increasing the lift in Pokegama Dam completed; repairs to Pine R., Leach Lake, and Winnibigoshish Dams, **89,** 1792.

1889-90. Extension and repairs to Winnibigoshish Dam and repairs to Leach Lake Dam, **90,** 2082.

1890-91. Sled road constr. bet. Leach Lake and Winnibigoshish Dams, and log sluice at latter place repaired, **91,** 2198.

1891-92. Constr. of dam for Sandy Lake Reservoir in progress, **92,** 1819.

1892-93. Completed reservoirs operated; continued constr. of Sandy Lake Dam; telephone lines built; jam piers built, gates repaired at Pokegama Falls Dam, **93,** 2266.

1893-94. Completed reservoirs operated; constr. of Sandy Lake Dam continued and other misc. work performed, **94,** 1698, 1703.

1894-95. Constr. of Sandy Lake Dam continued; completed reservoirs operated and maintained; telephone system enlarged, **95,** 2175.

1895-96. Sandy Lake Dam completed in Oct., 1895; studies for constr. of Gull Lake Reservoir continued; **96,** 1831. (For report on constr. and cost of Sandy Lake Dam, see **96,** 1833.)

1896-97. Small SS. built, using portions of dismantled SS. *General Poe,* **97,** 2139.

1898-99. Pine R. Reservoir natural embankment repaired by building 700′ dike; work on new dam at Lake Winnibigoshish begun, **99,** 2184.

1899-00. Work at Lake Winnibigoshish Dam continued (photographs, etc.); work on conversion of Leach Lake Dam begun; dikes under way at Pine R. Reservoir, **00,** 2788.

1900-01. Lake Winnibigoshish Dam completed; work on Leech Lake Dam about one-third finished; Dike No. 1 at Pine R. Dam practically completed, **01,** 2311 (report on Lake Winnibigoshish Dam, giving history, description, cost of reconstr., with sketches and photographs); **01,** 2313.

1902-03. Reconstr. of Leech Lake Dam completed, demolition old dam Pokegama Falls completed, quarters remodeled and working plant completed, **03,** 1529.

1903-04. Constr. Pokegama Falls Dam practically completed, placed in operation; sur. of various reservoirs mapped; obstr. removed bet. Brainerd and Grand Rapids, Minn., **04,** 2236.

1904-05. Constr. Pokegama Falls Dam completed; reconstr. Pine R. Dam begun; removal of obstr. bet. Brainerd and Grand Rapids continued, **05,** 1670.

1905-06. Reconstr. Pine R. Dam continued; removal of obstr. bet. Brainerd and Grand Rapids, Minn., continued, **06,** 1437.

1906-07. Reconstr. Pine R. Dam practically completed; preparations for reconstr. Sandy Lake Dam; obstr. removed bet. Brainerd and Grand Rapids, **07,** 1582.

1907-08. Reconstr. of Pine R. Dam completed; 6 dikes completed and 3 partly built at Pine R. Reservoir; reconstr. Sandy Lake Dam by hired labor begun; negotiations for flowage rights for Gull Lake Reservoir in progress, **08,** 1652.

1908-09. Constr. of dikes, Pine R. Reservoir, suspended Oct., 1908; work of reconstr. Sandy Lake Dam, with lock, continued; condemnation proceedings for Gull Lake Reservoir in progress, **09,** 1644.

1909-10. Reconstr. of Sandy Lake Dam in progress; condemnation proceedings Gull Lake Reservoir, **10,** 1803.

1910-11. Reconstr. of Sandy Lake Dam practically completed; constr. of Gull Lake Reservoir begun; preparation for work on canal bet. Lake Winnibigoshish and Leech Lake in progress, **11,** 1976.

1911-12. Reconstr. of Sandy Lake Dam completed; constr. of Gull Lake Reservoir Dam completed, foundation for dam-tender's dwelling put in, **12,** 2182.

PHYSICAL CHARACTERISTICS.

Of Mississippi above Falls of St. Anthony.

Discharge at St. Paul, **70,** 283, 284; **75,** ii, 440.

Area of watershed, **75,** ii, 437, 438; **79,** 1200.

Area of watershed and capacity of proposed reservoirs, **75,** ii, 439; **79,** 1200, 1214, 1215.

Slopes, **75,** ii, 435, 436.

Rainfall, Ft. Ripley, 1871–74, **75,** ii, 440.

General description of natural features, **70,** 284–289; **75,** 435–448; **79,** 1194–1245.

Rainfall observations, **80,** 1591, 1600, 1612; **81,** 1778, 1801; **82,** 1834; **83,** 1458; **84,** 1622.

Discharge, upper R., **80,** 1593, 1599; **81,** 1799, 1801, 1806; **83,** 1467; **84,** 1621, 1627; **87,** 1689, 1698.

Ratio of rainfall to drainage, **80,** 1591, 1597; **81,** 1774, 1780, 1781, 1801, 1807; **83,** 1457, 1469.

Effect of reservoirs on R., **80,** 1611; **86,** 1503; **87,** 1669, 1682, 1685, 1687.

Drainage areas of upper R., **81,** 1773, 1774, 1777, 1790; **83,** 1467; **87,** 1688.

Borings at Gull Lake Dam site, **81,** 1784.

Borings at Pine R. Dam site, **81,** 1788.

Elevation of points in Minnesota, Wisconsin, and Dakota, **81,** 1813.

Effect of temperature on velocity of discharge, **83,** 1470; **84,** 1619.

Thickness of ice, **84,** 1620.

Depth of bars below St. Paul, **87,** 1694.

Volume of discharge and effect of reservoirs on R., **88,** 1541.

When a discharge from Pokegama Reservoir raises the level of the Mississippi above that of Sandy Lake Dam, the conditions of head and pressure on the latter are reversed, requiring specially designed gates, **93,** 2265.

The effect of the reservoirs on the navigable depth above Falls of St. Anthony not considered as conclusively shown as might be, **93,** 2267.

The great Mississippi reservoir system, description of, **94,** 1704.

Rainfall observations, **94,** 1705.

Discharges from dams, **94,** 1705.

Rainfall and reservoir discharge, relation bet., **94,** 1709.

Areas and elevation of l.-w. surfaces in the lakes composing the Gull Lake Reservoir, **95,** 2176.

Slope of the water surface in the R. for a short distance below Pokegama Dam when 2,500 c. f. per second were being released in 1896, **96,** 1832.

The Crow Wing watershed considered the most productive of any in the upper Mississippi system, **97,** 2140.

Description of Mille Lacs Lake, Minn. Lake at headwaters of Rum R., a tributary of Mississippi, in Minn. Est. 4,462,000,000 c. f. rainfall could be collected in an average year, **97,** 2171.

Hydrological observations discontinued in 1897–98 because of lack of funds, **98,** 1814. (See Projects.)

Diagram showing max. water storage in Lake Winnibigoshish, Leech Lake, and Pine R. Reservoirs each year from 1884, **98,** 1814; **00,** 2798.

Gauge readings (diagrams), **99,** 2186.

Lands affected by discharge of water from Pokegama Dam, **99,** 2190.

Flowage Indian lands, **99,** 2184.

Data gained from sur. of Sandy Lake Dam to Brainerd, Minn., **01,** 2345, as follows:

Cause of overflow.—Prevention of floods by levees.—75 miles levee needed.—Prevention by cut-offs.—Estimates.—100,000 acres to be protected.—Discharge and gauge readings.—Routes suggested by cut-offs.—Bench marks.—Nature of overflowed lands.—Causes assigned by inhabitants.—Real cause, velocity not great enough to carry discharge.—Rainfall and run-off.—General information as to routes, estimated cost.

Lands affected by flowage, **01,** 2321.

854 sq. m. are more or less affected by reservoir flowage, **02,** 1674.

Petition from landowners requesting removal of U.S. dam at Cross Lake, claiming it overflows their lands, making impossible agricultural purposes, **03,** 1529.

Willow R. (**R.** on sur. by A. O. Powell, giving description, plans, est., etc.), **03,** 1531.

Description of Leech Lake Dam, **03,** 1535.

Description of Pokegama Falls Dam, **04,** 2239.

Remarks on wetness of concrete, and temperature of air when placed, **04,** 2240.

Capacity Sandy Lake Reservoir 3,200,000,000 c. f.; is of special importance, on account of proximity to St. Paul, in controlling depths, **06,** 1438.

Work done has materially improved chan. bet. Brainerd and Grand Rapids, Minn., **06,** 473.

PLANS. (See Estimates and Projects.)

Mississippi R.:

By Frank Cook, 1870, dams and reservoirs at Pokegama Falls, Pine Lake, and Mille Lacs, **70,** 285–287.

By Maj. Farquhar, 1875, dams of timber and masonry at various places, **75,** ii, 441.

By Capt. Allen, 1879, dams at Mud Lake, Leech Lake, Lake Winnibigoshish, Vermilion R., Pokegama, Pine R., and Gull Lake R., **79,** 1198–1200, 1216.

By Capt. Allen, 1879, dams at Big Dam, upper St. Croix R., Totogatic R., and Yellow R., **79,** 1206, 1218.

Chippewa R.:

By Capt. Allen, 1879, dams at Butternut Lake, Park Lake, and Rest Lake, **79,** 1208, 1221, 1222.

Winconsin R.:

By Capt. Allen, 1879, dams at Tomahawk R. and Pelican R., **79,** 1210, 1223.

PRIVATE (CORPORATE) WORK.

The water-power companies aided in making sur. by furnishing funds, **70,** 283.

PROJECTS. (See Estimates and Plans.)

By Capt. Allen, 1879, test dam at Lake Winnibigoshish; est., $70,000, **79,** 1194, 1205, 1211.

Since 1870 various plans proposed for imp. of Mississippi R. above Lake Pepin with system of reservoirs at sources of the Mississippi and its upper principal tributaries, by which the flood water could be impounded and subsequently discharged during season of l. w., **70,** 285–287; **75,** ii, 441; **79,** 1206–1223.

In 1880, following app. of June 14, 1880, proj. of Maj. Allen adopted providing for collection of surplus water during winter, spring, and early summer, and its systematic release during seasons of l. w. Proj. provided for constr. of 41 reservoir dams upon headwaters of Mississippi, St. Croix, Chippewa, and Wisconsin Rs. at an est. cost, excl. of land damages, of $1,809,083.50, **81,** 1761, 1763, 1770, 1781, 2748, 2753; **82,** 1830; **85,** 1749.

Description of dams, **81,** 1763; **83,** 1456, 1472 **87,** 1667, 1678.

BE., 1880, approv. of location and general plan of dam proposed by Maj. Allen at outlet of Lake Winnibigoshish, on Mississippi R., with recom. modifications in dimensions and constr., **81,** 1763. Modifications adopted, 1882, **83,** 1472–1474.

Effect of dams on l.-w. stages, **86,** 1503; **87,** 1669, 1682, 1685, 1687.

Consideration of further extension of system; BE., 1887, did not consider that the system should be extended to St. Croix, Chippewa, and Wisconsin Rs., **87,** 1680, 1690, 1692.

History of reservoirs proposed and built at headwaters of Mississippi, **92,** 1824.

Act 1892 app. $60,000 for care and mainten. of reservoirs, of which sum $30,000 could be spent in constr. of navigable pass through Sandy Lake Dam, **93,** 2265.

Board of 1892 approv., with one exception, plans submitted by Maj. Jones for navigable pass through Sandy Lake Dam; est., $43,026.24, **93,** 2271.

In 1895 Maj. Jones est. $110,000 to constr. reservoir at Gull Lake, **95,** 2178. Sundry civil act of June 4, 1897, app. $15,000 for land damages, etc., ensuing from constr. of reservoir and dam, **97,** 2139. Lt. Col. Jones, in 1897, est. $85,000 for reservoir with capacity of 2,712,000,000 c. f., by constr. of ditches connecting Gull, Round, and Long Lakes, and a timber dam at outlet of Gull Lake, incl. land damages, **97,** 2139. In 1898 Maj. Abbot reported proj. of damming Crow Wing R. and storing its flow in the proposed Gull Lake Reservoir chimerical; the expense apparently would be out of proportion to the benefits to be secured, **98,** 1814.

Reservoir sites, comparative cost of, in U. S. and India. Cost of system at Mississippi headwaters had been $8.78 in 1897 per 1,000,000 c. f. storage capacity, which included mainten. and repairs up to June 30, 1896, **97,** 2138.

In 1896–97 Lt. Col. Jones recom. sur. for subsidiary basin at Deer and Bass Lakes, and drg. in Pokegama Reservoir, the latter not being able to carry its own watershed in addition to what came in by leakage and other ways from the reservoirs above it, **97,** 2139.

In 1897 a recent ex. showed dikes were required to prevent escape of water from Pine R. Reservoir; est., cost of dike, $10,000, **97,** 2140.

After ex., 1896–97, Lt. Col. Jones recom. sur. in upper Crow Wing Basin for reservoir, **97,** 2140.

In 1898 Maj. Abbot believed Leech Lake and Winnibigoshish Reservoirs could not be safely filled until sur. and proper repairs had been made; that increase of land values at headwaters of the Mississippi made it a question of completing and making permanent the works already on hand, and of locating and paying for large areas which there was reason to believe had been submerged without compensation, Indian lands, among others, being involved, and that careful measurements before and after opening of reservoirs at the l.-w. season would give all the data really valuable in connection with hydrological observations, **98,** 1812, 1814.

Act Mar. 3, 1899, provided funds for conversion of Leech Lake Dam into a concrete and steel structure, **99,** 2183; **00,** 2789.

Act 1899 approv. application of unexpend. funds to renewal and repair of reservoir dams already constr. Est. cost of such work, incl. land damages and contingencies, $300,000. Money, therefore, for Gull Lake Reservoir applied to reconstr. of old dam at Lake Winnibigoshish, and to completing new dike at Pine R. Reservoir, **99,** 2183.

Act June 13, 1902, provided $10,000 to be used bet. Brainerd and Grand Rapids, Minn., **02,** 375.

Act June 13, 1902, provides for renewal and repair of dams, further investigation, ex. and sur. Pine R. and Sandy Lake Reservoirs, Willow R., sur. of flowage lines of reservoirs, purchase of lands, **03,** 1529.

Est. for constr. reservoir in Willow R., $550,000, **03,** 1537.

Remarks on desirability of constr. reservoir in Gull Lake, **06,** 1438.

Act Mar. 2, 1907, au. constr. low reservoir at Gull Lake, Minn.; capacity, 3,000,000,000 c. f.; cost, $70,000, land to be furnished free; also reconstr. of Sandy Lake Dam, without lock, for SS.; cost, $75,000, **07,** 499.

Above act amended by striking out words "without a lock for steamboats," **08,** 532.

Act June 25, 1910, au. constr. of an equalization canal bet. Winnibigoshish and Leech Lake Reservoirs;[1] est., $61,200, **10,** 632. Act Feb. 27, 1911, provides $10,000 for constr. ry. br. over canal, **11,** 678. Change in route of proposed canal suggested, westerly route desired, **12,** 2182.

[1] H. D. 363, 61st, 2d.

SURVEYS.

Mississippi R.:

1869–70. By F. Cook, under direction of Maj. Warren. **R., 70,** 282, 285.

1874–75. By J. D. Skinner, under direction of Maj. Farquhar. **R., 75,** ii, 434–441.

1878–79. By J. McCalman and R. Davenport, under direction of Capt. Allen. **R., 79,** 1193–1205, 1212–1217.

St. Croix R.:

1878–79. By H. S. Treherne, G. R. Stunz, M. L. Lum, W. H. Fuller, and J. Allard, under direction of Capt. Allen. **R., 79,** 1193, 1206, 1217–1220.

Chippewa R.:

1878–79. By J. H. Dager, R. T. Parker, W. W. Strong, W. W. Redfield, and G. O. Foss, under direction of Capt. Allen. **R., 79,** 1193, 1207–1209, 1220–1222.

Wisconsin R.:

1878–79. By C. Wanzer and R. T. Parker, under direction of Capt. Allen. **R., 79,** 1193, 1209–1211, 1222–1224.

Sources of Mississippi, **80,** 1590, 1597; **81,** 1761, 1783, 1802; **82,** 1833, 1835.

Sources of St. Croix, **80,** 1601, 1615.

Sources of Chippewa, **80,** 1607, 1624.

Sources of Wisconsin, **80,** 1609, 1632.

Sources of Rock R., **81,** 1770, 1807.

Sources of Cannon R., **82,** 1833; **84,** 1634.

Sources of Minnesota R., **84,** 1632.

Sur. and ex. under Maj. Jones were made, 1894–97, for reservoir at Gull Lake, and to determine the cost and practicability of giving it a capacity of 12,500,000,000 c. f., **95,** 2176; **97,** 2140.

Resur. of Pine R. Reservoir completed in 1897–98 showed orig. maps to have been inaccurate, **97,** 2140; **98,** 1813.

Ex. made, 1896–97, by Lt. Col. Jones for reservoir site on the upper Crow Wing, **97,** 2140.

Elevation of Mille Lacs Lake, **81,** 1827.

Ex. Mille Lacs Lake with view to constr. of dam at its outlet, and utilization as a part of the general upper Mississippi R. reservoir system, au. act June 3, 1896; made by Lt. Col. Jones, 1897 (local engineer reported favorably, but Chief of Engineers advised delaying action), **97,** 2170.

Sur. made below Pokegama Dam in 1897–98 by Maj. Abbot to determine flowage rights, **98,** 1813.

Act Mar. 3, 1899, provided for full and accurate sur. of flowage lines of Winnibigoshish, Leech Lake, Pokegama Falls, and Pine R. Reservoirs, for permanently marking such lines, and also for sur. and determination of cause and how to prevent floods bet. Sandy Lake and Brainerd, and their effect on navigation, **99,** 2183; **00,** 2788. **R.** by Maj. Abbot, June 4, 1900; ests.—levees, $750,000; canal, $937,000; cut-offs, $1,796,000,[1] **01,** 451, 2343.

Sur. of Willow R., with view to constr. reservoirs to retain flood water; cost prohibitive, **03,** 1531, 1536.

R. by BERH., Nov. 5, 1906, rel. to prevent. excessive floods in Aitken County. Recom. extension of reservoir system.[2]

Pre. ex. au. act Mar. 3, 1909, with plan and est. of cost, with view to an equalization canal bet. Lake Winnibigoshish and Leech Lake. **R.** by Maj. Shunk, June 17 and Aug. 5, 1909; est., $61,200[3] **10,** 642.

Maps:[3]

Showing proposed sites of reservoirs, **80,** 1600.

Drainage area of Pine R. Reservoir, **81,** 1790.

Proposed location of dam at Pokegama Falls, **81,** 1800.

Drainage area of Rock R., **81,** 1808.

Showing progress on Winnibigoshish Dam, **83,** 1456.

94, 1702. (See Operations.)

Sketches and photos, **01,** 2314.

Pine R. Dam, photo, **06,** 1438.

Reservoirs at headwaters **11,** 1978.

Part (n), HH-1 Mississippi River, Headwaters, Reservoirs at. (Operation and care.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Benefits of, from reservoirs, **05,** 1675; **06,** 1464, 1468.

Amount of capital interested in manuf. plants bet. St. Paul and Pokegama Dam, using R. as principal source of power, $13,000,000 to $15,000,000. Industrial development of Minneapolis largely due to water power. About $170,000,000 worth of manuf. products produced an. at Minneapolis. Turbines at Minneapolis alone create about 43,000 h. p. More than 16,000,000 bbls. flour produced an., which can be ground for one-fifth of the cost by steam power. Average rental of water power is less than $6 per h. p. per annum, **06,** 1469.

Prospective water power about 100,000 h. p., **06,** 1469.

Comparison of gain and loss to community at large, **06,** 1470.

[1] H. D. 113, 56th, 2d. [2] R. and H. C. 42, 61st, 2d. [3] H. D. 363, 61st, 2d.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

ENGINEERS.

Chief of Engineers. **R., 95,** 295; **96,** 256; **97,** 328; **98,** 318; **99,** 380; **00,** 437; **01,** 445; **02,** 375; **03,** 399; **04,** 424; **05,** 434; **06,** 474; **07,** 502; **08,** 534; **09,** 565; **10,** 635; **11,** 680; **12,** 821.

Boards. Constituted by S. O. No. 25 to consider and report upon matters connected with operation of reservoirs, convened Aug. 14, 1905, in St. Paul; spent 5 days inspecting reservoir district; held public hearings; **R.,** Nov. 27, 1905 (Maj. H. M. Chittenden, Maj. C. L. Potter, and Capt. W. V. Judson), **06,** 1443.

In charge:

Maj. W. A. Jones, 1895–97. **R., 95,** 2179; (Lt. Col.) **96,** 1841; **97,** 2142.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1816; (Maj.) **99,** 2190; **00,** 2800.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2322.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1675; **03,** 1538.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2242; **05,** 1675; (Lt. Col.) **06,** 1440.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1584.

Maj. F. R. Shunk, 1907–. **R., 08,** 1654; **09,** 1646; **10,** 1804; **11,** 1978; (Lt. Col.) **12,** 2185.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

W. C. Weeks. **R., 00,** 2804; **01,** 2325.

Thos. Robinson. **R., 04,** 2244; **05,** 1679.

LEGISLATION.

Laws and regulations governing operation of reservoirs, **06,** 1447.

OPERATIONS.

1894-95. Gates and machinery at Lake Winnibigoshish and Pine R. Dams repaired; top of Pokegama Falls Dam redecked, hydrological observations made, etc., **95,** 2180.

1895-96. Portion of Leech Lake timber structure replaced by embankment; small dam to strengthen ridge bet. Pokegama and Hale Lake built; hydrological observations made, **96,** 1842.

1896-97. Dams repaired; crevasse in Pine R. Reservoir closed by earthen dike; hydrological observations made, **97,** 2143.

1897-98. Dams repaired; road connecting Leech Lake and Winnibigoshish Dams repaired, **98,** 1816.

1898-99. Repairs made to Leech Lake, Winnibigoshish, Pokegama, and Pine R. Dams, and road connecting Leech Lake and Winnibigoshish Dams was repaired, **99,** 2191.

1899-00. Dike at Winnibigoshish, dams at Pokegama and Pine R., and road connecting Leech Lake and Winnibigoshish Dam repaired, **00,** 2801.

1900-01. Repairs to wagon road, embankment of dam, and to quarters at Pine R. and Sandy Lake Dams; new house for dam tenders at Lake Winnibigoshish commenced, **01,** 2323.

1901-02. Embankment at Lake Winnibigoshish Dam revet. extended; cofferdam at dam of Leech Lake raised 1′; Sandy Lake caving bank protected by brush fascines and riprap; dam-tender's house at Lake Winnibigoshish completed and repairs to house at Sandy Lake Dam, **02,** 1676.

1902-03. Lake Winnibigoshish and Leech Lake Reservoirs in operation; reconstr. completed; work of reconstr. Pokegama Falls Reservoir commenced; minor repairs to telephone line; and new dam-tender's house at Leech Lake Dam commenced, about three-fourths completed, **03,** 1538.

1903-04. Reconstr. Pokegama Falls Dam completed and placed in operation; minor repairs made; house at Leech Lake Dam practically completed; and preparatory work for new gauging station in progress, **04,** 2242.

1904-05. Minor repairs to dam-tender's quarters and telephone lines, **05,** 1676.

1905-06. Minor repairs to dam-tender's quarters and telephone lines; reservoir dikes near Bena, Minn., repaired and made water-tight; damaged revet. of dike and protection boom at Winnibigoshish Dam repaired; leaks in Leech Lake embankment made tight, **06,** 1440.

1906-07. Minor repairs, earthen-embankment repairs at Leech Lake Dam continued, and sluice piers extended, **07,** 1584.

1907-08. At Winnibigoshish Reservoir, dikes near Bena strengthened; road, telephone line, and dam repaired, etc.; at Leech Lake Reservoir, earthen embankment strengthened; at Pokegama Reservoir, repairs to revet. and minor repairs; Pine R. Reservoir, sluice gates painted; repairs to dam-tender's house, and fences renewed, **08,** 1654.

1908-09. At Winnibigoshish Reservoir, general repairs made; steel br. across piers of dam and approach constr.; at Leech Lake Reservoir, embankment revetted, cofferdam piling above dam recapped, and repairs to br. across dam; at Pokegama Reservoir, woodwork around dam repainted etc.; old buildings demolished, moved, painted, and grounds cleared, and R. bank protected; at Pine R. Reservoir, minor and misc. repairs, **09,** 1646.

1909-10. Minor repairs and alterations at all places; at Leech Lake Reservoir, revet. of dam completed, and work on alterations of quarters at Pine R. and Sandy Lake Dams under way, **10,** 1805.

1910-11. Minor repairs; at Leech Lake Reservoir, telephone line built, water supply and sewer system installed, and plans for br. approv.; at Pokegama Reservoir, heating plant installed at

office building, sewer outlet put in, well cleaned, etc.; at Pine R. Reservoir, constr. of dwellings completed, sewer system installed, barn built, plans for fishway approv.; at Sandy Lake Reservoir, constr. of buildings completed, sewer system installed, barn built, **11,** 1978.

1911-12. At Winnibigoshish Dam, alterations made and various items of installation work done, log-sluice abutment strenghtened, work on new fishway begun, etc.; at Leech Lake Dam, old br. removed, reinforced-concrete br. built, cellar in dwelling enlarged, hot-air furnace installed; at Pine R. Dam, fishway constr., **12,** 2185.

PHYSICAL CHARACTERISTICS.

The max. quantity of water held by the reser, voirs at any one time since their completion, **95,** 2179.

Effect of the reservoir system upon the R. during l-w. periods, **95,** 2180; **96,** 1842; **97,** 2142.

Relation of run-off to rainfall on the watershed of the Mississippi above Pokegama Falls Reservoir Dam from 1885, **96,** 1843.

Inundation of the valley of Pelican Creek caused by break in Pine R. Reservoir, **96,** 1844.

Effect of reservoir system is to increase stage of water at St. Paul by 12″ to 18″, **04,** 2242.

Table of discharge and difference in storage for year, **05,** 1676; **08,** 1655; **09,** 1647; **10,** 1805; **11,** 1979; **12,** 2186.

Relation of run-off to rainfall above Pokegama Falls Reservoir Dam, **05,** 1679.

Local opposition to reservoir system owing to land being overflowed, **05,** 435.

Descriptive and physical data, giving history, area of watershed and water surface, capacity, fluctuations, etc., pertaining to Lake Winnibigoshish, Leech Lake, Pokegama Falls, Sandy Lake, and Pine R. Reservoirs, **06,** 1444, etc.

Rate of progress of released water downstream; rainfall and run-off, based on 20 years' observations, **06,** 1446.

Mean an. evaporation from reservoir surfaces, **06,** 1447.

Manipulation of reservoirs in interests of navigation, **06,** 1448; **08,** 534.

Rainfall (in inches) and run-off (in billion c. f.) for 1905, **06,** 1448.

Gauge heights and volume of storage, **06,** 1449.

Consideration of complaints against reservoir system, **06,** 1450.

Principal complainants, **06,** 1451.

Board finds U. S. has not exceeded its rights, **06,** 1452.

Diagrams flow and run-off at and above Pokegama, **06,** 1452.

Contention of Itasca Paper Mill Co. that their water supply should be greater. Board is of opinion that co. has no legal right to any definite quantity of water. U.S. exercises unquestionable right to control flow, **06,** 1453.

Record of discharge observations before dams were commenced, **06,** 1455.

Mean discharge Pokegama Falls Dam (1884–1905); mean winter discharge, **06,** 1455.

Situation at Aitkin, Minn., loss through flood of 1905, $50,000, **06,** 1458–59.

Diagram of flow, **06,** 1458.

Drainage area above Pine Knoll, **06,** 1459.

Table showing effect of upper reservoirs upon flood at Aitkin, summer 1905, **06,** 1460.

Computation to determine flow of Sandy R. during flood period of 1905, **06,** 1462.

Remarks on probability of operating Sandy Lake Reservoir to mitigate ordinary floods in Mississippi R., **06,** 1462.

Methods of releasing water to help navigation, **06,** 1466.

Computed effects of reservoirs on gauge heights at St. Paul, under present system, **06,** 1467.

Remarks relating to influence of reservoir water below St. Paul, **06,** 1468.

Report by Lt. Col. Derby upon "present" system of operating reservoirs, **06,** 1470.

PRIVATE WORK.

An attempt to cause a crevasse, by digging a 5′ ditch, 50′ long, in the natural embankment of the Pine R. Reservoir, made July 22, 1898, by parties unknown. Plan foiled, no damage done, by the timely discovery by the dam tender, **99,** 2191.

PROJECTS.

In 1896 Sec. of War. allotted $5,000 for closing break in Pine R. Reservoir, **96,** 1844.

Local opposition to reservoirs (see Physical Characteristics), **05,** 435.

Total cost of reservoirs to July 1, 1905, $1,502,-657.84, **06,** 1448.

U. S. paid Indians $150,000 for overflowage rights, **06,** 1450.

Three solutions of problem of handling flood waters suggested: (1) Additional reservoirs on tributaries; (2) cut-offs and levees; (3) relief canal on straight line, Waldeck to Pine Knoll, **06,** 1463. Board recom. modification of "present" regulations, and invites attention to possibility of connecting Leech and Winnibigoshish Reservoirs with canal, **06,** 1472.

Desirable that measures be taken for securing more accurate gauge readings, **06,** 1474.

Board approves suggestion of private interests that a plan be adopted for systematic distribution of reservoir benefits, **06,** 1474.

SURVEYS.

Maps. **96,** 1844.

Of routes proposed for canal, Lake Winnibigoshish to Leech Lake (H. D. 363, 61st, 2d).

Reservoirs at headwaters, **11,** 1978.

Part (o), HH-1 Mississippi River—Experimental Towboats.

APPROPRIATIONS.

1910, $500,000, **12,** 1290.

ENGINEERS.

Chief of Engineers. R., 12, 1290.

Boards. Lt. Col. L. H. Beach, Lt. Col. H. C. Newcomer, Lt. Col. C. L. Potter, Maj. C. Keller, au. S. O. 38, office Chief of Engineers, Aug. 2, 1910, for making investigations, designing, and constr. 2 experimental towboats of modern but different types for use on the Miss. R. and tributaries, etc., **12,** 1290.

OPERATIONS.

1910-11. Committee of board visited Europe to observe European practice, **12,** 1290.

1911-12. Recom. of board, with tentative plans and est., under preparation, **12,** 1290.

PROJECTS.

See Boards. Board formed pursuant to provisions of sec. 1 of act June 25, 1910, **12,** 1290.

Part (p), HH-1 Mississippi River Mouths.[1] (Including maintenance of South Pass Channel.)

APPROPRIATIONS. (See p. 1089.)

App. to be returned to Treas., **71,** 515; **72,** 553; **73,** 600.

Method of making app. destroys value of imp. made, **70,** 323.

Amounts paid J. B. Eads for imp. of South Pass under acts Mar. 3, 1875; June 19, 1878; and Mar. 3, 1879, stated in the reports of the Chief of Engineers, $8,000,000, **01,** 1866.

Purchase of plant and materials from estate of J. B. Eads, $27,636.94; of lands and buildings, $35,000, **03,** 329–330.

COMMERCE.

Importance of imp., **66,** iv, 241; **69,** 265; **70,** 345; **74,** 778, 792, 797, 801, 808.

Number and draft of vessels passing mouth in 1869–77, **69,** 264; **71,** 511; **72,** 558; **73,** 601; **74,** 683; **75,** 823; **76,** 550; **77,** 427.

Size of larger vessels passing mouth, **74,** 817, 845.

Effect of work done on C., **72,** 554; **73,** 598.

Importance of reliable and adequate outlet for C. of valley, **74,** 778, 797, 801.

Necessity for buoys, and suggestions concerning, **67,** 367.

Vicious action of pilots, and towboat association, **69,** 263; **71,** 514; **72,** 552; **73,** 596, 599. Action of Congress concerning (see Legislation).

In 1897–98 C. considerably impeded by motion of large volumes of sand along bottom of chans., **98,** 1447.

Number of deep-draft vessels increased; able to carry full cargoes; business of New Orleans increased, and freight rates decreased, **06,** 386.

Statement of receipts and shipments, 1902 to 1911, incl., **12,** 648.

CONTRACTS.[2]

1866. H. Tyler, formation and mainten. of chan. in Southwest Pass, **66,** iv, 243. Annulled 1867 for inadequate character of means used, **67,** 38, 362; **70,** 324.

1868. Atlantic Works, Boston, dr. boat, $223,000, **68,** 478. Extension of time granted, **68,** 479. Completed May, 1868, **68,** 479.

1871. J. Roach, second dr. similar to first, **71,** 512; completed 1872, **72,** 553.

For yearly purchases, etc., see each an. report.

1902. Johnson Iron Works (Ltd.), furnishing new boiler and repairing U. S. tug *Startle*, $3,895, **03,** 1281.

1903. Oscar F. Barrett, furnishing st., $3.75 c. y., **03,** 1281. Johnson Iron Works (Ltd.), furnishing and installing boiler in U. S. boat *Chere Amie*, $2,575, **04,** 1888.

1904. W. G. Coyle & Co., coal, 34.95¢ bbl.; Oscar F. Barrett, st., $3.65 t., **04,** 1888. W. G. Coyle, coal, 34¢ bbl.; Johnson Iron Works (Ltd.), constr. barge, $2,250; Johnson Iron Works (Ltd.), rebuilding U.S. boat *Chere Amie*, $13,950, **05,** 1441.

1905. Ernest Lee Jahncke, constr. 4 barges, $2,800 each, **06,** 1302.

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[1] Sur.: **R.,** July 6, 1829; Feb. 9, 1837, est., $10,000,000; Jan. 30, 1839; Oct. 28, 1852, est., $30,000 and $315,000. (H. D. 482, 55th, 2d.)

[2] Proposals: Recom. concerning method of making, **66,** iv, 239. For forming and maintaining chan. at Southwest Pass, 1866, **66,** iv, 243. For constr. and delivery of dr. boat *Essayons*, **68,** 475. Rejected as excessive, **68,** 476. New proposals for. **68.** 477. For second dr. boat, *General McAlester*, **71,** 512.

1906. Oscar F. Barrett, st., $4.10 c. y.; W. G. Coyle, coal, 36¢ bbl., **06,** 1302. Richard M. Murphy, willows, $1.55 cord; Ellicott Machine Co., cast steel ball and socket joint for dr. *Gen. Abbot,* $547 for first joint, $347 for subsequent joints, **07,** 1415.

1907. Ellicott Machine Co., suction heads for dr. *Gen. Abbot,* $574 for first head, $436 for subsequent heads, **07,** 1415. Ellicott Machine Co., 6 lengths wrought-iron pipe for dr. *Gen. Abbot,* $1,136; Oscar F. Barrett, st., $4.15 c. y.; Houlton Lumber Co., y. p. piles and waling timbers (quantities and prices given), **07,** 1416. Richard M. Murphy, willows, $1.14 cord; James Shewan & Sons, repairs to dr. *Gen. Abbot,* $40,207.98; and addl. repairs, $5,449.50, **08,** 1477.

1908. Bucyrus Co., ball and socket joints for dr. *Gen. Abbot,* $320 for first joint, and $305 for subsequent joints; Ellicott Machine Co., suction heads for dr. *Gen. Abbot,* $379 each, **08,** 1477. Stern Foundry & Machinery Co., suction pipe for dr. *Gen. Abbot,* $220 each; Griscom-Spencer Co., ball and socket joints for dr. *Sumter,* $260 each, **09,** 1453. E. W. Vinyard, y. p. piles and waling timber; piles, 10¢ f.; waling timber, 15¢ f., **09,** 1454. Oscar F. Barrett, st., $4.25 c. y.; Robert M. White, willows, $1.09 and $1.24 cord, depending on place of delivery, **09,** 1457.

1909. Ellicott Machine Co., 2 sand pumps and 2 Y pipes for dr. *Sumter,* $4,277; Salmen Brick & Lumber Co., piles and waling timber (quantities and prices given); J. C. Jung, coal, 36.85¢ to 47.85¢ bbl., depending on place of delivery, **09,** 1454. Richard M. Murphy, st., $3.45 c. y., **09,** 1457. Jas. G. Swarbrick, subsistence supplies (articles, quantities, and unit prices given); total, $4,327.30, **09,** 1455. Swift & Co., fresh meats (articles, quantities, and unit prices given), $1,727.75, **09,** 1456.

1910. Salmen Brick & Lumber Co. (Ltd.), lumber and shingles (quantities and prices given), **10,** 1601. Southern Sawmill Co. (Ltd.), piles and waling timbers (quantities and prices given), **10,** 1602.

1911. Salmen Brick & Lumber Co., piles and waling timbers (quantities given), **11,** 1743.

1912. Salmen Brick & Lumber Co., piles and waling timbers (quantities and prices given), **12,** 1959.

(NOTE.—See cement contracts for furnishing stone, willows, and coal, under Southwest Pass.)

DEFENSE.

Suitable defense for proposed ship canal at Ft. St. Philip, **74,** 824.

ENGINEERS.

Chief of Engineers:

In relation to bill au. parties to take possession of Pass a Loutre, for constr. of canal; conclusion adverse, **68,** 483.

Letter of, to Sir Charles Lyell, concerning delta of Mississippi R., **70,** 365; to T. Lyman, concerning same, **70,** 376.

Report reviewing application of jetties to the imp. of mouth of Mississippi R.; rate of bar advance, **74,** 854.

Absence of littoral currents, Gulf currents would not be modified by jetties, **74,** 855.

Comparison of Sulina, mouth of Danube, with South Pass; reason for success of jetty system at the Danube, **74,** 856.

Method of bar formation at mouth of Mississippi R., **74,** 858.

Sulina bars have no resemblance to bars at mouth of Mississippi R., **74,** 859.

Jetties would require an. advance, **74,** 860.

Annual deposit on bottom of Gulf, not reduced by jetties; rate of bar advance, **74,** 865.

Cost and maintenance of jetties, **74,** 866.

Application of jetty system to mouth of Rhone, **74,** 888.

Memoranda concerning imp. of entrance to Mississippi R. with jetties, **75,** 959, 966, 968, 972.

R., 66, iii, 24; **67,** 37; **68,** 55, 483; **69,** 46; **70,** 61, 322; **71,** 64; **72,** 60; **73,** 63; **74,** 72, 776, 854; **75,** 37, 38, 78, 959, 966, 968, 972; **76,** 74; **77,** 72; **78,** 82; **80,** 141; **81,** 189; **82,** 186; **83,** 198; **84,** 206; **85,** 214; **86,** 212; **87,** 178; **88,** 166; **89,** 194; **90,** 14, 175; **91,** 19, 221; **92,** 22, 215; **93,** 20, 238; **94,** 20, 219; **95,** 21, 244; **96,** 24, 214; **97,** 25, 277; **98,** 36, 269; **99,** 40, 317; **00,** 41, 360, 366; **01,** 379, 385; **02,** 316; **03,** 328; **04,** 347; **05,** 358; **06,** 385; **07,** 400; **08,** 425; **09,** 442; **10,** 492; **11,** 529; **12,** 647.

Boards:

1837. Recom. dr. with bucket dr. at mouth of R., **70,** 323; **74,** 806, 841.

1852 (for application of app. of $75,000). Recom. (1) stirring up bottom; (2) if this fail, dr. with buckets; (3) if both fail, then parallel jetties at mouth of Southwest Pass (for which an addl. app. of $150,000 asked); (4) if needed, the closing of lateral outlets; (5) should all fail, a ship canal might be resorted to, **66,** iv, 237; **70,** 323; **74,** 793, 806, 841. (Commodore Latimer, U. S. N., Majs. Chase, Beauregard, and Barnard.)

1856. Recom. d. of Southwest Pass by stirring up bottom, **66,** iv, 237; **70,** 323, 334, 338; **74,** 793, 806, 842. (See Projects.)

1873. Report upon plan (submitted by Capt. C. W. Howell) for ship canal connecting Mississippi R. with Gulf of Mexico, **74,** 823. B. considered constr. of canal across Ft. St. Philip Peninsula presented no extraordinary engineering difficulties. Precise location of line and est. required more detailed ex., **74,** 823. Debouch of canal into Isle au Breton Pass approv.; also location (generally) of inner end on straight part of R. below Ft. St. Philip; doubtful practicability of founding lift lock by plan of surrounding cofferdam, **74,** 824. Recom. following modifications (see Projects); lock chamber to be 60′–65′ x 500′ w.; d. of water on miter sill, 25′; side slopes of canal 1′ upon 4′; jetties would

require increased dimensions; more data required for location in detail, and close est. of cost, **74,** 825. (Col. Barnard, Lt. Col. Newton, Majs. Gillmore, Warren, Craighill, and Weitzel, and Capt. Howell. Col. Barnard not fully concurring, submitted minority report.)

Minority report considered that, assuming canal to be built, a more comprehensive study required to fix location and details of cost; before resorting to canal, the superior advantages of natural mouths, and probability of utilizing them, should be considered, **74,** 826. Radical change in location desirable, **74,** 829. Stability of lock foundations insufficient, **74,** 830. Engineering difficulties underrated, **74,** 831.

Communication of Lt. Col. Newton reviewing minority report, **74,** 868.

Report of same board on imp. of Passes as an alternative to or in connection with the canal. Pass a Loutre assumed to be imp.; d. of 25′ required; jetties 2,200′ apart and each 24,000′ l., **74,** 833. Closure of north mouth of Pass necessary; delicate and difficult work of; general development of delta sufficient to destroy the most skillfully designed works, **74,** 834. Ultimate filling of area ahead of jetties; difficulties of imp. by jetties; relative advantages of a Loutre and Southwest Passes, **74,** 836. Means used and results obtained in imp. Vistula and Danube, **74,** 837, constitute no precedent in imp. of mouth of Mississippi, **74,** 838. Stirring can not be relied upon beyond 18′; can not be made a substitute for proper proj.; should be continued until proper proj. is completed, **74,** 839. Proj. of canal offers best and most certain means of attaining proper outlet to ocean, **74,** 840.

Minority report of Col. Barnard reviews past efforts to remove bars; conclusions and recom. of previous boards, **74,** 841. Success of stirring since 1867, **74,** 842. An attainable d. of 20′ possible, adequate for C. purposes, **74,** 844. Plan of jetties offered a probable attainment of d. w., **74,** 845. Discussion of application of jetties to Danube, Oder, Vistula, and Rhone, **74,** 846. Application to Mississippi R., **74,** 850. Closing of North Pass of a Loutre not desirable; constr. of jetties not as expensive as indicated by majority report, **74,** 851. South Pass should be selected for trial of jetties; action of jetties would retard bar advance; cost of jetties a fraction of cost of canal, **74,** 852. Inestimable value of open R. mouth navigation as opposed to canal, **74,** 853.

Minority report of Maj. Warren; data for detailed est. not possessed; canal only proj. that meets demands of U.S.; feasibility of; canal should be tried first, **74,** 853.

Review of minority report by Lt. Col. Newton, **74,** 871.

Review of entire question by Chief of Engineers, **74,** 854.

(Col. Barnard, Lt. Col. Newton, Majs. Gillmore, Warren, Craighill, and Weitzel, and Capt. Howell. Capt. Howell dissented in one point, viz, d. to be maintained by dr. 20′. Col. Barnard and Maj. Warren, not fully concurring, submitted minority reports.)

1874. To determine best method of obtaining and maintaining a sufficient d. of water at mouth of Mississippi R., either by canal from R. to Gulf or by d. natural outlets of R., **75,** 948. Board visited Europe for ex. and information; conclusions, **75,** 949.

Various canal routes considered; that commencing 5½ m. below Ft. St. Philip and debouching behind Sable Pt. considered best; length, 6½ m.; canal 200′ at bottom, 308′ at top, 27′ d.; lock near R. 7′ lift; dimensions 65′ x 200′ on grillage foundation; guard gates above and below lock, **75,** 950. Details, 956.

By d. natural outlets of R.; methods proposed; that by stirring inadmissible beyond d. 20′, **75,** 951. Plan of parallel jetties adopted in discussion, **75,** 952. South Pass selected; jetties to be 900′ apart, beginning at 30′ water within bar and running to 30′ without; l. of each jetty, 11,900′; details of, **75,** 953. Future rate of extension of bar, 1,000′ in 10 years, **75,** 954. Imp. of South Pass by jetties recom. in place of canal, **75,** 955. Recom. that entire amount for, be made at once available, **75,** 956. Details, **75,** 958.

(Lt. Cols. Wright and Alexander, Maj. Comstock, Messrs. H. Mitchell, T. E. Sickles, W. M. Roberts, and H. D. Whitcomb.)

Lt. Col. H. G. Wright did not concur in judgment of board as to probable success of jetty system, and reported that the canal proj. offered reasonable chances of success, **75,** 956. (See Chief of Engineers.)

In charge:

Maj. M. D. McAlester, 1866–68. **R., 66,** iv, 236; **67,** 362; **68,** 474.

Maj. F. E. Prime, 1868–69; **69,** 46.

Lt. W. D. Payne, 1869; **69,** 46.

Capt. C. W. Howell, 1869–78:

R., 69, 259; **70,** 326; **71,** 508; **72,** 551; **73,** 596; **74,** 682, 778; **75,** 822; **76,** 544; **77,** 419; **78,** 597.

On ship canal connecting Mississippi R. with Gulf of Mexico, **74,** 778.

Maj. W. H. Heuer, 1880–84. **R., 80,** 1123; **81,** 1245; **82,** 1329; **83,** 1031.

Capt. T. Turtle, 1884–85. **R., 84,** 1235.

Maj. W. H. Heuer, 1885–87. **R., 85,** 1377; **86,** 1225; **87,** 1345.

Capt. W. L. Fisk, 1888–91. **R., 88,** 1229; **89,** 1467; **90,** 1725.

Maj. J. B. Quinn, 1891–99. **R., 91,** 1805; **92,** 1469; **93,** 1795; **94,** 1333; **95,** 1725; **96,** 1469; **97,** 1731; **98,** 1447; **99,** 1815.

Maj. H. M. Adams, 1899–1904. **R., 00,** 2225; (Lt. Col.) **01,** 1865; **02,** 1324; **03,** 1279; **04,** 1886.

1st Lt. E. M. Adams, 1901. **R., 01,** 1881.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1438; **06,** 1299.

Col. E. H. Ruffner, 1907–08. **R., 07,** 1413; **08,** 1474.

Lt. Col. L. H. Beach, 1909–10, and 1912–. **R., 09,** 1451; **10,** 1600; **12,** 1958.

Maj. H. Burgess, 1911. **R., 11,** 1741.

Assistants:

Lt. D. W. Payne. **R., 68,** 478.

H. C. Collins, **77,** 428.

C. Donovan. **R., 80,** 1123; **81,** 1246; **82,** 1331; **83,** 1033; **84,** 1237; **85,** 1379; **87,** 1347; **88,** 1230; **89,** 1469; **90,** 1726; **91,** 1807; **92,** 1470; **93,** 1797; **94,** 1334; **95,** 1726 1737; **96,** 1471; **97,** 1734; **98,** 1449; **99,** 1817; **00,** 2227; **01,** 1867, 1883; **02,** 1327; **05,** 1443.

E. D. Jones. **R., 03,** 1283; **04,** 1890.

ESTIMATES. (See also Plans and Projects.)

By Capt. W. H. Chase, 1837, Ft. St. Philip ship canal, $8,619,299, **74,** 795.

By R. Montaigu, 1858, proj. for ship canal, $2,665,882, **74,** 822. D. Southwest Pass to 18′, $129,500; to 20′, $200,000, **66,** iv, 241. An. amount required to maintain chan., $400,000, **74,** 777.

By Capt. Howell, 1873, Ft. St. Philip ship canal, with connecting jetties, $7,370,803, **74,** 788.

By BE., 1873, foregoing proj. modified, $10,273,000, **74,** 825. More data required for close est., **74,** 825.

By BE., 1873, imp. of Pass a Loutre with jetties, $9,572,634, **74,** 835. Uncertainty of, **74,** 835.

By BE., 1874, Ft. St. Philip ship canal, $11,514,200, **75,** 951, 958.

By BE., 1874, imp. of South Pass by jetties, $7,942,110; of Southwest Pass by jetties, $16,053,124, **75,** 955, 959.

By Chief of Engineers, 1874, Ft. St. Philip ship canal, $13,000,000, **74,** 866. Imp. of South Pass, $17,000,000; imp. of Southwest Pass, $23,000,000, **74,** 867. Sur. of Southwest Pass, 1875–76, $16,656; 1876–77, $10,342, **75,** 976.

EXPENDITURES.

An. expend. required on any plan, **66,** iii, 24, iv, 240; **67,** 362; **68,** 483; **72,** 554; **74,** 807.

LEGAL PROCEEDINGS. (See Secretary of War.)

Purchase of lands and buildings of J. B. Eads estate along Pass, $35,000, **03,** 1280.

LEGISLATION.

Legal enactments required, giving officer in charge of public works a judicious control over use of chans., **71,** 64, 513; **72,** 60, 552; **73,** 63, 596, 599.

Draft of an act to facilitate execution and to protect certain works of public imp., **71** ,522.

Act of Congress, 1874, giving Sec. of War control over chans. of Passes, **74,** 72, 685.

Regulations fixed by Sec. of War concerning jurisdiction of chans., **75,** 826, 829.

Act of Congress providing for operations of J. B. Eads and others on South Pass, **75,** 170.

OPERATIONS.[1]

1837–39. Attempts to open Southwest Pass by dr. with bucket dr. failure, **70,** 323, 334, 338; **74,** 792, 806, 841. Further operations discontinued until 1852, **74,** 841.

1852–53. D. of Southwest Pass to 18′; subsequent rapid shoaling of chan., **70,** 323; **74,** 841. Further operations discontinued until 1857, **70,** 323.

1857–58. Attempts to d. Southwest Pass by jetties proving a failure, resort was had to stirring and harrowing on Southwest Pass and Pass a Loutre, **70,** 323; **74,** 842. Further operations discontinued until 1860, **70,** 324, 335.

1860–61. D. of Southwest Pass by (contract) use of scrapers; further operations discontinued until 1867, **70,** 324.

1867–68. Completion of U. S. dr. boat *Essayons* and d. of Pass a Loutre, **68,** 479; **70,** 335; **74,** 842.

1868–69. Continued operations of dr. boat *Essayons* on Pass a Loutre, d. chan. from 11½′ to 17′, **70,** 335; **74,** 842.

1869–70. Repair of dr. boat and continuation of dr. on Pass a Loutre, **70,** 326, 336.

1870–71. Operations continued on Pass a Loutre by U. S. dr. boat; suspended July, 1870, and not resumed until 1873; operations resumed at Southwest Pass and chan. d. by dr. boat to 19′; new machinery attached to the *Essayons*, **71,** 64 508, 512; **74,** 683.

1871–72. Operations of *Essayons* at Southwest Pass maintaining 18½′ d.; completion of U. S. dr. *General McAlester* and repair of the *Essayons*, **72,** 551, 553.

1872–73. U. S. dr. boats in operation on Southwest Pass until Mar., 1873, when they were trans. to Pass a Loutre; constr. of repair dock for dr., **73,** 596, 601.

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[1] Removal of bars by ordinary dr. a failure; adequate focalizing jetties enormously expensive, **66,** iii, 24, iv, 237.

Removal of bars by harrowing the only plan that has proved efficient, **66,** iii, 24, iv, 237; **70,** 325. Chan. can be maintained only by constant dr., **74,** 806.

History of early operations, **70,** 323, 334, 338; **74,** 792, 806, 841.

Favorable results obtained by subsequent operations, **68,** 55; **69,** 259; **70,** 326, 334.

Delays in operations caused by Pilots' and Tow Boat Association **69,** 263; **71,** 514; **72,** 552; **73,** 596, 599.

Depth obtained, and what is intended by, **74,** 686.

Operations of J. B. Eads at South Pass, **75,** 980.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

1873-74. Operations of Southwest Pass abandoned on account of a blockade from grounded vessels and consequent transferment of dr. to Pass a Loutre, **74,** 684; **75,** 78.

1874-75. Mainten. of Pass a Loutre to 17′-19′, **75,** 824.

1875-76. Operations on Pass a Loutre suspended Aug., 1875, and trans. to Southwest Pass, **76,** i, 544, 545.

1876-77. Continued on Southwest Pass, maintaining 17′-19½′, **77,** 419, 435.

1877-78. Imp. of South Pass by jetties having obtained 18′, further operations of dr. boat discontinued; the *Essayons* trans. to Sabine Pass, Tex.; dr. boat *General McAlester*, with entire crew, lost at sea, **78,** 82, 597.

1879-80. At Head of Passes small additions made to upper dam; on e. jetty, constr. of cribs at the outer end and of a concrete and rubble masonry parapet on the jetty was in progress, **80,** 1124. On w. jetty, work confined to placing spur cribs and to repair of jetty, **80,** 1134. Least d. through chan. bet. jetties, 31′; least w. of 30′ chan., 40′; least w. of 26′ chan., 200′, **80,** 1123, 1136.

1880-81. In South Pass, after the failure of dr. to reduce shoal areas, spur dikes built from e. shore, **81,** 1247. On e. jetty, placing of cribs at outer end and the constr. of concrete and rubble masonry parapet in progress, **81,** 1248. Localities of dr. operations, **81,** 1257. Least d. of through chan. bet. jetties, 30′; least w. of 30′ chan., 20′; least w. of 26′ chan., 230′, **81,** 1245, 1262, 1268.

1881-82. In South Pass, the old dam near head of Bayou Grande rebuilt for 95′; new dam built across Picayune Bayou; at mouth of South Pass, small additions made to masonry work and temporary works built to imp. chan.; on e. jetty, 16 spur cribs placed and additions made to masonry parapet; 1,813 l. f. of levee built along sea side of e. jetty and 2,125 l. f. built along w. jetty; 19 lattice wing dams built; dr. in operation during 87 days, **82,** 1329, 1332, 1335, 1336, 1340. Least d. through chan. bet. jetties, 30.8′; least w. of 30′ chan., 60′; least w. of 26′ chan., 210′, **82,** 1329, 1344, 1350.

1882-83. In South Pass, 11 wing dams built; 6,810 l. f. of auxiliary jetty built within and nearly parallel to line of e. jetty; dr. in operation during 17 days, **83,** 1032, 1034, 1036. Least d. through chan. bet. jetties, 31′; least w. of 30′ chan., 90′; least w. of 26′ chan., 240′, **83,** 1031, 1040, 1044.

1883-84. In South Pass, 2 wing dams built; repairs to Picayune Bayou Dam; inner e. jetty extended 1,630′; wing dam built at head of e. jetty; no dr. done since Feb., 1883, **84,** 1236, 1238, 1239. Least w. through chan. bet. jetties, 34′; least w. of 30′ chan., 150′; least w. of 26′ chan., 270′, **84,** 1236, 1242, 1246.

1884-85. Extension of inner e. jetty 605′; repair of wing dam, outer end of e. jetty; no dr. done since Feb., 1883, **85,** 1377, 1380. Least d. through chan. bet. jetties, 31.3′; least w. of 30′ chan., 130′; least w. of 26′ chan., 270′, **85,** 1377, 1385.

1885-86. Constr. commenced on inner w. jetty; repairs to inner e. jetty; constr. and repair of w. jetty wing dams, **86,** 1226. Least d. through chan. bet. jetties, 33.2′; least w. of 30′ chan., 170′; least w. of 26′ chan., 240′, **86,** 1231.

1886-87. Extension and repair to wing dams in South Pass; repairs to inner e. jetty; extension of inner w. jetty; constr. and repair to w. jetty wing dams; injury to masonry superstr. by gale of Oct., 1886, **87,** 1348, 1349. Least d. through chan. bet. jetties, 32.3′; least w. of 30′ chan., 130′; least w. of 26′ chan., 250′; imp. of chan. at outer ends of jetties, **87,** 1345, 1354.

1887-88. Repairs to upper dam at Head of Passes; 3 wing dams, aggregating 457′, built on w. side of Pass above Grand Bayou; repairs to inner jetty, **88,** 1229.

1888-89. Repairs to upper dam at Head of Passes; concrete wall over e. jetty rebuilt; repairs to inner e. and w. jetties; 6 wing dams built, **89,** 1472, 1473.

1889-90. Repairs to wing dams in Goat Isld. Reach; reconstr. of concrete wall on inner e. jetty completed; repairs to inner e. jetty, **90,** 1728.

1890-91. 257 cords of willows weighted with earth added to West 7-Head Dam; 53 l. f. of w. end of upper dam rebuilt; Wing Dam No. 2 in Goat Isld. Reach repaired; cribwork capping on e. jetty extended 800′; continuous crib built over the outer 353′ of inner e. jetty; cribwork built over outer 618′; wing-dam constr. and dr., **91,** 1808.

1891-92. Repairs to upper dam, West 7-Head Dam, and Wing Dam No. 2 in Goat Isld. Reach; cribwork capping on e. jetty continued 281′; repairs to inner e. and w. jetties; 8 new wing dams built, and repairs made to old ones, **92,** 1471, 1472.

1892-93. Wing dams constr. and inner line of jetties repaired; additions made to outer lines of e. jetty; dr. for 73 days performed in mainten. of d., etc., **93,** 1796.

1893-94. Dr. for 32 days, **94,** 1333.

1894-95. Outer dam at Head of Pass restored and dike built to close waterway bet. it and mainland; minor work of maintaining wing dams, jetties, and auxiliary works performed; dr. done for 96 days, **95,** 1725. Attempt made to close crevasse at Pass a Loutre, **95,** 1737.

1895-96. Structures maintained, and 169 days' dr. performed, **96,** 1469.

1896-97. Structures maintained, and dr. done during 110 days, **97,** 1731.

1897-98. Structures maintained, and dr. for 115 days done, **98,** 1447.

1898-99. Structures maintained, and about 49 days of dr. done, **99,** 1815.

1899-00. Structures maintained, and dr. done for about 879 hours, **00,** 2225.

1900-01. Structures maintained, dr. done for about 898 hours, and jetties and dams repaired at mouth, **01,** 1865, 1868. Repairs and alterations to dr. *Beta*, and 10,800′ chan. dr., **01,** 1882.

1901-02. Dr. bet. and beyond jetties, **02,** 1324; purchase of floating plant, jetties, dikes, and dams repaired, 2,700′ of chan. dr. to least d. of 31′ and to 30′, for a least w. of 40′; condition of chan., **02,** 1325.

1902-03. Extensive repairs made to various dikes and auxiliary works, **03,** 1279, 1283. Chan. beyond jetties dr. to 30′ x 100′, and, after shoaling, again dr. to 28′, **03,** 1280, 1284.

1903-04. 96,126 c. y. dr. from South Pass and 142,155 c. y. from beyond jetties, **04,** 1887. 9,755 s. y. of mattress placed around w. end of upper dam; 380′ of w. dike rebuilt and 8,417 s. y. mattress placed around the structure, **04,** 1890. 500′ inner w. jetty raised 2′, row of piles 3,150′ l. driven along inner e. jetty bet. Dams 16 and 24, and 2,325′ of jetty repaired; various repairs to wharves, buildings, and plant, **04,** 1891.

1904-05. 504,590 c. y. dr. by U. S. plant, **05,** 1439; various repairs to dikes, jetties, and dams, **05,** 1443; also to plant, **05,** 1444.

1905-06. Jetties and auxiliary works maintained and 385,840 c. y. dr., **06,** 1300.

1906-10. Jetties and auxiliary works maintained and dr. continued, **07,** 1413; **08,** 1474; **09,** 1452; **10,** 1600.

1910-11. Mainten. of jetties and auxiliary works, repairs to plant, **11,** 1741.

1911-12. Mainten. of jetties and auxiliary works, repairs to mattress sill across head of Pass a Loutre, and 14 days' dr. in outer chan., **12,** 1958.

PHYSICAL CHARACTERISTICS.

Bars at mouth of Mississippi R., **66,** iv, 236; **70,** 322; rate of advance of, **70,** 322, 377; **74,** 854, 857, 859, 865; **75,** 961, 968; **77,** 429; composition of, **70,** 331, 371; **77,** 431; method of formation, **74,** 804, 863, 865; **75,** 959; "drift" and "delta" bars, distinction bet., **75,** 967, 973; bars at mouth of Danube and Rhine dissimilar to, while those at mouth of Rhone are similar to Mississippi R., **75,** 967, 973.

Action of currents in Mississippi R. at h. and l. w., **74,** 804, 863, 865; currents of Gulf not littoral, **74,** 855; **77,** 433; sediment, amount carried to Gulf, **74,** 855, 862, 882; not greatest when velocity is highest, **74,** 863; **75,** 966; **77,** 433; velocity through Breton Isld. Pass, **74,** 790.

Mud lumps, rising of, **70,** 331; **77,** 431; composition of, **70,** 332, 372; theory of formation, **77,** 431.

Physical characteristics of delta, **70,** 352; **74,** 790, 803, 814, 848, 852, 854, 855, 857, 859, 862, 865, 882; **75,** 959; **77,** 429; depth of, **74,** 848, 852; age of, **70,** 377; delta of Nile compared with, **74,** 804.

Artesian wells at New Orleans, record of specimens from, **70,** 354; discussion of, **70,** 358; profile of, **70,** 362.

Ex. of specimens from bed of Mississippi R. **70,** 371.

Physical characteristics of Breton Isld. Sound and vicinity, **74,** 782, 814, 828; settlement of foundations on clay, **74,** 829, 830.

Extent of deposits over area outside of jetty ends, **80,** 1123, 1132; **81,** 1246, 1263; **82,** 1330, 1347, 1348; **83,** 1042; **84,** 1236, 1241; **85,** 1377, 1387; **86,** 1234; **87,** 1345, 1351, 1355.

D. of Pass a Loutre since 1875, **82,** 1330.

Force of waves at outer end of jetties, **83,** 1032; **87,** 1349.

Movement of sand waves, **87,** 1351.

Table of d. and w. of chan. through South Pass, **88,** 1235.

Dimensions of chan. through jetties, 1888, **88,** 1237; **89,** 1475.

Min. d. through jetties, 1875 to 1890, **90,** 1732.

Table giving d. through jetties at various dates, **92,** 1476.

Shoaling, **93,** 1795, 1796; **95,** 1725; **97,** 1731, 1732.

Gradual growth of bar at end of jetties, **93,** 1796.

D. and w.: South Pass throughout, **93,** 1801; **94,** 1338; **95,** 1730; **96,** 1473; **97,** 1739; **98,** 1453; **99,** 1823; **00,** 2231; **01,** 1869.

Through the jetties, **93,** 1802; **94,** 1339; **95,** 1731; **96,** 1475; **97,** 1740; **98,** 1454; **99,** 1824; **00,** 2232.

At various dates, **93,** 1803; **94,** 1340; **95,** 1732 **96,** 1476; **97,** 1742; **98,** 1455; **99,** 1825; **00,** 2233.

Changes in area in vicinity of ends of jetties in Gulf of Mexico, **94,** 1343, 1344; **95,** 1735; **96,** 1480; **97,** 1744–1746; **98,** 1458; **99,** 1829; **00,** 2236.

Velocity, sediment, and discharge observations, **94,** 1345, 1347; **96,** 1481; **97,** 1746; **98,** 1460; **99,** 1830.

Yearly mean elevation of water surface, **94,** 1346; **99,** 1831.

Effect of storms of 1894 to make increased d., **95,** 1725.

Port Eads gauge changed to conform to readjustment of plane of average flood tide in jetty chan., **96,** 1469.

Stage of R. at Carrollton, La., hydrographs of, **96,** 1480.

Causes of change in plane of average flood tide **96,** 1482.

Tidal observations, **96,** 1482; **97,** 1747.

Decrease in d. due to sand waves, **97,** 1731; **98,** 1447; **99,** 1815.

Table showing periods of mainten. of chan. from 1879, etc., **97,** 1737.

Deficiencies in d. of chan., **98,** 1460.

Damage by storm, **02,** 1327.

Table giving least d. through shoal reaches in South Pass jetty chan. and chan. beyond ends of jetties for each month of year (see each an. report).

Wearing of propeller bearings of dr., by silt, **06,** 1300.

Lack of motive power and rudder area, cause of vessels grounding, **06,** 1300.

Since U. S. undertook imp. there has been a general increase in d. of 2′; max. draft, 1908, 28′, **08,** 426.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

PLANS. (See Estimates and Projects.)

List of plans and machines proposed, **70,** 338.

By B. Buisson, 1832 (State engineer of Louisiana), ship canal bet. Mississippi R. and Breton Isld. Sound, **74,** 780, 793, 826.

By Maj. W. H. Chase, 1837. (See Projects.)

By R. Montaigu, 1852, ship canal, commencing 7 m. below Ft. St. Philip, and running ne. 6 m. to Gulf of Mexico; canal 100′ at water line, 30′ at bottom, 24′ d.; locks 80′ x 400′; berm 15′ w.; banks 10′ h., 15′ at top, 60′ at base. RR. on bank for towing vessels, **74,** 781, 816, 827.

By McClintock & Scott, 1868, to constr. (without cost to U.S.) a canal through Pass a Loutre, **68,** 483.

By J. B. Eads, 1875, d. South Pass, with jetties, **75,** 37, 170, 980. (See Projects.)

No plan efficient without an. expend., **66,** iii, 24, iv, 240; **67,** 362; **68,** 483; **71,** 516; **72,** 554; **74,** 807; harrowing only plan "so far" efficient, **66,** iii, 24, iv, 237; **70,** 325; results from jetties previously constr. (1857) do not encourage repetition, **66,** iii, 24; previous plans directed to chan. 18′ x 300′, **66,** iv, 239; **74,** 806.

Discussion of plan of imp. by ship canal, **74,** 780, 793, 823, 826, 841, 868; **75,** 949, 956; with jetties, **74,** 806, 831, 833, 842, 853, 854, 878, 884; **75,** 948, 951, 958, 959, 966, 968, 972; by raking and stirring, **66,** iii, 24, iv, 237; **67,** 365, 367, 370; **70,** 323, 329, 338; **74,** 792, 804, 841, 874.

History of Ft. St. Philip Canal, **74,** 793, 826.

Memoranda of various ship canals, **74,** 796, 817, 821.

PROJECTS. (See Estimates and Plans.)

By BE., 1837, d. Southwest Pass with bucket dr., **70,** 323; **74,** 792, 806 841.

By Maj. W. H. Chase, 1837, ship canal, beginning 2½ m. below Ft. Jackson, and extending 7 m. to Isle au Breton Pass; canal 30′ x 30′ x 100′; locks 20′ x 50′ x 200′; connecting jetties 100′ at base, 20′ at top, raised to level of h. w., **74,** 781, 794, 826, 831. **R.** of Col. J. J. Abert, 1839, caused abandonment of proj., **74,** 781, 827

By BE., 1852, d. Southwest Pass by stirring up bottom, **66,** iv, 237; **70,** 323; **74,** 793, 806, 841.

By BE., 1856, d. Southwest Pass by stirring up bottom; this was united (doubtingly on part of board) with sheet-pile jetties, **66,** iv, 237; **70,** 323, 334, 338; **74,** 793, 806, 842.

By Maj. M. D. McAlester, 1866, d. and maintain. chan. in Pass a Loutre, to be done with dr. specially constr., **66,** iv, 238; **67,** 362, 364, 367, 370; **68,** 55; **69,** 46; advantages of Pass a Loutre, **70,** 343.

By Capt. Howell, 1873, ship canal connecting Mississippi R. with Gulf of Mexico, beginning near Ft. St. Philip, and debouching into Breton Isld. Sound; canal bottom, w. 200′, d. 27′; locks 80′ x 400′, constr. of beton, faced with granite; guard lock on Sable Isld.; jetties connecting mouth of canal with d. w., **74,** 781, 825; modified by BE., **74,** 825. (See Boards, 1873.)

By BE., 1873, modified proj. of Capt. Howell. (See Boards, 1873.)

By BE., 1874, proj. or d. natural outlets of R. (South Pass) with jetties. (See Boards, 1874.)

By J. B. Eads, 1875, d. South Pass with jetties not less than 700′ apart, running from 30′ of water within the bar to 30′ without; to maintain the same for 20 years from time of first obtaining 30′, chan. to be not less than 350′ w., **75,** 37, 170, 980.

Proj. for imp. of mouths of Mississippi, 1837 to 1878, incl., proposed formation and mainten. of chan. 18′ d., through either Southwest Pass or Pass a Loutre, by stirring the bottom and by dr. This method of imp. discontinued, 1878, when imp. of South Pass by jetties had attained 18′. Incl. of sur., there was app. under these proj., 1829 to 1879, incl., $2,541,669.53.

Act Mar. 3, 1875, au. James B. Eads to build jetties and other works in South Pass, for ultimately obtaining and maintain. chan. 30′ x 300′ over bar at mouth of Pass through Pass into R. above.

Acts June 19, 1878, and Mar. 3, 1879, amended orig. act so that James B. Eads was only required to obtain chan. 26′ x 200′ at bottom, and having through it a central d. of 30′ without regard to w., these chans. to be maintained for 20 years from July 8, 1879. For this James B. Eads was to ultimately receive $5,252,000, and in addition $100,000 per an. for maintaining chan.

By Maj. Quinn for closure of Pass a Loutre crevasse in 1895, **95,** 1757.

In 1897, in view of the near assumption of the imp. by the U.S., Maj. Quinn est. that to continue the work, during the following 3 years, $2,000,000 would be required for purchase of materials and accumulation of working plant; $1,000,000 for labor and materials for extension of jetties and modification of dikes and dams, etc.; and that the an. expend. for mainten. would have to be placed at $150,000 yearly. An increase of from $10,000 to $12,000 yearly for inspection, etc., recom., **97,** 1732.

In 1897 Maj. Quinn advised providing $1,000 for surs. at the mouth, **97,** 1748.

S. C. act June 6, 1900, au. removal unusual obstr. during f. y. 1901 by use of M. R. C. dr. plant, and app. $25,000 for altering dr., **01,** 384.

Act June 13, 1902, au. use of U. S. dr. to maintain Pass, also au. purchase of lands bordering Pass from heirs of James B. Eads, deceased, **02,** 317.

Eads contract expired Jan. 28, 1901, since which time chan. maintained by U. S. under provisions act June 6, 1900, **01,** 379, 385.

Act May 28, 1908, incl. in proj. the dr. of shoals in R. bet. Cubits Gap and Head of Passes, to secure 35′ and practical w., by au. use of funds from this app., **08,** 426.

Chief of Engineers recom. that an. app. for mainten. be increased to $150,000, **06,** 386.

SECRETARY OF WAR.

Regulations fixed by, concerning use of entrances to Mississippi R., while in process of imp., **75,** 826.

SURVEYS.

1867. Of Southwest and a Loutre Passes by Coast Sur., **67,** 38, 362. Results of, **67,** 369, 375.

1869. Of Southwest Pass, **70,** 322, 330.

Sur., **72,** 553; **73,** 597; **74,** 684; **75,** 825; **76,** 548; **77,** 428.

Soundings; how made; description of lines and leads, **74,** 685. Precautions to be used, **74,** 686.

Sur. of South Pass from head to South Pass Lighthouse, **88,** 1234; **89,** 1473; **90,** 1729.

Beyond ends of jetties, **88,** 1239; **89,** 1478; **90,** 1730; **91,** 1809.

Ex. and sur. almost every year.

Minor, **02,** 1331; **03,** 1285; **04,** 1891.

Maps:

Mouths of Mississippi R. in 1722, 1724, 1731; location of center line of proposed canal (Maj. Warren) delta according to (Talcott's) sur., 1838; comparative profiles of South and Southwest Passes and Sulina mouth of Danube; comparative charts of sur. of 1838, 1867, 1874, **74,** 888.

Map showing proj. for imp. of Rhone; comparative profiles of; of Sulina mouth of Danube, **75,** 874.

Location and sections of Ft. St. Philip ship canal; of South Pass, with location of proposed jetties, sections of, **75,** 958.

Comparative profiles of Southwest Pass, 1868, 1871, 1876, **77,** 430.

Pass a Loutre, **77,** 434.

Chan. bet. jetties, **80,** 1144; **81,** 1270; **82,** 1352; **83,** 1046; **84,** 1242, 1248; **85,** 1390; **86,** 1238.

D. over area seaward from the end of the jetties, **80,** 1144; **81,** 1270; **82,** 1352; **83,** 1042, 1046; **84-** 1243, 1248; **85,** 1390; **86,** 1238.

List of charts accompanying reports, **81,** 1246; **82,** 1331; **83,** 1033; **84,** 1237; **85,** 1379; **86,** 1225.

South Pass, **86,** 1236; **87,** 1256; **02,** 1330; **03,** 1284; **04,** 1892; **05,** 1438; **07,** 1414.

Chan. bet. jetties, **88,** 1242; **89,** 1479; **90,** 1735.

Chart of portion of South Pass, showing location of jetties at its mouth, **91,** 1816.

93, 1804; **94,** 1346; **95,** 1740; **96,** 1484; **97,** 1750; **98,** 1460; **99,** 1832; **00,** 2238; **01,** 1870; **08,** 1474.

Head of Passes, **03,** 1284; **04,** 1892; **05,** 1438; **07,** 1414.

Chan. beyond end of jetties, **04,** 1892.

HH-5 Pass a Loutre, Mississippi River.[1]

APPROPRIATIONS.[2] (See p. 1089.)

CONTRACTS.

1897. J. Stewart & Co., closure of crevasse, $136,015, **98,** 1488. Supple., **98,** 1487.

1899. Hunter & Frey, sill across the head of Pass a Loutre, Mississippi R.; mattress, $1.15 s. y.; riprap st., $3.25 t. ($171,402.65), **00,** 2248.

ENGINEERS.

Chief of Engineers. **R., 97,** 291; **98,** 280; **99,** 321, 323; **00,** 365; **01,** 382, 383; **02,** 314, 315; **03,** 324, 325; **04,** 343, 345; **05,** 354, 355; **06,** 381; **07,** 396; **08,** 421.

In charge:

Maj. J. B. Quinn, 1897. **R., 97,** 1776; **98,** 1487; **99,** 1839, 1841.

Maj. H. M. Adams, 1900, and 1902–04. **R., 00,** 2245, 2246; (Lt. Col.) **02,** 1322–23; **03,** 1275–76; **04,** 1881–83.

Lt. E. M. Adams, 1901. **R., 01,** 1877, 1878.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1429; **06,** 1295.

Col. E. H. Ruffner, 1907–08. **R., 07,** 1399; **08,** 1455.

Assistant. F. F. Axtell. **R., 01,** 1880.

OPERATIONS.

1897–98. Efforts made to close the crevasse, **98,** 1487.

1898–99. Closure of the crevasse completed Nov. 13, 1898, but storm of the next day rendered more work necessary, **99,** 1840.

1900–01. Break in dam washed out 31′ wider; description of condition of dam, **01,** 1877. Mattress sill built across Pass, **01,** 1878. Method employed in sinking mats, **01,** 1880.

1904–05. Constr. of dr. *Benyaurd* completed (see Southwest Pass), **05,** 1430.

1905–06. 85′ dam washed out; continued tendency of crevasse to gradually close up, **06,** 1295.

PHYSICAL CHARACTERISTICS.

Severe storm Nov. 14, 1899, washed the dam out at 2 sections for 170′, **99,** 1840.

210′ of dam washed out, **02,** 1322.

[1] Sur.—**R.** (this report includes an est. of $100,000 an. for mainten.), Apr. 6, 1857. (H. Doc. 482, 55th, 2d.)
[2] 1899, $200,000, **99,** 1841; 1900, $300,000, **00,** 2247; total, $750,000.

Crevasse gradually closing, **05,** 1429.

Constr. of sill has been most potent factor in reducing crevasse discharge, **05,** 1430.

PROJECTS.

By Maj. Quinn, 1897, closure of crevasse with Wakefield sheet piling backed with piles, the toe of the dam to be protected if necessary with brush mattresses, the dam to be in 2 sections, 1,900′ and 4,750′ inf., resp., **98,** 1487.

By Maj. Quinn, 1899, mattress sill, weighted with st., across head of Pass a Loutre, Mississippi R.; est., $166,000 (continuing contract), **99,** 1841.

Maj. Quinn est., 1899, $115,000 to close break (642′ w.) in dam, **00,** 2245.

For expend. of $300,000 app. act June 6, 1900, in constr. sill across Pass a Loutre, and constr. and operating one or more drs.; est., completing sill, $125,000, and dr., $175,000; approv. July 2, 1900, **01,** 384.

Specifications for constr. sill across "Cubits Gap" and "The Jump," and building up sill across Pass a Loutre; approv. 1907, to be paid for with the "present" balance, and as much more as is necessary from app. for Southwest Pass, **07,** 1400.

SURVEYS.

Vicinity of crevasse, **03,** 1276; **04,** 1882.

Vicinity of Pass a Loutre, **05,** 1429.

Maps:

98, 1488; **99,** 1840; **00,** 2246.

Crevasse in Pass a Loutre, **02,** 1322; **03,** 1276; **04,** 1882; **05,** 1430; **06,** 1296.

HH-8 South Pass, Surveys and Examinations at.

APPROPRIATIONS. (See p. 1089.)

ENGINEERS.

Chief of Engineers. **R., 03,** 328; **04,** 347; **05,** 357; **06,** 384; **07,** 399; **08,** 424; **09,** 444; **10,** 495; **11,** 532; **12,** 650.

In charge:

Lt. Col. H. M. Adams, 1903–04. **R., 03,** 1278; **04,** 1885.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1435; **06,** 1298.

Col. E. H. Ruffner, 1907–08. **R., 07,** 1412; **08,** 1473.

Lt. Col. L. H. Beach, 1909–10, and 1912–. **R., 09,** 1459; **10,** 1604; **12,** 1960.

Maj. H. Burgess, 1911. **R., 11,** 1745.

Assistant. C. Donovan. **R., 05,** 1435.

OPERATIONS.

1902–03. Various exs. and surs. made, and plane of reference changed from average flood tide to m. l. w., **03,** 1278.

1903–04. Various exs. and surs. made, **04,** 1885.

1904–05. Various exs. and surs. made; discharge measurements; results of discharge measurements, **05,** 1437.

1905–06. Various surs. made; discharge measurements, **06,** 1298.

1906–07. Various exs. and surs. made in Pass and beyond end and of sill across and crevasse in Pass a Loutre; ranges estab. to locate sills across Southwest Pass and proposed sills across Cubits Gap and The Jump, **07,** 1412.

1907–08. Various exs. and surs. made in Pass, beyond jetties, of Pass a Loutre crevasse, and bet. Cubits Gap Light and head of South Pass; ranges estab. for placing of sills across Cubits Gap and The Jump, **08,** 1473.

1909–12. Various exs. and surs. made, **09,** 1459; **10,** 1604; **11,** 1745; **12,** 1960.

PHYSICAL CHARACTERISTICS.

South Pass is an outlet of the Mississippi R. and flows in a generally southern direction. Its l.—from the Head of the Passes to the Gulf of Mexico—is about 13 m. Prior to imp. it was obstr. by bar at its mouth and head over which d. of 9′ and 13′, resp., existed at l. w. (mean low Gulf level), while through the balance of the Pass there were d. of more than 30′, except at 2 intermediate localities, where the d. were 27′ and 28′. The w. of the Pass varies bet. 530′ and 850′.

PROJECTS.

Act June 13, 1902, au. continuation of exs. and surs. as heretofore during contract with James B. Eads and associates, **03,** 1278.

SURVEYS.

Maps:

South Pass, **03,** 1284; **04,** 1892; **05,** 1438; **07,** 1414; **08,** 1474; **09,** 1460; **10,** 1604.

Head of Passes, **03,** 1284; **04,** 1892; **05,** 1438; **06,** 1298; **07,** 1414; **08,** 1474; **09,** 1460; **10,** 1604.

HH-10 SOUTHWEST PASS.

APPROPRIATIONS. (See p. 1089.)

COMMERCE. (See Physical characteristics.)

Description of. Vast C. interests concerned, **99,** 1866, 1924.

CONTRACTS.

1901. William R. Trigg Co., constr. of dr., $286,605, **02,** 1324; contract annulled, **04,** 345.

1903. Christie & Lowe, constr. 2 jetties, brush mattress, 96¢ s. y.; riprap, $4 t.; concrete, $6.10 c. y.; Johnson Iron Works (Ltd.), furnishing and installing boiler in U. S. boat *Chere Amie,* $2,575, **04,** 1884.

1904. Johnson Iron Works (Ltd.), rebuilding U. S. boat *Chere Amie,* $13,950, **05,** 1432.

1905. New York Shipbuilding Co., constr. pump casing for U. S. dr. *Barnard,* $2,710, **05,** 1432. Johnson Iron Works (Ltd.), constr. sur. boat, $7,189, **05,** 1433.

1906. Schwartz Foundry Co., making certain repairs to U. S. dr. *Benyaurd,* $4,721.50, **07,** 1403. Ellicott Machine Co., furnishing ball and socket joints for dr. *Benyaurd,* $560 for first and $360 each addl. joint, **07,** 1405. Woodward, Wight & Co., subsistence supplies for dr. (quantities and unit prices given), **07,** 1403, 1407. Ellicott Machine Co., 2 lengths iron pipe and 4 steel flanges, $36 and $19.75 each, resp.; also addl. pipes and flanges, at $36 and $18 each, resp., **07,** 1405. Jos. Edwards & Co., cast-steel elbows and sleeves for dr. *Benyaurd;* elbows, $232.50 each; first sleeve, $258; subsequent ones, $230 each, **07,** 1406. Gulfport Creosoting Co., creosoted piles and waling timber; 40′ piles, $12; 50′ piles, $13.10; waling timbers, $24.07, **07,** 1406.

1907. W. G. Coyle & Co., coal, 40½¢ bbl.; The Cudahy Packing Co., meat for dr. (quantities and prices given); Whitney Supply Co., rubber suction pipe for dr. *Benyaurd,* $300 per length, **07,** 1406. W. G. Coyle & Co., coal, 40.45¢ to 47.45¢ bbl., dependent on place of delivery, **07,** 1407. Whitney Supply Co. (Ltd.), rubber suction pipe for dr. *Benyaurd,* $880; Stern Foundry & Machinery Co., coal chutes, $154.46, **07,** 1409. Woodward, Wight & Co., bolts, nuts, washers, rope, etc. (quantities and prices given), **07,** 1410. The Fairbanks Co., hoisting engine, etc., $2,800; Gulfport Creosoting Co., creosoted piles, lumber and timber (quantities and prices given), **07,** 1411. Ellicott Machine Co., cast-steel ball and socket joints for dr. *Benyaurd,* $344 each; Christie & Lowe, constr. sill across Cubits Gap and The Jump, and placing addl. mattresses on sill across Pass a Loutre, $210,194.20, **08,** 1465. Bowers Southern Dredging Co., dr. 14¢ c. y. (contract modified 1908, making prices for certain parts of work 13¢ and 6½¢ c. y.), **08,** 1467. Stern Foundry & Machinery Co., bolts, washers, etc. (quantities and prices given); Salmen Brick & Lumber Co., creosoted lumber and piles; 50′ piles, $19.95 each; 30′ piles, $11.95 each; 25′ piles, $9.95 each; lumber, $52.50 M f. b. m., **08,** 1468. Jas. G. Swarbrick, subsistence supplies (quantities and prices given), **08,** 1465.

1908. Joseph Edwards & Co., cast-steel elbows and sleeves for dr. *Benyaurd;* elbows, $192.50; sleeves, $178.50 each, **08,** 1468. Jas. G. Swarbrick, subsistence supplies (quantities given); Swift & Co., meats (quantities and prices given); Ellicott Machine Co., ball and socket joints for dr. *Benyaurd,* $343 each; Bucyrus Co., cast-iron pump runners, etc., for dr. *Benyaurd,* $2,594, **08,** 1469. J. C. Jung Co., coal, 36.85¢ to 47.85¢ bbl., dependent on place of delivery, **08,** 1471. Haubtman & Loeb (Ltd.), 2 duplex vertical engines for dr. *Benyaurd,* $678 for 2; Jahncke Navigation Co., dr., crew, and equipment, $213 per day; Penn Bridge Co., constr. steel-frame building, $12,400, **08,** 1472. Stern Foundry & Machinery Co., suction pipes for dr. *Gen. Abbot,* $220 each, **08,** 1473. Oscar F. Barrett, 6,000 c.y. st., $4.25 c. y.; Robert M. White, willows, $1.09 and $1.24 cord, dependent on place of delivery, **09,** 1448. Peter Eskald, constr. sheet-pile dams in outlet bayous, $47,300 (contract modified by agreement of Apr. 29, 1909); Stern Foundry & Machinery Co., repairs to dr. *Benyaurd,* $11,137.10; Crescent City Machine & Mfg. Works, certain repairs and alterations to dr. *Benyaurd,* $9,853.05, **09,** 1449. E. A. Sammons Co. (Ltd.), boiler and installing in machine shop, $4,150; Salmen Brick & Lumber Co. (Ltd.), lumber (quantities and prices given), **09,** 1450.

1909. E. A. Sammons Co. (Ltd.), ice machine, refrigerating plant, and distilling plant, and installing in machine shop, $3,800; Fairbanks Co., machines and engine, and installing in shop, $13,000; Peter Eskald, constr. 16 houses and 1 office building, $34,940; Salmen Brick & Lumber Co. (Ltd.), creosoted piles and lumber (quantities and prices given); Richard M. Murphy, st., $3.45 c. y., **09,** 1450. Richard M. Murphy, willows, $1.50 cord, **10,** 1597. W. G. Coyle & Co., coal, 35¢ and 39¢ bbl. and $3.60 t., dependent on place of delivery; Schwarzchild & Sulzberger Co., meats (prices and quantities given); Peter Eskald, combined pile driver and derrick plant, $9,192.06, **10,** 1598. Christie & Lowe, extending e. jetty, mattresses in place, $1.30 s. y.; riprap st. in place, $4 t.; Bowers Southern Dredging Co., removing mattress sill across Southwest Pass, $40,000; dr., 10¢ c. y., and furnishing dr. plant, $5 per day, **10,** 1566.

1910. Salmen Brick & Lumber Co. (Ltd.), piles and waling timber (quantities and prices given), and 40′ creosoted piles, 36¢ l. f.; Bryan Black-Lumber Co., 60′ l. p. waling timbers, 20¢ l. f., **10,** 1599. W. G. Coyle & Co., coal (quantities and prices given); Richard M. Murphy, willows, $1.20 cord; Salmen Brick & Lumber Co. (Ltd.), creosoted piles (prices given), **11,** 1739. Robinson Lumber, Veneer & Box Co., waling timbers, $24 M f. b. m., **11,** 1740.

1911. The Johnson Iron Works (Ltd.), general repairs to U. S. dr. *Benyaurd,* $8,941.25; The Bucyrus Co., parts for U. S. dr. *Benyaurd,* 2 pump casings,

$1,500; 2 each back head castings, cast-iron glands, brass bushings, water rings, $1,125; Christie & Lowe, constr. and sinking brush mattresses with st., $1.30 s. y. mattresses, $4 t. st.; Robinson Lumber, Veneer & Box Co., creosoted y. p. piles and lumber (quantities and prices given), **11,** 1740. Oscar F. Barrett, st., $3.45 c. y., **11,** 1741. New Orleans Coal Co., coal (prices given), **12,** 1955.

1912. Robinson Lumber, Veneer & Box Co., piles and lumber (prices given); A. E. Massey, st., $3.40 c. y., **12,** 1955. Robinson Lumber, Veneer & Box Co., piles and lumber (prices given), **12,** 1956.

ENGINEERS.

Chief of Engineers. **R., 99,** 40, 322, 337; **00,** 365, 366, 383; **01,** 383; **02,** 315; **03,** 325, 326; **04,** 344, 345; **05,** 354, 355; **06,** 382; **07,** 396; **08,** 422; **09,** 439; **10,** 489; **11,** 526; **12,** 645.

Boards:

Convened, New Orleans, La., Nov. 27, 1898, by S. O. No. 9, dated Mar. 7, 1898 (see Surveys). **R., 99,** 1864. (Col. H. M. Robert, Majs. J. B. Quinn and D. C. Kingman.)

Convened, New Orleans, La., Apr. 25, 1899, by S. O. No. 61, dated Mar. 15, 1899 (see Surveys). **R., 00,** 2288. (Col. H. M. Robert and Maj. G. McC. Derby, Corps of Engineers, and R. Moore and W. Starling, civil engineers.)

In charge:

Maj. J. B. Quinn, 1898–99. **R., 99,** 1839, 1914.

Maj. H. M. Adams, 1900, and 1902–04. **R., 00,** 2245, 2287; (Lt. Col.) **02,** 1323; **03,** 1276, 1277; **04,** 1882.

Lt. E. M. Adams, 1901. **R., 01,** 1878.

Lt. Col. C. B. Sears, 1905–06. **R., 05,** 1430, 1431; **06,** 1296.

Col. E. H. Ruffner, 1907–08. **R., 07,** 1400; **08,** 1456.

Lt. Col. L. H. Beach, 1909–10, and 1911–. **R., 09,** 1441; **10,** 1594; **12,** 1951.

Maj. H. Burgess, 1911. **R., 11,** 1735.

Assistants:

J. A. Ockerson. **R., 99,** 1870.

C. Donovan. **R., 04,** 1884; **05,** 1433.

LEGAL PROCEEDINGS.

Condemnation proceedings, instituted by U. S. dist. atty. for acquisition of lands necessary for proj. imp., settled by compromise, **03,** 1277.

OPERATIONS.

1901-02. Plans for dr. revised and contract let, **02,** 1323.

1903-04. 12,600 l. f. foundation mattress laid in e. jetty, **04,** 1883. Description of contractor's plant, **04,** 1884.

1904-05. 433,422 s. y. mattress and 112,560 t. st. placed in jetties; outer bar d. 2′, **05,** 1434. New dr. *Benyaurd* completed, **05,** 1430.

1905-06. 415,603 s. y. mattress, and 117,868 t. st. placed in jetties, **06,** 1296; chan. through outer bat d. to 16′, **06,** 1297.

1906-07. 78,074 s. y. mattress, 61,027 t. st., and 24,250 c. y. concrete placed in jetties; dr. continued, **07,** 1401. Statement of work done from 1903 to 1907, incl., **07,** 1400.

1907-08. 19,444 s. y. mattress, 8,170 t. st., and 20,260 c. y. concrete placed in jetties, and jetties completed, **08,** 1456. 98,500 s. y. mattress and 22,162 t. st. placed in new sill across Cubits Gap and The Jump, and in building up old sill across Pass a Loutre, work completed; 1,642,193 c. y. dr. under contract, **08,** 1457; and dr. by U. S. plant continued, **08,** 1458.

1908-09. 1,661,075 c. y. dr. by U. S. plant, and 1,932,125 under contract, **09,** 1442. Dams aggregating 1,522 l. f. built across 9 outlet bayous; various repairs and imps. to plant at Burrwood, incl. the starting of 16 dwellings and an office, and installing boiler, engines, machinery, refrigerating and distilling plant; work done on building up jetties, closing minor outlet bayous, and on revets., **09,** 1443.

1909-10. 2,782,458 c. y. dr. by U. S. plant and 17,946 c. y. under contract; e. jetty extended seaward 2,600′, using 70,778 s. y. mattress and 26,542 t. st.; 16 houses and office building completed, **10,** 1594. One spur dike 600′ l. completed and 4 others commenced, **10,** 1595. Work on removal of mattress sill across Southwest Pass, **10,** 1594. Constr. of barges, wharf, etc., **10,** 1595.

1910-11. 3,153,214 c. y. removed by U. S. dr., removal of mattress sill across head of Southwest Pass by contract completed, jetties built up, spur dikes built, repairs to plant, and misc. work, **11,** 1737. Dr. *Barnard* trans. to Gulfport H. and Chan., **11,** 528.

1911-12. 4,177,182 c. y. dr. by U. S. dr., work on jetty extension practically completed, Double Bayou closed, but h. w. makes break; e. jetty raised, spur dikes extended, **12,** 1952.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 1865; **99,** 2289. Southwest Pass is one of the principal outlets of the Mississippi R. It flows in a generally sw. direction and its length from the Head of the Passes to the Gulf of Mexico is about 15 m. It was obstr. by a bar at its mouth, having a depth of only 9′ over it, while the remainder of the Pass had depths ranging from 26′ to 83′ at l. w. (mean low Gulf level). The width of the Pass varies between 1,200 and 2,400′.

Prior to the opening of South Pass to deep-draft vessels Southwest Pass was the entrance to the R. generally used by vessels bound to and from the port of New Orleans, **12,** 645.

Practicability of obtaining a 35′ chan. of navigable width, **99,** 1866.

Hydrography, **99,** 1886. Gauge readings, **99,** 1891.

Profile of the Pass, **99,** 1895.

Movement of crest of bar, **99,** 1895.

Discharge measurements, **99,** 1896. Pass a Loutre, The Jump, and at Cubits Gap, **99,** 1906.

Grounding of ships, list of ships, **99,** 1937.

Settlement and compression of mattresses, **05,** 1434.

Rules and regulations for navigation of Southwest Pass prescribed by Sec. of War, May 29, 1909, **09,** 441.

PROJECTS.

History of attempted imp. of mouth of Mississippi, **99,** 1914.

BE., 1898, est., 1899, $13,000,000 to make navigable chan. through Southwest Pass, **99,** 1869.

BE., 1899, est., 1900, $6,000,000 for a 35′ chan. m. l. w., 1,000′ w., with 2 jetties to maintain chan.; constr. of sills across various outlets; closing of minor outlets below the forts, and constr. of necessary dr. plant, purchased land, with $150,000 addl. per an. for mainten., **00,** 2288, 2291, 2293, 2297; proj. au., 1902, **02,** 316; **03,** 327.

Methods of jetty constr., **00,** 2294.

Capacity of dr., **00,** 2299.

Lands acquired. (See Legal proceedings.)

Necessity of increasing proposed l. of jetties, owing to shifting of bar; est. addl. cost, $465,000, **05,** 1431; **06,** 383.

Plans and specifications for constr. sill across Cubits Gap and The Jump, and placing addl. mattresses on and building up sill across Pass a Loutre, au. May 17, 1907 (see Pass a Loutre), **07,** 398.

Act May 28, 1908, au. dr. when necessary to secure 35′ bet. Cubits Gap and Head of Passes, to be paid for from app. for sur. and imp. of South Pass and Southwest Pass, **08,** 422, 424, 426.

Specifications for dr. 22,400′ of chan. to 35′ d. and 500′ w. au. Aug. 7, 1907; est., $475,440, **08,** 1457.

Questionable benefit of sills across Cubits Gap and The Jump, and increased height of sill across Pass a Loutre, **09,** 1444.

Addl. dr. plant au. act Mar. 3, 1909, **12,** 645.

SURVEYS.

Joint resol. Congress, Feb. 17, 1898, au. sur. of Southwest Pass, and report upon practicability of securing navigable chan. of adequate w. and of 35 d. at m. l. w. of the Gulf of Mexico throughout the Southwest Pass. Sur., 1899, by Maj. Quinn for BE. (**R.** fav.; see Projects), **99,** 1864.

Triangulation, **99,** 1871. Triangle sides, **99,** 1872. Geopgraphical positions, **99,** 1875. Shore line and topography, **99,** 1877. Precise levels, **99,** 1878. Bench marks, **99,** 1878. Range elevations, **99,** 1880. Meter ratings, **99,** 1898, 1907.

Act Mar. 3, 1899, provided for appointment of a board of 4 engineers, of whom 2 "shall be" from civil life, to prepare and report a proj. for securing navigable chan. of suitable w. and of 35′ d. m. l. w. of the Gulf of Mexico throughout the Southwest Pass, to submit detailed est. of the cost of each and every feature of the proj., and to report especially whether necessary to constr. inner jetties (see Projects), **00,** 2288.

Minor, **05,** 1435; **09,** 1443; **10,** 1595; **11,** 1737; **12,** 1953.

Discharge measurements, **09,** 1444; **10,** 1596.

Subsidence of jetties **10,** 1596.

Maps:

Chart showing location of jetties, **04,** 1884; **11,** 1736.

Details of mattress constr., **04,** 1884.

Progress chart, **05,** 1432; **06,** 1296; **07,** 1402.

Part of Southwest Pass, **07,** 1402; **08,** 1460; **09,** 1444; **10,** 1596.

HH-15(a) Cairo (Ohio River) to Mouth.

(Including levees and reclamation of alluvial basin; imp. of R. below Cairo; estab. of gauges on Mississippi and protection of water front at Memphis, Vicksburg, and New Orleans and several other Hs.)

APPROPRIATIONS. (See p. 1089.)

Detailed lists of money statements, **01,** S., 21; **02,** S., 19; **03,** S., 29; **04,** S., 28; **05,** S., 27; **06,** 2485; **07,** 2626; **08,** 2659; **09,** 2662; **10,** 2940; **11,** 3187; **12,** 3727.

COMMERCE.

Effect of levees on, **74,** 390; **75,** 559, 563; **79,** 1018, 1819.

Requirements of, **79,** 1011.

Saving to C. by increased d., **79,** 1011, 1021.

Registered tonnage plying on the lower Mississippi, **91,** 3576.

Shipments of bulk grain by barges to New Orleans during 1890, **91,** 3578.

Statement showing approx. receipts and shipments of freight by R. for 1890–91, **91,** 3686, 3718.

Impossible to obtain an exact statement of the freight traffic on the R. without employing special agents. Statistics collected by local bodies at so

few places that the total traffic can only be guessed at, **95,** 3674.

R. traffic, its character and volume, **01,** S., 33.

Diagram, traffic at St. Louis, **01,** S., 40.

Diagram, tonnage at St. Louis and Louisville, **01,** S., 40.

Receipts and shipments at principal ports, **02,** S., 48; **03,** S., 72.

Foreign C., New Orleans, tonnage over 5,000,000, **02,** S., 153; **03,** S., 299.

Growth of population, business, and wealth along alluvial valley since protection has been given, **04,** S., 24; **05,** S., 24.

At Wickliffe, Ky., insignificant, **04,** S., 247.

Revival of interest in R. trans., owing to its cheapness and the inadequate facilities of RRs. The Kansas City-Missouri River Navigation Co. has "recently" been organized with a view to restoring the immense traffic by water bet. St. Louis and Kansas City, **10,** 2976.

CONTRACTS.[1]

1888. Serbian, Wright & Co., levees, Plum Pt., 15½¢ c. y., **88,** 2198. T. Sullivan, levees, Plum Pt., 14¾¢ c. y., **88,** 2198. D. T. Hartnett, levees, White River Front, 14¾¢ and 15¢ c. y., **88,** 2207. J. T. Jefferson, levees, White River Front, 16¢ c. y., **88,** 2207. J. J. Cooney, levees, White River Front, 19¢ c. y., **88,** 2207. R. Moore, dr., Vicksburg H., 18¢ c. y., **88,** 2282. W. L. Killebrew, brush, $1.09 cord; st., $1.39 c. y., **88,** 2283. E. Evans, willow braces, 40¢ each; willow stringers, 87½¢ each, **88,** 2283. Purcell & Greace and Arnold & De Garis, levees, Tensas Front, 25¢ c. y., **88,** 2286. Tapper & Fisher, levees, Amos Bayou, 17¢ c. y., **88,** 2287. W. R. Harvey, levees, Panther Forest, 19¢ c. y., **88,** 2287. L. C. Dulany, levees, Leland Second Loop, 16¢ c. y., **88,** 2287. W. R. Harvey, levees, Brooks Break, 18¢ c. y., **88,** 2287. W. R. Harvey, levees, Matthews Bend, 19¢ c. y., **88,** 2287. Andrews Bros., levees, Whiskey Chute, 28¢ c. y., **88,** 2287. McTighe & McKee, levees, Grand Lake, 22¢ c. y., **88,** 2287. Ogden & Jones, levees, Kempe, 28½¢ c. y., **88,** 2304. R. M. White, levees, Deer Park, 14⅝¢ c. y., **88,** 2304.

1889. S. P. McKelvey, st., 67.5¢ c. y., **89,** 2666. Madison Marine RR. Co., 20 wooden barges, $2,625 per barge, **89,** 2668. W. O. Flynn & Co., embankment, 18⅜¢ c. y.; excavation, 20¢ c. y.; grubbing, $175 acre; filling timber, $30 acre, **89,** 2691. D. T. Hartnett, J. K. Jeffries, and Arnold & McDonel, enlargement and repair of levee, Robinsonville, 15¾¢ c. y., **89,** 2691. Flynn & Cook, levees, Webb, 15¢ c. y., **89,** 2691. Fudge & Kearns, enlargement of Blands Bayou, 15½¢ c. y., **89,** 2691. G. Hartweg, st., $1.95 t., **89,** 2702. E. Evins, brush, $1.27½ cord; poles, $1.47½ cord, **89,** 2704. E. Evins, brush, $1.17½ cord; poles, $1.67½ cord; st., $1.73⅝ c. y., **89,** 2709. Alabama Dredging & Jetty Co., dr., Vicksburg, 17¢ c. y., **89,** 2713. R. Johnson, levees, Duval, 13¢ c. y., **89,** 2714. J. A. Cannon, levees, Greenville, 13¾¢ c. y., **89,** 2715. T. Sullivan, levees, Skipworth, 16½¢ c. y., **89,** 2715. Ogden & Jones, Kempe Levee, 28½¢ c. y., **89,** 2727. J. McGinty, levees, Tensas Parish, 19¢ c. y., **89,** 2728. J. Poitevent, lumber, $10.90 M f. b. m., **89,** 2731. J. H. Gardner, poles, $2.75 to $3 cord; brush, $1.68 cord, **89,** 2731.

1890. E. Evins, brush, $1.27 cord; poles, $1.47 cord, **90,** 3242. G. Hartweg, st., $1.50 t., **90,** 3242. Bryant & Pickett, brush, $1.05; poles, $1.50 cord. Harvey & Scott, levees, 23¢ to 24¢ c. y., **91,** 3618. Hunter & Frey, brush, $1.02; poles, $1.50 cord, **91,** 3619. Harvey & Scott, levee enlargement, 22¢ to 28¢ c. y., **91,** 3643. J. M. Whitehill, levees and repairs, 18½¢ to 25¢ c. y. A. R. Fudge, levees, 24¾¢ c. y. The Sunnyside Co., levees, 16¢ c. y. R. E. Craig, levee repair, 17½¢ to 19¢ c. y., **91,** 3644. J. Scott & Son, levees, 23½¢ c. y., **91,** 3644.

1891. Monongahela & Western Dredging Co., dr., 26¢ c. y., **92,** 3148. Pardesky & Lyman, levees, 16.95¢ c. y., **92,** 3150. T. Sullivan, levee enlargement, 15½¢ c. y., **92,** 3150. E. Hely, st., $1.65 to $1.75 c. y., **92,** 3165. Orgill Bros. & Co., wire, 2.70¢ to 6.88¢ lb., **92,** 3166. Hartnett & O'Brien, levees, 18¢ c. y.; O. Ferguson & Sons, levee work, 18.96¢ c. y., **92,** 3166. F. M. Ferguson, levee work, 16.94¢ to 18.44¢ c. y., **92,** 3166. T. Sullivan, levee work, 15¾¢ c. y., **92,** 3167. Little Rock Granite Co., st., $1.50 t., **92,** 3195. Hunter & Frey, brush, $1.10 and $1.12 cord; poles, $1.75 cord, **92,** 3195. W. L. Killebrew, brush, $1.33, $1.43, and $1.14 cord, **92,** 3195. E. Evins, brush, $1.17; poles, $1.97 cord, **92,** 3195. H. E. Coffin, wire, 2.79¢ lb.; strand, $4.81 100 lbs.; cable, $17.95 and $18.68 100'; spikes, $2.59 100 lbs.; staples, $2.99 100 lbs.; manila rope, $9.22 100 lbs., **92,** 3195. Broderick & Bascom Co., manila rope, $9 100 lbs., **92,** 3195. J. M. Whitehill, levees, 25¢ c. y., **92,** 3199. B. Talley, levees, 13¾¢ c. y.; J. E. Mulcahey and J. M. Sullivan, levees, 16.20¢ c. y.; T. Sullivan, levees, 18½¢ c. y.; T. W. Scott, levees, 12¾¢ c. y.; Ware & Donaven, levees, 13½¢ c. y., **92,** 3200. A. A. Arnold & Co., levees, 16⅝¢ c. y., **92,** 3201. J. A. Ware, levees, 14¢ c. y., **92,** 3201. Cary & Bradburn, levees, 14.98¢, 23.79¢, and 22.98¢ c. y.; T. A. Helgason, levees, 14.74¢ c. y., **92,** 3232. J. Scott & Son, levees, 15½¢ c. y.; N. W. Irish, levees, 14⅞¢ c. y.; Gibson & Deaton, levees, 15.98¢ and 16.98¢ c. y.; Louis Le Sassier, levees, 16¢ c. y., **92,** 3232. Andrews Bros. Constr. Co., levees, 13.44¢ c. y.; A. G. Gillespie, levees, 18½¢ c. y., **92,** 3233.

1892-93. About 100 contracts for levee work, at prices ranging from 10¢ to 57¢ c. y., **93,** 3746, 3814, 3890.

Hunter & Frey, brush and poles; E. Hely, 20,000 c. y. st., $1.70 to $1.85 c. y., **93,** 3745. J. H. Cary removing Nonconnah Rock, $2.65 c. y.; F. Hartweg, 25,000 c. y. st., $1.20 to $1.69 c. y.; Weigel Bros. & Co., 10 barges, $3,100 each; D. S. Barmore,

[1] Tabulation showing steady reduction in prices due to continuing app. prevailing since 1892, **95,** 3628.

9 barges, $3,170 each; S. M. Flesher, 10 barges, $2,800 each, **93,** 3747. J. B. & W. L. Killebrew, st., $1.489 c. y. and 49.9¢ c. y.; S. M. Flesher, 15 brush barges, $2,970 each; Woodward & Wight Co., yellow pine, $28 and $33 M, **93,** 3815. Bucyrus Steam Shoval & Dredge Co., dr. plant, $69,500; J. W. Worthington & Co., 3,500 t. r., at $2.50; R. M. White, brush and poles, $7,410; Pelican Saw Mill & Mfg. Co., 2 barges, $6,574; C. Telson, 2 barges, $7,300, **93,** 3819.

1893-94. About 100 contracts for levee work, at prices ranging from 8¢ c. y. to 66¢ c. y., **94,** 2913, 2963, 3028.

J. S. McTighe & Co., st., $1.25 to $1.67 c. y., **94,** 2913.

1894-95. About 100 contracts for levee work, prices ranging from 7.93¢ c. y. to 60¢ c. y., **95,** 3854, 3925.

Misc. contracts for brush, piles, wire, etc., **95,** 3797.

Mississippi Valley Marine Ry. & Dock Co., docking and repairing SS., $7,393.25; J. F. Oliver, st., 40¢ and 50¢ c. y.; E. Burke, st., 50¢ c. y.; F. Hartweg, st., $1.19 to $1.59 c. y., **95,** 3800. D. S. Barmore, hull of sur. boat *Illinois*, $2,060, **95,** 3687.

1895-96. About 50 contracts for levee work, at prices ranging from 7.75¢ c. y. to 24¢ c. y., **96,** 3646, 3676, 3736.

Misc. contracts for brush, poles, wire, etc., **96,** 3646.

E. J. Howard, new hull for *Patrol*, $9,980; New York Dredging Co., hydraulic dr., $124,940; F. Hartweg, 200,000 bu. coal, 8.25¢, **96,** 3498.

1896-97. About 50 contracts for levee work, at prices ranging from 7.92¢ to 25¢ c. y., **97,** 3722, 3765, 3829.

Misc. contracts for brush, wire, etc., **97,** 3722.

Springfield Boiler & Mfg. Co., hydraulic dr., $102,000 and $106,000; Cairo City Coal Co., 200,000 bu. coal, 6½¢; contracts for towboat service, $35 to $70 per day, **97,** 3568. E. Lignon & Co., st., 46¢ c. y.; Hunter & Frey, brush, 97¢ and $1.04 cord; poles, $1.50 and $1.60 cord; E. Hely, st., $1.29 to $1.44 c. y., **97,** 3722. A. P. Birch, 4,000 t. r., $2.21; D. & J. Tranchine, 1,000 t. r., $1.72; L. J. Mestier & Co., 3,000 t. r., $2.40, **97,** 3829.

1897-98. About 100 contracts for levee work, at prices ranging from 8.74¢ to 27.5¢ c. y., **98,** 3364, 3407, 3453.

Misc. contracts for brush, poles, etc., **98,** 3366.

Cincinnati Marine Ry. Co., 1 pile sinker, $1,465; 4 others at $1,684; Iowa Iron Works, altering hull of dr. *Beta*, $26,900; 5 steam tenders, $45,672 each; F. Hartweg, coal, 350,000 bu., at 10.4¢; L. M. Rumsey Mfg. Co., 2 pumps, $2,734 each; J. O'Brien Boiler Works, boilers, $2,740; M. A. Sweeney Co., 3 small steam tenders, $7,749 each; 4 contracts, towboat service, $40 to $75 per day, **98,** 3174. W. A. Kirk, dr. in Wolf R., 12¢ c. y.; removing obstr., $9 per hour, **98,** 3364. Iowa Iron Works, steel towboat, $27,500, **98,** 3453.

1898-99. About 75 contracts for levee work, at prices ranging from 8.99¢ c. y. to 24.94¢ c. y., **99,** 3534, 3584, 3649.

Misc. contracts for brush, poles, etc., **99,** 3535.

Springfield Boiler & Mfg. Co., hydraulic dr., $94,970; refrigerating plant, $2,980.50; F. Hartweg, 350,000 bu. coal, 9.9¢, **99,** 3348.

1899-00. About 100 contracts for levee work, at prices ranging from 9.35¢ c. y. to 32¢ c. y., **00,** 4820, 4871, 4924.

Misc. contracts for brush, poles, etc., **00,** 4820.

Memphis Machine Works, refrigerating plant, 6, $13,140; Iowa Iron Works, 18 steel pontoons, $131.37 each; New Jersey Foundry & Machine Co., 80 pontoons, $29.80 each; H. Vogt Machine Co., 80 pontoons, $72.68 each; 8 boilers, $4,000, **00,** 4571.

1900. Aderholdt & Lowrance, levee work, station 8/9 to 11/0, 19.87¢ c. y.; J. H. Cary, levee work, lower St. Francis dist., 12½¢ to 23½¢ c. y., **01,** S., 265.

1901. Frederick Hartweg, 350,000 bu. coal, 10¼¢ bu., **01,** S., 55. Z. T. Anderson, levee work, White River levee dist., 24½¢ c. y., **01,** S., 265. Misc. levee contracts, **01,** S., 296.

1902. The Mon. R. C. C. & C. Co., 300,000 bu. coal, 11½¢ bu., **02,** S., 47. Misc. contracts for brush, poles, levee work, **03,** S., 191, 271. J. O. Wright, barges; C. H. Whipple & C. D. Leeper, earthwork, **03,** S., 299.

1903. Standard Oil Co., oils; Woodward, Wight & Co., provisions; Louis Darring & L. Mouledons, vegetables, etc.; R. T. Clark, earthwork, **03,** S., 299. Martin Heinzelman, 5 2-horse teams, $99 mo. each, **03,** S., 60.

1904. Ed. J. Howard, rebuilding hull of U. S. S. *Minnetonka*, $15,000; rebuilding hull of U. S. S. *Patrol*, $6,800; the Mon. R. C. C. & C. Co., coal, 13¢ bu., **04,** S., 60. Misc. contracts for levee work, **04,** S., 160, 275. Woodward, Wight & Co., groceries, $5,004.50; Geo. W. Davidson & Co., vegetables, $141.54; W. H. Pritchartt & Co., $515.25; Natchez Dressed Beef Co., meats, $1,511.08; Wm. Wirt Johnston, 1 wooden decked hull. $4,100; Hearin & Ryan, levee work, 11.97¢ c. y., **05,** S., 282.

1905. C. Jutte & Co., coal, 9¢ bu.; the Springfield Boiler & Mfg. Co., constr. dr. and pipe line, $238,998.17, **05,** S., 71. Misc. contracts for levee work, **05,** S., 211, 281. The Springfield Boiler & Mfg. Co., constr. self-propelling hydraulic dr. and pontoon pipe line, $238,998.17, **06,** 2513.

1906. West Kentucky Coal Co., coal, 9.9¢ bu.; Chas. H. Organ, water-front privileges, $150 per annum; Matthew C. Williams, water-front privileges, $100 per annum; Humphrey Fullerton, trustee, lease of office room, $4,272 per annum, **06,** 2513. Misc. contracts for levee work, st., brush, etc., **06,** 2551, 2573, 2608.

1907. The Mon. R. C. C. & C. Co., coal, 11½¢ bu.; Chas. H. Organ, water-front privileges, $150 per annum; Matthew C. Williams, water-front privileges, $100; Humphrey Fullerton, lease of

office rooms, $4,272 per annum, **07,** 2660. Misc. contracts for levee work, **07,** 2700, 2727, 2768.

1908. Misc. contracts for levee work, **08,** 2754, 2786, 2830. Chas. Hegewald Co., 3 boilers for grader, $4,999; Ed. J. Howard, 2 material barges, $6,900; C. W. Hunter, brush and poles, $1.45 cord, **08,** 2787.

1909. H. I. Crandall & Sons, constr. side-haul ry. dry dock, $100,220; the Mon. R. C. C. & C. Co., coal, 10½¢ bu.; Chas. H. Organ, water-front privileges, $150 per annum; Matthew C. Williams, water-front privileges, $100 per annum; Nina Realty Co., lease of office rooms, $6,724, **09,** 2699. Misc. contracts for levee work, **09,** 2760, 2796, 2842. Acme Boiler & Constr. Co., steel pontoons, $4,500, **10,** 2973.

1910. The Mon. R. C. C. & C. Co., coal, 12¢ bu.; the Springfield Boiler & Mfg. Co., steel-plate suction head, $1,500; Nina Realty Co., lease of office and storage rooms, $6,724; C. H. Organ, water-front privileges, $250 per annum, **10,** 2973. Misc. contracts for levee work, **10,** 3067, 3107.

1911. Nina Realty Co., lease of office and storage rooms, $6,724 per annum; C. H. Organ, water-front privileges, $250 per annum, **11,** 3228. Misc. contracts, rent of river front, levee work, 1s and 2d dists., **11,** 3286, 3287. Misc. levee contracts, 3d dist., **11,** 3319; 4th dist., **11,** 3356. Diamond Coal & Coke Co., coal, 11½¢ bu.; Ed. J. Howard, constr. SS. *Jupiter* and *Saturn*, $17,175 each, **12,** 3767.

1912. M. A. Sweeney Shipyard & Foundry Co., constr. SS. *John Ewens*, $23,490; C. H. Organ, water-front privileges, $250 per annum; Nina Realty Co., lease of office and storage rooms, $6,724 per annum; Cumberland Telephone & Telegraph Co., lease of telephones, $8 per mo.; the Bell Telephone Co. of Mo., lease of telephones, $9.50 per mo., **12,** 3767. Misc. contracts for levee work, etc., **12,** 3898, 3977.

DEFENSE.

Importance of Vicksburg to defense of the Mississippi R., **71,** 379.

ENGINEERS.

Chief of Engineers. R.:

Sur. of Mississippi, **77,** 78; **78,** 88; **79,** 117.

Levees, **68,** 54; **70,** 405; **74,** 380; **79,** 1015.

Reclamation of waste lands, **69,** 51, 322, 327; **75,** 39, 536; **78,** 110, 853; **79,** 1015.

Estab. of gauges, **70,** 402; **71,** 60; **72,** 57; **73,** 60; **75,** 70; **76,** 79; **77,** 78; **78,** 88; **79,** 117.

Mississippi below Cairo, **75,** 37; **78,** 841; **79,** 43, 1007.

Memphis H., Tenn., **77,** 78; **78,** 88; **79,** 117; **80,** 157; **81,** 204; **82,** 201.

Vicksburg H., Miss., **78,** 88, 637; **79,** 117; **80,** 157; **81,** 205; **82,** 202.

Natchez, Miss., and Vidalia, La., **80,** 157, 158; **81,** 205; **82,** 202.

Mouth of Red R., La., **80,** 151; **81,** 205; **82,** 203.

New Orleans H., La., **78,** 85; **79,** 107; **80,** 141; **81,** 190; **82,** 187, 1357, 1359.

Miss. R. Commission. **R., 81,** 336; **82,** 325; **83,** 340; **84,** 344; **85,** 258; **86,** 247; **87,** 340; **88,** 306; **89,** 365; **90,** 330; **91,** 422; **92,** 396; **93,** 459; **94,** 420; **95,** 469; **96,** 418; **97,** 525; **98,** 528; **99,** 616; **00,** 694; **01,** 657; **02,** 578; **03,** 639; **04,** 707, 708; **05,** 716; **06,** 794; **07,** 812; **08,** 863; **09,** 909; **10,** 1015; **11,** 1074; **12,** 1288.

Boards:

To investigate and report on permanent plan for reclamation of alluvial basin, 1874; reported resort to cut-offs dangerous; division of tributaries impracticable; reservoirs for holding flood water impracticable; artificial outlet impracticable; permanent system of levees only practicable plan; general considerations, **75,** 39, 539, 564. (Majs. Warren and Abbot, Capt. Benyaurd, and Messrs. Sickles and Herbert.)

To investigate and report on the protection of water front of Vicksburg, 1877. Pre. report, **78,** 642. Final report, **78,** 638. Recom., 1st, protection of Delta Pt.; 2d, constr. of bar dike from De Soto Isld.; 3d, dr. on inner bar; 4th, diversion of Yazoo R., **78,** 638. (Col. Simpson, Maj. Suter, and Capt. Benyaurd.)

To investigate and report on the protection of water front of New Orleans, 1877. Recom. protection of banks with pile and brush revet. and brush mats; est., $476,000, **78,** 85, 614, 616; **79,** 875. (Maj. Weitzel, Capts. Howell and Benyaurd, and Messrs. Harrod, D'Hemecourt, and Wood.)

To investigate and report on l.-w. imp. below Cairo, and effect of permanent system of levees, 1878. General considerations of imp., **79,** 1008. Board reported l.-w. d. of 10′ would satisfy demands of C., **79,** 1011; that imp. should be effected by narrowing the shoal and wide reaches of the R. to about 3,500′, and protection of caving banks, **79,** 1014; that constr. be determined by trial, **79,** 1013; and that one of the worst places should be selected for trial, **79,** 1013.

Board reported that C. would be benefited by a permanent system of levees; taken in connection with a l.-w. imp., **79,** 1017, 1018. (Cols. Barnard and Tower, Lt. Col. Wright, and Majs. Comstock and Suter.)

Convened Apr., 1880, to consider plans for permanent imp. of mouth of Red R. **R., 80,** 1284. (Cols. Tower and Newton and Maj. Abbot.)

Constituted, S. O. No. 97, C. of E., 1881, to ex. and report upon condition of work in progress for the protection of the city front of New Orleans. **R., 82,** 1359, 1366. (Majs. Suter, Benyaurd, and Stickney, and Capt. Ernst.)

BERH. concurs on inadvisability of imp. at Wickliffe, Ky., **04,** S., 245.

Act Mar. 2, 1907, appoints board to ex. R. below St. Louis, with view to obtaining 14′ chan., **07,** 2674.

Act June 25, 1910, au. Sec. of War to appoint commission to ex. R. below St. Louis, with view to securing 14′ chan., **10,** 3003.

Mississippi River Commission:

R., 81, 2720, 2740; **82,** 2745; **83,** 2111; **84,** 2408; **85,** 2535, 2589; **86,** 2143; **87,** 2689, 2749, 2753; **88,** 2191, 2213; **89,** 2593, 2596; **90,** 3083; **91,** 3397, 3446; **92,** 2887; **93,** 3545; **94,** 2697; **95,** 3617; **96,** 3403; **97,** 3505; **98,** 3137; **99,** 3291; **00,** 4525; **01,** S., 3; **02,** S., 3; **03,** S., 3; **04,** S., 3; **05,** S., 3; **06,** 2469; **07,** 2605; **08,** 2637; **09,** 2641; **10,** 2917; **11,** 3163; **12,** 3695.

Members of the commission:

Col. Q. A. Gillmore (Bvt. Maj. Gen., U. S. A.), 1879–88; president, 1879–82, 1884–88.
Col. C. B. Comstock (Bvt. Brig. Gen., U. S. A.), 1879–95; president, 1882–84, 1888–95.
Col. G.L. Gillespie, 1895–1901; president, 1895–1901.
Col. C. R. Suter, 1879–96.
J. B. Eads, 1879–83.
B. Harrison, 1879–81.
B. M. Harrod, 1879–1904.
H. Mitchell, U. S. C. & G. S., 1879–88.
R. S. Taylor, 1881.
Lt. Col. O. H. Ernst, 1888–94.
G. Davidson, U. S. C. & G. S., 1888–90.
S. W. Ferguson, 1883–90.
H. Flad, 1890–98.
H. L. Whiting, U. S. C. & G. S., 1890–97.
Col. A. Stickney, 1894–1903; president, 1901–03.
Maj. T. H. Handbury, 1896–1902.
H. L. Marindin, U. S. C. & G. S., 1897–1904.
J. A. Ockerson, 1898–.
Lt. Col. H. M. Adams, 1901–04.
Maj. T. L. Casey, 1902–06.
H. B. Richardson, 1904–09.
H. P. Ritter, U. S. C. & G. S., 1904–.
Col. C. B. Sears, 1904–08; president, 1906–08.
Lt. Col. J. L. Lusk, 1906.
Col. O. H. Ernst, president, 1903–06.
Col. W. H. Bixby, president, 1908–10.
Chas. H. West, 1910–.
Col. W. L. Fisk, president, 1910–11.
Col. W. T. Rossell, 1906; president, 1911–12.
Maj. J. G. Warren, 1906–.
Col. C. McD. Townsend, 1911–; president, 1912–.

Engineers in charge:

Lt. Col. W. F. Raynolds:
R., Vicksburg H., **71,** 377.

Maj. C. R. Suter:
R., Mississippi bet. Cairo and New Orleans, **75,** ii, 496; **78,** 841.

Capt. (Maj., 1879) W. H. H. Benyaurd, 1877–82.
R.:
Memphis, **77,** 490; **78,** 637; **79,** 979; **80,** 1337; **81,** 1381; **82,** 1498.
Vicksburg, **78,** 637; **79,** 974; **80,** 1333; **81,** 1384; **82,** 1502.
R., estab. of gauges, **76,** 600; **77,** 493; **78,** 646; **79,** 982.
Natchez and Vidalia Hs., **80,** 1332; **81,** 1386, **82,** 1506.
Mouth of Red. R., La., **80,** 1282, 1288; **81;** 1389; **82,** 1511, 1515.

Capt. (Maj., 1879) C. W. Howell:
R., New Orleans, **78,** 614; **79,** 875; **80,** 1145; **81,** 1271.
R., estab. of gauges, **75,** 533.

Maj. W. E. Merrill:
R., estab. of gauges, **72,** 426; **73,** 517; **74,** 487.

Maj. C. B. Comstock:
R., sur. of Mississippi, **77,** 1106; **78,** 1356; **79,** 1891.

Maj. A. Stickney, 1881–82:
R., New Orleans H., **82,** 1354.

Col. C. B. Comstock. **Rs.:**
Change of plane at Red R. Landing, notes on Col. Suter's paper, **93,** 3564.
Flood report for 1890, note on, **90,** 3107.
Levees, effect of, on l.-w. navigation; dissent from M. R. C. report, **87,** 2767.
Levees, effect of, on bed of R., with data of the Po, Rhine, and Yellow Rs., **90,** 3093.
Levees, views on; dissents from M. R. C. reports, **83,** 2152; **84,** 2435.
Outlets proposed at Lake Borgne condemned, **90,** 3105.
Overflow, effect of, in diminishing velocity and effect of levees on flood heights in 1882 and 1883, **85,** 2877; **88,** 2220.

Capt. Derby:
Use of dr. *The Ram* to build levees, **95,** 3922.
Homochitto levees, **96,** 3472.
Flood heights, 4th dist., **00,** 4551.

Maj. Ernst:
R., mouth of Illinois to Ohio R.
R., 85, 2855, 2939; **86,** 2156; **87,** 2722.
Proj., **83,** 2119.

B. M. Harrod:
Paper on protection of banks, **85,** 2880.

H. B. Herr:
R. on discharge observations, Hampton Landing, 1878, **87,** 2701.

Capt. Leach. **Rs.:**
Sediment and discharge observations at Carrollton, **83,** 2209; upper Mississippi, **83,** 2226.

Secondary triangulation, Cairo to Keokuk, **84,** 2443.
Citizens Bluff protection, Memphis, **88,** 2208.
Condition of levees, 1887 and 1888, **89,** 2663.
Experimental velocity observations of 1882, with results, **85,** 2691.

H. L. Marindin. **Rs.:**
Comparison of surs. in vicinity of Passes, **83,** 2308.
Abstract from report on Cubits Gap, **85,** 2549.

Capt. Millis:
R. on sur. near crevasses, **94,** 3064.

H. Mitchell. **Rs.:**
Bends and their relation to d. and section, **83,** 2300.
Levees, **83,** 2300; **87,** 2767.
Regimen elements of the R., **90,** 3119.
Cubits Gap sur. and gaugings, 1868, 1875, 1876, **83,** 2302.

Capt. C. Palfrey:
Early maps of the R., **93,** 3703.

Capt. Powell. **Rs.:**
Measurement of flood-line depression of 1890, below Red. R. Landing, from contiguous crevasses, **91,** 3463.
Effects of outlets on the bed of the R. below them, **91,** 3465.
Relation bet. mean bank height and mean h. w., Cairo to Baton Rouge, **90,** 3137.
L. and distribution of front levee lines in the alluvial valley of the R., **90,** 3111.

Capt. Roessler:
Nonconnah Rock sur., **92,** 2913.

Capt. Rossell. **Rs.:**
Vicksburg H. sur., levees, etc., **88,** 2292; **89,** 2662; **91,** 2663.
Bend sur. of 3d dist., **90,** plates 13 to 15, Appendix H.

Lt. Col. Stickney:
Bank-protection plan, **97,** 3536.

Lt. Col. Suter. **Rs.:**
Effects of crevasses on gauge readings below Red R., 1890, **91,** 3444.
Effects of levee constr. and suggestions for relief from excessive flood heights, **95,** 3649.
Flood travel on the lower R., **92,** 2905.
Investigation of discharge measurements of the R., **91,** 3417; and of effects of Ames crevasse, 1891, **92,** 2905.

Capt. Townsend:
L.-w. soundings, Lake Providence Reach, **93,** 3786.
Gauge relations, 3d dist., **94,** 2967.
Influence of Mississippi basin on flood heights. **95,** 3661.
R. on remarks on regulation of Rs., **93,** 3762.

Capt. Waterman:
Gulf levels at Port Eads, **96,** 3481.
Dr., Cairo to Memphis, **97,** 3588.

H. L. Whiting:
New Orleans chans. compared, 1874–1894, **95,** 3669.

Capt. J. H. Willard:
Old bench marks of Delta, **90,** 3179.

Committees:
Committee on dr. (Lt. Col. Suter, H. Flad), **R., 93,** 3570.
Special committee to make a statement for Congress showing the amount and cost of permanent bank protection. **R.,** B. M. Harrod, H. Flad, **96,** 3439; A. Stickney (minority), 3440.
Special committee to form a general plan on which to base future recom. to Congress for imp. R. under act creating commission. **R.,** Col. Suter, **96,** 3441; Lt. Col. Stickney, 3448.
Committee on constr. on future works required in the lower R. to contract and fix the chan., and to protect the banks against erosion, **R.,** Col. Suter, B. M. Harrod, and Lt. Col. Stickney, **96,** 3456; H. Flad, 3459.
Committee on levees on the amount and cost of levees to protect against probable future floods. **R.,** B. M. Harrod, Lt. Col. Stickney, **96,** 3460.
Reports and tables relating to dr. operations and tests for dr. *Alpha,* 1894–95. **R.,** H. Flad. chairman committee on dredges, **96,** 3461.

Secretary's office, M. R. C.:
Capt. S. S. Leach, 1879–85:
Rs., 82, 2765 (Sen. ex. doc. 10, 47th Cong. 1st sess.); **83,** 2155; **84,** 2441; **85,** 2573.
Capt. T. Turtle, 1885–87:
R., 85, 2887; **86,** 2153; **87,** 2697.
Capt. S. S. Leach, 1887–88;
R., 87, 2769.
Lt. J. L. Lusk, 1888:
R., 88, 2230.
Capt. C. F. Powell, 1888–90:
R., 89, 2604, 2611; **90,** 3112, 3179.
Capt. C. F. Palfrey, 1890–93:
R., 91, 3446; **92,** 2914; **93,** 3573.
Lt. J. G. Warren, 1893–94.
Lt. G. A. Zinn, 1894–95:
R., 94, 2717; **95,** 3672.
Capt. H. E. Waterman, 1895–98:
R., 96, 3492; **97,** 3563; **98,** 3158.
Capt. M. M. Patrick, 1898–1904:
R., 99, 3337; **00,** 4557; **01,** S., 41.
Capt. G. P. Howell, 1901–03:
R., 02, S., 32.
Capt. W. B. Ladue, 1903–06:
R., 03, S., 59; **04,** S., 41; **05,** S., 55; **06,** 2500.

Capt. G. R. Lukesh, 1906–08:
R., 07, 2645; **08,** 2677.

1st Lt. C. H. Knight, 1908–10:
R., 09, 2677; **10,** 2956.

Lt. Col. C. L. Potter, 1910–:
R., 11, 3206; **12,** 3749.

1st and 2d Districts, M. R. C. (Memphis, Tenn.):

Maj. A. M. Miller,[1] 1882–84.

Capt. C. B. Sears,[1] 1884–85.

Capt. J. B. Quinn, 1882.

Capt. J. G. D. Knight, 1882–85:
R., 83, 2278, 2282; **84,** 2755, 2791; **85,** 2741–2772.

Capt. S. S. Leach, 1885–88, 1888–90:
R., 85, 2942, 2995; **86,** 2158, 2161; **87,** 2724, 2731, 2873, 2878; **88,** 2262, 2270; **89,** 2679, 2689.

Capt. W. T. Rossell, 1888:
R., 88, 2262, 2270.

Capt. S. W. Roessler, 1890–95:
R., 90, 3196, 3211; **91,** 3580, 3586; **92,** 3145, 3147; **93,** 3713; **94,** 2859.

Capt. G. D. Fitch, 1895–97:
R., 95, 3756; **96,** 3598; **97,** 3696.

Capt. M. M. Patrick, 1897–98:
R., 98, 3343.

Capt. E. E. Winslow, 1898–1902:
R., 99, 3504; **00,** 4783; **01,** S., 232; **02,** S., 90.

Capt. E. W. Van C. Lucas, 1902–05:
R., 03, S., 168, 172; **04,** S., 132; **05,** S., 152.

Capt. W. D. Connor, 1905–08:
R., 06, 2528; **07,** 2675; **08,** 2716.

Capt. G. R. Lukesh, 1908.

Maj. M. L. Walker, 1908–10:
R., 09, 2727; **10,** 3004.

Capt. C. S. Smith, 1910–:
R., 11, 3260; **12,** 3866.

3d District (Vicksburg, Miss.):

Capt. W. L. Marshall, 1882–84:
R., 83, 2285; **84,** 2814.

Capt. C. B. Sears, 1884–86:
R., 85, 2772, 2784, 2960; **86,** 2164.

Capt. W. T. Rossell, 1886–89:
R., 87, 2736, 2881; **88,** 2276; **89,** 2699.

Capt. S. S. Leach, 1889.

Capt. W. Young, 1889–90:
R., 90, 3228.

Capt. S. W. Roessler, 1890–91.

Capt. C. McD. Townsend, 1891–96:
R., 91, 3627; **92,** 3170; **93,** 3752; **94,** 2919; **95,** 3804; **96,** 3652.

Capt. G. D. Fitch, 1896.

Lt. H. C. Newcomer, 1896–99:
R., 97, 3725; **98,** 3370; **99,** 3537.

Capt. C. L. Potter, 1899–03:
R., 00, 4824; **01,** S., 266; **02,** S., 108; **03,** S., 219.

Capt. E. W. Van C. Lucas, 1903–05:
R., 04, S., 132.

Capt. G. M. Hoffman, 1905–07:
R., 05, S., 197; **06,** 2552; **07,** 2701.

Capt. C. S. Smith, 1907–11:
R., 08, 2756; **09,** 2760; **10,** 3032.

Capt. J. A. Woodruff, 1911–:
R., 11, 3287; **12,** 3899.

4th District (New Orleans, La.):

Capt. A. M. Miller, 1882.

Maj. A. Stickney, 1882–86:
R., 83, 2297; **84,** 2868; **85,** 2815, 2971; **86,** 2164.

Maj. C. W. Raymond, 1886:
R., 87, 2744.

Capt. D. C. Kingman, 1886–90:
R., 87, 2893; **88,** 2294; **89,** 2720; **90,** 3289.

Capt. J. Millis, 1890–94:
R., 91, 3665; **92,** 3207; **93,** 3816; **94,** 2974.

Maj. J. B. Quinn, 1894:
R., 95, 3622.

Capt. G. McC. Derby, 1894–1902:
R., 95, 3858; **96,** 3682; **97,** 3769; **98,** 3414; **99,** 3589; **00,** 4874; (Maj.) **01,** S., 311; **02,** S., 136.

Maj. J. H. Willard, 1898.

Capt. H. Jervey, 1898–99.

Capt. C. S. Bromwell, 1902–04.
R., 03, S., 272; **04,** S., 249.

Col. H. M. Adams, 1904:

Capt. J. F. McIndoe, 1904–08:
R., 05, S., 250; **06,** 2574; **07,** 2729; **08,** 2788.

1st Lt. W. Willing, 1908.

Capt. H. Burgess, 1908–11:
R., 09, 2799; (Maj.) **10,** 3069; **11,** 3320.

Capt. C. O. Sherrill, 1911–:
R., 12, 3941.

Assistants:

Capt. C. R. Suter:
R., Vicksburg, **71,** 378.

G. Burney;
R., Memphis, **79,** 980; **80,** 1338; **81,** 1383; **82,** 1507.

T. G. Dabney:
R., Vicksburg, **78,** 644; **79,** 975.

Capt. H. M. Adams:
R., sur., **77,** 1110; **78,** 1358.

Lt. D. W. Lockwood:
R., sur., **77,** 1197; **78,** 1381; **79,** 1922.

J. A. Ockerson:
R., sur., **79,** 1931.

J. Eisenman:
R., sur., **79,** 1935.

J. H. Darling:
R., sur., **79,** 1938.

[1] Second district only.

L. L. Wheeler:
R., sur., **79,** 1942.

J. B. Johnson:
R., sur., **79,** 1963.

Lt. C. F. Powell:
R., sur., **78,** 1385.

F. W. Lehnartz:
R., sur., **78,** 1386.

G. Y. Wisner:
R., sur., **78,** 1395; **79,** 1930.

Lt. P. M. Price:
R., sur., **79,** 1929.

W. M. Rees:
R., **81,** 1391.

T. J. Dabney:
R., **80,** 1334; **81,** 1385, 1386.

Assistants, secretary's office, M. R. C.:

C. W. Clark:
R., relation bet. mean bank height and mean h. w., Cairo to Baton Rouge, **90,** 3140.

W. G. Comber. **Rs.:**
Resur., Vicksburg to Glenora, **95,** 3700.
Sur. of Atchafalaya R., **05,** S., 78.

E. S. Davis:
R., transalluvial levels, **84,** 2580.

J. H. Davis:
R., discharge observations at Columbus, Ky., **84,** 2600, 2616; at Grafton, **84,** 2664.

C. Donovan:
R., changes in depth at Head of Passes, 1880–90, **91,** 3576.

J. Ewens:
R., discharge observations, **84,** 2636, 2660; **85,** 2636.

O. W. Ferguson:
R., precise leveling, **85,** 2620; **92,** 2946, 2954.

G. H. French. **Rs.:**
Resur., Arkansas R. to Glenora, **95,** 3699.
Tape-line meas. and precise leveling, **03,** S., 74.

W. Gerig:
R., experimental dike work, **00,** 4778; **05,** 5128.

J. B. Johnson:
R., precise levels and h.-w. observations, **83,** 2174, 2177; **85,** 2575, 2609.

L. C. Jones:
R., regimen elements of the R., **90,** 3119.

F. B. Maltby. **Rs.:**
Dr., **99,** 3490. Field work, topography, 1891, **92,** 3105. Care and repair of dr. plant, **02,** S., 89; **03,** S., 123; **04,** S., 80. Efficiency tests of hydraulic dr., with plates and charts, **03,** S., 136; **04,** S., 98.

E. L. Harman:
R., adjusting precise level loop, **05,** S., 80.

T. Middleton:
R., plant repairs, etc., **98,** 3291; **99,** 3487.

A. T. Morrow. **Rs.:**
Surs.; caving banks, etc., **92,** 3109; **99,** 3371.
Secondary triangulation, **94,** 2797; **95,** 3697.
Tertiary triangulation and st. lines, **93,** 3603.
Topographical work, **93,** 3600; **94,** 2798; **95,** 3698; **00,** 4603.
L.-W. sur., **99,** 3373.
Field work, **01,** S., 57; **03,** S., 97.
D.-W. sur., **03,** S., 167.
Results of hydrographic sur., **05,** S., 41.

J. A. Ockerson. **Rs.:**
Crevasses, **91,** 3473.
Crossing d., Cairo to Red R., **89,** 2613.
Cross-section elements, mouth of Arkansas to Vicksburg, **96,** 3577.
Gauge inspections, **93,** 3654; **95,** 3691.
Device for printing signs on maps, **85,** 2574, 2898.
Changes, Grand Gulf to Donaldsonville, **84,** 2687; Head of Passes, **91,** 3575; Gulf level, **96,** 3481.
R. profile, Cairo to Donaldsonville, **91,** 3486.
Stages of R. and filling of bed, **96,** 3484.
Surs., field work, office reduction, plant repair, etc., **83,** 2266; **84,** 2568; **85,** 2681; **92,** 3110; **94,** 2727; **95,** 3688; **96,** 3500; **97,** 3620; **98,** 3214.
R. traffic, its character and vol., **01,** S., 33.

J. A. Paige:
R., precise leveling, **93,** 3620; **92,** 3074.

W. G. Price:
R., discharge observations, **84,** 2584, 2874; **85,** 2691; **92,** 3248, 3249.

H. P. Ritter:
R., discharge observations, etc., **84,** 2627, 2661; **85,** 2618.

J. A. Seddon. **Rs.:**
Discharge data, 1884–85, **91,** 3424.
Rate of flood travel on lower R., **92,** 2907.

C. W. Stewart:
R., secondary triangulation, **92,** 2932, 2934; **93,** 3589.

H. Stewart:
R., floods of 1882, **85,** 2593, 2609, 2618.

C. W. Sturtevant (see also First and Second districts). **Rs.:**
Dr.—location, **97,** 3695; tests, **98,** 3341; dr., Cairo to Passes, **98,** 3310.
Care and repair of plant, **00,** 4759.
Care and repair of plant and dr. operations, **01,** S., 217; **02,** S., 74.

K. Tully. **Rs.:**
Computing work, **95,** 3701.
Office records, publications, etc., **99,** 3474; **00,** 4740.
Reduction of discharge observations of 1893, **94,** 2819.
Gauges, reduction of data, etc., **01,** S., 126; **02,** S., 53; **03,** S., 97; **04,** S., 63; **05,** S., 87.

E. H. Twining:
R., experimental velocity observations, **85**, 2691, 2719.

L. L. Wheeler. **Rs.:**
Precise levels, **84**, 2463, 2547.
Slope observations, **85**, 2900.
Topography, **84**, 2576; **85**, 2689.

Surveyor W. S. Williams:
R., precise levels, **99**, 3405; **00**, 4622; **01**, S., 69.

C. M. Winchell:
R., topography, **84**, 2573; **85**, 2687, 2893; **90**, 3181.

G. Y. Wisner:
R., triangulation, **83**, 2172.

H. B. Wood:
R., resurs. in front of crevasses, **84**, 2577.

Assistants, 1st and 2d districts M. R. C.:

J. Burney:
R., Memphis H., **84**, 2796.

F. S. Burrows:
R., Memphis sur., **84**, 2803.

E. L. Cooley:
R., Bullerton Towhead revet., **94**, 2897.

N. B. Craig:
R., Plum Pt. Reach sur. and discharge observations, **85**, 2769.

F. A. Fisher:
R., Helena Reach sur., **84**, 2807.

A. J. Frith. **Rs.:**
Plum Pt. Reach, **84**, 2764; **85**, 2748.
Mattress boat with wire-net machine, **83**, 2282.

W. Gerig. **Rs.:**
Dr. *Beta*, constr. and tests, **96**, 3630.
Discharge observations, **91**, 3497; **92**, 3119; **93**, 3664; **94**, 2810.
Helena, **97**, 3718.
Hickman H., **95**, 3767.
Hopefield Bend, **94**, 2904.
Memphis, **97**, 3717, 3718.
New Madrid H., **94**, 2878; **95**, 3770.

G. W. Geuder:
R., Gold Dust Works, **84**, 2768; **85**, 2751.

B. B. Gordon. **Rs.:**
Fletchers Bend, Plum Pt. Reach and Oceola Bar, **96**, 3616.
Gold Dust Dam, **95**, 3780.

W. A. Gould:
R., Fletchers Bend to Elmot Landing, **85**, 2755.

S. P. Hatfield:
R., Plum Pt. Reach, **84**, 2780; **85**, 2764.

A. F. Kilpatrick:
R., discharge observations, **93**, 3664, 3673; **94**, 2808, 2809; **04**, S., 201.

C. Le Vasseur. **Rs.:**
Elmot Chute Dam, **94**, 2890.
Nonconnah Rock, **97**, 3720; **99**, 3529.
Wolf R., **96**, 3625; **00**, 4817.
Operations during flood of 1903, **03**, S., 210.
Levees, **04**, S., 192, 198.
Constr. training wall, **04**, S., 203.
Caving banks, **04**, S., 212.

C. D. Marx:
R., Osceola Bars, **84**, 2772.

A. J. Nolty. **Rs.:**
Buffalo Bend, **98**, 3357.
Bullerton Towhead, **84**, 2776; **85**, 2761.
First district, **99**, 3513; **00**, 4796.
Memphis H., **98**, 3357.
Plum Pt. Reach, **91**, 3595, 3601, 3606; **92**, 3152; **93**, 3731; **94**, 2881; **95**, 3773; **96**, 3610; **97**, 3711.
New Madrid, **97**, 3711.
Constr. parties, **96**, 3610.
Plant, repair, care, etc., **96**, 3627; **98**, 3357; **99**, 3531; **00**, 4817; **01**, S., 258; **02**, S., 104; **03**, S., 200; **04**, S., 176; **05**, S., 180.
Constr. work, first district, **01**, S., 245; **02**, S., 101; **03**, S., 192; **04**, S., 162; **05**, S., 167.
Operations during flood, **03**, S., 202; **04**, S., 209.

W. H. Powless:
R., Plum Pt. Reach sur., **84**, 2785.

W. M. Rees. **Rs.:**
Hopefield Bend, **84**, 2797; **85**, 2775, 2958; **92**, 3161; **93**, 3726; **95**, 3785.
Memphis, **85**, 2777, 2957; **95**, 3786.
Levees, St. Francis, **91**, 3610; White R. sur., **91**, 3612, and seepage, **98**, 3353.
Plant repairs, etc., **94**, 2910.
Second district, **99**, 3521; **00**, 4808.
Constr. work, second district, **01**, S., 254; **02**, S., 101; **03**, S., 197; **04**, S., 166; **05**, S., 172.

L. E. Ritter:
R., discharge observations, Helena, 1890, **91**, 3532.

W. L. Seddon:
Osceola Dikes, **85**, 2756.

C. W. Sturtevant. **Rs.:**
Discharge observations, **91**, 3505, 3532; **92**, 3118; **94**, 2809.
Dr. work, experimental, **95**, 3792, 3795; **96**, 3619.
Plant repairs, **92**, 3163; **93**, 3743.

F. A. Yeager. **Rs.:**
Helena discharge observations, **84**, 2617.
Osceola, Bullerton, Plum Pt. Dikes, and Craighead Pt., **84**, 2779; **85**, 2768.

M. Gardner. **Rs.:**
Operations during flood, 1903, **03**, S., 218.
Levees, **04**, S., 204, 206; **05**, S., 189.

3d district M. R. C.:

W. T. Blunt:
Choctaw Bend Reach sur., **84**, 2867.

W. S. Brown:
R., upper Tensas levees, **98**, 3397.

W. M. Childs:
R., Mayersville Isld., **85**, 2797.

H. St. L. Coppee. **Rs.:**
Arkansas levees, **97**, 3742.
Delta Pt., **92**, 3181.

Greenville H., **90,** 3241.
Levee constr. methods, **95,** 3813.
Vicksburg H., **83,** 2294; **84,** 2844; **85,** 2812; **90,** 3234; **91,** 3629; **92,** 3181; **93,** 3784; **94,** 2944.
Yazoo levees, **98,** 3391; **99,** 3554· **00,** 4847.

H. D. Garden:
R., Tensas levees, **84,** 2856.

H. Goodrich:
R., h.-w. protection of levees, and flood of 1890, **90,** 3268.

L. L. Griffith. **Rs.:**
Discharge observations, Little Rock, **94,** 2818.
Surs., **05,** S., 194.

A. Hider. **Rs.:**
Ashbrook Neck, **92,** 3171; **93,** 3769; **94,** 2932.
Greenville, **92,** 3174; **93,** 3769.
Greenville Bend, **91,** 3638.
Lake Providence Reach, **83,** 2191; **84,** 2828; **85,** 2789, 2966; **87,** 2739; **90,** 3229.
Levees, protection, flood of 1890, **90,** 3256.
Louisiana Bend, **93,** 3769.
Plant repairs, etc., **93,** 3807; **94,** 2954; **95,** 3822; **96,** 3657; **97,** 3733 **98,** 3377; **99,** 3537; **00,** 4830.
Revet. work, **94,** 2931; **95,** 3816; **96,** 3657; **97,** 3733; **98,** 3377; **99,** 3537; **00,** 4830.
Surs., etc., **92,** 3188; **94,** 2945; **95,** 3820; **96,** 3657; **98,** 3377; **99,** 3537; **00,** 4830.
Constr. work, third district, **01,** S., 273; **02,** S., 113; **03,** S., 227; **04,** S., 180; **05,** S., 211.

J. J. Hoopes:
R., discharge observations, **90,** 3276; **91,** 3660.

L. Y. Kerr. **Rs.:**
Discharge observations, **94,** 2819.
Greenville H., **93,** 3774.
Mississippi levees, **97,** 3752; **04,** S., 241; **05,** S., 225.

C. H. Miller. **Rs.:**
Ashbrook Neck, **93,** 3770.
Discharge observations, **93,** 3665.
Wilson Pt. and crevasses, **94,** 2816, 2817.
Surs., **96,** 3667.

W. P. Richards:
R., surs., and observations, **91,** 3658.

C. P. Ruple:
R., dike work of Lake Providence Reach, **85,** 2800.

F. P. Spalding. **Rs.:**
Discharge observations, **90,** 3281.
Surs., etc., **90,** 3285.

H. Steubing. **Rs.:**
Grading plant, operations of, **84,** 2835.
Lake Providence Reach, st. distribution, **85,** 2812.

G. C. Thomas. **Rs.:**
Louisiana Bend, **93,** 3779.
Discharge observations, **93,** 3664.
Lake Providence, **95,** 3836.
Constr. work, third district, **01,** S., 285; **02,** S., 118; **03,** S., 239; **04,** S., 184.

E. D. Thompson:
R., Lake Providence Reach sur., **85,** 2804.

E. C. Tollinger. **Rs.:**
Arkansas and Mississippi levees, **97,** 3747.
Levees and dike work, Lake Providence Reach, **85,** 2802.
Levees, protection, and flood of 1890, **90,** 3266.
Louisiana Bend, **92,** 3178.
Discharge observations, **91,** 3497; **93,** 3667.
Upper Tensas levees, **98,** 3394; **99,** 3567; **00,** 4854.
Upper Tensas and lower Yazo levees, **01,** S., 295; **02,** S., 127; **03,** S., 255; **04,** S., 227; **05,** S., 229.

J. E. Turtle:
Pilchers Pt., **84,** 2842; **85,** 2794.

H. Vance:
R., Lake Providence Reach sur., **84,** 2840.

J. D. Van Meter. **Rs.:**
Greenville levees, **95,** 3845.
Mississippi levees, **97,** 3750.
Yazoo levees, **98,** 3387.

A. M. Todd. **Rs.:**
Constr. Ashbrook Neck and Greenville H., **01,** S., 281.
Lower Yazoo levees, **01,** S., 288; **02,** S., 121; **03,** S., 245; **04,** S., 214.
Upper Tensas levee, **05,** S., 240.

4th district M. R. C.:

H. S. Douglas. **Rs.:**
Crevasse observations, **90,** 3341.
Depot at New Orleans, **98,** 3443; **99,** 3634.
Homochitto levee district sur., **95,** 3901.
Kempe Bend levee sur., **85,** 2981; **00,** 4911.
Levees, **84,** 2868; **85,** 2816, 2979, 2981; **87,** 2910; **88,** 2311.
Tensas basin, **91,** 3696; **92,** 3239; front, **90,** 3316; lower, **93,** 3891; **94,** 3017; **95,** 3899.
Morganza Reach sur., **87,** 2911.
Natchez surs., **91,** 3720; **93,** 3817.
Natchez and Vidalia H., **95,** 3888; **97,** 3795; **98,** 3438; **99,** 3621; **00,** 4911.
New Orleans H., **88,** 2305; **89,** 2735, **90,** 3328; **97,** 3797; **99,** 3625.
Plant repairs, etc., **97,** 3806; **00,** 4911.
Red R. mouth, **87,** 2906.
Surs., gauges, and observations, **92,** 3250.
Tensas levees, **96,** 3718.
Revet. work, **01,** S., 341; **02,** S., 154; **03,** S., 301; **04,** S., 276; **05,** S., 283.

W. Garvin. **Rs.:**
Crevasses, Harlem and Jesuit Bend, **90,** 3338.
Levees, **90,** 3323.
New Orleans H., **91,** 3708; **92,** 3221; **93,** 3824; **95,** 3894; **96,** 3718.

Plant repairs, **95,** 3896.
Results of discharge observations, Carrollton, **92,** 3249.

W. J. Hardee. **Rs.:**
Atchafalaya R. sur., **87,** 2909.
Crevasse observations, **90,** 3340, 3344.
Levees, **98,** 3449.
Atchafalaya, Lafourche, and Pontchartrain, **93,** 3895; **94,** 3004, 3019; **95,** 3902; **96,** 3721; **99,** 3639.
New Orleans, **97,** 3812.
Red R. and below, **91,** 3704; **92,** 3243; **93,** 3846.
Tensas, Barataria, and Lake Borgne, **99,** 3639.

G. E. Mott. **Rs.:**
Discharge observations, **92,** 3248; **93,** 3910.
Red and Atchafalaya Rs., **92,** 3212.

B. J. Oliveira:
R., discharge observations, **90,** 3339; **91,** 3340; **92,** 3249.

W. G. Price. **Rs.:**
New Orleans H., **84,** 2879, 2881; **85,** 2845, 2987; **87,** 2905.
Red and Atchafalaya Rs., **88,** 2308; **89,** 2738; **90,** 3336; **91,** 3699.

J. Smyth, jr.:
R., levees, Lake Borgne and Barataria, **93,** 3902; **94,** 3009; **95,** 3907; **96,** 3733.

H. B. Watson (surveyor):
R., New Orleans, levees below, **97,** 3823.

A. O. Wilson. **Rs.:**
Old R., **86,** 2164.
Red R., mouth, **85,** 2982.
Red and Atchafalaya Rs., sur., **85,** 2833.
Plaquemine route, **85,** 2984.

A. F. Wooley, jr. **Rs.:**
Concrete ballasting, **00,** 4921.
Fords Crossing dr., **97,** 3811.
Red and Atchafalaya Rs., **95,** 3890; **96,** 3715; **97,** 3809; **98,** 3445; **99,** 3635; **00,** 3719; **01,** S., 356.
Sur., vicinity of crevasses, **94,** 3064.
Surs., gauges, and observations, **93,** 3910; **95,** 3894.

W. E. Knoblock:
R., levee work, **01,** S., 360; **02,** S., 171; **03,** S., 314; **04,** S., 294; **05,** S., 297.

L. E. Lion:
R., dr. lower Old R., **02,** S., 170.

D. M. Brock:
R., levees, **05,** S., 186.

E. B. Geddes:
R., Bondurant Chute, Kempe Bend, and Giles Bend, **05,** S., 290.

Civilian engineers, private (special reports):

H. N. Pharr, C. E., St. Francis levee board. **Rs.:**
High water of 1903, **03,** S., 42.
St. Francis levees, **05,** S., 46.

C. H. West, C. E., Mississippi levee district. **Rs.:**
High water of 1903, **03,** S., 45.
Mississippi levees, **05,** S., 47.

T. G. Dabney, C. E., Yazoo-Mississippi Delta levee district. **Rs.:**
High water of 1903, **03,** S., 48.
Yazoo-Mississippi Delta levees, **05,** S., 47.

H. B. Richardson, C. E., State Board of Louisiana:
R. on high water of 1903, **03,** S., 53.

Prof. W. B. Gregory:
R. on efficiency tests of hydraulic dr., **03,** S., 160.

F. M. Kerr, chief State engineer of Louisiana:
R. on levees, **05,** S., 48.

ESTIMATES. (See Plans and Projects.)

Maj. Abbot, 1869, repairing and perfecting levees in Louisiana, $15,020,000; in Mississippi, $4,150,000; in Arkansas, $19,060,000, **69,** 328, 330, 332, 334, 344, 347; **70,** 405; **74,** 382, 391.

By BE., 1874, to close existing breaks in levees, $3,459,450, **75,** 562. Perfecting existing system, $45,909,600, **75,** 563, 593, 627. Sur. of alluvial basin, $300,000, **75,** 537, 561.

LEGAL PROCEEDINGS.

Consequential injuries by increased overflow in unprotected localities. Suits begun. Information requested by legal dept. of the U. S., **94,** 2713; **95,** 3644.

LEGISLATION.

Recom. by M. R. Commission, **82,** 2764; **83,** 2151; **84,** 2428; **85,** 2869.

Organic act creating the commission, its intents and purposes, **96,** 3441.

Acts of Congress passed since Oct. 19, 1888, affecting the commission, **89,** 2606; **95,** 3730. Subsequent acts, **97,** 3572; **98,** 3181; **99,** 3351; **00,** 4574; **02,** S., 49; **03,** S., 74; **04,** S., 62.

Act 1904 gives Sec. of War au. to enter into contracts to extent of $1,000,000 for levee work, **04,** S., 5; **05,** S., 73; **06,** 2527; **07,** 2674; **08,** 2716; **09,** 2727.

Act June 25, 1910, au. Sec. of War to appoint commission to ex. Mississippi R. below St. Louis, with view to obtaining 14′ chan., **10,** 3002; **11,** 3260; **12,** 3865.

OPERATIONS.[1]

1878–79. Protection of Delta Pt. (Vicksburg; hired labor), **79,** 975, 977.

1878–79. Protection of city front of Memphis (hired labor), **79,** 117, 979, 981.

1878–79. Protection of city front of New Orleans (hired labor), **79,** 106, 875.

[1] Estab. of gauges, **72,** 57, 426, 428; **73,** 517; **74,** 487; **75,** 533; **76,** 600; **77,** 494; **78,** 646; **79,** 982.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

1879-80. Memphis, bank protection above Wolf R. for 1,300′, **80,** 1337, 1338. Vicksburg, 1,700′ of bank protection, **80,** 1335. Mouth of Red R., 57,800 c. y. dr. from bar, **80,** 1282. New Orleans H., 16,628 s. y. of shore protection, **80,** 1146.

1880-81. Memphis, 1,150′ of bank protection, **81,** 1381, 1383. Vicksburg, 1,000′ of bank protection, **81,** 1386. Natchez and Vidalia bank protection placed at Marengo Bend, **81,** 1387, 1388. Mouth of Red R., 38,574 c. y. dr. from inner bar, **81,** 1389, 1390. New Orleans, 12,060 s. y. shore protection **81,** 1272.

1881-82. Memphis, 11,460 s. y. of bank protection, **82,** 1498, 1499. Vicksburg, continuation of bank protection, **82,** 1502, 1503. Natchez and Vidalia, bank protection at Giles Bend, **82,** 1506, 1510. Mouth of Red. R., dr. continued, **82,** 1511. New Orleans, 48,456 s. y. of shore protection Carrollton Bend, **82,** 187, 1355; suspension of operations under existing proj. au. Sept., 1881, **82,** 1354, 1359.

Works trans. to Mississippi R. Commission, **82,** 1512.

1882. Bank protection and dike constr., Plum Pt. Reach, **83,** 2121, 2279. Bank protection Memphis H., **83,** 2122, 2282. Bank protection and dike constr. Lake Providence Reach, **83,** 2123, 2285. Bank protection, Vicksburg H., **83,** 2124, 2290, 2294. Dr. at mouth of Red and Atchafalaya Rs., **83,** 2125, 2297. Preparation for bank protection, New Orleans H., **83,** 2125, 2297. Repair of levees, **83,** 2150, 2283, 2292, 2298, 2346.

1883. Bank protection and dike constr., Plum Pt. Reach, **84,** 2413, 2757, 2764, 2768, 2772, 2776, 2779, 2780. Bank protection, Memphis H. and Helena Reach, **84,** 2414, 2791, 2796, 2797, 2803. Bank protection and dike constr., Lake Providence Reach; bank protection and dr., Vicksburg H., **84,** 2415, 2417, 2814, 2821, 2828, 2842, 2844. Dr. mouth of Red and Atchafalaya Rs., **84,** 2419, 2872. Bank protection, New Orleans H., **84,** 2421, 2879. Repair of levees, **84,** 2422, 2792, 2812, 2824, 2827, 2856, 2858, 2868.

1884. Bank protection and dike constr., Plum Pt. Reach, **85,** 2541, 2741, 2748, 2752, 2755, 2756, 2759, 2761, 2764, 2768; **86,** 2144. Bank protection, Memphis H., **85,** 2543, 2772, 2777; **86,** 2144. Bank protection, Memphis Reach, **85,** 2543, 2772, 2775. Bank protection and dike constr., Lake Providence Reach, **85,** 2544, 2784, 2789, 2794, 2797, 2800, 2802, 2812; **86,** 2144. Bank protection, Vicksburg H., **85,** 2545, 2786, 2812; **86,** 2144. Dr. mouth of Red R., **85,** 2546, 2833; **86,** 2144. Bank protection and dike constr., New Orleans H., **85,** 2546, 2844; **86,** 2144. Repair of levees, **85,** 2547, 2787, 2815, 2816; **85,** 2857; **86,** 2144.

1885. Bank protection and dike constr., Plum Pt. Reach, **85,** 2862, 2943, 2949; **86,** 2158. Bank protection, Memphis H., **85,** 2862, 2955, 2957; **86,** 2161. Repair and extension dikes, Lake Providence Reach, **85,** 2863, 2960, 2966; **86,** 2162. Dike constr. at mouth of Red R., and dr., **85,** 2864, 2971, 2982; **86,** 2164. Dike constr., New Orleans H., **85,** 2864, 2971, 2987; **86,** 2164. Repair of levees, **85,** 2864, 2964, 2971, 2979.

1885-86. Repair of works, Plum Pt. Reach, **87,** 2692, 2724. Repair of revet. at Hopefield Bend and reballasting part of revet., Memphis City front, **87,** 2692, 2731, 2750. Repair to Baleshed and Stack Isld. Dikes, **87,** 2692, 2736. Mainten. of chan. at mouth of Red R. by dr. and temporary wing dams, **87,** 2693, 2746, 2750. Repair of levees, **87,** 2693.

1886-87. Dike constr. and repair, Plum Pt. Reach; constr. of levee on upper side of Plum Pt., **87,** 2754, 2873. Extension of Memphis City front revet., **87,** 2755, 2878. Shore protection extended in Gouldsboro Bend; attempts to maintain chan. at mouth of Red R. by dr., and temporary wing dam, **87,** 2757, 2893, 2906.

1887-88. Repairs to plant, **88,** 2252. 21,782 c. y. st. delivered at Greenville and Hopefield Bend, **88,** 2253. 7 m. of levee built at White R. Front, consuming 376,550 c. y. earth, **88,** 2271, 2272. Banks graded and paved and subaqueous mattress work sunk at Greenville H., **88,** 2280. 140,877 c. y. dr. at Vicksburg H., and 6,800 l. f. of brush and st. dike built, **88,** 2283, 2285. 208,220 c. y. dike constr. bet. Amos Bayou and Arkansas City, **88,** 2286. 213,567 c. y. dike constr. under contract at Leland Second Loop, Brooks Break, Matthews Bend, and Whisky Chute, **88,** 2288. Brush and st. bank protection completed at Gouldsboro Bend, **88,** 2294. 19,588 l. f. of levee built at Kempe Bend, **88,** 2301. 5 crib spur dikes built, and 4 old pile dikes repaired in lower Old R., **88,** 2308. Sill No. 1 across the Atchafalaya at Simmesport completed, **88,** 2309.

1888-89. Repairs to towboat, inspection boat, barges, and general plant, **89,** 2666. 39,618 c. y. st. towed and deposited at Plum Pt., Bolivar, Greenville, Columbus, Hickman, and Daniels Pt., **89,** 2667. Constr. of 5 spur dikes begun at Columbus, Ky., **89,** 2680. Bank revet. at Hickman completed, **89,** 2680. Mattress built and st. revet. constr. at Plum Pt., **89,** 2681. 4,105 l. f. of brush and st. shore revet. laid at Memphis Reach, **89,** 2689. 3,170 l. f. of pile, brush, and st. dike built at Baleshed, **89,** 2701. 4,400 l. f. of brush mattress built and sunk, 4,250 l. f. of revet. built, and 10,154 c. y. st. used at Lake Bolivar Front, **89,** 2704. 325,045 c. y. earth consumed in levee work at Arkansas City, Eunice, Panther Forest, Whisky Chute, Lakeport, Louisiana Line, and near Stirling, **89,** 2715. 55,000 c. y. dr. from bar in lower Old R., **89,** 2724. 24,163 c. y. material placed in low dam on Sill No. 1, in the Atchafalaya R., **89,** 2723. 280,514 c. y. material placed in the Wilson Levee, **89,** 2728. Repairs to New Orleans H. plant, **89,** 2736. 53,100 s. f. brush mattress built and sunk at New Orleans H., **89,** 2737. 113,070 c. y. of cribwork built, **89,** 2738. 68,500 s. f. of mattress and 188,670 c. f. of cribwork placed in Spur No. 1, Greenville Bend, **89,** 2738.

1889-90. 19,131 c. y. st. towed and delivered at various points, **90,** 3185. Repairs to plant, **90,** 3185, 3186. Spur-dike constr. and bank revet. at Columbus, **90,** 3196. Hydraulic grading and constr. of subaqueous mattress work at Hickman, **90,** 3197. 3,000 l. f. of brush mattress placed in Fletchers revet., **90,** 3198. Brush mattress built and laid at Plum Pt., **90,** 3199. Pile dike built at Elmot Isld., **90,** 3200. Dikes 2, 3, 4, and 5 completed at Memphis H., **90,** 3211. Bank protection and dike constr. at Helena H., **90,** 3212. 6,024 l. f. of brush mattress bank protection placed at Louisiana Bend, **90,** 3230. 7,750 c. y. dr. at Vicksburg H., **90,** 3239. 540 l. f. of willow and st. dike built at Greenville, **90,** 3241. Repair and protection of levees from flood of 1890, **90,** 3256, 3289, 3317. Hard Times, and Wilson Levee, completed, **90,** 3289. Dike at Greenville Bend completed, and 1,000 l. f. of spur dike built, **90,** 3306. 26,000 t. of r. quarried, and Sill and Dam No. 3 completed on Atchafalaya R., **90,** 3309.

1890-91. Brush and st. dike constr. at Columbus, **91,** 3580. 4,500 l. f. of bank protection laid at lower end of Osceola Bar, **91,** 3582. Gaps closed and breaks repaired in Elmot Dike, **91,** 3583. Bank revet. at Ashport and Fletcher Bends, **91,** 3584. 762 l. f. of bank revet. constr. at Hopefield Bend, **91,** 3586. Repairs to plant for first and second districts, **91,** 3591. Southward extension of Helena Levee in progress, **91,** 3593. Closing crevasses and enlarging old levee over a distance of 90,300′ at Laconia Circle, **91,** 3594. 164,000 c. y. dr. at Vicksburg H., **91,** 3628. 465,573 c. y. dr. from canal at Delta Pt., **91,** 3630. Dike and jetty constr. in New Orleans H., **91,** 3672. Protection and repair of Pt. Pleasant, Hard Times, Kempe, and Gibsons Landing Levees, **91,** 3697. Dr. on lower and upper Old R., **91,** 3699, 3700. Levee constr. on right and left bank below Red R., **91,** 3704.

1891-92. Break repaired in Daniels Pt. revet., **92,** 2890. 3,250 l. f. of revet. constr. at Ashport Bend, **92,** 2891. Extension of revet. at Fletchers Bend, **92,** 2891. Revet. at Osceola Bar extended upstream 1,000′, **92,** 2892. Two breaks in Hopefield Bend revet. at Memphis, aggregating 3,350′, repaired, **92,** 2893. Helena Levee upon White R. Front extended southward 28,338′, **92,** 2894. Enlargement of existing levee upon Yazoo Front, above Hushpuckana, **92,** 2894. Ashbrook Neck revet. extended 3,800′, **92,** 2894. 6,600 l. f. of revet. built at Greenville, Miss., **92,** 2894. Revet. in Lake Providence Reach extending 5,000′, and 224 l. f. of existing revet. repaired, **92,** 2895. 315,079 c. y. dr. from canal at Vicksburg, **92,** 2895. 288,072 c. y. used in repairing breaks in levees at Catfish Pt., Greenville, Stella, and Shipland, lower Mississippi levee district, **92,** 2896. Extension of Lucca Loop Levee at Tensas Basin completed; levee at Opossum Fork enlarged; loops built at Sunnyside and Cracraft; spur constr. on Leland short line, and enlargement of levee below lower Boggy Bayou begun; total yardage placed, 270,377 c. y., **92,** 2896. Levee completed at Henderson, Tensas Basin, **92,** 2899. 9,840 l. f. of levee built at Hardscrabble, 11,632′ at Kempe, and 136′ at Ferriday Crevasse; total yardage, 399,831 c. y., **92,** 2900. On right bank, below Red R., the following l. of levee were built: 600′ at Nina, 8,021′ at Highland, 4,743′ at Mayflower, 3,686′ at Fortville, 3,400′ at Evergreen, and 783′ at Dumboine; total yardage, 435,500 c. y., **92,** 2900. On left bank, below Red R., the following l. of levee were constr.: 9,258′ at Southwood, 1,959′ at Tessier-Bourgeois, and 1,372′ at Southport; total yardage, 165,911 c. y., **92,** 2900.

1892-93. First district: Daniels Pt. revet. repaired; 8,504 addl. f. of Ashport Bend revet. covered; surs., gauge readings, and observations **93,** 3547, 3713.

Second district: Repairs, aggregating 4,200 l. f., and the strengthening of 1,300 l. f., made at Hopefield Bend revet.; enlargement of section of levees for over 5 m., and new levee about 1½ m. l. built at a point threatened by caving (503,448 c. y., and 439,106 c. y. addl., was done by local authorities). White R. Basin levees extended about 4 m., and much of the existing levees raised and strengthened. Misc. surs. and borings, **93,** 3549, 3719.

Third district: A further upstream extension of 2,610 l. f. completed the work at Ashbrook Neck revet.; in addition, a spur dike was built down the axis of the point. 4,450 l. f. mat work added to revet. at Greenville H. 5,838 l. f. added to Lake Providence Reach revet. Dike to prevent caving at Delta Pt. and Vicksburg H. building; 559,721 c. y. excavated (1891–93) from canal. About 20 m. of the lower Yazoo levees strengthened and raised to standard grade and dimensions. 1,203,000 c. y. earth placed in deficient parts of the upper Tensas levees; in addition, 250,000 c. y. placed by local authorities. 460,000 c. y. levee built in middle Tensas district; in addition, 258,000 built by local authorities. Misc. surs. and discharge observations, **93,** 3551, 3752.

Fourth district: 3 dr. employed in maintaining chan., successful in part only, from the Mississippi, through lower Old R. into the Red and Atchafalaya. Continuous bank revet. placed in intervals bet. the completed dikes in the Carrollton Bend, at Southport (New Orleans H.). Redistribution of the levee districts made, and 67.96 m. of levee imp., using 3,289,149 c. y. earth; 101.5 m. raised and enlarged by local authorities, 24 m. of this work but temporary work; 20 breaks on levees repaired. Misc. surs. and gauge observations made, **93,** 3554, 3816.

1893-94. First district: Sur. at Hickman to determine repairs needed; 900 l. f. revet. constr. at New Madrid; undermined revet. at Ashport Bend restored, and 3,980 addl. f. of bank covered; dam built at Gold Dust Dam; 4,018 l. f. revet. at Bullerton Towhead built; 1,148,000 c. y. levees built by the U.S. and local authorities, **94,** 2698.

Second district: Repairs at Hopefield Bend revet.; only 335 c. y. r. removed from Nonconnah Rock; 521,800 c. y. levees built by the U. S. in the upper Yazoo district and 269,106 c. y. by local authorities; 269,106 c. y. levees built in the upper

White R. district; 430,173 c. y. levees built in lower White R. district, of which 380,975 was new work, **94,** 2703.

Third district: Lake Bolivar Front revet. repaired; 972 c. y. st. added to Ashbrook Neck revet.; repair of Greenville H. revet.; repairs at Lake Providence Reach revet.; mat sunk at Delta Pt. and Vicksburg H. to prevent undermining; 27 m. of levees enlarged by the U. S. and 17 m. enlarged by local authorities, lower Yazoo district; crevasses closed, and 1,433,218 c. y. new levees built in upper Tensas district and 329,000 c. y. placed by local authorities; 673,634 c. y. levees built in middle Tensas district and 1,052,000 c. y. by State organizations, **94,** 2705.

Fourth district: Preparations made for opening upper Old R.; 12.4% of total length of levee system built by the U. S. this year, **94,** 2708.

General: Dr. experiments made, **94,** 2715.

1894-95. First district: Revet. in front of Hickman extended downstream 630′ and work of preceding years repaired and strengthened; 725′ brush mattress revet. added at New Madrid; revet. at Ashport Bend completed by adding 1,380′; 5,349′ bank protected in addition of previous work at Bullerton Towhead; 2 breaks at Gold Dust Chute repaired and the dam raised nearly to its former level; 4 m. levee built; levees built by local authorities, **95,** 3618.

Second district: Bank protection at Hopefield Bend; 1,260′ of unprotected gap at Memphis H. protected by mattresses 300′ w., **95,** 3620. 15 m. of levee being raised and extended in upper Yazoo levee district; about 4 m. levees built in upper White R. district; about 3 m. levees built in lower White R. levee district, **95,** 3620.

General: Experimental dr. carried on, **95,** 3620.

Third district: Revet. at Ashbrook Neck extended 1,275′ and some repairs made; 2,100′ of revet. spurs renewed and revet. carried upstream 1,020′, and some repairs made at Greenville H.; slight repairs made at Louisiana Bend and 4,780′ of revet. built at caving banks above the town of Lake Providence. 1,326,265 c. y. levees built in lower Yazoo district, 2,174,629 in upper Tensas, and 726,000 in middle Tensas; much work being done in repairing and reconstr., **95,** 3621.

Fourth district: 19,500′ Cowpen Neck levee built at Natchez and Vidalia; 315,000 c. y. dr. to keep open communication bet. the Mississippi and Red Rs.; obstr. removed from Bayou des Glaises; 744,000 s. f. mattress sunk bet. old spurs, and foundations for 4 new spurs laid at New Orleans. Not incl. the work of small repairs, 2,852,740 c. y. placed in levees, **95,** 3622.

General: Experimental dr., **95,** 3628.

1895-96. First district: At Daniels Pt. revet. general repairs were made, and revet. extended upstream 5,000′; 3,750 l. f. revet. built across chute at Osceola Bar to guard against reopening of the chute; constr. and operation of dr. for l.-w. navigation, **96,** 3405.

Second district: Slight repairs at Memphis H. dr. in Wolf R., **96,** 3407.

Third district: Slight repairs at Louisiana Bend revet.; 10,190 (1894-95) l. f. revet. built at Lake Providence; plant repaired; misc. work, **96,** 3408.

Fourth district: Spur built at Cowpen Neck, **96,** 3411.

Levees: Lower St. Francis district, 666,196 of the 972,039 c. y. placed, in all placed, by the U. S.; 1,571,-134 c. y. placed in White R. district; U.S. built 399,756 c. y. and the local levee board 894,096 c. y. in upper Yazoo district; U. S. built 1,149,410 c. y. and State levee board 718,514 c. y., lower Yazoo district; 588,333 c. y. built, Red Fork extension, and the U. S. built 1,661,499 c. y.; the State of Louisiana in the past 2 years added 73,268 c. y., in upper Tensas district, and other work done by local authorities; 958,849 c. y. built in middle Tensas district by U. S., State built 608,050 c. y.; U.S. built 424,262 c. y. levees, and State of Louisiana 342,399 c. y., lower Tensas district; in Atchafalaya district, 555,288 c. y. built, and 107,108 c. y. addl. by local authorities; upon side streams 1,854,056 c. y. built (1894-96) by local authorities, 656,911 c. y. built in Lafourche district, and 1,117,488 c. y. built (1894-96) by State levee district; 1,032,188 c. y. built in Pontchartrain district, and 140,037 addl. by local authorities; 165,941 c. y. built in Barataria district, and 36,615 addl. by State of Louisiana; 250,297 c. y. built in Lake Borgne district, and 43,906 addl. by State, **96,** 3414.

General: Experimental levee building with dr.; plant repaired and cared for; dr. tests made, and dr. plant increased, **96,** 3418, 3423.

1896-97. General: Surs., gauging, and observations of preceding years continued; dr. plant increased; plant repaired; much satisfactory dr. done **97,** 3505.

First district: 500′ revet. extended at New Madrid; Daniels Pt. revet. repaired; Fletchers Bend revet. extended southward and spur dike built, **97,** 3509.

Second district: Unprotected gap at Memphis H. partly closed by 1,212′ revet.; repairs at Helena H., and revet. extended downstream, **97,** 3511.

Third district: Break at Greenville H. revet. repaired; repairs at Louisiana Bend, **97,** 3512.

Fourth district: Levee at Cowpen Neck being enlarged; preparations being made to revet Giles Bend; dr. in lower Old R.; 4 spurs built at New Orleans H., and 4 other spurs built to reduce the interval bet. the first 4; dr. at Fords Crossing, **97,** 3515.

Levees: 154,241 c. y. placed in lower St. Francis district in addition to 33,061 by local authorities; 191,442 c. y. placed in White R. district, in addition to 105,000 by local boards; 378,792 c. y. built, in addition to 830,233 c. y. by local boards in upper Yazoo district; 256,153 c. y. placed in lower Yazoo district, in addition to 1,418,239 c. y. by local boards; 530,913 c. y. placed in upper Tensas district, in addition to 124,591 c. y. by local boards;

165,034 c. y. placed in lower Tensas district and 996,127 by State and local boards 864,684 c. y. placed in Atchafalaya district and 254,588 by State and local boards; 352,642 c. y. placed in Lafourche district and 59,126 c. y. by local and State boards; 180,226 c. y. added in Barataria district and 37,756 c. y. by State and local boards; 476,256 c. y. added in Pontchartrain district and 61,938 by State and local boards; 49,450 c. y. added to Lake Borgne levees and 91,013 by State and local boards, **97,** 3518. Large number of crevasses closed, **97,** 3524.

1897-98. General: Surs., observations, mapping, and dr. carried on; plant cared for and increased preparations made to have 6 drs. at work in the succeeding season, **98,** 3138.

Second district: Repair of bank protection at Hopefield Bend; bank revet. repaired at Memphis H.; some obstr. removed from Wolf R., **98,** 3140.

Third district: Ashbrook Neck revet. repaired; 1,850′ new revet. built at Greenville H. to repair break, and a number of minor repairs made; slight repairs at Lake Providence revet.; repairs at Delta Pt., **98,** 3141.

Fourth district: Enlargement of Cowpen Neck completed and 15 spur dikes placed to protect Giles Bend; 51,940 c. y. dr. from Old R., **98,** 3144.

Levees: 15,786,049 c. y. placed in levees, of which 9,179,851 c. y. were placed by the U. S., **98,** 3147.

1898-99. General: Same general work as that of preceding year, **99,** 3295.

Above Cairo: 602 l. f. repairs made at Eliza Pt.

First district: Revet. at New Madrid extended downstream 1,218′ and upstream 355′; submerged spur dikes under constr. at Caruthersville; repairs of Ashport Bend revet.; 2 cribs put in at Fletchers Bend to check encroachment; repairs at Osceola Bar revet.; experimental dike work, **99,** 3302.

Second district: Repairs at Hopefield Bend; about 28,000 c. y. dr., and some obstr. removed from Wolf R. mouth; 1,200′ of revet. work at Memphis H.; 2,314 c. y. r. removed from Nonconnah Rock; revet. at Helena H. carried downstream 926′ and repairs to old work made, **99,** 3307.

Third district: Repair of Ashbrook Neck revet. extensive repairs made at Greenville H.; caving banks at Lake Providence protected with mat work, **99,** 3309.

Fourth district: Spur constr. in progress at Natchez and Vidalia Hs.; 73,800 c. y. dr. at Old R.; 6 spur dikes and 2 buttresses built at New Orleans, **99,** 3312.

Levees: 10,823,294 c. y. built, of which 3,136,541 c. y. were built by State and local authorities, **99,** 3319.

1899-00. General: Similar work to that of the preceding year, **00,** 4527.

First district: Hickman revet. repaired; New Madrid revet. extended downstream; 1,890′ bank protected (1898–1900) at Caruthersville; 63,000 l. f. revet. in Plum Pt. Reach repaired, as was also the dike and dam systems for the closure of Elmot and Isld. 30 chutes, **00,** 4530.

Second district: Old and inferior work at Hopefield Bend displaced with new mat work, and extension and repairs at Helena H., **00,** 4531.

Third district: Repairs at Ashbrook Neck revet.; repairs in progress at Greenville H.; many repairs made at Delta Pt., **00,** 4532.

Fourth district: Preparations made for work the next season at Kempe Bend; revet. work in progress at Natchez and Vidalia Hs.; intermittent dr. at Old R., and misc. work at New Orleans H., **00,** 4533.

Levees: 8,196,887 c. y. built since 1899 and 8,101,881 c. y. addl. by State and local authorities, **00,** 4535.

1900-12. (Repairs have been continuously made to dr. plants, etc. For details of work and costs, refer to Assistants' reports.)

1900-01. Dr. operations and results, **01,** S., 9.

First district: Revet. repairs at Plum Pt. Reach, Daniels Pt., Fletchers Bend, and lower end Osceola Bar; work on experimental dikes, **01,** S., 12, 232, 245.

Second district: Revet. extension and repairs, Hopefield Bend; 54,363 c. y. dr. from Wolf R., **01,** S., 12, 232.

Third district: 4 chan. mats constr. and sunk at Ashbrook Neck; repairs to breaks and extension of mattress works at Greenville H.; repairs to breaks in revet. at Lake Providence; minor surs., **01,** S., 14, 266.

Fourth district: Repairs to Kempe Bend revet.; work on revet. in Bondurant Chute; repairs to spurs and paving banks at Natchez and Vidalia Hs.; preparations for work at New Orleans H., **01,** S., 15, 311.

Levees: Built by U. S., 6,534,645 c. y.; by local authorities, 5,808,806 c. y. Loss by caving, five-sixths of 1% during year, **01,** S., 18, 319. Dr. Red R., **01,** S., 356.

1901-02. Dr. operations and results, **02,** S., 39, 82.

First and second districts: Daniels Pt., dikes repaired by cribwork and small connecting mat; Fletchers Bend, revet. repaired by 815 l. f. connecting mat, **02,** S., 91. Hopefield Bend, dikes built, and repairs to revet., **02,** S., 92. Wolf R., 51,060 c. y. dr., **02,** S., 93.

Third district: Lake Providence revet. extended 1,800′; breaks repaired, **02,** S., 110.

Fourth district: Mats sunk and revet. extended 1,100′ at Natchez and Vidalia Hs., **02,** S., 136. Work on sill dams, Atchafalaya R.; 57,000 c. y. dr. from Old R., **02,** S. 138. Revet. work at New Orleans H., **02,** S., 139. Minor repairs and preparation for resuming work at Kempe Bend revet., **02,** S., 142.

Levees: 713,180 c. y. built by U. S. and 6,227,573 c. y. by local or State authorities, **02,** S., 16. Loss by caving, three-fourths of 1%, **02,** S., 16.

1902-03. Revet. repaired above Cairo, **03,** S., 10. Dr. operations and results, **03,** S., 65. Sum-

mary of work done during h.-w. period, **03,** S., 213. Tables of h.-w. operations in various districts, **03,** S., 251, 264.

First district: Repairs and paving to revet. at Caruthersville, Mo., **03,** S., 169. Plum Pt. Reach, break repaired at Ashport Bend, Osceola Bar, and Fletchers Bend; experimental dike work, 2,810 l. f. put in opposite Hathaways Landing, Tenn., **03,** S., 10, 170.

Second district: 42,250 c. y. dr. from Wolf R., repairs to caving banks at Helena, Ark., **03,** S., 13, 172.

Third district: Repairs to revet. at Lake Bolivar Front, extension 500′; repairs to break; reinforcing mat put in at Ashbrook Neck; breaks in Lake Providence revet. repaired, **03,** S., 220. Repairs to bank and paving at Greenville H., **03,** S., 14, 220.

Fourth district: Revet. at Bondurant Chute extended 600′ downstream, and at Kempe Bend 600′ extension downstream and 850′ upstream; 2,200′ revet. constr. for protection at Natchez and Vidalia Hs.; w. of sill dam, Atchafalaya R.; extension of revet. at New Orleans H., **03,** S., 16, 272.

Levees: 3,314,726 c. y. built by U. S. and 3,363,910 c. y. by local authorities; loss by caving, three-fourths of 1%, **03,** S., 23, 174.

1903-04. H.-w. operations, **04,** S., 209. Repairs to plant, **04,** S., 19, 176, 191. Constr. training wall, lower St. Francis levee district, **04,** 203. Dr. operations and results, **04,** S., 47, 81, 89.

First district: Plum Pt. Reach, repairs to revet. at Daniels Pt., Ashport Bend, Fletchers Bend; break in abattis dike near Hathaway Crossing repaired, **04,** S., 12, 133, 162.

Second district: Hopefield Bend, 2,600′ new revet., 840′ mat placed; 52,340 c. y. dr. and 153 snags and logs removed from Wolf R.; revet. operations at Helena, Ark., **04,** S., 14, 135, 166.

Third district: Lake Bolivar, repairs to revet.; repairs and paving, placing of mat at Greenville H. and Lake Providence, **04,** S., 15, 137.

Fourth district: Bondurant Chute revet. extended 188′ downstream; at Kempe Bend, 2,670′ revet. replaced, and 1,395′ of bank revetted; at Natchez and Vidalia Hs., repairs to revet.; at New Orleans H., Southport revet. extended 4,750 l. f., **04,** S., 17, 250.

Levees: 5,360,420 c. y. built by U. S. and 8,497,224 c. y. by local board, **04,** S., 20.

1904-05. Dr. operations, tables, etc., **05,** S., 61, 128, 139. Repairs to plant, **05,** S., 155, 224.

First district: Plum Pt. Reach, replacing revet. and reinforcing mattress at Fletchers Bend; minor repairs at other points, **05,** S., 10, 152, 169.

Second district: Hopefield Bend, 1,600′ revet. added, and 47,440 c. y. dr. from Wolf R., **05,** S., 12, 154.

Third district: Repairs and bank paving at Ashbrook Neck; 3-pocket mats placed at Greenville H.; 4,200′ revet. completed at Longwood, Miss.; pockets repaired at Lake Providence, **05,** S., 13, 197, 211.

Fourth district: 80,000 c. y. dr. from Old R.; revet. repaired and extended at Bondurant Chute; gaps closed by placing 2,885′ of mattress; 2,700′ of bank graded and 865′ paved at Kempe Bend; mattress work, paving and grading bank, Hs. of Natchez and Vidalia, **05,** S., 15, 250, 283.

Levees: 8,986,652 c. y. built by U. S. and 10,048,035 c. y. by local authorities, **05,** S., 20. Loss by caving, 2½%, **05,** S., 21.

1905-06. Repairs to plant, **06,** 2537, 2588; dr. operations, **06,** 2507, 2526; h.-w. operations, **06,** 2545.

First district: 2,200′ revet. replaced at Fletchers Bend, **06,** 2472, 2529.

Second district: 950′ revet. replaced at Hopefield Bend; 9,600 c. y. of material and 38 snags removed from Wolf R., **06,** 2473, 2532.

Third district: 2,134′ mattress placed and revet. reinforced and extended upstream 400′ at Lake Bolivar; 2 pocket mats placed at Greenville H., **06,** 2474, 2552.

Fourth district: 5,723′ of bank graded and repairs to existing work at Kempe Bend; closing gaps, Natchez and Vidalia Hs.; 28,385 c. y. dr. in Old R.; constr. of dikes at New Orleans H., **06,** 2477, 2574.

Levees: 3,313,148 c. y. built by U. S. and 5,416,160 c. y. by local authorities, **06,** 2483.

1906-07. Dr. operations, **07,** 2610, 2653, 2670; h.-w. operations, **07,** 2691. Repairs to plant, **07,** 2746.

First district: Pocket-mat constr. at Caruthersville, Mo.; bank paving in Fletchers Bend; repairs to pavement at Bullerton Bar, **07,** 2611, 2677.

Second district: Revet. breaks repaired and bank graded at Hopefield Bend; 7,420 c. y. dr. from Wolf R., **07,** 2612, 2678. Dike work at Walnut Bend and Old Town Bend, **07,** 2680.

Third district: Repairs to bank paving and pocket mat placed, Lake Bolivar; dikes repaired and mats placed at Ashbrook Neck; repairs to revet. break at Greenville H.; large break at Lake Providence repaired; mats placed covering 2,200; bank at Reid Bedford Bend, **07,** 2614, 2701.

Fourth district: Revet. extended, paving and grading repaired at Bondurant Chute; revet. extended, mattress placed, and bank graded at Kempe Bend; revet. extended upstream 1,100′ a Natchez and Vidalia Hs.; dikes and buttress placed, spurs repaired, and revet. laid at New Orleans H., **07,** 2617, 2729.

Levees: 2,334,740 c. y. built by U. S. and 4,704,390 c. y. by local authorities, **07,** 2621.

1907-08. Repairs and care of plant, **08,** 2652, 2682, 2778, 2804. Dr. operations, cost, etc., **08,** 2687 2705, 2714.

First district: Plum Pt. Reach, 4 dikes built, **08,** 2643, 2719.

Second district: Dr. at Wolf R.; 1,800′ bank revet. built at Walnut Bend; 3,615′ revet. built and bank paved at Old Town, Ark.; repairs at Hopefield Bend, **08,** 2645, 2717.

Third district: 1,250′ mattress placed, grading and paving at Lake Bolivar Front; mat placed connecting mat constr. at Greenville H.; mattress sunk, repairs completed at Lake Providence; placing 2 chan. mats and 7 connecting mats, bank protection, foot mats constr. at Fitlers Bend, **08,** 2647, 2756.

Fourth district: Repairs to bank pavement, grading banks and revet. at Bondurant Chute; mattress placed at Kempe Bend; revet. extended and repaired, bank graded and revet. at Natchez and Vidalia Hs.; dr. in Old R.; mattress revet. placed at New Orleans H., **08,** 2650, 2788.

Levees: 5,705,992 c. y. built by U. S. and 7,137,873 c. y. by local authorities, **08,** 2653.

1908-09. Repairs and mainten. of plant, **09,** 2681, 2745, 2793, 2816. Amount, cost, and details of dr. operations, **09,** 2685, 2710, 2724.

First district: Break in revet. at Caruthersville, Mo., repaired, and considerable repairs to revet. at Plum Pt. Reach, **09,** 2647, 2729.

Second district: Bar at mouth of Wolf R. dr.; revet. extended downstream about 1,884′ and 443′ upstream at Walnut Bend; small mat placed to repair slip at Helena, Ark.; revet. extended 1,200′ downstream at Old Town Bend, Ark., **09,** 2648, 2729.

Third district: 2,037′ revet. constr. at Panthers Forest; constr. of shore mat and repairs to mat at Greenville H.; 1,864 l. f. revet. constr. at Vaucluse, Ark.; breaks in paving repaired at Lake Providence; shore mat placed at upper end of revet.; bank regraded and paved at Fitlers Bend; 2 standard chan. mats added to revet.; bank graded and paved and brush work protection placed at Reid Bedford Bend, **09,** 2651, 2760.

Fourth district: Revet. extended 275 l. f., repairs and extension to pavement at Kempe Bend; lower revet. extended upstream 1,120 l. f., upper revet. downstream 400′, grading and paving banks at Natchez and Vidalia Hs.; dr. in lower Old R.; mattress work extended above the l.-w. marks; mattress placed and revet. extended downstream at New Orleans H., **09,** 2655, 2800.

Levees: 4,590,414 c. y. built by U. S. and 8,275,204 c. y. by local board; loss, 1⅛%, **09,** 2660.

1909-10. Repairs to plant, cost of, alterations, etc., **10,** 2933, 2963, 3015, 3061, 3087. Constr. of marine ry. dock, **10,** 2962. Dr. operations, **10,** 2923, 2965, 2968, 2982, 2998.

First district: Considerable repairs made to revet. at various bends at Plum Pt. Reach, **10,** 2921, 3004.

Second district: Repairs to works at Hopefield Bend; repairs to revet. at Walnut Bend; extension of 2,400′ made to revet. at Old Town, Ark., **10,** 2924, 3008.

Third district: Chan. mats added at Lake Bolivar, minor repairs made by constr. pocket mats and repairing upper slope at Ashbrook Neck; 301′ mat placed to repair settlement of bank at Panthers Forest; 3 chan. mats and 12 connecting mats and bank paving done at Leland Neck; repairs to bank paving and constr. chan. mat 741′ long at Greenville H.; slight repairs to upper bank paving at Lake Providence; extension of 1,000 l. f. added by constr. of chan. mat and connecting mats at Fitlers Bend; revet. extended upstream 961 l. f. and repairs to break in old revet. made at Reid Bedford Bend; minor repairs made at Red Fork, **10,** 2926, 3032.

Fourth district: Revet. extended 110′ downstream to cover pocket at Bondurant Chute; 2,105 l. f. revet. placed at Kempe Bend; repairs to revet. and spur levee at Natchez and Vidalia Hs.; various protection works at Giles Bend; dr. in lower Old R.; 3,955 l. f. bank protection placed at Carrollton Bend and New Orleans H., **10,** 2930, 3070.

Levees: 2,970,224 c. y. built by U. S. and 5,063,427 c. y. by local authorities, **10,** 2935.

1910-11. Dredges and dr. operations, **11,** 3168, 3215, 3238, 3254. Quantities dr. from 1899 to 1910, incl., **11,** 3221. Description of bars and work done on same, **11,** 3221. Plant, repairs, cost, etc., **11,** 3180, 3211; first and second districts, 3269; third district, 3311; fourth district, 3339.

First district: No work of any consequence this season.

Second district: Repairs to revet. at Hopefield Bend; 12,100 c. y. dr. and 5 logs removed from Wolf R.; revet. extended 580 l. f. downstream and 2,380 l. f. upstream at Walnut Bend; revet. extended 1,700′ downstream at Old Town, Ark., **11,** 3171, 3262.

Third district: Revet. extended 2,077 l. f. downstream at Panthers Forest; revet. extended 1,057′ downstream at Leland Neck; minor repairs at Greenville H.; revet. extended 1,000′ downstream at Vaucluse, Ark.; repairs to caving bank by placing mats at Fitlers Bend; constr. of 1,880′ mat extension and repairs to old work at Reid Bedford Bend; revet. constr. at Albemarle Bend, **11,** 3174, 3288.

Fourth district: Clearing timber off bank to prevent caving-in, and obstr. future revet. work, at Hard Times Bend; upper revet. extended upstream 900 l. f., and lower revet. downstream 2,373 l. f., bank graded and paved at Kempe Bend; gap closed and repairs made to revet. at Natchez and Vidalia Hs.; dr. done in lower Old R.; 7,850 l. f. revet. constr. in New Orleans H., **11,** 3177, 3323.

Levees: 4,348,518 c. y. built by U. S. and 4,924,497 c. y. by local authorities; loss, 1⅜%, **11,** 3182.

1911-12. Dredges and dr., **12,** 3702, 3757, 3823; plant, repairs, etc., **12,** 3712, 3753; first and second districts, **12,** 3878; third district, **12,** 3930; fourth district, **12,** 3961; h.-w. operations, **12,** 3916, 3966.

First district: 3,010 l. f. revet. placed at Golden Lake, Ark., **12,** 3704, 3866.

Second district: 32,160 c. y. dr. from Wolf R.; 2,804 l. f. revet. placed at Porters Lake, Ark.; re-

pairs to revet. at Helena, Ark.; 5,006 l. f. revet. placed at Sunflower, Miss., **12,** 3704, 3868.

Third district: 2,000′ revet. added at Lake Bolivar Front; 1,048′ revet. extended upstream at Ashbrook Neck; 1,000′ revet. extended downstream at Leland Neck; 1,000′ revet. extended upstream and repairs to old works at Greenville H.; 1,000′ revet. extended upstream at Vaucluse, Ark.; 3,900′ revet. placed at Grand Lake; connecting mattresses sunk along defective reaches and work regraded and repaved wherever necessary at Albemarle Bend, Miss.; extensive repairs to prevent failure of revet. at Delta Pt., La.; extension of revet. upstream 1,032 l. f. and repairs to old work at Reid Bedford Bend, **12,** 3705, 3899.

Fourth district: Clearing timber off the bank to prevent caving-in at Hard Times Bend; upper revet. extended upstream 441 l. f. and downstream 6,609 l. f.; lower revet. extended upstream 150 l. f. and downstream 792 l. f. at Kempe Bend; grading and paving upper bank, placing connecting mat, and replacing mattress work, and general repairs to Natchez and Vidalia Hs.; dr. in Old R.; 1,215 l. f. revet. placed, bank graded and paved, and 9,965 l. f. constr. at New Orleans H., **12,** 3708, 3941.

Levees: 2,844,752 c. y. built by U. S. and 3,484,579 c. y. by local authorities, **12,** 3719.

(NOTE.—Statements of operations, 1900 to 1912, incl. character, amount, and unit costs are given in detail in reports of officers in local charge, together with assistants' reports. See appendixes of an. reports.)

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By Gen. B. S. Roberts, 1866, reclaiming waste lands of lower R. by levees with waste weirs, etc. (reported impracticable), **69,** 51, 312, 320, 323.

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Views of the engineers of several levee districts on the lessons to be derived from the flood of 1897, **97,** 3543, 3548, 3551, 3558, 3562.

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Various tables are given each year showing amount, character, and cost of work done by local authorities for protection of water front in their districts. (See each an. report.)

PROJECTS. (See Estimates and Plans.)

By Brig. Gen. Humphreys, 1868, system of levees, Cape Girardeau to Gulf, to confine flood discharge to chan., **69,** 335, 344; **72,** 438; **74,** 392; **75,** 564, 574.

By Maj. Abbot, 1870, estab. of gauges on w. Rs. for perfecting information concerning floods, **70,** 402.

By Maj. Merrill, 1872, estab. telegraphic communication bet. gauges, **72,** 435.

By BE., 1874, to reclaim and protect alluvial basin: 1st, opening and maintaining Atchafalaya and Lafourche R. outlets; 2d, general system of levees, Cape Girardeau to Gulf, **75,** 564, 674.

By Capt. Suter, 1871, to prevent threatened cut-off at Vicksburg, by a continuous shore protection, covering R. bank and extending out into R. bed; est., $2,747,535, **71,** 381, 382. At Vicksburg H., Miss., the proj. of 1877 proposed the protection of the city water front by shore protection at Delta Pt., constr. of a dike on the crest of the bar extending from De Soto Isld., dr. in the inner H., and the diversion of Yazoo R.; est., $2,084,100, **78,** 638, 641; **79,** 974; **82,** 2761. The M. R. C., 1883, reported that further study should be given to the subject before final recom. be made, **84,** 2419.

By Maj. Suter, 1875, gradual l.-w. imp. of Mississippi, Cairo to Gulf, by contraction at wide, shallow places, by means of transverse dikes and closure of side chans., and by training walls, dikes to be composed of brush and st., dr. to be resorted to in hastening or assuring the formation of chans. at sites selected, **75,** ii, 512. An increase of l.-w. d. from 4½′ to 6′, all that should be attempted, **75,** ii, 496, 519, 520. General considerations affecting the imp., **75,** ii, 496; **78,** 842.

By Capt. Benyaurd, 1877, to protect water front of Memphis by shore protection for 7,600 l. f.; est., $170,000, **77,** 78, 492; **78,** 637; **79,** 979. Increased: 1882, to $204,211, **82,** 1498.

By BE., 1878, to imp. R. below Cairo to l.-w. d. of 10′, by contraction at wide, shallow places to about 3,500′, and by protection of caving banks, **79,** 1008, 1011, 1013, 1014; constr. to be determined by experience derived from the imp. of one of the worst places, **79,** 1013.

By BE., 1878, to protect water front of New Orleans by shore protection of pile and brush revet. aided by brush mats placed on shore slopes; est., $476,000, **78,** 614, 616; **79,** 875; **80,** 1151; **82,** 1362.

At Natchez and Vidalia, proj. of 1880 proposed protection of banks at Marengo and Giles Bends to prevent R. from cutting through into Concordia Bend; est., $939,600, **80,** 1333, 1353.

At mouth of Red R., the BE. of 1880 recom. continuation of dr. as a means of temporary imp., **80,** 1288.

The BE. of 1881 recom. that previously adopted plan of imp. be discontinued, **82,** 1365; that at Carrollton Bend the necessity for bank protection was alone presented, and that protection should consist of brush mattress of the greatest practical l. and of most substantial constr., **82,** 1366–1368.

Proj. recom. by M. R. C. contemplated imp. of R. below Cairo by contraction of waterway at all shoal points to comparatively uniform w., and the protection of banks from caving. Reported that necessary contraction of the waterway could be best accomplished with permeable dikes, by which new shore lines would be estab. and closing of chutes. By mattress revet. the new shore lines formed by the dikes were to be held, and wherever caving banks occurred to be protected against eroding by mattress revet. or some equivalent device, **81,** 2733; **82,** 2748, 2751; **83,** 2120; **85,** 2866. Commission recom. initial work of imp. should be upon the 200 m. of R. immediately below Cairo, **81,** 2736; **85,** 2866.

In relation to levees, reported by majority of commission that while levees in themselves were not necessary as a means of securing ultimately navigable chans., nevertheless, they believed that, besides giving protection to life and property against overflow, safety and ease to navigation, and facilities to C. by estab. landing places above the reach of floods, the repair and mainten. of existing extensive lines of levees would hasten the work of chan. imp. through the increased scour they would produce during high-river stages, **81,** 2732; **82,** 2754; **83,** 2353, 2373; **85,** 2552, 2865.

General:

In 1891 Commission took up the study of the most suitable means to temporarily relieve C. on the R. pending the extension of the works for permanently imp. chan. Conclusions reached that hydraulic drs. of large capacity gave the greatest promise of success, **93,** 3557; **94,** 2715; **99,** 3299.

Mattress modified in constr. to secure more flexibility and greater density. Extra cost justified by results, **93,** 3557.

Congress, 1894, asked for an opinion as to the desirability of separating the Mississippi and Red Rs. Description of work done up to this time by the commission. Commission of opinion that the separation through Old R. would estab. more fav. conditions for navigation of both streams, and for protecting from overflow the region along the banks. These objects could also be accomplished by this means more surely than by any other plan. Minority report favoring keeping Old R. open until Plaquemine Bayou Canal would be completed, and until other misc. work was done. **95,** 3639.

Suggestions by Lt. Col. Stickney for relief of lower Louisiana from excessive flood heights, **95,** 3649.

Considered settled, 1896, that in the plan for the permanent imp. of the chan. by contraction of its l.-w. width, the work of bank protection should precede permeable dikes and other structures of that class, and that the latter may be regarded as supple. in function and necessary only in a minority of cases, **96,** 3419.

Conclusions of commission, 1896, that it was not possible with the work employed up to that time to accomplish satisfactory permanent imp. of the R., Cairo to the Passes, as was necessary to meet the urgent demands of C., within any reasonable time. Dr. looked on as giving greater promise of success, **96,** 3422.

Commission est., 1896, complete revet. work, Cairo to Vicksburg, would cost $63,000,000, requiring 40 years to build, and that there would be an an. cost for mainten. of not less than 10% of the orig. expend., **96,** 3423.

Virtual abandonment of the work of permanently imp. the R., after expend. of a vast amount of money, decided on by the commission, 1896, the subject of a minority report by Lt. Col. Stickney, **96,** 3430.

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[1] H. D. 130, 56th, 2d.

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Ashport, Tenn., pre. ex. and sur. au. act Mar. 3, 1905, of Miss. R., from Ashport, Tenn., to highlands above overflow at or near the town of Ft. Pillow, and from Ashport e. to the highlands above overflow in Lauderdale Co., with view to imp. navigation of said section of R. and preventing overflow. **R.** by Miss. R. commission, Apr. 11, 1905, and Apr. 9, 1906 (unfav.),[2] **06,** 460.

R. by Miss. R. Com. upon cost of revetting banks from Cairo to Head of Passes. At an est. of $200,000 per m. the total cost would be about $157,800,000. Up to 1910 U. S. has spent over $24,000,000 and State and local organizations over $58,000,000.[3]

R. by Miss. R. Com. upon levee constr. bet. Vicksburg and Bayou Sara, giving information as to amt., char. of work, est. cost, and amt. of land to be benefited.[4]

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Extent of cut by dr., Lake Providence Reach, **02,** S., 132; **03,** S., 264; **04,** S., 244.

Floods:

Mississippi Valley overflowed area, 1891, **91,** 3650. Fourth district, **93,** 3920; **94,** 3062; **97,** 3836. Third district, **94,** 2870; **97,** 3836; **98,** 3377, 3458. First district, **97,** 3836; **98,** 3352, 3458; **99,** 3512; 3536. Maps, profiles, and hydrographs pertaining to Capt. Townsend's paper on flood heights, **95,** 3956; to Col. Suter's paper, **95,** 3956. Discharges below Cairo, 1851 to 1899, **00,** 4574, 4782.

St. Francis levee district, overflow area, flood of 1903, **03,** S., 44.

Holly Bush Crevasse breaks, **03,** S., 44.

Third district, overflow, **03,** S., 264.

Photos, flood of 1912, **12,** 3724.

Gauges:

Location of gauges, **93,** 3660.

Gauge relations bet. Cairo and Helena, diagram of, **94,** 2970.

Tide gauge at Biloxi, Miss., **96,** 3758; at Port Eads and East Bay, **99,** 3351, 3502.

Automatic tide gauge at Biloxi, Miss. (photos), **02,** S., 90.

Heights, **04,** S., 130.

High and low water (see Hydrographs):

Profiles, upper Tensas and lower Yazoo levee districts, **97,** 3836; **98,** 3377, 3458; **03,** S., 264; **04,** S., 244. Cairo to Ft. Jackson, **98,** 3179, 3458; **99,** 3351, 3502; **00,** 4574, 4782; **02,** S., 90; **03,** S., 68.

Profile, Cairo to Head of Passes, **04,** S., 130.

Profile of levee districts, **05,** S., 196; **06,** 2546.

Profile of slopes, **08,** 2704, 2748.

Profile of high water, **09,** 2726; **11,** 3210; **12,** 3752, 3892.

Profile of overflow areas, **12,** 3892, 3920, 3976.

Hydrographs:

Lake Providence Reach, **93,** 3768.

Carrollton and South Pass, 1877–94, **94,** 2858; 1891–92, **94,** 2558.

Dr., Cairo to Memphis, 1896, **97,** 3836.

St. Francis levee board, flood of 1897, **97,** 3836.

Cairo to Ft. Jackson, 1897, **97,** 3836; 1899–1900, **00,** 4574, 4782; **02,** S., 90; **03,** S., 68; **04,** S., 130; **05,** S., 42, 72; **06,** 2528; **07,** 2674; **08,** 2704; **09,** 2726; **10,** 2960; **11,** 3210; **12,** 3752.

Low water, season of 1897, **98,** 3179, 3458.

Cairo to Carrollton, 1888–99, **99,** 3351, 3502; **01,,** S., 224.

Biloxi, Port Eads, East Bay, and Red R. Landing, **99,** 3351, 3502.

R. and tributaries, 1871–99, **00,** 4574, 4782.

Harbors and miscellaneous places on the river:

Anderson Crossing (2 plates), **05,** S., 151.

Arkansas City, **89,** 2597. Ashbrook Neck, **93,** 3768.

Batchelors Bend, **90,** 3288. Bolivar, **89,** 2718; **90,** 3288. Batsells Bar, **98,** 3179, 3458. Bends, fourth district, **12,** 3976. Bend of Isld. 35, **10,** 3026. Bixbys T. H. Crossing (5 plates), **03,** S., 68; (5 plates) **04,** S., 130. Bondurant Chute, **03,** S., 298; **04,** S., 298; **05,** S., 280; **10,** 3106. Booths Pt. Crossing (3 plates), **01,** S., 232; (5 plates) **02,** S., 90; (3 plates) **03,** S., 68.

Carrolls to Foster Isld., **87,** 1560. Columbus City front, **90,** 3210. Cherokee Crossing, **98,** 3179, 3458; **01,** S., 364. Caruthersville, **99,** 3512, 3536; **00,** 4796, 4822; **09,** 2754; **10,** 3026. Corona Crossing (5 plates), **05,** S., 151.

Delta Pt., **89,** 2718. Darnells Pt. Crossing (2 plates), **03,** S., 68.

Delta Pt. Reach, **05,** S., 248. Densfords Crossing (4 plates), **05,** S., 150.

Fleeces Crossing, **98,** 3179, 3458; (3 plates) **01,** S., 364; (2 plates) **05,** S., 150.

Ferguson to Knowlton, Ark., shore line, **10,** 3026. Fletchers Bend, **09,** 2754; **10,** 3026. Foot of Isld. 16, crossing (2 plates), **05,** S., 150. Foot of Isld. 30, crossing (2 plates), **01,** S., 364.

Greenville, **88,** 2280; **89,** 2718; **90,** 3288; **92,** Atlas, 144; **93,** 3768; **99,** 3544, 3588. Greenville Bends, **90,** 3288. Graves Bayou Bar, **98,** 3179, 3458. Gold Dust Crossing, **98,** 3179, 3458. Giles Bend, **05,** S., 280; **09,** 2842; **10,** 3106; **11,** 3354. Graves Bayou Crossing (2 plates), **03,** S., 298. Greenville Reach, **04,** S., 244; **05,** S., 248.

Horsetail, **87,** 1558. Hopefield Bend and Memphis H., **88,** 2270; **89,** 2698; **91,** 3595; **98,** 3352, 3458; **09,** 2754; **10,** 3026.

Hickman, **90,** 3210; **95,** 3956; **00,** 4796, 4822. Helena, **90,** 3212; **97,** 3836; **99,** 3512, 3536; **00,** 4796, 4822; **09,** 2754; **10,** 3026. Hathaways Crossings, **98,** 3179, 3458; (6 plates) **02,** S., 190; (3 plates) **03,** S., 298; (7 plates) **04,** S., 130. Hatchee R. Crossing (18 plates), **02,** S., 90. Hickman Crossing, **01,** S., 364.

Islds. 8–115, **75,** ii, 520. Isld. No. 34 and Isld. No. 40, **98,** 3179, 3458. Isld. 20, chute of (2 plates), **04,** S., 130. Isld. 20, crossing (2 plates), **03,** S., 298. Isld. 21, crossing (2 plates), **03,** S., 298; (3 plates) **04,** S., 130; foot of (6 plates), **05,** S., 151. Isld. 35, bend of, **12,** 3892.

Joe Eckles Crossing (2 plates), **01,** S., 364; (3 plates) **02,** S., 90; (2 plates), **05,** S., 151.

Kempe Bend, **03,** S., 298; **04,** S., 298; **05,** S., 280; **09,** 2842; **10,** 3106. Kentucky Bend, **04,** S., 244; **05,** S., 248.

Lake Providence Reach, **88,** 2278; **89,** 2718; **90,** 3288; **92,** atlas, 146; **93,** 3768; **05,** S., 248. Louisiana Bend, **90,** 3288; **92,** Atlas, 145; **93,** 3768. Lazelles Bar, **98,** 3179, 3458. Lake Providence Bend, **04,** S., 244; **05,** S., 248. Last Chance Crossing (3 plates), **03,** S., 298. Lower Pt. Pleasant Crossing (5 plates), **05,** S., 151. Luxora Crossing (3 plates), **01,** S., 364; (2 plates) **04,** S., 130.

Memphis, **88,** 2208; **91,** 3595; **93,** 3730; **94,** 2918; **95,** 3956; **96,** 3758; **97,** 3836; **99,** 3512, 3536; **00,** 4796, 4822. Medleys Crossing, **98,** 3179, 3458. (See Hopefield Bend and, above). Memphis H. and Hopefield Bend, **09,** 2754; **10,** 3026. Memphis Reach, **11,** 3286. Montezuma Crossing (3 plates), **05,** S., 151.

Natchez Bend, **82,** 1510; **95,** 3956; **96,** 3758; **97,** 3836; **98,** 3436, 3458; **99,** 3619, 3654. New Orleans, **85,** 2987; **88,** 2294; **89,** 2718; **92,** atlas, 149, 150, 151; **95,** 3596; **97,** 3836; **98,** 3436, 3458; **99,** 3619, 3654. New Madrid, **95,** 3956; **97,** 3836; **99,** 3572, 3536; **00,** 4796, 4822. New Madrid, showing scour and discharge section, **00,** 4574, 4782. Natchez and Vidalia, Giles Bend, **01,** S., 364; **02,** S., 174; **03,** S., 298; **04,** S., 298. New Orleans Hs. (Carrollton Bend, Gouldsboro Bend, Algiers Pt.), **02,** S., 174; (Carrollton Bend) **03,** S., 298; **04,** S., 298; **10,** 3106; **11,** 3354. New Orleans Hs., **05,** S., 280.

Osceola Bar, **98,** 3179, 3458; **09,** 2754; **10,** 3026. O'Donnells Crossing, **01,** S., 364. Old Town, Ark., **09,** 2726; **10,** 3026.

Passes to Grand Prairie, **81,** 2738. Plum Pt. Reach, **88,** 2264; **89,** 2680; **90,** 3210; **93,** 3738; **95,** 3956; **96,** 3758; **97,** 3836; **98,** 3352, 3458; **99,** 3512, 3536; **00,** 4796, 4822; **09,** 2754; **10,** 3026. Presidents Isld. Crossing, **98,** 3179, 3458; (8 plates) **02,** S., 90; (3 plates) **04,** S., 130; (7 plates) **05,** S., 151. Patton, Ark., **09,** 2754; **10,** 3026. Peters Crossing (4 plates), **04,** S., 130; (2 plates) **05,** S., 151. Peters Lower or Ashley Pt. Crossing (2 plates), **03,** S., 298. Peters Upper Crossing (2 plates), **03,** S., 298. Peters Towhead Crossing (1 plate), **02,** S., 90. Plum Pt. (10 plates), **02,** S., 90. Pt. Pleasant Crossing (10 plates), **01,** S., 364. Pt. Pleasant Reach, **11,** 3286. Polks Crossing (1 plate), **02,** S., 90; (4 plates) **05,** S., 151. Porter Lake, Ark., **09,** 2754; **10,** 3026. Presidents Isld. Bar (6 plates), **01,** S., 364. Pt. Pleasant Bar, **98,** 3179, 3458; **99,** 3512, 3536.

Rocky Pt., **98,** 3179, 3458. Random Shot or Pecan Pt. Crossing (6 plates), **05,** S., 151. Reel foot Crossing (10 plates), **02,** S., 90; (2 plates) **05,** S., 151.

St. Louis Br. to Foster Isld., **87,** 1557. Sam Phillips Crossing, **98,** 3179, 3458. Slough Landing Neck, **09,** 2754; **10** 3026 Star Landing Bend and Porter Lake, **12,** 3892. Sunflower Bend, **10,** 3026; **12,** 3892.

Turnbull Isld., **88,** 2300. Third District Reach, **09,** 2842. Tyler Crossing (4 plates), **01,** S., 364.

Upper Crossing Isld. 34 (5 plates), **01,** S., 364.

Vicksburg, **78,** 644; **88,** 2284; **89,** 2718; **90,** 3288; **93,** 3768. Vaucluse, **89,** 2718.

Vidalia. (See Natchez.)

Walnut Bend, **09,** 2754; **10,** 3026; **11,** 3286.

Levees:

Arkansas, **91,** 3650; **93,** 3768. Atchafalaya, **93,** 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934. Atchafalaya, Lafourche, and Pontchartrain levee districts, **01,** S., 364; **02,** S., 174; **03,** S., 298; **04,** S., 298; **05,** S., 280; **06,** 2608; **09,** 2842; **10,** 3026, 3056, 3106.

Barataria and Lake Borgne, **93,** 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934; **01,** S., 364; **02,** S., 174; **03,** S., 298; **04,** S., 298; **05,** S., 280; **06,** 2608; **09,** 2842; **10,** 3026, 3056, 3106. Bondurant Chute, **01,** S., 364.

Crevasses, closing of, **93,** 3920; **97,** 2836.

First and second districts, **94,** 2918; **95,** 3956; **96,** 3758; **99,** 3512, 3536; **98,** 3352, 3458; **00,** 4796, 4822. Fourth district, **94,** 3062; **95,** 3596; **96,** 3758; **97,** 3836.

Homochitto, **96,** 3758; **99,** 3619, 3654.

Kempe Bend, **01,** S., 364.

Lafourche, **93,** 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934. Lake Borgne, **93,** 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934. Lines of

1897, **97,** 3836. Louisiana, **91,** 3650; **93,** 3768. Lower R., **91,** 3650. Levee districts, first and second, **12,** 3892; third, **12,** 3920; fourth, **12,** 3976.

Pontchartrain, **93,** 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934. Profiles, **93,** 3768; **94,** 3062; (Yazoo and Tensas levees) **94,** 2970; **95,** 3596; **97,** 3836; **98,** 3352, 3458; **99,** 3512, 3536; (St. Francis) **97,** 3836; **98,** 3352, 3458; **99,** 3512, 3536; (White R.) **97,** 3836; **98,** 3352, 3458; **99,** 3511, 3536; (first and second districts) elevations, **03,** S., 218; (lower Yazoo district) **05,** S., 248; **10,** 3056; (upper St. Francis levee district, Reelfoot district, lower St. Francis district, upper Yazoo district, and White R. district) **09,** 2726, 2786; (upper Tensas district) **10,** 3056.

Reelfoot levee district, **02,** S., 104; **03,** S., 218; **04,** S., 244; **05,** S., 196; **11,** 3286.

Second district, **93,** 3724. Sections (fourth district), **93,** 3920; **98,** 3352, 3458. Section of sinking levee at Stop Landing, **98,** 3377, 3458. St. Francis (lower) levee district, **01,** S., 266; **02,** S., 104; **03,** S., 218; **11,** 3286. Sections, **03,** S., 264. St. Francis (upper and lower) **04,** S., 244; **05,** S., 196, 248.

Tensas, **93,** 3768, 3920; **98,** 3436, 3458; **99,** 3619, 3654; **00,** 4909, 4934. Tensas (lower) and Homochitto levee districts, **01,** S., 364; **02,** S., 174; **03,** S., 264, 298; **04,** S., 298; **05,** S., 280; **06,** 2608; **09,** 2842; **10,** 3026, 3056, 3106. Tensas (upper) **04,** S., 244; **05,** S., 196, 248; **10,** 3056.

White R. district, **01,** S., 266; **04,** S., 244; **05,** S., 196, 248; **11,** 3286.

Yazoo (upper) levee district, **02,** S., 104; **03,** S., 218; **04,** S., 244; **05,** S., 196, 248; **11,** 3286. Yazoo (lower) levee district, **01,** S., 310; **02,** S., 132; **03,** S., 264; **04,** S., 244; **05,** S., 196, 248; **10,** 3056.

Regimen:

90, 3192. Lake Providence Reach, **93,** 3768.

Revetments:

Details of work (photographs), **90,** 3210. Lake Providence, **90,** 4830, 4870; **96,** 3758; **01,** S., 310; **02,** S., 132; **04,** S., 244; **05,** S., 248. Ashbrook Neck, **00,** 4830, 4870; **01,** S., 310; **04,** S., 244; **05,** S., 248; **10,** 3056. Greenville H., **00,** 4830, 4870. Giles Bend, **00,** 4909, 4934. Kempe Bend, **00,** 4909, 4934. Albemarle Bend, **11,** 3308. Ashport Bend, **04,** S., 244. Bolivar Front, Miss., **04,** S., 244; **05,** S., 248; **10,** 3056. Caruthersville, **04,** S., 244. Columbus, **04,** S., 244. Delta Pt., **00,** 4830, 4870; **04,** S., 244; **05,** S., 248. Delta Pt. Reach, **04,** S., 244. Fitler, **10,** 3056. Fletchers Bend, **04,** S., 244. Grand Lake, **12,** 3920. Greenville H., **00,** 4830, 4870; **01,** S., 310; **04,** S., 244; **05,** S., 248; **10,** 3056. Helena Front, **03,** S., 218; **04,** S., 244. Hickman, **04,** S., 244. Hopefield Bend, **04,** S., 244. Leland Neck, **10,** 3056; **11,** 3308. Longwood, **05,** S., 248. Louisiana Bend, **05,** S., 248. Lower Osceola and Bullerton Bars, **04,** S., 244. Memphis, **01,** S., 266; **02,** S., 104; **03,** S., 218; **04.** S., 244. New Madrid, **94,** 2918; **04,** S., 244. O'Donnels Bend, **04,** S., 244. Osceola Bars, **04,** S., 244. Panther Forest, **10,** 3056. Plum Pt. Reach, **01,** S., 266; **02,** S., 104; **03,** S., 218; **04,** S., 244. Reid Bedford, **10,** 3056.

River-stage bulletin:

Engraving, **03,** S., 68.

Rivers:

Red. R., at mouth, **88,** 2300. Atchafalaya and Mississippi, junction, **92,** atlas, 148. Red and Atchafalaya, Turnbull Isld. imp., **93,** 3920. White R., Clarendon, **94,** 2858. Atchafalaya and Red Rs., sill dams, **02,** S., 174. Lower Old R., **05,** S., 280.

Shore lines and channel sections:

Ashport Bend, Bullerton Bar, Daniels Pt., Helena, Ark., Helena Reach, lower Osceola Bar, Memphis Reach, Plum Pt. Reach, and Walnut Bend Reach, **05,** S., 196.

Surveys:

New Orleans, **93,** 3920. Natchez and Vidalia, **93,** 3920. Plum Pt. Reach, **94,** 2918. Results of surs. connecting Arkansas levees with Mississippi R. levees in Tensas district, **00,** 4830, 4870. New Bedford Bend, scour and fill sur., **01,** S., 224. Hopefield Bend, scour and fill sur., **05,** S., 196.

Triangulation:

Secondary, Port Louisa to Gordons Ferry, **93,** 3590; thence to Prairie du Chien, **94,** 2858; thence to Trempaleau, **95,** 2956; thence to Minneapolis (and stone lines), **96,** 3758; St. Paul to Aitkin, Minn., **99,** 3351, 3502 (incl. stone line bench marks).

Velocity observation:

Louisiana Bend, at Shipland, **93,** 3768.

Watercourses and drainage:

Upper St. Francis levee district, drainage culvert, plans, etc., **04,** S., 244.

HH-19(a) New Orleans, La. (Protection of river front.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Requirements of, **82,** 1390, 1393.

ENGINEERS.

Chief of Engineers. **R., 78,** 85; **79,** 107; **80,** 146; **81,** 197; **82,** 193.

Boards. To investigate and report, 1877, on protection of water front at New Orleans; recom. protection of bank by pile and brush revet. and brush mats; est., $476,000, **78,** 85, 614, 616; **79,** 875. (Maj. Weitzel, Capts. Howell and Benyaurd, and Messrs. Harrod, D'Hemecourt, and Wood.)

In charge:

Capt. C. W. Howell. **R., 78,** 614; **79,** 875.

Maj. A. Stickney. **R., 82,** 1390.

Assistant. H. C. Collins. **R., 82,** 1391.

OPERATIONS.

1878–79. Protection of city front (hired labor), **79,** 107, 876.

PLANS. (See Projects.)

By Maj. Stickney, 1882, break'r in 2 sections, in front of new canal entrance, and in front of Bayou St. Johns entrance; est., $280,000; **82,** 1390.

PRIVATE (CITY) WORK.

Old break'r built, 1872, by city of New Orleans, **82,** 1390, 1392.

PROJECTS. (See Plans.)

By BE., 1878, to protect city front by shore protection of pile and brush revet., aided by mats placed on shore slopes; est., $476,000, **78,** 614, 616.

SURVEYS.

At New Orleans, **78,** 614.

Au. act Mar. 3, 1879, **80,** 146; made by Maj. Stickney, 1882, **82,** 1390.

HH-19(b) Mississippi River — Cairo to New Orleans. ("Transportation Route to Seaboard.")

APPROPRIATION.

1874 (sur.), * $10,000, **75,** ii, 496. (See p. 1186.)

ENGINEERS.

Chief of Engineers. **R., 75,** 37; **78,** 110, 841.

In charge. Maj. C. R. Suter. **R., 75,** ii, 496; **78,** 841.

ESTIMATES. (See Plans.)

By Maj. Suter, 1875, sur. from Cairo to Red R., $75,000, **75,** ii, 520. Imp. of Mississippi to 10′ a doubtful undertaking at any reasonable cost, **75** ii, 519, 520.

PHYSICAL CHARACTERISTICS.

Description, **75,** ii, 505–511; **78,** 842, 844–847.

Floods, **75,** ii, 507.

List of obstr., **75,** ii, 513–519; **78,** 842–844.

Bar formation, **78,** 842–846.

Increase in w. of R. from 1821 to 1874, **78,** 847–851.

PLANS. (See Estimates.)

By Maj. Suter, 1875, careful sur.; est., $75,000, **75,** ii, 496, 520. For imp. by dikes and dams, h. of dams 10′ above extreme l. w.; dr.; bank protection; removal of snags and wrecks. At the beginning not to attempt to procure more than 4.5′–6′ l. w., and to begin on one of the worst points, **75,** ii, 511–513, 519, 520; **78,** 842, 847.

SURVEYS.

By Maj. Suter, 1874, from Cairo to New Orleans, **75,** 37, ii, 496.

Ex. by Maj. Suter, 1875, **75,** 37, ii, 496; **78,** 841.

Maps:

Of route, S. Doc. 307, 43d Cong., 1st sess.

25 sketches of R. from Kentucky boundary line to Red R., **75,** ii, 520.

* Allotment.

HH-26 Baton Rouge Harbor, La.

ENGINEERS.

Chief of Engineers. **R., 89,** 202.

In charge. Capt. W. L. Fisk, 1889. **R., 89,** 1511.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Fisk (**R.** unfav.), **89,** 1511.

HH-40 Grand Gulf, Miss. (Harbor.)

ENGINEERS.

Chief of Engineers. **R., 80,** 158; **81,** 213.

In charge. Maj. W. H. H. Benyaurd. **R., 81,** 1470.

Assistant. H. St. L. Coppée. **R., 81,** 1472.

PLANS.

By Maj. C. Benyaurd, 1880, dr. from Station to Ferry at Big Black R., thence to near Gauge No. 3 est., $1,054,780, **81,** 1476, 1477.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Benyaurd (**R.** unfav.), **81,** 1470.

HH-40(b) Palmyra Lake, La. and Miss.

COMMERCE.

Small, **84,** 1371.

ENGINEERS.

Chief of Engineers. **R., 84,** 227.

In charge. Maj. A. M. Miller. **R., 84,** 1370.

Assistant. T. M. Farrell. **R., 84,** 1371.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1370.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1883, by Maj. Miller (**R.** unfav.), **84,** 1370.

HH-42(a) Vicksburg, Miss. (Protection of water front.)

APPROPRIATIONS. (See p. 1089.)

DEFENSE.

Importance of Vicksburg to defense of the Mississippi R., **71,** 371.

ENGINEERS.

Chief of Engineers. **R., 78,** 88, 637; **79,** 117.

Boards. To investigate and report, 1877, on protection of water front, **78,** 638. (Col. Simpson, Maj. Suter, and Capt. Benyaurd.)

In charge:

Lt. Col. W. F. Raynolds, 1871. **R., 71,** 377.

Capt. W. H. H. Benyaurd, 1878–79. **R., 78,** 637; **79,** 974.

Assistants:

Capt. C. R. Suter. **R., 71,** 378.

T. G. Dabney. **R., 78,** 644; **79,** 975.

OPERATIONS.

1878–79. Protection of Delta Pt. by hired labor, **79,** 975, 977.

PROJECTS.

By Capt. Suter, 1871, to prevent threatened cut-off at Vicksburg, with continuous shore protection covering R. bank and extending out into R. bed; est., $2,747,535; **71,** 381, 382.

By BE., 1877, to protect water front, after formation of cut-off, by (1) protection of Delta Pt.; (2) bar dike; (3) dr. at inner bar; (4) diversion of Yazoo R.; est., $1,830,000, **78,** 638, 641.

SURVEY.

71, 378; **78,** 644.

Map. Of H., **78,** 644.

HH-42(b) Yazoo River (Mouth) and Vicksburg Harbor, Miss.

APPROPRIATIONS.

1892,	$75,000,	**93,** 2034.
1894,	265,000,	**95,** 1939.
1897,	350,000,	**97,** 1928.
1901,	510,000,	**01,** 2054.
1909,	44,000,	**09,** 1565.
1910,	4,000,	**10,** 1718.
1912,	5,000,	**12,** 2081.
Total,	1,253,000	

COMMERCE.

Average C. for the "last" 5 years, 303,466 t.; value, $7,922,000, **00,** 410.

Average an. C., 321,594 t., **04,** 393.

During several years, varied from 222,792 to 441,765 t., **12,** 771.

Effect on rates (see Summary, p. 1081), **12,** 771.

CONTRACTS.

1895. C. H. Dameron & Bro., excavating earth and placing it in embankment, 20.8¢ c. m. ($18,530.51), **96,** 1622.

1896. A. P. Martin, same work as preceding, 19⅜¢ c. m. ($23,875.23), **97,** 1929.

1899. Stone, Sand & Gravel Co., dr., 8.49¢ c. y. ($636,750); annulled Mar. 7, 1900, **99,** 2017; **00,** 2527.

1900. Atlantic, Gulf & Pacific Co., dr., 12.4¢ c. y. ($930,000), **00,** 2530.

1903. Helgason Bros. & Garbish, completing West Pass Levee, sec. 1, 25¢ c. y., and sec. 4, 32½¢ c. y., **04,** 2053. O. F. Barrett, r. for protecting ends and spur of levee, $2 t., **04,** 2052.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 265; **94,** 246; **95,** 274; **96,** 239; **97,** 306; **98,** 297; **99,** 357; **00,** 408; **01,** 421; **02,** 350; **03,** 370; **04,** 392; **05,** 407; **06,** 442; **07,** 467; **08,** 496; **09,** 524; **10,** 589; **11,** 636; **12,** 768.

Boards. Convened, S. O. No. 21, July 25, 1902; submits **R.** on proj. by Capt. Potter, for levee along left bank of Mississippi R., canal-end of levee to be turned toward De Soto Isld. for about 500′, ground to be protected by a mat 80′ w., and slope to be paved with st. Levee to be built to 4′ above highest recorded water, with an 8′ crown and 3 to 1 slopes, to point A; then, if circulating current be found to still exist, to be built on up toward Kings Pt.; est., $125,000 (Col. Amos Stickney, Maj. J. H. Willard, and Capt. C. L. Potter), **03,** 1387.

In charge:

Capt. J. H. Willard, 1892–99. **R.,** **93,** 2029; **94,** 1488; **95,** 1933; (Maj.) **96,** 1618; **97,** 1927; **98,** 1625; **99,** 2015.

Maj. T. L. Casey, 1900–01. **R.,** **00,** 2524; **01,** 2052.

Capt. C. L. Potter, 1902. **R.,** **02,** 1420.

Capt. C. S. Bromwell, 1903. **R.,** **03,** 1385.

Lt. Col. H. M. Adams, 1904–05. **R.,** **04,** 2051; **05,** 1543.

Capt. G. M. Hoffman, 1906–07. **R.,** **06,** 1372; **07,** 1507.

Capt. C. S. Smith, 1908–10. **R.,** **08,** 1577; **09,** 1564; **10,** 1715.

Capt. J. A. Woodruff, 1911–. **R.,** **11,** 1866; (Maj.) **12,** 2080.

Assistant.

H. M. Marshall. R., **93,** 2035; **94,** 1493; **95,** 1939; **96,** 1622; **98,** 1631.

T. C. Thomas. **R.,** **01,** 2057; **02,** 1422; **03,** 1388; **04,** 2053; **05,** 1547; **06,** 1373.

LEGAL PROCEEDINGS.

Negotiations for lands covering right of way, **94,** 1491; ex. of titles, etc., **95,** 1936; purchases au. and made, **95,** 1936; **96,** 1621; condemnation proceedings for a portion, **95,** 1936.

Acquisition of lands needed to build levee by condemnation, **03,** 1387.

Damages awarded for land condemned for levee purposes, **04,** 2052.

LEGISLATION.

By act Feb. 2, 1894, Mississippi au. cession of jurisdiction to U. S. over lands acquired for canals, etc., **95,** 1935; **96,** 1621.

Levees, located and mapped under an act of Mississippi, **98,** 1625.

Act creating Yazoo-Chickasaw levee district, and constituting board of levee commissioners, and defining powers and duties thereof, **98,** 1635.

OPERATIONS.

1894-95. Vicksburg H., bar at head of Lake Centennial, and lands along proposed cut grubbed and cleared, **95,** 1935, 1939.

1895-96. Grubbing and blasting done; dam at Centennial Lake in course of constr.; 94,254 c. m. earth excavated and placed in embankments; ditch to drain Lake Barnett under constr., **96,** 1621, 1622.

1896-97. Obstr. removed; 246,454 c. m. earth excavated and placed in embankments, **97,** 1927.

1897-98. Ditch to drain water ponded by canal embankments dug; road along canal repaired; cross sections of canal site made; reference signs, etc., repaired, **98,** 1625.

1899-00. Closure of West Pass of the lake completed; 73,106 c. y. dr. from chan. (contract annulled); and 42,100 c. y. dr. from mouth of canal near Kleinston, **00,** 2525, 2528.

1900-01. 1,026,743 c. y. dr. from Vicksburg H., using large proportion of spoil to build dikes, and 845,021 c. y. dr. from main cut, **01,** 2053. Statement of excavation by localities, **01,** 2062.

1901-02. 2,823,015 c. y. dr., **02,** 1421. Statement of excavation by localities, **02,** 1424.

1902-03. 1,055,977 c. y. dr., **03,** 1385. Statement of excavation by localities, **03,** 1390. Disposition of dr. material from Nov. 19, 1900, to June 30, 1903, **03,** 1393. Protection work of outlets at West Pass, **03,** 1393. Division route opened to navigation Feb., 1903, **03,** 372.

1903-04. 85,610 c. y. dr., completing excavation of diversion route from Old R. to Kleinston Landing. Work on levee constr. begun, at sec. 1, 15,563 c. y. built; sec. 2, 109,107 c. y. built, work completed; sec. 3, 112,365 c. y. built, and work completed; sec. 4, 71,869 c. y. built; protection work of end of levees done; trees planted, **04,** 2051.

1904-05. Levee work completed Sept. 30, 1904, a total of 429,677 c. y. built under contract; permanent protection constr. at both ends of completed levee; sliding banks cleared of timber and brush, **05,** 1545.

1905-06. Filling rain washes of slopes of levee, removing drift, clearing timber, etc., constr. brush and pile dike to protect levee berme on lake side, planting trees to secure protection from wave wash; fire extinguished in dry grass of West Pass Levee, **06,** 1372.

1906-07. Mainten. of West Pass Levee, cutting and burning weeds and grass, planting willows, etc., and wreck destroyed, **07,** 1507.

1907-08. Mainten. of West Pass Levee; laborers extinguished fire to timber-protection bulkheads, **08,** 1578.

1908-09. Mainten. work; extinguishing fire at bulkheads; bank-revet. work; removal of wrecks, **09,** 1564.

1909-10. Mainten. of West Pass Levee; grading and paving lake side of levee, and quantities and cost of work given; 5,074 c. y. used in enlargement and 815 c. y. in topping; removal of wrecks **10,** 1716.

1910-11. Mainten. work, gauges repaired and erected, 6 pile clusters placed; snag boat dr. 975 c. y. in Old R., **11,** 1866.

1911-12. 12,600 c. y. dr. from Old R., and 8,800 c. y. from Lake Centennial, **12,** 2080.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1627-1642; **93,** 2030; **94,** 1489; **95,** 1934; **96,** 1621; **97,** 1927; **98,** 1631.

Physical peculiarities that may be encountered in diverting the R., **93,** 2031.

Description of lands covering proposed right of way, **94,** 1491.

Gauge readings and discharge measurements, **93,** 2030, 2036; **98,** 1632.

H.-w. marks, **94,** 1501.

L.-w. marks, **94,** 1502.

Elevation of zeros of gauges, **94,** 1502.

Summary of borings, **94,** 1503.

Description of Vicksburg H. Tendency of bottom to which dr. had been carried to return to about the same grade with respect to the Kleinston gauge, indicating either deposit or forcing up of the bottom by sinking of sides, **95,** 1936.

Discharge observations at R. mouth, **95,** 1941.

Right of way 1,000 meters w., located to give the least amount of excavation and an easy curve for change of direction from Old R. to Lake Centennial, **96,** 1621.

Floods stopping work, **97,** 1927.

Duration and occurrence of certain water phases at Vicksburg, **98,** 1632.

Table showing height and duration of floods at Cairo, Ill., before and after completion of levee system in 1885; and at Vicksburg, **98,** 1634.

Rises, **01,** 2965.

Discharge and sediment losses, **01,** 2066.

Damage to spillways during inflow, **02,** 1428.

Natural changes in canal, etc., **03,** 1394.

Description of methods employed in levee building and protection work, **04,** 2057.

L.-w. w. and d. in Yazoo diversion canal, **05,** 1551.

Abnormal and representative slopes through Yazoo Canal, **05,** 1553.

Relation of canal chan. to grade, **06,** 1373.

Bank caving, **06,** 1374.

Fall from Lake Centennial to Mississippi R. at ends of West Pass Levee, **06,** 1375.

Fire damages timber-protection bulkheads, **08,** 1577.

Bulkheads badly decayed, **08,** 1578.

Scour, **08,** 1578; **10,** 1717.

Gauge readings, **11,** 1866.

PRIVATE WORK.

Efforts made to organize a levee district to cooperate with agencies at work for levee constr., **93,** 2031.

PROJECTS.

By Capt. Willard, 1892, new outlet from the former mouth of the Yazoo on Old R., through d. w. in Old R., across the lowland bet. Long and Barnett Lakes to Lake Centennial, around the head of De Soto Isld., along the front of Vicksburg, and entering the Mississippi on the chan. side of Kleinston; est., $1,500,000, **93,** 2029. Reduced by $300,000, **93,** 2034. Dr. in Vicksburg H. to 2 meters below zero of the Kleinston gauge, **95,** 1934. In 1897, excavation from Old R. to the Mississippi, under continous contract, **98,** 1625.

Table showing quantities of materials to be excavated from the Yazoo diversion canal at stated elevations, **98,** 1632.

Sec. of War, Mar. 10, 1900, au. dr. in Vicksburg H., **00,** 2528.

Capt. Potter, 1902, proposed constr. of a levee from point near mouth of H., along bank of Mississippi, across West Pass and to high ground at or near Kings Pt., to prevent circulation of eddy currents and consequent deposits in H.; approv. by BE. (see Boards), **02,** 351.

Capt. Smith recom., 1908, that bulkheads on lake side be removed and levee slope be brought to uniform grade and paved with riprap on a bed of gravel; est., $40,000, **08,** 1578. Au. Mar. 29, 1909, **09**56, 14.

SURVEYS.

Sur. and pre. work for constr. of canal, **93,** 2030; **94,** 1489; borings, **94,** 1493; precise levels, **94,** 1495; bench marks, **94,** 1499.

Resur. made at existing mouth of the R. to determine changes there, **98,** 1625.

Location and mapping of proposed levee lines along Chickasaw Bayou and Yazoo R. to Steele Bayou, **98,** 1625.

Minor, **01,** 2057; **03,** 1388; **05,** 1545; **06,** 1373; **08,** 1578; **09,** 1565; **10,** 1717.

Maps. **93,** 2034; **94,** 1494; **98,** 1634. Plates, **00,** 2532.

Yazoo R. diversion canal, **01,** 2067; **02,** 1422.

HH-96 Memphis, Tenn.

APPROPRIATIONS. (See p. 1089.)

ENGINEERS.

Chief of Engineers. R., 77, 78; **78,** 88; **79,** 117; **91,** 258; **93,** 280.

In charge:

Capt. W. H. H. Benyaurd. **R., 77,** 490; **78,** 637; **79,** 979.

Capt. S. W. Roessler, 1891–93. **R., 91,** 3587; **93,** 2133.

Col. C. B. Comstock, 1891. **R., 91,** 258.

Assistant. G. Burney. **R., 79,** 980.

OPERATIONS.

1878–79. Protection of city front, work done with hired labor, **79,** 117, 979, 981.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2133, 2135.

Sur. 1892 showed increase in h. and w. of bar over those of previous years, and a further extension downstream of about 400′, **93,** 2135.

Part of city front referred to by act of 1892, about 13,300′, protected already for more than half its length by citizens' dikes, **93,** 2135.

PRIVATE WORK.

Bank in front of the city protected by citizens' dikes. (See Physical characteristics.)

PROJECTS.

Capt. Benyaurd, 1877, to protect water front by shore protection for 7,600′; est., $170,000, **77,** 78, 492; **78,** 637; **79,** 979.

SURVEYS.

For protection of R. front, **78,** 637.

Ex. for removal of bar au. act Sept. 19, 1890; made, 1891, by Capt. Roessler (**R.** unfav.), **91,** 3587.

Ex. of H. for removal of bar forming opposite the upper part of the city, and for protection of the city front, au. act July 13, 1892; made, 1893, by Capt. Roessler, **93,** 2133. (**R.** unfav. to bar removal, but fav. to bank protection.)

HH-118 Reelfoot Lake, Tenn. and Ky.

ENGINEERS.

Chief of Engineers. R., 91, 258.

In charge:

Capt. S. W. Roessler, 1891. **R., 91,** 2073.

Col. C. B. Comstock, 1891. **R., 91,** 2074.

Assistant. W. M. Rees. **R., 91,** 2075.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2073, 2075.

SURVEYS.

Ex. near Reelfoot Lake to restrain the flow of water into the lake and adjoining lowlands, au. act Sept. 19, 1890; made, 1891, by Capt. Roessler (**R.** unfav.; too costly), **91,** 2073.

Maps. **91,** 2074.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

HH-127(a) Cairo (Ohio R.) to Falls of St. Anthony. (Except Meekers Island Lock and Dam, Rock Island Rapids, and Des Moines Rapids.)[1]

[Including upper Mississippi R., Mississippi bet. mouths of Illinois and Missouri, bet. mouths of Missouri and Maramec, bet. mouths of Missouri and Ohio, bet. mouths of Illinois and Ohio, bet. St. Paul and mouth of Illinois R. Also Hs. of La Crosse, Dubuque, Muscatine, Burlington, Ft. Madison, Alexandria, Alton, Quincy, and St. Louis. Also protection of R. opposite mouth of Missouri R. at Kaskaskia Bend, at Sawyers Bend, and near Cairo and mouth of the Ohio R.]

APPROPRIATIONS.[2] (See p. 1089.)

COMMERCE.

Importance of imp. to, **68,** 357; **74,** 330; **76,** 696; **77,** 516, 523, 531.

Requirements of, **75,** ii, 484, 485. Difficulties from shifting of chan., **75,** ii, 474.

Tonnage of R., comparative statement, **74,** 330, 337.

Alton H., danger of destruction, **68,** 371, 372; importance of, **68,** 377, 379; **71,** 318; **72,** 351.

St. Louis H., importance of, **71,** 324, 327; injury to shipping from ice, **77,** 81, 505; necessity of a winter H. at, **77,** 81, 506.

Ft. Madison H., injury to, by formation of bar in front of, **76,** 84, 688, 689.

Statistics:

Ft. Madison H., **76,** 690.

Burlington H., **76,** 694; **78,** 715; **79,** 1138.

Dubuque H., **76,** 696; **78,** 717; **79,** 1141.

General, **67,** 263; **68,** 377, 379, 662; **71,** 318, 327; **74,** 330, 337; **76,** 690, 694; **77,** 516, 531; **78,** 705; **79,** 1107.

CONTRACTS.[3]

1872. W. Johnson, Ellis Isld. Dam, **73,** 446. Labor at Sawyers and Venice Bends, **73,** 453. Grafton Stone & Transportation Co., material at Sawyers and Venice Bends, **73,** 453.

1873. T. Hackett, imp. at Horse Tail Bar and Sawyers Bend, **73,** 451. Contract at Sawyers Bend closed Jan., 1874, **74,** 325. On Horse Tail Bar, annulled for incompetency Sept., 1873, **74,** 328, 332, 335, 336. M. Keary & Bros., imp. at Sawyers Bend; contract annulled for delay, Oct., 1873, **74,** 325, 333, 335.

1875. H. Doering, materials and labor on sections 1 and 2, **76,** 648. G. Williams, materials and labor on sections 3 and 4, **76,** 648.

1876. A. M. Hutchinson, delivery of st. for riprap dam at Ft. Madison, **76,** 535.

1878. McDonald Bros., dam at La Crosse, **79,** 1127. D. S. Barmore, snag-boat hull, **79,** 1105.

1879. W. A. McConnell, dams and shore protection at Gilbert Isld., **79,** 1123, 1125. Trim & Co., dams and shore protection, Slim Isld., **79,** 1123, 1126.

DOCUMENTS. (Not printed in reports.)

H. Ex. Doc. 58, 39th Cong., 2d sess., sur. and method of imp. upper Mississippi R. and tributaries, **67,** 16, 260; **68,** 317, 362. H. Ex. Doc. 247, 40th Cong., 2d sess., general report on previous operations, with est. of work to be done, **68,** 300, 317. S. Ex. Doc. 50, 41st Cong., 3d sess., surs. bet. St. Louis and Alton, **72,** 348. Ex. Doc. 25, 42d Cong., 3d sess., pre. report on sur. bet. the Missouri and Ohio Rs., **73,** 469.

ENGINEERS.

Chief of Engineers:

Bet. St. Paul and Des Moines Rapids, **78,** 99; **79,** 129.

Bet. Des Moines Rapids and mouth of Illinois, **78,** 98; **79,** 130.

Bet. mouths of Illinois and Meramec Rs., incl. Hs. of Alton and St. Louis, **71,** 58; **72,** 54, 348; **73,** 54.

Bet. Missouri and Ohio Rs., **73,** 54, 56.

Bet. Illinois and Missouri Rs., **73,** 53.

Bet. Illinois and Ohio Rs., **74,** 60; **75,** 65; **76,** 80; **77,** 81; **78,** 93; **79,** 118.

St. Louis H., closing Cahokia Chute at, **75,** 66, 511; **76,** 81; **77,** 81; **78,** 93; **79,** 118.

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[1] Ex.—**R.** (indefinite) Dec. 22, 1822. Grand and Little chains: Sur.—**R.** May 10, 1844; est., $65,000 and $160,000. (H. D. 482, 55th, 2d.)

[2] Works for which app. should be made, **76,** 643, 654. App. should be confined to works in progress, **77,** 82, 512, 514; **79,** 1032. Effect of small app. on ultimate cost, **76,** 82, 646; **79,** 1032.

[3] Advantages of purchase in open market over contract system, **77,** 514. Disadvantages of contract system, **75,** ii, 493.

La Crosse H., **78,** 98; **79,** 130.

Dubuque H., **76,** 84; **77,** 84; **78,** 97; **79,** 132.

Muscatine H., **79,** 131.

Ft. Madison H., **76,** 84; **77,** 84; **78,** 97; **79,** 132.

Alexandria H., **79,** 133.

Burlington H., **76,** 84; **77,** 84; **78,** 97; **79,** 131.

Quincy H., **79,** 130, 133.

Transportation routes to seaboard, part of third subdivision Mississippi, from Falls of St. Anthony to Cairo, **75,** 37, 66; **76,** 92.

R., upper Mississippi, **66,** iii, 37; **67,** 16, 35; **68,** 49; **69,** 43; **70,** 56; **71,** 53; **72,** 50; **73,** 51; **74,** 59; **75,** 63; **76,** 82; **77,** 83; **78,** 96; **79,** 128.

Boards:

1867. Convened to ex. and report on R. channeler of W. H. Nobles, **68,** 669. Did not recom. constr. of Nobles's machine at expense of U. S., but suggested offering a prize by U. S. of $100,000 for invention and use of a successful R. channeler, **68,** 674. (Col. Macomb, Lt. Col. Wilson, Maj. Warren, W. M. Roberts, U. S. C. E., and Capt. Hains.)

1872. Convened to ex. and report on condition of R. bet. Alton and mouth of Meramec R. (42 m.) with view to preparation of plans and est. for imp. of Alton and St. Louis Hs., and protection of banks of R. opposite mouth of Missouri and near St. Louis, **72,** 54, 358.

Recom. imp. of Alton H. by closing chan. w. of Ellis Isld. by low dike, **72,** 54, 361, 366. Imp. of St. Louis H. by ultimately making e shore throughout entire l. of H. parallel to city front, reducing w. of R. to 1,200′ or 1,500′ with longitudinal dikes or jetties.

Considered that demands of C. required that R. Bischoffs Dike to East St. Louis Levee, be confined to above w. by raising and extension of Venice and Long Dikes, **72,** 55, 364, 366; **73,** 453; **74,** 327.

To prevent erosion of banks opposite mouth of Missouri R. by removal of snags from Mobile Chute, and at Sawyers Bend in place of opening Cabaret Slough, to protect banks, 2 m., by revet., **72,** 55, 363, 366.

Necessity of careful sur. bet. St. Louis and mouth of the Ohio, **72,** 55, 365; **73,** 449. (Lt. Cols. Newton and Raynolds, Majs. Warren and Merrill, and Capt. Allen.)

1879. Consideration of plans for imp. of Dubuque H. Recom. constr. of 2 low spur dikes on Dunleith shore as soon as dr. chan. showed signs of filling up, **79,** 1143. (Majs. Comstock, Houston, and Farquhar.)

In charge:

Maj. G. K. Warren, 1866–70:

Upper Mississippi, **66,** iii, 3; **67,** 16, 35.

R., **67,** 259; **68,** 299, 370; **69,** 187; **70,** 225.

Col. J. N. Macomb, 1870–77:

70, 56, 289. **R.,** **70,** 291; **71,** 259; **72,** 280; **73,** 413; **74,** 301; **75,** 452, ii, 454, 457; **76,** 654, ii, 176; **77,** 523.

Ft. Madison H., **76,** 688; **77,** 524.

Burlington H., **76,** 691; **77,** 524.

Dubuque H., **76,** 695; **77,** 525.

Maj. F. U. Farquhar, 1877–79:

R., **78,** 703; **79,** 1103.

Ft. Madison H., **78,** 711; **79,** 1139.

Burlington H., **78,** 714; **79,** 1138.

Dubuque H., **78,** 717; **79,** 1140

La Crosse H., **78,** 718; **79,** 1127.

Muscatine H., **79,** 1136.

Alexandria H., **79,** 1150.

Quincy H., **79,** 1130.

St. Paul to Dex Moines Rapids, **78,** 725; **79,** 1111.

Des Moines Rapids to mouth of Illinois, **78,** 724; **79,** 1122.

Lt. Col. W. F. Raynolds, bet. mouths of Illinois and Ohio Rs.:

Reports on Alton and St. Louis Hs., and sur. bet. Alton and mouth of Meramec R., **71,** 312.

St. Louis H., **72,** 349.

Mississippi R. opposite mouth of the Missouri, **72,** 355.

Col. J. H. Simpson, 1873–79; **73,** 53, 442:

Bet. mouths of Illinois and Missouri Rs., **73,** 442.

Bet. mouths of Missouri and Meramec Rs., **73,** 453.

Bet. Missouri and Ohio Rs., **73,** 448, 469.

Bet. mouths of Illinois and Ohio Rs., **74,** 324; **75,** 477, 497, ii, 471; **76,** 634, 649; **77,** 503; **78,** 677; **79,** 1023.

Protection of banks near Cairo, **76,** 643, 651.

Assistants:

H. C. Long, **68,** 49. **R.,** **68,** 320; **69,** 199; **70,** 225; **71,** 259. Death of, **71,** 259.

H. C. Long, Alton H., **68,** 371.

J. Throckmorton. **R.,** **72,** 308; **73,** 414.

J. B. Davis. **R.,** **74,** 302; **75,** 453; **76,** 655.

C. W. Durham. **R.,** **76,** ii, 177; **77,** 526; **78,** 703; **79,** 1105.

Capt. C. J. Allen:

Alton and St. Louis Hs. and sur. of Mississippi bet. Alton and Meramec R., **71,** 314.

Reopening Cabaret Slough, **72,** 350.

Mississippi opposite mouth of Missouri, **72,** 357.

Mississippi bet. Missouri and Ohio Rs., **73,** 470.

R. E. McMath:

Ellis Isld. Dam, **73,** 445.

Sawyers and Venice Bends, **73,** 453.

D. M. Currie:

Work at Sawyers Bend, **74,** 331.

Work bet. Illinois and Meramec Rs., **79,** 1034.

C. S. True:

Imp. of Horse Tail Bar, **74,** 336.

Protection of Kaskaskia Bend, **76,** 649.

Capt. O. H. Ernst:

Methods of work bet. mouths of Illinois and Ohio, **79,** 1039.

M. Meigs:

Imp. of upper Mississippi bet. St. Paul and La Crosse, **75,** ii, 455, 467; **77,** 534; **78,** 704.

Ft. Madison H., **77,** 534.

Burlington H., **77,** 535.

Dubuque H., **77,** 535.

C. W. Durham:

Ft. Madison H., **76,** 689, ii, 189.

Burlington H., **76,** 692, ii, 186.

Dubuque H., **76,** 696.

ESTIMATES. (See Plans and Projects.)

By H. C. Long, 1868, Alton H., high dike, closing slough w. of Ellis Isld., $112,000, **68,** 370, 371, 376; **72,** 361. By Capt. Allen, 1871, low dike, closing same slough, $14,662, **71,** 318, 327; **72,** 361. By BE., 1872, high dike, $75,000; low dike, $40,000, **72,** 55, 361, 366; **73,** 53, 446; **76,** 645; cost of low dike as completed, $31,368, **76,** 635.

By Capt. Allen, 1871, protection of banks opposite mouth of Missouri, by clearing Mobile Chute, etc.; for opening and clearing chutes, $25,000; for deflecting dike, $75,000, **71,** 320, 327; **72,** 356, 367. If by direct protection of banks by revet., $569,654; revised to $561,304; by jetties, $316,250, **72,** 351, 358. By BE., 1872, by revet., $500,000; by jetties, from $300,000 to $400,000, **72,** 362.

By BE., 1872, St. Louis H., raising and extending Venice and Long Dikes, part of ultimate proj. for permanent imp. of H., $197,324, **72,** 55, 364, 366; **73,** 455; **74,** 326; **76,** 636, 645.

By Col. Simpson, 1875, closing Cahokia Chute, chan. e. of Arsenal Isld., by low dam, $75,000, **75,** 505; **76,** 642; **77,** 505. Changed to high dam, 1877, with isld. revet., to furnish winter H., $104,600, **77,** 514; **78,** 686.

By Capt. Allen, 1871, protection of banks at Sawyers Bend, by reopening Cabaret Slough $408,841, **72,** 354. By BE., 1872, by revet. of about 2 m. of shore, $142,211, **72,** 55, 363, 366; **73,** 455; **74,** 326; **76,** 636, 645; **77,** 514; **78,** 686.

By Col. Simpson, 1874, imp. of Horse Tail Bar, with 4 contracting jetties and dam, closing slough, $148,500, **74,** 328. 1876, increased to $221,502, **76,** 639; **77,** 514; **78,** 686.

St. Paul to Cairo, 1872, Lt. Col. Raynolds, mouth of Missouri to Ohio R., $2,996,044, **73,** 448, 469; **76,** 645.

By Col. Macomb, 1875, St. Paul to La Crosse, $348,670, **75,** ii, 545, 466; **76,** ii, 180.

Bars bet. St. Paul and La Crosse, $200,000, **77,** 85, 529; for completing proj. bet. St. Paul and Montrose (Des Moines Rapids), $617,393, **76,** ii, 177, 189; **77,** 524; **78,** 99, 725.

By Maj. Farquahr, 1879, Des Moines Rapids to mouth of Illinois R., removal of obstr. and mainten. and rectification of chans., $2,046,396, **79,** 130.

By Col. Simpson, 1875, mouth of Illinois R. to Cairo, chan., $3,159,200; protection of banks, $4,000,000, **75,** 481, ii, 493; **76,** 643, 646; **77,** 513; **79,** 1032.

By Col. Simpson, 1876, protection of Kaskaskia Bend by revetting banks, $42,000; **76,** 81, 642, 650; **77,** 509; **78,** 686.

By Col. Simpson, 1876, near Cairo, protection of banks, by revet., 11,500 l. f. above Cairo, $172,500, 21,700 l. f., opposite Ohio, $325,000, **76,** 654; **77,** 511, 514; **78,** 686.

By Col. Macomb, 1875, Ft. Madison, Iowa, closing Niota Chute, etc., $30,186, **76,** 688, 690, ii, 188; **77,** 84, 524; **78,** 712.

By Col. Macomb, 1875, Burlington, Iowa, imp. of Rush Chute, etc., $35,221, **76,** 692, 694, ii, 186; **77,** 84, 525.

By Maj. Farquahr, 1879, revising previous projs. of 1875, and increasing cost to $49,656, **79,** 131.

By Col. Macomb, 1876, Dubuque, Iowa, opening cut from New Barney Cut to Waples Cut, and constr. of dams, etc., $32,120, **76,** 695, 698. 1877, modified by temporary imp. of bar by dr., $15,000, and constr. of training wall, $25,300, **77,** 84, 525, 535.

By BE., 1879, permanent imp., low spur dikes on Dunleith shore, $12,668, **79,** 1143.

By Maj. Farquhar, 1879, temporary imp. of chan. at Muscatine, Iowa, by dr., $19,250, **79,** 1137.

By Maj. Farquhar, 1879, bar at Alexandria, Mo., spur dikes, $30,946, **79,** 1150.

By Maj. Farquhar, 1879, imp. bar at Quincy, Ill., spur dikes; Quincy Bay by dr., $224,110, **79,** 1131.

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1871-72. Continued operations of; also building 1,600 l. f. of wing dams, **72,** 50, 308.

1872-73. Snag boat *McCaffrey* trans.; continued operation of *Montana;* dr. and snagging, **73,** 51, 414.

1873-74. Continued operation of *Montana;* jetties built at Pigs Eye, Newport, Rolling Stone, and Betsy Slough, **74,** 59, 301; **77,** 527.

1874-75. Continued operation of *Montana;* work at Pigs Eye Dam, **75,** 63, 453.

1875-76. Continued operations of *Montana;* constr. of dam at Ninningers Slough, **76,** 82, 654.

1876-77. Continued operations of *Montana;* constr. of dam at Ninningers Slough, **77,** 83, 527. Comparative maps of bars before and after imp., **77,** 528.

1877-78. Continued operations of *Montana,* **78,** 96, 703.

1878-79. Continued operations of *Montana* until fall of 1878, at which time her machinery was trans. to new hull; dimensions and cost of, **79,** 128, 1104, 1105, 1106.

Between St. Paul and Des Moines Rapids:

1878-79. Constr., with hired labor, of brush and st. dams at following bars: Pigs Eye, Newport, Hastings, and Prescott, Crats Isld., Beef Slough, Rolling Stone, Betsys Slough, Queens Bluff, and Bellevue; also the removal of r. and bowlders from Horse Isld. and Dallas Bars, **79,** 1112, 1118. Cost of work done, **79,** 1119.

Between Des Moines Rapids and mouth of Illinois R.:

1878-79. Shore protection and constr. of brush and st. dams by contract at Gilberts and Slims Isld., **79,** 130, 1122.

Between Illinois and Missouri Rs.:

1872-73. On Ellis Dam, **73,** 53, 445.

1873-74. Continued operations; material purchased in open market; labor hired, **74,** 60, 324.

1874-75. Completion of, at height of 10′ above l. w.; cost, $31,368, **75,** 65, 477; **77,** 634.

1875-76. Repairs, **77,** 634.

Between Missouri and Meramec Rs.:

1872-73. Operations at Sawyers and Venice Bends, **73,** 54, 454.

Between Illinois and Ohio Rs.:

1873-74. Operations at Sawyers and Venice Bends and Horse Tail Bar, **74,** 60, 324, 332, 334, 336.

1874-75. Repairs on Alton Dam; progress of protection of Sawyers Bend; completion of Venice Dike; progress at Horse Tail Bar; imp. of chan.; dams commenced at Ft. Chartres, Tow Head, and Turkey Isld., **75,** 65, 477.

1875-76. Operations at Sawyers Bend and Venice Dike limited to repairs; Horse Tail Bar, progress at; dams at Ft. Chartres, Turkey Isld., Liberty Isld., and Devils Isld., progress at, **76,** 80, 635, 639, 640.

1876-77. Piasa Dam commenced; repairs at Ellis Isld. Dam; no work at Sawyers Bend and Venice Dikes; Cahokia Chute, revet. of Arsenal Isld., and constr. of abutments for dam; progress at Horse Tail Bar, Liberty and Devils Islds., protective work near Cairo, **77,** 81, 504, 511.

1877-78. Completion of Piasa and Alton Dams; repairs at Sawyers and Venice Bends; completion of work at Venice; extension and repair of dam at Cahokia Chute; progress at Horse Tail Bar, and protection works below Dickeys Isld. and near Kaskaskia, **78,** 94, 678, 684, 686.

1878-79. Repairs at Sawyers and Venice Bends; Cahokia Dam completed to height of 9 and revet. of Arsenal Isld.; progress at Horse Tail Bar and protection works at Kaskaskia Bend and below Dickeys Isld., **79,** 118, 1023, 1035. Methods of work, **79,** 1035.

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1878-79. Completion of Niota Dam, **79,** 132, 1139.

At Burlington, Iowa:

1877-78. Partial constr. of dam from head of Rush Isld. to Otter Isld., 400 l. f. shore protection on islds., **78,** 97, 714.

1878-79. Completion of dam closing Rush Chute, with drg. at ss. landing, **79,** 131, 1138.

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1877-78. 39,261 c. y. of sand drd. from bar, **78,** 97, 717.

1878-79. 37,042 c. y. of sand drd. from bar, **79,** 1140.

At La Crosse, Wis.:

1878-79. Completion of dams by contract; closing Bates Chutes and shore protection, **79,** 130, 1127.

At Muscatine, Iowa:

1878-79. Removal, by dr., of 17,600 c. y. of sand from bar, **79,** 1136.

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By Capt. Allen, 1871, protection of banks opposite mouth of Missouri from erosion, by revet. of banks or by jetties, **72,** 351, 357, 362.

By Capt. Allen, 1871, protection of banks at Sawyers Bend from erosion by reopening Cabaret Slough by a dike 1,800′ in length, projecting from head of Cabaret Isld. obliquely into R. and deflecting about one-third of the R. into e. chan., "now" closed, thereby relieving w. chan. (Sawyers Bend); head of Cabaret Isld. to be revetted; spur dikes along e. shore, **72,** 349, 350, 353; regarded unfav. by Chief of Engineers, **72,** 348; BE. (1872) disapproved, **72,** 55, 363. Brush dams, constr. of, **75,** ii, 461, 466; **76,** ii, 180; strength of, **75,** ii, 462. Wing dams, action of, **75,** ii, 460; **76,** ii, 179. Shore protection by jetties or continuous work compared, **76,** 653. Removal of bars by scraping or by portable dams compared, **75,** ii, 485. Increasing l.-w. d. by discharge from reservoirs applicable only to small streams, **75,** ii, 486.

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By H. C. Long, 1868, imp. Alton H. by closing slough w. of Ellis Isld. with timber, brush, and st. dike about 10′ x 1,200′; est., $112,000, **68,** 371, 376. Approv. by Maj. Warren, **68,** 371.

Lt. Col. Raynolds, 1871, recom. proj. for low dike, **71,** 58, 318, 320; **72,** 355; recom. by BE. (1872) as deserving of immediate attention, **72,** 54, 361. Necessity of protecting head of isld. from erosion, **73,** 446; work began Sept., 1872; details and method of constr., **73,** 444; completed (1874) to 10′ above l. w., **75,** 65, 447; **77,** 635. Map of, **73,** 443.

By Lt. Col. Raynolds, 1871, protection of banks opposite mouth of Missouri by clearing Mobile Chute and Maple Isld. Slough of obstr., thereby giving increased facility for passage of h. w., with a deflecting dike at head of Mobile Isld., **71,** 58 312, 318, 320; **72,** 355.

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Capt. Allen, 1871, reported the preferable plan to be a contraction of waterway, consistent with table regimen, with longitudinal dikes throughout entire length of H., **71,** 326.

Chief of Engineers, 1872, regarded favorably the proj. of canalizing by dikes or by jetties for the entire length of the H., **72,** 348.

BE., 1872, reported ultimately the R. throughout length of H. should be made to flow in a permanent chan. with jetties or by longitudinal dikes, bringing the e. shore parallel to w. and distant therefrom from 1,200′ to 1,500′. The demands of C. require that R. from Bischoffs Dike to E. St. Louis Levee be confined within above-named limits by raising and extension of Venice and Long Dikes, **72,** 55, 364, 366; began in 1872, **73,** 54, 454.

Imp. of H. by closing Cahokia Chute (chan. e. of Arsenal Isld.); ultimate necessity of, **75,** 504. Action of city of St. Louis by building dike from w. shore into chan. w. of Arsenal Isld. complicated question of closing, **75,** 503, 511. Produced strong erosion on Arsenal Isld. and affected unfavorably works of imp. at Horse Tail Bar, **76,** 81, 637. Rapid destruction of Arsenal Isld. made its protection and the closing of Cahokia Chute imperative, **76,** 642; work began on, **77,** 81, 505. Danger to H. and shipping from ice, by throwing entire volume of R. through w. chan., necessitating raising of dike and formation of winter H. below dike and e. of Arsenal Isld., **77,** 81, 505.

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Horse Tail Bar, near St. Louis, constr. of 4 jetties, contracting waterway to w. of from 1,500′ to 1,800′; also dam closing Carroll Isld. Slough; jetties from 6′ to 8′ above extreme l. w., composed of brush mats or rafts, with st. ballast, **73,** 448, 470, 476; **74,** 327, 336. Work commenced, **74,** 60, 324. Training walls compared with cross dikes, **77,** 508.

By Lt. Col. Raynolds, 1872, mouth of Missouri to Ohio (proj. not given); reference, **73,** 448, 469; **76,** 645.

By Col. Macomb, 1875, St. Paul to mouth of Illinois R. to l.-w. d. of from 4½′ to 6′ (being part of Third Subdivision Mississippi River, Transportation Routes to Seaboard) by contraction and direction of the R., protection of shores, and closing of chutes with wing dams and training dikes, aided by scraping at bars, **75,** ii, 462, 466, 467; **76,** ii, 179. The work to be carried on by purchase of material in open market and hired labor until, at least, experience should indicate proper basis for contracts, **75,** ii, 467. List of bars bet. St. Paul and La Crosse requiring imp., **77,** 529; bet. La Crosse and Montrose, **76,** ii, 180.

By Col. Simpson, 1875, bet. mouths of Illinois and Ohio Rs. (part of Third Subdivision Mississippi, Transportation Routes to Seaboard); l.-w. d. to be obtained as follows: Mouth of Illinois R. to St. Louis, 6′; from St. Louis to mouth of Ohio R., 8′, **75,** ii, 483. Consideration of physical characteristics of R. in connection with plans for imp., **75,** ii, 471, 491. Requirements for maintaining navigable chan., **75,** ii, 485; undertaking so large that policy and economy required imp. of worst points first, **75,** ii, 489, 492. General plan for permanent imp. of natural chan. with l.-w. dams and dikes, composed of brush foundations, with riprap superstr., closing secondary chans., and bringing R. into single chan. of moderate w.; critical and uncertain operations to be carried on by hired labor, otherwise by contract, **75,** ii, 489, 494, 495. List of points requiring work, **75,** ii, 492. Necessary operations divided into those of imp. of chan. and protection of banks, **75,** ii, 493; **76,** 643, 654; **77,** 508, 512. Work to be done in 4 years, at cost for imp. of chan., $3,159,200; protection of banks, $4,000,000, **75,** 481, ii, 493; **76,** 643. 654; **77,** 508, 512.

By Col. Simpson, 1876, protection of banks at Kaskaskia Bend; danger of Mississippi effecting a junction with Kaskaskia not considered imminent; danger of attempting protection with small app. ($5,000); est. cost of proper protection, $42,000, **76,** 81, 643, 649. Increased necessity of protection from increased erosion, **77,** 81, 509.

By Col. Simpson, 1876, protection of banks near Cairo; bet. Dickeys Isld. and mouth of Ohio R. with brush rafts or mats, riprapped with st.; 11,500 l. f. requiring protection; est., $172,500, **76,** 643, 651, 653. Work began in 1876, **77,** 511.

By Col. Macomb, 1875, vicinity of Ft. Madison, Iowa, closing Niota Chute with dam 1,400′ l. and 3′ above l. w.; dam of brush foundation and riprap; also removal of small ledge of r. near Niota side, with dr. through bar to facilitate scour, **76,** 688, 690.

By Maj. Farquhar, 1879, extension of previous proj. by constr. of spur dikes from head of Niota Isld. toward Iowa shore, **79,** 132, 1139.

Vicinity of Burlington, Iowa, 1875, imp. Rush Chute; closing main chan. of R. from Otter Isld. to Rush Isld., together with closing of 2 interior chutes; dams to consist of riprap on brush foundations, **76,** 691, 693.

Dubuque H., Iowa, 1876, artificial cut from head of New Barney Cut to mouth of Waples Cut; artificial cut 150′ w. at bottom; also 3 riprap dams, with brush foundations, located across head of Seventh St. Slough, across New Barney Cut, and across Third St. opening, **76,** 695, 697.

Proj. modified, 1877, for temporary imp. of bar by dr. to extent of app. ($15,000), and subsequently permanent imp. by training wall, about 1,000′ l., upper end of New Barney Cut to RR. br., **77,** 84, 525, 535.

By BE., 1879, bar in front of landing, contracting waterway by 2 low spur dikes on Dunleith shore; work to be commenced as soon as dr. chan. showed signs of filling up, **79,** 1143.

By BE., 1877, front of La Crosse, Wis., closing chute on both sides of Bates Isld., **78,** 98, 721.

By Maj. Farquhar, 1879, front of Muscatine, Iowa, dr. 70,000 c. y. of sand; est., $19,250, **79,** 1137.

By Maj. Farquhar, 1879, front of Alexandria, Mo., 3 spur dikes on right bank and 1 on left; est., $30,946, **79,** 1150.

By Maj. Farquhar, 1879, front of Quincy, Ill., 3 dikes, and closing dam from right bank; Quincy Bay, dr.; est., $224,110, **79,** 1130, 1131.

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Falls of St. Anthony to mouth of Ohio, **68,** 49, 364; **75,** ii, 455. Methods, **68,** 303, 364. Requirements for proper surs., **68,** 307.

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Near Kaskaskia R., **76,** 649.

Keokuk to Grafton, **79,** 130.

St. Paul to Des Moines Rapids, **79,** 1119.

Des Moines Rapids to mouth of Illinois R., **79,** 1122.

Vicinity of Alexandria, **78,** 101; **79,** 133, 1150.

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St. Paul to the Falls of St. Anthony, at Alton, Ill., at Venice, Ill., and opposite mouth of Missouri R., au. act Mar. 3, 1879, **79,** 120, 136.

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HH-127(b) Ohio River to Illinois River. (Except ice harbor at St. Louis.)

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Amount to be benefited by imp., **80,** 1376. Draft of boats on upper Mississippi, **81,** 2755.

List of steamers, barges, and scows arriving at St. Louis, 1888 and 1889, with draft and tonnage, **89,** 1698; **90,** 1985; **91,** 2105; **92,** 1733.

CONTRACTS.[1]

1886. D. Kerwin, screw bolts; H. L. Fox & Co., spike iron and nails; Broderick & Bascom, rope; J. Cleary, piles, **87,** 1577, 1578.

1888. Glenwood Lime & Quarry Assn., st., 47¾¢ c. y., **88,** 1425. J. Cleary, piles, 8 to 10¢ f., **88,** 1428. W. D. Bangs, manila rope, 10.3¢ lb., sisal rope, 9.7¢ lb., **88,** 1428. Grafton Quarry Co., st., 40¢ c. y., **88,** 1428. W. D. Bangs, sisal yarn; 9.7¢ lb., **88,** 1428. M. M. Buck, oakum, 8¢ lb., **88,** 1428. W. L. Fox & Co., nails, 2¢ lb.; screw bolts, 8.7¢ lb.; iron, 1.9¢ lb., **88,** 1428. J. J. Hauk, wire, 3¢ lb., **88,** 1428.

1889. N. W. Tucker, piles, 5 to 7¢ f., **89,** 1680. H. E. Coffin, wire, 3¢ lb.; screw bolts, 2.3¢ lb., **89,** 1680. H. L. Fox & Co., manila rope, 13.6¢ lb.; nails, 1.9¢ lb.; spike, 2.6¢ lb., **89,** 1680. Grafton Quarry Co., st., 40¢ c. y., **89,** 1680. N. W. Tucker, brush, 95¢; poles, $1.47 cord, **89,** 1681.

1891. F. Duff, lumber, $23 to $51 M f. b. m., **91,** 2091. J. Cleary, piles, 6 to 8¢ l. f. Grafton Quarry Co., st., 45¢ c. y. A. W. Benedict, rope, 11.15¢ to 7.87¢ lb. J. J. Hauk, wire, 3.05¢ lb. H. E. Coffin, spike, 2.55¢ lb. H. L. Fox & Co., screw bolts, 2.29¢ lb., **91,** 2092. H. S. Brown, extensive dam, $38,270. S. S. Holbrook, 6 barges, $3,750 each. S. W. Coffin, 7 barges, $3,795 each, **91,** 2093.

ENGINEERS.

Chief of Engineers:

Bet. mouths of Illinois and Ohio Rs. **R., 80,** 159, 161; **81,** 220, 1569; **82,** 217; **83,** 224; **84,** 232; **85,** 259; **86,** 249; **87,** 212.

Alton H., Ill. **R., 80,** 161; **81,** 221; **82,** 219; **83,** 227; **84,** 234.

Cape Girardeau, Mo. **R., 80,** 161; **81,** 222; **82,** 220; **83,** 228; **84,** 235.

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Constituted, S. O. No. 144, C. of E., 1880, to ex. and report upon Capt. Ernst's plan for the imp. of R. near Piasa Isld. **R., 81,** 1569–1571. (Majs. Comstock and Suter and Capt. Mackenzie.)

Miss. R. Com. **R., 81,** 2742, 2755; **82,** 2762, 2780; **83,** 2226; **85,** 2539, 2861; **86,** 2143; **87,** 2691.

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In charge:

Col. J. H. Simpson, 1873–80:

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Maj. O. H. Ernst, 1880–86:

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Alton H., Ill. **R., 80,** 1398; **81,** 1573; **82,** 1644; **83,** 1183, 1239, 1288; **84,** 1527.

Cape Girardeau, Mo. **R., 80,** 1391; **81,** 1585; **82,** 1649; **83,** 1291; **84,** 1529.

Miss. R. Com., **85,** 259, 2555:

R., 85, 2539, 2861; **86,** 2143; **87,** 2691.

Maj. A. M. Miller, 1886–92:

R., 87, 1556; **88,** 1422, 1452; **89,** 1673; **90,** 1964; **91,** 2087; **92,** 1713.

Assistants:

D. M. Currie:

R., 74, 13; **75,** 1034; **80,** 1379; **81,** 1546; **82,** 1607; **83,** 1193; **84,** 1442; **88,** 1428; **89,** 1681; **90,** 1969; **91,** 2093; **92,** 1719; **93,** 2156; **94,** 1587; **95,** 2072; **96,** 1732; **97,** 2027; **98,** 1717; **99,** 2077; **00,** 2654; **01,** 2189.

C. S. True:

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M. E. Schmidt:

R., 81, 1559.

W. S. Mitchell:

R., 81, 1563; **82,** 1626; **83,** 1216; **84,** 1488; **88,** 1436; **89,** 1684; **92,** 1717; **93,** 2159, 2162; **94,** 1601; **95,** 2077; **96,** 1735; **97,** 2032.

P. C. F. West:

R., 81, 1565.

A. F. Fries:

R., 82, 1620, 1622.

Gerald Bagnell;

93, 2158; **94,** 1595; **95,** 2082; **96,** 1741.

C. V. Mersereau:

R., 82, 1629; **83,** 1230; **84,** 1495.

J. W. Record:

R., 82, 1633.

J. O. Holman:

R., 82, 1635; **83,** 1223, 1232; **84,** 1497, 1527; **88,** 1432; **89,** 1687; **90,** 1971, 1974, 1975; **92,** 1723; **93,** 2160; **97,** 2038.

C. D. Lamb:

R., 82, 1645; **83,** 1211, 1232, 1238, 1239, 1290; **84,** 1493; **88,** 1433; **89,** 1683, 1686; **90,** 1972; **91,** 2094; **93,** 2162.

E. D. Libby:

R., 83, 1212; **84,** 1483.

J. E. Savage:

R., 83, 1226; **84,** 1486, 1498.

Lt. F. V. Abbot:

R., 83, 1236, 1249; **84,** 1505.

B. E. Johnson:

R., 84, 1492.

J. A. Worthen:

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S. S. Van Norman:

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OPERATIONS.[1]

1879–80. St. Louis, closing of breach and repairs to dam at Cahokia Chute, **80,** 1361, 1379. Horsetail Bar, constr. of 2,500′ of training wall and 3,200′ of hurdles, **80,** 1365, 1379, 1384. Kaskaskia Bend, bank protection extended 1,100′ and mattresses placed along 3,305′ of the foot of the slope, **80,** 1366, 1389. Cairo Protection, the revet. was extended upstream 2,900′ and raised to 20′ above l. w. for its whole length, **80,** 1367, 1387.

1880–81. Horsetail Bar, 9,500′ of primary and 22,000′ of secondary hurdles constr., together with repairs to previous works, **81,** 1521, 1546–1552. Kaskaskia Bend, repairs made at breaches, 1,140′ of hurdle dike built from the lower end of St. Genevieve Isld., and 1,005′ of shore protection strengthened, **81,** 1524, 1559–1563. Cape Girardeau, preparations for constr. of hurdle dikes, **81,** 1585. Cairo Protection, repairs were made to revet., **81,** 1527, 1563, plate 17, page 1598.

1881–82. Alton H., partial constr. of 2,040′ of dike above head of Ashton Chute, **82,** 1644, 1646. St. Louis, the Arsenal Isld. revet. completed over distance of 3,500′ and the revet. extended downstream for addl. distance of 2,750′, **82,** 1593, 1608, 1620. Horsetail Bar, 16,914′ of hurdle dike built, **82,** 1594, 1609, 1622. Carrolls Isld., 1,695′ of shore revet. placed on w. side of isld., **82,** 1596, 1612, 1629, 1654, plate 10. Twin Hollows, 8,800′ of primary hurdles placed on w. side and 6,618′ of shore protection on e. side of R., **82,** 1597, 1598, 1611, 1613, 1626, 1631. Beards Isld., 3,550′ of shore protection placed and a hurdle 1,000′ l. placed across chute n. of isld., **82,** 1599, 1615, 1633. Jim Smiths, 1,000′ of hurdle dike built, **82,** 1600, 1616, 1635. Cape Girardeau, partial constr. of hurdle dikes, **82,** 1650, 1652, plate 20.

1882–83. Alton H., dike extended to 4,800′; action of dike highly satisfactory, **83,** 1183, 1184, 1239. St. Louis, the Arsenal Isld. revet. in progress over 3,253′ of its l.; at dam closing Cahokia Chute 2 hurdle dikes built, **83,** 1178, 1193, 1211, 1288, 1296, plate 1. Horsetail, 2,450′ of hurdle dike connecting

[1] General considerations relating to constr., **82,** 1601. Observations on pile driving, **84,** 1416, 1505.

Carrolls Isld. with Illinois shore, **83,** 1179, 1194, 1212, 1296, plate 2. Twin Hollows, hurdle dike constr. continued on w. bank, and shore protection on the e. bank, **83,** 1179, 1180, 1196, 1198, 1216, 1223, 1296, plate 4. Pulltight, 2,860′ of primary hurdles constr. and 2 secondary hurdles commenced, **83,** 1180, 1200, 1224. Beards Isld., shore protection extended 3,850′, **83,** 1180, 1201, 1226, 1296, plate 5. Chesley Isld., 4,305′ of shore protection placed on e. side of isld., 550′ at head of isld., and 900′ of hurdle dike built, closing chute w. of isld., **83,** 1181, 1202, 1230, 1296, plates 3 and 6. Jim Smiths, 7,650′ of primary hurdles built, **83,** 1182, 1204, 1232. Fosters Isld., 580′ of shore protection placed on w. side of isld., **83,** 1182, 1236. Piasa Isld., 385′ of old dam removed from dam across s. chute, **83,** 1183, 1238. Cape Girardeau, completion of hurdle dike to 3,100′, **83,** 1291.

1883-84. St. Louis, 2 hurdles across Cahokia Chute completed, **84,** 1443, 1527, 1526, plate 5. Horsetail, minor repairs to hurdles, constr. of 2,775′ secondary hurdles and 3,880′ shore protection on w. side of R., **84,** 1413, 1443, 1483, 1486, 1526, plate 1. Twin Hollows, minor repairs to hurdles and constr. of 1 secondary hurdle on w. bank and on e. bank extension in height of former shore protection, **84,** 1413, 1445, 1488, 1492, 1526, plate 2. Pulltight, repairs to primary hurdles, reconstr. of 1 and building of 2 addl. secondary hurdles, **84,** 1414, 1446, 1493, 1526, plate 2. Chesley Isld., completion of hurdle closing w. chute and its subsequent injury; bank protection placed on e. side, **84,** 1414, 1447, 1495 1526, plate 2. Jim Smiths, partial reconstr. of hurdles previously built, **84,** 1414, 1447, 1498, 1526, plate 2. Repairs to plant, **84,** 1502. Work trans. to Miss. R. Com., **85,** 259, 2855.

1884-85. Alton, the dike opposite and above the landing completed to 14′ above l. w. for 4,000′, **85,** 2855, 2939. St. Louis, 1,283′ bank protection placed at Arsenal Isld. and 1,035′ brought to top of bank; minor repairs made to Cahokia Chute hurdles, **85,** 1656, 2855, 2939, plate 1. Horsetail, 1,150′ of bank protection placed on w. side and 2,140′ of bank protection carried to height of from 16′ to 21′ above l. w.; on e. side, addl. hurdles placed, **85,** 2855, 2939. Twin Hollows, repairs made to hurdles on w. side and addl. hurdles constr., 2,825′ of bank protection placed on e. side of R., **85,** 2856, 2940. Pulltight, hurdles Nos. 3, 4, and 5 in progress of constr., **85,** 2856, 2940. Jim Smiths, hurdle constr. in progress, **85,** 2856, 2940. Cairo Protection, 4,563′ of bank protection placed, **85,** 2857, 2940.

1885-86. Carrolls Isld., the hurdle was extended 2,200′ and breaks in former hurdle repaired, **86,** 2157. Twin Hollows, 570′ of bank protection placed and riprap deposited upon bank at various points, **86,** 2157. Pulltight, primary hurdles and 1 of the secondary raised to 16′ above l. w., **86,** 2157. Chesley Isld., 670′ hurdle placed, **86,** 2157. Jim Smiths, 11,205 l. f. of hurdles raised 16′ above l. w., **86,** 2157. Cairo Protection, part of bank graded and covered with riprap, **86,** 2158. Repairs and extensions at Horsetail, Twin Hollows, Pulltight, Chesley Isld., and Jim Smiths, **87,** 2691, 2722.

1886-87. Piasa Isld., sand bar removed from chan.; Horsetail and Carrolls Isld., repair to hurdle closing e. chute; Twin Hollows, bank revet. placed; Chesley Isld., closure of gap in hurdle at w. chute; Jim Smiths, wattling raised to 16′ above h. w.; Sulphur Springs, constr. of hurdle dike; Cairo, bank protection, **87,** 212, 1557–1566.

1887-88. 2 hurdles built at Pulltight, **88,** 1423. 1,775 l. f. of bank revet. constr. at Jim Smiths, **88,** 1424. Repairs to existing hurdles and 1,620 l. f. of new hurdle built at Sulphur Springs, **88,** 1424. 175 snags and 162 leaning trees removed, **88,** 1424.

1888-89. Horsetail Bar, 450 l. f. of hurdle built at head of Carrolls Isld., and repairs to existing hurdle and revet., **89,** 1674. 115,450 s. f. brush mattress and st. bank protection placed at Twin Hollows, extending existing revet. 1,750′, **89,** 1674. 2,775 l. f. of hurdle built at Pulltight, **89,** 1675. 1,200 l. f. of hurdle built at Jim Smiths, **89,** 1676. Repairs to hurdles at Sulphur Springs, **89,** 1676. 7,170 l. f. of hurdle built at Lucas Crossing, **89,** 1676.

1889-90. 2,605 c. y. st. used in raising 1,100 l. f. of Piasa Dam to 6′ above l. w., **90,** 1965. 8,250 s. f. of submerged revet. and 63,500 s. f. of upper-bank protection placed at Twin Hollows, **90,** 1966. 1,260 l. f. of hurdle built at Pulltight, **90,** 1966. 53,100 s. f. of mattress built and sunk, and 1,390 l. f. of upper-bank protection placed at Jim Smiths **90,** 1967. 4,050 l. f. of hurdle built at Lucas Crossing, **90,** 1967.

1890-91. 2 hurdles located and 600 l. f. of mattress placed in protection of their shore ends at Rush Tower, **91,** 2093. 2 hurdles built at St. Genevieve, **91,** 2093. 9,744 cords of brush procured and piled for use, **91,** 2096. Repairs to plant, **91,** 2096.

1891-92. 110 piles, 45,400 c. y. brush, and 17,422 c. y. st. used in extension of submerged brush and st. dike at Alton, **92,** 1714. Hurdle constr. at Rush Tower continued; mattress 120′ x 4,000′ constr. and sunk in protection of portion of Calico Isld., **92,** 1714. Work at St. Genevieve completed by hurdle constr. and pile driving, **92,** 1715. Repairs to plant, **92,** 1715.

PHYSICAL CHARACTERISTICS.

Stability of wooded banks, **80,** 1368, 1369.

Bank erosion, **80,** 1369; **81,** 1524; **82,** 1599.

Volume of R. deposits at Horsetail Bar, **80,** 1364, 1379, 1423; **81,** 1521.

Navigable d. bet. St. Louis and Cairo, **81,** 1530, 1542; **82,** 1640; **83,** 1284; **84,** 1416, 1522; **87,** 1580.

Standard l. w., **81,** 1531.

L.-w. discharge, **81,** 1533; **82,** 2762.

Gauge records, **82,** 1638; **83,** 1282; **84,** 1521; **87,** 1579; **88,** 1441; **89,** 1692; **90,** 1979.

D. of water upon bars bet. St. Louis and Cairo for 1888, **88,** 1442; 1889, **89,** 1694; 1890, **90,** 1980; 1891, **91,** 2102; 1892, **92,** 1728.

H.-w. stages, **82,** 1618.

Amount of sediment in suspension, **82,** 2762.

Slope of R., **82,** 2763.

PLANS. (See Projects.)

In view of its ultimate inclusion in the general proj. for imp. of this section of the R., Maj. Miller, in 1888, did not recom. any separate imp. at Rush Isld. Bend and Ivy Landing, Ill., **88,** 1452.

PROJECTS. (See Plans.)

Object of imp. of R. from mouth of Illinois R. to mouth of Ohio R., 241 m., to obtain min. d. at standard l. w. of 6′ from mouth of Illinois R. to St. Louis, about 54 m., thence to mouth of Ohio, about 187 m., a l. w. d. of 8′.

General plan contemplated making imp. continuous, beginning at St. Louis and working downstream, by reducing R. to approx. uniform w. of 2,500′.

Methods employed silt-arresting devices, whereby the solid material caught from the R. deposited to form new shore lines, which, together with the natural banks of the R., are protected where necessary from caving and erosion by a revet. of brush and st. Est., $16,997,100.

81, 2745; **82,** 2763; **83,** 1187; **84,** 1417; **85,** 2861; **87,** 213, 1556, 1569.

At Alton H., Ill., the proj. of 1871 proposed closing the chute behind Ellis Isld. with a brush and st. dam, **71,** 318, 320; **72,** 361; **74,** 324.

Dam completed to 10′ above l. w. in 1874, **75,** 447.

In 1881 Maj. Ernst proposed removal of shoal in front of Alton Landing with deflecting dike from Missouri shore and above the head of Ellis Isld. Est., $120,000, **81,** 1573; **82,** 1644.

At Cape Girardeau, Mo., Maj. Ernst proposed, in 1881, an 8′ chan. bet. Cape Girardeau and Mintons Pt., with hurdle dikes from the end of Devils Isld., near Mintons Pt., and from Illinois shore opposite Cape Girardeau; est., $129,000, **81,** 1585, 1598; **82,** 1650. Plate xx, p. 1654.

Aggregate amount app. to June 30, 1890, $4,129,600; est. for completion, 1890, $12,557,500, **90,** 1969.

SURVEYS.

Opposite mouth of Missouri, **80,** 1400.

In vicinity of Piasa Isld., **81,** 1566.

At Fish Bend, near Ft. Chartres, **82,** 1670.

In vicinity of Venice, **80,** 1396.

1879–80, **80,** 1368.

1880–81, **81,** 1529, 1565, 1566.

1881–82, **82,** 1604.

At Rush Isld. Bend and Ivy Landing, Ill., ex. au. act Aug. 5, 1886; made, 1888, by Maj. Miller, **88,** 1452.

Maps:

At Alton H., **82,** 1654.

At St. Louis, **82,** 1654; **83,** 1296; **84,** 1526; **85,** 1656.

At Horsetail Bar, **81,** 1598; **82,** 1654; **83,** 1296, **84,** 1526; **85,** 1656; **88,** 1424.

From Carrolls Isld. to Meramec R., **81,** 1598.

At Kaskaskia Bend, **81,** 1598.

Near St. Genevieve, Mo., **81,** 1598.

At Cape Girardeau, **81,** 1598.

Near Piasa Isld., **81,** 1598.

From St. Louis to Foster Isld., **82,** 1654; **88,** 1424.

At Arsenal Isld., **82,** 1654; **83,** 1296.

From Carrolls to Chesley Isld., **82,** 1654; **83,** 1296; **84,** 1526; **85,** 1656.

At Carrolls Isld., **82,** 1654.

At Twin Hollows, **82,** 1654; **83,** 1296; **88,** 1424.

At Beards Isld., **82,** 1654; **83,** 1296.

At Cape Girardeau, **81,** 1598; **82,** 1654.

At Chesley Isld., **83,** 1296.

From Pulltight to Foster Isld., **88,** 1424.

From St. Louis Br. to Calico Isld., **89,** 1678.

From Horsetail to Meramec R., **89,** 1678.

From Meramec R. to Calico Isld., **89,** 1678; **90,** 1966.

From Bissells Pt. to Calico Isld., **90,** 1966; **91,** 2089.

From Turkey Isld. to St. Genevieve, **91,** 2089.

HH-127(c) Ohio River to Missouri River.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Decline probably caused by uncertainty of chan., **05,** 1591.

Remarks on freight-rate regulation by legislation, **05,** 1592.

Imp. has probably had a beneficial influence on freight rates, **10,** 620.

CONTRACTS.

1892. Abstract of proposals for furnishing piles, manila rope, sisal rope, wire nails, spikes, and screw bolts, aggregating about $25,027.45, **93,** 2153.

T. H. Truscott & Sons, 60 skiffs, $1,704. Clements Bros., 6 barges, $22,200. S. W. Coflin & Son, 6 quarterboats, $31,200; 7 barges, $26,929; 21 pile drivers, $31,374; and 10 open flats, $1,240. M. A.

Sweeney Co., towboat, $21,450; 2 steam tenders, $9,960. L. H. Skinner, 53 large decked flats, $17,834.50; 40 small decked flats, $7,590, **93,** 2155.

1893. Diamond Jo Line Steamers, 3 office and sur. boats, $13,200, **93,** 2155. D. S. Barmore, 6 barges, $21,540. E. J. Howard, 4 quarterboats, $21,560; 6 barges, $21,900. M. A. Sweeney Co., steam tender, $6,990; 2 small steam tenders, $8,800; office and sur. boat, $4,340. T. G. Isherwood, 100 flats, $26,300. Davis Boat & Oar Co., 30 skiffs, $885; 10 yawls, $700. G. T. Nelles, 11 pile drivers, $39,490, **94,** 1585–87. St. Louis Refrigerator & Wooden Gutter Co., piles, $82,162.69, **94,** 1587.

1894. Interstate Lumber Co., 12 model barges, $40,620, **95,** 2069.

1895. E. J. Howard, tow and dr. boat, $27,375, **95,** 2069. F. Hartweg, piles, $76,316.25, **95,** 2070. J. Cleary, st., $5,800. Bussen Bros., st., $5,000. J. Burns, st., $13,500. Hooker Colville Steam Pump Co., steam pumps for tow and dr. boat, $2,575, **95,** 2071. South St. Louis Foundry, steam capstans with engines for tow and dr. boat, $2,160. H. E. Coffin, rope, $5,225, **95,** 2072. J. Cleary, second-class piles, $17,022.50, **96,** 1727.

1896. F. Hartweg, piles, $13,564.68, **96,** 1727. M. Lorenz, st., $10,400. A. Bussen, st., $5,200, **96,** 1728.

1897. J. H. Crowder, first-class piles, $36,540. J. H. Crowder and H. A. Russell, second-class piles, $19,788. E. E. Burke, st., $9,600, **97,** 2022. Bucyrus Co., 2 hydraulic drs., $204,800, **97,** 2023. Cincinnati Marine Ry. Co., 6 model barges, $21,582. D. S. Barmore, 12 model barges, $45,600, **98,** 1710.

1898. E. J. Howard, steel towboat, $67,750, **99,** 2067.

1899. E. J. Howard, 3 steel steamboat tenders, $54,450. T. J. Moss Tie Co., piles, $14,841. F. Hartweg, piles, $26,665.50. J. A. Lohrum, 20,000 c. y. st., $8,800. E. E. Burke, 20,000 c. y. st., $9,400. R. C. Arnold, 60 flatboats, $19,140, **99,** 2067.

1903. M. E. Leming, lumber, $16.90 M f.; Clay City Mfg. Co., lumber, $12 M ft.; Frederick Hartweg, piles, first class, 14½¢ l. f.; second class, 11¢ l. f.; H. W. Bussen, st., 55¢ c. y.; Albert Bussen, st., 55¢ c. y.; C. F. Liebke Hardwood Mill & Lumber Co., oak lumber, $52.50 M; Grafton Quarry Co., st. and spalls, 60¢ c. y.; K. H. Killebrew & Co., st. and spalls, 50¢ c. y., **03,** 1451.

1904. R. N. Davis, second-class piles, 4¾¢ to 5¾¢ l. f.; M. E. Leming, lumber, $14.35 M; Albert Bussen, st., 60¢ c. y.; C. C. Huthmacher, st. and spalls, 60¢ and 50¢ c. y., resp.; H. W. Bussen, st., 60¢ c. y.; C. D. Davis, st. and spalls, 59¢ and 50¢ c. y., resp.; John Cleary, piles, first class, 11¢, and second class, 6½¢ to 9¢ l. f., **04,** 2140.

1906. Dubuque Boat & Boiler Works, parts of 2 hydraulic drs., $238,000, **07,** 1548.

1907. E. H. Abadie Co., 4 main pumping engines and 2 centrifugal dr. pumps, $34,595, **07,** 1548. Schoellhorn-Albrecht Machine Co., 4 hauling winches, $6,400, **07,** 1549.

1908. Western Electric Co., engines, dynamos, searchlights and arc lights for 2 drs., $3,205, **08,** 1621. C. J. and F. E. Briner, wiring, lamps, etc., for 2 drs., $1,440, **08,** 1622.

1909. Ohio River Contract Co., dr., $13,500, **10,** 1764.

1910. W. L. Killebrew & Co., 30,000 cords brush, $61,500; A. J. Molt, 10,000 piles, $60,229.42; Wm. R. Bush Constr. Co., 10,000 c. y. st., $6,800; C. C. Huthmacher, 13,000 c. y. st. and 3,000 c. y. spalls, $12,000; American Bridge Co., 35 steel flatboats and 15 steel barges, $218,125, and 20 steeflatboats and 10 steel barges, $137,500; Edw. Christman, test borings for waterway, Lockport, Ill., to Miss. R., sur., $5,000, **11,** 1920.

1911. J. F. Oliver, 10,000 c. y. st. and 2,500 c. y. spalls, $9,500; H. R. Zadow, 14,000 c. y. st. and 3,500 c. y. spalls, $11,375, **12,** 2128.

ENGINEERS.

Chief of Engineers:

R., 93, 281; **94,** 256; **95,** 288; **96,** 250; **97,** 318; **98,** 310; **99,** 39, 370; **00,** 426, 430; **01,** 435, 439, 2226; **02,** 366; **03,** 390; **04,** 412, 415; **05,** 424; **06,** 462; **07,** 487; **08,** 520; **09,** 550; **10,** 619; **11,** 664; **12,** 803.

Boards:

BERH., 1903, submitted new proj. for estab. and mainten. of suitable chan. bet. Ohio and Missouri R. **R., 04,** 2145, 2148.

BERH. **R.** on closing of Missouri Chute **04,** 2153.

In charge:

Maj. C. J. Allen, 1893–95:

R., 93, 2147; **94,** 1577; **95,** 2059.

Maj. T. H. Handbury, 1896–99:

R., 96, 1717; **97,** 2012; **98,** 1698.

Capt. E. Burr, 1899–1901:

R., 99, 2058; **00,** 2631, 2667, 2669; **01,** 2169, 2226; special **R.** on discharge meas., **01,** 2199; special **R.** on lumber mattress for subaqueous bank protection, with sketch, **01,** 2212; special **R.** on road scraper and floating derrick as applied to grading R. banks to receive revet., **01,** 2225.

Maj. T. L. Casey, 1902–06:

R., 02, 1597; **03,** 1445; **04,** 2129, 2151; **05,** 1587; **06,** 1402.

Col. C. B. Sears, 1907:

R., 07, 1535.

Capt. G. R. Lukesh, 1908:

R., 08, 1614.

Col. W. H. Bixby, 1909:

R., 09, 1598.

Lt. C. H. Knight, 1910:
R., 10, 1756.

Lt. Col. C. L. Potter, 1911–:
R., 11, 1902; **12,** 2111.

Assistants:

D. M. Currie, principal assistant engineer:
R., 93, 2156; **94,** 1587; **95,** 2072; **96,** 1732; **97,** 2027; **98,** 1717; **99,** 2077; **00,** 2654; **01,** 2189.

G. Bagnall:
R., Twin Hollows, **93,** 2158; Horsetail Bar, Carrolls Isld., Twin Hollows, Chesley Isld., and Pulltight, **94,** 1595; Horsetail Bar, Pulltight, Sulphur Springs, Fosters Isld., Lucas, and Cornice Isld., **95,** 2082; Horsetail Bar, Twin Hollows, Sulphur Springs, Fosters Isld., Lucas, Cornice Isld., and Liberty, **96,** 1741.

W. S. Mitchell:
R., Pulltight, **93,** 2159; Ft. Chartres, **93,** 2162; assistant engineer on securing st., **93,** 2166; Ft. Chartres and Rush Tower, **94,** 1601; Michaels Landing, Ft. Chartres, Turkey Isld., Ste. Genevieve, Devils Isld., **95,** 2077; Michaels Landing, Danby Landing, Bruce Isld., Crook Landing, Turkey Isld., Ste. Genevieve, Liberty, **96,** 1735; Michaels Landing, Ste. Genevieve, Chester, Ill.; Tower Isld., and on portable jetties, **97,** 2032; **05,** 1597.

J. O. Holman:
R., Rush Tower, **93,** 2160; gauge relation at medium and l.-w. stages resulting from protection works, **96,** 1747; surs. and gauges, **97,** 2038; use of disc anchor, with plates, **01,** 2221.

C. D. Lamb:
R., Chesley Isld., **93,** 2162; supt. of securing brush, **93,** 2165; supt. of engineer depot, **93,** 2167; **94,** 1608; **95,** 2085; **96,** 1757; **97,** 2042; **98,** 1726; **99,** 2084; **00,** 2661.

E. D. Libby:
R., on procuring brush, **94,** 1606; on procuring riprapping at Little Rock, Mo., **94,** 1607; on procuring brush and st., **96,** 1745; **97,** 2041.

OPERATIONS.

1892-93. Hurdle built and one under constr. at Twin Hollows. At Pulltight, work carried on at 5 hurdles (repairs, extension, and constr. of a new one). Bank protection repaired at Chesley Isld., **93,** 2148. At Rush Tower, bank protection constr., portion of bank revet., hurdle repaired, and constr. of new ones begun. Bank protected at Ft. Chartres, and 2 hurdles built and repaired, **93,** 2149.

Detailed constr. account, **93,** 2169.

1893-94. At Horsetail, bank protection constr. and 7 hurdles built; 4 hurdles built at Carrolls Isld., **94,** 1579. Minor repairs and extensions to revet. made at Twin Hollows, and new revet. built. At Twin Hollows West, hurdles extended and repaired, and 6 new ones built. 7 hurdles built at Pulltight, and others extended. Bank protected at Chesley Isld., and revet. constr. and repaired. At Rush Tower, repair of hurdle and extension of bank protection. Bank protection extended at Ft. Chartres, and 6 new hurdles built, **94,** 1580.

Material used, **94,** 1581. Detailed constr. account, **94,** 1612.

Plant repaired, **94,** 1582.

1894-95. At Horsetail, banks protected, **95,** 2060. Additions and extensions made to 4 hurdles at Pulltight. New hurdles constr. at Sulphur Springs, and old ones extended and repaired, aggregating in all 7,595 l. f. Old revet. extended at Fosters Isld. At Lucas, additions, extensions, and repairs made to hurdles. Constr. of 5 hurdles at Cornice Isld. begun. New hurdle built and another repaired at Michaels, **95,** 2061. Bank protected at Ft. Chartres, and chan. obtained through shoals by portable jetties, **95,** 2062. Bank-protection work begun at Turkey Isld. At Ste. Genevieve hurdles repaired and extended, banks protected, and constr. of new works begun. Portable jetty placed at Devils Isld. to make chan. through bar, and dr. done by boat of Miss. R. Com., **95,** 2063.

Total constr. work: 19,530 l. f. hurdles built; 555 l. f. repaired; and 10,566 l. f. bank protection built, incl. extensions and repairs. Material used, **95,** 2064.

Plant repaired, **95,** 2065.

Details of cost of labor and materials, deterioration of plant, engineering and office expenses, towing, etc., **95,** 2087.

Table showing cost of works to 1895, **95,** 2088.

1895-96. Bank protected at Horsetail Bar and at Twin Hollows. Hurdles extended and strengthened at Sulphur Springs, **96,** 1719. W. side of Fosters Isld. protected. Series of short hurdles begun at Lucas, and also a new line of hurdles to extend the work downstream; upper series of hurdles strengthened. 5 hurdles completed at Cornice Isld. Hurdles at Michaels Landing previously commenced completed, repairs and extensions made; bank protected. Revet. work at Danby Landing begun, **96,** 1720. Bank revet. constr. at Ft. Chartres, and hurdles built. W. bank of Turkey Isld. revet. At Ste. Genevieve, hurdles repaired, and 10 addl. ones built; on the Missouri side, 6 hurdles completed and 5 partly so. Banks protected at Liberty, and 7 hurdles built, **96,** 1721. Experiments made with temporary expedients, **96,** 1722.

Additions made to the plant, **96,** 1723.

Table showing cost of constr. of works, **96,** 1728. Table showing cost to 1896, **96,** 1729.

1896-97. At Sulphur Springs, hurdles repaired, extended, and added to. Hurdle repaired at Michaels Landing and new one begun. Bank protection repaired at Rush Tower. Hurdle repaired at Ste. Genevieve, 4 extended, and small amount of protection works built. Bank opposite Chester, Ill., revetted, **97,** 2014. At Liberty, 4

hurdles completed and new one built; revet. also built. Slough closed at Powers Isld. by hurdle dam, **97,** 2015.

Dr. done at various short shoals, **97,** 2016.

6,560 l. f. portable jetties constr. at 6 localities (field expend. of, **97,** 2017), **97,** 2016.

Constr. of hydraulic drs. by contract begun, **97,** 2017.

Plant repaired, **97,** 2020.

Cost of works during the year, **97,** 2025. Cost of whole work to 1897, **97,** 2026.

1897-98. 4 hurdles built at Arsenal Isld. Revet. repaired at Twin Hollows. At Chesley Isld., bank revetted with st. Hurdle at Michaels Landing completed, st. dike built, and a large quantity of drift sunk to strengthen hurdle works, **98,** 1700. Bank covered with st. at Osborne Fields. Revet. repaired at Danby Landing and at Sycamore Landing. At Turkey Isld., bank protection repaired, **98,** 1701. Hurdles and revet. repaired at Ste. Genevieve and 5 hurdles built at Moro Isld., **98,** 1701, 1702. At Ste. Genevieve, Mo., l. w. and bank revet. constr. Revet. begun in previous year at Chesley Isld. continued. Revet. at Anchor Landing and Wagners Landing repaired, **98,** 1702. 2 permeable hurdle dams built at Hamburg and shore mattress protection constr., **98,** 1703. Hurdle and mattress protection constr.[1] at Devils Isld., **98,** 1704.

At old head of Devils Isld. Chute, hurdles Nos. 9 and 11 built, **98,** 1704.

Drift utilized for works protection at Powers Isld. and revet. repaired, **98,** 1704. Hurdle built at Buffalo Isld., **98,** 1705.

Work of a temporary character done at about 9 places by portable jetties, dr., etc., **98,** 1705, 1706.

Plant modified and repaired and added to, **98,** 1706, 1707, 1708.

Cost of works of the year, **98,** 1713. Total cost of works to 1898, **98,** 1715.

1898-99. Contraction works built at Lucas; revet. at Osborne Field and at Danby Landing extended to 16′ stage; Missouri revet. at lower end of Ste. Genevieve extended downstream and raised to 16′ stage; bank at lower end of Kaskaskia Isld. revet. to 16′ stage to prevent erosion; subaqueous mattress placed opposite Chester. Ill., to prevent erosion of bank; closing chute at Seventy-six Landing; at Commerce Isld.; bank revet. to 8′ stage at Burnham Isld.; at Goose Isld., to reduce excessive w. of R.; and at Buffalo Isld. to contract R. and close the chute e. of Blackbird Isld. Repairs made at Osborne Field, Danby Landing, Ste. Genevieve Reach, Hamburg, Devils Isld., Commerce Isld., and to the bank protection above Cairo. Work by means of portable jetties and dr. done at Harrisonville and Platin Rock, Ste. Genevieve Bend, Seventy-six Landing, and Philadelphia Pt., **99,** 2059.

1899-00. Work similar to that of last year carried on at opposite to Missouri R. mouth, Twin Hollows, Chesley Isld., Lucas, Calico Isld., Michaels Landing, Osborne Field, Danby Landing, Ste. Genevieve, Kaskaskia Isld., Horse Isld. (opposite Chester), Liberty, Hamburg, and Devils Isld. Temporary imp. work carried on with dr. appliances and portable jetties at Sulphur Springs, Turkey Isld., Ste. Genevieve Bend, and at entrance to the winter H., **00,** 2633.

For cost of the works, and details of constr., etc., see reports of engineers in charge and reports of assistants.

1900-01. Bank and subaqueous protections extended at mouth of Missouri; Osborne Field, Liberty, Ill., Horse and Devils Islds.; revet. and subaqueous mattress built at Rush, Towhead, Penitentiary Pt., Ste. Genevieve, Mo., and Buffalo Isld.; bank protection raised at Liberty, Ill.; hurdle built at Ste. Genevieve, Ill., and extensive repairs made to revet. works at Danby Landing and Cairo, and to hurdle at Liberty, Mo., **01,** 2169–71. Dr. at Sulphur Springs, Crystal City, Stantons Towhead, Manskers, and Bainbridge; buoys placed, **01,** 2172; additions to plant, **01,** 2173.

1902-03. 4 hurdles built at Lucas, Ill., and 8 at Liberty, Mo.; bank protections at Rush Tower, Danby Landing, Rush Towhead, and Chester, and part of Turkey Isld. and Ste. Genevieve repaired and raised to from 26′ to 30′, and at Liberty, Ill., to from 22′ to 25′; new mattress built and line of piles driven at Chester; mattress and revet. built at Greenleaf Bend and repairs made at Cairo, **03,** 1445–47. Dr. at Crystal City, Ste. Genevieve Bend, and Philadelphia Pt.; repairs to plant, **03,** 1447.

1903-04. Bank protections repaired and extended at mouth of Missouri, Penitentiary Pt., and Greenleaf Bend; banks protected with mattresses and revet. at Crain Isld., Buffalo Isld., Hurricane Field, and Greenleaf Bend; hurdles built at Pulltight, Ste. Genevieve, mouth of Kaskaskia, Crain Isld., Liberty, Mo., Willard, Goose Isld., Greenleaf Bend, and Greenfield Bend; and new hurdle dam at Chesley Isld.; bank protections repaired or rebuilt at Danby Landing, Chester, Liberty Bend, and Greenleaf Bend; hurdles rebuilt at Liberty, Mo., **04,** 2129–34. Dr. at Okaw Crossing and bet. Ste. Genevieve Bend, and mouth of Okaw R., **04,** 2134.

1904-05. Bank protection extended at mouth of Missouri, Osborne Field, Danby Landing, Crain Isld., Liberty Bend, and Hurricane Bend; banks protected with mattresses and st. at Cape Girardeau and Dogtooth Bend; hurdles built at Pulltight, Fish Bend, Danby Landing, Penitentiary Pt., Ste. Genevieve, Chester, Willard Landing, and Minton Pt.; bank protection repaired or raised at Osborne Towhead, Chester, Devils Isld., Greenleaf and Greenfield Bends; hurdles repaired or rebuilt at Ste. Genevieve, Crain Isld., and Devils

[1] Constr. in part with funds from unexpend. balance of app. of $22,500 made by act Aug. 5, 1888, exhausting the balance.

Isld., **05,** 1598–1601. 525,000 c. y. dr. from various bars, **05,** 1602. Repairs and additions to plant **05,** 1603. Quarries, **05,** 1604.

1905-06. Bank protection at Sawyer Bend repaired and extended; hurdles built at St. Louis H., **06,** 1405–06. 280,000 c. y. dr. from various bars, **06,** 1406. Repairs, alterations, and additions to plant, **06,** 1407.

1906-07. Bank protection at Chesley Isld. repaired and extended; and banks protected at James Landing, Osborne Field, and Eliza Towhead; hurdles built at Osborne Field, Penitentiary Pt., and Crain Isld.; hurdle repaired at Willard Landing, and hurdle dams at Crain and Devils Islds., **07,** 1542–46. 1,279,000 c. y. dr. from various bars; repairs, alterations, and additions to plant, **07,** 1546.

1907-08. Bank protection extended at James Landing and Osborne Field; hurdle dams at Crain Isld., Willard Landing, and Devils Isld. repaired; spur hurdles built and bank protection repaired at Crain and Devils Islds., **08,** 1616–17. 989,000 c. y. dr. from various bars; repairs and alterations to plant, **08,** 1619.

1908-09. Bank protections repaired at James Landing, Liberty, Beech Ridge, and Cairo; hurdles built at Eliza Towhead, **09,** 1599, 1600–01. 1,335,350 c. y. dr. from various bars, **09,** 1601. Repairs, alterations, and additions to plant, **09,** 1602.

1909-10. Part of mattress and revet. work rebuilt and 3 short hurdles built at Pulltight; part of mattress and revet. work rebuilt at Chesley Isld.; part of mattress and revet. work rebuilt and 2 short hurdles built at Foster Isld., **10,** 1758. Part of mattress and revet. work rebuilt and 3 short hurdles built at Forest Home; part of mattress and revet. work rebuilt at Chester; part of mattress and revet. work rebuilt and a short hurdle built at Crain Isld., **10,** 1759. Mattresses built, st. work restored and 2 short hurdles built at Liberty Bend, Ill., **10,** 1760. 1,750,000 c. y. dr. by U. S. drs. from various bars, and 21,678 c. y. under contract from Grand Tower, **10,** 1761. Repairs to plant and damage by flood, **10,** 1762.

1910-11. Repairs to bank protection at mouth Mo. R., Sawyers Bend, Chester, Mo.; repairs to hurdles, restoration and extension of bank protection at St. Louis H., Arsenal Isld., Pulltight, Ill., Ft. Chartres, Mo.; repairs to revet. at Horsetail, Mo., Twin Hollows, Mo., Devils Isld.; new hurdles built at Union Pt., Ill., Crawford, Mo., Hanging Dog, Ill.; new bank protection built and repaired at Ft. Chartres, Ill., Liberty, Ill.; obstr. removed from Beaver Dam Rock; 3,500,000 c. y. dr. at various localities, R. gauges maintained, plant repaired, and series of test borings for Deep Waterway Board made, etc., **11,** 1902. Table of work in detail done by each dr., **11,** 1914.

1911-12. Repairs made to revet. at Twin Hollows, repairs and extension to hurdles at Pulltight, Ill., Sulphur Springs, Ill., Lucas, Ill., Penitentiary Pt., Liberty, Mo., Hanging Dog Isld., Ill., Union Pt., Ill., Crawford, Mo.; repairs to hurdles, paving, new bank protection built and repaired at Ft. Chartres, w. and e. side, Ill., Devils Isld., Ill., Eliza Towhead, Ill., Greenfield Bend, Mo., Chester, Mo.; 1,265,000 c. y. dr. by suction dr., 35,750 c. y. by dipper dr.; detailed statement given of dr. operations for year, repairs to plant, etc., **12,** 2113.

(NOTE.—Tabulated statements of character, amount, and cost of work, and accounts of property and material, printed each year in district engineer's report.)

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2151; **94,** 1583; **95,** 2066; **96,** 1722; **98,** 1705.

Damage of works by ice, etc., **93,** 2149; **97,** 2014; **98,** 1701, 1704.

Gauges, **93,** 2150; **95,** 2065; **96,** 1724.

Gauge relations, change of, at medium and low stages resulting from contraction works, **96,** 1747. Gauge readings and elevations at Bissells Pt. and St. Louis, **96,** 1750. Distances measured in the l.-w. chan. of 1895. St. Louis gauge, highest and lowest readinges ach month. Water surfaces at the gauges, **96,** 1752. Slope bet. gauges at medium and low stages. Oscillation bet. medium and low stages, **96,** 1753. Chan. crossings; average monthly d. during l.-w. period, **96,** 1754. Average monthly readings during l.-w. period. October averages of chan. and slope, **96,** 1755. Contraction works, **96,** 1756.

Depth on bars bet. St. Louis and Cairo, **93,** 2172.

Immense quantities of drift carried down by stream. This lodges against hurdles, and is sunk and made to strengthen these works, **94,** 1581; **95,** 2064; **98,** 1701, 1704.

Description of, at Ft. Chartres. Chan. through shoals obtained by portable jetties, **95,** 2062.

Description of, Devils Isld., **95,** 2063; **98,** 1704; Michaels Landing, **96,** 1720; Ste. Genevieve, **96,** 1721; Liberty, **96,** 1721.

Slope changes in the parts of the R. under imp., **96,** 1724.

Table of distances measured in l.-w. chan., 1895, **96,** 1752.

Description of, Powers Isld. Effect of closure of Doolans Slough to lessen trouble with shoals, **97,** 2015; **98,** 1704.

Description of, bet. Red Rock and Cairo. Gauges, **97,** 2039. Table of slopes bet. gauges, **97,** 2040. L.-w. gauge readings, 1891–96, **97,** 2040. Character of R. bed, etc., as determined by test borings. Discharge, **97,** 2041.

Description of, Arsenal Isld., **98,** 1700. Hamburg, Ill., Reach, **98,** 1703; closure of chute bet. islds. and Illinois shore by hurdles effective in increasing d., **98,** 1703; **99,** 2061.

Plates showing this part of the R. and the relation of the various works to each other and to the section of the R. affected by each, **00,** 2637, 2660.

Table of discharge measurements for 1900, **00,** 2659; 1901, **01,** 2197; 1902, **02,** 1598.

Description of, below Rockwood, Ill., **00,** 2669.

Description of Harrisonville H. and effect of contraction works there, **01,** 2227.

Difficulty of making ests. owing to tendency of chan. to shift, **04,** 2146.

Difference of hydraulic conditions above and below mouth of Ohio R., **04,** 2149.

Memorandum, by Col. Bixby, concerning lowering l.-w. plane in St. Louis H., with suggestions for correction, **09,** 1603.

Lowest stages at St. Louis and Grays Pt., 1878 to 1909, incl., **09,** 1606.

Gravel bar at Grand Tower, **10,** 621.

Damages to plant by ice gorges breaking up, **10,** 1762.

Discharge measurements, special reports on, **01,** 2194, 2197; **02,** 1598; **03,** 1449; **04,** 2135–36; **05,** 1605; **09,** 1603; **10,** 1763; **11,** 1917; **12,** 2126.

Chan. conditions, **12,** 2125.

Stages, **12,** 2124.

Gauges maintained and records plotted each year.

PRIVATE WORK.

Repairs to revet. at Sawyer Bend by Chicago, Burlington & Quincy Ry. Co., **05,** 1598.

Bank revetted at Cape Girardeau by St. Louis, Memphis & Southeastern Ry. Co., **05,** 1601.

PROJECTS.

Works of imp. so effective at Horsetail Bar (formerly probably one of the worst localities) that this locality is omitted from the list of those at which soundings are taken by steamboat men, **96,** 1719.

Act 1896 contained mandatory clause that $30,000, or as much of this amount as might be necessary, should be spent to remove the bar in front of Chester, Ill., and to protect w. bank opposite Chester, **97,** 2014. Act also provided that $50,000 might be spent for bank protection on e. side of the R. opposite mouth of Missouri R., **97,** 2021, and act of Mar. 3, 1899, $50,000, **99,** 2065.

Act June 3, 1896, provided that as much as might be necessary of the available funds should be applied to constr. of drs., portable jetties, and other suitable appliances; and mainten. and operation of same, with view to obtain and maintain chan., St. Louis to Cairo, not less than 9′ x 250′ at all periods of the year except when navigation would be closed by ice, **98,** 1709.

Development of various forms of constr. used and résumé of the various types used bet. 1872 and 1894, **94,** 1577. Minor changes, **95,** 2059; **96,** 1717; **97,** 2012; **98,** 1698.

App. of $1,000,000 an. recom., 1899–1900, by Capt. Burr for intelligently and economically carrying on the work, **00,** 2639.

Capt. Burr est., 1899, $174,000 to prevent cutting and caving of the banks, etc., at and near Wagners Landing, Ill., **00,** 2671.

By BERH., 1903, for estab. and mainten. of chan. 8 x 200″, and wider at bends, bet. St. Louis and Cairo, and 6′ bet. St. Louis and mouth of Missouri; est., by contraction works and bank protection, $20,000,000, and $400,000 an. for mainten. by dr., $450,000 for plant, $250,000 an. for operation of plant, and $300,000 an. for other work until results of dr. be known,[1] **04,** 2147.

By Maj. Casey, 1905, expend. available balance on emergency work, care of plant, drs., etc., and 1905 app. of $650,000 on alteration of drs., building 2 drs., dr. and contingent expenses, **05,** 1589.

Maj. Casey believes that an. expend. of $500,000 or $600,000 would be cheaper in the end, than to complete "present" proj. at cost of $22,000,000, **05,** 1590.

Act Mar. 3, 1905, au. dr. which virtually would stop all constr. work, **06,** 1403.

Col. Bixby suggested, 1908, constr. of a series of weirs, dams, and revet. to raise l.-w. plane at and above St. Louis; est., $1,300,000, **09,** 1609.

Act June 25, 1910, restores plan adopted 1881, together with dr., with view to completion within 12 years, **10,** 620.

SURVEYS.

Minor sur. (See an. reports of engineer in charge and assistants.)

Resur. of R. at l.-w. stage from Red Rock, Mo., to mouth of Ohio R. made, 1896–97, **97,** 2020.

Ex. and sur., with est., for imp. of chan. and to prevent cutting and caving of banks on the Illinois side at or near Wagners Landing, Jackson Co., below Rockwood, Ill., au. act Mar. 3, 1899; made, 1899, by Capt. Burr (see Projects). (Maps, **00,** 2660); **00,** 2668, 2669.

Pre. ex. au. act June 6, 1900, of Harrisonville H., with view to restoring it. **R.** by Capt. Burr, Aug. 31, 1900[2] (unfav.), **01,** 2226.

From mouth of Missouri R. to R. Des Peres for estab. of H. lines, **03,** 1450.

Pre. ex. au. act June 13, 1902, with view to closing Missouri Chute bet. Puckett Isld. and the Missouri shore. **R.** by Maj. Casey, Sept. 11, 1902[3] (unfav.), **04,** 2150.

Of St. Louis H., au. act Mar. 3, 1905 (see St. Louis H.), **06,** 1407.

Ex. and sur. au. act June 25, 1910, opposite city of St. Louis, from s. end of Cabaret Isld. to n. end of Arsenal Isld., with view to providing suitable chan. by revet. of bank, **12,** 807.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 805.

[1] H. D. 168, 58th, 2d. [2] H. D. 71, 56th, 2d. [3] H. D. 76, 58th, 2d.

Maps. **93,** 2152; **94,** 1582; **95,** 2090; **96,** 1758; **97,** 2046; **98,** 1722; **99,** 2084; **00,** 2660.

Mouth of Missouri to St. Louis, **05,** 1606.

St. Louis to Cairo, **05,** 1606.

Hydrographs, **05,** 1606.

Discharge charts, **05,** 1606.

Sawyer Bend and St. Louis H., **06,** 1402.

James Landing, **09,** 1599.

Wagners Landing, **09,** 1600.

Showing localities dr., **09,** 1602.

Slope profile, discharge curve, and hydrograph, **09,** 1610.

Mouth of Missouri R. to Waters Pt., **09,** 1610.

Missouri R. to Ohio R. (4 sheets), **10,** 1758.

Showing imp. works, Missouri R. to Ohio R. (4 sheets), **12,** 2120.

HH-127 (d) Mississippi River—Falls of St. Anthony to (Ohio R.) Cairo, Ill. ("Transportation Routes to Seaboard.")

APPROPRIATION.[1]

1874, $200,000[2] for sur. and reports, **75,** 34. (See p. 1166.)

COMMERCE.

Requirements of, **75,** ii, 484, 485.

CONTRACTS.

Disadvantages of contract system, **75,** ii, 493.

ENGINEERS.

Chief of Engineers. R., 75, 37, 66; **76,** 92.

In charge:

Col. J. N. Macomb, Falls of St. Anthony to mouth of Illinois R. **R., 75,** 63, ii, 454, 467; **76,** ii, 176.

Col. J. H. Simpson, mouth of the Illinois R. to Cairo, **75,** 65, ii, 471.

Assistants:

M. Meigs. **R., 75,** ii, 455, 467; **77,** 534.

C. W. Durham. **R., 76,** ii, 177.

ESTIMATES. (See Plans and Projects.)

By M. Meigs, 1875, imp. R. to l.-w. d. of 4½′ bet. St. Paul and La Crosse, 144 m., $348,670, **75,** ii, 454, 466; **76,** ii, 180, 189.

By C. W. Durham, 1876, similar imp. bet. St. Paul and Montrose, 491 m., as follows: St. Paul to La Crosse, 144 m., $348,670, **75,** ii, 454, 466; **76,** ii, 180, 189. La Crosse to Rock Isld. Rapids, 217 m., $105,459, **76,** ii, 185, 189. Rock Isld. to Des Moines Rapids, 130 m., $163,234, **76,** ii, 188, 189.

By Col. Macomb, 1875, imp. Rock Isld. Rapids to 4′, $80,000; 4½′, $507,092; 5′, $1,102,428; 6′, $2,403,590, **75,** ii, 469. Imp. Des Moines Rapids to complete to 5′, $480,000; for 6′, $953,133, **75,** ii, 471.

By Maj. Farquhar, 1879, imp. R. bet. Des Moines Rapids and Illinois R. at points obstr., $921,294; maintaining and rectifying chan., $1,125,102, **79,** 1123.

By Col. Simpson, 1875, imp. R. to l.-w. d. of 6′ bet. mouths of Illinois and Ohio Rs., as follows: Imp. R., $3,159,200; protecting banks, $4,000,000, **75,** ii, 493, 495.

PHYSICAL CHARACTERISTICS.

Of R. bet. St. Paul and mouth of Ohio, **75,** ii, 457, 471, 491.

Sediment, amount and effect of, **75,** ii, 473, 477, 481, 483, 502.

Sand bars, formation of, **75,** ii, 457, 474, 476, 502; **76,** ii, 179.

Progressive motion of, **75,** ii, 477, 484.

Rise of R. bottom during floods, **75,** ii, 477, 502.

Shifting of navigable chans., **75,** ii, 474; **76,** ii, 179.

Discharge of R., **75,** ii, 458, 475; **76,** ii, 178.

Fall of R., **75,** ii, 459, 471; **76,** ii, 178.

Floods in Mississippi and Ohio Rs. at different times, **75,** ii, 473.

Difference bet. waters of Mississippi and Missouri Rs., **75,** ii, 473, 482.

Current velocities, **75,** ii, 458, 476.

Section relation bet. h. and l. w., **75,** ii, 476.

Profile of water gauges, **75,** ii, 466.

River bends, effect of, **75,** ii, 488.

Natural division of R. bet. Illinois and Ohio Rs. into 3 sections, **75,** ii, 471.

PLANS. (See Estimates and Projects.)

Constr. of wing dams, **75,** ii, 461, 466. Action of wing dams, **75,** ii, 460. Strength of brush dams, **75,** ii, 462. Removal of bars by scraping com-

[1] Work for which app. should be first made, **76,** 643, 654. Effect of small app. on ultimate cost, **76,** 82, 646. Should be confined to works in progress, **77,** 82, 512.

[2] $10,000 allotted from this for Mississippi route, third division; $60,000 for Northern route, third subdivision; $46,000 for Southern route.

pared with results from portable dams, **75,** ii, 485 Plan of increasing l.-w. discharge by reservoirs applicable only to small Rs., **75,** ii, 486.

PROJECTS. (See Estimates and Plans.)

By Col. Macomb, 1875, imp. bet. St. Paul and mouth of Illinois R. to l.-w. d. of 4½′, by contraction and direction of R. by wing dams, closing of chutes, scraping at bars, and shore protection, **75,** ii, 462, 466; **76,** ii, 179.

By Col. Simpson, 1875, imp. bet. mouths of Illinois and Ohio Rs. to l.-w. d. of 6′ from mouth of Illinois to St. Louis and 8′ from St. Louis to Ohio R., **75,** ii, 483. By imp. of natural chans. by permanent means (use of l.-w. dams and dikes on brush foundations, with riprap superstr.); unification of chans. to single chan. of moderate w., **75,** ii, 489, 494, 495. General considerations affecting the proj., **75,** ii, 485, 489. Work to be done in 4 years, at a cost for imp. of special points, of $3,159,200; for mainten. and protection of banks, $4,000,000, **75,** 481, ii, 493; **76,** 643, 646; **77,** 513. Distinction bet. works of imp. and protection, **75,** ii, 493; **76,** 643, 654; **77,** 508, 512.

SURVEYS.

Bet. St. Anthony and Illinois Rs., 1874, **75,** ii, 454; **76,** ii, 176.

Bet. Illinois and Ohio Rs., 1874, **75,** ii, 471, 474.

Bet. Minnesota and Ohio Rs., 1866–69, **75,** ii, 455. Necessity of referring surs. to reference points beyond destructive action of Rs., **75,** ii, 456, 474.

HH-129(a) Mississippi River, at Beechridge, Above Cairo, Ill.

APPROPRIATIONS. (See p. 1089.)

ENGINEERS.

Chief of Engineers. R., 97, 321; **98,** 313; **99,** 373, 375; **00,** 429, 431; **01,** 438; **02,** 369; **03,** 392.

In charge:

Maj. T. H. Handbury, 1897–99. **R., 97,** 2047 **98,** 1732.

Capt. Edw. Burr, 1899–1901. **R., 99,** 2088; **00,** 2666, 2672, 2674; **01,** 2198.

Maj. T. L. Casey, 1902–03. **R., 02,** 1606; **03,** 1455.

OPERATIONS.

1897-98. Hurdle 275 l. f. long built, and over 16,000 l. f. bank revet., **98,** 1732.

1898-99. Revet. extended downstream 1,185′, and was carried up to levels varying from 30′ to 14′ above l. w. at the Cairo gauge, **99,** 2089.

1899-00. 5,000′ of the revet. raised to 33′ stage and for the remainder of its length to the 24′ stage; repairs made to the work done in previous years, **00,** 2666.

1902-03. Revet. repaired, **03,** 1455.

PHYSICAL CHARACTERISTICS.

The national cemetery at Mound City, at the mouth of Cache R., and the marine hospital at Cairo, probably in imminent danger of destruction by the breaking through of the Mississippi into Cache R., **97,** 2047.

Description of locality, **00,** 2675.

PROJECTS.

Congress, by sundry-civil act June 4, 1897, on information not obtained from the Engineer Dept., provided money to prevent the Mississippi from breaking into Cache R., near Cairo. Maj. Handbury submitted a proj. for revetting the bank from a point a short distance above the nearest point to Beechridge Station, as far as the funds would permit, after building a short hurdle to protect the revet., **97,** 2047; **98,** 1732.

Capt. Burr believed, 1899: (1) There was no immediate danger of the Mississippi R. breaking through into Cache R. at or near Beechridge, Ill., but there was danger of the partial or complete destruction of the incomplete work already begun for the prevention of caving of the bank at that place. (2) It would be desirable to make specific app. to protect the banks of the Mississippi R. at Beechridge, Ill. (3) It might cost $216,000 to make the desired imp., **00,** 2676, 2677.

SURVEYS.

Sur. made, 1898, of Greenleaf Bend in the R., and of Cache R. from this vicinity to its mouth on the Ohio R., near Mound City, Ill., **98,** 1732.

Ex. and sur. of Mississippi R. at or near Beechridge, Ill., to ascertain danger of said R. breaking through into Cache R., and whether it was desirable to make further specific app. to protect banks of the Mississippi R. at said place; and if so, the cost thereof, au. act Mar. 3, 1899; made, 1899, by Capt. Burr (**R.** fav.; see Projects), **00,** 2673, 2674.

Maps. **98,** 1732.

HH-188 St. Louis Harbor, Mississippi River.[1]

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Importance of H., **71,** 321, 327.

Injury to shipping from ice, **77,** 81, 505.

Necessity of winter H., **77,** 81, 506.

ENGINEERS.

Chief of Engineers. **R., 71,** 58; **72,** 54; **73,** 54; **74,** 60; **75,** 66, 511; **76,** 80; **77,** 81; **78,** 93; **79,** 118; **80,** 160; **81,** 222, 1574; **82,** 220; **89,** 230; **91,** 260; **92,** 250; **93,** 282; **94,** 258; **95,** 289; **96,** 252; **97,** 320; **98,** 312; **99,** 373; **00,** 428; **01,** 438; **02,** 368; **06,** 464.

Boards:

Convened, 1872, to ex. and report on condition of R. bet. Alton and mouth of Meramec R., with view to preparation of plans for imp. of * * * St. Louis H. and protection of banks * * * near St. Louis, **72,** 54, 358. Recom. imp. of H. by ultimately making e. shore throughout entire l. of H. parallel to city front, reducing w. of R. to 1,200′ or 1,500′ with longitudinal dikes or jetties. Reported that demands of C. required R. from Bischoffs Dike to East St. Louis Levee to be confined to above w. by raising and extension of Venice and Long Dikes, **72,** 55, 364, 366; **73,** 453; **74,** 327. (Lt. Cols. Newton and Raynolds, Majs. Warren and Merrill, and Capt. Allen.)

Convened, New York, Sept. 30, 1880, to report upon necessity for and location of ice H. according to proj. of Capt. Ernst, **81,** 1576–1582. Board doubtful as to necessity of ice H. at locality, **81,** 1575, 1577, 1583. (Cols. Tower and Newton and Lt. Col. Abbot.)

In charge:

Lt. Col. W. F. Raynolds, 1871–73. **R., 71,** 312, **72,** 349.

Col. J. H. Simpson, 1873–79. **R., 73,** 453; **74,** 325; **75,** 477, 497; **76,** 636; **77,** 505; **78,** 679; **79,** 1024, 1045.

Maj. O. H. Ernst, 1880–82. **R., 80,** 1390; **81,** 1573, 1578, 1582; **82,** 1648.

Maj. A. M. Miller, 1888–92. **R., 89,** 1711; **91,** 2109; **92,** 1737.

Maj. C. J. Allen, 1893–95. **R., 93,** 2177; **94,** 1615; **95,** 2091.

Maj. T. H. Handbury, 1896–98. **R., 96,** 1760; **97,** 2046; **98,** 1730.

Capt. Edw. Burr, 1899–1901. **R., 99,** 2087; **00,** 2664; **01,** 2198.

Maj. T. L. Casey, 1902. **R., 02,** 1604.

Assistants:

Capt. Allen. **R., 71,** 314; **72,** 350.

R. E. McMath. **R., 73,** 453.

D. M. Currie. **R., 79,** 1034; **91,** 2110; **92,** 1738.

J. O. Holman. **R., 91,** 2110; **92,** 1738.

ESTIMATES. (See Plans and Projects.)

By BE., 1872, to meet demands of C. by raising and extending Venice and Long Dikes, $197,324, **72,** 55, 364, 366; **73,** 455; **74,** 326; **76,** 636, 645.

By Col. Simpson, 1875, closing Cahokia Chute, chan. e. of Arsenal Isld., with low dam, $75,000, **75,** 505; **76,** 642; **77,** 505; **78,** 93. 1877. Changed to high dam, with isld. revet., $104,600, **77,** 514; **78,** 686.

By Col. Simpson, 1879, dikes at Bloody Isld., 1st, $549,950; 2d, $392,200; 3d, $13,380, **79,** 1047.

LEGISLATION.

Necessity of, for fixing H. and chan. lines at and near city of St. Louis, **75,** 66, 505, 511, 513.

OPERATIONS.

1872–75. At Venice and Long Dikes, **73,** 54, 454; **74,** 66, 324; **75,** 65, 477.

1875–76. Limited to repairs, **76,** 80, 635.

1876–77. Limited to repairs; revet. of Arsenal Isld. and abutments for dam; closing Cahokia Chute, **77,** 81, 504.

1877–78. Preservation of works at Sawyer Bend; extension of revet. at Cahokia Chute, **78,** 93, 678.

1878–79. Preservation of works at Sawyer Bend; completion of dam (closing Cahokia Chute) to height of 9′ above l. w.; revet. of Arsenal Isld., **79,** 119, 1024, 1027, 1035.

1890–91. 12,400 l. f. of hurdle dike built, **91,** 2109.

1891–92. 1,685 l. f. of hurdle dike built, **92,** 1783.

1901–02. Long Dike and Bischoff Dike raised and strengthened, and Hurdle No. 10 repaired and lengthened, **02,** 1605. Itemized statement of cost of work of during year, etc., **02,** 1602.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2092.

Extent and character of accretion produced by hurdles constr. in 1892; accretion increasing yearly, **94,** 1616; **95,** 2092.

PLANS. (See Estimates and Projects.)

Early plans for imp. H., **71,** 321; **72,** 349.

By Col. Simpson, 1879, dike from Bloody Isld. opposite city of East St. Louis n. to the dike opposite Brooklyn on the Illinois shore; reported unnecessary and injudicious, **79,** 1047.

By Maj. Ernst, 1880, formation of ice H. at Cahokia Chute, e. of Arsenal Isld., with levees, dams, and jetties; est., $182,000, **81,** 1581, 1582.

Inexpediency of an ice H. at locality proposed, **81,** 1575, 1577, 1583.

[1] Sur.—**R.,** Dec. 6, 1837, est., $158,554; Nov. 4, 1844, est., $262,900; Mar. 1, 1845. (H. D. 482, 55th, 2d.)

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

PRIVATE (CITY) WORK.

By St. Louis, to protect H., **71,** 321; expending, up to 1869, $840,121, **71,** 59.

Encroachment of city on waterway, **75,** 66, 497, 511, 513.

PROJECTS. (See Estimates and Plans.)

Early proj. for imp. H., **71,** 321.

Capt. Allen, 1871, reported preferable plan to be contraction of waterway, consistent with stable regimen, with longitudinal dikes throughout entire l. of H., **71,** 326.

Chief of Engineers, 1872, regarded fav. canalizing of entire l. of H., **72,** 348.

BE., 1872, considered that, ultimately, the R. throughout l. of H. should be made to flow in a permanent chan. with jetties or longitudinal dikes, bringing e. shore parallel with the w. and distant therefrom from 1,200′ to 1,500′. Demands of C. required R. from Bischoffs Dike to East St. Louis Levee to be confined within above-named limits, by the raising and extension of Venice and Long Dikes; est., $197,324, **72,** 55, 364, 366. Began in 1872, **73,** 54, 454.

Closing Cahokia Chute chan. e. of Arsenal Isld.; ultimate necessity, **75,** 504.

Action of city of St. Louis in building dike from shore into w. chan. of Arsenal Isld. complicated question of closing Cahokia Chute, **75,** 503, 511; producing erosion of Arsenal Isld. and unfav. affecting imp. at Horsetail Bar, **76,** 81, 637.

Rapid destruction of Arsenal Isld. made its protection and the closing of Cahokia Chute imperative; est., $104,600, **76,** 642. Work began, **77,** 81, 505.

Danger to H. and shipping from ice from throwing entire volume of R. through w. chan. necessitating raising of dike and formation of winter H. in pool below dike, e. of Arsenal Isld., **77,** 81, 505.

By Maj. Miller, 1888, removal of bars in upper H. with 19,800 l. f. of permeable pile and brush contraction works; est., $181,863, **89,** 1712.

SURVEYS.

69, 43, 108; **70,** 31, 228.

71, 58, 312, 314; **72,** 350.

76, 643, 644.

79, 120, 1031, 1045.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Miller, **89,** 1711.

Minor, **02,** 1606.

Ex. and sur. au. act Mar. 3, 1905, of H. and approaches to St. Louis, with view to preventing floods by reason of obstr. in Mississippi R. **R.** by Maj. Casey[1] (unfav.; see Ohio R. to Missouri R.) **06,** 464.

Maps. **91,** 2110; **92,** Atlas, 89.

HH-194(a) Missouri River to Minneapolis, Minn.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Large and important. Navigability of R. governs rates on RRs. of adjacent country, **93,** 2203.

Lake Pepin: After ex. of 1892, addl. Hs. of refuge recom., but one at that time thought sufficient, **93,** 2257.

Oquawka to Dallas City: After sur. of 1896, shown that levees proposed would not benefit navigation, but would increase value of lands protected, **97,** 2113.

City of Ft. Madison to Skunk R.: After sur. of 1896, similar conditions as in preceding note, **97,** 2132.

Drurys Landing to New Boston: Sur. in 1897. See preceding note, **97,** 2116.

Lagrange to Hannibal: See preceding note, **97,** 2122.

Egyptian Levee: See preceding note, **97,** 2126.

Iowa R. to Muscatine: See preceding note, **97,** 2133.

Quincy Bay H., Ill., C. important, **04,** 2219.

Comparison of freight rates bet. points having water competition and an inland point, **06,** 466.

In 1905, 4,089,318 t., **06,** 466; in 1911, 2,081,566 t., **12,** 809.

Diagram showing relation of tonnage app. and valuation, **12,** 2163.

Statement of freight rates by rail and R. from St. Louis to several points on upper Miss. R., **12,** 807.

CONTRACTS.

1892. M. Ahern, Chas. Sjogren, riprap r., $12,400; H. Ames, brush, $3,500; F. N. Truax, brush, $3,250; A. Kirchner, dams and shore protections, $47,250; **93,** 2207. E. R. Leach, riprap r., $2,500; A. Kirchner, riprap r., $15,900; dams and shore protections, $51,500; J. Schmoker, brush, $12,200, **93,** 2208. A. J. Whitney, dams and shore protections, $49,750; Patterson Bros., similar work, $49,750; D. M. Richardson, S. Monroe, riprap r. and slope-wall r., $1 960, **93,** 2209. W. Engelhard, riprap r., $3,900; W. A. Shain, brush, $1,400;

[1] H. D. 772, 59th, 1st.

P. Pence, brush, $750; Thompson & Gray, dams and shore protections, $92,000, **93,** 2210.

1893. Tacoma Mill Co., fir and cedar timber, $3,207.31; H. S. Brown, pile bulkhead, $8,900, **93,** 2211. J. Benson, furnishing r. on U.S. barges, $5,450; C. Massueger, furnishing brush on U.S. barges, $8,850, **94,** 1644. J. Richtman, shore protections, $44,000; A. Kirchner, riprap r., $5,300; C. Massueger, brush, $6,125, **94,** 1645. V. A. Bigelow and A. B. Teasdale, dams and shore protections, $38,500, $42,750; A. K. Roberts, furnishing riprap r. on U.S. barges, $16,325, **94,** 1646. Gasaway Bros., furnishing brush on U.S. barges, $4,500; M. H. Rogers, similar material, etc., $2,800; W. A. Shain, similar material, etc., $1,500; S. Monroe, similar material, etc., $6,000, **94,** 1647. J. Short, dams and shore protections, $46,000, $50,400; J. Richtman, similar work, $64,750, **94,** 1648. Hunter & Frey, furnishing brush on U.S. barges, $12,000, Patterson Bros., dams and shore protections; $38,000, **94,** 1649.

1894. A. Kirchner, dams and shore protections, $29,750, **95,** 2115; $29,750, **95,** 2116. J. Richtman, similar work, $31,000, $31,000, **95,** 2116; $26,500, $32,500, $30,000, **95,** 2117. A. J. Whitney, dr., 8.9¢ c. y., **95,** 2118.

1895. Patterson Bros., dams and shore protections, $31,900; Casgrain & McDonald, enlargement and repair of levees, $26,850, $32,850, **95,** 2118. A. Kirchner, dams and shore protections, $28,500, $28,500; J. Short, similar work, $32,700, **95,** 2119; $29,100, **95,** 2120. M. H. King, levees, $57,260, **96,** 1781.

1896. Patterson Bros., levees, $26,700; E. Callahan, levees, $15,732.50; J. A. O'Keefe & Co., levees, $46,755, **96,** 1782. A. J. Whitney, dr., 19¾¢ c. y.; C. H. Appleton, 15¢ c. y.; Fetter & Crosby, dams and shore protections, $37,000; A. Kirchner, similar work, $31,250, **97,** 2065; $29,750, $51,500. Patterson Bros., similar work, $26,750, **97,** 2066.

1897. A. Kirchner, dams and shore protections, $25,600; G. W. Farley & Co., similar work, $26,600; Patterson Bros. similar work, $39,000, **98,** 1753. A. Kirchner, $30,000; J. Short, similar work, $50,000; C. H. Appleton, dr., 14.9¢ c. y., **98,** 1754. A. J. Whitney, dr., 15¢ c. y.; McDonnell & Kennedy, levees, $62,649, **98,** 1755.

1898. J. Richtman, dams and shore protections, $37,500; J. Pickley, similar work, $66,842.50; Fetter & Crosby, $40,960; A. Kirchner, $108,390; J. Short, $88,200, **99,** 2109–2114

1899. B. H. Veto, riprap r., $4,650; brush, $3,440; H. Denno, riprap r., $2,600; M. E. Hueston, riprap r., $5,500; J. Short, riprap r., $7,840; brush, $10,000; M. Rust, brush, $24,040; Betts & Bolin, $3,100; A. C. Brant, $6,020; Mason & Winters, $11,055; W. O. Johnson & Sons, levees, $35,325; Cameron, McManus & Joyce, $19,053; H. S. Brown, dr. 15¢ c. y. ($100,000); A. Kirchner, dams and shore protections, $184,103; J. Richtman, $127,883; J. Pickley, $151,409; Fetter & Crosby, $232,878; J. Pellowski, riprap r., $3,240; W. L. Adams, $3,000; Pratt & Cash, $15,000; J. Kimmes, $9,800; C. Ott, brush, $13,500; G. L. Nichols, $3,250; J. W. Nason, $1,260, **99,** 2112.

1900. E. J. Howard, wooden hull ss., $32,000, **00,** 2698.

1902. Albert Kirchner, building dams and shore protections, Rock Isld. to Burlington, r., 97¢; brush, 28¢ c. y.; Burlington to Hannibal, r., 98¢; brush, 29¢ c. y., **03,** 1473.

1903. Fetter & Crosby, building dams and shore protections, Bellevue to Le Claire, r., $1.39; brush, 56¢ c. y., **04,** 2170. Albert Kirchner, building dams and shore protections, Burlington to Hannibal, r., $1.39; brush, 58¢ c. y., **04,** 2170.

1904. M. A. Sweeney Shipyard & Foundry Co., building wooden-hulled steam towboat, $16,000, **04,** 2170. Fetter & Crosby, building dam and shore protection, Hannibal to Hamburg, r., $1.40; brush, 55¢ c. y., **05,** 1619. A. B. Teasdale, building dams and shore protection, Bellevue to Le Claire, r., $1.24; brush, 35¢ c. y., **05,** 1619.

1905. Albert Kirchner, building dams and shore protections, Rock Isld. to Burlington, r., $1.39; brush, 51¢ c. y.; Burlington to Hannibal, r., $1.44; brush, 51¢ c. y., **05,** 1619. A. J. Whitney, building dams and shore protections, Savannah to Le Claire, r., $1.32; brush, 49¢ c. y., **06,** 1425.

1909. A. J. Whitney, constr. of dams and shore protections bet. Rock Isld. and Burlington, r., $1.45; brush, 55¢ c. y., **10,** 1785.

1910. Rust, Swift & Co., repair of dams and shore protection bet. Clarkesville and mouth of Illinois R., r., $1.55; brush, 60¢ c. y.; A. V. Fetter, constr. and repair of dams and shore protection bet. Keokuk and Hamilton, r., $165, and brush, 65¢ c. y.; Albert Kirchner, constr. and repair of dams and shore protection bet. Clayton and Dubuque, r., $1.53, and brush, 61¢ c. y., **11,** 1955.

1911. Albert Kirchner, constr. and repair of dams and shore protection, r., $1.69; brush, 68¢ c. y.; Albert V. Fetter, constr. and repair of dams and shore protection, r., $1.68; brush, 68¢ c. y.; Albert Kirchner, constr. and repair of dams and shore protection, r., $1.59; brush, 68¢ c. y.; Builders Sand & Gravel Co., constr. and repair of dams and shore protection, r., $1.57; brush, 68¢ c. y.; Albert V. Fetter, constr. and repair of dams and shore protection, r., $1.65 c. y.; brush, 65¢ c. y.; Rust, Swift & Co., constr. and repair of dams and shore protection, r., $1.55 c. y.; brush, 60¢ c. y.; Milwaukee Bridge Co., constr. of 1 steel drill-boat hull, $11,850 complete, **12,** 2164.

ENGINEERS.

Chief of Engineers. R., 93, 285, 287, 288; **94,** 262; **95,** 291, 293; **96,** 253; **97,** 322, 324, 325, 326; **98,** 314; **99,** 39, 375; **00,** 432, 434; **01,** 440; **02,** 370; **03,** 393; **04,** 415, 419; **05,** 426; **06,** 465, 470; **07,** 491, 496; **08,** 524; **09,** 554; **10,** 623; **11,** 667; **12,** 807.

Boards:

BERH., **R.,** 1903; proposed imp. by U.S., Quincy to Sny. Levee not desirable, **04,** 2217.

BERH. concurs in recom. that no modification of existing proj. of Quincy B. and H., Ill., be made, and that available funds be expend. in dr. opposite Broadway sewer to 6′ l. w.; cost, $4,500, **04,** 2221.

In charge:

Maj. A. Mackenzie, 1893–95. **R., 93,** 2200, 2248, 2251, 2253, 2254, 2257; **94,** 1639; **95,** 2108, 2159, 2162, 2163, 2168.

Lt. Col. W. R. King, 1896–97. **R., 96,** 1775; **97,** 2059, 2111, 2114, 2116, 2119, 2124, 2130, 2133.

Capt. C. McD. Townsend, 1898–1902. **R., 98,** 1743; **99,** 2102; (Maj.) **00,** 2692, 2756, 2759, 2763, 2765; **01,** 2238; **02,** 1618.

Maj. Jas. L. Lusk, 1903–04. **R., 03,** 1468; **04,** 2163.

Maj. C. McD. Townsend. **R., 04,** 2216, 2219.

Maj. C. S. Riché, 1905–09. **R., 05,** 1612; **06,** 1416; **07,** 1559; **08,** 1631; **09,** 1621.

Maj. Charles Keller, 1910–. **R., 10,** 1777; **11,** 1935; **12,** 2145.

Assistants:

Lt. C. Keller. **R., 95,** 2108, 2144; **96,** 1814; **97,** 2098; **98,** 1787.

Lt. W. V. Judson. **R., 94,** 1675.

M. Meigs, U.S. civil engineer. **R., 93,** 2227, 2230; **94,** 1667; **95,** 2135, 2165; **96,** 1804; **97,** 2086, 2122, 2127; **98,** 1777; **99,** 2144; **00,** 2727; **01,** 2272; **02,** 1646; **03,** 1487; **04,** 2189; **05,** 1638.

C. W. Durham. **R., 93,** 2211, 2233, 2235; **94,** 1679; **95,** 2149; **96,** 1802; **97,** 2083, 2102; **98,** 1773, 1790, 1791; **99,** 2139, 2158; **00,** 2720, 2741, 2742; **01,** 2269, 2283; **02,** 1634, 1637, 1650; **03,** 1484, 1491; **04,** 2186, 2195; **05,** 1634, 1646.

J. D. Dushane. **R., 94,** 1651; **95,** 2120; **96,** 1784, 1818, 1891; **97,** 2068; **98,** 1757; **99,** 2119; **00,** 2704; **01,** 2247; **02,** 1626; **03,** 1475; **04,** 2174; **05,** 1621.

W. A. Thompson. **R., 94,** 1655; **95,** 2123; **96,** 1788; **98,** 1761; **99,** 2122; **00,** 2709; **01,** 2251; **02,** 1627; **03,** 1478; **04,** 2177; **05,** 1624.

J. C. M'Elherne. **R., 94,** 1662; **95,** 2129; **96,** 1796; **97,** 2078; **98,** 1767; **99,** 2131; **00,** 2715; **01,** 2264; **02,** 1632; **03,** 1482; **04,** 2182; **05,** 1629.

S. Edwards. **R., 94,** 1672; **95,** 2141; **96,** 1810; **97,** 2093; **98,** 1783; **99,** 2151; **00,** 2734; **01,** 2260; **02,** 1630; **03,** 1480; **04,** 2180; **05,** 1627.

A. L. Richards. **R., 99,** 2153; **00,** 2736; **01,** 2278; **02,** 1648; **03,** 1489; **04,** 2193; **05,** 1644.

LEGAL PROCEEDINGS.

Deeds to right of way for about 30 m. of levee from Flint Creek to Iowa R. secured without cost, **95,** 2110.

OPERATIONS.

1892-93. Dam constr., shore protection, and removal of r. and bowlders carried on by day labor and U.S. plant bet. Minneapolis and St. Paul, bet. St. Paul and Lake Pepin, Minneiska, and La Crosse, at Rock Isld. Rapids, at vicinity of Keithsburg, Burlington, Dallas, Pontoosuc, Des Moines R., Hannibal, Hickory Chute, Louisiana, and Reeds Landing. By informal agreement, work with private plant performed bet. Minneapolis and St. Paul, dr. and removing r. and bowlders, and building dams and shore protections bet. Reeds and Minneiska. Under formal contract, dams and shore protections constr. bet. Reeds and Minneiska, bet. Genoa and Prairie du Chien, bet. Glenhaven and Dubuque, bet. Bellevue and Savanna, bet. Dubuque and Clinton, and bet. Keokuk and Quincy. Pier at Lake City repaired. Buoys and ranges on Rock Isld. Rapids maintained. Plant repaired, **93,** 2201.

1893-94. Dam constr., shore protection, and removal of r. and bowlders carried on by day labor and U.S. plant bet. St. Paul and Lake Pepin, bet. Minneiska and Genoa; at Rock Isld. Rapids, bet. Keithsburg and Montrose; at head of Des Moines Rapids; at vicinity of Canton, bet. Quincy and Clarksville; at Westport Chute, and bet. the Illinois and Missouri Rs. Under informal contract, dam and shore protections constr. bet. Smiths Bar and Lake Pepin, bet. Genoa and Prairie du Chien, bet. Glenhaven and Dubuque, bet. Dubuque and Clinton, bet. Keokuk and Quincy, bet. Quincy and Hannibal, bet. Clarksville and Hamburg bet. Hamburg and Cap au Gris, and bet. Cap au Gris and mouth of the Illinois R., **94,** 1639. Plant repaired. Bulkhead constr. at Whipple Creek Bar, **94,** 1640.

1894-95. Dam constr., shore protection, and removal of r. and bowlders carried on by hired labor, competitive purchase of materials, and use of U.S. plant bet. St. Paul and Lake Pepin, bet. Reeds Landing and Genoa, at Rock Isld. Rapids, bet. Keithsburg and Nashville, bet. Quincy and Clarksville, and bet. the Illinois and Missouri Rs. Under formal contract bet. Smiths bar and Lake Pepin, bet. Genoa and Prairie du Chien, bet. Dubuque and Clinton, bet. Muscatine and New Boston, bet. Quincy and Hannibal, bet. Hamburg and Cap au Gris, and bet. Cap au Gris and the Illinois, **95,** 2108. Plant repaired. Dr. done at Quincy B. Work on the raising and strengthening of banks, Warsaw to Quincy, begun, **95,** 2109.

1895-96. Dam constr., shore protection, dr., and removal of r. carried on by hired labor, competitive purchase of material, and use of U.S. plant bet. St. Paul and Lake Pepin, bet. Reeds Landing and Genoa, at Rock Isld. Rapids, bet. Keithsburg and Nashville, bet. Keokuk and Quincy, bet. Quincy and Clarksville, and bet. Illinois and Missouri Rs. Under informal contract bet. Glenhaven and Dubuque, bet. Dubuque and Clinton, bet. Rock Isld. and New Boston, bet. Hamburg and Cap au Gris, bet. Cap au Gris and Illinois R., and also at the Flint Creek to Iowa R. and Warsaw to Quincy Levees. Plant repaired, **96,** 1775. Dr. done in Quincy B., **96,** 1776.

1896-97. Dam constr., shore protection, dr. and removal of r., etc., carried on by hired labor and use of U.S. plant bet. St. Paul and Lake Pepin; at Kings Coulee, bet. Reeds Landing and Genoa; at Rock Isld. Rapids and H., bet. Keithsburg and Nashville, bet. Keokuk and Quincy, bet. Quincy and Clarksville; at Quincy B. and H., at Sny. Isld.

Levee, and bet. Illinois and Missouri Rs.; under informal contract, bet. Genoa and Prairie du Chien, bet. Dubuque and Clinton; at E. Dubuque H., bet. Rock Isld. and Muscatine, bet. Hamburg and Cap au Gris, bet. Cap au Gris and Illinois R., and at the Flint Cr. and Warsaw Levees, **97,** 2060. Plant repaired, **97,** 2102.

1897-98. Dam constr., shore protection, dr., removal of r., etc., carried on by hired labor and use of U.S. plant bet. St. Paul and Lake Pepin bet. Queens Bluff and Prairie du Chien; at Rock Isld. Rapids, bet. Keithsburg and Nashville, bet. Keokuk and Quincy, bet. Quincy and Hamburg, and bet. Illinois and Missouri Rs.; under informal contract, bet. Reeds Landing and Trempealeau, Minneiska, and Queens Bluff, Dubuque and Le Claire, Rock Isld. and Keithsburg, Keithsburg and Nashville, Keokuk and Quincy, and bet. Hamburg and Illinois R., **98,** 1743.

Under congr. allotments, operations undertaken at Burlington, Iowa; dr. Quincy B., Ill.; Warsaw to Quincy Levee, Flint Creek to Iowa R. Levee, H. of refuge at Kings Coulee, H. at Dubuque and at Muscatine; ss. landing at Quincy, and Sny. Isld. Levee, **98,** 1743.

1898-99. Dam constr., shore protection, dr., r. removal, etc., done by hired labor and U. S. plant bet. St. Paul and Lake Pepin, Winona and Cassville; at Rock Isld. Rapids, bet. Montrose and Nashville, Keokuk and Quincy, Quincy and Hamburg, and Hamburg and the Missouri R.; under formal contract, bet. Reeds Landing and Winona, Minneiska and Queens Bluff, Prairie du Chien and Dubuque, Dubuque and Le Claire, Rock Isld. and New Boston, New Boston and Burlington, Burlington and Montrose, Hamburg and the Illinois R. Under special allotments of Congress work carried on at Kings Coulee H. of refuge, Flint Creek to Iowa R. Levee, Warsaw to Quincy Levee, and dr. at Quincy B., Ill., **99,** 2102.

1899-00. Dam constr., shore protection, dr., removal of r., etc., done by labor and U.S. plant bet. St. Paul and Cassville; at Rock Isld. Rapids, bet. Montrose and Nashville, Quincy and mouth of the Missouri R.; under formal contract, bet. Reeds Landing and La Crosse, Lansing and Le Claire, Rock Isld. and Montrose, Keokuk and Quincy, Hamburg and the Missouri R. Under special allotments of Congress, work carried on at La Crosse H.; chan. at Clinton, Iowa; Flint Creek to Iowa R. Levee; Warsaw to Quincy Levee; Sny. Isld. Levee; dr. at Quincy B., and bar at Quincy, Ill., **00,** 2692.

1900-01. Work of dam constr., shore protection, dr., removal of r., etc., carried on by hired labor and use of U.S. plant bet. St. Paul and Dubuque, at Rock Isld. and Des Moines Rapids, and bet. Hannibal and Missouri R.; under formal contract, bet. Winona and La Crosse, Lansing and Le Claire, Rock Isld. and Montrose, Keokuk and Saverton, and Hamburg and the Illinois R.; also La Crosse H., Clinton, Flint Creek to Iowa R. Levee, Warsaw to Quincy Levee, B. and bar, **01,** 2239.

1901-02. Dam and shore protection, constr., and repairs carried on by hired labor and U.S. plant, near Teepeeota Pt. and La Crosse, and at Maple Isld., Portage, Cincinnati, and Mundys Landings, and Hickory Chute; similar work carried on, under contract, near Finleys Landing, on Hurricane Isld., and Islds. 208 and 209, near Dubuque, at Ninemile Isld., and near Bellevue and Horse Isld., **02,** 1619.

1902-03. Pier constr. at H. of refuge, Pepin; dam and shore protection constr. and repair carried on by hired labor and U. S. plant at Wilds Landing and Beef Slough, near Fountain City, Dakota, Dresbach, Bellevue, at Stone Slough, Deadmans Bar, along Flint Cr., to Iowa R. Levee, near Pontoosuc, below Alexandria, at Gregorys Bend, near Dallas, in Hackley and Canton Chutes, near Mundys Landing and in Hickory Chute; similar work under contract at and near Burlington, opposite Isld. 360 below Keithsburg, at Burlington, and above Johnsons Isld.; dr. at Stockholm H. of refuge, Fountain City, and Guttenberg Chan., Warsaw to Quincy Levee, broken by flood, **03,** 1469.

1903-04. Dam and shore protection constr. and repairs carried on by hired labor and U. S. plant near Wabasha, above Fountain City, near La Moille and Dresbach, below and opposite La Crosse in and above Guttenberg Chan., opposite Hannibal and Louisiana, and near Sterling and Stag Islds.; similar work carried on under contract near Isld. 283 and Burlington, at Smiths Isld., below Montpelier, near Dallas, at Ortons Isld., Marion City, Whitneys and Armstrong Bars, and near Quincy; 6,425 c. y. r. removed at Rock Isld. Rapids; dr. at St. Paul, opposite Harriet Isld., near Minneiska, in Guttenberg Chan., and on Whitneys Bar, **04,** 2164. Under special cong. allotments, repair of Warsaw-Quincy Levee begun; bar at Quincy dr.; dam raised and dr. and pile driving commenced at H. of refuge below Davenport; dams built and dr. done at Hannibal, **04,** 2165. Statement of expend. at various localities from commencement of imp. to 1904, **04,** 2168. Location, amount, and cost of dr. and r. removal from 1900 to 1903, incl., **04,** 2173. Dates on opening and closing of navigation at Rock Isld. from 1871 to 1903, **04,** 2173.

1904-05. Dam and shore protection constr. and repairs carried on by hired labor at Pt. Douglas, Beef Slough, near Minneiska, La Moille, Dresbach, Cottage Isld., below La Crosse and Genoa, at Bad Axe Bend, near Hurricane Isld., Parsons Bar, Cuivre Isld., Iowa Isld., Grafton and Portage Islds.; similar work carried on under contract, near Isld. 283, Smiths Isld., Horse Isld., Montpelier, Hersheys Chute, above Port Louisa, Keithsburg, near Johnsons Isld., Alexandria, Fox Isld. and Curtis, and at Quincy; r. removal at Rock Isld. Rapids; dr. at Islds. 49 and 36, Dubuque H., **05,** 1613. Pier lengthened at Pepin H. of refuge; dr. and pile driving completed at H. of refuge below Davenport; bar at Quincy dr.; 24,610 c. y. dr. at Hannibal, **05,** 1614.

1905-06. Dam and shore protection constr. and repair carried on by hired labor and U.S. plant

near Minneiska, La Moille, Dresbach Slough, Guttenberg Chan., Denmark Isld., at Hickory Chute and Portage; similar work carried on under contract near Elk R. and Savanna, above Keithsburg, near Johnsons Isld., at Bentons Isld., Crutchfield Prairie, Swift Slough, O'Connell Slough, and near Rush Isld.; r. removal at Rock Isld. Rapids; dr. at Mt. Vernon, Dubuque, Guttenberg Chan., and Clayton, **06,** 1417. Under special cong. allotments, dam and shore protection built along Warsaw-Quincy Levee; ice breakers built in H. of refuge below Davenport; pier at H. of refuge at Pepin extended, **06,** 1421. Est. of $60,000 for mainten. of existing works submitted, **06,** 1424.

1906-07. Dam and shore protection constr. and repair carried on by hired labor at or near Beef Slough Bar, Blacksmiths Isld., River Junction, Guttenberg Chan., Curtis Pt., Portage and Piasa Islds.; similar work under contract carried on at Savanna; r. removal at Rock Isld. Rapids; dr. at Beef Slough Bar, River Junction, Parsons Bar, Eagle Pt., and Guttenberg Chan., **07,** 1560. Under special cong. allotments, 135,837 c. y. dr. from bar at Quincy; dams built at Clinton, and small amount dr. at Muscatine H., **07,** 1563.

1907-08. Dam and shore protection constr. and repair carried on by hired labor and U. S. plant at or near Beef Slough Bar, Buffalo City Slough, Zumbro R., Minneiska, Winona, Dresbach Isld., River Junction, Guttenberg Chan., Cassville Slough, Ft. Madison, Elsah and Clarksville; similar work carried on under contract at or near Cassville Slough, Buffalo, above New Boston, at Tully, Polly, and Fabins Islds., Curtis Pt., and below Bayou St. Charles, using altogether about 327,000 c. y. r. and brush; r. removal, dr., and core wall constr. at Rock Isld. Rapids; boat yards estab. at Stillwater and Fountain City, **08,** 1631. Under special cong. allotments, shore protection raised and dam built opposite Buzzard Isld. along Warsaw-Quincy Levee; 44,730 c. y. dr. from H. at Muscatine; Hs. and landing places dr. at Dubuque, Fulton, Moline, Andalusia, and La Crosse, **08,** 1634.

1908-09. Dam and shore protection work carried on by hired labor and U. S. plant near Alma and Pine Islds., bet. Winona and La Moille, at Skinner Slough, Richmond, Blacksmiths Slough, near Buena Vista and Eagle Pt., and at Cassville Slough, and similar work, under contract, at Cassville Slough, near Buffalo, at Geneva Isld., near New Boston, at Port Louisa and Prentiss Slough, near Benton Isld., at Crutchfield Prairie and Bay Isld., bet. Keokuk and Hannibal, near Gilbert, Atlas and Denmark Islds., and at Hickory Chute, using altogether 355,605 c. y. r. and brush; dr. carried on bet. Wabasha and Fountain City, at Winona, La Moille, La Crosse, Prairie du Chien, near Guttenberg, at Eagle Pt. and Thomas Landing, and bet. Grafton and Alton; r. removal, dr., and constr. of concrete core wall at Rock Isld. Rapids; boat yards estab. at So. Stillwater and Dubuque, **09,** 1621–1627. Under special cong. allotments, shore protection built along Flint Cr., Iowa R. Levee; pier at Pepin H. of refuge completed; dr. at Hs. and landing places at Red Wing, La Crosse, Cassville, Eagle Pt., Savanna, Moline, Hamburg Quincy, and Prairie du Chien, **09,** 1628.

1909-10. Dams and shore protections built and repaired by hired labor and U. S. plant near Alma, at mouth of Zumbro R., opposite Fountain City, bet. Homer and La Moille, Cassville Slough, Eagle Pt., Harris Slough, and above Savanna, similar work under contract at Cassville Slough; Blackhawk Chute, Muscatine H., Port Louisa, Bay Isld., Lead Isld., Dutchman Isld., Burlington Isld., Thompsons Isld., Hackley Isld., Fox Isld., Gregory Pt., and Fabins Isld.; using 258,609 c. y. r. and brush; dr. near Alma, at Hastings, West Newton, Isld. 65, Harris Slough, Isld. 232, East Dubuque and Clinton, Eagle Pt. Landing, Davenport, below Prairie Bird Pt., above Keithsburg Br., at Keokuk and near Montrose; r. removal and core-wall constr. at Rock Isld. Rapids, **10,** 1777–1783. Large number of boats built or repaired at the various yards. By special cong. allotments, repairs were made at H. of refuge below Davenport; 730 l. f. revet. built at Muscatine; 172,663 c. y. removed from bar at Quincy; 98,050 c. y. from bar at Hamburg, and 28,763 dr. in raising ferry dike at Louisiana, **10,** 1784.

1910-11. Work in constr. of dams and shore protection by hired labor and U. S. plant bet. Alma and Fountain City, vicinity of Winona, bet. Homer and Dakota, below Dubuque, below Comanche, in Gilberts, Hickory, and Clarksville Chutes, at McCoys and Amaranth Islds., and near Mundays Landing; under formal contract, below Montpelier above Quincy, opposite mouth of Cuivre R., and at Parsons Bar; dr. at various localities, r. excavation in Moline Pool; work on 6′ proj. carried on at Rock Isld. Rapids. Total of r. placed in constr. works during year, 382,040 c. y. Under special allotments, dr. work was done at Davenport, Iowa, H. of refuge, Alton Slough, Quincy B. and H., Rock Isld., Burlington, and Moline, **11,** 668, 1936, etc.

1911-12. Constr. of dams and shore protection by hired labor and U. S. plant. bet. Alma and Foun, tain City, at Zumbro R., vicinity of Winona-Trempealeau, Richmond, and Dakota, at La Crosse, vicinity of Dubuque, Ninemile Isld., and Bellevue, at or near Clarksville, Taylor Isld., Cincinnati Landing, and Mundys Landing, and above Grafton; under contract, constr. work performed at Wabasha, McGregor, Cassville, Spechts Ferry, Dubuque, Linwood, Buffalo, Montpelier, Pine Cr., Flint Cr. Levee, Turkey Isld., Becks and Churchs Landings; dr. done at various localities. Special work under separate allotments as follows: 78,056 c. y. dr. from Alton Slough; 83,849 c. y. at Quincy B. and H.; 29,112 c. y. at Rock Isld.; 7,305 c. y. at Burlington; 13,111 c. y. at Moline; mainten. of levee bet. Flint Cr., and Iowa R.; repair work to plants. For details of all work, cost, etc., see reports, **12,** 2145.

(NOTE.—For detailed tabulated statement of character, location, amount, cost of work, comparative cost of material, fuel and subsistence, see reports of Engineer officers in charge and assistants.)

ORDNANCE DEPARTMENT WORK.

Description of chan. cut at Moline City H. by Ordnance Dept. to permit a freer flow of water to the water-power pool of the Rock Isld. Arsenal, **93,** 2253.

PHYSICAL CHARACTERISTICS.

For general description of, see the reports of the assistants under Engineers.

The velocity of the current. bet. Meekers Isld. and Minneapolis such as to prevent navigation, **93,** 2202.

H. w. retarding operations, **93,** 2201; **96,** 1775, 1776.

Description of, bet. Minneapolis and St. Paul, **93,** 2201.

H. and l. w. elevations bet. St. Paul and mouth of Missouri R., partial list of, **93,** 2236.

Obstr. to navigation due largely to immense quantities of silt from caving banks. The nature and extent of the work required to prevent this erosion, **96,** 1777.

Description of P. C. at following points:

Hamburg B.: Dr. of 1889 obliterated in 1893, **93,** 2250.

Iowa side of R. from Iowa R. to Burlington, **93,** 2251.

Moline City H., **93,** 2253.

Bellevue, **93,** 2255; **00,** 2760.

Lake Pepin: A wide stretch of the R. about 20 m. long and from 1½ to 2 m. wide, subject to sudden storms, **93,** 2257, 2258; **00,** 2764.

Quincy B., **95,** 2160. (See Quincy, Ill., below.)

La Crosse H.: The landing at, encroached upon by the sand and mud thrown out by the La Crosse R., **95,** 2163; **97,** 2117.

Bank from city of Warsaw to Quincy: Much damaged by floods of 1881, 1888, and 1892, **95,** 2164, 2165.

From Flint Creek to Iowa R., **95,** 2168.

Oquawka to Dallas City, **97,** 2112.

Drurys Landing to New Boston, **97,** 2115.

Lagrange to Hannibal: Bottom lands bet. these points, 25 m. distant, traversed by 4 considerable streams (see Projects), **97,** 2120.

Egyptian Levee: Portion sur. 1897 begins on Des Moines R. and terminates on w. bank of Mississippi, **97,** 2125.

City of Ft. Madison to Skunk R., **97,** 2131.

Iowa R. to Muscatine: Caving banks on the Iowa might cause trouble and expense, **97,** 2134, 2135.

Quincy, Ill.: But little sediment carried in this vicinity. The lower part only of Quincy B. of value, and much used for winter H. Table showing h. w. at Quincy Br., **00,** 2757, 2758.

Utilization of the forces exerted at h. w. and also those of l. w. for imp. of R. considered incompatible, **98,** 1748.

Distance, l.-w. elevations, fall, slope, and h. and l. w. stages at various points along R., **02,** 1624.

Effect of flood on corn crop, **03,** 1487.

Season of 1910 remarkable for long period of extreme l. w., **11,** 1938.

Discharge observations made, with description of methods used in gaining information, **11,** 1946, etc.

Max. draft, 1912, from Missouri R. to St. Paul, 658 m., at m. l. w., 4.5′, **12,** 809.

PRIVATE WORK.

By au. act 1892, $5,000 paid to M. J. Adams, making $35,176.33 in all, for tests supposed to have been made on the upper Mississippi of a supposed device for imp. chans. by forcing water through perforated pipes placed in the bottom of the stream. No test appears to have been made, **93,** 2202.

Act 1892 au. payment of $2,107.50 to Hannibal Ferry Co. for raising and strengthening upper Mississippi R. U.S. dikes opposite Hannibal in 1891. Payment made in 1893, **95,** 2143, 2144.

PROJECTS.

Works of imp. effective, **93,** 2203; **98,** 1743.

Orig. adopted proj., not materially changed at 1893, was for rectification of waterway by means of wing and closing dams, to obtain scour, and for chan. of sufficient w., and d. of 4½′ at l. w.; approx. cost being $20,000 per m., chan. d. to be eventually increased to 6′. Provision also made for removal of bowlders, dr. and constr. of piers at Rock Isld. Rapids. Custom is to select, when funds are available, such localities for imp. as at the time seem most detrimental to navigation, and the existing proj. may be considered one of general imp. and the execution of detailed plans for special localities. At 1898 recent acts of Congress had been directed to imp. of certain portions of the R. by preventing overflow over natural and other banks, thus contemplating the utilization of forces exerted at h. w. for d. chan., **93,** 2201, 2203; **98,** 1748.

After passage of act 1892 works in this section of the R. consolidated under this heading, **93,** 2201.

Quincy B., Ill.: By Maj. Mackenzie, 1893, for retaining levee on Whipple Creek Bar, using therefor a balance of app. for imp. of B. made 1890, **93,** 2202.

Act Aug. 17, 1894, allotted $15,000 from sundry-civil act of Aug. 18, 1894, for B. Maj. Mackenzie proposed continuation of dr. under this allotment to increase d., and to extend operations over the B., **95,** 2109. Act 1896 also allotted $15,000 for dr., **96,** 1776. Act Mar. 3, 1899, allotted $15,000 for dr., **99,** 2105.

Quincy H., Ill.: Act 1896 allotted $10,000 for ss. landing in this H. It was proposed to use this sum to remove the sand bar in front of the landing, **98,** 1747. Act Mar. 3, 1899, allotted $10,000 (expend. of this affected, 1899, by confusing local conditions), **99,** 2105.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Minneapolis, Minn.: In 1894 Maj. Mackenzie est. $2,205,159 to constr. 4 locks and 3 dams to extend navigation to flour mills at Minneapolis, and that $60,000 would probably be required for addl. dr. below Minnehaha Creek, **94,** 1683.

Bay City H., Wis.: Sundry-civil act Mar. 2, 1895, allotted $1,000 for dr. chan. to H. Lt. Col. Mackenzie proposed constr. of earthen pier instead, 300′ l., and 8′ w. on top, with crest elevation 8′ above l. w., **95,** 2110.

Kings Coulee, Lake Pepin (see Lake Pepin below): Act 1896 allotted $30,000 for H. of refuge in Lake Pepin. Plans made for constr. of pier or break'r about 800′ l., to be built of dr. material, chiefly gravel, and covered with riprapping, **97,** 2060.

Warsaw to Quincy, Ill.: In 1894, Maj. Mackenzie est. $85,500 to raise and strengthen banks bet. these points, **95,** 2165. Sundry-civil act Mar. 2, 1895, allotted $85,500, **95,** 2109. Act 1896 allotted $5,000 for repair and mainten., **97,** 2060. Act Mar. 3, 1899, allotted $5,000 for repair of levee, **99,** 2105.

Drurys Landing to New Boston, Ill.: In 1897 Lt. Col. King est. $343,245 to constr. levees 30 m. l. bet. these points, **97,** 2116.

Muscatine, Iowa: Act 1897 allotted $15,000 for removing sand bar in front of this place, **98,** 1746.

Iowa R. to Muscatine, Iowa: In 1897 Lt. Col. King est. $139,800 to constr. levee 24½ m. l., Iowa to Muscatine (about 2 m. of the levee would be on Iowa R.), **97,** 2135.

Oquawka to Dallas City, Ill.: In 1896 Lt. Col. King est. $340,250 to constr. levees about 4 m. l. bet. these points, **97,** 2113.

Egyptian Levee, Mo.: In 1897 Lt. Col. King est. $285,500 to raise and strengthen existing levee and to build new portions where needed (a large portion of this work would be on Des Moines and Fox Rs., nonnavigable), **97,** 2126, 2127.

City of Ft. Madison to Skunk R., Iowa: In 1896 Lt. Col. King est. $135,635 to constr. about 18 m. of levees (about 8 m. would be on Skunk R.), **97,** 2132.

East Dubuque, Ill.: Act 1896 allotted $5,000 to dr. this H., **97,** 2061. $30,000 allotted, 1897, for removal of sand bar obstr. chan. in front of the city, **98,** 1746.

Lagrange to Hannibal, Mo.: In 1897 Lt. Col. King est. $341,761 to constr. levees bet. these points (considerable part of this work would be on several small nonnavigable streams), **97,** 2121, 2122.

Sny Isld. Levee, Ill.: Act 1896 allotted $50,000 to protect this levee from erosion, and for mainten. of chan. by revet. works and otherwise. Applied to constr. of shore protection and dams at such localities as would not only imp. the l.-w. chan., but also afford protection to the levee, **97,** 2061; **98,** 1747.

La Crosse, Wis.: Act June 3, 1896, allotted $5,000 for this H., but a sur. called for by the same act showed that about $17,000 would be required to perform needful work. Allotment held until further funds should be available, **97,** 2061.

Flint Creek to Iowa R., Iowa: Sundry-civil act Mar. 2, 1895, allotted $85,000 for commencement of work of imp. this section of the R. banks to prevent overflow over the w. bank. Lt. Col. Mackenzie proposed, 1894, levee with slope of 3 to 1 on R. side and 2 to 1 on inside, natural banks to be raised and reinforced where necessary, height to be as funds would permit, est. cost being $305,000, **95,** 2109, 2110. A later est. was $250,000. Act June 3, 1896, allotted $75,000, **96,** 1777. Act 1897 allotted $50,000, **97,** 2060. Act Mar. 3, 1899, allotted $50,000 for completing earthwork revet., drainage, and part of enlargement proposed, **99,** 2105.

Rock Isld., Ill.: Act 1896 allotted $5,000 for mainten. of this H., which was expend. in r. excavation, **97,** 2061. $5,000 addl. was allotted by act Mar. 3, 1899, for further r. excavation, **99,** 2104.

Burlington, Iowa: In 1897–98 it was proposed to expend balance for this locality in redr. deposits from H., **98,** 1747.

Bellevue, Iowa: By Capt. Townsend, 1899, for a dam or causeway across Crooked Slough, 8′ above l. w. and 9′ w. on top, using general funds, **00,** 2761.

Lake Pepin: Capt. Townsend, 1899, est. $14,000 for pier or break'r 1,000′ l. at village of Pepin, **99,** 2765.

Clinton, Iowa: Act Mar. 3, 1899, allotted $25,000 for imp. and straightening chan., **99,** 2104.

Davenport, Iowa: Act Mar. 3, 1899, app. $10,000 for d. H., **99,** 2104. D. sufficient, 1900, and no proj. submitted, **00,** 2694.

Act June 13, 1902, provided that $10,000 app. by act Mar. 3, 1899, for imp. of R. at Davenport, with addl. app. of $5,000, be applied to constr. of H. of refuge from ice, at or below Davenport, and other imp. to H., **03,** 1486.

Act June 13, 1902, app. $20,000 for Quincy B. and for removing sand bar at ss. landing, Quincy, Ill., **04,** 2219.

By Maj. Riché, 1907, for securing and mainten. 6′ chan. by further contraction work, dr., a lateral canal at Rock Isld. Rapids, d. Des Moines Rapids

Canal, and repairs and mainten. during constr.; est., $20,000,000, and $300,000 an., after completion, for mainten.; adopted act Mar. 2, 1907, **07,** 491, 496. Detailed est. given, **07,** 1559. (See H. D. 341, 59th, 2d.)

SURVEYS.

Misc. sur. and ex., **93,** 2201, 2226, 2233, 2235; **94,** 1640, 1655, 1661, 1667, 1672, 1681; **95,** 2108, 2123, 2128, 2134, 2140, 2149; **96,** 1785, 1793, 1801; **97,** 2077, 2086, 2092; **98,** 1777.

Minor sur. and ex. made almost every year. (See references to reports of engineers in charge and of assistants.)

Bench marks, St. Paul to mouth of Missouri R. **93,** 2236, 2237.

Congress, by joint resol. of 1894, ordered transmission to it of any reports of surs. or ests. made since the preceding an. report relating to constr. of l. and d. bet. Chicago, St. Paul, Minneapolis & Omaha RR. br., at the city of St. Paul, and the Falls of St. Anthony, Minn. Est. submitted by Maj. Mackenzie in 1894, **94,** 1682.

Hamburg B.: Ex. of B. au. act July 13, 1892; made, 1892, by Maj. Mackenzie (**R.** fav.), **93,** 2248.

From Iowa R. to Burlington: Ex. of R., Iowa side, bet. these points, to determine best methods of removing bars and d. chan., au. act July 13, 1892. Reported in that year work had been and was still in progress in the locality, **93,** 2251.

Moline City H.: Ex. au. act July 13, 1892; made by Maj. Mackenzie in that year (**R.** unfav.), **93,** 2253.

Bellevue, Iowa: Ex. of R. at and near this place with view to so repairing and fixing dam that the ferry chan. would be restored, au. act July 13, 1892; made by Maj. Mackenzie in 1892, **93,** 2254. Sur. au. act Mar. 3, 1899; made by Capt. Townsend (**R.** fav.), **00,** 2759.

Lake Pepin, Wis.: Ex. to ascertain whether addl. Hs. of refuge were necessary, and if so, where they should be located, au. act July 13, 1892; made in that year by Maj. Mackenzie (**R.** fav. to one), **93,** 2257.

Quincy B.: Ex. required by act Aug. 17, 1894, and report rendered by Lt. Col. Mackenzie, **95,** 2159. Ex. for prevention of filling up of B. by h.-w. sediment au. act Mar. 3, 1899; made by Capt. Townsend (**R.** not fav.), **00,** 2756.

La Crosse, Wis.: Ex. of H. for removal and prevention of bar au. act Aug. 17, 1894; made in that year by Lt. Col. Mackenzie, **95,** 2162. Sur. au. act June 3, 1896; made, 1897, by Lt. Col. King (**R.** fav. only to separate app., and only on condition to be accepted by the city), **97,** 2116.

City of Warsaw to city of Quincy, Ill.: Sur. of bank bet. these points au. act Aug. 17, 1894; made by Lt. Col. Mackenzie in that year, **95,** 2163.

Flint Creek to Iowa R.: Sur. w. bank au. act Aug. 17, 1894; made in that year by Lt. Col. Mackenzie, **95,** 2168.

Oquawka to Dallas City, Ill.: Sur. of e. bank bet. these points au. by act June 3, 1896; made in that year by Lt. Col. King, **97,** 2111.

Drurys Landing and New Boston, Ill.: Sur. of e. side of R. bet. these points au. act June 3, 1896; made, 1897, by Lt. Col. King, **97,** 2114.

Lagrange to Hannibal, Mo.: Sur. of e. side of R. bet. these points au. act June 3, 1896; made by Lt. Col. King in 1897, **97,** 2119.

Egyptian Levee: Sur. of this levee along w. bank of R. and est. of cost of raising and straightening it called for by act June 3, 1896. **R.** by Lt. Col. King in 1897, **97,** 2124.

City of Ft. Madison to mouth of Skunk R., Iowa: Sur. of w. side of R. au. act June 3, 1896; made by Lt. Col. King, **97,** 2130.

Iowa R. to Muscatine, Iowa: Sur. of w. bank au. act June 3, 1896; made, 1897, by Lt. Col. King, **97,** 2133.

Lake Pepin: Ex. and sur. of e. shore of lake near village of Pepin for pier or H. of refuge au. act Mar. 3, 1899; made by Capt. Townsend, 1899 (see Projects), **00,** 2763.

Minor, **01,** 2250, 2261, 2264, 2271, 2274, 2277, 2282, 2284; **02,** 1632, 1636, 1638; **03,** 1478, 1480, 1482, 1487, 1488, 1489; **04,** 2185, 2188, 2191, 2195; **05,** 1624, 1627, 1629, 1634, 1643, 1646; **06,** 1417, 1419, 1420; **07,** 1561, 1562, 1564; **08,** 1631–33; **09,** 1622–24, 1627; **10,** 1778, 1780; **11,** 1937, 1939, 1941–43; **12,** 2146, etc.

Report on levee from Flint Cr. to Iowa R., from pre. sur. of 1894 to its completion in 1900, incl. attending legislation and legal proceedings, specifications for, history of work, maps, cross sections, details, **02,** 1637.

H.-line sur. at St. Paul, **03,** 1478.

Ex. au. act June 30, 1902, of e. bank from city of Quincy to Sny Levee, view to imp. nagivation by preventing overflow of banks. **R.** by Maj. Townsend, July 28, 1902 [1] (unfav.), **04,** 2216.

Pre. ex. and sur. au. act Mar. 3, 1905, of Hamburg B., Ill., with view to preventing formation of bar at mouth. **R.** by Maj. Riché, Mar. 25 and Nov. 29, 1905 [2] (unfav.), **06,** 470.

Act Mar. 3, 1905, au. ex. and sur. bet. Missouri R. and St. Paul, Minn., with view to preparing est. for securing chan. 6′ d., **06,** 470. **R.** by Maj. Riché, Oct. 1, 1906; est., incl. work on Rock Isld. and Des Moines Rapids, $20,000,000,[3] **07,** 496.

Pre. ex. and sur. au. act June 13, 1902, of Quincy B. and H. **R.** by Maj. Townsend, July 14 and Dec. 19, 1902; est., $4,500,[4] **11,** 419, 2218.

[1] H. D. 80, 58th, 2d. [2] H. D. 577, 59th, 1st. [3] H. D. 341, 59th, 2d. [4] H. D. 112, 58th, 2d.

Pre. ex. opposite Thomas Landing, in Calhoun Co., Ill., to provide suitable chan., au. act June 25, 1910. **R.** by Maj. Keller, Oct. 22, 1910[1] (unfav.), **11,** 674.

Ex. and sur. au. act Feb. 27, 1911, bet. Calhoun Pt. and Mason Isld., Ill., **12,** 814.

Maps:

Flint Cr. to Iowa R. Levee, **02,** 1642.

Vicinity of Dakota and Dresbach, **03,** 1473.

Vicinity of Horse Isld., **03,** 1486.

From St. Paul, Minn., to St. Louis, Mo. (3 sheets), **11,** 1936.

HH-196 Alton Harbor, Ill.

APPROPRIATIONS.[2] (See p. 1089.)

COMMERCE.

Importance of H., **68,** 377, 379; **71,** 318; **72,** 351.

CONTRACT.

1872. W. Johnson, Ellis Isld. Dam, **73,** 446.

ENGINEERS.

Chief of Engineers. **R.,** **71,** 58; **72,** 54; **74,** 60.

Boards. Convened, 1872, to ex. and report on condition of R. bet. Alton and mouth of Meramec R., with view to imp. of Alton and St. Louis Hs., * * * **72,** 54, 358; recom. imp. Alton H. by closing chan. w. of Ellis Isld. with low dike, **72,** 54, 361, 366. (Lt. Cols. Newton and Raynolds, Majs. Warren and Merrill, Capt. Allen.)

In charge:

Maj. G. K. Warren. **R.,** **68,** 370. Relieved May 31, 1870, by

Lt. Col. W. F. Raynolds. **R.,** **71,** 312; **72,** 348. Relieved Jan. 1, 1873, by

Col. J. H. Simpson. **R.,** **74,** 324; **75,** 477; **76,** 635; **77,** 504.

Assistants:

H. C. Long. **R.,** **68,** 371.

Capt. C. J. Allen. **R.,** **71,** 314; **72,** 350.

R. E. McMath. **R.,** **73,** 445.

ESTIMATES. (See Projects.)

By Capt. Allen, low dike closing same chan., $14,662, **71,** 318, 327; **72,** 361.

By BE., high dike, $75,000; low dike, $40,000 **72,** 55, 361, 366; **73,** 53, 446; **76,** 645; cost completed, $31,368, **76,** 635.

OPERATIONS.

1872-73. On Ellis Dam, **73,** 53, 445.

1873-74. Continued operations at; material purchased in open market; hired labor, **74,** 60, 324.

1874-75. Completion of, at height of 10′ above l. w.; cost, $31,368, **75,** 65, 477; **77,** 634.

PHYSICAL CHARACTERISTICS. (See Falls of St. Anthony to Ohio.)

Danger of destruction of H., **68,** 371, 372.

PROJECTS. (See Estimates.)

By H. C. Long, closing slough w. of Ellis Isld., with timber, brush, and st. dike, about 10′ x 1,200′; est., $112,000, **68,** 371, 376; approv. by Maj. Warren, **68,** 371.

By Lt. Col. W. F. Raynolds, recom. low dike, **71,** 58, 318, 320; **72,** 355.

Approv. by BE., and recom. as deserving immediate attention; est., $40,000, **72,** 54, 361; necessity of protecting head of isld., **73,** 446; work began Sept., 1872; details and method of constr., **73,** 444; completed (1874) to 10′ above l. w., **75,** 65, 477; **76,** 635.

SURVEYS.

1868. **68,** 371; **69,** 43, 188.

1870. **71,** 58, 312, 314; **72,** 350.

Early sur., **71,** 316, 321.

Maps. Alton and vicinity, **73,** 443.

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[1] H. D. 1237, 61st, 3d.

[2] 1872. Bet. mouths of Illinois and Missouri Rs., $25,000. Allotted to Alton H., **72,** 55; **73,** 442; **74,** 324; **76,** 645.

1874. For imp. of R. bet. Illinois and Ohio Rs., $200,000, of which $15,000 was allotted to Alton H., **74,** 61, 324, 325, 331; **75,** 477, 481; **76,** 645.

HH-199(a) Des Moines Rapids to the Mouth of the Illinois River.[1] (Except operations of snag boats.)

APPROPRIATIONS. (See p. 1089.)

CONTRACTS.

1879. S. Sample, shore protection and dams at Canton, **80,** 1508, 1514. Whitney & Sons., dr., Quincy, 15.4¢ c. y., and dam constr., **80,** 1545.

1880. Whitney & Son, shore protection and dams above Gregorys Landing, **81,** 1698. C. M. Cole, dam constr. and shore protection at Denmark Isld. and Westport Chute, **81,** 1698, 1699. W. A. & J. C. Patterson, dam constr. and shore protection, Alexandria, Mo., **81,** 1716. H. S. Brown, dr., Quincy, 18¢ and 20¢ c. y., **81,** 1718. H. S. Brown, dam constr., shore protection, and dr., Hannibal, **81,** 1721.

1881. W. A. & J. C. Patterson, dam constr., Alexandria H., Mo., **82,** 1786. H. S. Brown, dr., Quincy, 20¢ and 23¢ c. y., **81,** 1718. W. A. & J. C. Patterson, dam constr., Louisiana, **81,** 1723.

1882. Patterson Bros., shore protection and dams near Louisiana, **83,** 1400. H. S. Brown, brush and st. revet. below Quincy, **83,** 1400.

1884. H. S. Brown, dr., Quincy B., 14¢ c. y., **85,** 1687. Patterson Bros., shore protection and dams near Louisiana, **85,** 1685, 1687; **86,** 2853.

1885. H. S. Brown, dr., Quincy B., 14¢ c. y., **86,** 2854.

1886. H. S. Brown, shore protection and dams, **87,** 1610.

1887. Patterson Bros., shore protection and dams, **87,** 1610. E. M. Morton and others, towboat, **87,** 1612. J. Spect, centrifugal pump, **87,** 1612. M. Von Hein, flatboats, **87,** 1613.

1888. J. Richtman, brush, 72¢ c. y.; r., $1.53 c. y., **88,** 1463. Price & King, repairing levees, 10.9¢ c. y., **89,** 1717. A. J. Whitney, r., $1 to $1.29 c. y.; brush, 50¢ to 60¢ c. y., **89,** 1719. H. S. Brown, r., $1.50 c. y., **89,** 1720.

1890. M. Von Hein, repairing barges, $3,950. F. Menke, r., 64¢ c. y. Reid, Brose & Ebert, r., 68¾¢ c. y. H. L. Hart, r., 54¾¢ c. y.; brush, 29½¢ c. y. Hannibal Lime Co., r., 50¢ c. y. J. G. Fox, brush, 35¢ c. y., **91,** 2120.

1891. Tigue & McCaffery, r., 69¢ c. y. H. S. Brown, dr., 12.4¢ c. y., **91,** 2121.

1892. H. L. Hart, r., 62¢ to 66¢ c. y.; brush, 29½¢ c. y. Reid, Brose & Ebert, r., 69¾¢ c. y. Hannibal Lime Co., r., 53¢ c. y. F. W. Menke, r., 62¢ c. y., **92,** 1771.

ENGINEERS.

Chief of Engineers:

From Des Moines Rapids to mouth of Illinois R. **R., 80,** 172; **81,** 232; **82,** 227; **83,** 236; **84,** 239; **85,** 261; **86,** 249, 251; **87,** 217.

Alexandria H., Mo. **R., 80,** 175; **81,** 235; **82,** 233; **83,** 240.

Quincy, Ill. **R., 80,** 175; **81,** 235, 236; **82,** 233, 234; **83,** 241; **84,** 243; **85,** 265, 266, 1717.

Hannibal, Mo. **R., 80,** 175; **81,** 236; **82,** 234; **83,** 241.

Louisiana, Mo. **R., 80,** 177; **81,** 237; **82,** 234; **83,** 242; **88,** 196, 1466; **89,** 230; **90,** 206. **91,** 263; **92,** 253.

Boards:

Miss. R. Com. **R., 81,** 2742, 2755; **85,** 2539; **86,** 2143; **87,** 2690.

Convened, Quincy, Ill., Oct. 24, 1887, by S. O No. 77, to consider and report upon imp. of Mississippi R. from Des Moines Rapids to mouth of Illinois R. **R., 88,** 1466. (Lt. Col. Merrill, Majs. Mackenzie and Miller, and 2d Lt. Craighill.)

Convened, Quincy, Ill., Feb. 18, 1891, by S. O. No. 77, to report upon reopening of Willow Slough or some other chan. from Mississippi R. to Quincy B. **R., 91,** 2131. (Majs. Mackenzie, Miller, and Ruffner.)

In charge:[1]

Maj. A. Mackenzie, 1880–84:

From Des Moines Rapids to mouth of Illinois R. **R., 80,** 1506, 1514, 1526; **81,** 1696, 2755; **82,** 1763; **83,** 1395; **84,** 1560; **85,** 1685.

Trans. to Miss. R. Com., Sept. 1, 1884. **R., 85,** 261, 2539; **86,** 2143; **87,** 2690.

Trans. to Engineer Dept. by act Aug. 5, 1886, **86,** 459.

Capt. E. H. Ruffner, 1885–92. **R., 85,** 2851, 2860, 2935; **86,** 2154; **87,** 1607, 2719; (Maj.) **88,** 1461; **89,** 1717; **90,** 2005; **91,** 2119, 2125.

Maj. A. Mackenzie, 1888–92. **R., 88,** 1479; **92,** 1766.

Assistants:

O. N. Chaffee. **R., 81,** 1699, 1717, 1721; **83,** 1401; **84,** 1586, 1590.

C. W. Durham. **R., 82,** 1788; **83,** 1402, 1426; **84,** 1563.

E. F. Hoffmann. **R., 84,** 1565.

M. Meigs. **R., 84,** 1568.

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[1] Alexandria H., Mo. **R., 80,** 1543; **81,** 1715; **82,** 1786; **83,** 1424.
Quincy H. and B., Ill. **R., 80,** 1543; **81,** 1717; **82,** 1786; **83,** 1424, 1425; **84,** 1588, 1590; **85,** 1709, 1717.
Hannibal, Mo. **R., 80,** 1546; **81,** 1719; **82,** 1789; **83,** 1428.
Louisiana, Mo. **R., 81,** 1723, 1724; **82,** 1790; **83,** 1428.

OPERATIONS.[1]

1879-80. Constr. of brush and st. dams and shore protection at Canton, Gilberts Isld., and Slim Isld.; dr. at Hannibal and below Cincinnati Landing, **80,** 1506–1513. Quincy H., 1,800′ of spur dams built and 48,900 c. y. dr. from Quincy B., **80,** 1544–1545.

1880-81. Constr. of brush and st. dams and shore protection at Gilberts and Denmark Islds., Gregorys Landing, and Westport Chute, **81,** 1696–1699. 8,417 c. y. brush and st. placed in wing dams at Alexandria, **81,** 1717. Quincy Dam, closing square chutes commenced and 15,305 c. y. dr. from Quincy B., **81,** 1717, 1718. Hannibal, 54,000 c. y. dr. from bar, and constr. of dam at Glasscox Isld., **81,** 1719. Louisiana, spur dam opposite ss. landing commenced, **81,** 237.

1881-82. Constr. of brush and st. dams and shore protection at Gilberts and Denmark Islds., Gregorys Landing, Canton and Smoots Chutes; constr. of dr. and dumps in progress; operations at Dixon Quarry, **82,** 1763–1766. 3,785 c. y. brush and st. placed in wing dams at Alexandria, **82,** 1786. Proj. completed, **83,** 1426. Hannibal, 49,712 c. y. dr. from bar and lower wing dam completed, **82,** 234. Louisiana, spur dam completed to length of 1,000′, **82,** 1791.

1882-83. Constr. of brush and st. dams and shore protection at Gregorys Landing, Quincy, Hannibal, Louisiana, Cap au Gris, Bolters, and Dardenne Islds.; progress on dr. and dump boats; operations at Dixon Quarry, **83,** 1395–1403. Quincy B., 63,677 c. y. dr., **83,** 1426.

1883-84. Constr. of brush and st. dams and shore protection at Louisiana, Quincy, Gilberts Isld., Alexandria, Marion City, Hannibal, Canton, Denmark Isld., and Dardenne Isld.; dr. at Howards (Smoots) Crossing, and above Mundys Landing; completion of dr. and dumps, **84,** 1560–1570. Quincy, wing dams built in 1879 strengthened, and protection placed at head of isld. 427, **84,** 1589.

1884-85. Works trans. to Miss. R. Com., Sept. 1, 1884, **85,** 261.

Constr. of brush and st. dams and shore protection at Louisiana, Quincy, Brokau Isld., Canton, and La Grange and Bolton Islds., **85,** 1685, 2539, 2935.

1885-86. Repair of dams at Carrolls, Coon, and Slim Islds.; new dams commenced at Westport Chute; North and South Fritz Islds.; dr. at Quincy B., Hickory Chute, and Wyaconda Bar, **86,** 2143, 2154–2156, 2851, 2853. Repair of closing dams at Denmark, Carrolls, Hickory, and Slim Islds.; constr. of dams at Westport Chute and Fritz Islds.; completing revet. at Cincinnati Landing; dr. at Quincy B., Hickory Chute, and Wyaconda; minor repairs and work on shore protection, **87,** 2691, 2719.

1886-87. Dr. at mouth of Hamburg B.; dam constr. at Oyster Isld., Islds. 500 and 501, Gilberts Isld., Cincinnati Chute, and Turners Isld.; constr. and operation of hydraulic dr., **87,** 1608–1612.

1887-88. 4,627 c. y. r. and 3,762 c. y. brush placed in dam constr. near Cap au Gris; 3,000 c. y. r. and 1,339 c. y. brush used in st. protection at Isld. 500 and at Cap au Gris, **88,** 1461. 1,225 l. f. of brush and st. dam built at Martins Landing; 4,686 c. y. r. and 1,731 c. y. brush used in revet. at Peruque Isld. and Isld. 507; 2,211 c. y. r. placed in Dardenne Isld. Dam; 1,583 c. y. r. used in repair of shore protection at Bolters Isld. Towhead, **88,** 1462.

Under contract:

2,571 c. y. r. and 2,153 c. y. brush placed in dam and shore protection at Gilberts Isld.; 1,852 c. y. r. and 2,097 c. y. brush used in completion of main dam at Turners Isld., **88,** 1462; 7,127 c. y. r. and 5,628 c. y. brush used at Stag Isld. Dam; 5,220 c. y. r. and 2,832 c. y. brush used in constr. of 1,800 l. f. of wing dam above Hannibal, **88,** 1463.

1888-89. 245,000 c. y. material used in repair of levees, **89,** 1719; 37,962 c. y. r. and 23,670 c. y. brush used in constr. and repair of wing dams and shore protection, **89,** 1720.

Hired labor:

19,200 c. y. gravel dr. and dumped upon Westport Chute Dam; 3,706 c. y. dr. from chan. above Hamburg B., **89,** 1721.

1889-90. 24,200 c. y. r. and 12,108 c. y. brush used in constr. and repair of wing dams and shore protection, **90,** 2006.

67,568 c. y. dr. from bar in front of landing at Hannibal, **90,** 2007. Hydraulic dr. at Whitneys Bar, **90,** 2008. Extensive repairs to plant, **90,** 2010.

1890-91. Repairs to barges, **91,** 2120; 34,763 c. y. dr. at Cedar Creek Bar, **91,** 2121.

4,460 l. f. of shore protection laid at Cottonwood Isld., consuming 10,496 c. y. of brush and st., **91,** 2120; 36,203 c. y. dr. and dumped upon dam at head of Clarksville Isld.; 24,313 c. y. brush and st. bank protection placed at Sny Isld. Levee; 1,125 l. f. of wing dam built at Cottonwood Isld., **91,** 2122. Total r. and brush, used in wing dams and shore protection, 43,183 c. y., **91,** 2123.

1891-92. 48,200 c. y. material dr. in Quincy B., **92,** 1767.

Dam at Clarksville Isld. raised and strengthened; repairs to shore protection at Scotts Landing; 2,750 c. y. r. and 527 c. y. brush used in shore protection opposite foot of Hog-back Isld.; 1,800 c. y. r. and 871 c. y. brush used in wing dam at Hickory Chute; 1,252 c. y. r. and 1,362 c. y. brush used in constr. of wing dam at Tully Isld.; 19,542 c. y. gravel used in shore protection above Hannibal Br. and at bend of Tully Isld., **92,** 1767, 1768.

[1] Comparative cost of brush and st. pier since 1872 to 1885, **85,** 1405. Comparative cost of dr. from 1878 to 1885, **86,** 1407.

PHYSICAL CHARACTERISTICS.

L.-w. line, **80,** 1518.

Discharge of R., **80,** 1518.

List of bench marks, **80,** 1520.

Drainage area of tributaries, **80,** 1522.

Sediment obstr., **80,** 1531.

PLANS. (See Projects.)

In 1891 the BE. reported "reopening of Willow Slough or some other chan. from Mississippi R. to Quincy B." inadvisable, **91,** 2132.

PROJECTS.

The general proj. Des Moines Rapids to mouth of Illinois R., 161 m., closure of side chans. with low dams, usually of brush and st.; contraction of width of R., where excessive, with spur dikes of brush and st., and protection of banks subject to erosion with brush mattress, covered with st.; object sought, a l.-w. d. of about 5′, **81,** 2745; **85,** 2539; **87,** 217.

At Alexandria H., Mo., proj. of 1879 proposed imp. to 5′ at l. w. of Warsaw Crossing Bar with wing dams; est., $30,945.75, **79,** 1150; **83,** 240. Imp. accomplished in 1883 by expend. of $16,000, **83,** 1424.

At Quincy H. and B., proj. of 1879 proposed imp. of bar in front of the city landing with 3 spur dikes and 1 closing dam from the right bank, and imp. of Quincy for use as an ice H., and to accommodate C. by dr. to 6′; est., $224,110, **79,** 1130, 1131; **80,** 1543.

The proj. for imp. of R. at Hannibal, Mo., adopted in 1880, proposed removal of bar in front of city by dr., and prevention of its re-formation with spur dikes from Illinois shore; est., $60,000, **80,** 1547.

By Maj. Mackenzie, 1880, vicinity of Louisiana, Mo., 6′ at l. w., with spur dike from the Illinois shore opposite Louisiana, by removal of r. from chan. below br., the closing of Buffalo Isld. and Brokau Chutes, with spur dike from the Illinois shore below the br., and by shore protection of Buffalo Isld.; est., $55,000, **81,** 1723, 1726.

In 1887 BE. recom., pending preparation of consecutive plan for imp. of this portion of Mississippi R., that operations be continued under existing proj., the general purpose being to secure a l.-w. chan. throughout of an average w. of 2,000′ by constr. of works of contraction, closing duplicate chans. and isld. chutes, and revet. of banks, **88,** 1469, 1470.

SURVEYS.

St. Paul to mouth of Illinois R., **80,** 1514.

Burlington to Montrose, Iowa, **80,** 1526.

At Quincy, Ill., **85,** 266.

At Louisiana, **81,** 1724.

Sur. of Willow Slough, made, 1890, by Maj. Ruffner, **91,** 2125.

Maps:

Canton Bar, **80,** 1512.

Hannibal H., **80,** 1512.

Gilberts Isld., **80,** 1512.

Slim Isld. Bar, **80,** 1512.

Gregory Landing, **83,** 1396.

Vicinity of Louisiana, **84,** 1564.

Quincy H. and B., **80,** 1544; **83,** 1425.

HH-204 Clarksville Harbor, Mo.

ENGINEERS.

Chief of Engineers. **R., 89,** 231.

In charge. Capt. E. H. Ruffner. **R., 89,** 1722.

PLANS.

By Capt. Ruffner, 1889, closing the chute bet. Clarksville Isld. and the Illinois shore by a gravel dam 1,000′ l., and wing dam above head of the isld. from the Illinois shore, in such a direction and of such a l. as would serve to confine the chan. to the Missouri shore; est., $25,000, **89,** 1724.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Ruffner, **89,** 1722.

HH-215 Quincy Harbor, Ill.

APPROPRIATION. (See p. 1089.)

ENGINEERS.

Chief of Engineers. **R., 79,** 130, 133.

In charge. Maj. F. U. Farquhar. **R., 79,** 1130.

PHYSICAL CHARACTERISTICS.

Discharge and slope of R., **79,** 1130.

PROJECTS.

Maj. Farquhar, 1879, imp. of bar opposite city by: (1) 3 spur dikes and 1 closing dam from right bank; (2) imp. of Quincy B. by dr.; est., $224,110, **79,** 1130, 1131.

SURVEYS.

At Quincy, **78,** 101; **79,** 133, 1130.

HH-220 Warsaw, Ill.

ENGINEERS.

Chief of Engineers. **R., 91,** 264, 2134.

In charge. Maj. E. H. Ruffner, 1890. **R., 91,** 2134.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2135.

In 1890 Maj. Ruffner reported that removal of bar at this locality would be detrimental to that portion of the navigable R., **91,** 2136.

SURVEYS.

Ex. to remove bar au. act Sept. 19, 1890; made, 1890, by Maj. Ruffner, **91,** 2135.

HH-221 Alexandria Harbor, Mo.

ENGINEERS.

Chief of Engineers. **R., 78,** 101; **79,** 133.

In charge. Maj. F. U. Farquhar. **R., 79,** 1150.

PHYSICAL CHARACTERISTICS.

Discharge of R., **79,** 1150.

Slope of R., **79,** 1150.

PROJECT.

By Maj. Farquhar, removing bar with 3 spur dikes on the right bank and 1 on the left; est., $30,946, **79,** 1150.

SURVEY.

In vicinity of Alexandria, 1878, **78,** 101; **79,** 133.

HH-222(a) Des Moines Rapids. (Including canal and dry dock.)[1]

APPROPRIATIONS. (See p. 1089.)

Au. in app. bill to pay land damages, **68,** 396.

Effect of limited and irregular app., **67,** 280; **70,** 59; **72,** 324, 326, 328; **76,** 659.

Economy of large app., **71,** 288; **72,** 318; **73,** 323.

Cause for increased app., **72,** 324, 326.

COMMERCE.

Amount of C. benefited by imp., **67,** 266, 279.

Length of season of navigation, **67,** 278.

Suspended during l. w., **67,** 279.

Cost of transf. of cargoes, **67,** 279, 306.

Rapids a barrier to 40,000 m. of internal navigation, **67,** 279.

Dimensions of imp. required for C., **67,** 323.

Rules and regulations to govern use of canal, **78,** 745; **85,** 1701.

Total amount of traffic passing through canal, 1877 to 1891, **91,** 2182.

CONTRACTS.[2]

Henegan & Son, section work, **68,** 420; delay of, **69,** 221; failure and relinquishment of contract by, **69,** 221.

C. E. Tobie, st. for lower lock, **69,** 236; delay, **69,** 227; failure, **69,** 212, 227; **73,** 426.

J. J. Dull, continuing section work relinquished by Henegan & Son, **69,** 222.

Dull & Williams, continuing section work to amount of app., $200,000, **70,** 284, 308; work continued, on faith, by D. & W. after expiration of app., **70,** 295; extended to cover app., $250,000, **71,** 282; extended to cover app., $341,000, **71,** 283; reliable character of contractors, **72,** 317.

F. D. Van Wagenen, section work, **73,** 430.

J. W. Kittle, section work, **74,** 305; extension of time asked for and granted, **74,** 306; completed Dec. 26, 1874, **75,** 454.

Case & Co., st. for lock work, **69,** 227; new contract (from open market bids) made with, **71,** 286.

Wells, Timberman & Co., st. for lower lock, **71,** 287; **73,** 430; st. for guard lock, **75,** 462.

E. Owen, labor on lower lock, **69,** 236; **71,** 284, 285, 288; bad work, **78,** 737.

W. Johnson, labor on middle lock, **71,** 286, 288; **73,** 430.

J. W. Kittle, labor on guard lock, **74,** 305; extension of time granted, **74,** 306; contract completed Dec. 20, 1874, **75,** 454.

[1] Sur.—**R.,** July 12, 1829; Dec. 6, 1837, est., $189,622; Apr. 6, 1854, est., $219,810, $195,470. (H. D. 482, 55th, 2d.)

[2] Contract and hired labor, comparison of prices and cost, **75,** 460; **76,** 657, 659.

J. Clark, cement, **69,** 236; **71,** 287; new contract made, **71,** 287, 288; new contract made, **73,** 430.

St. Louis Cement Co., cement for guard lock, **75,** 462.

J. S. Rearden, lock-gate timber, **70,** 300, 308; abandoned Feb. 5, 1870, **70,** 300.

J. Carroll, remainder of lock-gate timber, **70,** 300, 308; contract completed Mar. 10, 1870, **71,** 288.

Copeland & Co., planing lock-gate timber, **70,** 300; completed Nov. 17, 1870, **71,** 288.

M. Sellers, lock-gate castings, **70,** 299, 308; completed May 19, 1871, **71,** 287.

1881. Tallant Marble Co., riprap st., $2.34 c. y., **82,** 1779.

1882. Patterson Bros., riprap st., $3 c. y., **82,** 1779.

1884. Patterson Bros., st., **85,** 1698, 1708.

1886. Patterson Bros., st., **87,** 1652.

1887. Meacham & Wright, hydraulic cement, **87,** 1652.

1888. Patterson Bros., st., $8,259, **89,** 1771. W. J. Bwatch, iron, $581.94, **89,** 1770. Carson & Rand, timber, $6,915, **89,** 1770.

1889. Patterson Bros., st., $10,350, **89,** 1771. Meacham & Wright, hydraulic cement, $1.16 bbl., **89,** 1771. F. W. Menke Stone & Lime Co., st. office building, $5,952, **90,** 2061.

ENGINEERS.

Chief of Engineers:

Order of, assigning Lt. Col. Wilson (Thirty-fifth Infantry) to charge, **67,** 273.

Letter concerning settlement of land damages, **68,** 395.

R., 66, 4, ii, 41, iii, 33, 37; **67,** 35; **68,** 52, 385; **69,** 44; **70,** 59; **71,** 55; **72,** 51, 319; **73,** 52; **74,** 59; **75,** 64; **76,** 83; **77,** 83; **78,** 101; **79,** 133; **80,** 177; **81,** 238; **82,** 232, 233; **83,** 239, 240; **84,** 242, 243; **85,** 263, 264; **86,** 253, 254; **87,** 219, 220, 221; **88,** 198, 199; **89,** 233; **90,** 208, 209; **91,** 266; **92,** 254, 255; **93,** 286; **94,** 263; **03,** 1505.

Boards:

The work previous to 1866 in charge of a BE., **66,** 4.

Board constituted, 1867, to consider and report on plan for imp. of Mississippi R. at Des Moines Rapids, without restrictions, **67,** 310. Board adopted and recom. modifications of proj. presented by Lt. Col. J. H. Wilson (see Project); recom. approv. by Chief of Engineers, **67,** 36, 265, 307, 350, 352. (Col. Macomb, Lt. Col. Wilson, Maj. Warren, W. M. Roberts, U. S. C. E., and Capt. Hains.)

Board convened, 1871, to report on condition of imp., progress made, work to be done, and causes of difference, if any, in est. cost of completion and est. submitted, **72,** 319. Board reviewed work done and to be done, **72,** 321, 323; reported it carried on in strict accordance with laws of Congress, **72,** 323; increased est. of completion due to partial app., **72,** 324. (Col. Macomb, J. H. Wilson, U. S. C. E., and Capt. Burnham.)

BERH. recom., 1903, private interests be allowed to constr. l. and d. at foot of rapids; also reported enlargement of existing canal unnecessary, **03,** 1505.

In charge:

Capt. J. H. Wilson, 1866–71; **66,** ii, 41; **67,** 273. **R., 67,** 264, 275; **68,** 385; **69,** 212; **70,** 293; **71,** 263.

Col. J. N. Macomb, 1871–77; **71,** 56. **R., 71,** 258; **72,** 282, 325; **73,** 416; **74,** 303; **75,** 454; **76,** 657; **77,** 536.

Joint report of Col. Macomb and J. H. Wilson, U. S. C. E., **72,** 325.

Capt. A. Stickney, 1878–81; **78,** 101. **R.** on mainten. and operations, **78,** 733; **79,** 1151; (Maj.) **80,** 1555; **81,** 1731.

Maj. A. Mackenzie, 1881–94. **R., 82,** 1777, 1781; **83,** 1413, 1416, 1422; **84,** 1576, 1580, 1586; **85,** 1697, 1700, 1707; **86,** 1465, 1468, 1477; **87,** 1639, 1644, 1651; **88,** 1518, 1521, 1527; **89,** 1767, 1772, 1776; **90,** 2060, 2064, 2070; **91,** 2172, 2174; **92,** 1772, 1773; **93,** 2240; **94,** 1683.

Maj. C. McD. Townsend, 1903. **R., 03,** 1500.

Assistants:

D. C. Jenné. **R.** on location and cost, **67,** 282. U. S. C. E. in local charge. **R., 68,** 396.

H. A. Ulffers, **67,** 275; **69,** 226; **70,** 298. **R.** on geology of rapids, **67,** 305.

E. F. Hoffman, **67,** 275.

Capt. L. C. Overman. **R., 68,** 391; **69,** 219.

A. Notz, **70,** 298.

O. S. Willey, **70,** 298; **72,** 319; **73,** 421.

2d Lt. J. E. Griffith, **69,** 228; **70,** 299; **71,** 288; **72,** 319; **73,** 421.

Mr. Bayless, **72,** 319.

Mr. Middleton, **72,** 319.

E. Bennet, **68,** 394.

A. H. Blaisdell, **71,** 284; **72,** 317; **73,** 421.

J. H. Striedinger, **68,** 394.

Capt. A. Stickney assigned to local charge Oct. 21, 1872, **73,** 416. **R., 73,** 416; **74,** 304; **75,** 455, **76,** 658; **77,** 537.

E. H. Worrall, **68,** 394; **69,** 224; **71,** 284; **72,** 319; **73,** 421.

O. L. Wetmore, **68,** 394; **69,** 224.

A. G. Keefer, **68,** 394; **69,** 226.

W. Hormuth, **68,** 394; **69,** 225; **70,** 298.

J. P. Frizzell, **69,** 226; **70,** 299.

Capt. A. H. Burnham in local charge, **71,** 266, 282; **72,** 315; **73,** 423.

Capt. A. Stickney, **73,** 416.

M. Meigs. **R., 82,** 1779, 1782; **83,** 1415, 1419, 1423; **84,** 1578, 1582, 1588; **85,** 1699, 1704, 1708; **86,** 1465, 1473, 1477; **87,** 1642, 1648, 1652; **88,** 1525, 1528; **89,** 1774; **90,** 2061, 2067, 2070; **91,** 2173, 2183; **92,** 1772, 1777.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

ESTIMATES. (See Plans and Projects.)

Orig. proj., imp. natural chan. 4′ x 200′, $2,662,797, **67,** 280, 324, 325, 350; increased w. and d., **67,** 325, 350.

Of plans discussed by BE., imp. natural chan. of R. by r. excavation 5′ x 200′, $3,504,182, **67,** 325, 350.

Of "dams entirely across R., with locks, etc.," $2,460,091, **67,** 327, 350.

Of G. Edmunds, plan "dam from isld. to Illinois shore, etc.," $1,926,720, **67,** 332, 350.

Of "an excavated shore chan. on Iowa side (with exterior embankment)," 5′ x 200′, $3,317,874; for other w. and d., **67,** 334, 350.

Of "canal on Illinois side" similar to dimensions of plan recom. by BE., $3,271,430, **67,** 343, 350.

Of Lt. Col. Wilson's plans, canal 6′x 300′, with chan. on Montrose Chain, 6′ x 200′, $3,390,000, **67,** 285, 338; for canal 300′ w. in embankment, 200′ in excavation, Montrose Chan. 6′ d., $3,110,000, **67,** 285, 338; for canal 5′ x 300′, Montrose Chan. 5′ d., $2,990,000, **67,** 286, 339; for canal 300′ w. in embankment, 200′ in excavation, Montrose Chan. 5′ d., $2,710,000, **67,** 286, 339.

Plan adopted and recom. by BE., July 20, 1867, and approv. by Sec. of War (see Projects), $2,500,000, **67,** 339.

Cost of mainten., $15,200 per year, **67,** 284.

Of cost of completion, Dec. 9, 1870, $1,326,134, **71,** 263; Aug. 1, 1871, $1,000,000, **71,** 288; as revised by BE., Dec. 2, 1871, $1,734,659, **72,** 325.

Canal excavation exceeds orig. est. 27,421 c. y.; reason for, **71,** 266; **72,** 324; cause of increased est., **72,** 51, 324, 326; **76,** 658.

Report of BE., Dec. 2, 1871, on work done and remaining to be done, with est. for, **72,** 320.

Of cost of entire completion, June 30, 1872, $1,723,481, **72,** 318.

Est. increased by 25,200 c. y. of r. on Montrose Chain, and not previously recognized, **76,** 658.

Est. cost of operation and mainten. of canal free from tolls, $40,000, **78,** 738, 747.

For boom at head of guard lock, $6,000; for increasing height of guard-lock walls, $16,000, **79,** 1155; for completion and operation of canal, $129,065, **79,** 1157.

LEGAL PROCEEDINGS.

Rules and regulations governing canal, **78,** 745.

LEGISLATION.

Laws of Iowa inadequate for condemnation of private lands for public use; passage of special law for; lack of au. in bill making app. to pay for land damages, **68,** 396.

Action of commissioners in settlement of land damages, **69,** 228.

Act of Congress providing that no tolls shall ever be collected on canal, **78,** 738.

Relating to operation of canal, **81,** 385.

Relating to constr. of dry dock, **82,** 233, 388.

Relating to constr. of pier, **85,** 1697.

OPERATIONS.[1]

1870-71. Progress on section work, **71,** 266, 282; progress on lock work, **71,** 267, 284. Difficulty from leaks under banks and into lock pits, **71,** 283.

1871-72. Progress on section and lock work, **72,** 315, 316. Operations suspended from July 21, 1871, for lack of funds, **72,** 317; review of past operations and work remaining to be done, **72,** 321, 323.

1872-73. Operations resumed Sept. 5, 1872, **72,** 417. Progress on section work, **73,** 418; near completion of lower and middle locks, **73,** 419. Injury to embankment during the winter, **73,** 417. Section work suspended from Nov. 9, 1872, **73,** 417. Injury to lock timber from exposure, **73,** 420.

1873-74. Completion of masonry at lower and middle locks, **74,** 303; completion of section work in lock section, **74,** 303, 304. U.S. assumes uncertain element of cost in constr. of cofferdams, **74,** 303, 306.

1874-75. Progress of section and lock work, **75,** 456. Rock excavation at entrance to canal completed, **75,** 454, 457. Constr. of catch pools at creek mouths, **75,** 455; **76,** 657. Difficulty from leaks under canal embankments, **75,** 454. Comparison of cost of work by hired labor and contract, **75,** 460.

1875-76. Removal of detached patches of r. by chisel boats, **76,** 657, 661. Progress on section and lock work, **76,** 657, 659, 661. Removal of r. from chan. through Montrose Chain, **76,** 660. Constr. of engine houses and machinery for operation of locks, **76,** 664. Cost of work with hired labor, **76,** 662. Disastrous effects of floods, **76,** 657, 659.

1876-77. Completion of locks and canal prism, **77,** 536, 538. Progress on lock gates and machinery, **77,** 539. Results obtained with hired labor, **77,** 537.

1877-78. Completion and opening of canal Aug. 22, 1877; partial failure of miter sills and repair of same, **78,** 101, 734, 739, 742. Purchase of dr. for operating in canal, **78,** 745.

1878-79. Mainten. and operation of canal; dr. r. from Montrose Chan. and from chan. in front of Montrose; also sediment from prism of canal; completion of lock gates and machinery, **79,** 133, 1151.

1879-80. 2,231 c. y. r. removed from chan., **80,** 1557; 39,336 c. y. mud removed from canal; lock grounds graded and riprap face wall built, **80,** 1558, 1561.

Operation of canal, **80,** 1560.

[1] History of dry-dock constr. at Des Moines Rapids Canal, **91,** 2176.

1880-81. 1,481 c. y. r. removed from chan., **81,** 1732. 2 timber cribs placed at entrance to canal; 9,003 c. y. mud removed from canal; grading lock grounds, **81,** 1734. Provision for future operation of canal, **81,** 385.

Operation of canal, **81,** 1734.

1881-82. 1,332 c. y. r. removed from chan., **82,** 1777, 1780; 352 c. y. st. placed for embankment protection, **82,** 1777; 67,790 c. y. mud removed from canal; repairs to canal embankment, **82,** 1781, 1783.

1882-83. 3,764 c. y. removed from chan.; 14,223 s. y. riprap face st. laid in canal embankment; preparations made for raising lower lock walls; repairs to guiding cribs, **83,** 1415; repair of canal embankment, locks, and dr.; 100,000 c. y. mud removed from canal, **83,** 1419, 1420.

Operation of canal, **83,** 1416.

Preparations for constr. of dry dock, **83,** 1423.

1883-84. 7,089 s. y. riprap protection placed on canal embankment; e. wing wall at foot of canal raised; 2,380 c. y. r. and 26,067 c. y. sand removed from chan., **84,** 1577, 1579. 824 c. y. r. and 77,931 c. y. sand removed from canal and approaches, **84,** 1583. Repairs to dr. boat and lock machinery, **84,** 1584.

Operation of canal, **84,** 1580.

Progress on dry dock, **84,** 1587, 1588.

1884-85. 4,608 c. y. riprap st. placed in canal embankment; west wing wall at foot of canal raised; 1,814 c. y. r. removed from chan., **85,** 1699. 500 l. f. canal embankment repaired; 44,103 c. y. of deposit dr. from canal and approaches, **85,** 1704.

Operation of canal, **85,** 1700.

Progress on dry dock, **85,** 1707.

1885-86. 5,284 s. y. riprap protection placed on canal embankment; 2 guiding cribs placed above guard lock, **86,** 1465. 65,970 c. y. of deposit removed from canal and approaches; repairs to lock machinery and dr., **86,** 1473, 1474.

Operation of canal, **86,** 1468.

Progress on dry dock, **86,** 1477. Cost of dr. in canal, **86,** 1474.

1886-87. 1,353 s. y. of slope wall laid on canal embankment; 1,313 c. y. st. placed along foot of embankment; 209 c. y. r. removed from Nashville Chan., **87,** 1640, 1642.

Operation and care of canal; 78,537 c. y. dr. from canal; repairs to canal embankment, **87,** 1644, 1648.

Progress on constr. of dry dock, **87,** 1651, 1652.

1887-88. 2,143 s. y. of slope wall laid on canal embankment, **88,** 1519.

Operation and care of canal, **88,** 1521, 1523, 1525.

47,333 c. y. dr. from canal, **88,** 1525. 2,232 c. y. masonry and 147 c. y. riprap laid and 1,713 c. y. earth and 272 c. y. r. excavated at dry dock, **88,** 1528.

1888-89. Constr. of floating boom, r. removal above Nashville, and elevation of lock walls at lower lock, **89,** 1768.

Operation and care of canal, **89,** 1772.

86,278 c. y. dr. from the canal, **89,** 1775. Grading and paving of bottom of dry dock completed, pump house built, and pumps set up, **89,** 1776.

1889-90. Lock chamber walls completed; st. office building built at lower lock and sluice tender's cottage at Sandusky; Sandusky sluice completed, **90,** 2062.

Operation and care of canal, **90,** 2064.

23,830 c. y. dr. from the canal, **90,** 2069. Dry dock completed, **90,** 2070.

1890-91. 3,318 c. y. riprap face st. laid in canal embankment; work of raising lock walls of middle lock completed, **91,** 2172.

Operation and care of canal and dry dock, **91,** 2174.

Lock completed in accordance with approv. proj., **91,** 2172.

1891-92. 1,017 c. y. riprap and 996 c. y. rubble st. used in repair of canal embankment; 1,271 s. y. of slope wall laid; lock walls raised and lock grounds filled and graded at middle lock, **92,** 1772, 1773.

Operation and care of canal and dry dock, **92,** 1772, 1773.

1893-94. 2 patches of r. drilled and blasted, and 1 guide pier built, **94,** 1683.

PHYSICAL CHARACTERISTICS.

Of upper Mississippi R. and Des Moines Rapids, **67,** 275, 277, 305, 312.

Range of water surface, **67,** 278, 318, 322.

Sediment, amount of, **67,** 321.

Volume of discharge, **67,** 321.

Relation between rise on rapids and rise on bars, **67,** 322.

Description of rapids and vicinity, **03,** 1500, 1507.

PLANS. (See Estimates and Projects.)

Of imp. previous to 1867, "removing obstrs." on rapids, **66,** iii, 36; by w., d., and straightening chan., by removing r. from R. bed, **67,** 264, 324,325, 335. Rejected by Capt. Wilson, requiring too long to complete, too expensive, and inadequate, **67,** 264, 280.

Of Lt. Col. J. H. Wilson, subsequently modified and recom. by BE.

Plans examined by Board as follows: **67,** 324; "for imp. natural chan. of R. by excavating r.," **67,** 324, 350; rejected as costly and inadequate, **67,** 325, 335. "For dams entirely across R., with locks for SS. and chutes for rafts, creating slack-water navigation," **67,** 326, 350; rejected as destroying present navigation during average and h. w., **67,** 328.

Of G. Edmunds, jr., "being a dam from isld. at upper chain to Illinois shore, with wall from w. end of dam, and running parallel with Iowa shore, etc.," **67,** 329, 350; rejected as experimental and inadequate, **67,** 333. For "an excavated shore chan. on Iowa side, with an exterior (R.) embankment," **67,** 333, 350; compared with plan recom. by BE., **67,**

343; rejected on account of cost, **67,** 335. For a similar imp. on Illinois side, **67,** 333. For "a canal imp. on Illinois side" (similar in constr. to canal recom. on Iowa side), **67,** 342, 350; compared with plan recom. by BE., **67,** 345; would require dam across R. at head of canal, or else excavation of r. from bed of R., **67,** 342, 348; rejected on account of the dam destroying navigation of R. during average and h. w., and increased cost from excavation of r. in bed of R., **67,** 342, 348. For "Livermore's imp. chutes," **67,** 348; rejected as experimental, **67,** 349. For "Brunot imp. float gate for sluices in dams;" not a proper plan of imp., but Board deemed it of sufficient value to call attention of dept. to it, **67,** 349.

PROJECTS. (See Estimates and Plans.)

Lt. Lee, 1837, natural chan. of R., excavation of r. to 4′ below l. w. of 1864, and for w. of 200′; plan partly carried out by removal of about 25,000 c. y. of r., costing $350,000, **66,** iii, 36; **67,** 264, 273, 324, 335. Considered by Col. Wilson as requiring too much time for completion, too expensive, and inadequate, **67,** 264, 280, 324, 335.

Lt. Col. J. H. Wilson (35th Infantry), 1867, for lateral canal 300′ w., 6′ d. on Iowa side, Keokuk to Nashville (7.6 m.), with 2 lifts and 1 guard lock; embankments 20′ w. at top, carried 4′ above h. w., and protected inside and out with riprap, the canal connecting with a through cut along natural chan. of upper chain, the through cut to be 5′ (or 6′) x 200′ d., **67,** 36, 264, 281, 282, 335. Modified by BE. May 13, 1867, viz, embankment to be reduced to 10′ w. at top, to be carried 2′ above h. w., canal to be reduced in excavation to w. of 250′, the riprap on canal side of the embankment to be carried to 12′ above canal bottom, the canal to have a minimum d. of 5′ and a maximum of 8′, lock chambers to remain as fixed by Lt. Col. Wilson (80′ x 350′), reverse gates at outlet unnecessary; the through cut along natural chan. of upper chain to be further investigated by engineer in charge; details not fixed on to be left to be arranged by engineer in charge, subject to approv. of dept., **67,** 36, 265, 307, 350. Approv. by Sec. of War, concurred in by Chief of Engineers, **67,** 36, 265. Pier at lower lock changed from 300′ to 150′ l., **71,** 267. (Col. Macomb, Lt. Col. Wilson, Maj. Warren, W. M. Roberts, U. S. C. E., and Capt. Hains.)

Closed canal so far completed, 1877, as to permit passage of boats; opened to navigation Aug. 22, 1877, **78,** 101, 739, 742. In 1880 it was proposed to raise side walls of middle lock and build 2 guiding cribs at guard lock, **80,** 1562; **84,** 1577. In 1884, proposed to place 2 sluices opposite largest creek to prevent silt being carried into canal, **84,** 1577; **86,** 1467.

In 1882 Maj. Mackenzie proposed constr. of dry dock in connection with canal 100′ x 400′, and located on R. side of canal above middle lock; est., $125,000, **83,** 1422, 1423.

From 1856 to 1886, $4,517,950 had been app. for constr. of canal and chan. through rapids, $360,500 for mainten. and operation of canal, and $108,750 for constr. of dry dock, leaving amount required to complete canal proj. $101,745, and dry dock, $16,250, **86,** 1467, 1469, 1478.

In 1889 Maj. Mackenzie proposed raising lock walls of lower lock, constr. of an office building at lower lock, r. excavation above guard lock, sluice constr., and protection of outside slope of canal embankment; est., $47,194, **89,** 1768.

Proj. completed in 1892, **92,** 1772.

Maj. Townsend reported, 1902, that l. and d. at foot of Des Moines Rapids, such as was proposed to be built by private interests would probably imp. navigation over the canal and locks, also that there seemed to be no necessity, present or prospective, of increasing size of locks; cost of such enlargement about $1,000,000, **03,** 1500.

SURVEYS.

Sur. previously made by Lee and Warren of little use in later ex., **67,** 275.

Sur., comparison of, **67,** 316.

Sur. to determine land damages, **68,** 395.

Sur. and test levels, to determine accuracy of previous, **72,** 317.

Sur. in 1876 develop 25,200 c. y. of r. not previously est., **76,** 658.

Ex. au. act June 13, 1902, to determine the effect on navigation of a l. and d. at the foot of rapids; also to determine necessity and cost of enlarging locks of present canal. **R.** by Maj. Townsend, Dec. 2, 1902, **03,** 1500. (See Projects.)

Maps:

Maps of sur., Appendix i, **66.** List of maps and plans made to June 30, 1868, **68,** 394.

91, 2177.

HH-222(b) Des Moines Rapids Canal and Dry Dock. (Operation and care of.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Description of it will be found at the commencement of each yearly report.

Large and important, a large portion being in lumber.

The traffic of the canal for 1900 showed an increase over the 2 previous years' l. w., especially in 1900,

compelling rafts to make use of the canal instead of going over the rapids, **00,** 2744.

Amount dependent on height of water in R., **04,** 2196; **05,** 429.

ENGINEERS.

Chief of Engineers. **R., 93,** 287; **94,** 263; **95,** 292; **96,** 254; **97,** 323; **98,** 316; **99,** 376; **00,** 433; **01,** 441; **02,** 371; **03,** 395; **04,** 418; **05,** 429; **06,** 468; **07,** 494; **08,** 527; **09,** 558; **10,** 626; **11,** 671; **12,** 811.

In charge:

Maj. A. Mackenzie. 1881–95. **R., 93,** 2241; **94,** 1684; **95,** 2152.

Lt. Col. W. R. King. 1896–97. **R., 96,** 1820; **97,** 2104.

Capt. C. McD. Townsend, 1898–02. **R., 98,** 1794; **99,** 2160; (Maj.) **00,** 2744; **01,** 2284; **02,** 1651.

Maj. Jas. L. Lusk, 1903–04. **R., 03,** 1491; **04,** 2196.

Maj. C. S. Riché, 1905–09. **R., 05,** 1647; **06,** 1425; **07,** 1568; **08,** 1640; **09,** 1633.

Maj. Chas. Keller, 1910–12. **R., 10,** 1788; **11,** 1957; **12,** 2167.

Assistants:

Lt. C. Keller. **R., 95,** 2152.

M. Meigs, U. S. C. E. **R., 93,** 2246; **94,** 1689; **95,** 2156; **96,** 1825; **97,** 2107; **98,** 1800; **99,** 2166; **00,** 2750; **01,** 2288; **02,** 1653; **03,** 1494; **04,** 2198; **05,** 1649.

OPERATIONS.

1892-93. 113,954 c. y. dr., and buildings, etc., repaired, **93,** 2241, 2242, 2246.

1893-94. Lower lock gates repaired, and those of middle lock rebuilt; portion of plant rebuilt and repairs made; booms maintained and repaired; 2 cribs repaired, and 58,025 c. y. dr., **94,** 1684.

1894-95. Lock machinery repaired, as was also canal embankment and guide piers; small amount of r. removed, and plant repaired and additions made, **95,** 2152.

1895-96. Lock gates and machinery repaired; 48,128 c. y. dr.; portions of plant rebuilt, and repairs made, **96,** 1821, 1826.

1896-97. 57,269 c. y. dr., **97,** 2104. Gates, machinery, and buildings repaired; plant repaired, and additions made, **97,** 2107, 2108.

1897-98. 54,551 c. y. dr., **98,** 1794. Gates, machinery, and buildings repaired, **98,** 1800.

1898-99. 43,248 c. y. dr., and buildings and machinery repaired, **00,** 2166.

1899-00. 102,208 c. y. dr., and 2 r. removed; buildings and machinery repaired, **00,** 2750.

1900-01. Lower lock gates rebuilt, repairs made to lock walls, machinery and dr. plant; 149,948 c. y. dr., **01,** 2285, 2288.

1901-02. Minor repairs to lock walls, sluices, culverts, machinery and dr. plant; 151,786 c. y. dr., **02,** 1651.

1902-03. Extensive repairs made to middle and lower locks to Sandusky Sluice and to boom at lower lock; minor repairs to embankment and various buildings; 107,221 c. y. dr., **03,** 1492.

1903-04. Minor repairs to locks and buildings; 69,225 c. y. dr., **04,** 2196. Work at shop and dry dock, **04,** 2199.

1904-05. Minor repairs to locks and buildings; 161,970 c. y. dr., **05,** 1647. Work at shop and yards, **05,** 1651. Table of material removed from 1879 to 1905; total, 2,011,261 c. y., **05,** 1649.

1905-06. Leaks in locks repaired, lower guard lock gates rebuilt, and others repaired. 170,482 c. y. dr., work at shop and dry dock, **06,** 1427.

1906-07. Minor repairs to gates of locks and docks and to sluice; 146,040 c. y. dr.; repairs to piers; work at shop and dry dock, **07,** 1568.

1907-08. Small repairs to locks, and extensive imp. to dry dock; 249,556 c. y. dr., **08,** 1640.

1908-09. Upper gates of guard lock and gates of middle lock rebuilt. Work at shop and dry dock; 109,694 c. y. dr., **09,** 1633.

1909-10. Repairs to locks and buildings; large amount of work at dry dock and shop; 231,645 c. y. dr., **10,** 1788.

1910-11. Minor repairs, 175,962 c. y. dr., **11,** 1958.

1911-12. 111,261 c. y. dr.; work on power dam and dry dock continued; **12,** 2166.

NOTE.—(For itemized yearly statements of expend. see district engineer's report.)

PHYSICAL CHARACTERISTICS.

Dates of opening and closing of the canals since date of first opening will be found in each yearly report.

Pools below grade are shortening yearly, w. of canal prisim decreasing; **05,** 1651.

Shoaling caused by flood; **08,** 1640.

PRIVATE WORK.

Keokuk & Hamilton Water Power Co., by au. of Congress, engaged on constr. of large dam, **11,** 1959; **12,** 2166.

PROJECTS.

Dry dock utilized each year by boat owners for repair of boats, etc., on payment of a small fee, **93,** 2242. (See each yearly report thereafter.)

In 1896 Lt. Col. King gave it as his opinion that it was a great mistake to install costly steam or hydraulic machinery on canals of this kind for operation of gates and wickets, **96,** 1820.

SURVEYS.

Of canal, **04,** 2199; **05,** 1652.

HH-222(c) St. Paul to Des Moines Rapids. (Except H. of refuge in Lake Pepin, ice H. at Dubuque, Rock Isld. Rapids, and Des Moines Rapids.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

C. interests affected by obstr. at Rock Isld. Rapids, **89,** 1762.

CONTRACTS.

1879. Winston Bros., shore protection, Hastings, **80,** 1497. S. J. Truax, shore protection and dams, Smiths Bar, **80,** 1497. Jenkins & Van Gorder, shore protection and dams, Mt. Vernon Bar and Winona, **80,** 1499. Whitney & Sons, r. removal near Horse Isld.; dr., Keithsburg, **80,** 1505. Brown & Co., dr., Dubuque, 17¢ c. y., **80,** 1534.

1880. S. J. Truax, shore protection and dams above Red Wing and below Wabasha, **81,** 1689. J. Richtman, shore protection and brush dams near Fountain City and above Winona, **81,** 1689. Whitney & Sons, dr., Rock Isld. H., 20¢ c. y., **80,** 1704; dr., Muscatine, 20¢ c. y., **81,** 1706.

1881. S. J. Truax, shore protection and dams Reeds Landing to Wabasha, 81, 1690. A. J. Whitney & Sons, dr., 98¢ c. y., below Keithsburg, **81,** 1690. Whitney & Sons, dr., Dubuque, 25¢ c. y., **82,** 1768; dams and shore protection, Andalusia, **81,** 1705.

1882. P. S. Davidson, shore protection and dams, bet. La Crosse and Brownsville, and bet. Homer and Queens Bluff, **83,** 1387, 1388. J. Richtman, shore protection and dams bet. Mt. Vernon and Fountain City, **83,** 1388.

1883. B. E. Linehan, dr., Dubuque, 12¢ c. y., **84,** 1571.

1884. A. J. Whitney, dr., Muscatine, 16¢ c. y., **84,** 1675.

1885. A. D. Fleak, dr. hull, **85,** 1673. Truax & Robinson, poles and brush, **85,** 1673. Patterson Bros., riprap, **85,** 1674. C. H. Appleton, dr., St. Paul, 16⅝¢ c. y., **85,** 1675. T. G. Isherwood, 6 flatboats, **85,** 1675. M. Von Hein, 6 dump boats, **85,** 1675.

1887. A. Richtman, dams and shore protection. S. D. Truax, dams and shore protection. A. Kirchner, riprap r. W. M. Roberts & Co., riprap r., **87,** 1624, 1629.

1889. Patterson Bros., dams and shore protection; st., $1.20 c. y.; brush, 40¢ c. y. A. J. Whitney, dams and shore protection; $1.20 c. y. for st., and 40¢ c. y. for brush. A. J. Whitney, dams and shore protection; $1.15 c. y. for st., and 40¢ c. y. for brush. A. J. Whitney, dam and shore protection; $1.30 c. y. for st., and 50¢ c. y. for brush, **89,** 1738.

1890. A. J. Whitney, dr., 17¢ c. y., **91,** 2168.

1891. J. Richtman, constr. and repair of dams and shore protection; st., $1.20 c. y., and brush, 27¢ c. y., **91,** 2153. W. A. Patterson, constr. and repair of dams and shore protection; 90¢ c. y. for r., and 50¢ c. y. for brush, **91,** 2153.

1892. J. Richtman, constr. and repair of brush and r. dams and shore protection; $1.20 c. y. for r., and 27¢ c. y. for brush, **92,** 1795. Patterson Bros., constr. and repair of brush and r. dams and shore protection; 90¢ c. y. for r., and 40¢ c. y. for brush, **92,** 1801.

ENGINEERS.

Chief of Engineers:

St. Paul to Des Moines Rapids. **R., 80,** 171; **81,** 232; **82,** 229; **83,** 235; **84,** 239; **85,** 261; **86,** 260; **87,** 219.

Guttenberg, Iowa. **R., 81,** 233; **82,** 230; **83,** 237; **85,** 266.

Dubuque, Iowa. **R., 80,** 172; **81,** 233; **82,** 230; **83,** 237; **84,** 240; **85,** 262; **86,** 252; **87,** 221.

Rock Isld. H., Ill. **R., 80,** 173; **81,** 234; **82,** 231; **83,** 238; **84,** 241; **85,** 263.

Andalusia, Ill. **R., 80,** 177; **81,** 234; **82,** 231; **83,** 238.

Muscatine, Iowa. **R., 80,** 173; **81,** 234; **82,** 231; **83,** 238; **84,** 241.

Burlington, Iowa. **R., 80,** 174; **81,** 235.

Fort Madison, Iowa. **R., 80,** 174; **81,** 235; **82,** 232; **83,** 239.

R., 88, 197, 1510; **89,** 232, 1750; **90,** 208; **91,** 265; **92,** 255.

Boards:

Miss. R. Com. **R., 81,** 2742, 2755.

Convened, St. Paul, Aug. 25, 1887, by S. O., No. 67, to ex. and report upon test of "Adams" flume. **R., 88,** 1511. (Majs. Allen and Adams and Capt. Marshall.)

Convened, Rock Isld., Jan. 16, 1889, by S. O., No. 59, to report upon proj. for imp. of R. at Rock Isld. Rapids. **R., 89,** 1751. (Col. Poe and Majs. Mackenzie and Marshall.)

In charge:

Maj. A. Mackenzie, 1880–92:

St. Paul to Des Moines Rapids. **R., 80,** 1493, 1532; **81,** 1686, 2755; **82,** 1754; **83,** 1382; **84,** 1550; **85,** 1669, 1710; **86,** 1412; **87,** 1623.

Guttenberg, Iowa. **R., 81,** 1700; **82,** 1767; **83,** 1405; **85,** 1718.

Dubuque, Iowa, **R., 80,** 1532; **81,** 1700; **82,** 1768; **83,** 1405; **84,** 1571; **85,** 1691; **86,** 1424, 1425; **87,** 1653.

Rock Isld. H., Ill. **R., 80,** 1539; **81,** 1703; **82,** 1773; **83,** 1411; **84,** 1575; **85,** 1695.

Andalusia, Ill. **R., 81,** 1704; **82,** 1774; **83,** 1411.

Muscatine, Iowa. **R., 80,** 1539; **81,** 1706; **82,** 1775; **83,** 1411; **84,** 1575.

Burlington, Iowa. **R., 80,** 1541; **81,** 1707.

Ft. Madison, Iowa. **R.,** 80, 1541; **81,** 1715; **82,** 1776; **83,** 1412.

R., 88, 1480; **89,** 1731; **90,** 2033; **91,** 2147; **92,** 1779.

Assistants:

J. L. Gillespie. **R., 80,** 1496; **81,** 1690; **82,** 1757; **83,** 1388; **84,** 1554; **85,** 1676.

M. Meigs. **R., 80,** 1499, 1534; **81,** 1692; **82,** 1759, **87,** 1637; **88,** 1506; **89,** 1745, 1748; **90,** 2056; **91;** 2165, 2171; **92,** 1809, 1813.

E. F. Hoffman. **R., 80,** 1504; **81,** 1695; **82,** 1761; **83,** 1392; **84,** 1558.

C. W. Durham. **R., 84,** 1559, 1575; **85,** 1679; **86,** 1415; **87,** 1631; **88,** 1491, 1504; **89,** 1739, 1746; **90,** 2038, 2059; **91,** 2154, 2169; **92,** 1787, 1812.

G. A. Marr. **R., 85,** 1684.

OPERATIONS.[1]

1879-80. Constr. of brush and st. dams and shore protection at Hastings, Prescott, Smiths Bar, Crats Isld., Beef Slough, Mt. Vernon, Rolling Stone, Betsy Slough, Winona, La Crosse, and Cassville Slough, and in dr. and removal of bowlders at Horse Isld., Smiths Isld., and Keithsburg, **80,** 1496–1505.

Dubuque: 19,573 c. y. dr. from bar in front of landing, **80,** 1534.

Muscatine: 15,107 c. y. dr. from bar in front of landing, **80,** 1540.

Ft. Madison: Raising Niota Chute Dam, constr. of dike bet. Islds. 390 and 391, shore protection at foot of Isld. 391, and dr. at ferry landing, **80,** 1542.

1880-81. Constr. of brush and st. dams, and shore protection at Nininger Slough, Red Wing, Wabasha, Beef Slough, Pomme de Terre Slough, Rolling Stone, Winona, Cassville Slough, Guttenberg, Rush Chute, and Shokokon Slough; r. removal at Horse Isld. and dr. at Keithsburg, **81,** 1687, 1690–1695.

Guttenberg: Commencement of dam for closing Swift Slough, **81,** 1700.

Rock Isld. H.: 7,402 c. y. dr. from bar, **81,** 1703.

Muscatine: 23,830 c. y. dr. from bar, **81,** 1706.

Burlington: Strengthening of Rush Chute Dam, and placing of shore protection at head of isld. and the chute, **81,** 1708.

1881-82. Constr. of brush and st. dams, and shore protection bet. St. Paul and Hastings; bet. Reeds Landing and Wabasha at Rolling Stone, Betsy Slough, near Wilds Landing, Winona, Rush Chute, and Shokokon Slough, and dr. in Coon Slough Bends, **82,** 1754, 1757–1763.

Guttenberg: Completion of Swift Slough Dam, **82,** 1767.

Dubuque: 3,570 c. y. dr. from shoal near Ferry Landing at East Dubuque, **82,** 1767.

Rock Isld. H.: 407 c. y. dr. from bar, **82,** 1773.

Andalusia: Progress on dam constr. and shore protection at islds. 319, 320, and 321, **82,** 1774.

Muscatine: 18,294 c. y. dr. from bar and mouth of Papoose Creek, **82,** 1775.

1882-83. Constr. of brush and st. dam and shore protection bet. St. Paul and Hastings, at Alma, Wabasha, Homer, Queens Bluff, Mt. Vernon, Fountain City, La Crosse, Brownsville, Guttenberg, Cassville Slough, Rush Chute, Shokokon Slough, and Montrose, **83,** 1383–1395.

Guttenberg: 1,520′ of shore protection placed on isld. opposite the town, **83,** 1405.

Ft. Madison: 1,320′ of shore protection placed at heads of Islds. 392 and 393, **83,** 1412.

1883-84. Constr. of brush and st. dams and shore protection bet. St. Paul and Hastings; bet. Homer and Queens Bluff, near Winona, at Ft. Madison and Montrose, and dr. below Minneiska, **84,** 1551, 1554–1560.

Dubuque: 23,436 c. y. dr. from middle grounds and in front of East Dubuque Landing, **84,** 1571.

Sur. of Rock Isld. H., **84,** 1575.

Muscatine: 17,251 c. y. dr. from bar, **84,** 1575.

1884-85. Constr. of brush and st. dams and shore protection bet. St. Paul and Hastings; bet. Reeds Landing and Winona, at La Crosse, Fountain City, Cassville Slough, Guttenberg, Andalusia, and Ft. Madison; dr. near Bad Axe, at Hs. of Muscatine and Ft. Madison, Rock Isld. Rapids; constr. of dr. and dump scows, **85,** 1667, 1669 1676–1685.

Rock Isld. H.: 18,558 c. y. dr. from bar, thereby completing all work required, **85,** 1696.

1885-86. Constr. of brush and st. dams and shore protection at St. Paul, bet. St. Paul and Hastings, in vicinity of Fountain City, and at Coon and Cassville Sloughs; dr. below Alma and at West St. Paul, **86,** 1412–1416.

Dubuque: 37,968 c. y. dr. from upper part of bar, **86,** 1425.

1886-87. Dam and shore protection constr. and repaired bet. St. Paul and Hastings, at Red Rock, bet. Homer and Queens Bluff, Otter Isld. and Nauvoo, at Crooked Slough, Chimney Rock, Andalusia and Rolling Stone Slough; r. removed at Rock Isld. Rapids, Drews Prairie, and Dallas; wrecks removed at Hastings and Wabasha; removal of bar at foot of Coon Slough, **87,** 219, 1623, 1631–1639; 4,677 c. y. dr. from bar opposite Dubuque, **87,** 1653.

1887-88. 89,035 c. y. r. and 71,766 c. y. brush used in constr. and repair of wing dams and shore protection at Andalusia and Crooked Slough, bet. Minneiska and Winona, Reeds Landing and Minneiska, Sand Prairie and Savanna, Guttenberg and Waupeton, and Homer and Queens Bluff, **88,** 1491, 1502. 1,343 c. y. r. blasted and removed at Rock Isld. Rapids, and 28,596 c. y. sand dr., **88,** 1503, 1504. 860 c. y. r. removed at Drews Prairie and at Crossing below Isld. 395; repairs to Shokokon Dams Nos. 1 and 2; Dam No. 5 built at Vixen Chute, **88,** 1507.

[1] History of past operations, **81,** 2757. Comparative cost of dr., 1878 to 1885, **86,** 1407.

9,500 l. f. of shore protection constr. at Isld. 395, Sauerweins Bend, and at foot of Burlington Isld., **88,** 1508.

1888-89. 56,498 c. y. r. and 71,264 c. y. brush used in revet., bank protection, and constr. of wing dams at Fountain City, West Newton Bar, Isld. 395, Shokokon and Crooked Sloughs, and Ft. Madison; also bet. St. Paul and Prescott, **89,** 1739–1748. Buoyage of Rock Isld. Rapids, **89,** 1744. Repairs to break'r at Lake City and to shore protection at Burlington and Sauerweins Bend, **89,** 1744–1746. 460 c. y. r. blasted and removed, and 1,883 c. y. r. placed in dam constr. at Rock Isld. Rapids, **89,** 1747.

1889-90. 261,625 c. y. r. and 285,659 c. y. brush used in constr. of wing dams, training walls, and bank protection bet. St. Paul and Prescott, Prescott and Lake Pepin, Reeds Landing and Fountain City, Guttenberg and Waupeton, Fairport and Muscatine; also at Winona, Crooked Slough, Keithsburg, Pontoosuc, and Ft. Madison, **90,** 2038–2059. Buoyage of Rock Isld. Rapids, **90,** 2049. 2,156 c. y. r. blasted and removed, and 9 guide piers built at Rock Isld. Rapids, **90,** 2050, 2052. Constr. and repair of plant, **90,** 2055.

1890-91. Dams 24 and 25 at Pine Bend completed; Dam No. 22 lengthened, **91,** 2156. Shore protection of Isld. No. 13 repaired; Dams 44 to 48 constr. at Grey Cloud Landing, **91,** 2156. Dams 32 and 33 built at Ninninger, and Dams 2, 26, 27, 30, and 31 raised, **91,** 2157. Dr. through bar opposite Dam No. 10, **91,** 2157. Aggregate l. of above works, 3,390′ consuming 5,074 c. y. of r. and 12,044 c. y. of brush, **91,** 2158. 1,130 l. f. of wing dam constr. at Reeds Landing and vicinity of Teepecota Pt., **91,** 2160. Repairs to dam at head of Pomme de Terre Slough, **91,** 2160. 4,985 l. f. of wing dam built and repaired, consuming 11,286 c. y. r. and 11,795 c. y. brush at Fountain City and Wilds Landing, **91,** 2161. Break in dam across Harper Slough repaired, **91,** 2162. Buoys reset on Rock Isld. Rapids, **91,** 2162. 1,659 c. y. r. blasted and 2,119 c. y. dr. and removed from St. Louis Chain, Rock Isld. Rapids, **91,** 2164. Repairs to pier at Lake City, **91,** 2165. 14,837 c. y. r. and 10,720 c. y. brush used in constr. of dams and shore protection in vicinity of Burlington and Dallas **91,** 2166. Repair and constr. of plant, **91,** 2169. 22,370 c. y. r. and 20,307 c. y. brush used in constr. of dams and shore protection at Reeds Landing, Minneiska, La Crosse, Prairie du Chien, and Clinton, **91,** 2170. 9,082 c. y. of material dr. at Port Byron H., **91,** 2170. 11,465 c. y. of material, 240 c. y. of bowlders, and 1 wreck removed at Montrose H., **91,** 2171.

1891-92. 1,230 c. y. r. blasted and removed below Minneapolis, **92,** 1788. 2,720 l. f. of bank revet. constr. at Pike Isld., **92,** 1789. Dr. at Groveland Park, Minnehaha, Pike Isld., and above Ft. Snelling, **92,** 1789. 8,055 l. f. of brush and r. dam built bet. St. Paul and Prescott, **92,** 1792. 3,120 l. f. of brush and r. dam built bet. Prescott and Lake Pepin; 20,867 l. f. of brush and st. dam and shore protection built bet. Reeds Landing and Minneiska, **92,** 1796. 15,405 l. f. of brush and r. wing dam and shore protection built bet. Minneiska and La Crosse, **92,** 1798. 2,571 l. f. of dam and shore protection built and repaired bet. La Crosse and Crooked Slough, **92,** 1800. 7,019 l. f. of brush and r. wing dam built at Prairie du Chien, **92,** 1801. 760 l. f. of wing dam built at Cassville Slough, **92,** 1802. 1,350 l. f. of dam and shore protection built in vicinity of Clinton, **92,** 1802. 37,094 c. y. of material dr. at Port Byron H., **92,** 1803. 3,390 c. y. solid r. blasted and removed, 2,672 c. y. of st. used in constr. of guide piers, and 2,960 l. f. of wing dam built at Rock Isld. Rapids, **92,** 1806. Constr. and repair of plant, **92,** 1807. 11,069 l. f. of brush and r. dam and revet. constr. bet. Keithsburg and Montrose, **92,** 1811. 11,465 c. y. of material dr. at Montrose H., **92,** 1812. 16,965 c. y. of material dr. at Pike Isld., **92,** 1813.

PHYSICAL CHARACTERISTICS.

Specific gravities of sand, **80,** 1504.

Current observations at Burlington, **81,** 1708.

Depths before and after imp., **81,** 2446.

Character of material in bed of R., **81,** 2734; **83,** 2758.

Slope of R., **81,** 2744.

Discharge of, **81,** 2744.

PLANS. (See Projects.)

Act of July 5, 1884, required **R.** concerning value of Sny Isld. Levee to imp. of R. and an est. for strengthening and preserving levee to maintain its benefit. Maj. Mackenzie did not consider that as a levee it had benefited navigation except as closure to certain chutes. Cost of strengthening such closing parts est. at $16,515, **85,** 1710–1717.

By BE., 1889, canal around Rock Isld. Rapids 10½ m. l., with w. of from 200′ to 500′ and a l. w. d. increasing from 6′ to 12′, having 2 locks 80′ x 325′; est., $4,000,000, **89,** 1750, 1767.

PROJECTS. (See Plans.)

General proj. for imp. of R., St. Paul to Des Moines Rapids, gradual bringing of the R. into one chan. with brush and st. dams, by which chutes closed and w. places contracted; also protection of caving banks and heads of islds. At special localities dr. resorted to as an aid to the contracting and regulating works, **81,** 2745; **85,** 1383.

At special locations:

At Guttenberg, Iowa, proj. was closure of Swift Slough and protection of head of the isld. opposite town, **81,** 1694, 1700; **85,** 1720.

At Dubuque, Iowa, proj. of 1876 proposed artificial cut, Waples to New Barneys Cuts; also closure of Seventh St. Slough, New Barneys and Waples Cuts, **76,** 696. Modified in 1877 for temporary imp. of bar by dr. and subsequently its permanent imp. by constr. of training dike from upper end of New Barneys Cut to RR. br., **77,** 525.

In 1879 BE. recom. imp. of bar with 2 contracting dikes from Dunleith Shore if dr. chan. then in progress in front of Dubuque Wharf showed signs of refilling. Est. cost of dikes, $12,668, **79,** 1143; **80,** 1532. Dr. successful, dikes omitted, **86,** 1424.

At Rock Isld. H. proj. of 1879 proposed removal, by dr., of bar along levee and part of large bar extending from foot of Rock Isld., covering the SS. landing. Est., $26,759.15, **80,** 1539; **85,** 1695. Proj. completed in 1884, **85,** 1696.

At Andalusia, Ill., proj. of 1880 proposed imp. of chan. of approach bet. main chan. and landing with dams bet. Illinois shore and Isld. 321, bet. Islds. 320 and 321, and bet. Islds. 318 and 319, together with necessary shore protection. Est., $18,000, **81,** 1705, 1706.

At Muscatine, Iowa, proj. of 1879 proposed temporary imp. of bar in front of city landing by dr. Est., $19,250. **79,** 1137; **80,** 1540.

At Burlington H., Iowa, proj. of 1875–79 proposed imp. of Rush Chute by removal of bar at its head by dr. and contraction of chan. at foot of chute by rectifying dams with shore protection. Est., $69,656.57. **76,** 691, 693; **79,** 1138; **80,** 1541. After 1881 this imp. carried on under app. for imp. Mississippi R. bet. St. Paul and Des Moines Rapids, **81,** 1708.

At Ft. Madison proj. of 1875 proposed closing Niota Chute and protection of heads of adjacent islds., **76,** 688; **79,** 1139.

In 1889 BE. proposed imp. of existing navigable chan. through Rock Isld Rapids, giving l. w. d. of 4′, by r. excavation, with wing dams, erection of guide piers, and dr.; est., $330,000, **89,** 1750, 1761.

SURVEYS.

From Falls of St. Anthony to St. Paul, au. act Mar. 3, 1879; made by Maj. Allen, 1879, **80,** 1660.

At Andalusia, au. act Mar. 3, 1879; made by Maj. Mackenzie, 1880, **81,** 1705.

Ex. of Isld. Levee au. act July 5, 1884; made by Maj. Mackenzie, **85,** 1710, 1717.

At Guttenberg, au. act July 5, 1884; made by Maj. Mackenzie, 1884, **85,** 1718.

Maps:

Below Ninninger, Minn., **84,** 1554.

At Pine Bend, **84,** 1558.

Bellevue Bar, **80,** 1506.

Beef Slough, **80,** 1506.

Mt. Vernon Bar, **80,** 1506.

Winona Bar, **80,** 1506.

Cassville Slough, **80,** 1506.

Keithsburg Bar, **80,** 1506.

Dubuque, **80,** 1532.

Muscatine, **80,** 1540.

Ft. Madison, **80,** 1540.

Burlington, **81,** 1540.

Wabasha, **86,** 1418.

Boulanger Slough, **86,** 1420. **89,** 1766.

HH-224 Hamilton Slough, Ill.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 234; **91,** 267, 2185.

In charge. Maj. A. Mackenzie, 1888–92. **R.,** **89,** 1781; **91,** 2185.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Mackenzie (**R.** unfav.), **89,** 1781.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Mackenzie (**R.** unfav.), **91,** 2186.

HH-227 Fort Madison Harbor, Iowa.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Blockade of, by bar in front of city, **76,** 84, 688, 689.

CONTRACTS.

1877. A. M. Hutchinson, st. for riprap dam, **76,** 535; **78,** 713.

1878. A. McArthur, rock in dam, **79,** 1140.

ENGINEERS.

Chief of Engineers. **R.,** **76,** 84; **77,** 84; **78,** 97; **79,** 132.

In charge:

Col. J. N. Macomb. **R.,** **76,** 688; **77,** 524.

Maj. F. U. Farquhar. **R.,** **78,** 711; **79,** 1139.

Assistants:

C. W. Durham. **R.,** **76,** 689, ii, 188.

M. Meigs. **R.,** **77,** 534.

OPERATIONS.

1877–78. Partial constr. of dam across Niota Chute, with shore protection at ends, **78,** 97, 712.

1878–79. Completion of Niota Dam, **79,** 132, 1139.

PHYSICAL CHARACTERISTICS.

Discharge of R. at Ft. Madison, **76,** 689.

PROJECTS.

Imp. of R. in vicinity, 1875, by closing Niota Chute by riprap dam on brush foundation 3′ x 1,400′ above l. w.; also removal of small ledge of r. near Niota side and dr. through bar to facilitate scour, $30,186, **76,** 688, 690, ii, 188; **77,** 84, 524; **78,** 711.

By Maj. F. U. Farquhar, 1879, extension of previous proj. by constr. of spur dam from head of Niota Isld. toward Iowa shore, $8,586, **79,** 132, 1139.

SURVEYS.

Vicinity of Ft. Madison, 1875, **76,** 688.

HH-231 Burlington Harbor, Iowa.

APPROPRIATIONS. (See p. 1089.)

CONTRACTS.

1877. J. Hussell, r. for dams, **78,** 716.

ENGINEERS.

Chief of Engineers. **R.,** **76,** 84; **77,** 84; **78,** 97; **79,** 131.

In charge:

Col. J. N. Macomb. **R.,** **76,** 691; **77,** 524. Relieved Nov. 15, 1877, by Maj. F. U. Farquhar, **78,** 714. **R.,** **78,** 714; **79,** 1138. (H. D. 74, 45th, 3d.

Assistants:

C. W. Durham. **R.,** **76,** 692, ii, 186.

M. Meigs. **R.,** **77,** 535.

OPERATIONS.

1877-78. Partial constr. of dams from head of Rush Isld. to Otter Isld., and 400 l. f. shore protection on islds., **78,** 97, 714.

1878-79. Completion of dam, closing Rush Chute, dr. to facilitate landing of SS., **79,** 131, 1138.

PROJECTS.

1875. Imp. Rush Chute, closing main chan. of R. from Otter to Rush Isld., together with closing of 2 interior chutes by dams, all consisting of riprap on brush foundations; est., $35,221, **76,** 691, 693.

1879. By Maj. Farquhar, modifying previous proj. by dr. at head and foot of Rush Chute, and building of rectifying dams with shore protection, est., completion, $49,656, **79,** 1138. (H. D. 74, 45th; 3d.)

SURVEYS.

Vicinity of Burlington, 1875, **76,** 691.

HH-240 Muscatine Harbor, Iowa.

APPROPRIATIONS. (See p. 1089.)

ENGINEERS.

Chief of Engineers. **R.,** **79,** 131.

In charge. Maj. F. U. Farquhar. **R.,** **79,** 1136.

OPERATIONS.

1878-79. 17,600 c. y. dr., **79,** 1136.

PROJECTS.

Maj. F. U. Farquhar, 1879, temporary imp. of bar by dr. 70,000 c. y. sand; est., $19,250, **79,** 1137.

HH-245 Rock Island Rapids.[1]

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Imp. justified, **67,** 274, 301.

Importance of, **73,** 434; **77,** 546.

Injury to navigation by obstr., **67,** 290; **75,** 465.

Fav. results of work done, **69,** 243; **73,** 431.

Range lights proposed, **73,** 431.

CONTRACTS.[2]

C. G. Case & Co., monthly removal of at lseat 5,000 c.y. of r., **67,** 267, 361; **68,** 388. Question with as to r. removal below bottom, **69,** 247; **71,** 290. Skillful work done, **70,** 303. Contract completed Sept., 1870, **71,** 290.

Wagenen & Harroun, removal of r., **70,** 303.

Harroun, removal of r., **70,** 303. Death of, and release of heirs from contract, **71,** 290. Unfinished

[1] Sur.—**R.,** July 12, 1829; Sept. 16, 1836; Dec. 6, 1837, est., $154,658; Apr. 6, 1854, est., $123,620 and $450,150. (H. D. 482, 55th, 2d.)

[2] Injurious effect of laws governing contracts, **67,** 268. Saving by hired labor over contract, **74,** 312; **76,** 666; **77,** 544.

contract let to J. J. Dull, **71,** 290. Energy of contractor, **72,** 332. Contract closed Oct., 1872, **73,** 431.

Dull & Williams, excavation on Winnebago Chain, made Aug., 1872; completed May, 1873, **74,** 311.

G. Williams, excavation of several chains June, 1873, **73,** 436; completed Oct., 1873, **74,** 311. New contract made Aug., 1874; completed Oct., 1874, **75,** 462. Work done cheaper by contract than hired labor, **74,** 312. New contract made Aug., 1875; completed Apr., 1876, **76,** 666. Contract made for hire to U. S. of chisel boats, Oct., 1876, **77,** 544; renewed for season of 1877, **77,** 545.

1879. Whitney & Sons, dr. broken r. from Moline Chain, **79,** 1132, 1133, 1134.

DEFENSE.

Plan adopted shall secure to the naval vessels of the U. S. safe and convenient navigation, **67,** 274.

ENGINEERS.

Chief of Engineers. **R., 67,** 36; **68,** 53; **69,** 45; **70,** 60; **71,** 55; **72,** 51; **73,** 52; **74,** 59; **75,** 64; **76,** 83; **77,** 83; **78,** 96; **79,** 131; **80,** 173; **81,** 233; **82,** 231; **83,** 238; **84,** 241; **85,** 263; **86,** 252; **87,** 219.

Boards:

Recom., 1886, (1) that SS. chan. be enlarged to min. w. of 200′ and a navigable d. of 4′; (2) that excavated material be deposited to confine volume of water, as far as practicable, to new chan.; (3) that cofferdams be used in carrying on work; (4) that work should not be commenced until app. be made to cover its est. cost; (5) that imp. by l. and d. inadmissible, **67,** 298. (Capt. Hains, James Worral, C. E., D. C. Jenné, C. E., and W. F. Shunk, C. E.) Recom., 1871, an immediate app. of $200,000 to complete work. Previous est. increased by existence of several patches of r. not hitherto considered, **72,** 320. (Col. Macomb, Lt. Col. Wilson, U. S. C. E., and Capt. Burnham.)

In charge:

Lt. Col. J. H. Wilson, 35th Infantry, 1866–70. **R., 67,** 267, 274, 286; **68,** 388; **69,** 214; **70,** 302; **71,** 264.

Col. J. N. Macomb, 1870–77. **R., 71,** 259; **72,** 285; **73,** 431; **74,** 311; **75,** 462; **76,** 666; **77,** 541.

Maj. F. U. Farquhar, 1877–80. **R., 78,** 708; **79,** 1132.

Maj. A. Mackenzie, 1880–87. **R., 80,** 1534, 1537; **81,** 1701; **82,** 1771; **83,** 1407; **84,** 1572; **85,** 1694; **86,** 1427; **87,** 1625.

Assistants:

Capt. P. C. Hains. **R., 67,** 287, 358.

W. D. Clark, **67,** 288.

J. E. Abbott, **67,** 288.

Capt. C. J. Allen. **R., 68,** 421; **69,** 237; **70,** 308.

E. F. Hoffmann:

Sur. of rapids in 1867, **68,** 427.

R., 68, 427; **71,** 289; **72,** 329; **73,** 431; **74,** 311; **75,** 464; **76,** 667; **77,** 543; **78,** 709; **79,** 1133; **80,** 1536; **82,** 1772; **83,** 1409; **84,** 1574.

C. J. Pauli, **68,** 431; **72,** 334; **73,** 435.

J. P. Frizell. **R., 68,** 436.

C. H. Benck, **72,** 332; **73,** 435; **74,** 313; **75,** 467 **76,** 674; **77,** 546.

H. Lambach, **72,** 332.

C. Durham, **72,** 332.

J. F. Wallace, **72,** 334; **73,** 435; **74,** 313; **75,** 467; **76,** 674.

A. Stibolt, **73,** 435; **74,** 316; **75,** 467; **76,** 674; **77,** 546.

E. Cramer, **76,** 674.

C. W. Durham. History of imp., **86,** 1429.

ESTIMATES. (See Plans and Projects.)

Entire completion under proj., 1867, by removal of 57,451 c. y. of r., $813,602, **67,** 37, 267, 296, 298; **68,** 288. Deemed reliable by officer after experience of first year, **67,** 359.

1869. To complete, $300,000, **69,** 217.

1871. To complete, $200,000, **72,** 320. Cause for increased est., **72,** 320.

1873. To complete, $112,000, **73,** 431, 434. Explanation of increased est., **73,** 434.

1874. To complete, $80,000, **74,** 311. Cause for increased est., **74,** 316; **75,** 462. Small difference bet. pre. and final est. of quantities on Lower Chain, **67,** 37, 267, 296; **76,** 668.

1879. For completion of existing proj., $12,000, **79,** 131, 1133.

LEGISLATION.

Required for condemnation of private lands for public good, **67,** 269. Laws with reference to contracts operate against economy, **69,** 217.

OPERATIONS.

Suspended from 1856 to 1866, **66,** 4. Prior to 1866 were confined to removal of r. in natural chan. **67,** 292; **68,** 434. Operations carried on by contract from 1866 to 1876, and afterwards by hired labor.

1866-67. Removal of r. on Duck Creek Chain by chisel boats; constr. of cofferdam on reef below Duck Creek, **67,** 37, 359.

1867-68. Continued operations on Duck Creek Chain by chisel boats and cofferdams, **68,** 37, 434.

1868-69. Operations at Duck Creek, Moline, and Sycamore Chains; cofferdam completed at Campbells Chain; destruction of cofferdams by floods and collisions, **69,** 45, 214, 215, 238, 242, 244.

1869-70. Continued operations at Sycamore and Campbells Chains; completion of r. removal at Duck Creek and Moline Chains, **70,** 60, 302, 309.

1870-71. Delay in work from death of contractor; removal of r. from Smiths, Sycamore, Crab

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Isld., and St. Louis Chains, **71,** 56, 259. Removal of Campbells Chain completed Sept., 1871, **71,** 270, 281.

1871-72. Work confined to points presenting greatest obstr.; statement of r. removed, **72,** 51, 282, 329, 332.

1872-73. Completion of r. removal at Smiths, Crab Isld., and St. Louis Chains, table showing total amount of r. removed from 1867 to 1873, **73,** 52, 431, 435.

1873-74. Limited operations from lack of app. about 7,200 c. y. yet to be removed to complete imp. removal of r. from e. draw chan.; Rock Isld. Br., **74,** 59, 311, 315.

1874-75. Limited operations from lack of app.; 2,650 c. y. of r. removed from Lower Chain, **75,** 64, 462, 465; **76,** 666.

1875-76. Completion of r. removal on Lower Chain; removal of r. on St. Louis Chain by hired labor; table showing r. removed (84,358 c. y.) from 1867 to 1875, **76,** 83, 666, 669, 673.

1876-77. Continuation of r. removal by hired labor; progress on Moline Chain; cost by hired labor and contract compared, **77,** 83, 542, 544.

1877-78. Continuation of r. removal by hired labor; results from hired labor and contract compared, **78,** 96, 708, 709.

1878-79. Continuation of operations (except dr.) by hired labor; near completion of the work; cost by hired labor compared with contract; details of drilling and blasting, **79,** 131, 1132, 1135.

1879-80. 1,513 c. y. r. removed at St. Louis Chain; removal of obstr. washed into chan. by ice; constr. and estab. of buoys, **80,** 1537.

1880-81. Detailed sur. to determine location of patches of r. requiring removal; placing of experimental buoys, **81,** 1702.

1881-84 415 c. y. r. removed at St. Louis Chain; estab. of buoys, **82,** 1771, 1772.

1882-84. Mainten. of buoys, **83,** 1407, 1409; **84,** 1572.

1884-85. Removal of sand from Campbell Chain Cut and mainten. of buoys, **85,** 1694.

1885-87. Mainten. of buoys, **86,** 1427. Work merged in imp. of Mississippi R. from St. Paul to Des Moines Rapids, **87,** 219, 1625.

PHYSICAL CHARACTERISTICS.

Fall of rapids, **67,** 267; **68,** 421, 433; **69,** 241.

Current observations, **68,** 433; **69,** 241; **70,** 310.

Bed of rapids, character of, **67,** 288; **69,** 241, 242; **70,** 311.

Ice, action of, **67,** 358.

Contour of bottom, **69,** 241.

Peculiar character of the bottom on Campbells Chain, **70,** 311.

Description of R. at Rock Isld. Rapids, **80,** 1537.

H.-w. discharge, **81,** 1702.

H.-w. elevation, **86,** 1448.

PLANS. (See Estimates and Projects.)

Dams across R., with locks for SS. and chutes for rafts; inadequacy of, **67,** 292.

Independent lateral canal, not deemed desirable, **67,** 293.

Chan. 4′ x 200′ (see Projects), **67,** 293.

Positive requirements of any plan, **67,** 293.

By Maj. Mackenzie, 1880, w. chan. of 200′ to 400′; est., $1,258,866, **80,** 1538; **86,** 1464.

PROJECTS. (See Estimates and Plans.)

Previous proj. suspended, 1856 to 1866, **66,** 4; seems to have been imp. of natural chan. by removal of r. with chisel boats, **67,** 292; **68,** 434.

By Maj. Wilson, 1866, excavation of r. to 4′ and w. of 200′, aided by diversion into chan. of as large a volume of water as practicable; r. to be removed by chisel boats and dr., also by excavation within cofferdams, **67,** 36, 273, 287, 293, 295, 298, 299; **68,** 388; requiring removal of 57,451 c. y. r., **67,** 298; **68,** 388. Approv. by BE. and recom. Dec. 19, 1868 (see Boards), **67,** 299. Excavation to be made to preserve existing regimen of R., side slopes 1 upon 2, **69,** 239. Change in line of proposed chan. on Smiths Chain, **72,** 329. Advisability of doing work by hired labor discussed, **74,** 312, 313. Change of proj. on Lower Chain from cut to imp. of natural chan., **74,** 315. Success of doing work with hired labor in 1875-76, **76,** 667.

Proj. of 1866 proposed imp. of R., Le Claire, Iowa, to Rock Isld., Ill., 14 m., by excavation of r. to afford chan. at least 4′ x 200′, referred to l. w. of 1864, **67,** 273-299; **68,** 388; **74,** 315; **80,** 1537; **86,** 1429. Practically completed in 1879, except removal of small and isolated patches of r.

Amount app. to 1866, $1,166,650, **86,** 1462, 1463.

SURVEYS.

Instructions as to character of, **67,** 274.

Extent of, **67,** 288.

Results of, **67,** 289, 358.

Previous, of Maj. Warren, used in part, **67,** 288.

Novel method of taking soundings, **68,** 428; **69,** 251; **75,** 466.

Sounding machine of E. F. Hoffmann, **68,** 428; **69,** 251; **75,** 466.

Results developed by, **69,** 241; **72,** 282, 334; **75,** 466.

Resur. of rapids made, **71,** 270; **72,** 282, 334; **75,** 466; develop further patches of r. to be removed, **72,** 282, 334.

Method of inspecting work done, **76,** 669; **77,** 543.

History of early sur., **86,** 1433.

Maps:

List of, **69,** 250; **70,** 312; **71,** 291; **73,** 434; **80,** 1538.

Of Lower Chain, **75,** 466; **76,** 668; **77,** 544.

Rock Island Rapids **86,** 1436, 1462.
Duck Creek Chain, **86,** 1454.
Moline Chain, **86,** 1456.
Sycamore Chain, **86,** 1457.
Campbells Chain, **86,** 1458.
Smith and Upper Chain, **86,** 1458–1460.
St. Louis Chain, **86,** 1460.
Lower Chain, **86,** 1462.

HH-248(a) Moline, Ill. (Water power.)

CONTRACTS.

Bet. U. S. and Water Power Co., use of power in arsenal shops, **78,** 749, 751.

ENGINEERS.

Chief of Engineers. **R., 78,** 35, 749.

Commission of Engineers:

To examine, 1877, into contracts made bet. U. S. and Moline Water Power Co., **78,** 35, 749. History of earlier proceedings, **78,** 750. Obligations of U. S., **78,** 751. Commission reported specific complaints of company unsustained, with possible exception that U. S. failed in full excavation of cofferdam in pool and a mass of st. at mouth of canal, **78,** 753. (Brig. Gen. Humphreys, Lt. Col. Wright, and Maj. Abbott.)

PRIVATE (CORPORATE) WORK.

History of Moline Water Power Co., **78,** 749.

Jurisdiction of the Water Power Co., **78,** 750.

Contracts bet. U. S. and company for use of power, **78,** 750.

Complaints by company as to failure of U. S. in its obligations, **78,** 751.

HH-248(b) Moline Harbor, Ill.

APPROPRIATIONS. (See p. 1089.)

CONTRACTS.

1906. Dravo Contracting Co., constr. lock, **06,** 1429.

ENGINEERS.

Chief of Engineers. **Rs. 89,** 234; **04,** 419, 2206; **05,** 429; **06,** 468; **07,** 495; **08,** 528; **09,** 558; **10,** 627.

Boards. BEHR. recom. that sur. and est. be made for lock at Moline, Ill., and after considering report of sur. and est. recom. that lock be constr., **04,** 2210, 2211.

In charge:

Maj. A. Mackenzie, 1888. **R., 89,** 1777.

Maj. C. McD. Townsend, 1904. **R., 04,** 2207, 2211.

Maj. C. S. Riché, 1905–09. **R., 05,** 1652; **06,** 1428; **07,** 1570; **08,** 1642; **09,** 1635.

Maj. Charles Keller, 1910–. **R., 10,** 1790.

Assistant. C. W. Durham. **R., 04,** 2213.

OPERATIONS.

1904-05. Plans prepared for lock, and plant repaired, **05,** 1653.

1905-06. U. S. dr. *Ajax* and *Vulcan* repaired; derrick boom dr. built; 5,232 c. y. r. broken up; in lower approach 9,949 c. y. r. broken up, at cost of $3.20 c. y.; 6,733 c. y. riprap dr. and placed in dam, at cost of $1.09 c. y.; 21,000 c. y. sand and gravel placed in dam, at cost of 26¢ c. y., **06,** 1429.

1906-07. Constr. of dam and approaches 15,686 c. y. r. broken up; 37,098 c. y. riprap dr.; 62,682 c. y. sand and broken r. placed in dam; building and repairing dike; 19,730 c. y. broken r. used in constr. of lock; 10,080 c. y. r. removed; 11.230 c. y. concrete put in place, **07,** 1570.

1907-08. 10,516 c. y. r. broken up, at cost of $3.60 c. y.; 21,166 c. y. r. dr., at cost of 85¢ c. y., **08,** 1642.

1908-09. Part of canal bank raised and surfaced; 13,200 c. y. mud dr., **09,** 1635.

1909-10. Canal banks imp.; 61,990 c. y. mud dr., at cost of 9¢ c. y.; 871 c. y. mud and st. dr., at cost of 15¢ c. y.; 385 c. y. r. removed, at $2.50 c. y.; 2,300 c. y. mud dr., at 3¢ c. y., **10,** 1791.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 2212.

PROJECTS.

By Maj. Townsend, 1903, dr. chan. and building l. and d. in Mississippi R. at Moline, Ill.; est., $386,000, and $10,000 an. for operation and mainten.; adopted, **04,** 2212, 2214.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Mackenzie (**R.** unfav.), **89,** 1777.

Ex. and sur. with view to constr. of lock au. act June 13, 1902; made, 1903, by Maj. Townsend,[1] **04,** 419, 2206.

Sur. of pool chan. and lower approach to lock made, 1909, by Maj. Keller, **10,** 1791.

[1] H. D. 397, 58th, 2d.

See p. 1068. MISSISSIPPI RIVER. See special index, p. 1071.

HH-248(c) Moline, Ill. (Operation and care of lock at.)

ENGINEERS.

Chief of Engineers. **R., 08,** 528; **09,** 559; **10,** 627; **11,** 671; **12,** 811.

In charge:

Maj. C. S. Riché, 1908–09. **R., 08,** 1643; **09,** 1636.

Maj. Charles Keller, 1910–. **R., 10,** 1791; **11,** 1960; **12,** 2169.

OPERATIONS.

1908. Lighting system designed and installed and backfills completed, **08,** 1643.

1909-10. Combined office and dwelling building constr.; minor repairs and imp. made, **10,** 1791.

1910-11. 2,100 c. y. dr. from lock entrance and ice chute, tool house and barn and lockmen's dwelling erected, and repairs made to structures, electric wiring, etc., **11,** 1960.

1911-12. 3,469 c. y. r. removed from approaches and general repairs made, **12,** 2168.

HH-258(a) Clinton, Iowa.

ENGINEERS.

Chief of Engineers. **R., 91,** 267.

In charge. Maj. A. Mackenzie, 1890. **R., 91,** 2187, 2188.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2188.

PLANS.

By Maj. Mackenzie, in 1890, closing dam bet. Little Rock Isld. and the towhead to its left; est., $5,000, **91,** 2189.

SURVEYS.

Sur. to remove bars n. of Little Rock Isld., at and above Clinton, au. act Sept. 19, 1890; made, 1890, by Maj. Mackenzie, **91,** 2188.

HH-258(b) Beaver Island, Clinton, Iowa.

ENGINEERS.

Chief of Engineers. **R., 89,** 234.

In charge. Maj. A. Mackenzie, 1888. **R., 89** 1784.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 1785.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Mackenzie (**R.** unfav.), **89,** 1784.

HH-270 Dubuque Harbor, Iowa.[1]

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Importance of imp., **76,** 696; **78,** 717; **79,** 1141.

Necessity for ice H., **82,** 1769.

Use of H. by vessels, **84,** 1572.

CONTRACTS.

1877. G. Williams, dr., **78,** 717.

1878. A. McArthur, dr., **79,** 1141.

1882. B. E. Linehan, dr., 19⅞ ¢ c. y., **83,** 1407.

1884. A. J. Whitney, dr., 11¢ c. y., **85,** 1694.

ENGINEERS.

Chief of Engineers. **R., 76,** 84; **77,** 84; **78,** 97; **79,** 132; **82,** 230; **83,** 237; **84,** 240; **85,** 262; **86,** 252; **87,** 222.

Boards. Consideration of various plans for imp., 1879; **79,** 1143. (Majs. Comstock, Houston, and Farquhar.)

In charge:

Col. J. N. Macomb. **R., 76,** 695; **77,** 525.

Maj. F. U. Farquhar, **78,** 717. **R., 78,** 717; **79,** 1140.

Maj. A. Mackenzie, 1880–88. **R., 82,** 1769; **83,** 1406, **84,** 1571; **85,** 1691; **86,** 1426; **87,** 1656; **88,** 1529.

[1] Sur.—**R.,** Dec. 29, 1844; est., $10,277, $64,875. (H. D. 482, 55th, 2d.)

Assistants:

C. W. Durham. **R., 76,** 696.

M. Meigs. **R., 77,** 535.

OPERATIONS.

1877-78. 39,261 c. y. sand removed from bar in front of SS. landing, **78,** 97, 717; **79,** 132, 1141.

1878-79. 37,042 c. y. sand dr. from bar in front of SS. landing, **79,** 1140; results obtained, **79,** 1140, 1143.

1882-83. 55,733 c. y. dr., **83,** 1407.

1883-84. 37,062 c. y. dr., **84,** 1571.

1884-85. 70,770 c. y. dr., **85,** 1693.

1885-86. 45,927 c. y. dr., **86,** 1426.

1886-87. Operations suspended awaiting action of RR. company in filling areas contiguous to H., **87,** 222.

PHYSICAL CHARACTERISTICS.

Formation of bar, cause of, **76,** 696.

PRIVATE WORK.

Of citizens of Dubuque, 1879, for imp. of bar, **79,** 1142.

PROJECTS.

For imp. of H. 1876, by artificial cut, from head of New Barney Cut to mouth of Waple Cut, 150′ w. a, bottom; also 3 riprap dams, with brush foundations, located across head of Seventh St. Slough, across New Barney Cut, and across Third St. opening, $32,120, **76,** 695, 697. Modified by temporary imp. of bar, by dr. to extent of latest app. ($15,000), and subsequently permanent imp. by training wall, $25,300, about 1,000′ l., from upper end of New Barney Cut to RR. br., **77,** 84, 525, 535.

Of BE., 1879, for imp. of bar in front of landing by contracting waterway, by 2 low spur dikes on Dunleith shore, work to be commenced as soon as existing dr. chan. showed signs of filling up, $12,668, **79,** 1143.

By Maj. Mackenzie, 1880, for ice H. by formation of dr. basin at Waple Cut, an area of about 11 acres and a l. w. d. of 6′; est., $40,000, **82,** 1770, 1771. Area increased in 1884 to about 16 acres, **84,** 1572; **87,** 222.

SURVEYS.

1868–69. **69,** 43, 188; **70,** 228; **76,** 696

Results of previous, **79,** 1142.

Map. **84,** 1572.

HH-297 La Crosse Harbor, Wis.

APPROPRIATIONS. (See p. 1089.)

CONTRACTS.

1878. McDonald Bros., dams closing Bates Chute, **79,** 1127.

ENGINEERS.

Chief of Engineers. **R., 78,** 98; **79,** 130 **99,** 377; **00,** 433; **01,** 442; **02,** 372; **03,** 396; **04,** 418; **05,** 430; **06,** 470.

Boards.

To examine and report, 1877, on condition of chan., cause of changes, and to recom. such works as might be necessary to restore the chan.; board reported condition of chan. better than in times past, changes due to closing chan. e. of Minnesota Isld.; and recom. closing of chutes on both sides of Bates Isld. and protection of head of Grand Isld., **78,** 98, 719, 721. (Col. Macomb and Majs. Weitzel and Merrill.)

In Charge:

Maj. F. U. Farquhar. **R., 78,** 718; **79,** 1127.

Capt. C. McD. Townsend, 1899–1902. **R., 99,** 2171; (Maj.) **00,** 2755; **01,** 2295; **02,** 1660.

Maj. J. L. Lusk, 1903–04. **R., 03,** 1500; **04,** 2203.

Maj. C. S. Riche, 1905–06. **R., 05,** 1657; **06,** 1432.

OPERATIONS.

1878-79. Completion, by contract, of dams closing Bates Isld. Chutes and protection at head, **79,** 130, 1127.

1899-00. Work on lateral bulkhead in progress; **00,** 2755.

1900-01. Bulkhead and cross dam completed good progress made with filling, **01,** 2295.

1901-02. 84,000 c. y. dr.; fill partly completed, **02,** 1660.

1902-03. Levee graded; 17,000 sq. ft. s. relaid, **03,** 1500.

1904-05. 700′ shore protection built and Dam 2 repaired, **05,** 1657.

PRIVATE (CITY) WORK.

La Crosse to make some needed changes in its sewers, **99,** 2171.

PHYSICAL CHARACTERISTICS.

Formation of bars, **78,** 720.

PROJECTS.

BE., 1877, chan. in front of city, closing chute on both sides of Bates Isld., and protecting head of Grand Isld., **78,** 98, 721.

By Lt. Col. King, 1897, lateral bulkhead 1,575′ l., across dam 450′ l., and certain amount of filling bet. lateral bulkhead and shore; est., $17,000, **97,** 2117. **99,** 2171.

HH-317 Lake Pepin, Wis. (Harbor of refuge.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Necessity for H. of refuge, **82,** 1795; **83,** 1404.

CONTRACTS.

1885. H. E. Stevens, break'r at Stockholm, **85,** 1688, 1690.

ENGINEERS.

Chief of Engineers. **R., 81,** 238; **82,** 235; **83,** 237; **84,** 240; **85,** 262; **86,** 251; **87,** 222; **88,** 199, 200; **89,** 234; **90,** 209.

In charge. Maj. A. Mackenzie, 1881–90. **R., 82,** 1794; **83,** 1404; **84,** 1570; **85,** 1687; **86,** 1422, 1424; **87,** 1657; **88,** 1529, 1532; **89,** 1777; **90,** 2072.

Assistant. W. A. Thompson. **R., 88,** 1535.

OPERATIONS.

1884–85. Constr. 135 l. f. earth embankment and 230′ crib constr. at Stockholm, **85,** 1688.

1885–86. Extending break'r to l. of 579′, **86,** 1422.

1887–88. 512 l. f. cribwork sunk to extend break'r, **88,** 1531.

1888–89. Repair and reconstr. break'r, **89,** 1777.

1889–90. Riprap placed at crib foundations, **90,** 2074.

PROJECTS.

By Maj. Mackenzie, 1882, Hs. of refuge at Lake City, Minn., and Stockholm, Wis., by extending from the shore a break'r at each place 1,000′ l.; est., $228,000, **82,** 1796; **83,** 237.

SURVEYS.

For H. of refuge au. act June 14, 1880, **81,** 238; made by Maj. Mackenzie, 1881, **82,** 1794.

Maps. **90,** 2074.

HH-319 Lake City, Minn.

COMMERCE.

Small; population about 3,000, **04,** 2205.

ENGINEERS.

Chief of Engineers. **R., 04,** 419.

Boards. BERH. concurs in opinion of DO. on inadvisability of imp. **R., 04,** 2206.

In charge. Maj. C. McD. Townsend, 1904. **R., 04,** 2204.

PHYSICAL CHARACTERISTICS.

This so-called inner H. is a pond situated in the point of land extending into Lake Pepin at Lake City; area of pond about 520,000 sq. ft., **04,** 2204.

SURVEY.

Pre. ex. of inner H. for H. of refuge, au. act June 13, 1902. **R.,** Maj. Townsend, July 10, 1902 (unfav.),[1] **04,** 419, 2204.

HH-332(a) St. Paul Harbor.

ENGINEERS.

Chief of Engineers. **R., 12,** 831.

In charge. Lt. Col. F. R. Shunk, **12,** 814.

SURVEYS.

Ex. and sur. au. act June 25, 1910, of H. and chan. **12,** 831.

[1] H. D. 182, 58th, 2d.

HH-332(b) St. Paul to Falls of St. Anthony, Minn.

COMMERCE.

Lumber manufacture from 1870 to 1886, **88,** 1562, 1571.

ENGINEERS.

Chief of Engineers. **R., 88,** 206.

In charge. Maj. C. J. Allen, 1886. **R., 88,** 1560, 1563.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1566.

PLANS.

By Maj. Allen, 1887, Chicago, St. Paul, Minneapolis & Omaha RR. br. to landing below Washington Ave. Br., Minn., dr. and works of contraction; est., $146,000; or for 4′ l. w. navigation with wing dams, closing dams and revet., dr., and 2 l. and d.; est., $2,361,060, **88,** 1568–1570.

SURVEYS.

From Falls of St. Anthony to St. Paul, au. act Mar. 3, 1879; made by Maj. Allen, 1879, **80,** 1660.

Au. act Aug. 5, 1886; made, 1887, by Maj. Allen, **88,** 1563.

HH-332(c) Minneapolis to St. Paul, Minn. (Locks and dams between.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

At 1898 restricted because of the swift current and numerous rocks and bowlders, **98,** 1811.

None except loose logs, on account of swift currents and obstr., **01,** 2301.

Constr. of these 2 l. and d. should develop passenger traffic and reduce rates on flour and grain shipped from Minneapolis, **05,** 432.

In 1911, 9,000,000 f. b. m. logs; approx. 40,000 t. floated down R., **12,** 816.

CONTRACTS.

1900. Commercial Wood & Cement Co., 55,000 bags cement, 67.02¢ per bag. St. Paul Foundry Co., steel and cast-iron members of lock gate, $7,643. Youngstown Bridge Co., 1 lower lock gate, $9,510. **00,** 2777.

1902. New Jersey Foundry & Machine Co., steelwork, **03,** 1524, 1526.

1904. Rogers Lumber Co., lumber; St. Paul Foundry Co., grated covers and foot-walks, $1,030, and maneuvering machinery, $1,244, **04,** 2231.

1905. The Menz Lumber Co., 432,000 f. b. m. fir lumber, $7.25 M f. b. m.; E. O. Fellows Coal Co., 7 cars coal, $2.80 t., **05,** 1665.

ENGINEERS.

Chief of Engineers. **R., 95,** 292; **96,** 254; **97,** 323; **98,** 316; **99,** 378; **00,** 434; **01,** 443; **02,** 373; **03,** 396; **04,** 420; **05,** 431; **06,** 470; **07,** 497; **08,** 529, 542; **09,** 560; **10,** 629, 643; **11,** 675; **12,** 815.

Boards. Act June 25, 1906, creates commission to ex. and report to Sec. of War concerning use by U. S. of waters of Miss. R. flowing over dams bet. St. Paul and Minneapolis (Lt. Col. G. McC. Derby, Corps of Engineers; Capt. A. W. Kimball, Q. M., U. S. A., Chief Engr. Carl M. Green, U. S. Revenue-Cutter Service), **06,** 472. **R.,** Sept. 26, 1907,[1] **08,** 542.

Appointed to ex. R. with view to modifying proj. (Maj. C. S. Riche, Maj. F. R. Shunk, and Maj. C. S. Bromwell), **09,** 561. Hearing held at St. Paul, attended by representatives of State of Minn. and cities of St. Paul and Minneapolis, **09,** 1642. **R.** dated Jan. 31, 1910, submitted with est. of $380,000 for imp.,[2] **10,** 643.

In charge:

Maj. A. Mackenzie, 1894–95. **R., 94,** 1640, 1681; **95,** 2158.

Lt. Col. W. R. King, 1896–97. **R., 96,** 1828; **97,** 2110.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1809; (Maj.) **99,** 2173; **00,** 2768.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2298.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1662; **03,** 1523.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2230; **05,** 1663; (Lt. Col.) **06,** 1434.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1578.

Maj. F. R. Shunk, 1907. **R., 08,** 1649; **09,** 1641; **10,** 1799; **11,** 1973; (Lt. Col.) **12,** 2179.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

A. O. Powell. **R., 99,** 2181; **00,** 2778; **01,** 2302; **02,** 1666; **03,** 1525; **04,** 2231; **05,** 1665.

R. Davenport. **R., 00,** 2785; **01,** 2307; **02,** 1671; **03,** 1525; **04,** 2235.

G. W. Freeman, **07,** 1579.

[1] H. D. 218, 60th, 1st.

[2] H. D. 741, 61st, 2d.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

LEGAL PROCEEDINGS.

Steps taken to secure land necessary for Lock No. 2, **95,** 2159; **96,** 1828; **97,** 2110; land secured, **98,** 1810.

Acquisition of land and flowage rights for Lock No. 1, **99,** 2180; (map) **00,** 2773, 2786; **01,** 2300.

List of lands subject to flowage, **01,** 2308; **02,** 1663.

Land sheet, Lock and Dam No. 1, **02,** 1672.

OPERATIONS.

1897-98. Constr. plant procured and buildings for it erected, **98,** 1811.

1898-99. Preparations made for constr. of Lock and Dam No. 2; plant erected; cofferdam almost completed (photographs), **99,** 2174.

1899-00. Cofferdam for Lock No. 2 nearly finished; lock excavation nearly completed; large part of lumber floor of lock chamber laid; concrete work on land well begun (sketches of concrete forms and photographs of works in progress); cement tests made (diagrams), **00,** 2768.

1900-01. Excavation and constr. foundations of Lock No. 2, except laying of floor, completed; lock walls seven-eighths completed; erection of gates commenced; backing of land wall one-third completed; cofferdam for dam partly built; test borings at site of Lock and Dam No. 1 commenced, **01,** 2300.

1901-02. Lock No. 2 practically completed; cofferdam for w. 273′ of Dam No. 2 completed; excavation within inclosure nearly completed and some concrete work done; lands and flowage rights for Lock and Dam No. 1 nearly all acquired, **02,** 1662.

1902-03. Work on Lock and Dam No. 2 confined to w. 273′ of dam; concrete work practically completed and erection of 2 bear-trap sluice gates carried on; preliminary work at Lock and Dam No. 1, **03,** 1524.

1903-04. At Lock and Dam No. 2, completion of w. 273′ of dam and constr. of cofferdams for middle or last section; at Lock and Dam No. 1, roads built, buildings and scales erected, lock cofferdam and track grading for hoist nearly completed, **04,** 2230.

1904-05. Lock and Dam No. 2 completed and slight repairs made to parts; at Lock and Dam No. 1, lock cofferdam completed, buildings erected, steam derrick erected, and preparations for commencing work made, **05,** 1663.

1905-06. Lock No. 2 pumped out and floor repaired; block of concrete placed at upper end e. pier; at Lock No. 1, excavation for land wall carried on and additions made to plant, **06,** 1435.

1906-07. Repairs to disrupted floor, Lock No. 2, completed; sluice gate rods replaced by chains at Dam No. 2; foundations for land wall, Lock and Dam No. 1, completed; Lock No. 2 opened for navigation, **07,** 1579.

1907-08. Work on land wall and floor of lock at Lock and Dam No. 1 in progress; at Lock and Dam No. 2, keeper's dwelling constr.; Lock and Dam No. 2 placed under operation and care July 1, 1907, **08,** 1650.

1908-09. Constr. of lock chamber completed and building of cofferdam for abutment in progress, **09,** 1641.

1909-10. Operations at Lock and Dam No. 1 suspended and plant repaired and renewed, **10,** 1800.

1910-11. At Lock and Dam No. 1, old lock floor blasted out and new floor laid; removal of old miter sill and excavation for new one almost completed; work of increasing height and thickness of lock wall in progress, and cofferdam for power house 50% completed, **11,** 1973.

1911-12. At Lock No. 1, work on lower miter sill removal completed and sill rebuilt about 5½′ lower; raising of walls practically completed; 3 sections of dam 48′ l. built; cofferdam for power-house foundation completed, **12,** 2180.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2202.

Characteristics of stream in vicinity to be considered in designing dams, **99,** 2179.

Much trouble at Lock No. 2 caused by large water-bearing seams in the r. underlying the site (photographs), **00,** 2770.

Rises delay work, **04,** 2230; **05,** 1665.

Sediment causes damage to sluice gate rods at Lock and Dam No. 2 (photos), **07,** 1578.

PROJECTS.

By Maj. Mackenzie, 1894, Lock and Dam No. 2 in proposed series of 4, below Meekers Isld., to carry slack water from that point to Washington Ave. Br., at Minneapolis, with lift of 13.8′; est., $598,235, **94,** 1681; **95,** 2159.

By Capt. Abbot, 1898, purchase and erection of plant, building cofferdam, and purchase of 15,000 t. st. for lock constr.; details of lock, gates, and dam section to be subject to approval of BE., **99,** 2179.

Act Mar. 3, 1899, provided for carrying on this work, together with that for Lock and Dam No. 1 (lift of 13.3′, placed just above Minnehaha Creek; est. cost, $568,222), under continuous contract, but permitting hired labor whenever necessary; at a cost in addition to app. of $150,000 of not to exceed $815,579.33, **99,** 2179.

Table showing actual cost compared with est. cost of works. See reference to works for each year.

Plans and ests. for Lock and Dam No. 2; est. increased from $598,235 to $733,000. Plans were considered by BE., **01,** 2298.

Revised est. for completing Locks and Dams Nos. 1 and 2, $1,466,000, due to rise in price of material and labor, unexpected difficulties, and imp. in type of

work proposed, **02,** 1666. Increase approv. act Mar. 3, 1905, **05,** 431.

Act Mar. 2, 1907, modifies proj. to require chan. d. of 6′ instead of 5′; necessary to increase lifts of 2 dams, and d. on lower miter sill Lock No. 1 to 6′ at l. w., **08,** 530.

Act June 25, 1910, adopted modification of proj. to provide at Lock and Dam No. 1 for a lift of 30′ instead of 13.33′, as orig. contemplated, at an increased cost of $635,000, incl. $180,000 for flowage rights, **10,** 630.

SURVEYS.

Misc. sur., **95,** 2159.

R., Sept. 26, 1907, by commission appointed act June 25, 1906, on use by U. S. of water flowing over dams bet. St. Paul and Minneapolis,[1] **08,** 542.

Act Mar. 3, 1909, appointed B E. to ex. and report on modification of imp. **R.,** Jan. 31, 1910; est., $380,000,[2] **10,** 643.

Maps.[1] (Sketches, photographs, etc. See Legal proceedings, Operations, and Physical characteristics.)

Land sheet Lock and Dam No. 1, **02,** 1672.

Photographs showing silt, etc., sluice gate, Lock and Dam No. 2, **07,** 1580.

Of imp. **11,** 1974.

HH-332(d) Minneapolis to St. Paul, Minn. (Operating and care of locks and dams.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

300,000 t. logs passed dam in 1907, **08,** 531.

ENGINEERS.

Chief of Engineers. **R.,** **08,** 531; **09,** 562; **10,** 631; **11,** 677; **12,** 817.

In charge:

Capt. E. H. Schulz, **08,** 829.

Maj. F. R. Shunk, 1908–. **R.,** **08,** 1651; **09,** 1643; **10,** 1801; **11,** 1975; (Lt. Col.) **12,** 2181.

Assistant:

1st Lt. J. N. Hodges, **12,** 814.

OPERATIONS.

1907–08. Upper needle dams put in; r. dumped to prevent scour; new chains put in bear-trap sluice gate, **08,** 1652.

1908–12. Minor repairs to filling valves, operating machinery and buildings, etc., **09,** 1643; **10,** 1801; **11,** 1975; **12,** 2181.

PROJECT.

Act June 25, 1910, modified proj. by providing increase in height proposed for Lock and Dam No. 1, after which Lock and Dam No. 2 would not be needed, **10,** 631.

HH-332(e) Meekers Island Lock and Dam.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Importance of, set forth in memorial of Minnesota Legislature, **68,** 369.

C. hardly justifies expend., **74,** 288.

DOCUMENTS. (Not printed in reports.)

H. D. 58, 39th, 2d, **67,** 260; **70,** 277.

ENGINEERS.

Chief of Engineers. **R.,** **67,** 35; **73,** 51; **74,** 58; **75,** 62; **76,** 85; **77,** 86; **78,** 99; **79,** 134; **80,** 179; **81,** 241; **82,** 237; **83,** 244; **84,** 245; **85,** 268; **87,** 223; **88,** 201.

In charge:

Maj. G. K. Warren, 1866–70. **R.,** **67,** 260; **68,** 369; **70,** 277.

Col. J. N. Macomb, 1870–73 ;**70,** 56. **R.,** **73,** 411.

Maj. F. U. Farquhar, 1873–78; **73,** 50. **R.,** **74,** 287; **76,** 703; **77,** 571; **78,** 727.

Capt. C. J. Allen, 1878–90. **R.,** **79,** 1168; (Maj.) **80,** 1575; **81,** 1747; **82,** 1809; **83,** 1438; **84,** 1599; **85,** 1733; **86,** 1485; **87,** 1663; **88,** 1536.

Assistants:

Capt. A. Stickney. **R.,** **70,** 275.

F. Cook. **R.,** **70,** 278.

LEGISLATION.

Release of land grant, by act of Congress, necessary before work could be commenced, **73,** 411; **75,** 62; **76,** 85, 703; **77,** 571; **78,** 99, **79,** 134, 1168.

Act July 23, 1868, granting Minn. 200,000 acres of land in aid of constr. of l. and d., **73,** 411; **81,** 1747.

Act Mar. 3, 1873, requiring relinquishment of grant before application of app., **73,** 411; **81,** 1747.

[1] H. D. 218, 60th, 1st.

[2] H. D. 741, 61st, 2d.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

PHYSICAL CHARACTERISTICS.

At Meekers Isld., **70,** 275.

PRIVATE WORK.

Grant of land to persons purposing building of l. and d., **73,** 411. Necessity of release before U.S. undertakes work, **77,** 571; **78,** 99, 727; **79,** 134.

PROJECTS.

By Maj. Warren, 1867, l. and d. across Mississippi R. at Meekers Isld., to carry 4′ over rapids; lift of lock, 13′; est., $235,655, **67,** 259; **70,** 277, 278; **74,** 287; **81,** 1747.

By Maj. Farquhar, 1874, timber dam with lock having a lift of 17′, with faces of granite masonry; dimensions 80′ x 300′, dam to be of timber; est., $922,121, **74,** 287; **81,** 1747.

SURVEYS.

For l. and d., **67,** 260.

Further sur. indicated necessity of another l. and d. near Minnehaha Creek, **68,** 369.

Sur. not completed, **73,** 411.

Resur. made, **74,** 287.

Bet. St. Paul and Minneapolis au. act Aug. 5, 1886, **87,** 230, 1663.

HH-335(a) Falls of St. Anthony. (Preservation.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Justification of work; threatened destruction of the falls an interference with future navigation of R., **69,** 211; **70,** 282.

CONTRACTS.

1876. Cook & Folsom, 2 timber dams to protect lime r. from action of ice. Henry & Abraham, gravel filling for tunnels and cavities in sand r. above dike, **77,** 565.

1877. Cole & Hammond, timber for remodeling apron. F. Winston, 450 cords of bowlders put in place at foot of apron, **77,** 565.

DOCUMENTS. (Not published in reports.)

H. D. 118, 41st, 2d, **70,** 283; S. D. 59, 42d, 2d, **72,** 302.

ENGINEERS.

Chief of Engineers. **R., 70,** 58; **71,** 56; **72,** 49; **73,** 50; **74,** 57; **75,** 61; **76,** 84; **77,** 85; **78,** 99; **79,** 134; **80,** 178; **81,** 239; **82,** 236; **83,** 243; **84,** 244; **85,** 266, 1728; **86,** 255; **87,** 223; **88,** 200.

Boards:

Convened, Minneapolis, Minn., Aug. 10, 1872. Recom. Col. Macomb's plan (see S. D. 59, 42d, 2d), **72,** 302, but submitted that "since its cost is in excess of available app. it is best to continue 'present' lining of tunnel, and in the interim make study for permanent preservation of falls; work should not be commenced without available app. of $200,000; a modification of the 'present' dam should be made to restore waterway to natural w., and $37,000 should be expend. on tunnel in accordance with plan of the union committee," **72,** 302, 303; **73,** 409; **74,** 285. (Col. Macomb, Lt. Col. Kurtz, Majs. Weitzel, Poe, and Houston.)

Convened, Minneapolis, Minn., Apr. 15, 1874. Recom. (1) 2 dams should be constr. on lines marked on map (see map, **74,** 286), consisting of timber cribs filled with st.; lower dam to be 4½′ and upper dam 4′ high; foot of lower dam to be connected with old apron, the object being protection of limest. covering at crest of falls; (2) that apron should be put in repair and extended downstream on the w. side of Hennepin Isld.; (3) introduction of a concrete dike (to be constr. in a tunnel), extending across R. and near crest of falls; bottom of dike to be in a homogeneous stratum of sandst., and to extend upward to under side of limest.; dike about 38′ high, at least 4′ w., and about 2,000′ l., **74,** 284. Necessity of speedy relief the cause for modification of plan of board of 1872, which plan should be ultimately carried into effect, **74,** 285; **79,** 1164. (Col. Macomb, Lt. Col. Kurtz, Majs. Weitzel, Poe, and Farquhar.) Memorial of citizens' committee to Board of Engineers, **72,** 304.

Constituted by S. O., No. 5, C. of E., 1886, to ex. and report upon probable effect of proposed br. at Minneapolis upon works of the U.S. for preservation of falls. **R., 86,** 2111–2116. (Lt. Col. Poe, Majs. Mackenzie and Allen.)

In charge:

Maj. G. K. Warren, 1869–70. **R., 69,** 210. (H. D. 118, 42d, 2d, **70,** 283.)

Col. J. N. Macomb, 1870–73. **R., 71,** 257, 298; **72,** 279, 296.

Maj. F. U. Farquhar, 1873–78. **R., 73,** 408; **74,** 277, 280; **75,** 356; **76,** 698; **77,** 563; **78,** 725.

Capt. C. J. Allen, 1878–90. **R., 79,** 1160; (Maj.) **80,** 1565, 1568; **81,** 1739; **82,** 1800; **83,** 1431; **84,** 1596; **85,** 1721, 1729; **86,** 1479; **87,** 1660; **88,** 1536.

Assistants:

F. Cook. **R., 70,** 278; **71,** 294, 297.

Capt. W. H. H. Benyaurd. **R., 73,** 409.

J. L. Gillespie. **R., 74,** 282; **76,** 700; **77,** 564.

J. P. Frizell. **R., 79,** 1161.

R. Davenport. **R., 85,** 1725.

ESTIMATES. (See Plans and Projects.)

By F. Cook, apron and dam to protect falls, $245,000, **70,** 281; closing Hennepin Isld. Tunnel, $76,000, **70,** 58.

By BE., 1874, 2 dams on top of limest., $24,420; repair of apron, $65,000; dike under the limest., $130,372; wall at head of ledge, $200,000, **74,** 284, 285; **76,** 699.

Aggregate, $419,792, **74,** 284, 285; **76,** 699; **78,** 726.

To complete dike, 1876, $28,502. Cause for increased est. **76,** 699; **78,** 726.

For entire completion as proposed by board of 1874, $294,226, **76,** 700; **78,** 726.

LEGAL PROCEEDINGS.

Of mill owners and others, **82,** 236, 1800; **83,** 1432; **84,** 1596; **85,** 1722, 1729.

Danger to works of U.S. by insecure condition of private dam, **85,** 1723, 1727.

Against J. B. Bassett, for encroachments on U.S. works, **82,** 236, 1800; **85,** 1729.

LEGISLATION.

Effort to obtain land grant to aid in the preservation of the falls, **70,** 283.

Structures erected across natural waterways of navigable streams without au. of Congress, **72,** 303; **74,** 286.

OPERATIONS.

The threatened destruction of falls induced operations of water-power companies in 1870, **70,** 283; **73,** 302; **74,** 279; **79,** 1163.

1870-71. Operations by water-power companies, **72,** 303; **79,** 1163; by U.S. in closing tunnel bet. Hennepin and Nicollet Islds., by permanent wall of masonry at mouth of tunnel, and filling upper part of tunnel with clay puddle, **71,** 56, 257, 294.

1871-72. Repair of cofferdams and protection of the work at the head of the tunnel, **72,** 297; **79,** 1163.

1872-73. Constr. of masonry bulkhead in tunnel with timber lining on floor, **73,** 408, 410; **79,** 1164.

1873-74. Constr. of timber and concrete bulkhead to replace one of masonry destroyed, **74,** 277, 279, 281.

1874-75. Constr. of concrete dike under falls began in July, 1874, **75,** 356; **79,** 1165.

1875-76. Constr. of concrete dike continued, **76,** 700; **79,** 1165.

1876-77. Completion of concrete dike in Nov., 1876; repair of apron to dam, **77,** 85, 565; **79,** 1165.

1877-78. Repairs to apron and dam, **78,** 99, 725; **79,** 1165.

1878-79. Constr. of protection wall at west end of apron, and removal of old cribs and cofferdams from chan., **79,** 134, 1159.

1879-80. Constr. of log sluice at w. end of apron and protection and repair of toe of apron, **80,** 1565, 1568, 1570.

1880-81. Repairs to apron by cribs placed at lower end, **81,** 1740.

1881-82. Preparations for repairs to apron, **82,** 1800.

1882-83. Repairs to apron in progress, **83,** 1432.

1884-85. Repairs to aprons, **85,** 1723.

PHYSICAL CHARACTERISTICS.

Of falls and bed of R., **69,** 210; **70,** 279; **72,** 299, 302; **74,** 281; **79,** 1161.

Recession of falls, **69,** 210; **70,** 279; **72,** 302; rate of, **86,** 1480; **87,** 1660.

Destruction of falls, **73,** 408.

Condition of, **74,** 283.

Observations made on a spring in the tunnel, **74,** 283.

L. w. discharge at Minneapolis, **81,** 1743.

Description of falls, **86,** 1480; **87,** 1660.

PLANS. (See Estimates and Projects.)

By F. Cook, apron to carry the water away from the foot of the falls, **70,** 279; for a wall entirely across the R., **72,** 300.

By Col. Macomb, submitted to BE., 1872 (reference to S. D. 59, 42d, 2d), **72,** 302.

By "board of construction" and "citizens' committee," for preservation of the falls (see Private work), with apron to protect foot of the falls, and lining and plugging the sandst. tunnel, **72,** 304.

By Maj. Farquhar, to place concrete dike as near the crest of the falls as possible, **74,** 281; that upper wall at the head of the ledge (recom. by BE., 1872) be dispensed with, **76,** 700.

In 1885 Maj. Allen proposed extending the main apron in front of Farnham & Lovejoy's dam, removal of a part of a point of r. in the R., continuing the line of submerged cribs across the bed of the R. at the toe of the apron, and repairing the main and e. apron; est., $210,000. **85,** 1724, 1727; **86,** 1481.

PRIVATE (PRIVATE, CITY, AND CORPORATE) WORK.

Plan for preservation of the falls, and amount of work done by cities of St. Anthony and Minneapolis and the water-power companies, **72,** 304; **79,** 1163; $333,000 spent, **74,** 287; **79,** 1164, 1165.

BE. of 1872 recom. $37,500 of available app. be expend. on tunnel under the direction of and in accordance with the plans of the citizens' committee, **72,** 303; **73,** 409; **79,** 1163.

Undermining of the falls caused by an attempt of the water-power companies to increase the availability of the water power, **70,** 283; **72,** 302; **74,** 279; **79,** 1162.

Location of dams of the water-power companies, **70,** 280.

See p. 1068. **MISSISSIPPI RIVER.** See special index, p. 1071.

Tunnel bet. Hennepin and Nicollet Islds. built by mill owners in 1868, **85,** 1722; **87,** 1660.

Expend. by citizens of $334,000 to arrest threatened destruction of falls, **85,** 1722.

Danger to works of U.S. arising from insecure private dam, **85,** 1723, 1727, 1730.

Proposed constr. of st. br. just above the falls, **86,** 1481, 2111.

PROJECTS. (See Estimates and Plans.)

By Col. Macomb, 1870, protection of foot and face of the falls by an apron, and the closure of Hennepin Isld. Tunnel by gravel and clay, **70,** 58; **71,** 294; **79,** 1164. Further proj. submitted to BE., 1872, described in S. D. 59, 42d, 2d, **72,** 302. Success of proj. dependent on integrity of the apron, **72,** 296. Disapprov. as involving a cost far in excess of availble app., **72,** 302.

By BE., 1872, that lining of tunnel be continued, and dams of the water-power companies be modified to restore waterway to natural w. (see Board of Engineers), **72,** 303.

By Maj. Farquhar, that dams be raised at least 2′, and 2 addl. dams be built, 1 at edge of falls, the other midway bet. the edge and the angle made by 2 sections of existing dams, insuring a protecting d. of at least 4′ on the limest. ledge, **73,** 409.

By BE., 1874. (See Board of Engineers.)

Previous to adoption of proj. of 1874 $200,000 had been app. and applied toward closing tunnel bet. Hennepin and Nicollet Islds. by timber and masonry bulkheads and the filling of the upper part of the tunnel with clay and puddle, **71,** 257–294; **72,** 297; **73,** 408–410; **74,** 277; **85,** 1722.

The proj. of 1874 provided for constr. of concrete dike across R. and underneath limest. ledge, the constr. of flooding or rolling dams to protect the upper surface of the ledge, and the constr. of a timber apron and wings to prevent the recession of the crest of the falls, **74,** 284; **76,** 699; **85,** 1722; **86,** 255, 1480. Est., $419,792, **74,** 285. Increased in 1876 to $529,726.31, **76,** 700; **78,** 726. Reduced in 1884 to orig. est., **84,** 1596; **86,** 1481. The dike was completed in 1876 and remaining works in 1878, **77,** 565; **79,** 1159–1165; **86,** 255.

In 1879 a log sluice placed at w. side of the apron, **80,** 1565; **86,** 1480.

In 1888 $210,000 est. as necessary for completion of the existing proj., **88,** 201.

SURVEYS.

Information from sur. made for water-power companies, **69,** 210.

Sur. showing details of formation and previous work done, **72,** 296.

Maps:

Of falls and vicinity, showing location of work done under the last proj., **74,** 286.

82, 1800; **83,** 1434; **85,** 1726.

HH-335(b) Falls of St. Anthony. (Above.)

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

Not unimportant, **68,** 359; **70,** 281, 288.

C., **74,** 300; **75,** ii, 453; **76,** 702.

Obstr. to, from booms and logs, **75,** ii, 448.

Small, upper R., **80,** 1573, 1574; **86,** 257.

Freight rates on upper R., **87,** 1666.

Increasing with the settlement of the country, the latter largely hastened by the imp. of the R., **93,** 2263.

Constr. of near-by RR. reducing traffic by R., **94,** 1695.

DOCUMENTS. (Not printed in reports.)

H. D. 25, 28th, 2d, **75,** ii, 435. H. D. 58, 39th 2d., **70,** 282; **67,** 260; **69,** 211. H. D. 247, 40th, 2d, **70,** 283. H. D. 118, 41st, 2d, **70,** 283.

ENCROACHMENTS.

Injury to works from loggers, **80,** 1573; **81,** 1834.

ENGINEERS.

Chief of Engineers. **R., 70,** 59; **74,** 58; **75,** 62; **76,** 85; **77,** 86; **78,** 99; **79,** 134; **80,** 178; **81,** 240, 247; **82,** 237; **83,** 244; **84,** 245; **85,** 267; **86,** 256; **87,** 224; **88,** 201; **89,** 234; **90,** 210; **91,** 268; **92,** 256; **93,** 288; **94,** 264; **95,** 294.

In charge:

Maj. G. K. Warren, 1867–70. **R., 67,** 260; **68,** 362; **69,** 211; **70,** 282.

Col. J. N. Macomb, 1870; **70,** 56.

Maj. F. U. Farquhar, 1873–78. **R., 74,** 298; **75,** 359, ii, 434; **76,** 702; **77,** 570; **78,** 726.

Capt. C. J. Allen, 1878–90; **79,** 1159. **R., 79,** 1165; (Maj.) **80,** 1572; **81,** 1743, 1832; **82,** 1803; **83,** 1435; **84,** 1597; **85,** 1731; **86,** 1483; **87,** 1664; **88,** 1537; **89,** 1787.

Maj. W. A. Jones, 1890–95. **R., 90,** 2077; **91,** 2192; **92,** 1816; **93,** 2261; **94,** 1693; **95,** 2171.

Assistants:

J. D. Skinner. **R., 74,** 299; **75,** ii, 436, 441.

A. E. Stephens. **R., 75,** ii, 442.

L. Y. Schermerhorn, **75,** ii, 442. **R., 75,** ii, 446.

F. Cook. **R., 70,** 281.

R. Davenport. **R., 81,** 1745; **82,** 1804; **91,** 2194.

F. Terry. **R., 83,** 1436.

J. P. Frizell. **R., 81,** 1835.

ESTIMATES. (See Plans and Projects.)

By F. Cook, 1870, 3 natural reservoirs near headwater, and on affluents, $114,000, **70,** 284, 287.

By Maj. Farquhar, 1873, to obtain a chan. from Minneapolis to St. Cloud, 4′ x 200′, $43,035, **74,** 300.

By Maj. Farquhar, 1874, system of natural reservoirs, $488,551, **75,** ii, 441.

By Maj. Farquhar, 1875, chan. 3′ x 200′, $75,390; chan. 5′ x 200′, $144,667, **75,** 359, ii, 449, 452; **77,** 570; **78,** 99, 727; **79,** 1165. St. Cloud to Conradis Shoals, chan. 3′ x 200′, $1,943,210; chan. 5′ x 200′, $1,957,783. Conradis Shoals to Grand Rapids, chan. 3′ x 200′, $11,620; chan. 5′ x 200′, $54,127, **75,** ii, 450, 453.

By Capt. Allen, 1879, system of natural reservoirs, $336,458, **79,** 1204, 1205, 1216. Amount required for completion of existing proj., $124,667, **79,** 134, 1167.

LEGISLATION.

Required (if imp. be made), concerning booms and logs, **75,** ii, 448.

OPERATIONS.

1874. Constr. of 2,735 l. f. of brush and gravel dams, 314 l. f. of brush protection at Thousand Islds.; also removal of bowlders on Battle and Coon Rapids; work done by hired labor, **75,** 359.

1876-77. Dr. rapids—hired labor, **77,** 570.

1878-79. Continuation of brush dams, and removal of bowlders from rapids by hired labor, **78,** 727.

1878-79. Removal of gravel and bowlders from rapids by hired labor, **79,** 134, 1165. History of previous operations, **79,** 1166.

1880-81. Removal of bowlders, snags, and trees, and constr. of wing dams at rapids bet. Aitkin and Grand Rapids, **81,** 1743, 1746.

1881-84. Removal of bowlders and snags and constr. of wing dams bet. Aitkin and Grand Rapids above the Northern Pacific RR., **82,** 1803, 1805; **83,** 1435, 1437; **84,** 1598.

1884-85. Removal of bowlders at Grand Rapids, **85,** 1731.

1888-89. 1,524 snags and logs and 60 c. y. r. removed from chan., and 8,318 overhanging trees from banks, **89,** 1788.

1890-91. 554 c. y. dr. and 957 c. y. of bowlders removed from chan.; 168 cords of brush and 696 c. y. r. used in constr. of 1,409 l. f. of wing and training dams, **91,** 2193.

1891-92. 191 snags and 346 leaning trees removed from chan. and banks, **92,** 1816.

1892-93. Over 130 c. y. bowlders removed, **93,** 2262.

PHYSICAL CHARACTERISTICS.

Physical geography of valley, **75,** 389; of R., **68,** 307; **70,** 285.

Description of, **69,** 211; **70,** 284; **74,** 300; **75,** 389, ii, 435, 437, 439, 440, 444, 446; **76,** 702.

Discharge of R., **70,** 283; **75,** ii, 446; **76,** 702. Of affluents, **75,** ii, 439, 444, 446.

Rainfall on watersheds, **70,** 287; **75,** ii, 438, 440.

Area of watersheds, **70,** 286; **75,** ii, 435, 437; **79,** 1200, 1214.

Ratio of rainfall to watershed, **70,** 287; **75,** ii, 438.

Natural reservoirs, areas, **70,** 284, 286; **75,** ii, 435, 437.

Physical characteristics of headwaters, **70,** 285, **75,** 389, ii, 435, 437; of falls and rapids, **74,** 300; **75;** ii, 435, 440, 442, 446.

Slope of R. surface, **69,** 211; **75,** ii, 435, 442.

Discharge of upper R., **81,** 2744; **82,** 1807.

Drainage basin, area of upper, **81,** 2743.

Slope of R., **81,** 2744.

Caving banks, **87,** 1664.

The 3 completed reservoirs at the headwaters of the R. above Grand Rapids considered able to provide sufficient w. and d. for SS. on R. at and above Brainerd, **93,** 2262.

PLANS. (See Estimates and Projects.)

By F. Cook, 1870, passing Falls of St. Anthony by dam, lock, and canal, **70,** 280. For retaining water of tributaries in natural reservoirs, to be used during the otherwise low stage, **70,** 284, 285. Reex. by Maj. Farquhar, 1875, as to sites of reservoirs, **75,** ii, 435; amount of water retained, **75,** ii, 438. Method of constr., **75,** ii, 440.

By Maj. Farquhar, 1875, St. Anthony to Grand Rapids, 237 m., canals, dams and locks, wing dams, and dr. to 3′ or 5′, with chan. w. of 200′, **75,** ii, 449, 452.

By Maj. Allen, 1880, passage of Sauk Rapids, Minn., by means of a l. and d. Est., $464,000 to $647,000. **81,** 1833, 1836.

PROJECTS. (See Estimates and Plans.)

By Maj. Farquhar, 1874, Minneapolis to St. Cloud, 5′, by removal of sand, gravel, and bowlder bars, and constr. of wing dams. Work done at 1,000 Islds. and Battle and Coon Rapids, **75,** 359, ii, 449, 452; **77,** 570; **78,** 99. Est., $144,667; **75,** 359, ii, 449–452; **86,** 1483; **87,** 1664.

App. of $45,000, made 1874–76, expend. on this proj., **79,** 1166; **80,** 1572.

Since 1880 operations carried on under proj. for imp. of R., Aitkin to Grand Rapids, 165 m., removal of snags, trees, and bowlders, and constr. of wing dams, to afford 3′ d. during l. w. stages. Est., Conradis Shoals to Grand Rapids, 252 m., $54,127.50. **75,** ii, 450, 453; **80,** 1573; **86,** 1484; **87,** 1664.

In 1889 $18,000 est. as required for completion, increasing est. to $63,000, **89,** 1789; **90,** 2078.

SURVEYS.

Of headwaters, made at expense of water-power companies, **70,** 283.

1872. R., Falls of St. Anthony to point 4 m. above, **72,** 296.

1874. R. bet. Falls and St. Cloud, **74,** 298; 1875, **75,** ii, 441.

From Falls to headwaters, **75,** ii, 441.

Gauging R., 1875, **75,** 359, ii, 435; 1876, **76,** 702.

At Sauk Rapids, Minn., au. by act June 14, 1880, **81,** 247; by Maj. Allen, 1880, **81,** 1832.

Maps:

Moose Rapids, Sandy Lake Rapids, Ox Portage Rapids, Crooked Rapids, Pine Rapids, **81,** 1746.

Potters Chute, Hales Rapids, Pine Rapids, Crooked Rapids, Batsons Cut, Ox Portage Bar and Rapids, Noyes Rips, Sandy Lake Rapids, Moose Rapids, Island Rapids, Tow Head Rapids, **91,** 2195.

HH-335(c) Pokegama Falls to Falls of St. Anthony. "(Transportation Route to Seaboard.")

ENGINEERS.

Chief of Engineers. R., 75, 37. (See p. 1186.)

In charge. Maj. F. U. Farquhar. **R., 75,** ii, 441.

Assistants:

J. D. Skinner, **75,** ii, 442, 453.

A. E. Stevens, **75,** ii, 442, 453.

L. Y. Schermerhorn, **75,** ii, 442, 453.

ESTIMATES. (See Plans.)

By Maj. Farquhar, 1875, approx., for l. and d. at Sauk Rapids, $464,000 to $647,000, **75,** ii, 450; at Blanchards Rapids, $332,352, **75,** ii, 450; at Cashs Isld., $446,430, **75,** ii, 450; at Little Falls, $695,127, **75,** ii, 450. For 5′ cnan., Falls of St. Anthony to Grand Rapids, $2,156,578; for 3′ chan., $2,030,220, **75,** ii 453.

PHYSICAL CHARACTERISTICS.

Description of R., Pokegama Falls to Falls of St. Anthony, with distances and elevations, **75,** ii, 442–452.

List of obstr., **75,** ii, 442–452.

Geological formations, **75,** ii, 445, 446.

Discharge of R., **75,** ii, 444, 446.

Artificial obstr., **75,** ii, 448, 449.

PLANS. (See Estimates.)

By Maj. Farquhar, 1875, imp. R. to 3′ to 5′ by chan. 200′ w., by closing secondary chan., dr., and constr. of wing dams **75,** ii, 447, 452; aided by l. and d. at the worst rapids, **75,** ii, 449.

SURVEYS.

Sur. au. and in progress, Pokegama Falls to Falls of St. Anthony, 1874, **75,** 37; completed, Maj. Farquhar, 1875, **75,** 37, ii, 441.

Map. Map of routes, S. D. 307, 43d, 1st, part 2.

HH-344(a) Brainerd to Grand Rapids, Minn.

APPROPRIATIONS. (See p. 1089.)

COMMERCE.

In 1911, about 1,500 t. misc. freight, 1,050 passengers; also about 150,000,000′ f. b. m. logs, rafts of hardwood, poles, and pulp wood floated, **12,** 820.

No RRs. parallel this portion of R., and inhabitants depend on R. for means of transportation. Work done has given safer and more commodious chan. and doubtless kept down freight rates on R., **12,** 821.

ENGINEERS.

Chief of Engineers. R., 10, 634, 643; **11,** 679 **12,** 819, 831.

In charge. Maj. F. R. Shunk, 1910–. **R., 10,** 1804; **11,** 1977; (Lt. Col.) **12,** 2184.

First Lieut. J. N. Hodges, **12,** 814.

OPERATIONS.

1910–11. Preparation of working plant; SS. *Oriole* purchased from Mississippi Trans. Co., **11,** 1978.

1911-12. SS. *Oriole* equipped as a dr. and snag boat and removed 9,354 c. y. soft material, 350 bowlders, and 275 snags; 376 trees cut, **12,** 2184.

PROJECTS.

Act June 25, 1910, adopted proj. for chan. not less than 3.5′ d., l. w., by dr., constr. wing dams and cut-offs,[1] **10,** 634.

(See this Index, p. 1123.)

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909, bet. Brainerd and Grand Rapids, Minn. **R.** by Maj. Shunk, Sept. 1 and Dec. 18, 1909; est., $22,555,[1] **10,** 643.

Pre. ex. au. act June 25, 1910, with view to removal of ledge in Aitkin Co., at or near Pine Knoll. **R.** by Maj. Shunk, Dec. 28, 1910[2] (unfav.), **12,** 831. Maps. **11,** 1978.

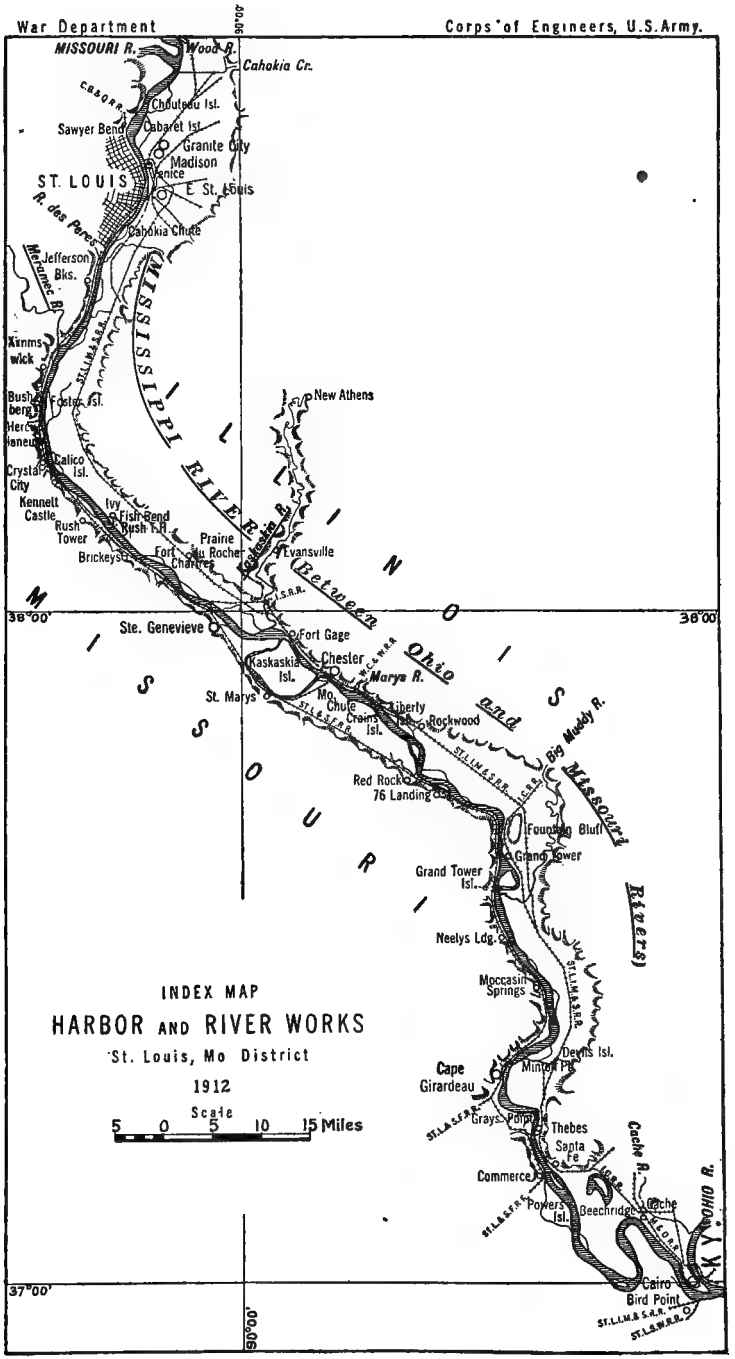
[1] H. D. 607, 61st, 2d.

[2] H. D. 282, 62d, 2d.

RIVER AND HARBOR WORKS.

UPPER MISSISSIPPI RIVER SYSTEM.

II.—ST. LOUIS, MO., DISTRICT.


War Department
Corps of Engineers, U.S.Army.
INDEX MAP
HARBOR AND RIVER WORKS
St. Louis, Mo District
1912
Scale
5 0 5 10 15 Miles
MISSOURI R.
Wood R.
Cahokia Cr.
Chouteau Isl.
Sawyer Bend
Cabaret Isl.
Granite City
Madison
Venice
ST. LOUIS
E. St. Louis
R. des Peres
Cahokia Chute
Jefferson Bks.
Meramec R.
Kimmswick
Bushberg
Herculaneum
Foster Isl.
Calico Isl.
Crystal City
Kennett Castle
Ivy
Fish Bend
Rush Isl.
Rush Tower
Brickeys
Prairie du Rocher
Fort Chartres
Kaskaskia R.
Evansville
New Athens
MISSISSIPPI RIVER
ILLINOIS
Between Ohio and Mississippi Rivers
MISSOURI
Ste. Genevieve
Fort Gage
Kaskaskia Isl.
Chester
Marys R.
St. Marys
Mo. Chute
Liberty
Crains Isl.
Rockwood
Big Muddy R.
Red Rock
76 Landing
Founding Bluff
Grand Tower
Grand Tower Isl.
Neelys Ldg.
Moccasin Springs
Devils Isl.
Mintons Pt.
Cape Girardeau
Grays Point
Thebes
Santa Fe
Cache R.
Commerce
Powers Isl.
Beechridge
Cache
OHIO R.
KY.
Cairo
Bird Point
36°00'
37°00'
90°00'

II.—ST. LOUIS, MO., DISTRICT.

In charge of U. S. Engineer Office, Custom-house, St. Louis, Mo.

NOTE.—This district includes the Mississippi R. from Ohio R. to Missouri R. and the tributaries of the Mississippi R. within such limits.

II [1] 1 Mississippi R. (See HH)
II 2 Cairo, Ill. (1) (See HH)
II 3 Big Muddy R., Ill. (1)
II 4 Kaskaskia R., Ill. (1)
II 5 E. St. Louis, Ill. (1) (See HH)
II 6 Wood R., Ill. (1) (See JJ)
II 7 Alton, Ill. (1) (See JJ)
List now returns down Miss. R. toward Cairo on west bank.
II 8 Missouri R., Mo. (1) (See GG)
II 9 St. Louis, Mo. (1) (See HH and GG)
II 10 Meramec R., Mo. (1)
II 11 Bird Pt., opp. Cairo, Ill. (1) (See HH)

II-4 KASKASKIA RIVER, ILL.

APPROPRIATIONS.

1890, $6,000, **91,** 2118.
1892, 4,500, **92,** 1746.

Total, 10,500

COMMERCE.

Flour trade; **88,** 1454.

ENGINEERS.

Chief of Engineers. R., 88, 195; **91,** 263; **92,** 252; **93,** 284; **94,** 260; **95,** 290; **96,** 252.

In charge:
Maj. A. M. Miller, 1886–92. **R., 88,** 1453; **91,** 2118; **92,** 1745.
Maj. C. J. Allen, 1893–95. **R., 93,** 2185; **94,** 1624; **95,** 2093.
Maj. T. H. Handbury, 1896. **R., 96,** 1761.

Assistants:
C. D. Lamb. **R., 88,** 1456.
R. Klemm. **R., 92,** 1746.

OBSTRUCTIONS.

Brs. crossing the Kaskaskia, **88,** 1455.

OPERATIONS.

1891-92. Constr. of quarters and preparation of plant; 31,838 c. f. of st. dike built at Evansville Shoal; r. removal at Kaskaskia and Ninemile Shoal, **92,** 1746.

1893-94. Some snags, etc., removed; 170 c. y. r. removed from chan.; dikes at Evansville repaired, **94,** 1625.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1453.

PROJECTS.

By Maj. Miller, 1888, New Athens to mouth, l.-w. d. of 3′ at a Mississippi stage of 6½′, by removal of 2 r. and gravel shoals; est., $6,000, **88,** 1455, 1456. Increased to $10,500 in 1892, **92,** 1746; **95,** 290, 2093, 2094.

SURVEYS.

Sur., **R.** Feb. 14, 1838; est., $70,720. (H. D. 482, 55th, 2d.)

Sur. au. act Aug. 5, 1886; made, 1888, by Maj. Miller, **88,** 1455.

II-10 MERAMEC RIVER, MO.

COMMERCE. (See Physical characteristics.)

ENGINEERS.

Chief of Engineers. R., 80, 161; **81,** 223.
In charge. Capt. O. H. Ernst. **R., 81,** 1596.

PHYSICAL CHARACTERISTICS.

Meramec not navigable, and not susceptible to such imp. as would adapt it to the c. of the surrounding country, **81,** 1597.

SURVEY.

Au. act June 14, 1880; made, 1880, by Capt. Ernst (see Physical data), **81,** 1596.

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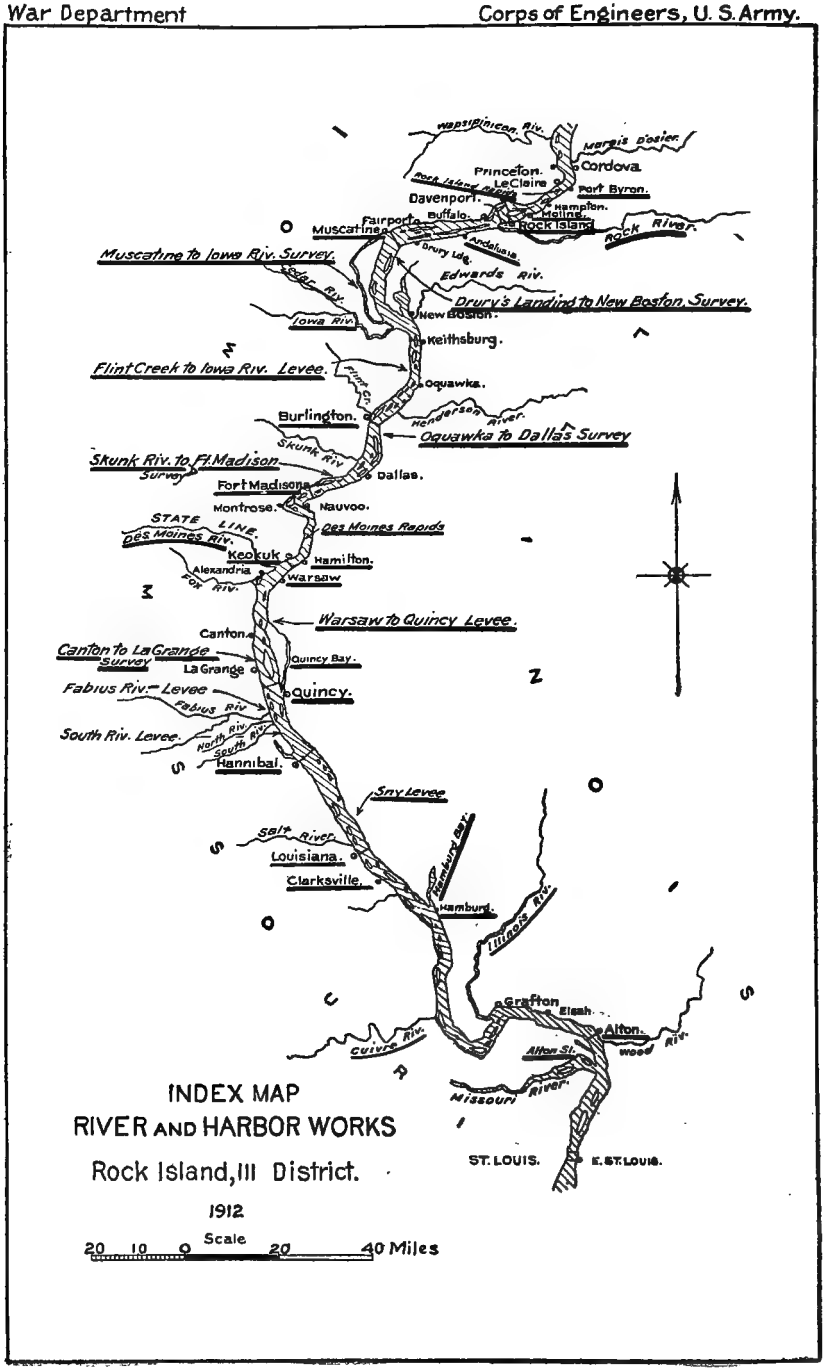
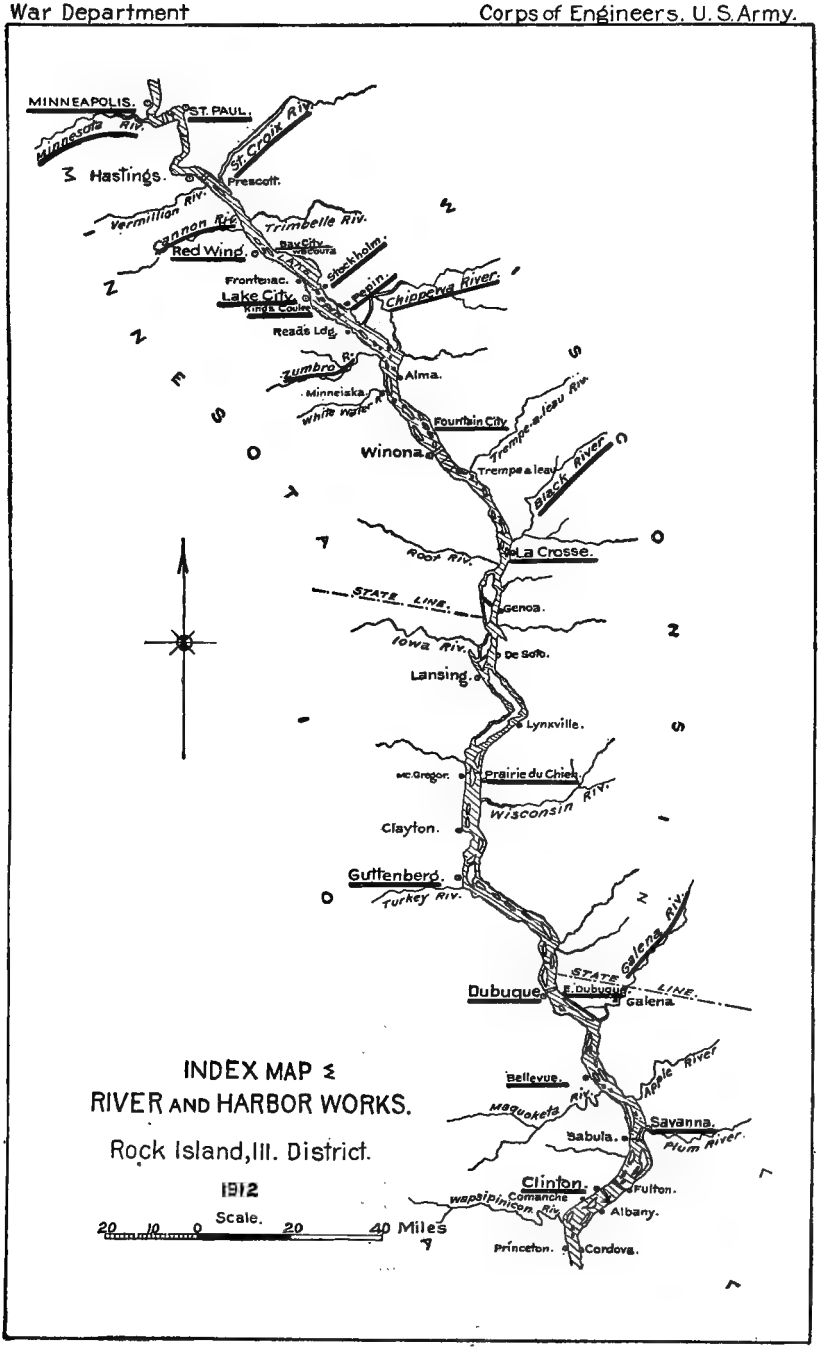
[1] Data concerning the imp. of the Miss. within the St. Louis, Mo., engineering district is embraced with all other data about the Miss. under H H, p. 1067.

RIVER AND HARBOR WORKS—UPPER MISSISSIPPI RIVER SYSTEM.

JJ.—ROCK ISLAND, ILL., DISTRICT.


War Department
Corps of Engineers, U. S. Army.
Wapsipinicon Riv.
Marais d'osier
Princeton.
Cordova.
Rock Island Rapids
LeClaire
Port Byron.
Davenport.
Hampton.
Moline.
Buffalo.
Fairport
Muscatine
Rock Island
Rock River.
Andalusia.
Drury Ldg.
Muscatine to Iowa Riv. Survey.
Cedar Riv.
Edwards Riv.
Drury's Landing to New Boston, Survey.
New Boston.
Iowa Riv.
Keithsburg.
Flint Creek to Iowa Riv. Levee.
Flint Cr.
Oquawka.
Burlington.
Henderson River.
Oquawka to Dallas Survey
Skunk Riv.
Skunk Riv. to Ft. Madison Survey
Dallas.
Fort Madison
Montrose.
Nauvoo.
STATE LINE.
Des Moines Rapids
Des Moines Riv.
Keokuk
Hamilton.
Alexandria
Warsaw
Fox Riv.
Warsaw to Quincy Levee.
Canton.
Canton to La Grange Survey
La Grange
Quincy Bay.
Fabius Riv. Levee
Quincy.
Fabius Riv.
South Riv. Levee.
North Riv.
South Riv.
Hannibal.
Sny Levee
Salt River.
Louisiana.
Clarksville.
Hamburg Bay.
Hamburg.
Illinois Riv.
Grafton
Elsah.
Alton.
Wood Riv.
Cuivre Riv.
Alton St.
Missouri River.
ST. LOUIS.
E. ST. LOUIS.
INDEX MAP
RIVER AND HARBOR WORKS
Rock Island, Ill District.
1912
Scale
20 10 0 20 40 Miles

War Department Corps of Engineers, U. S. Army.



JJ.—ROCK ISLAND, ILL., DISTRICT.

In charge of the U. S. Engineer Office,
Rock Island, Ill.

NOTE.—Mississippi R., from Wood R. (Alton, Ill.), to Omaha bridge at St. Paul, Minn., and tributaries on East bank of Upper Mississippi R., from Wood R. to Illinois-Wisconsin line, and on west bank from Vermilion R., Minn., to mouth of Missouri R.

JJ 1 [1] **Mississippi R.** (See HH, p. 1067.)
JJ 2 Wood R., Ill. (1)
JJ 3 [2] **Illinois R., Ill. (1)** (See NN Dist.)
JJ 4 [2] **Sangamon R., Ill. (3)** (See NN Dist.)
JJ 5 [2] **Mackinaw R., Ill. (3)** (See NN dist.)
JJ 6 [2] **Vermilion R., Ill. (3)** (See NN Dist.)
JJ 7 [2] **Mazon R., Ill. (3)** (See NN Dist.)
JJ 8 [2] **Kankakee R., Ill. (3)** (See NN Dist.)
JJ 9 [2] **Des Plaines R., Ill. (3)** (See NN Dist.)
JJ 10 [2] **Du Page R., Ill. (3)** (See NN Dist.)
JJ 11 [2] **Fox R., Ill. (3)** (See NN Dist.)
JJ 12 [2] **Little Vermilion R., Ill. (3)** (See NN Dist.)
JJ 13 [2] **Spoon R., Ill. (3)** (See NN Dist.)
JJ 14 Henderson R., Ill. (1)
JJ 15 South Fork—only tributary (14)
JJ 16 Pope R., Ill. (1)
JJ 17 Edwards R., Ill. (1)
JJ 18 Rock R., Ill. and Wis. (1)
JJ 19 Green R., Ill. (18)
JJ 20 Illinois and Mississippi Canal, Ill. (18)
JJ 21 Pecatonica R., Ill. (18)
Ascending by east bank:
JJ 22 Plum R., Ill. (1)
JJ 23 Apple R., Ill. (1)
JJ 24 Galena R., Ill. (1)
JJ 25 Vermilion R., Minn. (1)
JJ 26 Cannon R., Minn. (1)
JJ 27 Chub Cr., Minn. (26)
JJ 28 Heath Cr., Minn. (26)
JJ 29 Wolf Cr., Minn. (26)
JJ 30 Mackenzies Cr., Minn. (26)
JJ 31 Prairie Cr., Minn. (26)
JJ 32 Lit. Cannon R., Minn. (26)
JJ 33 Belle Cr., Minn. (26)
JJ 34 Spring Cr., Minn. (26)
JJ 35 Hay Cr., Minn. (26)
JJ 36 Wells Cr., Minn. (1)
JJ 37 Gilbert Cr., Minn. (1)
JJ 38 Collins Cr., Minn. (1)
JJ 39 Kings Cr., Minn. (1)
JJ 40 Zumbro R., Minn. (1)
JJ 41 N. Br. Zumbro R., Minn. (40)
JJ 42 S. Br. Zumbro R., Minn. (40)
JJ 43 Dadys Cr., Minn. (1)
JJ 44 Sanke Cr., Minn. (1)
JJ 45 Indian Cr., Minn. (1)
JJ 46 Whitewater R., Minn. (1)
JJ 47 N. Whitewater R., Minn. (46)
JJ 48 S. Whitewater R., Minn. (46)
JJ 49 Rollingstone Cr., Minn. (1)
JJ 50 Pleasant Valley Cr., Minn. (1)
JJ 51 Cedar Cr., Minn. (1)
JJ 52 Big Trout Cr., Minn. (1)
JJ 53 Dakota Cr., Minn. (1)
JJ 54 Pine Cr., Minn. (1)
JJ 55 Root R., Minn. (1)
JJ 56 Middle Br., Minn. (55)
JJ 57 South Br., Minn. (55)
JJ 58 South Fk., Minn. (55)
JJ 59 Upper Iowa R., Iowa (1)
JJ 60 Yellow R., Iowa (1)
JJ 61 Turkey R., Iowa (1)
JJ 62 Little Maquoketa R., Iowa (1)
JJ 63 Maquoketa R., Iowa (1)
JJ 64 Wapsipinicon R., Iowa (1)
JJ 65 Iowa R., Iowa (1)
JJ 66 Cedar R. (tributary), Iowa (65)
JJ 67 Skunk R., Iowa (1)
JJ 68 Des Moines R., Iowa and Wis. (1)
JJ 69 Raccoon R., Iowa (68)
JJ 70 North R., Iowa (68)
JJ 71 Middle R., Iowa (68)
JJ 72 South R., Iowa (68)
JJ 73 Fox R., Mo. (1)
JJ 74 Fabius R., Mo. (1)
JJ 75 Middle Fabius R., Mo. (1)
JJ 76 North R., Mo. (1)
JJ 77 South R., Mo. (1)
JJ 78 Salt R., Mo. (1)
JJ 79 Elk Fork, Mo. (78)
JJ 80 South Fork, Mo. (78)
JJ 81 Cuivre R., Mo. (1)

[1] Data concerning the imp. of the Miss. within the Rock Island engineering district is embraced with all other data about the Miss. under HH, p. 1067.

[2] The Illinois, with its tributaries, is geographically a part of the JJ District group of waterways trib- to the Mississippi. Data concerning the Illinois, etc., are printed with data of NN Engineering District (Chicago, Ill.), because of the imp. of the Illinois as a part of the waterway system connecting the Great Lakes at Chicago and vicinity with the Mississippi.

JJ-18 ROCK RIVER, ILL. AND WIS.[1]

APPROPRIATION.

July 7, 1838 (sur.),[2] $1,000.

COMMERCE.

Extension of navigation from the Illinois and Mississippi Rs. to Rockford would not materially affect rates from cities along Rock R. to principal markets for their products, **04,** 2227.

DOCUMENTS. (Not published in reports.)

H. D. 15, 40th Cong., 1st sess. **R.** of sur., **67,** 17.

ENGINEERS.

Chief of Engineers. R., 66, iii, 35; **67,** 17, 37; **04,** 419; **10,** 801; **11,** 674; **12,** 814.

Boards. BERH. concurs in Maj. Townsend's report upon inadvisability of imp. **R., 04,** 2228.

In charge:

Lt. Col. J. H. Wilson (35th Infantry), 1866–67. **R., 67,** 272.

Maj. C. McD. Townsend, 1904. **R., 04,** 2223.

Maj. C. S. Riché, **10,** 797.

Maj. Chas. Keller, **11,** 666; **12,** 807.

Assistants. J. Worrall and W. F. Shunk, **67,** 272.

PLANS.

By Lt. Col. Wilson, (1) 22 d. and l. and an independent canal with locks for the remaining distance; canal 88′ w. in deep cutting, and 98′ w. in shallow cutting; 7′ d.; est., $14,738,730; (2) smaller canal and slack-water navigation, giving 5′; est., $5,252,013, **67,** 272.

SURVEYS.

1866. By J. Worrall, under the direction of Lt. Col. Wilson. **R., 67,** 272.

Pre. ex. from mouth to Rockford au. act June 13, 1902. **R.** by Maj. Townsend[3] (unfav.), **04,** 419, 2223.

Pre. ex. and sur. au. act Mar. 3, 1909, **10,** 801; **11,** 674; **12,** 814. (**R.** to come.)

JJ-18(b) YAHARA RIVER, WIS.

ENGINEERS.

Chief of Engineers. 10, 801.

In charge. Maj. C. S. Riché, **10,** 796.

SURVEY.

Pre. ex. from Madison to Janesville au. act Mar. 3, 1909. **R.** by Maj. Riché, Sept. 17, 1909 (unfav.); **10,** 801.[4]

JJ-20 ILLINOIS AND MISSISSIPPI CANAL, ILL.

Part.	Title.	Period.	Appropriations.
a	Hennepin Canal (Transportation Routes to Seaboard)	1871–1875	
b	Hennepin Canal—Illinois R. to Miss. R.	1871–1886	$45,000.00
c	Illinois and Mississippi Canal, Ill	1890–1912	7,645,960.00
d	Illinois and Mississippi Canal (imp. of Rock R. Pool)	1907–1911	
e	Illinois and Mississippi Canal (lock at head of feeder)	1911–1912	
f	Illinois and Mississippi Canal (operation and care of Milan section)	1895–1912	194,353.75
g	Illinois and Mississippi Canal (operation and care) E. and W. sections and feeder	1908–1912	767,997.81
	Total		8,653,311.56

Part (a), JJ-20 Hennepin Canal. ("Transportation Routes to Seaboard.")

ENGINEERS.

Chief of Engineers. R., 75, 37.

In charge. Col. J. N. Macomb. **R., 75,** ii, 524.

Assistant. F. C. Doran, **75,** ii, 524. **R., 75,** ii, 526.

ESTIMATE. (See Plans.)

By F. C. Doran, 1875, route from point near Rock Isld., on the Mississippi, to Chicago, on Lake Michigan, $19,780,534, **75,** ii, 525. Amended by Col. Macomb to $20,421,819, **75,** ii, 525.

[1] Sur.—R., Jan. 1, 1840; est., $178,250. (H. D. 482, 55th, 2d.)

[2] Sur. was with view to imp. R. from the Illinois line as far up as the contemplated intersection with the Milwaukee and Rock R. Canal, and also of the haven of the said R. next below Lake Kushkenong to Madison. (Treas. Doc. 373, 1882.)

[3] H. D. 169, 58th, 2d.

[4] H. D. 398, 61st, 2d.

PHYSICAL CHARACTERISTICS.
Described, **75,** ii, 525, 527, 530.

PLANS. (See Estimates.)
By Col. Macomb, (1) enlarging and d. Illinois & Michigan Canal, Chicago to Joliet, to 160′ x 8′ x 32.65 m.; est., $11,532,932.40, **75,** ii, 527; (2) slack-water navigation, Joliet to La Salle, by l. and d., incl. canal around the rapids at Marseilles, 66.63 m.; est., $4,347,879.80, **75,** ii, 530; (3) independent canal, Hennepin, on the Illinois, to Watertown, on the Mississippi; est., $3,899,722.64, **71,** 306; **75,** ii, 530; addl. for locks, $641,284, **75,** ii, 525. Total cost, $20,421,819, **75,** ii, 525.

SURVEYS.
Sur. au. and in progress, 1874, **75,** 37.
Completed to Hennepin Canal route and extension to Chicago by F. C. Doran, 1875, **75,** ii, 524, 526.
Map of route, S. D. 307, 43d Cong., 1st sess.

Part (b), JJ-20 Hennepin Canal, Illinois River, to Watertown, Mississippi River. (Ship canal.)

APPROPRIATIONS.

1882,	$30,000,	**83,** 290.
1886,	15,000,	**86,** 457.
Total,	45,000	

COMMERCE.
Important, **83,** 1780; **86,** 1738.
Effect of water transportation on freight rates, **83,** 1781.

ENGINEERS.
Chief of Engineers. **R., 71,** 57; **83,** 289; **84,** 291; **85,** 314; **86,** 309, 1708; **87,** 275, 2127.

Boards. Of 1886 to report upon the Hennepin Canal. **R., 87,** 2137–2141. (Lt. Cols. Comstock and Poe and Maj. Post.)

In charge:
Lt. Col. J. H. Wilson (35th Infantry), 1871. **R., 71,** 264, 265.
Col. J. N. Macomb, 1871. **R., 71,** 302.
Maj. W. H. H. Benyaurd, 1882–86. **R., 83,** 1754, 1788; **84,** 1950; **85,** 2056; **86,** 1733.
Maj. T. H. Handbury, 1886. **R., 86,** 1711, 1735.

Assistants:
H. A. Ulffers, **71,** 264. 265.
G. P. Low, jr. **R., 71,** 302.
J. Worrall, C. E., **71,** 304.
H. B. Herr. **R., 83,** 1763.
G. Y. Wisner. **R., 83,** 1773.
G. A. M. Liljencrantz. **R., 86,** 1719.

ESTIMATES. (See Plans.)
By J. Worrall, C. E., canal from RR. br. at Colona to Rock Isld. City, locks 30′ x 150′, $902,283.45, **71,** 304. Modified by change of plan, **71,** 304.
By G. P. Low, ship canal, Hennepin, on the Illinois R., to Watertown, on the Mississippi R., incl. l. and d.: E. division, 25.9 m., $5,779,277.24; w. division, 39.4 m., $4,429,566.13; feeder division, 38.1 m., $2,270,849.90, **71,** 303, 304, 305; total est., $12,479,493, **71,** 305. For C. canal, e. division, $1,467,202.44; w. division, $1,429,708.50; feeder division, $1,002,811.70; total, $3,899,722.64, **71,** 306; **75,** ii, 530.

LEGISLATION.
Relating to sur., **83,** 1755.
Form for act ceding Illinois & Michigan Canal to U. S., **83,** 1787.

PHYSICAL CHARACTERISTICS.
Description of, **71,** 305.

PLANS. (See Estimates.)
By G. P. Low, jr., ship canal, Hennepin, on the Illinois R., to Watertown, on the Mississippi R., 7′ x 160′ locks, 75′ x 350′: E. division, from Illinois R. to the junction of the feeder at Devils Slough, 25.9 m., with an aggregate lift of 207′, requiring 19 locks, **71,** 303; w. division, from junction of the feeder to the Mississippi near Watertown, with an aggregate lift of 92′, requiring 9 locks, **71,** 304; feeder division, to be 7′ x 140′ x 38 m., **71,** 305. For canal for C. purposes, 6′ x 60′; locks, 21′ x 350′, **71,** 306.
By Maj. Benyaurd, 1882, canal bet. Hennepin, on the Illinois R., and vicinity of Watertown, on the Mississippi R., prism 7′ x 80′, lock 30′ x 170′.
By the Marais d'Osier route, 65 m. l.; est., $5,811,367.
By Watertown route, 65 m. l.; est., $7,207,646.
By Rock Isld. route, 74½ m. l.; est., $6,672,890, **83,** 1757, 1758, 1762, 1772, 1788; **86,** 1709.
Revised, 1885, to $6,709,536, **86,** 1709.
Preference given to Marais d'Osier route, **83,** 1760, 1761; **86,** 1710, 1715, 1734; **87,** 2140.
In 1885 addl. surs. made for the Watertown and Rock Isld. routes and the following ests. submitted by Capt. Handbury:
Watertown route (via Penneys Slough), 65 m. l., $6,306,552, **86,** 1709, 1713, 1722.
Rock Isld. route (via Penneys Slough and Rock R.), 77 m. l., $6,554,052, **86,** 1709, 1713, 1722.
Rock Isld. route (via Green R., revised), 74½ m. l., $6,709,536, **86,** 1709, 1713, 1722.
The Chief of Engineers suggested adopting Rock Isld. route, **86,** 1710.
Advantages of Rock Isld. route, **86,** 1710, 1728, 1732, 1748.
The BE., 1886, preferred the Marais d'Osier route, **87,** 2140.

PRIVATE (CORPORATE) WORK.
Description of Illinois & Michigan Canal, **83,** 1774.

SURVEYS.
By G. P. Low, jr. **R., 71,** 302.
Au. act Aug. 2, 1882, **83,** 290; made by Maj. Benyaurd, 1883, **83,** 1754, 1756.
History of surs. previous to 1882, **83,** 1755.
Addl. surs., 1885, **86,** 1708, 1728.
Maps of Hennepin, Illinois, and Michigan Canals, **87,** 2171.

Part(c), JJ-20 Illinois and Mississippi Canal, Ill.

APPROPRIATIONS.

1890,	$500,000,	**91,** 2633.
1892,	500,000,	**92,** 2300.
1894,	190,000,	**95,** 2730.
1896,	45,000,	**96,** 2614.
1897,	875,000,	**97,** 2828.
1898,	1,427,740,	**98,** 2455.
1899,	700,000,	**99,** 2859.
1900,	1,000,000,	**00,** 3816.
1901,	975,000,	**01,** 3018.
1902,	733,220,	**02,** 2119.
1905,	300,000,	**05,** 2148.
1906,	200,000,	**06,** 1788.
1910,	[1] 75,000,	**10,** 2172.
1911,	125,000,	**11,** 1971.
Total,	7,645,960	

CONTRACTS.

1892. Informal contract for fencing, **93,** 2839. A. J. Whitney, lock pit and foundation, Lock 37 (work uncompleted). J. Killeen, lock pit and foundation, Lock 36, $14,679.60. J. D. Lynch, 3 m. of canal trunk earthwork, sand and pebbles, $40,2.6.02. D. Sears, lock pit and foundation and guard lock, $1,673.28, **93,** 2838.

1894. King Bridge Co., superstr. for 2 metal swing brs., $11,200, **94,** 2171. W. Callahan, earthwork of m. 1, 2, 5, and 8, $29,879.04. E. Phelan, earthwork of m. 3 and 4, $23,041.66. J. Carroll, earthwork of m. 6, $6,002.88. Kenefick & Strang, earthwork of m. 7, $7,837.42. Mall & Doan, pits and foundations of Locks 1, 2, 3, and 4 (piles, earthwork, timber, ironwork, concrete), $41,547.03. Heidenreich Co., pits and foundations of Locks 6 and 7 (earthwork, piles, timber, ironwork, concrete), $18,872.12. Coil & McIvor, pit and foundation of Lock 5 (earthwork, piles, timber, ironwork, concrete), $8,010.90, **95,** 2734.

1895. Circular letter proposals for cement, **96,** 2618.

1897. Katz, Crandall & Callahan, earthwork of m. 9–16, $119,475. Cogan & Pound, 11 lock pits and foundations and 2 aqueducts (excavation, piles, timber, ironwork, concrete), $96,735.85. McArthur Bros., concrete and iron culverts, $24,815, **97,** 2832. J. J. McCaughey, earthwork of m. 17 and 18, $17,105.90. Globe Construction Co., earthwork of m. 19–23, $132,002.80. R. C. Cushing Co., earthwork of m. 24, $8,277. H. A. Boedker & Co., lock pits, and foundations, Locks 19, 20, 21 (excavation, piles, timber, ironwork, concrete), $26,239, **98,** 2459.

1898. Toledo Bridge Co., superstr. of 5 steel brs., $8,200, **98,** 2459. J. E. Loomis, earthwork of m. 3 and 4 of feeder line, $24,893.25. Corbett & Currie, earthwork of m. 5 of feeder line, $9,502.71. Callahan Construction Co., earthwork of m. 1, 2, and 8 of feeder line, $67,503.19. Cogan & Pound, earthwork of m. 6 and 7 of feeder line, $42,155.52. J. Berkery, earthwork of m. 9, 10, and 11 of feeder line, 2,177,744 c. y., 8.4¢; 132,182 c. y., 16½¢. Kinser & Sons, earthwork of m. 12–16, feeder line, 98,696 c. y., 11¢, and 297,515 c. y., 10¢, **99,** 2865.

1899. J. G. Wagner, br. across Rock R., $25,000. Kinser & Sons, earthwork of m. 19 and 20, feeder line, 241,823 c. y., 11.85¢. Callahan Construction Co., earthwork, m. 21 to 29, feeder line, 288,502 c. y., 15½¢; 372,263 c. y., 17½¢; 393,189 c. y., 16¢; 102,592 c. y., 9¾¢; 127,604 c. y., 12½¢; and 167,621 c. y., 13¾¢; pits for 7 arch and constr. 10 pipe culverts, for feeder line (earthwork, concrete, iron pipe, ironwork, timber, piles), $60,096.32, **99,** 2865. G. W. Jackson Construction Co., m. 17 and 18 of feeder line earthwork, 245,712 c. y., 9¾¢, **99,** 2865. Carnegie Steel Co., 3 brs., $40,473.27. Lassig Bridge & Iron Works, superstr. of 2 ry. brs., $29,195. Katz & Callahan, earthwork of m. 28, 29, 42 of w. section, and 26, 27, and 28 of e. section, $60,729.45. T. W. Kinser & Sons, earthwork of m. 40, w. section, $14,093.99. J. J. McCaughey, earthwork of m. 45 and 48, w. section, $24,526.35. Toledo Bridge Co., 5 steel highway brs., $13,400. B. William, earthwork of m. 9, 10, and 11 of feeder line, $40,546.24, **00,** 3825.

1900. Chicago Bridge & Iron Works, superstr. of ry. br., $17,910, **00,** 3825. Lassig Bridge & Iron Works, superstr. of RR. br.; Lafayette Bridge Co., superstr. of highway br., **01,** 3026. S. P. Bennett, earthwork, m. 36, w. section; Katz & Callahan, earthwork, m. 37 and 38, w. section; Pound Constr. Co., earthwork, m. 34, w. section; Flynn Bros., earthwork, m. 33 and 35, w. section, **02,** 2121.

1901. T. W. Kinsen & Sons, earthwork, m. 50 and 52, w. section; Katz & Callahan, earthwork, m. 49, w. section; King Bridge Co., superstr. single-track RR. br., **02,** 2121.

1902. Chas. Stone, pits and foundations for 4 aqueduct brs.; Cowan & Pound, pits and foundations for 2 locks and 4 culverts; Wallace Marshall, superstr. for 6 highway brs.; Chicago Bridge & Iron Co., superstr. for 21 highway brs.; Katz & Callahan, earthwork, m. 31; John J. McCaughey, earthwork, m. 29, 30, and 32, **02,** 2121. Page & Shnable, foundations and walls for l. and ps.; Callahan Bros. & Katz, earthwork, m. 58 and 59, **03,** 1924.

1903. Savage Construction Co., pits and foundations for 4 aqueduct brs.; Chicago Bridge & Iron Co., superstr. for 4 highway brs., **04,** 2961.

1904. A. E. Morton, removing cross banks and building embankments at highway br. sites; Winston Bros. Co., earthwork, parts of m. 34 and 60; Wisconsin Bridge & Iron Co., superstr. of single-track RR. br.; Marquette Cement Mfg. Co., 4,000 bbls. Portland cement; Callahan Bros. & Katz, earthwork, m. 53 and 57, **04,** 2961. Winston Bros. Co., earthwork, m. 21; Modern Steel Structural Co., sluice gates, and manufacture and delivery of Aqueduct No. 9; Springfield Bridge & Iron Co., aqueducts; Lawrence D. Weaning, lock gates, valves, etc.; Briar Bluff Coal & Mining Co., 500 t. coal; Pittsburgh Steel Constr. Co., superstr. for 4 steel highway brs.; John Marsch, earthwork, m. 22, **05,** 2149.

1905. Marsh & Bingham Co., white oak timber; W. L. Serrel, Oregon fir timber; Boeckler Lumber Co., yellow pine timber, **05,** 2149. John Lingham, foundation and masonry of house at guard lock; Francis Beidler & Co., yellow pine timber, **06,** 1789.

1906. Wallace Marshall, manufacture and delivery of 21 steel highway brs.; Page & Shnable, excavating outlet from Lock 29 into Rock R.; Eli C. Hess, woodwork of house at guard lock, **06,** 1789. Russel Wheel & Foundry Co., emergency gates and sluice gates; Horace E. Horton, hoisting carriages; Vulcan Iron Works, metal work for gates and valves; Russel Wheel & Foundry Co., supple., 6 sluice gates, **07,** 1945.

1908. J. C. Simpson & Co., lumber and millwork for 25 houses for lock tenders and overseers, **08,** 2012.

ENGINEERS.

Chief of Engineers. R., **89,** 292; **90,** 263; **91,** 334; **92,** 320; **93,** 364; **94,** 336; **95,** 374; **96,** 329; **97,** 418; **98,** 406; **99,** 482; **00,** 546, 550; **01,** 532, 534; **02,** 455; **03,** 496; **04,** 542; **05,** 550; **06,** 610; **07,** 637; **08,** 684; **09,** 720; **10,** 798; **11,** 672, 674; **12,** 812, 814.

Boards. Convened, Rock Isld., Sept. 12, 1891, by S. O. No. 48, to consider and **R.** upon the location of the w. terminus of the Illinois and Mississippi Canal. **R.,** **92,** 2302. (Col. Poe, Maj. Mackenzie, and Capt. Marshall.)

In charge:

Capt. W. L. Marshall, 1889–99. **R.,** **89,** 2148; **90,** 2580, 2581, 2604; **91,** 2633, 2640, 2646, 2650; **92,** 2297; **93,** 2832; **94,** 2162; (Maj.) **95,** 2726; **96,** 2608; **97,** 2825; **98,** 2447; **99,** 2853.

[1] For lock in Rock R.

Maj. J. H. Willard, 1899–1903. **R., 00,** 3810; **01,** 3014, 3066; **02,** 2119; **03,** 1920.
Maj. C. S. Riché, 1903–05. **R., 04,** 2957.
Lt. Col. W. H. Bixby, 1905–06. **R., 05,** 2144.
Maj. C. S. Riché, 1906–10. **R., 06,** 1785; **07,** 1940; **08,** 2008; **09,** 2010.
Maj. Chas. Keller, 1910–. **R., 10,** 2169; **11,** 1963, 1971; **12,** 2171, 2177.

Assistants:
G. A. M. Liljencrantz. **R., 89,** 2149; **90,** 2601.
L. L. Wheeler. **R., 91,** 2643, 2653, 2655; **92,** 2301; **93,** 2838; **94,** 2172; **95,** 2758; **96,** 2652, 2656; **97,** 2859, 2861, 2870; **98,** 2482; **99,** 2886; **00,** 3850; **01,** 3044, 3069; **02,** 2129; **03,** 1925; **04,** 2961; **05,** 2149.
Lt. H. Jervey. **R., 95,** 2743; **96,** 2618; **97,** 2847.
J. C. Long. **R., 93,** 2844; **94,** 2178; **95,** 2763; **96,** 2638; **97,** 2862; **98,** 2466; **99,** 2871; **00,** 3829; **01,** 3026; **02,** 2125; **03,** 1927; **04,** 2964; **05,** 2151.

LEGAL PROCEEDINGS.

For right of way, etc., **93,** 2835; **94,** 2180; **95,** 2728; **97,** 2827; **98,** 2454. All right of way obtained, **99,** 2855.

Rock R. declared navigable by decree of U. S. Circuit Court, up to and beyond Sterling, prior to app. of $25,000 for constr. of a br. to replace the br. at Moline, **98,** 2448.

Right of way, etc., **01,** 3045; **02,** 2129; **03,** 1924; **04,** 2958; **05,** 2146; **06,** 1786; **07,** 1940.

Cogan & Pound, failure to complete contract; case settled, **08,** 2010.

Land leases, **12,** 2177.

R. by Chief of Engineers in re claim "Globe Cons. Co." U. S. settled claim by payment of $16,178.79.[1]

OBSTRUCTIONS.

Brs. obstr. navigation, **96,** 2609.

OPERATIONS.

1888-91. Preparations of drawings, plans, and est. for the proposed canal, **89,** 2148; **90,** 2580; **91,** 2633; **92,** 2301.

1892-93. Western section: 2 lock pits and foundations completed; about 300,000 c. y. earthwork excavated from canal trunk and placed in embankment; dams, locks, and culvert in course of constr.; earth and st. excavations and embankment constr. in progress; warehouses built, etc., **93,** 2833.

1893-94. Western section: 3 locks, 7 sluices, 1 culvert, and abutments for pontoon br. completed; the earthwork and r. excavation of the canal around the lower rapids of Rock R. nearly completed, and preparations made for constr. of dams, brs., gates, etc., **94,** 2163, 2164.

1894-95. Western section: Several brs. constr., excavation and embankments along the section completed, cofferdams and cross banks removed, approaches to locks dr., banks riprapped, lock houses constr., gates hung, and dams completed; nearly completing canal around the lower rapids of Rock R., which was opened to navigation on Apr. 17, 1895, **95,** 2727.

Eastern section: 4 m. canal trunk and 4 lock foundations completed, and similar work in progress; culverts constr. and others in course of constr.; several locks commenced, 5 m. of constr. RR. laid, warehouses and 1 br. built, **95,** 2729.

Cement tests made, **95,** 2743.

1895-96. Western section: Dr. plant built, the entrance at the Mississippi dr., pile revets. constr., filling placed, riprapping done, and similar work performed, **96,** 2610, 2611.

Eastern section: 6 locks completed, the masonry of an aqueduct and 2 culverts also completed, as well as foundations for 3 locks. All masonry on first 8 m. has been completed at the end of year, and also nearly all the earthwork, **96,** 2612.

Cement tests made, **96,** 2618.

1896-97. Western section: Mississippi entrance dr., and also approaches to landing at Blossomburg, wing dams constr. at mouth of Rock R., **97,** 2827.

Eastern section: Earthwork of sixth m. completed and preparations made for continuing work next year, **97,** 2826.

Cement tests made, **97,** 2847.

1897-98. Western section: Preparations made for continuing work next year, **98,** 2454.

Eastern section: 8 m. canal trunk completed, 2 practically completed, and work on 8 m. more begun; foundations of 9 locks completed, and work begun on 5 more and also 1 aqueduct; 3 brs. erected and 8 culverts built. About 8 m. of canal trunk lined with st., filling behind 7 locks and splay walls completed; masonry of 3 locks and abutments of 5 highway brs. constr., and approaches to brs. nearly completed; several buildings (lock houses, etc.) erected, and 5 m. of constr. track laid, **98,** 2449, 2450.

Cement tests made, **98,** 2451, 2480.

1898-99. Eastern section: 9 m. lined with st., superstr. of 2 brs. placed, approaches to 5 brs. completed, masonry of 11 locks and the abutments of 2 aqueduct brs. and 1 highway br. completed and of 1 highway br. begun; culvert placed under canal; 164,937 c. y. earth filling placed behind lock walls and aqueduct abutments and approaches to brs., all by hired labor. By contract, 4 m. completed and 2 more partly completed; pits and foundations of 5 locks and of 2 aqueduct brs. completed. Feeder line: Work in progress on 15 m. of trunk, 778,735 c. y. being placed, **99,** 2853.

1899-00. Eastern section: About 2 m. of earthwork completed; about 7 m. of trunk lined; abutments and approaches to 5 highway brs. completed, and 3 other such works under way; abutments and approaches to 2 RR. brs. completed and for 1 other in progress; about 6 culverts completed, and superstr. of 2 aqueduct brs. erected, all by hired labor. By contract, nearly 4 m. completed; superstr. of 5 highway, 1 single-track and 1 double-track RR. br. completed. Feeder line: Concrete masonry work on culverts and for about 5 brs. carried on by hired labor. By contract, 2,480,867 c. y. earthwork executed; foundations for 4 culverts completed; 4 pipe culverts completed and pits for 5 more partly excavated.

Western section: Warehouse built and 4 others in progress; 2 culvert pits excavated, fencing done, and right of way staked out, and earthwork completed by hired labor. By contract, about 414,773 c. y. earthwork executed, **00,** 3810.

1901-12. For detailed progress of work on constr. of this canal, with itemized summary of expend., see an. **Rs.** for each year on following pages: **01,** 3014; **02,** 2118; **03,** 1920; **04,** 2957; **05,** 2144; **06,** 1785; **07,** 1940; **08,** 2008; **09,** 2010; **10,** 2169; **11,** 1963; **12,** 2171. (See Contracts for character of work.)

1907-08. Canal formally opened to navigation, Oct. 24, 1907, **08,** 2008.

PHYSICAL CHARACTERISTICS.

Description of approv. canal route, **90,** 2582.

Elevations of h. w. in 1892 along Rock R. from Pennys Slough to the Mississippi, **93,** 2843.

Stages of the Mississippi at Rock Isld. for 1893, **93,** 2843.

Rock R. gauged in 1895–96 and its discharge found to be 723 c. f. per second less than previously est., **96,** 2610.

Description of Sterling route of canal, **96,** 2653.

Description of Green R. route, **97,** 2868.

Part of feeder line situated in Cecils Slough found to overlie a deep peat bog, making necessary surs. for different line, **00,** 3811.

Excessive rains causing damages and delays to operations, **03,** 1920.

Complaints from landowners in reference to drainage, **07,** 1940.

Descriptive and historical sketch by Mr. Wilbert L. Bonney, with drawing and photographs, **08,** 2012. (See also **10,** 799, 800.)

See Projects.

[1] S. D. 103, 59th, 2d.

PLANS. (See Projects.)

Location of proposed canal and feeder routes, **90,** 2588, 2589, 2601.

Dimensions of proposed canal and constr. proposed, **90,** 2589.

Details of lock, br., sluiceway, and dam constr., **90,** 2590.

Itemized est., **90,** 2596.

General considerations relating to the work, **90,** 2599; **91,** 2639. Total est., $6,925,960, **90,** 2597; **92,** 2300.

Western terminus of canal located by BE., 1891, upon the s. side of the principal mouth of Rock R., **92,** 2310.

PRIVATE WORK.

Sterling Hydraulic Co. given permit to constr. a water-power station, **08,** 2009.

PROJECTS. (See Plans.)

Comparative est. of alternate lines from m. 6.5 to m. 12.4, incl., **93,** 2845.

Tabular statement of comparative ests. for constr. of canal from m. 25 w. to mouth of Green R. by 2 routes, **94,** 2181.

Capt. Marshall, 1893–94, est. the cost of the canal around the lower rapids of Rock R., excl. of surs. and expenses of right of way, at $472,000, **94,** 2166.

By Maj. Marshall, 1896–97, locating feeder 4 m. w., leaving Rock R. at Sterling instead of Dixon; est., $1,654,733.30, **96,** 2655; **97,** 2868.

By Maj. Marshall, 1896, location of w. section of canal via Green R. route; est., $2,048,444.97, **97,** 2867, 2869.

Comparative est. of cost of alternate lines for canal, surs. of 1895 and 1897, resp., in vicinity of Colona, Ill., **97,** 2861.

By Capt. Marshall, 1888, and modified in subsequent years, for constr. of a canal about 75 m. l. and at least 80′ w. at the water surface, 7′ d., with locks 170′ l. bet. quoins and 30′ w., admitting barges carrying 600 short t., from 1¼ m. above Hennepin, Ill., thence via Bureau Creek Valley and over the summit to Rock R. at the mouth of Green R., thence by slack water in Rock R. to a canal around the lower rapids of the R. at Milan, to the Mississippi at the mouth of Rock R.; ascending through 21 locks and descending by 10 lift locks, with 1 guard lock, with a feeder line 29 m. l.; est., 1890, $6,925,959.70, **97,** 2870; est., 1896, $7,157,379.74, **97,** 2870; **98,** 2447.

Plans for flushing culverts carried under the canal (drawings), **99,** 2858.

Intermediate masonry ps. substituted for pedestals and columns on the feeder line, **99,** 2858.

Line F of the various routes sur. in place of the line through the boggy Cecils Slough chosen, **00,** 3811.

Lock site near Colona changed to prevent extensive changes in the grade of 2 RRs. intersecting near that point, **00,** 3811.

Aqueduct over Green R. on the feeder line to be used in drawing down both the feeder line and the summit level in case of accident or when repairs are to be made, **00,** 3812.

Special **R.** of Maj. Willard, with revised est. on completion of this canal. Submits **R.,** Jan. 6, 1902, stating excess cost to be $1,985,591.72, making total of $8,911,551.12, **02,** 2121.

Act Mar. 3, 1905, au. constr. of fixed dam with movable crest in Rock R., **05,** 550.

Act June 25, 1910, au. constr. of lock in Rock R. Dam; est., $75,000.

Illinois and Mississippi Canal. Lock at head of feeder, **10,** 799; **11,** 1965.

Act Feb. 27, 1911, au. $125,000 for imp. Illinois and Mississippi Canal by raising Aqueduct 1, Lock 4, one highway br. and approaches and the banks of the canal where the canal crosses East Bureau Creek, just below the Chicago, Rock Isld. & Pacific Ry. br., **11,** 1971.

A thorough sur. demonstrated that work indicated not necessary or desirable, and flood troubles in no way due to constr. of canal. An alternative proj. proposes protection of certain portions of the canal bank, lowering bed of Bureau Creek in vicinity of Aqueduct 1, and dr. of creek from Bridge 3 to Illinois R. Cost to be paid from fund available for canal constr. and operating and care; and return 1911 app. to Treas., **12,** 814.

SURVEYS.

Misc. surs. for location of main line, feeder, etc. (see Physical characteristics, 1900), **93,** 2835; **94,** 2166; **95,** 2728; **96,** 2650, 2652, 2656; **97,** 2827, 2861, 2866; **98,** 2479.

Sur. for feeder line along Sterling route made by Maj. Marshall, 1895–96, **96,** 2611, 2653.

Sur. of Green R. route made, 1896, by Maj. Marshall, **97,** 2867.

Ex. of Rock R. feeder for l. and d., au. act June 6, 1900. **R.,** Maj. Willard, Oct. 19, 1900; est., $75,000,[1] **00,** 550; **01,** 534, 3066.

Maps. **91,** 2649; **94,** 2176; **96,** 2670; **97,** 2878; **98,** 2482, 2484.

Drawing and photographs, **08,** 2013, 2018.

Photograph (sluice gates and counterpoises), **09,** 2010.

Part (d), JJ-20 Illinois and Mississippi Canal, Ill. (Improvement of Rock River Pool, Ill.)

APPROPRIATIONS. (See Projects below.)

Summary of expense, 1905–1911, $125,946.92, **11,** 1965.

ENGINEERS.

Chief of Engineers. **R.,** **07,** 495; **08,** 529; **09,** 559; **10,** 628; **11,** 672.

In charge:

Maj. C. S. Riché, 1907–10. **R.,** **07,** 1573; **08,** 1645; **09,** 1638.

Maj. Chas. Keller, 1910–11. **R.,** **10,** 1794; **11,** 1963.

Assistant. R. Monroe. **R.,** **11,** 1963.

OPERATIONS.

1906–07. 11,076 c. y. r. blasted, 32,080 c. y. sand dr., and 20,485 c. y. r., sand, etc., removed by U. S., **07,** 1574.

1907–08. Removing sand, rs., bowlders, etc., **08,** 1645.

1908–09. 15,445 c. y. r. blasted, 19,722 c. y. loose r. dr., and 3,879 c. y. sand and mud dr. by US., **09,** 1639.

1909–10. 19,134 c. y. blasted, 65,907 c. y. r. dr., and 114,933 c. y. sand and gravel dr. by U. S., **10,** 1794.

1910–11. Dr., blasting r., etc., **11,** 1963.

PHYSICAL CHARACTERISTICS.

Description of, **07,** 495, 1573.

Rock R. Pool extends from vicinity of Green R. (Lock 29) to head of Rock R. Rapids (Lock 30), 8½ m.

PROJECTS.

Allotment of $20,000 made from constr. Illinois and Mississippi Canal, to be used in gaining a chan. 80′ x 5′ in Rock R. Pool, Locks 29–30, by dr. and r. excavation, etc., **07,** 496. (See Appropriations above.)

SURVEYS.

Made, 1902. Est. for 80′ x 7′ chan., $69,000, **07,** 1573.

[1] H. D. 126, 56th, 2d.

Part(e), JJ-20 Illinois and Mississippi Canal, Ill. (Lock at head of feeder.)

APPROPRIATIONS. (See p. 1237.)

ENGINEERS.

Chief of Engineers. **R., 11,** 672; **12,** 812.

In charge. Maj. Chas. Keller, 1911–. **R., 11,** 1965; **12,** 2171.

OPERATIONS.

1910-11. Cofferdam constr. and 50 c. y. concrete deposited in s. bank retaining wall, **11,** 1965.

1911-12. Work on lock constr. in progress, **12,** 2171.

PHYSICAL CHARACTERISTICS.

Several breaks made in cofferdam by very heavy ice running in Rock R. during Mar., 1912, **12,** 2171.

PROJECT.

Act June 25, 1910, au. constr. of lock in dam in Rock R. at head of feeder,[1] **11,** 1965.

Part(f), JJ-20 Illinois and Mississippi Canal—Operation and care—Milan Section, Ill.

APPROPRIATIONS.[2]

1895,	$255.00
1896,	5,309.17
1897,	4,752.46
1898,	4,502.39
1899,	3,304.92
1900,	5,379.84
1901,	4,806.18
1902,	11,014.93
1903,	11,398.94
1904,	13,198.47
1905,	13,601.96
1906,	9,694.47
1907,	8,423.46
1908,	13,428.19
1909,	19,700.00
1910,	18,908.01
1911,	28,863.39
1912,	17,811.97
Total,	194,353.75

COMMERCE.

Description of, **96,** 2672; **97,** 2880.

After opening of canal rates on coal reduced, **96,** 2672; **97,** 2880.

In 1896–97, 56,621 t. passed through canal around the Rock R. Rapids, necessitating 1,531 lockages, **97,** 2880.

1911, 50,000± t., 3,800 passengers, **12,** 813.

ENGINEERS.

Chief of Engineers. **R., 95,** 375; **96,** 331; **97,** 420; **98,** 408; **99,** 484; **00,** 549; **01,** 442; **02,** 372; **03,** 395; **04,** 418; **05,** 430; **06,** 469; **07,** 495; **08,** 528; **09,** 559; **10,** 627; **11,** 673; **12,** 813.

In charge:

Maj. W. L. Marshall, 1895–99. **R., 95,** 2770; **96,** 2672; **97,** 2880; **98,** 2486; **99,** 2888.

Maj. J. H. Willard, 1899–1900. **R., 00,** 3853.

Maj. C. McD. Townsend, 1901–03. **R., 01,** 2291; **02,** 1656.

Maj. J. L. Lusk, 1903–05. **R., 03,** 1496; **04,** 2200.

Maj. C. S. Riché, 1905–10. **R., 05,** 1654; **06,** 1429; **07,** 1573; **08,** 1644; **09,** 1637.

Maj. Chas. Keller, 1910–. **R., 10,** 1793; **11,** 1967; **12,** 2172.

Assistant. L. L. Wheeler. **R., 97,** 2881; **98,** 2487; **99,** 2890; **00,** 3854.

LEGAL PROCEEDINGS.

The au. of the U. S. to order the alteration of an obstr. br. below Moline sustained by the U. S. Circuit Court, **97,** 2880.

Injunction against G. W. Griffin, **08,** 1644.

OBSTRUCTIONS.

Navigation obstr. by 3 brs. above the head of the canal around the rapids of Rock R., **95,** 2771.

OPERATIONS.

1894-95. Canal around the lower rapids of Rock R. opened to navigation on Apr. 17, 1895. Operation and mainten. in progress from this date on, **95,** 2770.

(For account of operations, etc., in detail, see each an. **R.**)

1900-01. 1,759.3 c. y. dr.; willows cut and removed from chan., **01,** 2291.

1901-02. Dr. and general repairs to works, **02,** 1656.

1902-03. General repairs to works, **03,** 1496.

1903-04. Dr. and general repairs to works, **04,** 2200.

1904-05. General repairs, **05,** 1655.

1905-06. 10,711 c. y. dr., and general repairs, **06,** 1429.

1906-07. 8,798 c. y. dr., and general repairs, **07,** 1572.

1907-08. 7,495 c. y. dr.; repairs to structures, **08,** 1644.

1908-09. Repairs to brs., other works, etc., **09,** 1637.

1909-10. Dr.; repairs to structures, etc., **10,** 1793.

1910-11. 15,954 c. y. dr. by U. S., and general work of mainten., **11,** 1966.

1911-12. 63 c. y. dr., repairs to revet., and minor and general repairs, **12,** 2172.

Part(g), JJ-20 Illinois and Mississippi Canal—Operation and care—Eastern and Western Sections, and Feeder, Ill.

APPROPRIATIONS.[2]

1908,	$86,005.92,	**08,** 2026.
1909,	170,398.93,	**09,** 2014.
1910,	172,755.80,	**10,** 2172.
1911,	$168,537.76,	**11,** 1970.
1912,	170,299.40,	**12,** 2176.
Total,	767,997.81,	**12,** 813.

[1] H. D. 126, 56th, 2d.

[2] Expend. under the permanent-indefinite app. provided by act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

COMMERCE.

Description of, importance, etc., **09,** 2017.
1911, 38,000± t., 4,500 passengers; t. 50% greater than in 1910, **12,** 813.

ENGINEERS.

Chief of Engineers. **R., 08,** 686; **09,** 722; **10,** 801; **11,** 673; **12,** 813.

In charge:
Maj. C. S. Riché, 1908–10. **R., 08,** 2026; **09,** 2014.
Maj. Chas. Keller, 1910–. **R., 10,** 2172; **11,** 1967; **12,** 2174.

Assistant. Death of Mr. J. C. Long, **10,** 2174.

LEGAL PROCEEDINGS.

Land leased to concerns for business purposes, to erect ice houses, warehouses, etc., at nominal charge, **09,** 2014, 2018.

OPERATIONS.

1907-08. Canal formally opened to navigation Oct. 24, 1907; forces organized, repairs to works, etc., **08,** 2026.
1908-09. Charts of canal distributed to shippers, trees planted along banks, repairs to breaks, etc., **09,** 2014.
1909-12. Mainten. and imp. work, **10,** 2172; **11,** 1967; **12,** 2174.

PHYSICAL CHARACTERISTICS.

Breaks in works, drainage conditions, etc., **09,** 2014.

JJ-21 PECATONICA RIVER, WIS. AND ILL.

ENGINEERS.

Chief of Engineers. **R., 84,** 244.
In charge. Maj. A. Mackenzie. **R., 84,** 1593.

PHYSICAL CHARACTERISTICS.

Description of; has 2 branches uniting in se. part of Lafayette Co., Wis.; R. then flows through Green and Stephenson Cos., Ill., to its junction with Rock R. at Rockton, Winnebago Co., about 60 m. from Wayne, **84,** 1593.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Mackenzie (**R.** unfav.), **84,** 1593.

JJ-24 GALENA RIVER, ILL.

Part.	Title.	Period.	Appropriations.
a	Galena R., Ill.	1878–1890	$166,000.00
b	Galena R. (operating and care)	1894–1912	107,234.70
	Total		273,234.70

Part(a), JJ-24 Galena River, Ill.

APPROPRIATIONS.

1878,	$30,000, **78,** 98.
1879,	12,000, **79,** 133.
1880,	12,000, **80,** 1549.
1881,	12,000, **81,** 1728.
1890,[1]	100,000, **90,** 3673.
Total,	166,000

COMMERCE.

Important, **74,** 290, 293, 294, 295; **79,** 1149.
RR. connections, **74,** 294.

CONTRACTS.

1878. H. S. Brown, dr., 17 to 25¢ c. y., **79,** 1146, 1148.
1879. H. S. Brown, dr., **80,** 1549. Whitney & Son, dr., **80,** 1549.
1881. Whitney & Son, dr., **81,** 1728. Informal agreement with Whitney & Son and H. S. Brown, dr., **81,** 1727.

ENGINEERS.

Chief of Engineers. **R., 73,** 51; **74,** 58; **78,** 98; **79,** 132; **80,** 176; **81,** 237; **82,** 235.

In charge:
Maj. F. U. Farquhar, 1873–79. **R., 74,** 289; **78,** 724; **79,** 1146.
Capt. A. Mackenzie, 1880–82. **R., 80,** 1548; **81,** 1727; **82,** 1791.

Assistants:
J. D. Skinner. **R., 74,** 291.
W. L. Kidder and J. C. McElherne, inspectors **79,** 1147.
M. Meigs. **R., 82,** 1792.

ESTIMATES. (See Plans and Projects.)

By J. D. Skinner: 1st, 6′ chan. throughout, $459,141; 2d, 4′ chan. throughout, $233,233; 3d, modification of 1st and 2d, $377,014, **74,** 290, 292.

OPERATIONS.

1878-79. By removal of 100,975 c. y. by dr., chans. of the following dimensions were obtained: 3′ x 35′–50′ x 1,670′, 3′–4′ x 35′–40′ x 2.9 m., 4½′ x 100′ x 1,700′, 4½′ x 60′ x 1,300′, **79,** 132, 1147.
1879-80. 72,902 c. y. dr., **80,** 1548.
1880-81. H. dr. to l. w. grade and cut made from above cut-off to woolen mill, **81,** 1727.
1881-82. 51,358 c. y. dr., **82,** 1793.

[1] See Galena River, operating and care—Projects.

PHYSICAL CHARACTERISTICS.

Description of, **74,** 289, 290, 291; **79,** 1146.
Discharge of R., **75,** 291.

PLANS. (See also Estimates and Projects.)

By J. D. Skinner, 1873, dr. chan. 4′–6′, **74,** 291 292.

PROJECTS.

By Maj. Farquhar, 1873, dr. cut-off to 6′ above and 4′ below; closing Harris Slough; also constr. of dams of dry masonry backed by earth across the 3 principal ravines, to intercept sediment from inflowing streams; est., $400,000, **74,** 290, 291, 292; **78,** 98; **80,** 1548.

SURVEYS.

Au., mouth to Galena, **73,** 51.
Made by J. D. Skinner, **74,** 58, 289, 291.
Galena to junction with Mississippi R., 1879, **80,** 1548.

Part (b), JJ-24 Galena River, Ill. (Operating and care.)

APPROPRIATIONS.[1]

1894,	$635.68	
1895,	6,000.00	
1896,	3,400.00	
1897,	8,588.20	
1898,	5,890.05	
1899,	3,226.87	
1900,	8,750.94	
1901,	12,077.01	**01,** 2294.
1902,	9,166.68	**02,** 1658.
1903,	2,937.27	**03,** 1498.
1904,	2,916.49	**04,** 2202.
1905,	3,833.28	**05,** 1656.
1906,	2,679.91	**06,** 1431.
1907,	2,805.06	**07,** 1575.
1908,	4,000.00	**08,** 1646.
1909,	4,500.00	**09,** 1639.
1910,	13,608.06	**10,** 1796.
1911,	4,960.52	**11,** 1962.
1912,	7,258.68	**12,** 2170.
Total,	107,234.70	**12,** 2170.

COMMERCE.

Large and important. (See each an. **R.**)
Lock open for navigation, 1912, 225 days; 3,141 SS. and other craft, carrying 10,445 passengers and 2,400 t., 1911–12, **12,** 812.

ENGINEERS.

Chief of Engineers. R., 94, 263; **95,** 292; **96,** 254; **97,** 323; **98,** 316; **99,** 377; **00,** 433; **01,** 442; **02,** 372; **03,** 395; **04,** 418; **05,** 430; **06,** 469; **07,** 496; **08,** 529; **09,** 560; **10,** 628; **11,** 672; **12,** 812.

In charge:
Maj. A. Mackenzie, 1894–95. **R., 94,** 1691; **95,** 2157.
Lt. Col. W. R. King, 1896–97. **R., 96,** 1826; **97,** 2109.
Capt. C. McD. Townsend, 1898–1902. **R., 98,** 1802; **99,** 2168; (Maj.) **00,** 2752; **01,** 2293; **02,** 1658.
Maj. J. L. Lusk, 1903–04. **R., 03,** 1498; **04,** 2202.
Maj. C. S. Riché, 1905–09. **R., 05,** 1655; **06,** 1431; **07,** 1574; **08,** 1646; **09,** 1639.
Maj. Charles Keller, 1910–. **R., 10,** 1795; **11,** 1962; **12,** 2169.

Assistants:
Lt. C. Keller. **R., 95,** 2157.
J. C. McElherne, **03,** 1498.

OPERATIONS.

1894–95. Dr. done and lock repaired, **95,** 2158.
1896–97. 30,375 c. y. dr., **97,** 2109.
1898–99. New lock house built on the site of the old one, which had been destroyed by fire, **99,** 2168.
1899–00. Ice house built, 42,600 c. y. dr., and 2,240 c. y. brush used for retaining fence, **00,** 2752.
1900–01. Repairs to locks and dr. plant, **01,** 2293.
1901–02. Minor repairs; l. and d. in very bad condition; 46,795 c. y. dr., **02,** 1658.
1902–07. Minor repairs to locks, dam, grounds, etc., **03,** 1498; **04,** 2202; **05,** 1655; **06,** 1431; **07,** 1574.
1907–08. Minor repairs made to l. and d., 4,410 c. y. mud and gravel dr., **08,** 1646.
1908–09. Small repairs made to l. and d.; repairs made to dam at Aiken and 2 dams were built at Old Harris and Fish Trap Sloughs, **09,** 1639.
1909–10. Small repairs to dam and lock house; new gate built; 106,127 c. y. dr., **10,** 1796.
1910–11. Small repairs made to lock, dam, and buildings; 11,649 c. y. dr., **11,** 1962.
1911–12. Repairs to lock, dam, and buildings; 36,085 c. y. dr., **12,** 2169.

PHYSICAL CHARACTERISTICS.

Necessity for dr. will forever recur, **97,** 2109.

PROJECTS.

Act of 1890 au. city of Galena to complete imp. of the R. at the city, and to constr. dam rising not more than 12′ above l. w. with a lock not less than 52′ x 280′, $100,000 to be paid by the U. S. to the city when a chan. had been opened and maintained one season to a d. of at least 3′ and of a w. sufficient to accommodate any raft or boat that would pass through the lock. This sum paid in 1894 after a sur. The Corps of Engineers assumed charge on Mar. 12, 1894, under a proj. for the operation and care of the works, 3 men being employed, **94,** 1691.
By Lt. Col. Mackenzie, 1894, dr. in Harris Slough, and for repair of lock, the floor and miter sills of which were in bad condition, **95,** 2157.

SURVEYS.

Minor surs., **95,** 2158; **00,** 2752. (See Annual **Rs.**)

JJ-26 CANNON RIVER, MINN. (Reservoirs.)

COMMERCE.

Statistics, **67,** 263.

ENGINEERS.

Chief of Engineers. R., 66, ii, 41, iii, 36; **81,** 247; **82,** 242; **84,** 250.

In charge:
Maj. G. K. Warren, **66,** ii, 41. **R., 67,** 259, 262, 263.
Maj. C. J. Allen. **R., 82,** 1833.

Assistants:
J. P. Frizell. **R., 82,** 1835; **84,** 1634.
R. Davenport. **R., 84,** 1635.

PHYSICAL CHARACTERISTICS.

Drainage area and reservoir capacity, **82,** 1834; **84,** 1635.

SURVEYS.

In progress, **66,** iii, 36; **67,** 262.
Au. act Mar. 3, 1881; made by Maj. Allen, **82,** 1833.

[1] Expend. under the permanent-indefinite app. act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

JJ-40 ZUMBRO RIVER, MINN.[1]

JJ-65 IOWA RIVER, IOWA.[2]

ENGINEERS.

Chief of Engineers. **R., 84,** 244; **10,** 629.

In charge:
Maj. A. Mackenzie. **R., 84,** 1591.
Maj. C. S. Riché, **10,** 622.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Maj. Mackenzie (**R.** unfav.), **84,** 1591.
Pre. ex. au. act Mar. 3, 1909. **R.,** Maj. C. S. Riché, Dec. 4, 1909 (unfav.),[3] **10,** 629.

JJ-66 CEDAR (Red Cedar) RIVER, IOWA.[4]

ENGINEERS.

Chief of Engineers. **R., 10,** 629.
In charge. Maj. C. S. Riché, 1910. **10,** 622.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Riché, Dec. 4, 1909 (unfav.),[5] **10,** 629.

JJ-68 DES MOINES RIVER, IOWA.[6]

ENGINEERS.

Chief of Engineers. **R., 11,** 885; **12,** 1057.
In charge. Lt. Col. C. S. Riché, **11,** 856; **12,** 1025.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909; ex. made, **R.** Feb. 10, 1910; Sec. of War au. sur. (**R.** to come), **11,** 885; **12,** 1057.

JJ-68(b) DES MOINES AND IOWA RIVERS, IOWA.

APPROPRIATION.

1838, $1,000.

For sur., with view to imp. R. (Treas. Doc. 373, 1882.)

JJ-81 CUIVRE RIVER, MO.[7]

APPROPRIATIONS.

1880,	$2,000,	**80,** 1550.
1881,	5,000.	**81,** 1730.
1882,	5,000,	**82,** 1793.
Total,	12,000	

COMMERCE.

Unimportant, **72,** 393. Large quantities of coal and iron, **72,** 392.

CONTRACTS.

1881. H. S. Brown & Co., dr., 25 and 20¢ c. y., **81,** 1729.
1882. H. S. Brown & Co., dr., 22½¢ c. y., **83,** 1429.

ENGINEERS.

Chief of Engineers. **R., 71,** 59; **72,** 56; **79,** 133; **80,** 176, 177; **81,** 237; **82,** 235; **83,** 242.

In charge:
Lt. Col. W. F. Raynolds, 1872. **R., 72,** 390.
Maj. A. Mackenzie, 1879–83. **R., 80,** 1549, 1550; **81,** 1729; **82,** 1793; **83,** 1429.

Assistants:
A. H. Blaisdell, **72,** 391.
C. W. Durham. **R., 80,** 1551.

OPERATIONS.

1880–81. 19,319 c. y. dr.; 13,609 snags and trees removed and felled, **81,** 1729.
1882–83. 20,000 c. y. dr.; snags and trees removed, **83,** 1429.

PHYSICAL CHARACTERISTICS.

General, **72,** 393; obstr., **80,** 1552.

PLANS. (See Projects.)

By A. H. Blaisdell, 1872, imp. R., mouth to Big Creek, 4′ chan., $48,292.50; 6′ chan., $80,736. To Big Creek Bar, not incl. the removal of said bar, 4′ chan., $14,615; 6′ chan., $20,671. To within ½ m. of Big Creek, 4′ chan., $33,677.50; 6′ chan., $60,065, **72,** 395.

PROJECTS. (See Plans.)

By Capt. Mackenzie, 1879, dr. chan. from 2′ x 80′–100′ l. w., through the shoals; brush and r. dam across lower part of Cuivre Slough, and removing snags, wrecks, and obstr.; est., $30,000, **80,** 1553.

SURVEYS.

Au. act Mar 3, 1871, assigned to Lt. Col. Raynolds, and made under his direction by A. H. Blaisdell. **R., 72,** 391.
Au. act Mar. 3, 1879; made, 1879, by Capt. Mackenzie, **80,** 1550.

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[1] Sur.—**R.,** Jan. 21, 1867. Est., $200,000, $850,000, and $1,500,000. (H. D. 482. 55th, 2d.)
[2] Sur.—**R.,** Oct. 9, 1841; est., $32,000. (H. D. 482, 55th, 2d.) Act May 6, 1870, declares Iowa R. unnavigable north of Wapello; act Aug. 7, 1894, Wapello to Toolsboro (1½ m. from mouth).
[3] H. D. 698, 61st, 2d.
[4] 1839, $1,500 app. for sur. with view to imp. stream above Moscow, and connection of the imp. part with Mississippi R. by a canal, extending to or near to Bloomington. (Treas. Doc. 373, 1882.)
[5] H. D. 696, 61st, 2d.
[6] Sur.—**R.,** Oct. 9, 1841; est., $29,000; Apr. 12, 1842. (H. D. 482, 55th, 2d.)
[7] Act Mar. 23, 1900, declares Cuivre R., Mo., unnavigable.

RIVER AND HARBOR WORKS—UPPER MISSISSIPPI RIVER SYSTEM.

KK.—ST. PAUL, MINN., DISTRICT.

War Department
Corps of Engineers, U.S. Army
DOMINION OF CANADA
LAKE OF THE WOODS
RAINY LAKE
Kettle Falls
Ranier
International Falls
Rainy River
Black R.
Baudette Riv.
Baudette
Spooner
Zippel
Arnesen
Warroad
Warroad Riv.
Emerson
St. Vincent
Pembina
Oslo
Thief River Falls
Red Lake R.
Red Lake
Red Lake Falls
Redby
E. Grand Forks
Grand Forks
Crookston
Bellmont
Red River of the North
Wild Rice Riv.
Bemidji
Lake Itasca
Walker
Leech Lake
Cass Lake
Big Fork Riv.
Little Fork Riv.
Vermilion Lake
Bow String Lake
Dam
Lake Winnibigoshish
Mississippi and Leech Rivers
Grand Rapids
Canal
Leech R.
Pokegama Lake
DULUTH
LAKE SUPERIOR
Fargo
Moorhead
Sheyenne River
Whitefish Lake
Sandy Lake
Mississippi Riv. between Brainerd and Grand Rapids
SUPERIOR
Pine Riv.
Gull Lake
Aitkin
Pine Knoll
St. Croix Lake
Ottertail River
Ottertail Lake
Crow Wing Riv.
Wahpeton
Fergus Falls
Breckenridge
Bois de Sioux Riv.
Brainerd
Mille Lac
Onamia
Kettle Riv.
MINNESOTA
Little Falls
White Rock
Diamond
Lake Traverse
Dakomin
Valley Landing
Brown's Valley
Big Stone Lake
Ortonville
Whetstone River
Lac qui Parle
Rum Riv.
Snake R.
St. Croix River
St. Cloud
Sauk Rapids
Taylors Falls
Elk River
Anoka
Mississippi Riv.
Crow Riv.
Chippewa River
MINNEAPOLIS
ST. PAUL
Stillwater
Hudson
Afton
Lake St. Croix
Prescott
Chippewa River
Montevideo
Lock & Dam No. 2
Lock & Dam No. 1
Mississippi Riv. between St. Paul and Minneapolis
Hastings
Lake Pepin
Lac qui Parle Riv.
Yellow Medicine River
Minnesota River
Redwood River
Cottonwood Riv.
New Ulm
Le Sueur
Cannon River
Red Wing
Wabasha
Mankato
Blue Earth River
WISCONSIN
SOUTH DAKOTA
NORTH DAKOTA
IOWA
Sioux River
Missouri River
INDEX MAP
RIVER AND HARBOR WORKS
St. Paul, Minn. District
1912
Scale of Miles
0 25 50 75 100

KK.—ST. PAUL, MINN., DISTRICT.

In charge of U. S. Engineer Office,
St. Paul, Minn.

NOTE.—Mississippi R. from St. Paul, Minn., to headwaters and tributaries on east bank from Illinois-Wisconsin line, and on west bank from headwaters to Minnesota R., Minn.

KK [1] 1 Mississippi R. (See HH.)
KK 2 Illinois-Wisconsin States line.
KK 3 Little Platte R., Wis. (1)
KK 4 Grant R., Wis. (1)
KK 5 Wisconsin R., Wis. (1)

Wisconsin R. is geographically a part of waterways group KK, being a tributary of the Mississippi. For convenience of engineer oversight, it is under the care of the Milwaukee Engineer Office. The Wisconsin is a part of a waterway system connecting Lake Michigan with the Mississippi. Hence, data concerning the Wisconsin are printed with the data of MM group. See p. 1306.

KK 6 Blue R., Wis. (5)
KK 7 Fox R., Wis. (5) (See KK 5 and MM 15, p. 1306.)

This waterway is connected to Wisconsin R., but it flows naturally into the tributary waters of L. Michigan.

KK 8 Plover R., Wis. (5)
KK 9 Eau Claire R., Wis. (5)
KK 10 Pine R., Wis. (5)
KK 11 Prairie R., Wis. (5)
KK 12 Little Rice R., Wis. (5)
KK 13 Somo R., Wis. (5)
KK 14 Spirit R., Wis. (5)
KK 15 Wood R., Wis. (5)
KK 16 Aux Plain R., Wis. (5)
KK 17 Yellow R., Wis. (5)
KK 18 Little Nicedah R., Wis. (5)
KK 19 Lemonweir R., Wis. (5)
KK 20 Baraboo R., Wis. (5)
KK 21 Pine R., Wis. (5)
KK 22 Eagle R., Wis. (5)
KK 23 Kickapoo R., Wis. (5)
KK 24 Bad Axe R., Wis. (1)
KK 25 La Crosse R., Wis. (1)
KK 26 Black R., Wis. (1)
KK 27 Trempealeau R., Wis. (1)
KK 28 Waumandee R., Wis. (1)
KK 29 Beef or Buffalo R., Wis. (1)
KK 30 Chippewa R., Wis. (1)
KK 31 Eau Claire R., Wis. (30)
KK 32 Yellow R., Wis. (30)
KK 33 Fisher R., Wis. (30)
KK 34 Jump R., Wis. (30)
KK 35 Deertail R., Wis. (30)
KK 36 Flambeau R., Wis. (30)
KK 37 Thornapple R., Wis. (30)
KK 38 Burnett R., Wis. (30)
KK 39 E. Br. Chippewa R., Wis. (30)
KK 40 W. Br. Chippewa R., Wis. (30)
KK 41 Duncan Cr., Wis. (30)
KK 42 Red Cedar R., Wis. (30)
KK 43 Rush R., Wis. (1)
KK 44 Isabelle Cr., Wis. (1)
KK 45 Trimbelle R., Wis. (1)
KK 46 Big R., Wis. (1)
KK 47 St. Croix L. and R., Wis. (1)
KK 48 Willow R., Wis. (47)
KK 49 Apple R., Wis. (47)
KK 50 Trade R., Wis. (47)
KK 51 Wood R., Wis. (47)
KK 52 Clam R., Wis. (47)
KK 53 Yellow R., Wis. (47)
KK 54 Namacagon R., Wis. (47)
KK 55 Eau Claire R., Wis. (47)
KK 56 Moose R., Wis. (47)
KK 57 Tamarack R., Minn. (47)
KK 58 Crooked R., Minn. (47)
KK 59 Sand R., Minn. (47)
KK 60 Kettle R., Minn. (47)
KK 61 Snake R., Minn. (47)
KK 62 Sunrise R., Minn. (47)
KK 63 Coon Cr., Minn. (1)
KK 64 Rum R., Minn. (1)
KK 65 Elk R., Minn. (1)
KK 66 Thibbetts Br., Minn. (65)
KK 67 St. Francis R., Minn. (65)
KK 68 Snake R., Minn. (65)
KK 69 Rice Cr., Minn. (65)
KK 70 Mayhew Cr., Minn. (65)
KK 71 Lit. Rock Cr., Minn. (1)
KK 72 Platte R., Minn. (1)
KK 73 Skunk R., Minn. (72)
KK 74 Nokasippi R., Minn. (1)
KK 75 Buffalo Cr., Minn. (1)
KK 76 Whitely Cr., Minn. (1)
KK 77 Sand Cr., Minn. (1)
KK 78 Rabbit R., Minn. (1)
KK 79 Cedar Cr., Minn. (1)
KK 80 Mud R., Minn. (1)
KK 81 Rice R., Minn. (1)
KK 82 Sandy R., Minn. (1)
KK 83 Libby Br., Minn. (1)

[1] For data about Miss. R. within KK district see p. 1067.

KK 84 E. Two Rs., Minn. (1)
KK 85 Swan R., Minn. (1)
KK 86 Prairie R., Minn. (1)
KK 87 Bass Cr., Minn. (1)
KK 88 Deer R., Minn. (1)
KK 89 First R., Minn. (1)
KK 90 Second R., Minn. (1)
KK 91 Third R., Minn. (1)
KK 92 Turtle R., Minn. (1)
KK 93 Grant Cr., Minn. (1)
KK 94 Yellowhead R., Minn. (1)
KK 95 Leech R., Minn. (1)
KK 96 Vermilion R., Minn. (1)
KK 97 Cow Horn Cr., Minn. (1)
KK 98 Pokegama Br., Minn. (1)
KK 99 Willow R., Minn. (1)
KK 100 Lit. Willow R., Minn. (1)
KK 101 Dean Br., Minn. (1)
KK 102 Pine R., Minn. (1)
KK 103 Crow Wing R., Minn. (1)
KK 104 Gull R., Minn. (103)
KK 105 Pillager Cr., Minn. (103)
KK 106 Mosquito Br., Minn. (103)
KK 107 Swan Cr., Minn. (103)
KK 108 Farnam Br., Minn. (103)
KK 109 Swamp R., Minn. (103)
KK 110 Straight R., Minn. (103)
KK 111 Shell R., Minn. (103)
KK 112 Cat R., Minn. (103)
KK 113 Leaf R., Minn. (103)
KK 114 Partridge R., Minn. (103)
KK 115 Long Prairie R., Minn. (103)
KK 116 Lit. Elk R., Minn. (1)
KK 117 Pike Cr., Minn. (1)
KK 118 Swan R., Minn. (1)
KK 119 Hay Cr., Minn. (1)
KK 120 Lit. Two Rs., Minn. (1)
KK 121 Two Rs., Minn. (1)
KK 122 Spunk Br., Minn. (1)
KK 123 Stony Cr., Minn. (1)
KK 124 Watab R., Minn. (1)
KK 125 Sauk R., Minn. (1)
KK 126 St. Augusta Cr., Minn. (1)
KK 127 Plum Cr., Minn. (1)
KK 128 Clearwater R., Minn. (1)
KK 129 Silver Cr., Minn. (1)
KK 130 Otter Cr., Minn. (1)
KK 131 Crow R., Minn. (1)
KK 132 N. Br. Crow R., Minn. (131)
KK 133 S. Br. Crow R., Minn. (131)
KK 134 Elm Cr., Minn. (1)
KK 135 Shingle Cr., Minn. (1)
KK 136 Minnehaha Cr., Minn. (1)
KK 137 Minnesota R., Minn. (1)
KK 138 Ninemile Cr., Minn. (137)
KK 139 Purgatory Cr., Minn. (137)
KK 140 Carver Cr., Minn. (137)
KK 141 Bevens Cr., Minn. (137)
KK 142 High Isld. Cr., Minn. (137)
KK 143 Rush R., Minn. (137)
KK 144 Nicollet Cr., Minn. (137)
KK 145 Eightmile Cr., Minn. (137)
KK 146 Rock Cr., Minn. (137)
KK 147 Beaver Cr., Minn. (137)
KK 148 Hawk Cr., Minn. (137)
KK 149 Chippewa R., Minn. (137)
KK 150 Pomme de Terre R., Minn. (137)
KK 151 Fivemile Cr., Minn. (137)
KK 152 Stony Run, Minn. (137)
KK 153 Big Stone Lake, and Whetstone R., Minn. and S. Dak. (137)
KK 154 Yellowbank R., Minn. (137)
KK 155 Lac Qui Parle R., Minn. (137)
KK 156 Stony Run, Minn. (137)
KK 157 Yellow Medicine R., Minn. (137)
KK 158 Redwood R., Minn. (137)
KK 159 Big Cottonwood R., Minn. (137)
KK 160 Lit. Cottonwood R., Minn. (137)
KK 161 Morgan Cr., Minn. (137)
KK 162 Lyons Cr., Minn. (137)
KK 163 Blue Earth R., Minn. (137)
KK 164 Shanaska Cr., Minn. (137)
KK 165 Cherry Cr., Minn. (137)
KK 166 Lit. Le Sueur Cr., Minn. (137)
KK 167 Wildcat Cr., Minn. (1)
KK 168 Crooked Cr., Minn. (1)
KK 169 Winnebago Cr., Minn. (1)

List now proceeds to—

KK 170 RED RIVER OF THE NORTH SYSTEM.

(From international boundary line to junction of Bois des Sioux and Ottertail Rs.)

KK 171 Pembina R., N. Dak. (170)
KK 172 Tongue R., N. Dak. (171)
KK 173 Park R., N. Dak. (170)
KK 174 Cart Cr., N. Dak. (173)
KK 175 N. Br. Park R., N. Dak. (173)
KK 176 Mid. Br. Park R., N. Dak. (173)
KK 177 S. Br. Park R., N. Dak. (173)
KK 178 Salt R., N. Dak. (170)
KK 179 Turtle R., N. Dak. (170)
KK 180 N. Fk. Turtle R., N. Dak. (179)
KK 181 S. Fk. Turtle R., N. Dak. (179)
KK 182 English Coulee, N. Dak. (170)
KK 183 Elm Coulee, N. Dak. (170)
KK 184 Buffalo Coulee, N. Dak. (170)
KK 185 Goose R., N. Dak. (170)
KK 186 Sheyenne R., N. Dak. (170)
KK 187 Maple R., N. Dak. (186)
KK 188 Wild Rice R., N. Dak. (170)
KK 189 Bois des Sioux R., Minn.-N. and S. Dak. State line and Lake Traverse, N. Dak. and Minn. (170)
KK 190 Ottertail R., Minn. (170)
KK 191 Pelican R., Minn. (190)
KK 192 Buffalo R., Minn. (170)
KK 193 S. Br. Buffalo R., Minn. (192)
KK 194 Wild Rice R., Minn. (170)
KK 195 S. Br. Wild Rice R., Minn. (194)
KK 196 Marsh R., Minn. (170)
KK 197 Sand Hill R., Minn. (170)
KK 198 Red Lake R., Minn. (170)
KK 199 Clearwater R., Minn. (198)
KK 200 Thief R., Minn. (198)
KK 201 Grand Marais R., Minn. (170)
KK 202 Snake R., Minn. (170)
KK 203 Middle R., Minn. (202)
KK 204 Tamarack R., Minn. (170)
KK 205 Two Rs., Minn. (170)

KK 206 S. Fk. Two Rs., Minn. (205)
KK 207 Mid. Fk. Two Rs., Minn. (205)
KK 208 N. Fk. Two Rs., Minn. (205)

The list now proceeds with the—

KK 209 RAINY RIVER SYSTEM.

(Partly in Canada, and extending toward the head of Lake Superior.)

Continuous waterway—North Lake to Lake of the Woods. Main streams or bodies are as follows:

KK 210 Lake of the Woods, Minn. and Canada (209)
KK 211 Warroad R., Minn. (210)
KK 212 Zippel R., Minn. (210)
KK 213 Rainy R. and L., Minn. and Canada (209)

Tributaries (left bank):

KK 214 Winter Road R., Minn. (213)
KK 215 Baudette R., Minn. (213)
KK 216 Rapid R., Minn. (213)
KK 217 Black R., Minn. (213)
KK 218 Big Fork R., Minn. (213)
KK 219 Lit. Fork R., Minn. (213)
KK 220 Rainy Lake, Minn. and Canada (209)
KK 221 Rat Root R., Minn. (220)
KK 222 Kabetogama Lake, Minn. (209)
KK 223 Ash R., Minn. (222)
KK 224 Namekan Lake, Minn. and Canada (209)
KK 225 Moose R., Minn. (224)
KK 226 Namekan R., Minn. (224)
KK 227 Lit. Vermilion Lake, Minn. and Canada (209)
KK 228 Vermilion R., Minn. (227)

Main streams or bodies:

KK 229 Loon R., Minn. and Canada (209)
KK 230 Loon Lake, Minn. and Canada (209)
KK 231 Lac La Croix, Minn. and Canada (209)
KK 232 Iron Lake, Minn. and Canada (209)
KK 233 Crooked Lake, Minn. and Canada (209)
KK 234 Basswood Lake, Minn. and Canada (209)
KK 235 Birch R., Minn. (234)
KK 236 Sucker Lake, Minn. and Canada (209)
KK 237 Knife Lake, Minn. and Canada (209)
KK 238 Otter Track Lake, Minn. and Canada (209)
KK 239 Saganaga Lake, Minn. and Canada (209)
KK 240 Granite Lake, Minn. and Canada (209)
KK 241 Pine Lake, Minn. and Canada (209)
KK 242 Magnetic Lake, Minn. and Canada (209)
KK 243 Gun Flint Lake, Minn. and Canada (209)
KK 244 North Lake, Minn. and Canada (209)

KK-5 WISCONSIN RIVER, WIS.

(See MM–15 on p. 1306, also p. 1247.)

KK-30 CHIPPEWA RIVER, WIS.

Part.	Title.	Period.	Appropriations.
a	Chippewa R.	1872–1887	$123,214.86
b	Chippewa R., Yellow Banks	1882–1887	30,000.00
c	Chippewa R., including Yellow Banks	1888–1902	55,000.00
	Total		208,214.86

Part (a), KK-30 Chippewa River, Wis.

APPROPRIATIONS.

1876 { $1,800.00, **76,** 707, sur.
1876 { 10,000.00, **77,** 87, 574.
1878, 10,000.00, **78,** 100, 729.
1879 { 8,000.00, **79,** 135, 1170.
1879 { 4,664.86, **79,** 1168, sur.
1880, 10,000.00, **80,** 1577.
1881, $10,000.00, **81,** 1749.
1882, 35,000.00, **82,** 1811.
1884, 15,000.00, **84,** 1601.
1886, 18,750.00, **86,** 1488.

Total, 123,214.86

CONTRACTS.

1877. Winston, Douglass & Winston, js., **77,** 574.

1881. Simar & Morton, dams, brush and st. shore protection, **81,** 1750.

DOCUMENTS. (Not printed in reports.)

R. of Maj. Farquhar of Jan. 30, 1875, H. Doc. 75, 43d Cong., 2d sess., **76,** 707, 709.

ENGINEERS.

Chief of Engineers. R., 72, 52; **75,** 63; **76,** 85; **77,** 86; **78,** 100; **79,** 135, 136; **80,** 179; **81,** 241; **82,** 238; **83,** 245; **84,** 246; **85,** 268; **86,** 258; **87,** 225, 229.

In charge:
Maj. G. K. Warren, 1868. **R., 68,** 306, 360, 365, 369, 370.
Col. J. N. Macomb, 1872, **72,** 52.
Maj. F. U. Farquhar, 1874–78. **R., 75,** 375; **76,** 707; **77,** 574; **78,** 728.
Capt. C. J. Allen, 1878–87. **R., 79,** 1168, 1171; **80,** 1575; **81,** 1748; **82,** 1810; (Maj.) **83,** 1439; **84,** 1600; **85,** 1734; **86,** 1486; **87,** 1699, 1726.

Assistants:
J. E. Turner, **75,** 376.
M. E. Schmidt, **76,** 709.
C. Wanzer. **R., 79,** 1174.
G. Wells. **R., 80,** 1577.
A. O. Powell. **R., 84,** 1602.
V. D. Simar. **R., 85,** 1735.
A. Johnson. **R., 87,** 1729.

ESTIMATES. (See Plans.)

By Capt. Allen, 1879, completing existing proj., $111,892.50, **79,** 1170.

LEGISLATION.

Required to prevent injury to navigation by br. constr., **83,** 1440.

OPERATIONS.

1877-78. Constr. of w. j., 4,013′, and 405′ of e. j., **78,** 728, 729.

1878-79. Repairs to w. j.; completion of e. j.; l., 2,110′, **79,** 135, 1169, 1171.

1879-80. 1,360 l. f. brush and st. dams to close chan. behind Flower Pot Isld., and chute behind Little Missouri Isld.; 290′ of base laid for dam at Flower Pot Cut-off; repairs to 950′ of w. j., **80,** 1575.

1880-81. Repairs to existing works, **81,** 1748.

1881-82. 1,108 cords brush and 6,603 c. y. st. placed in brush and st. dams; 40 c. y. excavated, **82,** 1810.

1882-83. 7,763 c. y. st. and 2,746 cords of brush put into 650 l. f. of work, **83,** 1439.

1883-84. 611 cords brush and 1,142 c. y. st. placed in dams; excavation of bar at Flower Pot Cut-off Dam, **84,** 1602.

1884-85. 2,938 c. y. st. and 3,943 of brush placed in dams; repairs to e. and w. js., and to Flower Pot Dam, Battle Isld. Dam, Dead Lake Cut-off Dam, and Threemile Prairie revet.; 1,000 l. f. of j. constr. and obstr. removed from Shaws Rapids, **85,** 1734.

1885-86. Repairs to w. j. by hired labor, **86,** 1486. List of dams, js., and revets. constr. and kept in repair, 1877 to 1886, **86,** 1487.

1886-87. Dam constr. at Eau Claire, Fivemile Bluff Bar, and Twin Islds., **87,** 1700.

PHYSICAL CHARACTERISTICS.

Description, **75,** 376; **76,** 707; **79,** 1172, 1176.
Unprecedented h. w., **80,** 1576.
Obstr., **80,** 1578.
Causes of extraordinary overflows on the Chippewa and Wisconsin Rs., **87,** 1726.

PLANS. (See Estimates and Projects.)

By Maj. Warren, 1868, surs., $5,000 and $10,000, and for protecting R. from sliding banks, $5,000, **68,** 306, 360, 365, 369, 370.

By J. E. Turner, 1874, wing dams and removal of obstr.; est., $167,645, **75,** 379.

By Maj. Farquhar, 1875, dam at Upper Dalles, $213,691.55; dam at Lower Dalles, $244,888.56, **76,** 707, 708. Removing obstr., $139,892.50, **77,** 574; **78,** 729; **79,** 1169.

By C. Wanzer, 1879, revet. the sand banks with slabs and edgings, **79,** 1172, 1179.

PRIVATE AND STATE WORK.

L. and d. built by State au., **77,** 574.
Training walls and brush dams at mouth of R., **79,** 1172.
List and description of private dams; injurious effects of, **79,** 1173, 1178.

PROJECTS. (See Estimates and Plans.)

By Maj. Farquhar, 1875, dr., wing dams, and removing obstr., Eau Claire to mouth. Est., $139,892.50, of which amount $64,102.50 was est. as the cost of protecting the "Yellow Banks" from erosion, **76,** 708; **77,** 574; **78,** 729; **79,** 1169; **80,** 179.

Est. revised in 1883 by omitting cost of work at Yellow Banks and increasing the cost of the remaining work to $132,476, **83,** 1440; **87,** 1699. From 1876 to 1886, incl., $116,750 was app. Est. of completion of existing proj., 1887, $55,523, **87,** 1701, 1702.

SURVEYS.

By J. E. Turner, under direction of Maj. Farquhar, 1874. **R., 75,** 375.

By M. E. Schmidt, under direction of Maj. Farquhar, 1875. **R., 76,** 707.

Ex., Eau Claire to mouth, **80,** 1575.

Of headwaters in connection with reservoirs on the sources of the Mississippi R., **80,** 1607, 1624; **81,** 1781.

Ex. of causes of overflow of the Chippewa and Wisconsin Rs. au. act Aug. 5, 1886; made by Maj. Allen, **87,** 1726.

Maps:
81, 1748; **83,** 1440.
Flower Pot Isld. to Mississippi R., **87,** 1702.
Sevenmile Bluff to Dark Slough, **87,** 1702.
At Eau Claire, **87,** 1702.

Part (b), KK-30 Chippewa River at Yellow Banks, Wis.

APPROPRIATION.

1882, $30,000, **83,** 1443.

ENGINEERS.

Chief of Engineers. R., 83, 245; **84,** 246; **85,** 269; **86,** 259; **87,** 226.

In charge. Maj. C. J. Allen, 1883–. **R., 83,** 1442; **84,** 1603; **85,** 1737; **86,** 1488; **87,** 1703.

Assistant. A. O. Powell. **R., 84,** 1605.

OPERATIONS.

1882-83. Bank protection in progress at Waubeek, **83,** 1442.

1883-84. Bank protection completed at Waubeek, Rumseys, and Mary Dean Banks, **84,** 1604; **86,** 1489.

1884-85. Repairs to Waubeek Bank protection, **85,** 1738.

PROJECTS.

By Maj. Allen, protection of about 24,000 l. f. of R. bank at 5 points below Eau Claire; est., $96,000, **83,** 1442; **86,** 1489.

Part (c), KK-30 Chippewa River, Including "Yellow Banks," Wis.

APPROPRIATIONS.

1888,	$10,000,	**88,** 1546.
1890,	10,000,	**90,** 2086.
1892,	5,000,	**92,** 1836.
1894,	10,000,	**95,** 2190.
1896,	10,000,	**96,** 1851.
1899,	10,000,	**99,** 2195.
Total,	55,000	

COMMERCE.

Lumber interests, **89,** 1796; an. t. of rafted lumber about 300,000 t., and of loose logs about 1,000,000 t., **00,** 437.

Description of, **95,** 2187.

Chan. sur., 1896, sufficient for the limited needs of the C. involved, **96,** 1864.

Confined to rafting of manufac. lumber and running of logs, **02,** 376.

ENGINEERS.

Chief of Engineers. R., 88, 203; **89,** 236; **90,** 212; **91,** 270; **92,** 258; **93,** 290; **94,** 266; **95,** 296; **96,** 256, 259; **97,** 328; **98,** 319; **99,** 380; **00,** 437; **01,** 445; **02,** 376.

In charge:

Maj. C. J. Allen, 1878–90. **R., 88,** 1542; **89,** 1794.

Maj. W. A. Jones, 1890–97. **R., 90,** 2084; **91,** 2201; **92,** 1833; **93,** 2272; **94,** 1718; **95,** 2183; Lt. Col.) **96,** 1849, 1864; **97,** 2152.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1821; (Maj.) **99,** 2195; **00,** 2806.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2327.

Maj. R. L. Hoxie, 1901–02. **R., 02,** 1677.

Assistant. R. Davenport. **R., 98,** 1823; **99,** 2196; **00,** 2808; **01,** 2328.

OPERATIONS.[1]

1887-88. Training dam at Eau Claire leveled off and repaired; dam at Dark Slough repaired and extended 95′; brush and st. dams at Fivemile Bluff, Battle Isld., and Dead Lake Cut-off, and js. at mouth of R. repaired; shore revet. at head of e. j. extended 150′; repairs to revet. at Yellow Banks, **88,** 1542–1545.

1888-89. 1,305 l. f. of wing dam built at Plum Isld. Flats; 576 l. f. of dam and revet. built at Battle Isld., Dark Slough, and Wacouta Isld. Dams. Repairs to existing works; 3,026 c. y. st. and 1,314 c. y. brush used, **89,** 1795.

1889-90. Repairs to e. and w. js. at mouth of R.; 90 cords st. and 164 cords brush used, **90,** 2085.

1891-92. Pile boom built at Dead Lake Cut-off; Plum Isld. Flats Dam No. 2 built, and foundation courses of Dam No. 3 laid, **92,** 1834.

1892-93. Brush and st. dam built at Eau Galle Flats; Plum Isld. Flats Dam No. 3 repaired, **93,** 2273.

1893-94. Eau Galle Flats Dam, injured by ice, repaired, **94,** 1719.

1894-95. Closing dam built at Plum Creek, and Plum Isld. Flats Dam repaired, **95,** 2188.

Table as in preceding year.

1895-96. Repairs made to Plum Isld. Dam No. 3 and to e. j. at R. mouth; Wacouta Isld. Dams Nos. 2 and 3 built to assist Wacouta Isld. Dam No. 1 in maintaining l. w. flow on right side of isld., **96,** 1850.

1896-97. Wacouta Isld. Dam No. 1 repaired, **97,** 2152.

1897-98. Dams repaired, **98,** 1821.

1898-99. Eau Galle Dam repaired, and Dead Lake Bar Dam being constr., 4,800 c. y. dr. at Dead Lake Bar, **99,** 2197.

1899-00. 10,675 c. y. dr.; new dams built at Plum, Crow, and Wacouta Islds.; repairs made to the Old Plum Isld. Dams, **00,** 2806, 2808.

1900-01. Dams repaired at Plum Isld. Bar, **01,** 2327.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2183.

Severe ice jams, **93,** 2273.

PROJECTS.

In 1888 $45,523 est. as required for completion of the Chippewa R. imp., and $66,000 for completion of imp. at Yellow Banks, making a total for completion of both projs. of $111,523, **88,** 1544–1546. Increased in 1889 to $115,737.72, **89,** 1797; **91,** 2201.

Under act June 13, 1902, further imp. abandoned, **02,** 376.

SURVEY.

Sur. for 2 m. s. of Dells Dam au. act Aug. 17, 1894; **R.** (unfav.) by Lt. Col. Jones, 1896, **96,** 1864.

KK-47 ST. CROIX LAKE AND RIVER, MINN. AND WIS.

APPROPRIATIONS.

1878,	$10,000,	**78,** 101.
1879,	8,000,	**79,** 135.
1880,	10,000,	**80,** 1581.
1881,	8,000,	**81,** 1752.
1882,	30,000,	**82,** 1815.
1884,	9,000,	**84,** 1608.
1886,	7,500,	**86,** 1493.
1888,	10,000,	**88,** 1549.
1890,	8,000,	**90,** 2089.
1892,	8,000,	**92,** 1838.
1894,	4,000,	**95,** 2193.
1896,	15,000,	**96,** 1853.
1899,	9,000,	**99,** 2198.
1902,	2,000,	**02,** 1679.
1904,	*865,	**04,** 2246.
1905,	$4,000,	**05,** 1680.
1907,	4,000,	**07,** 1587.
1909,	3,600,	**09,** 1648.
1910,	4,000,	**10,** 1806.
1911,	3,600,	**11,** 1980.
Total,	158,565	

COMMERCE.

Artificial obstr. to, **75,** 373; **79,** 1181.

C. interests of St. Croix Valley, **75,** 375.

Extent of the logging and lumber interests, **91,** 2205, 2206; **92,** 1839.

Description of, **95,** 2192.

Total t. passing over the R. an. about 2,000,000 t., **00,** 438.

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* Allotment.

[1] List of dams, js., and revets., and Yellow Banks protections, constr. and kept in repair from 1877, **94,** 1720; **95,** 2189.

ENGINEERS.

Chief of Engineers. **R., 75,** 63; **78,** 100; **79,** 135; **80,** 180; **81,** 243; **82,** 238; **83,** 246; **84,** 247; **85,** 269; **86,** 259; **87,** 227; **88,** 203; **89,** 237; **90,** 212; **91,** 271; **92,** 259; **93,** 291; **94,** 266; **95,** 297; **96,** 257; **97,** 329; **98,** 320; **99,** 381, 385; **00,** 437, 442; **01,** 446; **02,** 376; **03,** 400; **04,** 425; **05,** 435; **06,** 476, 483; **07,** 503; **08,** 535; **09,** 566; **10,** 636, 757; **11,** 681; **12,** 821, 831.

In charge:

Maj. G. K. Warren, 1868. **R., 68,** 369.

Maj. F. U. Farquhar, 1875–78. **R., 75,** 372; **78,** 732.

Capt. C. J. Allen, 1878–90. **R., 79,** 1179; (Maj.) **80,** 1580, 1601, 1661; **81,** 1751; **82,** 1813, 1816; **83,** 1444; **84,** 1606; **85,** 1738; **86,** 1490; **87,** 1705; **88,** 1547; **89,** 1798.

Maj. W. A. Jones, 1890–97. **R., 90,** 2087; **91,** 2203; **92,** 1837; **93,** 2275; **94,** 1721; **95,** 2191; (Lt. Col.) **96,** 1852; **97,** 2154.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1823; (Maj.) **99,** 2197; **00,** 2809, 2836, 2839.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2329.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1678; **03,** 1540.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2245; **05,** 1680; (Lt. Col.) **06,** 1474.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1587.

Maj. F. R. Shunk, 1907–. **R., 08,** 1656; **09,** 1648; **10,** 1806; **11,** 1980; (Lt. Col.) **12,** 2187.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

D. H. Ainsworth, 1874–75, **75,** 373.

O. F. Knapp, 1878–79, **79,** 1180.

V. D. Simar. **R., 80,** 1615.

R. Davenport. **R., 98,** 1825; **99,** 2199; **00,** 2811; **01,** 2332; **03,** 1541; **04,** 2247; **05,** 1681.

LEGISLATION.

Memorial to Congress from the legislature of Minnesota asking for the imp. of the St. Croix R. (referred to), **68,** 369.

The act of May 9, 1900, entitled "An act authorizing the Sec. of War to make regulations governing the running of loose logs, steamboats, and rafts on certain rivers and streams," the result of a controversy in progress for the preceding 3 years bet. the loggers and steamboatmen on the upper St. Croix R., **00,** 2809.

Sec. of War issued regulations to govern the floating of logs, etc., and other methods of navigation, **01,** 2330. New regulations issued by Sec. of War, 1904, to govern traffic; regulations satisfactory to both sides of controversy, **04,** 2245.

OPERATIONS.

1878–79. 1,200′ of caving bends protected by brush and st. revet.; 2,360 snags, 1,832 stumps, 5,715 leaning trees, 32 cribs, 68 logs, 16 piles, and 523½ c. y. of bowlders removed, **79,** 1180.

1879–80. 520 snags, 377 stumps and trees, 41 c. y. bowlders, and 4 cribs removed; 1,100 c. y. brush and 2,562 c. y. st. placed; 1,000 l. f. of shore graded and revetted, and 575 l. f. of dams built, **80,** 1580.

1880–81. 636 snags, 380 logs, stumps, and trees, 69 c. y. r., 8 piles, and 1 crib removed; 3,231 c. y. r. and 868 cords brush placed in 1,500 l. f. dam and revet., **81,** 1751.

1881–82. 173 stumps, snags, and trees removed; 3,314 c. y. r. and 2,896 cords brush placed in 3,300 l. f. of dam and revet.; 997 l. f. of old revet. repaired, **82,** 1814.

1882–83. 1,777 l. f. dam and 1,379 l. f. of shore protection built, and 87 snags, 313 stumps, 6 cribs, and 1 wreck removed; pile and sheet dam commenced at Catfish Bar, and 1,500 c. y. gravel removed from same place, **83,** 1444, 1445.

1883–84. 260 snags, 227 stumps, trees, and logs, and 156 c. y. material removed; work on pile and brush training dam at Hudson Bar continued; 9,000 c. y. dr. from Catfish and Hudson Bars, **84,** 1607.

1884–85. 133 sunken logs removed from chan.: 1,000 l. f. of pile dam at Hudson strengthened; 3,900 c. y. gravel removed from Catfish Bar, **85,** 1739.

1885–86. Dam at Hudson Bar extended 165′ and furnished with brush and st. protection; 3,000 c. y. dr. from chan., **86,** 1491.

1886–87. 6,694 c. y. dr. from Hudson and Catfish Bars; 1,105 l. f. of dam, **87,** 1706. Statement of past operations, **87,** 1705, 1706.

1888–89. 605 snags, logs, and piles, 3 c. y. r., and 2 drift piles removed from chan., and 125 overhanging trees cleared from banks; 715 l. f. wing dam built, **89,** 1799.

1890–91. 25,919 c. y. dr., **91,** 2204.

1891–92. 880 c. y. dr. at Hudson Bar; 91 snags removed from chan., and repairs made to Log House Dam, **92,** 1838.

1892–93. 15,724 c. y. dr. at 2 bars, **93,** 2276.

1893–94. Over 6,000 c. y. dr., **94,** 1723.

1894–95. Nearly 9,000 c. y. dr., **95,** 2192.

1897–98. A few dams repaired and small pump dr. built, **98,** 1823.

1898–99. Barges and dr. repaired, **99,** 2199.

1899–00. Dr. imp. and a new dam built at head of Folsoms Isld., just below Taylors Falls, **00,** 2809.

1900–01. 5 short dams and 1 shore protection (220′ l.) built, 3 dams repaired, and chan. dr. through old dam and 2 gravel bars, **01,** 2329.

1902–03. Repairs to plant, **03,** 1540.

1904–05. Repairs to dr. and barges, **05,** 1680.

1906–07. 932 c. y. dr., 300′ training dam repaired, and repairs made to dr. plant, **07,** 1587.

1907–08. 355 c. y. dr., 5 wing dams repaired, and dr. and barges repaired, **08,** 1656.

1908–09. Dam near Taylors Falls, Minn., repaired, **09,** 1648.

1909–10. 1,320 c. y. dr., and repairs to dam at Taylors Falls completed, **10,** 1806.

1910–11. 300 c. y. removed from Catfish Bar, dike repaired, and dr. dismantled, **11,** 1980.

PHYSICAL CHARACTERISTICS.

General, **75,** 373; **95,** 2191.

Natural obstr., **75,** 373, 374; **79,** 1181.

Shoals forming in chan., **02,** 1679.

PROJECTS.

By Maj. Farquhar, 1874, constr. of wing and brush dams; cutting down overhanging trees; for the removal of boom piers, snags, etc., all tending toward giving 3′ of water; est., orig., of $21,758; increased by Capt. Allen to $35,000, **75,** 375; **78,** 100; **79,** 1182. Expend. under this proj., $18,000, **83,** 1445.

Proj. au. 1880 and modified as to cost in 1882 consisted, in addition to the removal of obstr. from the chan. bet. Taylors Falls and Prescott, of the contraction of the l. w. chan. into one of nearly uniform w., especially at the bars and crossings, with brush and st. js., and dams of the same material to close isld. chutes and secondary chans.; est., $83,450, **88,** 203, 204. Increased, 1889, for repairs to existing works, extension of dams at Hudson Bar, constr. of wing dams on right bank of chan., and dr.; revised est., $108,700, **89,** 1801; **91,** 2204.

Act June 3, 1896, added the imp. of the H. and water front of Stillwater, Minn., to proj.; increasing est. to $136,700, **97,** 2154.

Maj. Abbot est., 1899, $1,000 per an. to make the imp., **00,** 2839.

SURVEYS.

By D. H. Ainsworth, 1874, under the direction of Maj. Farquhar. **R., 75,** 372.

Of R. from Taylors Falls to Prescott, 1880, **80,** 1661.

Sur. of headwaters of St. Croix in connection with reservoirs on headwaters of Mississippi R., **80,** 1601–1624.

Minor sur., etc., **97,** 2154.

Sur. made, 1895–96, by Lt. Col. Jones at head of St. Croix Lake to devise a plan of imp., **96,** 1853.

Ex. and sur. of St. Croix R. from Stillwater H.

to Taylors Falls, Minn., with view to making R. accessible to SS. and other craft, au. act Mar. 3, 1899; ex. and est. submitted (no sur. made) by Maj. Abbot (**R.** fav.; see Projects), **00,** 2837, 2839.

Pre. ex. au. act Mar. 3, 1905, of St. Croix R. **R.** by Lt. Col. Derby, Mar. 15, 1906; est., $3,600 an. for mainten. of existing proj.,[1] **06,** 483.

Pre. ex. au. act Mar. 3, 1905, of canal connecting Lake Superior and Mississippi R., via St. Croix R. **R.** by Lt. Col. Fitch, Aug. 30, 1909[2] (unfav.), **10,** 757.

Pre. ex. au. act June 25, 1910, at Afton, Minn. **R.** by Maj. Shunk, Nov. 7, 1910[3] (unfav.), **12,** 831. Maps. **87,** 1706.

KK-47(b) HUDSON HARBOR, WIS.

ENGINEERS.

Chief of Engineers. **R.,** **87,** 229; **91,** 274, 2218.

In charge:
Maj. C. J. Allen, 1886. **R.,** **87,** 1723.
Maj. W. A. Jones, 1891. **R.,** **91,** 2219.

Assistant. F. T. Hampton. **R.,** **87,** 1723.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1723; **91,** 2219.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Maj. Allen (**R.** unfav.), **87,** 1723.

Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Jones (**R.** unfav.), **91,** 2220.

KK-61 SNAKE RIVER, MINN.

COMMERCE.

C. statistics given, **81,** 1827.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 183; **81,** 247.

In charge. Capt. C. J. Allen, 1881. **R.,** **81,** 1825.

Assistant. F. Terry. **R.,** **81,** 1827.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 1827.

PROJECTS.

Capt. Allen est., 1880, it would cost $5,000 to remove bowlders from the chan., **81,** 1826.

SURVEY.

Sur. au. act June 14, 1880; made, 1880, by Capt. Allen (**R.** unfav.; see Projects), **81,** 1825.

KK-115 LONG PRAIRIE RIVER AND ITS SOURCES, MINN.

ENGINEERS.

Chief of Engineers. **R.,** **01,** 451.

In charge. Maj. F. V. Abbot, 1900. **R.,** **01,** 2362.

Assistant. R. Davenport. **R.,** **01,** 2364.

SURVEY.

Pre. ex. au. act June 6, 1900. **R.,** Maj. Abbot, Aug. 2, 1900[4] (unfav.), **01,** 451, 2361.

KK-136(b) LAKE MINNETONKA, MINN. (Survey.)

APPROPRIATION.

1905, $7,000, **06,** 1480.

ENGINEERS.

Chief of Engineers. **R.,** **06,** 482; **07,** 510; **08,** 541.

In charge. Lt. Col. G. McC. Derby, 1906. **R.,** **06,** 1480.

OPERATIONS.

Sur. completed, map made, sent to Lake Sur. Office for photolithographing, **06,** 482.

PHYSICAL CHARACTERISTICS.

"The lake drains into Minnehaha Cr."—Office, KK Dist.

PROJECT.

Act Mar. 3, 1905, au. sur. for charting purposes only, **06,** 482.

[1] H. D. 686, 59th, 1st. [2] H. D. 304, 61st, 2d. [3] H. D. 422, 62d, 2d. [4] H. D. 97, 56th, 2d.

KK-137 MINNESOTA RIVER, MINN.

APPROPRIATIONS.

1867, $37,500, **68,** 51, 344.
1870, 10,000, **70,** 57.
1871, 10,000, **71,** 54.
1872, 10,000, **72,** 50.
1873, 10,000, **73,** 51.
1874, 10,000, **74,** 58.
1875, 10,000, **75,** 63.
1876, 10,000, **76,** 85; **77,** 572.
1878, 10,000, **78,** 100, 728.
1888, 10,000, **88,** 1551.
1896, 4,000, **96,** 1856.
1899, 1,000, **99,** 2200.
1902, 2,500, **03,** 1542; **08,** 1658.
1905, 3,000, **05,** 1682.
1907, 2,000, **07,** 1589.
1909, 2,000, **09,** 1650.
1910, 2,200, **10,** 1808.
1911, 2,000, **11,** 1982.

Total, 146,200 (less $21.32 ret. to Treas., $146,-178.68, **12,** 2188).

COMMERCE.

Not unimportant, **68,** 357; **70,** 293; **75,** 367, 408, 416.

Importance above Yellow Medicine R. less than hitherto stated, **73,** 438, 440.

No C. above Little Rapids, **77,** 571; **78,** 728.

Capabilities of R. for, **75,** 402.

Existing and future C., Minnesota Valley, **88,** 1572, 1582.

None found at localities ex. in 1895, **95,** 2207.

After RR. penetrated the Minnesota Valley, navigation of the R. practically ceased, **97,** 2156.

Stream at present used chiefly by excursion SS. and small pleasure launches, **11,** 683.

CONTRACTS.[1]

1867. S. A. Hooper, removal of snags and bowlders, **67,** 262; **68,** 345; **79,** 1183; terms of, **68,** 346; continued, 1871, **71,** 257; **72,** 280.

1875. F. D. Winston, **76,** 703.

1877. Douglas & Winston, **77,** 571; **79,** 1184.

1878. Warren & Perkins, **79,** 1184, 1186.

DOCUMENTS. (Not published in reports.)

H. Doc. 58, 39th Cong., 2d sess., **67,** 260; **74,** 288.

ENGINEERS.

Chief of Engineers. **R., 66,** iii, 36; **67,** 35; **68,** 51; **69,** 44; **70,** 57; **71,** 54; **72,** 50, 52; **73,** 50, 53; **74,** 58; **75,** 62, 63; **76,** 85; **77,** 86; **78,** 100; **79,** 135; **80,** 181, 183; **81,** 243, 247; **82,** 239; **83,** 247; **84,** 247, 250; **85,** 270; **86,** 260; **87,** 227–229; **88,** 204, 206; **89,** 238; **90,** 213; **91,** 271; **92,** 260; **93,** 292; **94,** 267; **95,** 298, 300; **96,** 258; **97,** 330; **98,** 320; **99,** 382, 385; **00,** 438, 443; **01,** 447; **02,** 377; **03,** 401; **04,** 426; **05,** 437; **06,** 477; **07,** 504; **08,** 536; **09,** 568; **10,** 637, 643; **11,** 682; **12,** 823.

In charge:

Maj. G. K. Warren, 1866–70, **67,** 259. **R., 67,** 259; **68,** 299; **69,** 191; **70,** 227; **75,** 380.

Col. J. N. Macomb, 1870–73, **70,** 56. **R., 70,** 292; **71,** 257; **72,** 280; **73,** 438.

Maj. F. U. Farquhar, 1873–78, **73,** 50. **R., 73,** 411; **74,** 288; **75,** 360; **76,** 703; **77,** 571; **78,** 728.

Capt. C. J. Allen, 1878–90. **R., 79,** 1182; (Maj.) **80,** 1582; **81,** 1754, 1831; **82,** 1819; **83,** 1447; **84,** 1609, 1637; **85,** 1741; **86,** 1494; **87,** 1710; **88,** 1551, 1571, 1574; **89,** 1803.

Maj. W. A. Jones, 1890–97. **R., 90,** 2090; **91,** 2207; **92,** 1840; **93,** 2278; **94,** 1725; **95,** 2194, 2206; (Lt. Col.) **96,** 1855; **97,** 2156

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1826; (Maj.) **99,** 2200; **00,** 2812, 2840.

Maj. I. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2334.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1680; **03,** 1542.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2247; **05,** 1682; (Lt. Col.) **06,** 1475.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1588.

Maj. F. R. Shunk, 1907–. **R., 08,** 1657; **09,** 1649; **10,** 1807; **11,** 1981; **12,** 2187.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

E. Bell, **68,** 346; **69,** 199. **R., 71,** 272.
C. E. Davis. **R., 68,** 347; **75,** 416.
O. H. Maxwell, **68,** 347.
R. A. Brown. **R., 73,** 438; **75,** 383.
E. H. Douglass, **75,** 360.
J. Cullen. **R., 79,** 1187.
J. B. Parkinson. **R., 81,** 1754.
R. Davenport. **R., 84,** 1633, 1638; **00,** 2813; **03,** 1543.
F. T. Hampton. **R., 88,** 1572.

ESTIMATES. (See Plans and Projects.)

By Maj. Warren, 1867, 4′ d., mouth of Minnesota to Yellow Medicine R., $775,500, **67,** 260; **74,** 288; **75,** 381; or for a 2′ to 3′ d., incl. l. and d. at Little Rapids, $117,000, **67,** 260; or for a 4′ navigation, n. end of Lake Traverse to mouth of Minnesota R., by canal and R. imp., $12,560,000, **75,** 414.

By C. E. Davis, 1868, 4′ slack-water navigation, mouth of Minnesota to Yellow Medicine, with l. and d., $757,250, **75,** 441.

By R. A. Brown, 1873, upper Minnesota, 13 m., dr. and wing dams, $2,925, **73,** 439.

By Maj. Warren, 1867, l. and d. at Little Rapids, $60,000, **67,** 260; revised est., 1868, $30,000, **68,** 369.

By Maj. Farquhar, 1875, for same, $116,868, **75,** 360; revised, $127,463, **76,** 704; or to secure at least 4′ for 116 m. above mouth by slack-water navigation, obtained with locks and Poirée system of needle dams, $733,868.63, **75,** 364; **78,** 728; **79,** 135, 1183, 1185; comparison of cost with that of canal, **75,** 364; or removing snags and trees above Little Falls, $31,441, **75,** 364; **76,** 704. Cost of detailed sur. for location of canal from Lake Traverse to mouth, $75,000, **75,** 416.

OPERATIONS.[2]

1866–67. Sur., **67,** 261.

1867–68. 1,728 snags, 4,581 overhanging trees removed, **68,** 349.

1868–69. 2,082 snags removed, **69,** 191.

1869–70. 410 snags and 29 c. y. r. and bowlders removed below Mankato, **70,** 293.

1870–71. 743 snags and 848 c. y. r. and bowlders removed, **71,** 257.

1871–72. 1,630 c. y. r. and bowlders removed, Yellow Medicine to Ft. Ridgley, **72,** 307.

1872–73. Removing bowlders and trees, **73,** 51, 411.

1873–74. 2,709 snags, 3,109 overhanging trees, and 527 c. y. r. and bowlders removed below Minnesota Falls, **74,** 288.

1874–75. Sur., **75,** 360.

1875–76. 1,319 snags, 1,952 overhanging trees, and ½ c. y. r. and bowlders removed, 20 m. below Mankato, **76,** 703.

1877–78. 1,712 snags, 904 overhanging trees, and 6 c. y. r. and bowlders removed, 29 m. of R. below St. Peter, **78,** 728.

1878–79. 2,637 snags, 3,067 overhanging trees, and 9 c. y. r. and bowlders removed, 35 m. of R. below Henderson, **79,** 1184.

1893–94. Brush and wing dam built at R. mouth, **94,** 1727.

1894–95. Dam slightly repaired; temporary chan. dr. through Ft. Snelling Chute, **95,** 2196.

1896–97. Dam crest raised 1½′; and some dr. done in Ft. Snelling Chute, **97,** 2157.

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[1] Difficulty of doing work by contract, **68,** 350; **70,** 227.

[2] General character of obstr., **75,** 408. Further imp. of natural chan. unjustified, **75,** 408. Snags must be removed each year, **77,** 571. Cost of snags removed, **79,** 1184. History of previous operations, **79,** 1182.

1899-00. 2,705 c. y. dr., **00,** 2814.
1902-03. Ft. Snelling Chute dr. to 3′, **03,** 1542.
1903-04. Small break discovered in dam near mouth, **04,** 426.
1904-05. Repairs to dr. plant, **05,** 1682.
1905-06. 4,274 c. y. dr.; break in dam repaired, **06,** 1475.
1907-08. No work done, stage of R. too high, **08,** 1657.
1908-09. 2,960 c. y. dr.; part of dam removed; 2 wing dams, aggregating 748′, built; snagging operations commenced, **09,** 1649.
1909-10. 3,600 c. y. dr.; wing dam 290′ l. built; snagging continued, **10,** 1807.
1910-11. 8,378 c. y. removed; repairs to floating plant, **11,** 1981.

PHYSICAL CHARACTERISTICS.

Of ancient and present R., **68,** 307; **75,** 385, 417.
Headwaters of Minnesota, **73,** 438; **75,** 404, 417, 443.
Altitude of points, **73,** 440; **75,** 361, 404, 410.
Valley formerly the course of a great R., **75,** 386.
Draining Lake Winnipeg, **75,** 389.
Evidences of former extension of Winnipeg, **75,** 390.
Surface geology, **75,** 392.
Hypothesis for change in outlet of lake, **75,** 394.
Slope, cross section, and discharge of Minnesota, **75,** 404, 406, 407.
Tributaries and area drained by, **75,** 412.
Discharge measurement, table of, **75,** 442; **88,** 1575.
Effect of freshets, **81,** 1755.
Rate of R. erosion at Belle Plaine, **81,** 1832.
Drainage area of source of R., **84,** 1632.
Depths obtained by proj. of 1893, **94,** 1727.
H. w. and ice damaging works, **94,** 1727; **97,** 2157.
Description of banks, **00,** 2840.
Difficulties of dr. (bar)—broken stone, logs, snags, etc., **06,** 1475.
Description, **09,** 568.

PLANS. (See Estimates and Projects.)

By Maj. Warren, 1867: 1st, 4′ d., mouth of Minnesota to Yellow Medicine R., 237 m., with l. and d., H. Doc. 58, 39th Cong., 2d sess., **67,** 260; **74,** 288; **75,** 440. Objection to, **75,** 403, 408; **79,** 1182 (see proj. of Maj. Farquhar). 2d, 2′ to 3′ navigation by removing snags and bowlders, aided by dr., l. and d. at Little Falls, **67,** 260; **74,** 288; **79,** 1182. Difficulties of, **75,** 360, 403 (see Projects). 3d, 4′ navigation, n. end of Lake Traverse to mouth of Minnesota with canal 5′ x 86′ x 100′, on right bank (except when passing through lakes) to below confluence of Chippewa R.; thence along left bank to Little Rapids (Falls); thence by R. imp. to mouth; l. of canal and lake imp., 251 m.; R., 30 m., **75,** 409. Propriety of, **75,** 416. Plan most feasible, **75,** 403 (see proj. of Maj. Farquhar).

By C. E. Davis, 1868, 4′ slack-water navigation, mouth of Minnesota to Yellow Medicine R., 237 m., with l. and d.; locks 40′ x 170′, lift 11′ to 15′, **75,** 416–442. Objections to, **75,** 403, 408.

By R. A. Brown, 1873, mouth of Yellow Medicine to foot of Minnesota Falls, 13 m., chan. 50′ w., 1′ d., by dr. and wing dams, **73,** 439. Small importance of, **73,** 438.

By Maj. Allen, 1882, increasing the l. w. discharge of the R. by additions from a reservoir system at Big Stone Lake. C. would not warrant the expense, **84,** 1632.

By Maj. Allen, 1888, slack-water navigation by (1) 6 masonry locks and movable dams with from 7′ to 14′ lifts; also removal of snags; est., $1,527,738; (2) 10 masonry locks and movable dams with lifts from 6′ to 8.3′; also removal of snags; est., $1,883,968, **88,** 1580.

PROJECTS. (See Estimates and Plans.)

The proj. under which operations have been carried on since the date of the first app., 1867, removal of snags, trees, rocks, and bowlders from the chan. 1867 to 1879, incl., $117,500 app. and applied toward this proj., **67,** 259; **80,** 181; **86,** 1496.

Proj. of 1867 for permanent imp., modified by the sur. of 1874–75, proposed a slack-water navigation from mouth to South Bend, 116 m., by canals, locks, and dams; est., incl. $34,585.10 for clearing R. of obstr., of $733,868.63, **67,** 260; **75,** 364; **86,** 261; **87,** 1710. Of this est. $30,000 was expend. bet. 1875 and 1879 in clearing obstr., **86,** 1496; **92,** 1840.

By Maj. Farquhar, 1875, 4′ for 116 m. above mouth of Minnesota R. with l. and d.; dams to be provided with Poirée system of movable needles; locks 50′ x 200′; lift 11′ and 13′, **75,** 362. Advantages of, compared with canal, **75,** 365. Not open to objections urged against permanent dams, **75,** 362, 364. Necessity of l. and d. at Little Rapids on either plan, **75,** 365. Importance of work at Little Rapids, **68,** 369.

Act of 1892 made the whole app. of 1888 available for the general imp., deferring imp., required by act 1888, at Belle Plaine, **93,** 2281.

By Maj. Jones, 1893, imp. lower reach of the R., Chaska to Mississippi R., at Ft. Snelling, 28.6 m.′ by dr. and diversion of the chan. to make it flow through 1 of its 2 outlets, **94,** 1726.

Proj. of 1899 to remove the bar at the mouth; est., $1,000, **99,** 382.

$2,500 app. 1903, to be used at discretion of Sec. of War for removal of dam near mouth, **03,** 1542.

Removal of dam at mouth (damaged) and dr. accumulated shoals recom., and approv. by Sec. of War, May 26, 1908, **08,** 1657, 1658.

Maj. Shunk recom. discontinuance of expend., as C. "does not" warrant imp., **11,** 1981–82.

SURVEYS.

Made in 1866–67 from mouth of Minnesota to Yellow Medicine, **67,** 259. Character of, **68,** 301, 305, 364; **70,** 224; **75,** 380, 416. Instructions to assistants making, **68,** 303. Outfits for, **68,** 306. Above mouth of Yellow Medicine, **72,** 280, 306; **73,** 438; **75,** 382, 443.

Mouth to South Bend, 1874–75, 116 m., **75,** 360.

Proposed, Lake Traverse to mouth, for canal location, organization, and cost, **75,** 415.

Early sur. and exploration, **75,** 383.

Near Belle Plaine au. act June 14, 1880, **80,** 183; made by Maj. Allen, 1880, **81,** 1831; **84,** 1637.

At the source, au. act Aug. 2, 1882, **84,** 250; made by Maj. Allen, 1882, **84,** 1632.

Ex. au. act Aug. 5, 1886, for imp. with l. and d., **87,** 229.

Sur. for l. and d. imp., au. act Aug. 5, 1886; made 1888, by Maj. Allen, **88,** 1571, 1574.

Minor sur., **93,** 2281.

Ex. for bank protection opposite Belle Plaine, and to prevent the R. cutting through a neck there, and for bank protection at city of Mankato, au. act Aug. 17, 1894; made by Maj. Jones, 1895 (**R.** unfav.), **95,** 2206.

Ex. for protecting the banks at or near St. Peter, in Nicollet Co., Minn., au. act Mar. 3, 1899; **R.** (unfav.) submitted, 1899, by Maj. Abbot, **00,** 2841.

Pre. ex. and sur. au. act Mar. 3, 1909; also to ascertain whether, for mainten. of navigation, storage reservoirs are necessary at or near headwaters of said R., and to determine what portion of cost should be borne by owners of water power and others. **R.,** Maj. (now Lt. Col.) Shunk, 1909 and 1910; est., $1,500,000 1st cost, with $3,000 an. mainten., provided State or local interests bear one-half 1st cost ($750,000), and operation of Lac qui Parle Reservoir be left entirely to U. S.,[1] **10,** 643; **11,** 688; **12,** 831.

Maps:
Of mouth, **75,** 386.
Of head, **75,** 387.
Of islds. left in ancient valley, **75,** 388.
88, 1574.

[1] H. D. 700, 62d, 2d.

KK-153(a) BIG STONE LAKE AND LAKE TRAVERSE, MINN. AND S. DAK.

(See also KK–189(a) and 190, p. 1259 and Part (c) K–170 p. 1258.)

APPROPRIATIONS. (See p. 1067.)

ENGINEERS.

Chief of Engineers. **R., 85,** 296; **95,** 300; **98,** 322; **00,** 442; **01,** 450; **02,** 381; **03,** 404.

In charge:
Maj. C. J. Allen, 1884–85. **R., 85,** 1951.
Maj. W. A. Jones, 1895–97. **R., 95,** 2208; (Lt. Col.) **98,** 1834.
Capt. F. V. Abbot, 1897–1900. **R., 98,** 208; (Maj.) **00,** 2833.
Maj. D. W. Lockwood, **01,** 443.
Capt. H. M. Chittenden, 1901. **R., 01,** 2342.
Maj. R. L. Hoxie, 1901–03. **R., 02,** 1684; **03,** 1549.

Assistant. C. W. Weeks. **R., 98,** 1837.

PHYSICAL CHARACTERISTICS.

Description of. Considered a part of the reservoir system of the Mississippi. The utilization of Big Stone Lake would involve a consideration of Lake Traverse also as a reservoir, **85,** 1951; **95,** 2209; **98,** 1835.
Run-off, **00,** 2836; **01,** 2343; **02,** 1685.
Big Stone Lake drains into Minnesota R. and L. Traverse into Bois de Sioux R.

PROJECTS.

Maj. Allen reported that the desired connection bet. the lakes would require canal and lock; est., $400,000, **85,** 1953.
In 1897 Lt. Col. Jones est. it would cost $350,000 to constr. reservoirs out of Big Stone Lake and Lake Traverse, **98,** 1836.

SURVEYS.

Ex. au. act July 5, 1884; made by Maj. Allen (**R.** unfav.), **85,** 1951.
Ex. with view to constr. of reservoirs au. act Aug. 17, 1894; made, 1895, by Maj. Jones (local engineer reports fav.; not concurred in by Chief of Engineers), **95,** 2208.
Sur. of the lake and also Lake Traverse, Minn., au. act June 3, 1896; made, 1897, by Lt. Col. Jones (see Projects), **98,** 1834.
Sur. with view to constr. reservoirs for the imp. of navigation of the Minnesota R., and est. of cost of imp., au. act Mar. 3, 1899; progress **R.** submitted, 1900, by Maj. Abbot (necessary observations and measurements should cover about 3 years), **00,** 2833.

KK-170 RED RIVER OF THE NORTH, DAK. AND MINN.

Part.	Title.	Period.	Appropriations.
a	Red R. of the North, Minn. and Dak	1874–1912	$333,123.00
b	Red R. of the North, Goose Rapids, Dak. and Minn	1879–1891	50,000.00
c	Red R. of the North and trib. above Fergus Falls and Crookston, Minn., and Big Stone Lake, Minn. and S. Dak	1897–1903	.....
	Total	.....	383,123.00

Part (a), KK-170. Red River of the North, Minn. and Dak.

APPROPRIATIONS.[1]

1876, $10,000, **77,** 87.
1878, 30,000, **78,** 100.
1879, 25,000, **79,** 136.
1880, 20,000, **80,** 1585.
1881, 18,000, **81,** 1757.
1882, 10,000, **82,** 1822.
1884, 10,000, **84,** 1611.
1888, 20,000, **88,** 1555.
1890, 25,000, **90,** 2096.
1892, 25,000, **92,** 1845.
1894, 15,000, **95,** 2199.
1896, 20,000, **96,** 1858.
1899, 25,000, **99,** 2201.
1899, [2] 5,000, **00,** 2828.
1902, 10,000, **02,** 1681.
1904, *1,623, **04,** 2249.
1905, 9,000, **05,** 1683.
1907, 15,000, **07,** 1590.
1909, $7,500, **09,** 1651.
1910, 7,500, **10,** 1809.
1911, 7,500, **11,** 1982.
1912, 17,000, **12,** 2189.

Total, 333,123

COMMERCE.

Important, **74,** 298; **75,** 372; **78,** 730, 732.
Comparative statement of freight moved by SS., 1879 to 1891, **92,** 1849.
940 sq. m. would probably be benefited by imp. of Red Lake R., and imp. recom. after ex. of 1895, **95,** 2211.
After ex., 1897, Chief of Engineers recom. sur. to obtain C. data, etc., that would determine worthiness of Red Lake R. for imp., **97,** 2174.
Description of, **00,** 2819.
Effect on rates, **07,** 507.

* Allotment.
[1] 1886, $46,947.65, **86,** 1499. Transf. from Red R. of the North at Goose Rapids, **87,** 1722.
[2] Red Lake and Red Lake R., Minn. (Sur.)

ENGINEERS.

Chief of Engineers. **R., 73,** 51; **74,** 58; **75,** 63; **77,** 87; **78,** 100; **79,** 135; **80,** 181, 183; **81,** 244, 247; **82,** 239; **83,** 247; **84,** 248; **85,** 270; **86,** 261; **87,** 228, 230; **88,** 204, 206; **89,** 239; **90,** 214; **91,** 272; **92,** 261; **93,** 293; **94,** 268; **95,** 299, 301; **96,** 258; **97,** 330, 333; **98,** 320; **99,** 382, 385; **00,** 439, 441, 443; **01,** 447; **02,** 378; **03,** 401; **04,** 427; **05,** 438; **06,** 478; **07,** 505; **08,** 537; **09,** 569; **10,** 638; **11,** 683; **12,** 824, 831.

In charge:

Maj. F. U. Farquhar, 1873–78. **R., 74,** 295; **75,** 370; **77,** 575; **78,** 729, 730.

Capt. C. J. Allen, 1879–90. **R., 79,** 1189; (Maj.) **80,** 1583; **81,** 1756, 1828; **82,** 1820; **83,** 1448; **84,** 1610; **85,** 1742; **86,** 1496; **87,** 1712, 1733; **88,** 1552, 1584, 1586; **89,** 1806.

Maj. W. A. Jones, 1890–97. **R., 90,** 2093; **91,** 2210; **92,** 1843; **93,** 2282; **94,** 1728; **95,** 2197, 2211; (Lt. Col.) **96,** 1856; **97,** 2158, 2173.

Capt. F. V. Abbot, 1897–1900. **R., 98,** 1827; (Maj.) **99,** 2200; **00,** 2814, 2828, 2841.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2335.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1680; **03,** 1543.

Maj. G. McC. Derby, 1903–06. **R., 04,** 2248; **05,** 1683; (Lt. Col.) **06,** 1476.

Col. J. B. Quinn, **07,** 496.

Capt. E. H. Schulz, 1907. **R., 07,** 1589.

Maj. F. R. Shunk, 1907–. **R., 08,** 1658; **09,** 1650; **10,** 1808; **11,** 1982; (Lt. Col.) **12,** 2188.

1st Lt. J. N. Hodges, **12,** 814.

Assistants:

D. W. Wellman, **74,** 295.

M. E. Schmidt, **75,** 370.

C. J. Morris, **78,** 732.

C. Wanzer. **R., 79,** 1192; **80,** 1586; **81,** 1757; **82,** 1822.

R. Davenport. **R., 82,** 1824; **83,** 1450; **87,** 1716, 1719, 1734; **88,** 1553, 1585; **90,** 2096; **91,** 2212; **92,** 1845, 1847; **93,** 2284, 2285; **94,** 1730; **95,** 2199; **97,** 2161; **98,** 1830; **99,** 2202; **00,** 2817; **01,** 2337; **03,** 1545; **04,** 2250.

LEGAL PROCEEDINGS.

Prosecution of the Northern Pacific RR. for refusing to abate trouble due to a large landslide caused by it, seriously obstr. R. close to Grand Forks, **98,** 1827.

Injunction obtained preventing further efforts by the Northern Pacific RR. to raise their Grand Forks embankment, **99,** 2201.

OBSTRUCTIONS.

Formation of bars in Red R., **02,** 1681; **05,** 1683.

OPERATIONS.

1877–78. Removal of obstr. from Moorhead to Frog Pt., **78,** 100, 729.

1878–79. Dr. built; removal of 11,631 c. y.; obstr. removed from 9 m. of R., **79,** 135, 1189, 1190, 1192.

1879–80. 57,610 c. y. dr., 219 snags and 4,151 overhanging trees removed, **80,** 1584.

1880–81. 43,561 c. y. dr. and 254 snags and trees removed, **81,** 1756.

1881–82. 53,217 c. y. dr., **82,** 1821.

1882–83. 112,539 c. y. dr., 335 stumps and snags and 321 c. y. bowlders removed, **83,** 1449.

1884–85. 36,138 c. y. dr., **85,** 1743.

1885–86. 36,303 c. y. dr. and 4,550 l. f. of training dam built, **86,** 1497.

1886–87. 71,747 c. y. dr. from shoals; 13,822 l. f. wing dams built, **87,** 1718.

1887–88. 26,886 c. y. dr.; 618 l. f. wing dams built; 9 trees and 30 c. y. r. removed from chan., **88,** 1552.

1888–89. 40,767 c. y. dr.; 7,798 l. f. wing dams built, **89,** 1807.

1889–90. 36,908 c. y. dr.; 1,450 l. f. wing dams built; 8,125 l. f. training dams built, **90,** 2094.

1890–91. 44,535 c. y. dr., and 9,525 l. f. wing and training dams built, **91,** 2211.

1891–92. 100,442 c. y. dr., and 23,695 l. f. wing dams and training walls built, **92,** 1844.

1892–93. Over 65,000 c. y. dr. and placed in wing and training dams, **93,** 2283.

1893–94. Nearly 15,000 c. y. dr. and placed in training dams; some bowlders, snags, and other obstr. removed, **94,** 1729.

1894–95. Plant repaired. Nearly 19,000 c. y. dr. and placed in training and wing dams, **95,** 2198.

1895–96. Over 4,600 c. y. dr. and placed in training dams, **96,** 1858.

1896–97. Over 26,000 c. y. dr.; small derrick plant built; bowlders and other obstr. removed, **97,** 2159.

1897–98. Some dr. done and some bowlders, etc., removed from Red R., **98,** 1827, 1828.

1898–99. Repairs made to plant, **99,** 2201.

1899–00. 37,700 c. y. dr.; 14,576 bowlders and 1,794 snags and other obstr. removed, **00,** 2818.

1900–01. 35,030 c. y. dr. and snags and leaning trees removed from Red. R.; 304 snags, stumps, bowlders, etc., removed from Red Lake R., **01,** 2335.

1902–03. 17,425 c. y. dr. and 134 snags removed from Red R., and repairs made to plant; 2,029 snags, bowlders, etc., removed from Red Lake R., and plant repaired, **03,** 1545.

1903–04. 7,125 c. y. dr. and 99 obstr. removed from Red R., **04,** 2250.

1905–06. 22,400 c. y. dr., 224 obstr. removed from Red R., and repairs made to floating plant, **06,** 1476.

1906–07. 18,900 c. y. dr. and 300 obstr. removed from Red R., **07,** 1589.

1907–08. 35,950 c. y. dr. and 432 obstr. removed from Red R., **08,** 1658.

1908–09. 25,000 c. y. dr., 6,900 l. f. training dam constr., and 235 obstr. removed from Red R., **09,** 1650.

1909–10. 37,950 c. y. dr. from Red R., and 5,800 l. f. training dikes built, **10,** 1808.

1910–11. 42,100 c. y. dr. and 173 obstr. removed from Red R., **11,** 1982.

1911–12. 59,265 c. y. dr. and 36 snags and deadhead logs removed from Red R., **12,** 2188.

PHYSICAL CHARACTERISTICS.

Descriptions, **74,** 295, 296; **75,** 370, 371; **78,** 730; **79,** 1192.

Rainfall, **74,** 296.

List of obstr., **74,** 297; **75,** 371; **78,** 730.

Hypothesis by Maj. Warren that the Minnesota R. once drained "this" valley, and carried its waters into the Mississippi, **75,** 389–392, 394.

R. subject to landslides which can not be anticipated, **94,** 1729; and were unusually numerous in 1894–95, blocking chan. for 50 or 60 m. n. of Grand Forks, **95,** 2198.

Ice sinking snag boat, **97,** 2159.

Description of, Red Lake R., a drainage outlet of Red Lake. R. tributary of Red R. of the North. Effect of regulation of water supply, **95,** 2211; **97,** 2174, 2175.

Red R. of the North formed by the confluence at Breckenridge of the Bois de Sioux and Ottertail Rs., **00,** 2842.

Description of, banks of the R., floods (1882–97), Red Lake system, site for reservoirs, and landslides, **00,** 2842, 2844, 2845.

Connection during flood stages bet. Red Lake and Clearwater R., **00,** 2830. Run-off, **00,** 2830.

PLANS. (See Projects.)

By Maj. Farquhar, 1874, Red R., bet. Goose Rapids and Frog Pt., l. and d. at Goose Rapids, dr. on bars, removal of bowlders from rapids, snags, and overhanging trees; est., $212,308; more detailed sur. required to perfect plan, **74,** 297, 298.

By Maj. Allen, 1887, Moorhead to Fergus Falls, contraction works and removal of snags, bowlders, and leaning trees; est., $22,663.98, **88,** 1587.

PRIVATE (CORPORATE AND STATE) WORK.

Drainage work done by Minnesota, and the Great Northern RR., showing such drainage to be possible, but expensive; spring floods possibly exaggerated by this very drainage work, **00,** 2846.

PROJECTS. (See Plans.)

By Maj. Farquhar, 1878, Breckenridge to n. boundary line, dr., removal of obstr., and constr. of l. and d., as follows: Raft and flatboat navigation, Breckenridge to Moorhead, $22,664; imp. of R. from Moorhead to Goose Rapids, $4,428; l. and d. below Goose Rapids, $219,288; from Goose Rapids to Frog Pt., $32,880; from Frog Pt. to boundary line, $85,338. Aggregate est., $364,598.

By Capt. Allen, 1879, reducing cost of l. and d. to $190,000; reduced total est. to $335,310, **79,** 1191; **81,** 1757. Revised to $179,310 in 1883, **83,** 1450; **87,** 1712.

In 1887 cost of completing imp. est. at $79,598.37, **88,** 204; **91,** 2210.

In 1893 Maj. Jones est. $67,320, or $307,320 from commencement of work, to complete "existing" proj., an increase, due to 8-hour law, and increase in quantity of dr. material, **93,** 2282.

By Maj. Jones, 1895, imp. of Red Lake R., bet. Thief R. Falls and Red Lake, by removal of bowlders and a bar, for which Congress allotted $5,000 in 1896, **96,** 1857.

SURVEYS.

By D. W. Wellman, from Moorhead to Pembina, **73,** 51; **74,** 58, 295.

By M. E. Schmidt, ex., Moorhead to Breckenridge, **75,** 370.

By C. J. Morris, 1877, ex. from Frog Pt. to n. boundary of the U. S., **78,** 100, 730.

Ex., Fargo, Dak., to Breckenridge, Minn., au. act June 14, 1880; made, 1880, by Capt. Allen, **81,** 1828.

Ex., Moorhead to Fergus Falls., Minn., au. act Aug. 5, 1886; made by Maj. Allen (**R.** unfav.), **87,** 1733; **88,** 1586.

Ex. of Red Lake R. with view to imp. it from Thief R. Falls to Red Lake, au. act Aug. 17, 1894; and made, 1895, by Maj. Jones (**R.** fav.), **95,** 2211. Another made, 1897, by Lt. Col. Jones with view to constr. of d. and l. at outlet of lake, au. act June 3, 1896 (**R.** fav.), **97,** 2173.

Ex. with view of ascertaining what imp., if any, should be made to govern and repress floods, and prevent undue erosion of banks, au. act Mar. 3, 1899; made, 1899, by Maj. Abbot (**R.** unfav.), **00,** 2842.

Sur., Red Lake and Red Lake R., Minn., with view to constr. of dam with locks at the outlet of the lake, for imp. navigation of Red R. of the North and Red Lake R., Minn., and est. cost of imp., au. act Mar. 3, 1899; progress **R.** submitted, 1900, by Maj. Abbot (final **R.** to be made when a sufficiently prolonged record of the run-off secured), **00,** 2830.

Ex., Fargo to international boundary line, au. act Mar. 3, 1905. **R.** by Lt. Col. Derby; est., $7,500,[1] **06,** 483.

Ex. with view to d. and straightening chan. au. act Mar. 2, 1907. **R.** by Maj. Shunk, Nov. 13 1907[2] (unfav.), **08,** 542.

Ex. of Bois de Sioux R., Lake Traverse, and Big Stone Lake, with view to diverting flood waters of Red R. into Minnesota R., Minn., au. act Mar. 2, 1907. **R.** by Maj. Shunk, Dec. 4, 1907[3] (unfav.), **08,** 542.

Pre. ex. of Red Lake R., Minn., bet. Thief R. Falls and Red Lake, au. act Mar. 3, 1909. **R.** by Maj. Shunk, Aug. 10, 1909[4] (unfav.), **10,** 643.

Pre. ex. of Red R. of the North and its headwaters, to determine whether storage reservoirs be necessary. **R.** by Maj. Shunk, Aug. 2, 1911[5] (unfav.), **12,** 831.

Maps.[6] **95,** 2212.

Part (b), KK-170 Red River of the North, at Goose Rapids, Dak. and Minn.

APPROPRIATIONS.

1881,	$20,000,	**81,** 1761.
1882,	30,000,	**82,** 1828.
Total,	[6] 50,000	

COMMERCE.

Increase in transportation of grain since commencement of imp., 1879, **81,** 1760.

ENGINEERS.

Chief of Engineers. **R.,** **81,** 244; **82,** 240; **83,** 248; **84,** 248; **85,** 271; **86,** 262; **87,** 229; **91,** 274.

In charge:

Maj. C. J. Allen, 1881–88. **R.,** **81,** 1760; **82,** 1827; **83,** 1454; **84,** 1612; **85,** 1745; **86,** 1500; **87,** 1721; **88,** 1555.

Maj. W. A. Jones, 1891. **R.,** **91,** 2220.

PROJECTS.

By Maj. Allen, 1879, l. and d. at Goose Rapids having lift of 12′, est. $219,288, **79,** 1191; **81,** 1760; **87,** 1721.

In 1884 revised plans and est. submitted, **84,** 1613; **87,** 1722.

Total amount app. to 1887 being considered too small to warrant commencement of operations, app. trans., 1887, to general imp. of Red R., **87,** 1722.

After reex., 1891, Maj. Jones **R.** Red R. of the North not worthy of slack-water imp. at Goose Rapids, **91,** 2221.

Part (c), KK-170 Red River of the North, and Tributaries above Fergus Falls and Crookston, Minn., and Big Stone Lake, Minn. and S. Dak.

(See KK–153(a), p. 1256.)

COMMERCE.

C. interests, **92,** 1862.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 274; **92,** 262, 1853.

In charge:

Maj. W. A. Jones, 1892. **R.,** **92,** 1853, 1863.

Col. O. M. Poe, 1892. **R.,** **92,** 1862.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 1855.

Description of, Red R. of the North, with tributaries, and Big Stone Lake and Lake Traverse, **92,** 1855.

PLANS.

By Maj. Jones, 1892, 2 reservoir systems at Red Lake and Lake Traverse, at headwaters of tributaries of the Red R. of the North, to diminish effects

[1] H. D. 416, 59th, 1st.
[2] H. D. 400, 60th, 1st.
[3] H. D. 493, 60th, 1st.
[4] H. D. 483, 61st, 2d.
[5] H. D. 616, 62d, 2d.
[6] See footnote to app., Part (a), p. 1256.

of floods, and to store water for use at low stages in the Red R. system; est., $860,000, **92,** 1872.

In 1892 Chief of Engineers did not consider R. worthy of imp. to this extent, **92,** 1854.

SURVEY.

Au. act Sept. 19, 1890; made, 1892, by Maj. Jones, **92,** 1863.

KK-186(a) CREEL BAY, TOTTEN BAY, AND MINNEWAUKEN SHOALS, IN DEVILS LAKE, N. DAK.[1]

ENGINEERS.

Chief of Engineers. **R., 91,** 274, 2223.

In charge. Maj. W. A. Jones, 1891. **R., 91,** 2223.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Maj. Jones (**R.** unfav.), **91,** 2223.

KK-189(a) LAKE TRAVERSE, MINN. AND S. DAK.

(See also KK–153(a), p. 1256, and KK–190, below.)

APPROPRIATIONS.

1912, $7,510, **12,** 2192.

COMMERCE.

Small, but growing; carried by 2 boats of 60 and 90 t. 2 barges, 2 and a 30-passenger launch, **12,** 2191. Imp. can have no effect on rates, **12,** 830.

ENGINEERS.

Chief of Engineers. **R., 08,** 542; **11,** 688; **12,** 829.

In charge. Maj. F. R. Shunk, 1908–. **08,** 529; **11,** 675; **R.** (Lt. Col.), **12,** 2192.

PHYSICAL CHARACTERISTICS.

Description of, **12,** 829.

In ne. cor. of S. Dak.; part of boundary line bet. S. Dak. and Minn. The source of Bois de Sioux R., which in turn is one of the sources of the Red R. of the North. 25 m. x 1½ m. Upper part 19 m. l. and lower part 6 m. l., connected by narrows. Lower part is shallow. **12,** 829.

PROJECT.

Act July 25, 1912, au. proj. for dr. chan. through narrows 11,500′ x 50′ at bottom, with side slopes of 2 on 1, and 4′ m. l. w.; est., $7,510,[2] **12,** 829.

SURVEYS.

Pre. ex. of Bois de Sioux R., Lake Traverse, and Big Stone Lake, and portages bet. said lakes and R., for diverting flood waters of Red R. of the North into Minnesota R., au. act Mar. 2, 1907. **R.,** Maj. Shunk, Dec. 4, 1907 (unfav.),[3] **08,** 542.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Maj. Shunk, Aug. 16, 1909, and Oct. 29, 1910; est., $7,510,[3] **11,** 688.

Maps.[2]

KK-190 OTTER TAIL LAKE AND RIVER, RED LAKE AND RED LAKE RIVER, BIG STONE LAKE AND LAKE TRAVERSE, MINN. AND S. DAK.

Part.	Title.	Period.	Appropriations.
a	Otter Tail Lake and R., Minn	1897–1903	$3,000.00
b	Otter Tail Lake and R., Red Lake and Red Lake R., Big Stone Lake and Lake Traverse, Minn. and S. Dak	1902–1911	10,000.00
	Total		13,000.00

Part (a), KK-190 Otter Tail Lake and River, Minn.

APPROPRIATIONS.

1899, $3,000 (sur.), **00,** 2830.

ENGINEERS.

Chief of Engineers. **R., 97,** 333; **00,** 442; **01,** 450; **02,** 380; **03,** 404.

In charge:

Lt. Col. W. A. Jones, 1897. **R., 97,** 2172.

Maj. F. V. Abbot, 1900. **R., 00,** 2830.

Maj. D. W. Lockwood, **01,** 443.

Capt. H. M. Chittenden, 1901. **R., 01,** 2341.

Maj. R. L. Hoxie, 1901–03. **R., 02,** 1684; **03,** 1548.

Assistant. T. M. Fowble. **R., 00,** 2833.

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[1] Near the headwaters of, but not connected to, Sheyenne R., N. D. "Not connected to any waters of the U. S. outside N. D., and hence not properly subject to imp. by the Federal Government," **91,** 2223.

[2] H. D. 1391, 61st, 3d.

[3] H. D. 493, 60th, 1st.

PHYSICAL CHARACTERISTICS.

Description of. Lake one of the largest of a group near headwaters of Red R. of the North. Nearly 8,600,000,000 c. f. could probably be collected in an average year, and this water could probably be utilized to increase the depth of the R. for a portion of its length by 2′ or 3′, and control of it would save the adjacent lands from destructive floods, **97,** 2173.

Description of locality, general features, reservoir, and dam sites, watershed, and area and capacity of reservoir, **00,** 2833.

Table of run-off, May 1, 1899, to June 30, 1901, incl.; pre. **R.,**[1] **01,** 2342.

Table of run-off, May 1, 1899, to June 30, 1902, incl., **02,** 1684.

SURVEYS.

Ex. for constr. of dam at lake outlet to imp. navigation of Red R. of the North au. act June 3, 1896; made, 1897, by Lt. Col. Jones (**R.** fav. to sur.), **97,** 2172.

Sur. with view to constr. of dam at outlet of lake, for imp. navigation on Red R. of the North, Minn., and est. cost of imp., an. act Mar. 3, 1899; **R.** on pre. ex. made, 1900, by Maj. Abbot (ex. to be continued), **00,** 2832.

Part (b), KK-190 Otter Tail Lake and River, Red Lake and Red Lake River, Big Stone Lake and Lake Traverse, Minn. and S. Dak.

(See KK–198(a) and (b), following.)

APPROPRIATIONS.

1902, *$10,000, **04,** 2260.

COMMERCE.

C., Red R., 20,086 t., 1902; Red Lake R. (excl. of logs), 500 t., **04,** 2262.

ENGINEERS.

Chief of Engineers. R., 04, 430; **05,** 441; **06,** 482; **07,** 509; **08,** 540; **09,** 573; **10,** 642; **11,** 687; **12,** 829.

Boards. BERH. and DE. reviews Maj. Hoxie's report of 1904; unfav. to U.S. making dam at outlet of Otter Tail Lake to imp. navigation of Red R. of the North, and reservoirs on Big Stone Lake and Lake Traverse, for imp. of navigation of Minnesota R. Chief of Engineers unfav. to U.S. making d. and l. at outlet of Red Lake, **04,** 2260–2289.

In charge:

Maj. G. McC. Derby, 1903–06. **R., 04,** 2260; **05,** 1686; (Lt. Col.) **06,** 1479.
Col. J. B. Quinn, **07,** 496.
Capt. E. H. Schulz, 1907. **R., 07,** 1593.
Maj. F. R. Shunk, 1907–. **R., 08,** 1661; **09,** 1652; **10,** 1811; **11,** 1985; **12,** 2191.
1st Lt. J. N. Hodges, **12,** 814.

OPERATIONS.

Detached sur. and hydrological observations made, and the latter continued to May 15, 1904, and in subsequent years (see Engineer in charge), **04,** 430.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 2260–65.
Floods affecting localities, **04,** 430.

PROJECTS.

Act June 13, 1902, provided for continuation of the sur. of localities, with view to constr. of reservoirs for imp. of navigation of Red R. of the North, and Minnesota R., **04,** 430.

SURVEYS.

Report of Maj. Hoxie, Aug. 11, 1903, giving in detail plans, but expresses no opinions or recom.[2] (see Boards, above); ests., Red Lake and Red Lake R., $270,456.60; Otter Tail Lake and Otter Tail R., $58,095; for Big Stone Lake and Lake Traverse, $357,957, $435,266, or $1,176,972, **04,** 2261, 2262.

KK-198(a) RED LAKE RIVER, MINN.

(See Part (b), KK–190, above.)

ENGINEERS.

Chief of Engineers. R., 87, 229.
In charge. Maj. C. J. Allen. **R., 87,** 1724.
Assistant. R. Davenport. **R., 87,** 1725.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 1724.

SURVEYS.

Ex. au. act Aug. 5, 1886; made by Maj. Allen (**R.** unfav.—"costly"), **87,** 1724.

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* Allotment. [1] H. D. 672, 56th, 1st. [2] H. D. 539, 58th, 2d.

KK-198(b) RED LAKE AND RED LAKE RIVER, MINN.

(See Part (b), KK–190, p 1260.)

APPROPRIATIONS.

ENGINEERS.

Chief of Engineers. **R., 01,** 450; **02,** 380; **03,** 403.

In charge:
Maj. F. V. Abbot, **01,** 443.
Maj. D. W. Lockwood, **01,** 443.
Capt. H. M. Chittenden, 1901. **R., 01,** 2340.
Maj. R. L. Hoxie, 1901–03. **R., 02,** 1683; **03,** 1548.

PHYSICAL CHARACTERISTICS.

Table of run-off, May, 1899, to June, 1901, **01,** 2341.
Table of run-off, May, 1899, to Aug. 1901, **02,** 1683.

KK-210 LAKE OF THE WOODS, MINN.

ENGINEERS.

Chief of Engineers. **R., 12,** 831.
In charge. Lt. Col. F. R. Shunk, **12,** 814.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, at or near Anersen, Minn., with view to securing increased H. facilities, **12,** 831.

KK-211 WARROAD HARBOR AND RIVER, MINN.

APPROPRIATIONS.

1899,	$3,000,	**99,** 2205.
1902,	45,000,	**02,** 1682.
1905,	35,000,	**05,** 1685.
1909,	4,000,	**09,** 1652.
1907,	*4,000,	**09,** 1652.
1910,	7,700,	**10,** 1810.
1912,	13,200,	**12,** 2190.
Total,	111,900	

COMMERCE.

600 t. 1899–1900, **00,** 441.
Description of, **01,** 2357.
In 1904, 12,683 t., **04,** 429.
Town of Warroad, 5 years old in 1905, has a population of about 1,000, **05,** 440.
No RRs. in competition with SS. on lake, **12,** 827.
Diagram (app., freight, etc.), **12,** 2190.

CONTRACTS.

1903. 3 emergency contracts, **03,** 1547.

ENGINEERS.

Chief of Engineers. **R., 99,** 384; **00,** 440; **01,** 449, 451; **02,** 379; **03,** 403; **04,** 429; **05,** 440; **06,** 480; **07,** 508; **08,** 539; **09,** 572; **10,** 640, 643; **11,** 685; **12,** 826.

Boards. BERH. **R.,** Dec. 22, 1903, on advisability of continuing imp., recom. it is desirable to carry out present proj.,[1] **04,** 2253.

In charge:
Maj. F. V. Abbot, 1899–1900. **R., 99,** 2204; **00,** 2820; **01,** 2357.
Maj. D. W. Lockwood, **01,** 443.
Capt. H. M. Chittenden, 1901. **R., 01,** 2339.
Maj. R. L. Hoxie, 1901–03. **R., 02,** 1682; **03,** 1547.
Maj. G. McC. Derby, 1903–06. **R., 04,** 2251; **05,** 1684; (Lt. Col.) **06,** 1477.
Col. J. B. Quinn, **07,** 496.
Capt. E. H. Schulz, 1907. **R., 07,** 1591.
Maj. F. R. Shunk, 1907–. **R., 08,** 1660; **09,** 1651; **10,** 1810; **11,** 1984; (Lt. Col.) **12,** 2189.
1st Lt. J. N. Hodges, **12,** 814.

Assistants:
C. W. Raynor. **R., 01,** 2359.
R. Davenport. **R., 03,** 1547; **04,** 2252; **05,** 1685.

OPERATIONS.

1898–99. Gauge estab., **99,** 2204.
1903–04. 8,625 c. y. dr., **04,** 2253.
1904–05. 26,923 c. y. dr., **05,** 1685.
1905–06. 117,416 c. y. dr., **06,** 1477.
1906–07. 75,039 c. y. dr., **07,** 1591.
1907–08. 105,405 c. y. dr., **08,** 1660.
1908–09. 19,566 c. y. dr.; 168′ dike completed **09,** 1651.
1909–10. 22,200 c. y. dr.; dike completed to 700′, **10,** 1810.
1910–11. 86,144 c. y. dr., **11,** 1984.

PHYSICAL CHARACTERISTICS.

Description of, **99,** 2204.
The level of the Lake of the Woods controlled by a dam in Canadian territory at the outlet of the lake, the locality being known as Rat Portage, **99,** 2204.
Warroad R. for a short distance is a navigable tributary of the Lake of the Woods, from the American side, **01,** 2357.

PROJECTS.

Maj. Abbot recom., 1900, the retention of the remainder of the $3,000 orig. app. until enough funds would be provided by Congress to build a dr. and tender with suitable scows to do the dr., **00,** 2820.
Act June 13, 1902, provides for constr. of dr. and dr. in H. and R.; cost, $45,000,[2] **02,** 1682.
Act Mar. 3, 1905, provides for dr. a chan. 100′ w., 7′ d., with turning chan. for boats at inner H., **05,** 440.
Act June 25, 1910, provides for enlarging turning basin to be 900′ x 500′; cost, $5,700, $2,000 an. for mainten.,[3] **10,** 641.

SURVEYS.

Pre. sur., 1899, by Maj. Abbot, **99,** 2204.
Pre. ex. au. act June 6, 1900, of Warroad H. and R. **R.** by Maj. Abbot, June 21, 1900, with plan for imp.; cost, $45,000,[2] **01,** 451, 2356.
Pre. ex., with view to d. chan., au. act Mar. 3, 1909. **R.** by Maj. Shunk, Nov. 13, 1909, and Feb. 5, 1910, with plan for imp., at cost of $5,700,[3] **10,** 643.
Maps. (Photographs of dr., **04,** 2252), **05,** 1686; **06,** 1478; **11,** 1984.

* Allotment. [1] H. D. 396, 58th, 2d. [2] H. D.92, 65th, 2d. [3] H. D. 703, 61 st, 2d.

KK-212 ZIPPEL (river) BAY, MINN.

APPROPRIATIONS.

1911, $27,781, **11,** 1985.

COMMERCE.

There is no RR. near Zippel; imp. therefore has no effect on rates, **11,** 687.
In 1911, 420 t., **12,** 828.

ENGINEERS.

Chief of Engineers. R., 11, 688; **12,** 828.
In charge. Maj. F. R. Shunk, 1911–. **R., 11,** 1984; (Lt. Col.) **12,** 2190.
1st Lt. J. N. Hodges, **12,** 814.

OPERATIONS.

1910-11. 1,000 c. y. removed, **11,** 1985.
1911-12. 75,541 c. y. dr.; constr. of dike commenced, **12,** 2190.

PROJECTS.

Act Feb. 27, 1911, adopted proj. for chan. through bar separating H. from B., 10′ x 200′ at mean summer level of Lake of the Woods, and building a j. 2,800′ l. for protection of chan. and also to serve as break'r for outer anchorage area; est., $27,781,[1] **11,** 687.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Shunk, Nov. 18, 1909, and Oct. 13, 1910,[1] **11,** 688.
Maps.[1]

KK-213 RAINY LAKE AND RIVER, MINN.

ENGINEERS.

Chief of Engineers. R., 06, 483; **10,** 643; **12,** 831.

In charge:
Maj. G. McC. Derby, **06,** 470.
Maj. F. R. Shunk, **10,** 629; **12,** 814.

SURVEYS.

Pre. ex. of R. au. act Mar. 3, 1905. **R.** by Maj. Derby, Dec. 14, 1905[2] (unfav.), **06,** 483.

Pre. ex. of mouth of R. au. act Mar. 3, 1909. **R.** by Maj. Shunk, Sept. 8, 1909[3] (not advisable to imp. until cooperation of Dominion of Canada be secured), **10,** 643.
Pre. ex. of Rainy Lake, with view to locating points dangerous to navigation by reason of submerged rocks. **R.** by Maj. Shunk, Nov. 18, 1909[4] (unfav.), **10,** 643.
Pre. ex. and sur. au. act June 25, 1910, with view to removing obstr. in chan of R. at Rainier (**R.** to come), **12,** 831.

KK-218(a) BIG AND LITTLE FORK RIVERS, MINN.

ENGINEERS.

Chief of Engineers. R., 06, 483; **07,** 511.
In charge. Lt. Col. G. McC. Derby, 1906, **06,** 470; **07,** 496.

SURVEY.

Pre. ex. au. act Mar. 3, 1905; **R.** by Col. Derby, Oct. 31, 1906, unfav.,[5] **06,** 483; **07,** 511.

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[1] H. D. 1276, 61st, 3d.
[2] H. D. 431, 59th, 1st.
[3] H. D. 455, 61st, 2d.
[4] H. D. 723, 61st, 2d.
[5] H. D. 215, 59th, 2d.

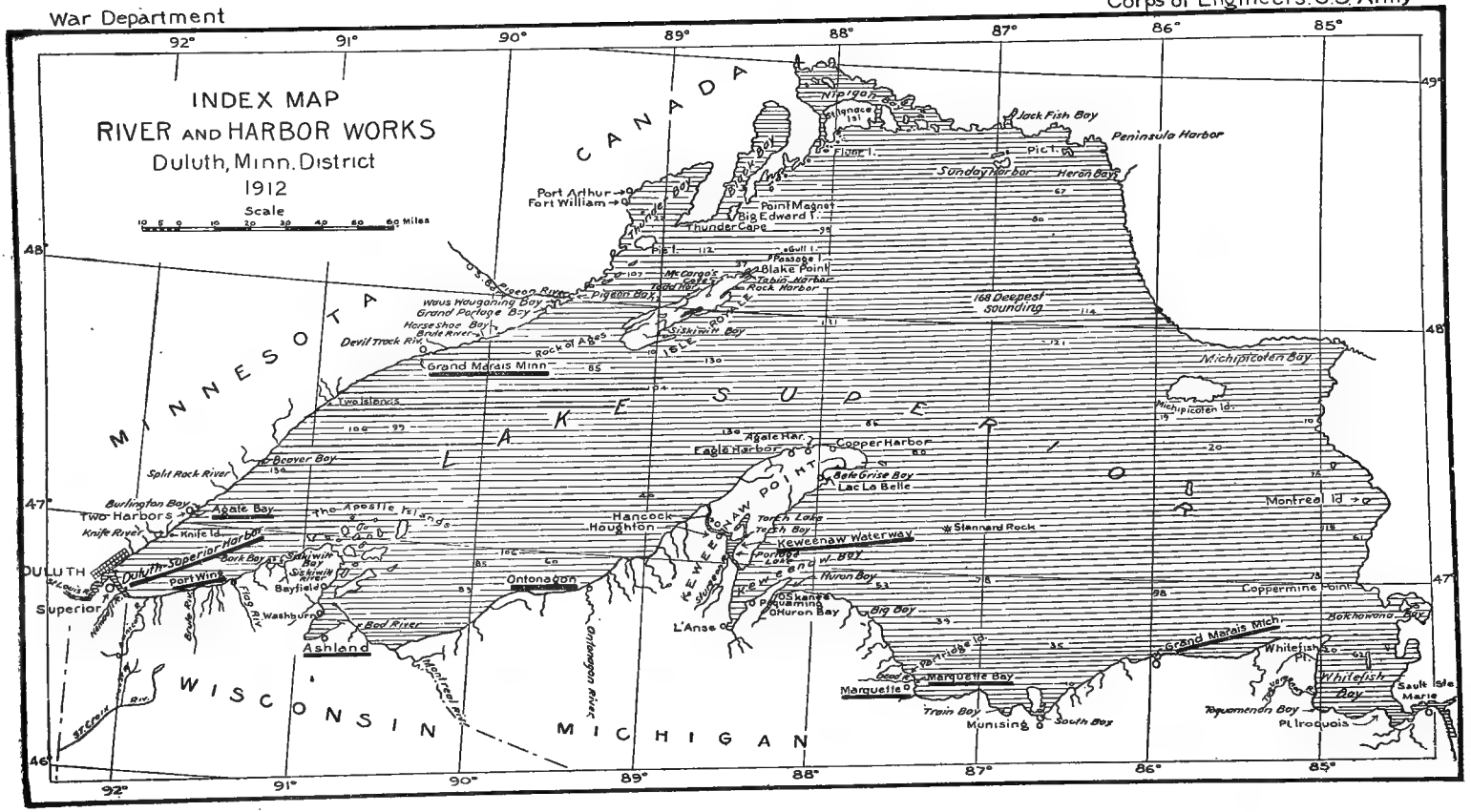
RIVER AND HARBOR WORKS.

GREAT LAKES SYSTEM.

LL.—DULUTH, MINN., DISTRICT.

War Department

Corps of Engineers. U.S. Army



LL.—DULUTH, MINN., DISTRICT.

In charge of U. S. Engineer Office,
Canal Park, Duluth, Minn.

LL 1 Lake Superior.
LL 2 Pigeon B., Minn. (1)
LL 3 Pigeon R., Minn. (2)
LL 4 Waus-wau-goining B., Minn. (1)
LL 5 Grand Portage B., Minn. (1)
LL 6 Horse Shoe B., Minn. (1)
LL 7 Brule R., Minn. (1)
LL 8 Devil Track R., Minn. (1)
LL 9 Grand Marais H., Minn. (1)
LL 10 Two Islds., Minn. (1)
LL 11 Beaver B., Minn. (1)
LL 12 Split Rock R., Minn. (1)
LL 13 Burlington B., Minn. (1)
LL 14 Agate B., Minn. (1)
LL 15 Two Harbors, Minn. (1)
LL 16 Knife R., Minn. (1)
LL 17 Knife Isld., Minn. (1)
LL 18 Duluth-Superior, Minn. and Wis. (1)
LL 19 St. Louis R., Minn. and Wis. (18)
LL 20 Cloquet R., Minn. (19)
LL 21 White Face R., Minn. (19)
LL 22 Floodwood R., Minn. (19)
LL 23 Nemadji R., Wis. (18)
LL 24 Brule R., Wis. (1)
LL 25 Flag R., Wis. (1)
LL 26 Port Wing, Wis. (1)
LL 27 Bark B., Wis. (1)
LL 28 Siskiwit B., Wis. (1)
LL 29 Siskiwit R., Wis. (28)
LL 30 Bayfield, Wis. (1)
LL 31 Washburn, Wis. (1)
LL 32 Ashland, Wis. (1)
LL 33 Bad R., Wis. (1)
LL 34 Montreal R., Wis. and Mich. (1)
LL 35 Ontonagon R., Mich. (1)
LL 36 Eagle H., Mich. (1)
LL 37 Agate H., Mich. (1)
LL 38 Copper H., Mich. (1)
LL 39 Bete Grise B., Mich. (1)
LL 40 Lac La Belle, Mich. (1)
LL 41 Keweenaw Waterway, Mich. (1)
LL 42 Portage Lake, Mich. (41)
LL 43 Torch B., Mich. (41)
LL 44 Torch Lake, Mich. (41)
LL 45 Sturgeon R., Mich. (41)
LL 46 L'Anse, Mich. (1)
LL 47 Pequaming, Mich. (1)
LL 48 Huron B., Mich. (1)
LL 49 Skanee, Mich. (48)
LL 50 Big B., Mich. (1)
LL 51 Partridge Isld., Mich. (1)
LL 52 Presque Isle, Mich. (1)
LL 53 Dead R., Mich. (1)
LL 54 Marquette, Mich. (1)
LL 55 Train B., Mich. (1)
LL 56 South B., Mich. (1)
LL 57 Munising, Mich. (1)
LL 58 Grand Marais, Mich. (1)
LL 59 Taquamenon B., Mich. (1)
LL 60 Taquamenon R., Mich (1)

List returns here, back to waterways, etc., on Isle Royal, near Pigeon B. (2)

LL 61 Rock H., Mich. (1)
LL 62 Tobin H., Mich. (1)
LL 63 McCargoe Cove, Mich. (1)
LL 64 Todd H., Mich. (1)
LL 65 Washington H., Mich. (1)
LL 66 Siskiwit B., Mich. (1)

LL-1(a) LAKE SUPERIOR. (Harbors of refuge on north shore.)

ENGINEERS.

Chief of Engineers. **R., 08,** 647.
In charge. Maj. G. D. Fitch, **08,** 626.

SURVEY.

Pre. ex. au. act Mar. 2, 1907, for locating Hs. of refuge on n. shore. **R.,** Maj. Fitch, Oct. 17, 1907 (unfav.) (H. D. 450, 60th, 1st), **08,** 647.

LL-5 GRAND PORTAGE AND WANS-WAU-GOISING BAY (Waus-wau-goining), MINN. (Harbor of refuge.)

ENGINEERS.

Chief of Engineers. **R., 81,** 247; **82,** 266.
In charge. Capt. C. J. Allen. **R., 82,** 2110.

PHYSICAL CHARACTERISTICS.

Locality described, **82,** 2110.

PROJECTS.

In 1882 Capt. Allen est. a H. of refuge at Grand Portage B. would cost $111,677, and at Wans-wau-goising B. $91,807, **82,** 2111.

SURVEYS.

Ex. au. act Mar. 3, 1881; made by Capt. Allen (**R.** unfav.), **82,** 2110.

LL-9 GRAND MARAIS HARBOR, MINN.

APPROPRIATIONS.

1879,	$10,000,	**79,** 150.
1880,	10,000,	**80,** 1883.
1881,	20,000,	**81,** 2031.
1882,	20,000,	**82,** 2107.
1884,	10,000,	**85,** 1950.
1886,	10,000,	**86,** 1638.
1888,	15,000,	**88,** 1815.
1890,	22,350,	**91,** 2284.
1892,	10,000,	**92,** 2122.
1894,	3,000,	**95,** 2528.
1896,	3,000,	**96,** 2335.
1899,	30,000,	**99,** 2606.
1902,	2,000,	**02,** 2002.
1905,	2,000,	**05,** 1968.
1907,	5,000,	**07,** 1824.
1910,	2,000,	**10,** 2050.
Total,	174,350	

COMMERCE.

Object of imp. to make a H. of refuge, **75,** 184.

Importance of locality as a H. of refuge, **88,** 1814; **90,** 2282; **98,** 2218.

In 1893 C. small, but at that time and in subsequent years the place was considered as a probable future shipping point for the large deposits of minerals in the back country, **93,** 2651; **98,** 2217.

In 1895, 913 t., valued at $91,300, **96,** 2334.

Increasing, **01,** 506; **05,** 509; **06,** 559; **11,** 788, 2254.

Increase in population and business of village of Grand Marais, **04,** 2744; **05,** 1968.

No RRs. running to H., so no comparison of rates by rail and water can be made. Existing C. could not have been carried on under conditions existing before imp., **06,** 559.

Not large, **12,** 2447.

H. of use to C. by reason of refuge it affords, **12,** 945.

In 1878, valued at $6,000; 1911, $175,000, the increase being due to imp. by US., **12,** 945.

CONTRACTS.

1879. Williams & Upham, dr., 28¢ c. y., **80,** 1883.

1881. C. M. Wilson, break'r constr., **81,** 2032.

1882. Williams & Upham, dr., 30¢ c. y., **83,** 1625. C. P. Macdougall, break'r constr., **83,** 1626.

1884. Williams & Upham, dr., 25¢ c. y., **85,** 1950.

1886. Williams & Upham, dr., 24¾¢ c. y., **87,** 1956.

1888. Williams, Upham & Co., dr., 24¢ c. y., **89,** 1997.

1890. Williams, Daugherty & Upham, dr., 20¢ c. y., **91,** 2485.

1892. Williams, Daugherty & Upham, dr. 39,000 c. y., 23¢ c. y., **93,** 2653.

1895. Same firm, dr., 20¢ c. y., **95,** 2529.

1897. R. Smith, dr., 17½¢ c. y., **97,** 2587.

1900. Butler-Ryan Co., break'r constr. (embankment, cribs, st. filling, etc.), $28,982.60, **00,** 3549.

ENGINEERS.

Chief of Engineers. R., 75, 40; **79,** 150; **80,** 201; **81,** 270; **82,** 265; **83,** 274; **84,** 273; **85,** 295; **86,** 289; **87,** 255; **88,** 232; **89,** 267; **90,** 241; **91,** 310; **92,** 296; **93,** 336; **94,** 308; **95,** 343; **96,** 300; **97,** 385; **98,** 378; **99,** 448; **00,** 513; **01,** 505; **02,** 429; **03,** 464; **04,** 503, 518; **05,** 508; **06,** 558; **07,** 584; **08,** 626, 648; **09,** 658; **10,** 731; **11,** 787; **12,** 943.

Boards. BERH. reviewed **R.** on pre. ex., 1903, to ascertain necessity for making any change in, or addition to, c. p. **R.,** Apr. 9, 1903, concurs in opinion of DO. and DE. (see Surveys), **04,** 2786.

In charge:

Maj. F. U. Farquhar, 1874–75. **R., 75,** 184.

Capt. C. J. Allen, 1879–86. **R., 79,** 1475; (Maj.) **80,** 1882; **81,** 2029; **82,** 2106; **83,** 1624; **84,** 1822; **85,** 1949; **86,** 1637.

Capt. J. B. Quinn, 1886–91. **R., 87,** 1954; (Maj.) **88,** 1814; **89,** 1996; **90,** 2282.

Capt. W. L. Fisk, 1891–92. **R., 91,** 2484; **92,** 2121.

Maj. C. B. Sears, 1893–1901. **R., 93,** 2651; **94,** 2009; **95,** 2528; **96,** 2333; **97,** 2585; **98,** 2217; **99,** 2605; **00,** 3547.

Maj. D. W. Lockwood (temp.), **01,** 505.

Capt. D. D. Gaillard, 1901–03. **R., 01,** 2821; **02,** 2001.

Maj. L. H. Beach, 1903. **R., 03,** 1791.

Capt. C. L. Potter, 1903–06. **R., 04,** 2743; (Maj.) **05,** 1967; **06,** 1693.

Maj. G. D. Fitch, 1906–11. **R., 07,** 1823; **08,** 1893; (Lt. Col.) **09,** 1899; **10,** 2049.

Maj. F. R. Shunk. **R., 11,** 2253; **12,** 2447.

OPERATIONS.

1879-80. 19,199 c. y. dr., **80,** 1883.

1880-81. 16,666 c. y. dr., **81,** 2030.

1881-82. Mayhew Pt. break'r built, **82,** 2107.

1882-83. Shore connection and bulkhead crib nearly finished, **83,** 1624.

1883-84. Work on break'r continued; 16,667 c. y. dr., **84,** 1822.

1884-85. 31,625 c. y. dr.; repairs and filling to break'r, **85,** 1949.

1886-87. Dr. resumed, **87,** 1956.

1887-88. Dr. in anchorage area continued, **88,** 1814.

1888-89. 14,572 c. y. dr., **89,** 1996.

1889-90. 47,927 c. y. dr., **90,** 2282.

1890-91. Repairs to break'r, **91,** 2484.

1891-92. 70,851 c. y. dr.; repairs to break'r, **92,** 2122.

1893-94. About 39,131 c. y. dr., **94,** 2010.

1895-96. About 15,000 c. y. dr., **96,** 2335.

1896-97. About 16,000 c. y. dr., **97,** 2586.

1899-00. Break'r constr. under way, **00,** 3548.

1900-01. Break'r constr. in progress, **01,** 2822.

1901-02. Break'r completed, **02,** 2002.

1903-04. Repairs to break'r after damage by storm, **04,** 2744.

1906-07. Minor repairs c. break'r, **07,** 1823.

1909-10. Minor repairs, **10,** 2049.

1910-11. Minor repairs, **11,** 2253.

PHYSICAL CHARACTERISTICS.

Description of, **75,** 184; **86,** 1637. The only H. of refuge on the n. shore of Lake Superior bet. Agate B. and the international boundary line; 110 m. ne. from Duluth, a natural B., ¼ m. x ½ m.; area, 61 acres, **93,** 2651; **98,** 2217; **12,** 943.

Damage to works by storms, **01,** 2822; **04,** 2744; **06,** 1693; **10,** 2050.

Condition of work, d. of water, etc., **01,** 2822; **03,** 1792; **04,** 503; **05,** 509; **10,** 731, 2050; **11,** 788, 2254.

Damage to works by vessels, **11,** 2253.

Decay of timber, and damage to facing timber by ice, **12,** 2447.

Min. d., 1911, 15′, **12,** 944.

PRIVATE WORK.

Damage to w. break'r by steamer in 1910, repaired by owners of vessel, **11,** 2254.

PROJECTS.

By Maj. Farquhar, 1875, dr., within and bounded by Mayhews Pt. and the inner shore line, and constr. of timber and st. break'r to narrow the entrance and afford shelter for vessels; est., $139,669.40, **75,** 184; **79,** 150; **80,** 1882, 1883; **86,** 290.

In 1887, Capt. Quinn proposed extension of the dr. area and of the break'r, **87,** 1954.

From 1887 to 1888 operations were conducted under Maj. Quinn's proj. of 1887, for an extension of the dr. area and the break'r; est. (incl. cost of orig. proj.), $254,444, **87,** 1954; **88,** 1814.

In 1889, Maj. Farquhar's proj. of 1875 was substituted, **75,** 184; **79,** 150; **80,** 1882, 1883; **86,** 290; **89,** 1996; **92,** 2122.

By Capt. Fisk, 1892, for expending app. of 1892 ($10,000) in increasing the 16′ area by dr., **93,** 2652.

Maj. Sears, 1899, proposed applying app. of 1899 to constr. of 350′ of break'r from w. pt. under the existing proj., **99,** 2606.

Proj. 1912 understood to cover 2 break'r ps., each 350′, from e. and w. points of B., or 1 p., 700′, from e. point, and dr. an anchorage area of 26± acres to 16′; est., $163,954.63, **12,** 944.

SURVEYS.

By Maj. Farquhar, **75,** 40, 184.

Pre. ex. to ascertain necessity of making any change in, or addition to, e. p., au. act June 13, 1902. **R.,** Capt. Gaillard, Jan. 17, 1903 (unfav.) (H. D. 213, 58th, 2d), **04,** 504, 518, 2783.

Pre. ex., with plan and est. of cost of imp. for rebuilding entrance ps. and enlarging basin, au. act Mar. 2, 1907. **Rs.** (fav.), Oct. 16 and Nov. 23, 1907, and Jan. 4, 1908; est., $70,416 (H. D. 939, 60th, 1st), **08,** 648.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 944.

Maps. (H. D. 939, 60th, 1st.) **81,** 2032; **85,** 1950; **87,** 1954; **90,** 2282; **03,** 1792.

LL-9(b) GRAND MARAIS, MICH. (Harbor of refuge.)

APPROPRIATIONS.

1880,	$10,000.00,	**80,** 1902.
1881,	20,000.00,	**81,** 2038.
1882,	40,000.00,	**82,** 2117.
1884,	35,000.00,	**84,** 1832.
1886,	26,250.00,	**86,** 1649.
1888,	50,000.00,	**88,** 1834.
1890,	50,000.00,	**91,** 2510.
1892,	30,000.00,	**92,** 2147.
1894,	20,000.00,	**95,** 2578.
1896,	24,000.00,	**96,** 2388.
1899,	25,000.00,	**99,** 2721.
1901,	*348.32,	**01,** 2882.
1902,	70,000.00,	**02,** 2040.
1904,	*5,000.00,	**04,** 2780.
1905,	50,000.00,	**05,** 2010.
1907,	30,000.00,	**07,** 1865.
1910,	40,000.00,	**10,** 2093.
1911,	10,000.00,	**11,** 2297.

Total, 535,598.32 (incl. misc., $535,723.32, **12,** 2484).

COMMERCE.

Imp. to afford H. of refuge bet. White Fish Pt. and Grand Isld. H., 90 m., **71,** 129, 130. One of great cost unwarrantable, **71,** 130.

Necessity for H. of refuge, **81,** 2043.

The importance of the place increasing, **93,** 2689; **94,** 2038; **95,** 2577; **96,** 2387; **97,** 2641; **98,** 2286.

RR. connections made with the H., **94,** 2038; **95,** 2577; **96,** 2390.

In 1897, 807 vessels entered and departed, with a total t. of 142,536 t., **98,** 2286; 1,910 t., 1887; 116,050 t., 1898 (in 1892, 310 vessels entered and departed; 1899, 864), **00,** 3611.

Effect of proj. on rates, **06,** 579; **08,** 646; **11,** 812.

Max. development reached, 1907. Decrease since then due to exhaustion of pine-timber supply. H. useful as a refuge, and should be maintained by periodical dr., **10,** 755, 2092; **11,** 812, 2297; 1911, 13,600 t., a decrease under 1910 of 30%, **12,** 2485.

CONTRACTS.

1882. C. S. Barker, labor and material for p. constr. and for dr., 25¢ c. y., **83,** 1636.

1884. J. H. Gillett, superstr. and p. extension, **85,** 1974.

1886. C. Southerland, p. extension, **87,** 1999.

1888. M. H. Fitzpatrick, dr., 19½¢ c. y., **89,** 2025.

1889. Powell & Mitchell, superstr. constr., $24,928, **89,** 2025.

1890. H. Steele, repairs to p. work, $1,500; C. S. Barker, dr., 17¢ c. y., **91,** 2511.

1892. Powell & Mitchell, p. extension (mattresses, st., etc.), $34,680.50, **93,** 2691.

1895. W. H. Holden, pile-dike constr.; piles, 10¾¢ l. f.; timber, incl. ironwork, etc., $28 1,000 b.m., **95,** 2578. Contractor failed after completing a large part of the work, **96,** 2387.

1896. G. Taylor, building pile dike, $4,733.16. Failed, **96,** 2389. F. L. McDonald, same work, $5,761.88. Failed, **96,** 2389; **97,** 2640.

1897. A. & D. Sang, p. extension; mattress and st. foundation work, $49.98 l. f.; st. for extra riprapping, $8 cord in place, **97,** 2642.

1899. W. C. Davidson, p. repairs; some informal contracts, **99,** 2721.

1900. Powell & Mitchell, p. repairs, **00,** 3612.

1903. Powell & Mitchell, extending, completing, and riprapping ps. (prices given), **03,** 1826.

1904. Lake Superior Contracting & Dredging Co., dr. 40,000 c. y., 17¢ c. y., s. m., **04,** 2781. Hugh Steele, riprap repairs to dike, 6,976 t., $1.94 t., **05,** 2008.

1905. Powell & Mitchell, repairs to dike (prices given), **06,** 1728.

1908. Lake Erie Dredging Co., dr. bet. ps., 18¾¢ c. y., **09,** 1939.

1910. Edward Bros. Dredge Co., dr., 22¢ c. y.—total about $10,000; Barney & Wigman, r. filling in ps., $2 c. y. in place—total about $1,000, **10,** 2093.

1911. Great Lakes Dredge & Dock Co., riprap for repairs, $2.25 t., **12,** 2484.

1912. Edward Bros. Dredge Co., dr. about $18,000 worth of shoals from entrance to H., 25¢ c. y., **12,** 2484.

ENGINEERS.

Chief of Engineers. **R., 71,** 37; **80,** 203; **81,** 273, 2053; **82,** 267; **83,** 276; **84,** 275; **85,** 298; **86,** 292; **87,** 258; **88,** 235; **89,** 273; **90,** 246; **91,** 316; **92,** 301; **93,** 343; **94,** 314; **95,** 351; **96,** 307; **97,** 392; **98,** 384; **99,** 455; **00,** 520; **01,** 513; **02,** 438; **03,** 474; **04,** 516; **05,** 523; **06,** 577; **07,** 602; **08,** 645; **09,** 681; **10,** 754; **11,** 811; **12,** 971.

Boards. Convened, Marquette, Mich., July 18, 1881, by S. O. No. 14, to **R.** upon a plan for H. of refuge near Grand Marais, Mich. **R., 81,** 2050. (Lt. Col. Comstock and Majs. Weitzel and Robert.)

In charge:

Maj. D. C. Houston. **R., 71,** 129, 130.

Lt. Col. H. M. Robert, 1880–83. **R., 80,** 1902; **81,** 2038; **82,** 2117.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1635.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1831; **85,** 1973.

Capt. C. E. L. B. Davis, 1886–89. **R., 86,** 1646; **87,** 1999; (Maj.) **88,** 1832.

Maj. J. B. Quinn, 1889–91. **R., 89,** 2023; **90,** 2303.

Capt. W. L. Fisk, 1891–92. **R., 91,** 2509; **92,** 2145.

Maj. C. B. Sears, 1893–1901. **R., 93,** 2689; **94,** 2037; **95,** 2576; **96,** 2386; **97,** 2640; **98,** 2285; **99,** 2719; **00,** 3610.

Maj. D. W. Lockwood (temp.), **01,** 505.

Capt. D. D. Gaillard, 1901–03. **R., 01,** 2880; **02,** 2040.

Maj. L. H. Beach, 1903. **R., 03,** 1824.

Capt. C. L. Potter, 1903–06. **R., 04,** 2779; (Maj.) **05,** 2008; **06,** 1727.

Maj. Graham D. Fitch, 1906–11. **R., 07,** 1863; **08,** 1936; **09,** 1937; **10,** 2091.

Maj. F. R. Shunk, 1911–. **R., 11,** 2296; (Lt. Col.) **12,** 2483.

Assistant. L. Y. Schermerhorn. **R., 81,** 2041, 2049.

* Allotment.

ESTIMATES. (See Plans and Projects.)

By Maj. D. C. Houston: (1) ps. to 18′ and dr. of chan., $481,525, **71,** 37, 129; (2) modification of first 2 parallel ps. and dr., $291,930, **71,** 37, 130; (3) new chan. and ps., $167,707.04, **71,** 37, 131.

OPERATIONS.

1882-83. 26 cribs built and 5 sunk; 19,029 c. y. dr.; constr. of inspector's house completed, **83,** 1635.

1883-84. 9 cribs sunk in extension of w. p.; constr. of e. p. begun by sinking 600 l. f. of crib-work; entire work riprapped and decked; 13,075 c. y. dr.; breach through sand spit closed with brush and st., **84,** 1831.

1884-85. 400 l. f. superstr. completed and w. p. extended 50′, **85,** 1973.

1885-86. W. p. extended 250 l. f. and e. p. 150′; 100 l. f. superstr. on w. p. completed; 200 l. f. pile p. constr. by hired labor, **86,** 1647.

1886-87. Preparations for extension of w. p.; 200 l. f. of w. p. repaired; total amount of work accomplished, **87,** 1999, 2000.

1887-88. W. crib p. extended 200′, by sinking 4 cribs, **88,** 1833.

1889-90. 75,392 c. y. dr., **90,** 2303.

1890-91. Repairs to p. work and dr., **91,** 2509.

1891-92. Chan. 175′ w. with a least d. of 17′ dr. bet. ps., **92,** 2146.

1892-94. E. p. extended 300 l. f., **93,** 2690; **94,** 2037.

1895-96. About 4,000 l. f. of dike built, **96,** 2387.

1896-97. About 1,000 l. f. of dike built, **97,** 2640, 2641.

1897-98. About 300 l. f. of dike built and 250 l. f. of w. p. extended, **98,** 2286.

1900. P. repairs and extension of e. p. 200′ in progress, **00,** 3611.

1900-01. Repairs to w. p., **01,** 2881.

1902-03. Extension of ps. and completion of superstr. of e. p., **03,** 1825.

1903-04. P. extension completed; repairs to ps.; 10,133 c. y. dr. under contract, **04,** 2779.

1904-05. 33,233 c. y. dr.; pile dike repaired with riprap, **05,** 2008.

1905-06. Repairs to 3,600′ of dike in progress, **06,** 1727.

1906-07. Dike repairs completed, **07,** 1864.

1907-08. Minor repairs to e. p.; trees planted bet. sand fences, **08,** 1937.

1908-09. 98,929 c. y. dr. under contract; repairs to ps.; sand fences w. of w. p. lengthened, **09,** 1937–38.

1909-10. 50,487 c. y. dr. from bar at entrance; repairs to ps.; extension of sand fences, **10,** 2091–92.

1910-11. Repairs to e. p., **11,** 2296.

1911-12. 37,775 c. y. dr.; riprap placed at end of w. p.; embankment built up to 10′ from water surface; empty pockets of w. p. refilled with riprap, **12,** 2483–84.

PHYSICAL CHARACTERISTICS.

Variation of position of chan., **71,** 132.

Nw. winds the most prevalent, **71,** 132.

Description of, **71,** 129, 132; **93,** 2689; **94,** 2037.

The H. slowly filling up with sand rolled in by the waves through the interval bet. the e. p. and the e. shore, **95,** 2577.

Bar formation, **96,** 2386; **97,** 2640.

Severe storms and ice formation damaging works constr., **96,** 2387; **97,** 2640; **98,** 2286.

Pile dike completed 1897 being gradually strengthened by sand accumulations, **00,** 3611.

Continued advance of lake shore w. of entrance. Pile dike across natural entrance to H. arresting to great extent movement of sand into H.; still some movement of sand through dike, **03,** 1825.

Dike damaged by ice, **04,** 2780.

Further advance lakeward of 22′ curve, **05,** 2009; **09,** 1938.

Damage to w. p. by ice, **10,** 2092.

H. on s. shore of Lake Superior, 313 m. e. of Duluth and 90 m. w. of Sault Ste. Marie. It is a d. w. B., well protected from storms, 18–57′ x ⅜ m. x 1½ m., **12,** 971.

PLANS. (See Estimates and Projects.)

By Maj. Houston: (1) 2 converging ps. to 18′ at the entrance; dr. of chan., **71,** 37, 139; (2) modification of first 2 parallel ps. 600′ apart, location and dr. similar to first, **71,** 37, 130; (3) to open a chan. w. of entrance and to protect it by 2 parallel ps. 300′ apart, **71,** 131; (4) single p., **71,** 130.

By Lt. Col. Robert, 1881: (1) Artificial entrance, by cutting through the w. spit near its w. extremity; est., $425,535, $502,425, $508,887, $511,445; (2) imp. of natural entrance; est., $561,506, $625,526, $603,020, $667,040, $595,034, $659,054, $661,980, $726,000, **81,** 2045, 2046, 2047, 2048.

PRIVATE WORK.

Chan. dr., 1884, d. by private enterprise, **84,** 1831.

PROJECTS. (See Estimates and Plans.)

By BE., 1881, forming H. of refuge, Grand Marais, Mich., by providing access to the B. through 2 parallel ps., 1,550′ and 1,900′, resp., with a dr. chan. bet. them of 20′ x 500′ at its lake end, and 18′ x 300′ at its H. end; est., $450,000, **81,** 2053; **87,** 1999; **91,** 2510.

By Maj. Sears, amending existing proj., to provide close-pile dike across the interval bet. the e. p. and the e. shore; total est., $484,000, **95,** 2577; **12,** 971.

By Maj. Sears, 1899, expend. app. 1899 in extending e. p., and in extensive repairing of old ps., **99,** 2720.

Maj. Potter est., 1905, that owing to advance of 22′ curve lakeward 400′–500′ since proj. to extend ps. out to 22′ was au. would require an addition of 360′ to w. p.; est., $40,320—and of 704′ to e. p.; est., $78,848; or about $36,000 more than orig. est. As sand movement is generally from w. to e., w. p. should be extended first, when full extension of e. p. may be found unnecessary, **05,** 2009.

Est. for extending ps. to 22′ revised, 1907, by Maj. Fitch, to $43,200 for w. p., and $84,480 for e. p., or about $44,512 more than orig. est., **07,** 1864.

Lt. Col. Fitch est., 1909, that to extend ps. to 22′ would require l. w. p. 450′; est., $54,000—and e. p. 794′; est., $95,280; or total of $149,280, exceeding orig. est. by about $103,879. The 22′ curve has advanced lakeward 500′–600′ since proj. was au., **09,** 1938.

SURVEYS.

Ex. au. act Mar. 3, 1871; made by Maj. Houston. Agreement of ex. with result of Lake Sur., **71,** 37, 129, 131.

Made, 1880, by Col. Robert, **81,** 2039.

Minor sur., **93,** 2689; **94,** 2037; **95,** 2577; **03,** 1826.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 972.

Maps. **81,** 2040; **88,** 1834; **89,** 2024; **90,** 2304; **92,** atlas, 101; **03,** 1826; photographs, **10,** 2092.

LL-10 TWO ISLANDS (Saxton), MINN.

COMMERCE.

Unimportant, 1899, **00,** 3629.

ENGINEERS.

Chief of Engineers. R., 00, 521.

In charge. Maj. C. B. Sears, 1899–1900. **R., 00,** 3629.

PHYSICAL CHARACTERISTICS.

Description of. "A location with a name but without a habitation." On the n. shore of Lake Superior, about 31 m. from Grand Marais, Minn. Name due to 2 islds., bet. which and the shore is an area of 80 acres, **00,** 3629.

SURVEY.

Ex. for H. of refuge au. act Mar. 3, 1899; made by Maj. Sears, 1899 (**R.** unfav.), **00,** 3629.

LL-11 BEAVER BAY, MINN. (Harbor of refuge.)

ENGINEERS.

Chief of Engineers. **R., 81,** 247; **82,** 266; **08,** 647.

In charge. Capt. C. J. Allen, 1878–86. **R., 82,** 2108.

Assistant. S. L. Bayless, **82,** 2109.

PLANS.

For 2 crib break'rs, 1,450 l. f. in l.; est., $150,000, **82,** 2109.

SURVEYS.

Au. act Mar. 3, 1881; made, 1881, by Capt. Allen, **82,** 2108.

Pre. ex. and sur. of n. shore of Lake Superior for Hs. of refuge, incl. Beaver B., au. act Mar. 2, 1907; made, 1907 (**R.** unfav.) (H. D. 450, 60th, 1st), **08,** 647.

LL-12 SPLIT ROCK RIVER, MINN. (Bay at mouth of.)

ENGINEERS.

Chief of Engineers. **R., 04,** 518, 2800.

Boards. BERH. reports that it is not advisable to undertake constr. of H., **04,** 2802.

In charge:
Capt. D. D. Gaillard, 1903–04. **R., 04,** 2800.
Capt. C. L. Potter, **04,** 503.

SURVEY.

Pre. ex. au. act June 13, 1902, with view to constr. H., **04,** 518. **R.** by Capt. Gaillard, Jan. 16, 1903 (H. D. 170, 58th, 2d) (unfav.), **04,** 2800.

LL-13 BURLINGTON BAY, MINN.

COMMERCE.

Duluth & Iron Range RR. Co.'s business taxes capacity of adjacent H. (see Physical characteristics), **01,** 2893.

ENGINEERS.

Chief of Engineers. **R., 01,** 514.

In charge. Maj. C. B. Sears, 1901. **R., 01,** 2890, 2898.

Assistants:
J. H. Darling. **R., 01,** 2892, 2899.
M. W. Lewis. **R., 01,** 2905.

PHYSICAL CHARACTERISTICS.

Details, winds, etc., **01,** 2892, 2901.

B. one of 2 Bs. at Two Harbors, Minn., the other being Agate B. (q. v.), **01,** 2890.

PLANS.

Details of proposed break'r, **01,** 2902.

SURVEY.

Pre. ex. and sur. au. act June 6, 1900; **Rs.** by Maj. Sears, Aug. 13 and Nov. 10, 1900; est., $435,000 for break'r. As imp., though desirable, would benefit only one corporation, considered inadvisable by Div. Engr. Col. J. W. Barlow for U.S. to undertake work (H. D. 114, 56th, 2d), **01,** 514, 2889, 2891.

LL-14 AGATE BAY HARBOR, MINN.

APPROPRIATIONS.

1886,	$22,500.00,	**87,** 1952.
1888,	15,000.00,	**88,** 1813.
1890,	25,000.00,	**90,** 2284.
1892,	30,000.00,	**92,** 2125.
1894,	30,000.00,	**95,** 2531.
1896,	50,000.00,	**96,** 2337.
1899,	71,708.00,	**99,** 2609.
1902,	2,000.00,	**02,** 2004, 2005.
1905	2,000.00,	**05,** 1970.
	66.19 (misc.),	**05,** 1970.
1906,	*500.00,	**06,** 1695.
1907,	4,000.00,	**07,** 1826.
1908,	*4,078.69,	**08,** 1895.
1910,	2,000.00,	**10,** 2052.
1911,	2,000.00,	**11,** 2256.
Total,	260,852.88 ($260,786.69,	**12,** 2449).

COMMERCE.

Necessity for imp., **85,** 1955–1958.

Description of; increasing every year, large shipments of ore, **93,** 2654; **98,** 2221.

Value of cargo t. for 14 years ending 1899, est. at $40,000,000, **00,** 3552.

Saving in cost of transportation by water as compared with that by rail, $1.79 to $1.90 per t. Imp. indispensable aid to C., **06,** 560; **11,** 790; **12,** 947.

Value of, compared with expend. of the U.S., **09,** 660.

CONTRACTS.

1887. Steele Bros. & Co., 400 l. f. of break'r constr., **87,** 1953.

1888. Thomas Dwyer, timber break'r constr., $12,449, **89,** 1999.

* Allotment.

1891. Campbell & McDonald, constr. of 200 l. f. of break'r, $23,400, **91,** 2487.
1892. Powell & Mitchell, crib break'r constr., $42,052.50, **93,** 2656.
1894. McCurdy & McCurdy, riprap work, $50.20 l. f., **95,** 2532.
1896. S. Meniece, riprapping p., $12.50 and $35 l. f., **96,** 2338.
1897. Porter Bros., riprapping embankment, $63.17 l. f.; S. Meniece, break'r repairs (timber, st., etc.), $1,138.75, **97,** 2591.
1898. King & Steele, break'r extension (timber, st., etc.), $15,300, **98,** 2222.
1899. Engle & Osman, 313 l. f. riprap embankment, $26,520.49, **99,** 2609.
1900. Powell & Mitchell, break'r extension (cribs, st. filling, etc.), $36,135.50, **00,** 3552.
1900. Powell & Mitchell, p. extensions. Cribs 18½' x 24', $55.30 l. f.; cribs 18½' x 30', $67.55 l. f.; superstr. 6' x 24', $20 l. f.; superstr. 10' x 30', $37.70 l. f., **01,** 2826.
1906. Sang & Preston, repairing damage to e. break'r, **06,** 1695.
1907. J. W. Preston, repairs to e. break'r at 2 points, **07,** 1825.

ENGINEERS.

Chief of Engineers. R., 85, 296; **87,** 255; **88,** 231; **89,** 268; **90,** 241; **91,** 311; **92,** 296; **93,** 336; **94,** 308; **95,** 344; **96,** 301; **97,** 386; **98,** 378; **99,** 449; **00,** 513; **01,** 506; **02,** 429; **03,** 465; **04,** 504; **05,** 509; **06,** 560; **07,** 585; **08,** 628; **09,** 660; **10,** 732; **11,** 789; **12,** 945.

In charge:
Maj. C. J. Allen, 1885. **R., 85,** 1954, 1955.
Capt. J. B. Quinn, 1886–87. **R., 87,** 1951.
Maj. J. B. Quinn, 1888–1892. **R., 88,** 1812; **89,** 1998; **90,** 2283; **91,** 2486.
Capt. W. L. Fisk, 1892. **R., 92,** 2123.
Maj. C. B. Sears, 1893–1901. **R., 93,** 2654; **94,** 2011; **95,** 2530; **96,** 2336; **97,** 2588; **98,** 2220; **99,** 2608; **00,** 3551.
Capt. D. D. Gaillard, 1901–02. **R., 01,** 2824; **02,** 2003.
Maj. Lansing H. Beach, 1903. **R., 03,** 1793.
Capt. Chas. L. Potter, 1904–06. **R., 04,** 2745; **05,** 1969; **06,** 1694.
Maj. Graham D. Fitch, 1907–10. **R., 07,** 1825; **08,** 1895; (Lt. Col.) **09,** 1901; **10,** 2051.
Maj. F. R. Shunk, 1911–. **R., 11,** 2255; (Lt. Col.) **12,** 2449.

Assistants:
R. Hunt. **R., 85,** 1957.
J. P. Parkinson. **R., 85,** 1954.

LEGAL PROCEEDINGS.

After 4 trials the U. S. Court of Appeals affirmed verdict against Davidson Steamship Co., awarding $4,012.50 for damage by SS. *Shenandoah* to e. p.; U. S. Supreme Court decided in favor of U. S., **02,** 2003; **03,** 1793; **04,** 2746; **05,** 1969; **06,** 1695; **07,** 1825; **08,** 1895.

OPERATIONS.

1886-87. Preparations for break'r extension, **87,** 1952.
1887-88. 400 l. f. e. break'r built, **88,** 1812.
1888-89. Break'r extension continued, **89,** 1998.
1889-90. 150 l. f. e. break'r built, **90,** 2284.
1890-91. Extension e. break'r continued, **91,** 2486.
1891-92. Break'r extension continued, **92,** 2124.
1892-94. W. p. extended 200 l. f., **93,** 2655; **94,** 2012.
1894-97. 300 l. f. riprapping done, and in progress, **95,** 2531; **96,** 2337; **97,** 2589; and e. break'r repaired, **97,** 2589.
1897-98. About 400 l. f. riprapping done in connection with preceding year, and extension of w. p. in progress, **98,** 2220, 2221.
1898-99. Extension of w. p. completed; embankment extension of e. p. in progress, **99,** 2608.
1899-00. P. extensions in progress, **00,** 3551.
1900-01. W. p. completed to 900'; 183' r. embankment of e. p. built, completing embankment for this p.; extension of e. p. still in progress; 4 cribs sunk, **01,** 2825.
1901-02. Proj. completed Nov. 1, 1901, **02,** 430, 2004.
1905-06. Greater part of damage to e. break'r by storm of Nov., 1905, repaired, at cost of $3,046, **06,** 1695.
1906-07. Repairs to e. break'r completed, and repairs also made at 2 points on break'r at cost of $1,644.11 for latter, **07,** 1825.
1909-10. Repairs of damage by collision to superstr. of w. break'r made by hired labor and purchase of materials, at cost of $993.05, and repairs to its outer wall of timber, damaged by ice, made by same method, at cost of $2,091.01, **10,** 2051, 2052.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 1812; **90,** 2283; **93,** 2654; **98,** 2220; **12,** 944.
Description of Bs., **85,** 1954; **87,** 1951. Direction of winds from, 1873–1883, **85,** 1959.
Semicircular H. of 2,000' radius, 27 m. e. of Duluth, a large part of good navigable d., **93,** 2654; **94,** 2011; **95,** 2530.
Variation of water level extends from 0 to about +1' above l. w. datum; d. at entrance 50', thence 20' to ore ps., **02,** 430.
D., 50' at entrance. Vessels drawing 20' can reach docks, **11,** 789.

PLANS.

By Maj. Allen, 1885, for break'r, Agate B., 1,200' l., and in Burlington B. 1,100' l., with d. of areas behind break'rs by dr.; est., $370,000, **85,** 1956.

PRIVATE (CORPORATE) WORK.

Under license by Sec. of War, Duluth & Iron Range RR. Co. completed new coal dock and pulp-wood dock in e. H., **06,** 1695; **07,** 1825; began constr. of ore dock with steel superstr., first one in US. of that material, **08,** 1895; tore down iron-ore dock No. 1 and built foundation for new dock, **11,** 2256. Reconstr. completed, **12,** 2449.

PROJECTS.

By Capt. Quinn, 1887, for 2 break'rs Agate B., 1,000' and 900', resp., extending from e. and w. points of B.; opening bet. ends of break'rs 1,340'; area inclosed, 109 acres; est., $213,000, **87,** 1951. Increased in 1888 to $244,208, **88,** 1812; **89,** 1998; **90,** 2284.
By Maj. Sears, 1892, expend. $30,000, in building crib break'r from near w. side of the entrance out into the B. in line of prolongation of e. p., **93,** 2655.
Maj. Sears proposed, 1899, to apply app. of 1899 to extension of w. break'r, and whatever remained to repair of old part of e. p., **99,** 2608. Increase in l. of e. break'r by 50' approv., 1899, **00,** 3551.

SURVEYS.

Au. act July 5, 1884; made by Maj. Allen, 1885, **85,** 1955.
Maps. **87,** 1952; **03,** 1793.

LL-16 KNIFE RIVER HARBOR, MINN.

ENGINEERS.

Chief of Engineers. R., 11, 813.
In charge. Lt. Col. G. D. Fitch, **11,** 787.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** Lt. Col. Fitch, Oct. 29, 1910 (unfav.) (H. D. 25, 62d, 1st), **11,** 813.

LL-18 DULUTH-SUPERIOR HARBOR, MINN. AND WIS.

Part.	Title.	Period.	Appropriations.
a	Superior City H	1866–1879	$315,305.64
b	Duluth H	1870–1894	852,299.20
c	Superior B	1873–1879	22,628.16
d	Superior B. and St. Louis B., Wis	1880–1894	357,500.00
e	Minn. Pt., Superior B., Wis	1889–1892	4,895.00
f	Allouez B	1893–1895	.....
g	Duluth-Superior Hs., Minn. and Wis	1896–1912	5,745,553.00
	Total	.....	[1] 7,317,648.69

Part (a), LL-18 Superior City Harbor, Wis. (Natural entrance to Bay of Superior.)

APPROPRIATIONS.[2]

1867,	$63,000.00, **67,** 20; **68,** 26.
1869,	* [3] 44,550.00, **69,** 22.
1870,	40,000.00, **70,** 33.
1871,	60,000.00, **71,** 30.
1872,	50,000.00, **72,** 30.
1873,	[4] 41,322.64
1875,	* [5] 5,433.00, **75,** 40.
1876,	*3,000.00, **76,** 36, 93.
1878,	3,000.00, **78,** 112, 1128.
1879,	5,000.00, **79,** 150.
Total,	315,305.64

COMMERCE.

C. importance as a future RR. center, **67,** 60; **68,** 81; **73,** 128.
C. requires 16′ at m. l. w., **67,** 252.

CONTRACTS.

1867. R. G. Coburn, timber, **67,** 62.
1867-68. P. White, iron bolts and spikes. Coburn & Ray, framing. D. Smoke, materials, **67,** 57, 62; **68,** 83.
1869. R. G. Coburn, materials and labor, **69,** 72.
1874. Proposals for st., $5.15 to $13.95 cord, **74,** 134.
1876. H. M. Peyton & Co., brushwork, **76,** ii, 319.

ENGINEERS.

Chief of Engineers. R., 66, iii, 9; **67,** 20, 252; **68,** 26; **69,** 23; **70,** 33, 127; **71,** 30; **72,** 29; **73,** 30; **74,** 35; **75,** 40; **76,** 93; **77,** 97; **78,** 112; **79,** 150.

Boards. Convened, Chicago, Ill., Apr. 16, 1873, to consider and report on best mode of applying app. Mar. 3, 1873. Recom. (1) completion of ps. at both Superior entrance and Duluth Canal, with dr. at both entrances; (2) dr. chan., Superior B., from natural entrance to the docks of Superior City and Duluth. **R., 73,** 129. (Col. Macomb, Lt. Col. Tower, and Majs. Weitzel, Houston, and Farquhar.)

In charge:
Maj. W. F. Raynolds, 1866–67, **66,** iii, 8. **R., 66,** iv, 87; **67,** 256.
Maj. J. B. Wheeler, 1867–70. **R., 67,** 55; **68,** 79; **69,** 71.
Maj. D. C. Houston, 1870–73. **R., 70,** 89; **71,** 108; **72,** 111.
Maj. F. U. Farquhar, 1873–78. **R., 73,** 128, 131; **74,** 132; **75,** 183; **76,** ii, 319; **77,** 837; **78,** 1128.
Capt. C. J. Allen, 1878–79. **R., 79,** 1468.

Assistants:
H. Bacon. **R., 67,** 60; **68,** 80; **69,** 71.
E. C. Clark, **68,** 82.
J. B. Schrom, **68,** 82.
Capt. J. W. Cuyler, **69,** 23, 71.
Capt. A. M. Miller. **R., 72,** 111.
J. P. Frizell. **R.** (historical sketch of the work), **79,** 1470.

ESTIMATES. (See Plans and Projects.)

By Maj. Raynolds, 2 pile ps. 5,000′, $178,000, **66,** iii, 10, iv, 89; with 2,000′ single row of piling, $145,500, **66,** iv, 89; 200′ longer on each p., $25,000, **67,** 256.
By H. Bacon, 4,300′ crib ps. 20′ w., with 42,000 c. y. dr., $309,716, **67,** 62; for cut through Minn. Pt. (110,000 c. y. dr.) and 3,000′ crib ps. 20′ w., $252,780, **67,** 62; for crib ps., 1 to 18′ w., and st. protection to beach at Minn. Pt., $263,300, **68,** 26, 84. Est. diminished, with reasons therefor, **68,** 83.
By Maj. Wheeler, completion of work, 1869; extension of ps., $155,300, **69,** 73; **70,** 90.
By Maj. Houston, addl., $10,000, **72,** 111.

OPERATIONS.

Historical sketch of operations, **79,** 1470.
1867-68. 768 l. f. n. p., Minn., built; 374½ cords of st. deposited at Minn. Pt. as embankment to close outlet, **67,** 61; **74,** 132; **68,** 82; **69,** 23.
1868-69. 320 l. f. n. p., Minn., built; 32 l. f. s. p., Wis., built; 178′ wing dam built, **69,** 23; **70,** 127.
1869-70. 32 l. f. n. p., Minn., built; 608 l. f. s. p., Wis., built, **70,** 89.
1870-71. 768 l. f. n. p., Minn., built; 96 l. f. s. p., Wis., built, **71,** 30; **79,** 1473.
1871-72. 768 l. f. n. p., Minn., built; 1,184 l. f. s. p., Wis., built; scraping in chan. (10′ gained), **72,** 30, 111.
1872-73. 200 l. f. n. p., Minn., built; [6] 792 l. f. s. p., Wis., built; scraping (12′ gained), **73,** 30, 131.

* Allotment.
[1] Total, **12,** 2458, $7,313,203.69, which includes misc. $19,467.69, but omits app. [Part (e), LL-18], $4,895, and calls app. 1869 [(a) LL-18] $45,000.
[2] Remarks on want of consistency and uniformity in making app., **68,** 79.
[3] Called $45,000, **70,** 127; **74,** 132.
[4] Called $63,950.80, **74,** 132 (allotted from app., 1873, Superior Bay); **12,** 2458.
[5] Allotted from app. for repair of Hs. on n. lakes.
[6] 642′+150′.

1874-75. No operations (12½′ gained), **75,** 183.
1875-76. 300 l. f. n. p., Minn., built; 720′ brush protection of beach (12′ gained), **76,** 93, ii, 319.
1876-77. Repairs to n. p., **77,** 97.
1877-78. Brush and st. protection built at the "opening" on Minn. Pt., and repairs to outer cribs, **78,** 112, 1128.
1878-79. 3,000 willows set out on beach; dr. (10′ gained), **79,** 1468.

PHYSICAL CHARACTERISTICS.

West end of Lake Superior, **71,** 1471.
Superior B., and chan. at the mouth of the St. Louis R., **66,** iii, 9, iv, 88; **67,** 60.
Ice in lake, **68,** 82.

PLAN. (See Estimates.)

By H. Bacon, cut across Minn. Pt. 200′ w., with cribbed sides, **67,** 61.

PROJECT. (See Estimates.)

By Maj. Raynolds, to close entrance to St. Louis R. from 800′–300′ by 2 ps., on the s. 2,000′, on the n. 3,000′, to 12′, without dr. (which would benefit interested parties); cost, $178,000, **66,** iii, 10, iv, 89. If to 16′, $50,000 addl., **67,** 252; to 14′, $25,000, **67,** 256. As adopted, included protection to beach on Minn. Pt. by enrockment of rubblest.; crib ps. 3,904 l. f., 1′–18′ w.; cost, $263,300, **68,** 26, 81.

SURVEYS.

Made by U. S. Lake Sur., Aug., 1866, **66,** iv, 88; **67,** 559.
Made from ice in 1869–70, **70,** 89.
Special sur. by Maj. Houston and W. H. Newton, C. E., **73,** 137, et seq. (See Superior Bay.)

Part (b), LL-18 Duluth Harbor, Minn.

APPROPRIATIONS.

1871,	$60,000.00,	**71,** 30.
1872,	50,000.00,	**72,** 29.
1873,	[1] 36,049.20,	**71,** 838; **73,** 131.
1874,	10,000.00,	**74,** 132.
1875,	35,000.00,	**75,** 40.
1876,	15,000.00,	**76,** 93.
1878,	30,000.00,	**78,** 111, 1127.
1879,	25,000.00,	**79,** 150.
1880,	25,000.00,	**80,** 1876.
1881,	40,000.00,	**81,** 2022.
1882,	45,000.00,	**82,** 2098.
1884,	45,000.00,	**84,** 1813.
1886,	56,250.00,	**86,** 1631.
1888,	80,000.00,	**88,** 1807.
1890,	100,000.00,	**90,** 2288.
1892,	125,000.00,	**92,** 2130.
1894,	75,000.00,	**95,** 2538.
Total,	852,299.20.	

COMMERCE.

Interests of C. set forth in detail in S. Doc. 68, 41st Cong., 2d sess.
Present needs of shipping, **89,** 2006.
Harbor basin: Used much by large C. bound to W. Superior, **93,** 2657; **94,** 2014; **95,** 2534; **96,** 2340.
North Shore Chan.: Increasing C., **93,** 2658; **94,** 2015; **95,** 2534; **96,** 2340.
Rices Pt. Chan.: By far the most important part of the H. imp. at the head of the lake, **93,** 2658; **94,** 2014; **95,** 2534; **96,** 2340.

CONTRACTS.

1871. Munger & Gray, 10 cribs 30′ x 50′, **71,** 107.
1873. Munger & Gray, repairing ps., Duluth Canal, **73,** 131.
1875. Pardee & Dodge, dr., 15¢, **75,** 181.
1877. Williams & Upham, dr., 14¾¢ c. y., **77,** 837.
1879. Williams & Upham, dr., 12¢ c. y., **79,** 1465; dr., 14¢ c. y., **80,** 1877.
1880. Williams & Upham, dr., 16¢ c. y., **81,** 2022.
1881. Williams & Upham, dr., 14¢ c. y., **81,** 2022.
1882. Williams & Upham, dr., 16¢ c. y., **83,** 1616.
1884. Williams & Upham, dr., 14¢ c. y., **85,** 1940.
1887. Williams, Upham & Co., dr., 15½¢ c. y., **87,** 1940. C. S. Barker, repairs to ps. and placing buoys and constr. of crib, **87,** 1941.
1888. Williams, Upham & Co., dr., 15½¢ c. y., **89,** 2004.
1890. Williams, Daugherty & Upham, dr., 14¢ c. y., **91,** 2492.
1892. F. H. Quinby and F. Omeis, protection crib and repairing canal p., $10,000, **92,** 2130. Williams, Daugherty & Upham, dr., 15 and 21¢ c. y., **93,** 2662.
1894. Same firm, dr., 13.4, 15, and 20¢ c. y., **95,** 2545. Dwyer & Amory, 2 signal stations, $598, **95,** 2546. E. McCue, p. repairs, $5,699.35, **95,** 2546.

ENGINEERS.

Chief of Engineers. **R., 70,** 38; **71,** 30; **72,** 29; **73,** 29, 137; **74,** 35; **75,** 39; **76,** 93; **77,** 97; **78,** 111; **79,** 149; **80,** 200; **81,** 268; **82,** 264; **83,** 272; **84,** 271; **85,** 294; **86,** 287; **87,** 253; **88,** 229; **89,** 268, 274; **90,** 242, 247; **91,** 311; **92,** 297; **93,** 337; **94,** 309; **95,** 343, 352. **R.** to Sec. of War on the canal and dike and their effect on the H. of Superior, Wis., **72,** 150. Directs the order of expend. of $100,000 app. for the works in this vicinity, **73,** 130.

Boards:

Convened, Milwaukee, Wis., 1870. Recom. the 3d plan, that for dr. **R., 70,** 125; **79,** 1472. (Col. Macomb, Lt. Col. Raynolds, Majs. Wheeler, Weitzel, and McFarland.)
Convened, Chicago, Ill., 1873. Recom. a certain order of expend. of $100,000 app. for the works in this vicinity. **R., 73,** 129. (Col. Macomb, Lt. Col. Tower, Majs. Weitzel, Houston, and Farquhar.)
Convened, Duluth, by S. O. No. 3, 1881. **R., 81,** 2026. (Maj. Houston and Capts. Mackenzie and Allen.)

In charge:

Maj. J. B. Wheeler, 1870. **R., 70,** 110.
Maj. D. C. Houston, 1871–73. **R., 71,** 107; **72,** 105; **73,** 135.
Maj. F. U. Farquhar, 1873–78. **R., 73,** 128; **74,** 131; **75,** 181; **76,** ii, 317; **77,** 837; **78,** 1127.
Capt. C. J. Allen, 1878–86. **R., 79,** 1465; (Maj.) **80,** 1875; **81,** 2019; **82,** 2095; **83,** 1613; **84,** 1809; **85,** 1937; **86,** 1627.
Capt. J. B. Quinn, 1886–92. **R., 87,** 1935; (Maj.) **88,** 1803; **89,** 2000; **90,** 2285, 2310, 2311; **91,** 2489.
Capt. W. L. Fisk, 1892. **R., 92,** 2126.
Maj. C. B. Sears, 1893–1900. **R., 93,** 2657; **94,** 2014; **95,** 2533, 2579.

Assistants:

Capt. J. W. Cuyler. **R., 70,** 111.
Capt. A. M. Miller. **R., 72,** 105.
T. Shiels, **79,** 1466; **80,** 1878.
J. P. Frizell. **R.** (historical sketch), **79,** 1470.
G. Wells. **R., 82,** 2098; **84,** 1816.
S. L. Rice. **R., 90,** 2318.
Lt. G. D. Fitch. **R., 90,** 2320.

[1] Allotted from $100,000 for Duluth and Bay of Superior.

ESTIMATES. (See Plans and Projects.)

Detailed, of Capt. Cuyler, for imp., 3 plans, **70,** 113.

By Maj. Houston, for increasing the strength of the break'r, $367,000, **73,** 135.

By Maj. Farquhar, 1874, dr. 1,078,957 c. y., 25¢, $269,739, **74,** 132; **76,** ii, 318; **77,** 837. For rebuilding dike, $87,199, **74,** 133. Repairs of ps., 1875, $6,305, **75,** 182; **76,** ii, 318.

LEGAL PROCEEDINGS.

Ownership of land occupied by canal entrances not invested in the U.S., **93,** 2657; **94,** 2014; **95,** 2533; **96,** 2340. Efforts to secure ownership, **95,** 2533.

By condemnation proceedings the land on which the bench marks of the base line of the primary triangulation of Lake Superior were situated procured in 1894–95, **95,** 2537.

Proposed rules and regulations for government of navigation in the various chans., **95,** 2536.

LEGISLATION.

Resolutions of Legislature of Minn. and report of its select committee on necessity for imp. of the H., S. Doc. 58, 41st Cong., 2d sess. Injunction by U.S. against Duluth Canal, **72,** 106.

Congress, 1894, au. opening of negotiations for the acquirement by the U.S. of ownership of the land on which are situated the canal entrances, **95,** 2533.

OBSTRUCTIONS.

The towing of large bag rafts obstr. waterways and of much inconvenience to vessel interests, **95,** 2536; **96,** 2341.

OPERATIONS.[1] [2]

1871–72. 10 cribs (30′ x 50′) in extension of break'r already built (400′) by Northern Pacific RR. Co., **71,** 107. Extension 400′, making total l. 950′, **72,** 105. Break'r extensively repaired, **72,** 105.

1872–73. 5 cribs (30′ x 50′) placed in extension of break'r, **73,** 29, making it 1,200′ l., **79,** 1473. Storm, Nov., 1872, destroyed 650′ of the s. p., **73,** 131. Extensions stated at 750′ and repairs due to storm at 143′, **74,** 131. Break'r practically abandoned, **79,** 1474.

1873–74. Ps. on each side of canal rebuilt, revets. repaired, opening made through dike, and dr. H.; cost, $32,049.20, **74,** 132.

1874–75. 45,171½ c. y. dr. from H. and repairs made on ps., **75,** 181.

1875–76. 169,544½ c. y. dr., **76,** ii, 317; 40 acres being dr.; dike almost disappeared, urgent repairs needed, **75,** 182.

1876–77. 310½ cords of st. placed along face of n. p., **77,** 97, 837.

1877–78. Dr. through bar on n. side of dike and in the inside H.; 83,150 c. y. removed, **78,** 111, 1127.

1878–79. 158,179 c. y. dr. from inside H.; 250 l. f. of cribwork renewed on n. face of canal, **79,** 149. Total dr., Duluth H., to June 30, 1879, 457,000 c. y., **79,** 1475.

1879–80. 168,508 c. y. dr. from inner H. and area n. of canal; repairs to ps.; 150 l. f. revet. built at Wisconsin Pt.; 16,666 c. y. dr. from new cut, **80,** 1879, 1880.

1880–81. 113,158 c. y. dr. from inner H.; repairs to s. and old ps.; 21,859 c. y. dr. from bet. ps., **81,** 2020.

1881–82. 194,169 c. y. dr., of which 179,169 c. y. were by contract; repairs to ps., **82,** 264, 2096, 2098.

1882–83. 114,492 c. y. dr.; 1,170 l. f. decking laid on n. and s. ps., **83,** 1614.

1883–84. 91,832 c. y. dr., **84,** 1816, 1817.

1884–85. Pierhead repaired; 173,102 c. y. dr., **85,** 1937, 1938.

1885–86. 63,186 c. y. dr.; 51 cords st. riprap placed in s. p., **86,** 1629.

1887–88. 159,940 c. y. dr. from H. basin; general repairs to n. and s. canal ps., **88,** 1805.

1888–89. 172,860 c. y. dr. from Rice Pt. and North Shore chans., **89,** 2003.

1890–91. 234,366 c. y. dr. from Rice Pt. Chan., **91,** 2489.

1891–92. Dr. in N. Shore Chan., **92,** 2127.

1892–93. Rices Pt. Chan.: Much dr. done, **93,** 2658. N. Shore Chan.: Dr. in progress, **93,** 2658.

1893–94. Rices Pt. Chan.: Over 50,000 c. y. dr., **94,** 2014. N. Shore Chan.: Dr. 160′–250′ w., **94,** 2015. Canal: N. p. repaired, **94,** 2014.

1894–95. Canal Entrance: Ps. repaired, **95,** 2534. St. Louis R. above Grassy Pt.: Dr. in progress, **95,** 2535.

Constr. of permanent base marks of the primary triangulation of Lake Superior begun, **95,** 2537.

1895–96. N. Shore Chan.: Dr. done, **96,** 2340. St. Louis R. above Grassy Pt.: Dr. of previous year completed, **96,** 2341.

The base marks in course of constr. previous year completed, **96,** 2341.

PHYSICAL CHARACTERISTICS.

Description of, **70,** 111; **72,** 150; **79,** 1466, 1471; **89,** 2000.

St. Louis R. above Grassy Pt.: Description of, and chan. dimensions, **93,** 2659; **96,** 2340.

N. Shore Chan., St. Louis B.: Description of, and chan. dimensions, **93,** 2658; **96,** 2340.

Rices Pt. Chan.: Chan. dimensions, **93,** 2657; **95,** 2534.

PLANS. (See Estimates and Projects.)

By Capt. Cuyler, break'r 2,622′ l.; cost, $387,253; canal, ps., and inner H.; cost, $270,014; dr. for 12′ on interior H.; cost, $132,241. The latter adopted by BE., **70,** 38, 125; **79,** 1472.

By Maj. Houston, to add 2,600′ to break'r built (400′) by Northern Pacific RR. Co., **71,** 107; for increasing strength of the break'r, **73,** 135.

By Maj. Quinn, 1890, timber and st. break'r, 2 parallel cribwork ps., and dr. canal to 22′; est., $2,345,842, **90,** 2316.

PRIVATE (CITY AND CORPORATE) WORK.

By Duluth, 1870, cutting of a canal through Minn. Pt. to connect the lake with the B., and a dike, **71,** 107; **79,** 1473. Canal enlarged to 250′ w., **72,** 105. Discussion of the canal and dike work and the effect on the H. at entry of Superior B., **72,** 106; **79,** 1473. **R.,** Chief of Engineers, giving history of the injunction and proceedings in regard to this dike, **72,** 150, 159. More fully stated in S. Doc. 60, 42d Cong., 2d sess. Résumé of same, **79,** 1473. **R.,** special sur., by Maj. Houston and W. H. Newton, **73,** 145. L. S. & M. RR. Co. placed 200 cords of st. on side of n. p., **76,** ii, 318. 400′ of break'r built by the Northern Pacific RR. Co., **71,** 107. Northern Pacific RR. built extensive wharves and slips, **72,** 108.

PROJECTS. (See Estimates and Plans.)

By Capt. Cuyler, dr. an interior H.; adopted by BE., **70,** 38, 125.

By Maj. Houston, to add 2,600′ to break'r built (400′) by Northern Pacific RR. Co., **71,** 107.

Stated by Capt. Allen as providing for 16′ d. in H. at l. w., and repairs and mainten. of the ps. Constant dr. required to amount of $50,000 per an., **79,** 1466.

By Maj. Farquhar, 1874, to afford by dr. a 16′ anchorage in the H.; est. $269,739.25, **74,** 132; **80,** 200.

By BE., 1881, for mainten. of dr. areas, enlargement of H. by dr. to accommodate vessels drawing 16′, and mainten. of ps. bordering canal; est., $212,988.36, **81,** 2026; **86,** 1627.

Revised, 1884, by Maj. Allen, making total cost of above proj. $305,424, **84,** 1811; **86,** 1628; **87,** 1940.

By Capt. Quinn, 1887, dr. Rice Pt. Chan. to 16′; est., $119,552, **88,** 1805. Total cost proj. imp., $332,540, **88,** 1807.

[1] Historical sketch of, **79,** 1470.

[2] Condition of break'r, 1874–75, S. D. 29, 43d, 1st.

Canal: Description of works constr., **93,** 2657; **94,** 2014; **95,** 2534.
St. Louis R. above Grassy Pt.: By Capt. Fisk, 1891, dr. chan. where necessary 100′ x 16′ up to Fond du Lac; est., $113,000, **92,** 2151; **93,** 2659.

SURVEYS.
Under Maj. Wheeler, by Capt. Cuyler, **69,** 29; **70,** 38, 111; **79,** 1472. Special sur. by Maj. Houston and W. H. Newton, **73,** 145. (See Superior Bay.)
Of H., 1880, by Capt. Allen, **80,** 1875.
Au. act Aug. 11, 1888; made, 1890, by Maj. Quinn, **90,** 2311.
Act July 13, 1892, au. investigation of the ownership of the land occupied by the canal entry, etc.; made by Maj. Sears in 1892, **93,** 2664.
Maps. **82,** 2102; **85,** 1944; **86,** 1632; **87,** 1944; **91,** 2490; **93,** 2658.

Part(c), LL-18 Superior Bay, Wis.

APPROPRIATION.
1873, $100,000, **73,** 30 (but $22,628.16 expend. on this part, **74,** 132).

CONTRACT.
Dodge & Moses, 1873, dr., 18½ and 28¢ c. y., **73,** 131, 132.

ENGINEERS.
Chief of Engineers. R., 73, 30; **74,** 35. Decision on **R.** of BE., **73,** 130. **R.** to Sec. of War on sur. by Maj. Houston and W. H. Newton, C. E., **73,** 137.

Boards. Convened, Chicago, Ill., Apr. 16, 1873. Recom. a certain order for expend. of the $100,000 app., **79,** 1474. **R., 73,** 129. Decision of Chief of Engineers, **73,** 130. (Col. Macomb, Lt. Col. Tower, and Majs. Weitzel, Houston, and Farquhar.)

In charge:
Maj. D. C. Houston, 1873. **R., 73,** 141, 148.
Maj. F. U. Farquhar, 1873. **R., 73,** 128, 132.

Assistants:
J. Pierpont, 1873 (special sur.). **R., 73,** 162.
J. P. Frizell. **R.** (historical sketch of the work), **79,** 1470.

ESTIMATES. (See Projects.)
Maj. Farquhar, repairs of dike, $55,000, **73,** 132; $87,199, **74,** 133. Dr., $100,000 in addition to $100,000 app., **73,** 132.

OPERATIONS. (See also Survey.)
Historical sketch, **79,** 1470.
1873-74. Dr. commenced in chan. from d. w. to Quebec Wharf. Opening made in dike and 2 protection cribs placed therein, **73,** 132; **74,** 132.

PHYSICAL CHARACTERISTICS.
M. w. l., Superior B., **73,** 140.
Physical geography of w. end of Lake Superior, **73,** 141; **79,** 1471.

PROJECT.
By BE., chan. 13′ x 200′, from existing chan. in Superior B. to Quebec Wharf, Superior City, an opening to be made through the dike, **73,** 130.

SECRETARY OF WAR.
Letter to, from Gov. C. C. Washburn, of Wis., appointing W. H. Newton, of Minneapolis, Minn., as engineer on part of Wis. to make special sur. of Superior B., etc., **73,** 149.

SURVEYS.
Observations made on currents and water levels, **72,** 106.
Special sur. by Maj. Houston and W. H. Newton, C. E., at request of governor of Wis., **73,** 137, et seq.; **79,** 1474. Mr. Newton's criticism of Maj. Comstock's tide-gauge record. Letter from Maj. Comstock, **73,** 139. Maj. Houston's **R., 73,** 141, 148. J. Pierpont's **R., 73,** 162. **R.** of W. H. Newton, C. E., to Sec. of War, **73,** 173.
Sur. au. act Mar. 3, 1879, to find best and most economical plan for H. imp. for the head of Lake Superior, **79,** 136, 1469.
Maps. List of maps accompanying **Rs.** on the special sur., **73,** 155.

Part(d), LL-18 Superior Bay and St. Louis Bay, Wis.

APPROPRIATIONS.

1880,	$5,000,	**80,** 1882.
1881,	10,000,	**81,** 2025.
1882,	40,000,	**82,** 2105.
1884,	45,000,	**84,** 1820.
1886,	22,500,	**86,** 1636.
1888,	50,000,	**88,** 1811.
1890,	65,000,	**90,** 2294.
1892,	70,000,	**92,** 2136.
1894,	50,000,	**95,** 2552.
Total,	357,500	

COMMERCE.
Large harborage of B., **80,** 1886.
Decline of C. up to 1880, **81,** 269.
Necessity, 1881, for increased harborage, **81,** 2027.
Increase of C., **83,** 1623; **87,** 1950.
Chans., Superior B., should be d. to correspond with increased demands of vessels, **85,** 1964; **86,** 1635.
In 1895, $47,304,140± per an., **96,** 2348.

CONTRACTS.
1881. Williams & Upham, dr., 18 and 20¢ c. y., **82,** 2105.
1882. Williams & Upham, dr., 17¢ c. y., **83,** 1621.
1884. Williams & Upham, dr., 24¢ c. y., **84,** 1818; 15¢ c. y., **85,** 1947.
1886. C. S. Barker, dr., 18¢ c. y., **87,** 1949.
1888. C. S. Barker, dr., 14½¢ c. y., **89,** 2013.
1891. C. S. Barker, dr., 14¢ c. y., **91,** 2498.
1892. C. S. Barker, dr., 14½¢ c. y., **93,** 2672.
1893. E. McCue, p. repairs, $4,589.80, **94,** 2022.
1894. C. S. Barker, dr., 12½¢ c. y. R. B. Dear, p. repairs; timber, $15.50 1,000 f. b. m.; r., $6 cord, **95,** 2553.
1895. F. L. McDonald, p. repairs, $5,167, **95,** 2553.

ENGINEERS.
Chief of Engineers. R., 80, 201; **81,** 269; **82,** 264; **83,** 273; **84,** 272; **85,** 294, 296; **86,** 288; **87,** 254; **88,** 230; **89,** 270; **90,** 243; **91,** 312; **92,** 298; **93,** 338; **94,** 310; **95,** 346; **96,** 303.

Boards. Convened, by S. O. No. 3, C. of E., 1881. (Maj. Houston and Capts. Mackenzie and Allen), **R., 81,** 2024, 2029. (See Projects.)

In charge:
Maj. F. U. Farquhar, 1879. **R., 79,** 1468.
Maj. C. J. Allen, 1879–86. **R., 80,** 1880; **81,** 2024; **82,** 2103; **83,** 1618; **84,** 1818; **85,** 1944, 1959; **86,** 1632.
Capt. J. B. Quinn, 1886–91. **R., 87,** 1945; (Maj.) **88,** 1809; **89,** 2010; **90,** 2291.
Capt. W. L. Fisk, 1891–92. **R., 91,** 2495; **92,** 2132.
Maj. C. B. Sears, 1893–96. **R., 93,** 2668; **94,** 2019; **95,** 2549; **96,** 2346.

Assistants:
J. P. Frizell. **R., 80,** 1889.
G. Wells. **R., 83,** 1621.
J. B. Parkinson. **R., 85,** 1963.

LEGAL PROCEEDINGS.

Title to land occupied by the s. p. not vested in the U. S.; necessary steps to secure the title recom., **93,** 2668; **94,** 2019; **95,** 2550; **96,** 2347.

OPERATIONS.[1]

1879–80. Dr. at Rices and Connors Pts. Repairs to ps. at entry and the preservation of Minn. and Wis. Pts., by hired labor, **80,** 201, 1880.
1880–81. Repairs, by hired labor, to ps. and shore protection at Minn. Pt., **81,** 2024.
1881–82. Repairs to ps. at entry and dr. 53,466 c. y. from entry Nemadji R. and Quebec Wharf Chans., **82,** 2103.
1882–83. Protection of Minn. Pt. Beach, by hired labor, 103,629 c. y. dr. from chans. at the entry, Quebec Wharf, and Northern Pacific RR. dock, **83,** 1619.
1883–84. Repairs by hired labor, to Minn. Pt. shore protection; 90,674 c. y. dr. from chans. at entry, Quebec Wharf, and Northern Pacific RR. dock, **84,** 1818.
1884–85. Extensive repairs, by hired labor, to 867 l. f. of the s. p., with slight repairs to n. p. and sand fence at the opening; 152,788 c. y. dr. from chans. at the entry, Quebec Wharf, and Northern Pacific RR. dock, **85,** 1944.
1885–86. Repairs to ps. at entry, by hired labor; 34,485 c. y. dr. from chans. at entry, in St. Louis R., and at Quebec and Northern Pacific RR. docks, **86,** 1634. Ruling d. of chans. dr., **86,** 1634.
1886–87. D. chan. along Wis. Dock line, St. Louis B., **87,** 1947.
1887–88. 32,473 c. y. dr. from chans. and dock area, **88,** 1810.
1888–89. 75,700 c. y. dr., **89,** 2011.
1889–90. 84,286 c. y. dr., **90,** 2292.
1890–91. 110,375 c. y. dr., **91,** 2496.
1891–92. 165,875 c. y. dr., **92,** 2134.
1892–94. 68,966 c. y. dr. and ps. strengthened, **93,** 2670; **94,** 2019.
1894–95. N. and s. ps. repaired, and dr. in progress, **95,** 2550, 2551.
1895–96. Dr. of preceding year completed, **96,** 2347.

PHYSICAL CHARACTERISTICS.

Changes at head of B., **80,** 1885, 1889.
Movement of drift, **80,** 1886.
Time of opening and closing B. in winter, **80,** 1889.
Oscillation of lake surface, **80,** 1891.
Description of St. Louis B. and R., **85,** 1963.
Description of, **88,** 1809; **89,** 2010.
Shoaling on the Wis. side, **93,** 2668; **94,** 2019; **95,** 2550; **96,** 2347.

PLANS.

By Maj. Allen, 1885, imp. of St. Louis B. by dr. chan. 16′ x 250′ on the Wis. side past Connors Pt. to 1,000′ along the RR. br.; est., $70,950, **85,** 1959, 1963; **87,** 1947.

PROJECTS.

By BE., 1881, enlargement of H. area and chan. facilities by d. to 16′ chan. in entry bet. the ps., thence parallel to shore of Superior B., past mouth of Nemadji R., to Quebec Wharf, thence along w. side of B. to intersection with the chan. of St. Louis R. opposite Connors Pt.; also the d. of Nemadji R. for about half a mile; est., dr., $287,080; preservation of existing ps. by repairs at est. of $25,000. Est. entire proj., $312,080, **81,** 270, 2024, 2028; **82,** 2103.

1884 Cong. au. d. to 16′ chan. of St. Louis R. within Superior B., thereby adding $33,000 to the orig. est. for existing proj., **85,** 294, 1962; **86,** 1633; **87,** 1948.

1888 the est. of $345,080 was increased by $114,156, for completion of the chan. along the Wis. Dock line in St. Louis B., making total required for completion of the extended proj., 1888, $341,736, **88,** 1810, 1811.

By Maj. Sears, 1892–93, expend. app. 1892, $70,000, as follows: P. repairs; dr. entry and w. chan. at narrow points up to and through the Quebec Chan.; for a new chan. from Quebec Dock along the w. side of Superior B.; for. w. chan. in St. Louis B.; for extending chan. in St. Louis B. w. along the W. Superior Dock line, **93,** 2669.

By Maj. Sears, expend. $30,000 of the app. of 1894 in extending the Superior Dock line chan., and $15,000 dr. along the Wis. Dock line, **95,** 2551.

Act 1896 au. d. of all the chans. to 20′ with corresponding w., the dr. of turning basins at the junctions of the chans., and renewal of the entrance ps., **96,** 2347.

SURVEYS.

By Capt. Allen, 1880, to determine best plan for H. imp. for head of Lake Superior, **80,** 1884, 1889.
Sur., St. Louis B. and R. from Connors and Rices Pts. to foot of first falls, au. act July 5, 1884; made by Maj. Allen, **85,** 1959.
Maps. **85,** 1944; **87,** 1944; **90,** 2292.

Part(e), LL-18 Minnesota Point, Superior Bay, Minn.

APPROPRIATION.

1890, [2]$4,895, **91,** 2499.

CONTRACT.

1891. Campbell & McDonald, sand-fence constr., $3.45 running f., **91,** 2499.

ENGINEERS.

Chief of Engineers. **R., 89,** 274; **90,** 247; **91,** 313; **92,** 299.

In charge:
Maj. J. B. Quinn, 1888–91. **R., 90,** 2306, 2307.
Capt. W. L. Fisk, 1891–92. **R., 91,** 2499; **92,** 2137.

OPERATIONS.

1890–91. 1,216 l. f. sand fence built, completing proj., **91,** 2499.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 2306.

PROJECTS.

By Maj. Quinn, 1889, to preserve Minn. Pt. from inroads of the lake by constr. of 1,216 l. f. of sand fence; est., $4,895, **90,** 2308.
Proj. completed, 1891, **91,** 2499.

SURVEY.

Au. act Aug. 11, 1888; made, 1889, by Maj. Quinn, **90,** 2307.

[1] History of previous operations, **79,** 1470; **86,** 288, 1632.
[2] Unexpend. money, $45.92, turned into Treas., 1893, **93,** 2673.

Part (f), LL-18 Allouez Bay, Wis.

COMMERCE.

Description of, **93,** 2693; **95,** 2551, 2585.

Extensive docks built, 1892, and subsequent years, for shipment of ore, etc. (see references above).

ENGINEERS.

Chief of Engineers. R., 93, 344; **95,** 352.

In charge. Maj. C. B. Sears, 1893–95. **R., 93,** 2692; **95,** 2584.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2693; **95,** 2585.

Empties into Superior B. near its s. end and almost opposite the U.S. ps. which define the Superior entrance; is some 3,900 y. in l., and has average w. of 1,300 y., **93,** 2693. Forms part of the H. of Superior West, the city limits extending beyond its most e. boundary. Its topography makes it a good, natural site for the location of ore docks, etc., **95,** 2585.

PRIVATE (CORPORATE) WORK.

In 1892 the Duluth & Winnipeg RR. Co. had dr. a chan. 18′ x 75′ x 3,700′ at cost of $195,000, and expected to spend for other imp. in the H. $592,000, **93,** 2693.

PROJECTS.

By Maj. Sears, dr. to 20′ in the B. as part of the dr. for imp. of Duluth-Superior H.; est., $289,810, **95,** 2586.

SURVEYS.

Ex. au. act July 13, 1892; made, 1892, by Maj. Sears (**R.** fav.), **93,** 2692.

Sur. au. act Aug. 17, 1894; made, 1894, by Maj. Sears (see Projects), **95,** 2585.

H. lines estab. by Sec. of War, 1893, **95,** 2586.

Part (g), LL-18 Duluth-Superior Harbors, Minn. and Wis.

APPROPRIATIONS.

1896,	$50,000.00,	**96,** 2343.
1897,	437,500.00,	**97,** 2594.
1898,	770,138.00,	**98,** 2227.
1899,	300,000.00,	**99,** 2613.
1900,	793,187.50,	**00,** 3557.
1901,	320,000.00,	**01,** 2834.
1902	200,000.00	**02,** 2009.
	459,727.50	
1905,	270,000.00,	**05,** 1978.
1906,	100,000.00,	**06,** 1704.
1907	725,000.00	**07,** 1837.
	200,000.00	
1909,	470,000.00,	**09,** 1910.
1910,	500,000.00,	**10,** 2063.
1912,	150,000.00,	**12,** 2457.
Total,	5,745,553.00	(incl. $19,467.69 from sales, $5,765,020.69, **12,** 2457).

COMMERCE.

1895, est. at nearly $50,000,000, **96,** 2341; 1896, at $112,000,000, **97,** 2593; in 1897, at nearly $120,000,000, **98,** 2225.

Description of, **95,** 2542, 2543.

C. interests of Duluth and Superior identical and of great importance, **95,** 2579.

The great bulk of the C. passing through the Sault Ste. Marie Canal, Mich., goes to the Hs. of Duluth and Superior, **93,** 2659; **94,** 2016; **95,** 2535, 2580.

Constr. of 20′ chan. recom., **95,** 2535, 2580.

Comparative table of vessel C. of U. S. ports, 1896–97, shows Duluth-Superior H. to be 4th in tonnage and 6th in value of C. by water alone, **98,** 2225.

Expend. justified by the immense C. it has accommodated, **01,** 508.

T. only exceeded by New York, Philadelphia, and Boston, **02,** 2008.

Description of lake C., **04,** 2750, 2751; **06,** 1701.

Comparison of cost of imp., effect on freight rates, etc., **06,** 563, 564, 565. Greatest draft of vessels carrying ore, **06,** 1697.

T. of Duluth-Superior exceeded, it is believed, only by ports of New York and Philadelphia; U. S. imp. has been an indispensable aid to C., **07,** 589, 590; in 1912, only by port of New York, **12,** 953.

Remarks on C., showing increases and decreases during 1909, **10,** 2065.

Effect of proj. on freight rates, **11,** 795.

Diagram of relation of freight t., value, and app., **02,** 2008; **05,** 1984; **12,** 2460.

1911, 30,672,846 t. From 1867 to 1911, t. totaled 365,865,859 t. T. 57% of that which passed the Sault locks same year of 1911. Cost of U.S. works about one-sixth of 1% of the value of the freight traffic. An. expense by U.S. about 1¢ for each ton of t. for 1911; and about one-half of 1% of the saving in cost of transportation by water as compared with rail, 1911. Effect of U.S. works, in 1911, to save about $1.92 per t., or about $58,891,864. Some of this saving should be credited, of course, to U.S. works making other Great Lakes chans. usable with Duluth H. The fact that the U.S. chans. of the Great Lakes are available to shippers keeps down freight rates on RRs. contiguous—this is in addition to the preceding advantages. **12,** 953.

CONTRACTS.

1896. West Duluth Land Co., dr. out dike, 40¢ l. f. Williams, Green & Williams, dr., 12¢ c. y. C. S. Barker, dr., 11¾¢ c. y., **97,** 2596.

1897. S. Meneice, p. repairs, $552.25. Williams, Green & Williams, and also C. S. Barker, dr., 7½, 8, and 10¢ c. y., **97,** 2597. F. Davis, p. repairs, etc., $24,217.10. J. N. Dennis, pile dike constr., $4,995. Duluth Dredge & Dock Co., removing old dock, $500±, **98,** 2230. J. H. Carlson, furnishing and placing riprap at Superior entry ps., 71¢ s. t., $28,400. Moran & O'Brien, boathouse, $386.57. F. P. Tims, boathouse, warehouse, dock, oilhouse, etc., $3,000±, **98,** 2231.

1898. King & Steele, building substr. for s. p. of canal entrance—dr., timber, piles, r., etc.—total, $170,779.50. C. B. B. Inman, removing wreck, $1,300, **98,** 2233. King & Steele, concrete blocks for s. p. of canal entrance, $4.95 c. y. of concrete, **98,** 2234.

1899. Northwestern Lime Co., 12,000 bbls. Portland cement, $2.19 bbl., **99,** 2615. Butler-Ryan Co., substr. of n. p. (dr., 20¢ c. y.; lumber, piles, ironwork, r., gravel, plant, cribs), $160,330, **99,** 2616. C. Stone, setting footing concrete blocks, s. p.; concrete superstr., s. p.; building and placing concrete footing blocks, n. p.; $38,313.70, **99,** 2617.

1900. Northwestern Lime Co., 9,000 bbls. Portland cement, $2.29 bbl. **00,** 3559. C. Stone, concrete superstr. of n. p.; setting footing blocks, $41,796.40, **00,** 3560.

1901. Whitney Bros., 9,000 t. riprap, $1 t.; crushed r., $2 t.; Magnetite Foundry Co., 98 lamp-posts and 220 globes, $3,235.74, **01,** 2831–2832.

1903. Illinois Steel Co., 65,000 bbls. Portland cement, $2.17 bbl., delivered in sacks (4 sacks to bbl.) less 10¢ a sack returned, **03,** 1802. Hugo & Tims, furnishing and driving piles, 15.7¢ l. f.; Sunset Lumber Co., 500,000 f. b. m., $8.90 M, f. o. b. cars at Washington or Oregon points; Lake Superior

Contracting & Dredging Co., dr. p. trench, 15¢ c. y.; G. A. Wieland, 43,000 c. y. pebbles or gravel, $1.08½ c. y.; H. B. Waite Lumber Co., fir lumber, prices and quantities listed, **03,** 1803.

1904. Lake Superior Contracting & Dredging Co., dr. 80,000± c. y., 12½¢ c. y., s. m., from Superior H. Basin, in front of Nemadji R., and Superior entrance ps., **04,** 2755.

1905. Lake Superior Contracting & Dredging Co., sand, 25¢ c. y.; r., $1 c. y., and $25 hour for use of plant, **05,** 1980.

1906. Northwestern Steam Boiler & Mfg. Co., boiler in U. S. S. *Vidette*, $2,300, **07,** 1839.

1907. Great Lakes Dredge & Dock Co., building n. rubble mound break'r at Superior entry, Wis., prices, etc., given; Racine Boat Mfg. Co. building steel tug, $35,950, **08,** 1908.

1908. Great Lakes Dredge & Dock Co., hire of dipper dr., $25 hour; hydraulic dr., etc., $35 hour; Belmont Iron Works, 633,516 lbs. steel plate for Superior entry, prices listed; Zenith Dredge Co., dr. 100,000 c. y. from shoals, East Gate Basin, 12¢ c. y., **08,** 1908. Whitney Bros. Co., placing 5,000 y. gravel, $1.08 c. y., **09,** 1912. Great Lakes Dredge & Dock Co., dr. Duluth H. Basin, 10½¢ c. y., **10,** 2064.

1909. J. H. Younker, 135,000 l. f. piling, 13½¢ l. f.; Duluth-Superior Dredging Co., dr. about $20,000 worth of shoals, 13½¢ c. y., **09,** 1912. Great Lakes Dredge & Dock Co., riprap for cribs ($5,500), $1.25 t.; Whitney Bros. Co., $26,000 worth gravel for crib filling, $1.15 c. y.; Great Lakes Dredge & Dock Co., riprap for cribs ($6,000), $1.25 s. t., **10,** 2065.

1910. Ellicott Machine Co., dr. machinery, $5,480; Whitney Bros. Co., 4,000 c. y. gravel, $1 c. y.; D. G. Cutler Co., 10,000 bbls. cement, $1.48 bbl.; Duluth-Superior Dredging Co., dr. shoals in St. Louis B., prices listed; Great Lakes Dredge & Dock Co., building part of rubble mound break'r at Superior entry ($15,000±), $1.60 t. for filling and same price for 10 t. st., **10,** 2064, 2065. Duluth-Superior Dredging Co., dr. part Duluth H. basin ($240,000), Oct. 11, 1910, prices given; Great Lakes Dredge & Dock Co., building part of rubble mound break'r ($142,000), prices given, **11,** 2268.

1911. Great Lakes Dredge & Dock Co., dr. ($55,000), prices given; Northern Dredge & Dock Co., dr. shoals ($16,000), 17¢ c. y., **11,** 2268. Racine Boat Co., gasoline H. tug, $13,950; Racine Boat Co., supple., change in constr. of launch, $20.80; Great Lakes Dredge & Dock Co., furnishing and placing rubblest. covering, Superior entry ($9,000), $1.65 t.; Duluth-Superior Dredging Co., dr. ($14,000) Superior entry, prices given, **12,** 2459.

ENGINEERS.

Chief of Engineers. R., 96, 301; **97,** 386; **98,** 379; **99,** 449; **00,** 514; **01,** 507; **02,** 430; **03,** 466, 1829; **04,** 505; **05,** 510; **06,** 561; **07,** 586, 603; **08,** 629, 648; **09,** 661; **10,** 734, 757; **11,** 790; **12,** 947.

Boards:

Commission convened Sept. 24, 1894, under au. of S. O. No. 40, Aug. 18, 1894, to consider and **R.** on the cost of d. the Hs. of Duluth and Superior to 20′. **R., 95,** 2539. (Gen. O. M. Poe, Maj. J. F. Gregory, and Maj. C. B. Sears.)

In charge:

Maj. C. B. Sears, 1893–1900. **96,** 2339; **97,** 2592; **98,** 2223; **99,** 2611; **00,** 3554.

Capt. D. D. Gaillard, 1901–02. **R., 01,** 2828; **02,** 2005.

Maj. L. H. Beach, 1903. **R., 03,** 1794, 1828–30.

Capt. C. L. Potter, 1904–06. **R., 04,** 2747; (Maj.) **05,** 1971; **06,** 1696.

Maj. G. D. Fitch, 1907–10. **R., 07,** 1827; **08,** 1896; (Lt. Col.) **09,** 1902; **10,** 2053.

Maj. F. R. Shunk, 1911–. **R., 11,** 2257; (Lt. Col.) **12,** 2450.

Assistants:

F. L. Dever. **R.,** (dr.), **99,** 2623; **00,** 3569; **01,** 2843; **02,** 2017.

J. H. Darling. **R.,** (ps., maps), **99,** 2633; **00,** 3566; **01,** 2850; **04,** 4133.

C. Coleman. **R.,** (ps.), **99,**26 44; **04,** 3779; **05,** 1986; **09,** 1907.

M. W. Lewis. **R., 09,** 1907.

LEGAL PROCEEDINGS.

1897 Sec. of War prescribed regulations etc., for using the chans. of the H. to the great convenience of vessel interests. Rules required rafts to use Superior entrance and to keep out entirely of the Duluth Canal, and to use the raft spans of drawbrs. instead of the drawspans. Copy of the rules, etc., **98,** 2226.

City of Duluth deeded to the U.S. all its landed interests in and adjacent to Duluth Canal. Condemnation proceedings instituted for remainder of the land needed, **97,** 2593.

Acquirement of title to land needed for H. imp. Condemnation proceedings for, and purchase of land, **98,** 2224; **99,** 2611; **00,** 3555. Condemnation for part of the land stopped because of exorbitant awards, **00,** 3555.

Titles to land covered by Duluth Canal and that at Wis. entry and mouth of Nemadji R. acquired for sums of $53,919.05 and $40,608.94, resp., **01,** 2828.

An isld. in St. Louis R., lands near the mouth of Nemadji R., and 4 pieces of land near Spirit Lake acquired under condemnation proceedings, **02,** 2005.

Condemnation proceedings advanced for obtaining lot needed to complete rectangle on Minn. Pt., **04,** 2748.

At 1912, all land necessary for w. of Duluth Canal acquired by deed of gift, purchase, or condemnation, at cost of $53,919.05; land at Wis. entrance, mouth of Nemadji R., and marshy isld. in St. Louis R., at cost of $42,795.94; at Grassy Pt. and Spirit Lake, $3,146.20; Minn. Pt., incl. street vacated by city, $7,200, **12,** 952.

History of extended litigation bet. Wis. and city of Duluth. Reference to "History of Duluth Harbor" by Judge J. D. Ensign, published 1900, **12,** 2450.

OBSTRUCTIONS.

Rules and regulations affecting revision of brs.; also dumping regulations, **10,** 2061.

References to brs., **11,** 2263.

Grassy Pt. Br. destroyed by fire; reconstr. Work on constr. other brs., **12,** 2455.

OPERATIONS.

1896-97. Dr. 26,000,000± c. y. in progress, **97,** 2593, 2596, 2597. Plans prepared for constr. of st. ps. at canal entrances of the Duluth Canal, and for w. of the canal, **97,** 2594. Ps. repaired, **97,** 2597.

1897-98. In connection with preceding year, 2,637,284 c. y. dr. Constr. of s. p. Duluth Canal in progress, and p. at the Superior entrance strengthened, using of r. alone 13,299 t. Wreck removed, **98,** 2224, 2225.

1898-99. 4,202,229 c. y. dr.; new s. p. under way; substr. of new n. p. begun; constr. and placing of concrete footing blocks in progress; cements tested; ps. strengthened and repaired, and 22,217 t. riprap placed; dike at Superior entrance repaired (sketches of ps. and concrete molds, etc.), **99,** 2611, 2612.

1899-00. 4,920,387 c. y. dr.; superstr. new s. p. completed; substr. of new n. p. under way; footing blocks for ps. made and some laid; strengthening of ps. at Wisconsin entrance completed, **00,** 3555.

1900-01. 3,867,095 c. y. removed, **01,** 2829. 11 cribs of new n. p. sunk and filled and deck timbers laid on all; 16 steel connecting plates fastened to cribs, under water; 13 connecting plates secured at crib joints, s. p., **01,** 2830. Old s. p. removed at cost of $15,000; both sides of new s. p. riprapped with st. removed from it; shoal bet. old and new s. ps. removed by dr.; pipe well sunk on each side of new ps. for electric cables, etc.; crib destroyed in 1900, and removed at cost of $600; 1,078.5 t. riprap delivered; 135 monolithic blocks, containing 6,438.66 c. y. concrete, built and placed in superstr. of s. p., **01,** 2831. 569 concrete footing blocks set in superstr. of n. p. of Duluth Canal, and 80 monolithic blocks, containing 3,512.22 c. y. concrete

completed; 12,073 bbls. Portland cement delivered, and testing prosecuted; 98 lamp-posts and 220 globes furnished and set, **01,** 2832.

1901-02. 3,894,480 c. y. removed from Superior and Allouez Bs., St. Louis B., and St. Louis R.; st. removed from chan. of Duluth Canal; 9,081 t. riprap for new ps. of Duluth Canal delivered, **02,** 2006. 87 monolithic blocks, consisting of 3,975 c. y. concrete, built in superstr. of n. p., completing p.; 628.6 c. y. concrete placed in H. walls; 619.4 c. y. concrete placed in walls of canal by hired labor; iron lamp-posts set in place, **02,** 2007. 40,000 c. y. deposited on U.S. submerged lands, Duluth Canal, by hydraulic drs., **02,** 2008.

1902-03. 2,175,768 c. y. removed; work completed, **03,** 1794. 21,375 c. y. pumped from H. to fill U.S. land n. side of Duluth Canal, and 25,000 c. y. pumped from Duluth H. Basin to fill U.S. lands s. of canal; work completed, **03,** 1796, 1797. Land surfaced with alluvial soil at 15¢ c. y. for delivery, and 40¢ c. y. for spreading, by hired labor, and grass seed sown; concrete sea walls and park walls about U.S. land and cribs at shore ends of ps. completed; preparation begun for constr. of new concrete ps. at Wis. entry; cement warehouse, wharf, and slip constr., **03,** 1797. 88,000 c. y. dr. from s. p. trench; preparation of plant in progress; cement received and testing prosecuted, **03,** 1798. Land purchased on Minn. Pt., **03,** 1799.

1903-04. 24,050 c. y. dr. from Superior H. and entry; concrete ps. at Duluth Canal wired for electric lighting, **04,** 2747. Plans approv. for vessel yard on Minn. Pt., **04,** 2748. Preparation of plant for laying in new ps., Wis. entry, **04,** 2748, 2749. Dr. trench for w. half of s. p. completed, bearing piles driven; 8,069 c. y. gravel and 9,971 bbls. Portland cement delivered, **04,** 2749, 2750. 33 subaqueous monolithic blocks built, **04,** 2750.

1904-05. 55,744 c. y. dr., contract completed, **05,** 1971. Imp. of U.S. property on Minn. Pt. in progress, **05,** 1972. Lighting of ps., etc.; life preservers placed, **05,** 1794. Work on concrete ps., Superior entry, continued, **05,** 1974, 1986. Protection dike, partly destroyed, replaced by cribs, **05,** 1975.

1905-06. Engineer building erected for office purposes, **06,** 1697. Lookout building for vessel watchman erected on s. p. of Duluth Canal, **06,** 1698. Inner sea wall built to protect U.S. grounds from flooding, **06,** 1698. Constr. of concrete ps. at Superior entrance continued; timber cribs of protection structure carried away by storm; a third more substantial break'r built, but carried away by storm; a fourth protection built and dr. of p. trench in progress, **06,** 1698–99. Laying of concrete delayed for more than a year, **06.** 1699.

1906-07. Inner concrete parapet 3′ h. built to protect against heavy seas; 3 concrete steps provided; grounds graded and terraced; concrete walks around office building laid for a distance of 1,117′; concrete pavement built over spillway; 37′ of outer concrete sea wall, which had settled, rebuilt; inner concrete sea wall repaired; canal parks imp. by hired labor; 3,161 t. riprap and 1,000 c. y. coarse gravel placed to prevent movement of sand under ps., **07,** 1827–30.

1907-08. Framing mill, etc., installed, for constr. of timber and concrete ps., seaward end of break'r; U.S. derrick excavated 10,492 t. large riprap from base of old ps. and placed it in rubble mound of south break'r; 3 large cribs completed and 3 partly finished, all by hired labor; n. rubble mound in place, June 30, 1908, **08,** 632.

1908-09. 88,923 c. y. dr. for enlarging E. Gate Basin, completing total of 92 acres; 1,716,567 c. y. dr. for extension of Duluth H. Basin; total area now 249 acres of d. w.; 43,904 c. y. excavated in removing shoals; work on n. concrete revet. in progress; 8 timber steel-plated cribs completed; piles driven for break'r ends, **09,** 1902, etc. 66,761 t. st. placed in n. rubble mound break'r, 8,610 t. in s. rubble mound, **09,** 1907. New floating plant constr., **09,** 1908.

1909-10. 157,905 c. y. dr. in extension of basin, completing contract; d., 22′–24′; area dr., 70 acres, making basin with 249 acres area; 185,967 c. y. dr. under contract for removing shoals, **10,** 2054. 8 large, steel-plated timber cribs forming 450′ of each of the rubble mound break'rs sunk, work completed; 1,890 piles driven for foundation of break'r heads; 9,273 t. riprap placed around base of cribs, **10,** 2056. N. concrete revet. completed, **10,** 2055. Concrete footing blocks for break'r heads completed; concrete superstr. to both break'r heads completed; large monolithic concrete blocks superimposed on footing blocks; work on n. rubble mound break'r continued; 840′ rubble mound completed, forming, with 450′ break'r head, very effective break'r; s. rubble mound break'r continued; heavy riprap from old canal ps. placed in break'r; break'r built up to w. level for 260′, d. 16′–20′, **10,** 2058. U.S. hydraulic dr. undergoing modifications; scow enlarged, **10,** 2059.

1910-11. Extension of basin for Duluth H.; 903,499 c. y. dr.; dr. for removal of shoals continued, **11,** 2258. N. concrete revet.—300 l. f. trestles removed, 2,786 t. riprap placed behind inner end, and 7,559 c. y. refilling p. trench, by hired labor and U.S. plant, **11,** 2259. Work on concrete superstr. to break'r heads completed; detailed statement given, **11,** 2259. 25,367 t. riprap removed from old canal ps. and placed in and against revets. and the 2 break'r heads; 800′ old n. p. removed; 12,929 t. st., taken from old n. p., placed against n. side of n. break'r; 2,694 t. st. from old n. p. used in reinforcing w. end s. break'r head; 665 t. st. placed in the s. rubble mound break'r, **11,** 2260. 27,637 t. st. placed in n. rubble mound break'r; 189,666 c. y. dr. by U.S. and deposited where needed; 28,517 c. y., s. m., excavated from shoals on n. side of chan., **11,** 2261. Superstr. of n. break'r shore revet. completed and riprapped; superstr. of s. break'r shore revet. completed for 300′, riprapped on sides with large st., **11,** 2261.

1911-12. Extension of Duluth H. Basin—1,382,511 c. y. dr.; proj. 74% completed. Dr. for removal of shoals—103,087 c. y. dr. (14,642 c. y. deducted). N. concrete revet.—completed, total of 20,000 c. y. deposited, refilling trench against revet.; total of 479 t. riprap placed. S. concrete revet.—completed, 5,000 c. y. placed, refilling revet. trench s. side; 1,982 t. riprap placed close to p.; riprap taken from old canal ps., **12,** 2451, 2452. Removing old canal ps.—the old n. p. entirely removed; 2,110 l. f. crib and superstr. removed; old s. p. in process of removal; 24,777 t. st. taken from both ps. for various parts of new work, **12,** 2452. N. break'r head—11,549 t. riprap placed on n. side; 2,145 t. riprap placed against s. break'r head; st. taken from old canal ps., **12,** 2452. Rubble mound break'rs—3,353 t. st. placed at outer end of shore revet. of n. break'r; 8,251 t. placed in s. break'r, all done by U.S. plant and hired labor, **12,** 2452. Dr. with U.S. hydraulic dr. *Tortoise*—309,939 c. y. excavated and placed where needed, **12,** 2453. 308,636 c. y., s. m., excavated and deposited at dumping grounds in Lake Superior, by contract. Work, incl. 29 c. y. r., done on the n. side inner chan. Break'r shore revet.—on s. shore revet. 96 l. f. st. and pile foundation built, **12,** 2453–54. Patrol launch *Nemadji* built, **12,** 2456.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2539, 2540; **97,** 2592; **98,** 2223.

H., held by commission of 1894 to include all the navigable waters lying inside of Minn. Pt. and along the fronts of the cities of Duluth and Superior, and the city limits, resp., **95,** 2539.

Results obtained by works of imp., **98,** 2223.

Table of distances in different chans. and basins included in the H., **00,** 3575.

Variation of w. level from 0 to +1′, above l. w. datum, **02,** 432; **12,** 952.

Height, length, and velocity of storm waves observed, and dynamometers installed, **02,** 2007.

Effects storm, Nov., 1905, **06,** 1700, 1701.

Capacity or area of protected H. space, **10,** 2061.

Details, soundings, etc., **11,** 2262.

Details, **12,** 947.

H., at extreme w. end of Lake Superior, forms a terminus of the Great Lakes waterway. Its area is 19 sq. m., of which 11 sq. m. are available for wharves and slips and 8 sq. m. are outside H. lines and available for chan. and basins. H. consists of Duluth Canal, Wis. entrance, Superior B., Allouez B., St. Louis B., and St. Louis R. to the limits of Duluth and Superior, about 20 m. from orig. natural entry, **12,** 947.

PRIVATE (CITY AND CORPORATE) WORK.

Work of erecting suspended-car transfer, or aerial ferry, by Duluth, under license granted by Sec. of War, in progress, **04,** 2747; erected; regulations for operation approv. by Chief of Engineers, **05,** 1972, 1973, 1974. Aerial ferry repaired, **06,** 1697.

Ore dock, St. Louis B., extended, **05,** 1975. Water and gas pipes laid across canal and US. lands, and gas pipe laid across St. Louis R., **05,** 1975, 1976.

Laying of city water and gas mains under canal ps. in progress; Duluth Telephone Co. laid cables in underground conduit through U.S. grounds, Duluth Canal, and submarine cable across bottom of chan., **06,** 1698. Other imps., **06,** 1703.

Constr. of a number of private wharves necessitates large amounts of sand filling; 928,462 c. y. sand excavated from E. Gate Basin and from Duluth H. Basin, **10,** 2055.

City furnishes current to light ps. of Duluth Canal, **12,** 952.

PROJECTS.

By BE. (commission), w. and d. to 20′ the existing chans. imp. under previous proj. for d. of 16′; for a new chan., 20′ d., along Minn. Pt. dock line; for new chans. in Allouez B. (see Allouez Bay); for extensive turning and anchorage basins 20′ d. at junctions of 2 or more chans.; for w. Duluth Canal; and for replacing with substantial structures of timber and monolithic concrete the ps. at the Duluth Canal and Wis. entrances. Est., $1,806,667 for Duluth H., and $1,323,886 for Superior H., **95,** 2540–2542; **96,** 2339; **97,** 2593; **98,** 2224.

Act June 3, 1896, consolidated the works of Duluth and Superior, and provided for continuous contracts amounting to $3,080,553, **96,** 2339; **99,** 449.

[Proj. of 1896 done at much less than est., permitting purchase of lands ($106,561.19), rebuilding Duluth Canal ps. ($650,000±), leaving balance of $275,000± toward Wis. entrance p., **12,** 948.

By Capt. Gaillard, for U.S. dr. plant; est., $143,000; an. mainten., $33,700, **01,** 2830.

Drawings showing plans of p. constr., **01,** 2850, 2858.

By Capt. Potter, for H. patrol; est., $45,000, **04,** 2751, 2752; **05,** 1976, 1977.

Modifications of existing proj.: Act June 13, 1902, revet. piers Superior entry all-concrete, increasing orig. est. by $650,000. Act Mar. 2, 1907, au. excavation of lake approach of Duluth entrance to 30′ x 300′ ($10,000), and the following at Superior entry: Concrete revet. p. on n. side of entrance, like that of 1904 on the s. side, these 2 revet. 500′ apart and terminating near the lake shore of Wis. Pt.; (b) 2 converging break'rs from shore to 30′ d. with an opening of 600′ on line with axis of the inner entrance, to be of rubble mound style, terminating in a crib and concrete p. at outer and pile p. at inner end; (c) dr. bet. the break'rs to make chan. 30′ x 600′, and dr. to make stilling basin; (d) dr. chan. bet. revet. to 24′; (e) protecting shore line by riprap; and (f) w. Superior front chan. inside the H.; est., $1,703,000. Same act called for addl. dr. near the draw span of the Northern Pacific RR. br.; est., $55,000. Act May 28, 1908, au. expend. of moneys app. already for dr. inside Duluth entrance, embracing enlargement by about 209 acres of the anchorage area of the Duluth Basin, by dr. to 22′, l. w. datum (4,590,000 yds.; cost, $550,800; later increased to 5,600,000 yds.; cost, $672,000). The several modifications make total est. $3,090,500, and with the first est. make a grand total of $6,221,053. **12,** 948.

SURVEYS.

By joint res., Congress au. Sec. of War to appoint a commission of 3 engineers to ex. the Hs. of Duluth and Superior, etc., to find cost of obtaining 20′ d. for **R.** to Congress. **R.** made, 1894 (see Projects), **95,** 2538.

Ex., Superior and Duluth Hs., for 20′ au. act Aug. 17, 1894; made by Maj. Sears, 1895 (**R.** fav.), **95,** 2579.

St. Louis R., **01,** 2832.

H. and St. Louis R., **02,** 2007.

Through ice, over all chans. and basins constr. or imp.; 124,730 soundings taken, at 3¢ per sounding for field work alone, **03,** 1796.

Of H., **05,** 1971; **06,** 1696.

Ex. and sur. au. by resol. of Congress, June 20, 1906, for determining what modification, if any, should be made in plan of imp. **R.,** Maj. Fitch, Sept. 5, 1906; est., Superior entry, $1,703,000; Duluth entrance, $10,000; an. mainten., $2,500 (H. D. 82, 59th. 2d), **07,** 604.

Pre. ex. and sur. au. act Mar. 2, 1907, Duluth H. **R.,** Maj. Fitch, June 20, 1907; est., $550,800 (H. D. 221, 60th, 1st), **08,** 648.

Pre. ex. and sur. au. act Mar. 3, 1909, for increased anchorage area, vicinity of Superior entry. **R.,** Lt. Col. Fitch, June 7, 1909 (unfav.) (H. D. 317, 61st, 2d), **10,** 757.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 949.

Maps.

98, 2226 (sketches of ps., and concrete molds, etc.), **99,** 2702.

(H. D. 82, 59th, 2d; H. D. 221, 60th, 1st; H. D. 317, 61st, 2d):

Photographs showing character of concrete work on ps., **01,** 2832; **10,** 2058.

03, 1808; (photo) **07,** 1836; **11,** 2258.

Pile cut-off machine, **09,** 1908.

LL-19(a) ST. LOUIS RIVER, MINN. AND WIS.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 317; **92,** 302; **04,** 518, 2803; **10,** 757; **11,** 814.

Boards. BERH. **R.,** **04,** 2806. (See Surveys.)

In charge:
Maj. J. B. Quinn, 1890. **R.,** **92,** 2148.
Col. O. M. Poe, 1890. **R.,** **92,** 2148.
Capt. W. L. Fisk, 1891. **R.,** **92,** 2151.
Capt. D. D. Gaillard, 1904. **R.,** **04,** 2804.
Lt. Col. G. D. Fitch, **10,** 731; **11,** 787.

Assistant. J. H. Darling. **R.,** **92,** 2152.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 2151.

PLANS.

By Capt. Fisk, 1891, chan., by dr. where necessary, 100′ w. at bottom and 16′ d. up to Fond du Lac; est., $113,000, **92,** 2151.

SURVEYS.

Sur. from Grassy Pt. in St. Louis B. to Fond du Lac; made, 1891, by Capt. Fisk, **92,** 2151.

Pre. ex. au. act June 13, 1902, of R. from foot of rapids to New Duluth, Minn., with view to increasing d. to 8′. **R.** by Capt. Gaillard, Jan. 16, 1903 (H. D. 215, 58th, 2d) (unfav.), **04,** 518.

Pre. ex. of R. from upper limit of present proj. to st. quarries at Fond du Lac, au. act Mar. 3, 1909. **R.** by Lt. Col. Fitch, June 15, 1909 (H. D. 320, 61st, 2d) (unfav.), **10,** 757.

R. by BERH., Mar. 15, 1910, requested by Commerce Com. U.S. Sen. Board is of opinion it would be inadvisable to undertake imp. work. Minnesota Steel Co. states they feel they will not need any water facilities on Spirit Lake for a number of years to come. (S. D. 439, 61st, 2d.)

Pre. ex. of R. from head of present proj. near n. end of Spirit Lake up to New Duluth, thence up to the st. quarries near Fond du Lac, au. act June 25, 1910. **R.** by Lt. Col. Fitch, Oct. 29, 1910 (H. D. 29, 62d, 1st) (unfav.), **11,** 814.

LL-19(b) LAKE SUPERIOR TO MISSISSIPPI RIVER. (Canal.)

APPROPRIATION.

1894, $10,000, **95,** 2588.

COMMERCE. (See Projects.)

Description of lake C. at Duluth and of C. on St. Croix R., **00,** 3626.

ENGINEERS.

Chief of Engineers. R., 95, 353; **00,** 521; **10,** 757.

In charge:
Maj. C. B. Sears, 1895. **R., 95,** 2587; **00,** 3614.
Lt. Col. G. D. Fitch, **10,** 731.

Assistants:
Lt. C. H. McKinstry. **R., 96,** 2396, 2398.
J. Krey. **R.,** St. Louis R. route, **96,** 2443; Brule-St. Croix route, **96,** 2409, 2424; **00,** 3616.
E. W. Lewis. **R.,** Nemadji-Kettle route, **96,** 2432.
Q. A. Thomas. **R.,** St. Louis R.-Mississippi R. route, **96,** 2438, 2442.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2588; **96,** 2393, 2396; **00,** 3622.

The results obtained from ex. and explorations of the 3 designated routes justified making sur. of only 2 of these routes—via Allouez B., Brule and St. Croix Rs.; via St. Louis, East Savannah, and Prairie Rs., and Sandy Lake, **96,** 2393, 2394.

In 1896 Maj. Sears considered route No. 1 (Brule-St. Croix) to be the most feasible, **96,** 2395.

Brule-St. Croix route: Pre. **R.** on, **96,** 2424; final **R., 96,** 2409. Gauging, **96,** 2395, 2412, 2430. Distances, **96,** 2414. Rises to be overcome, **96,** 2415. Lockage from Lake Superior to Mississippi R., **96,** 2415. Available amount of water at the summit level, **96,** 2416. List of lands to be occupied by proposed canal and feeder, **96,** 2416. Approx. est. of excavation, **96,** 2417. Description of characteristics of Allouez B. and the Brule R., **96,** 2410; of Brule R. Valley, **96,** 2411; of St. Croix R. from the summit to the Mississippi, **96,** 2412. Approx. est. for dams, **96,** 2420; for locks and lifts, **96,** 2421. Summary of data, **96,** 2423. List of prominent bench marks, **96,** 2424. List of dams in operation for logging purposes or otherwise along the route, **96,** 2431. List of dams selected for the storage of water or canalization purposes along the route, **96,** 2432.

Nemadji-Kettle route: Description of characteristics, **96,** 2432. Drainage areas, **96,** 2437. Gauging, **96,** 2437.

St. Louis R.-Mississippi route: Description of, **96,** 2438, 2442, 2444. Gaugings, **96,** 2441. Sur., **96,** 2442, 2443. Water power of the St. Louis R., **96,** 2445. Distances and elevations, **96,** 2446. Water supply for the summit, **96,** 2446. Est. cost of acquisition of lands, **96,** 2447; of excavation, **96,** 2447. Approx. quantities and cost of dams, **96,** 2450; locks and lifts, **96,** 2452. List of prominent bench marks, **96,** 2454.

Summary of approx. data for routes proposed, **96,** 2398.

Length of the different routes, **96,** 2401. Lifts to be overcome by the different routes, **96,** 2402.

List of terminal Hs., **96,** 2402.

Water supply, **96,** 2402. Total amount of water required and available for the different routes, **96,** 2405. Water required for the summit and dependent levels of St. Louis-Mississippi route, **96,** 2405; Brule-St. Croix, **96,** 2406; Nemadji-Kettle, **96,** 2407.

Sectional dimensions of certain constr. and proposed canals of the world, **96,** 2409.

Comparison of some of the canals of the world, **00,** 3627.

Comparison of rail and canal routes, **00,** 3622.

PROJECTS.

In 1896 Maj. Sears est. $7,050,000 to constr. barge canal 80′ w. at the water surface and 59′ w. at the bottom, and 7′ d., along route No. 1, exclusive of the cost of compensation for the vested rights of the logging interests; $10,575,715 to constr. a canal of similar dimensions along route No. 3, exclusive of compensation for the vested rights of water companies for the use of the water of the St. Louis R.; and $18,015,112 to constr. a SS. canal along the same route 100′ w. at bottom, 121′ w. at water surface, and 7′ d. If the terminal for the waterway should be near St. Paul, route No. 3 would cost $19,000,000 more for barges and, if practicable, $30,000,000 for SS., **96,** 2394.

Maj. Sears reported, 1899, that canal costing about $7,000,000 was feasible, but that because of the proximity of many well-equipped RR. lines, and the great cost of canal transportation as compared with other methods, the constr. of the canal not a public necessity, **00,** 3614.

Approx. est. of reimbursement of dam and water companies, **00,** 3628.

SURVEYS.

Ex. and sur. for the location of a canal connecting Lake Superior with Mississippi R. by 3 designated routes au. act Aug. 17, 1894; made by Maj. Sears, 1894–96 (see Projects), **95,** 2587; **96,** 2390.

Supple. **R.** called for by act Mar. 3, 1899; made by Maj. Sears, 1899 (**R.** not fav. to U.S. constr. canal; see Projects), **00,** 3613.

Pre. ex. of canal connecting Lake Superior and the Mississippi R., by way of St. Croix R., Minn. and Wis., au. act Mar. 3, 1909. **R.,** Lt. Col. Fitch, Aug. 30, 1909 (H. D. 304, 61st, 2d) (unfav.), **10,** 757.

LL-23 NEMADJI RIVER, WIS.

COMMERCE.

Description of, **93,** 2694.

ENGINEERS.

Chief of Engineers. R., 93, 344.
In charge. Maj. C. B. Sears, 1892. **R., 93,** 2692.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 2694. Empties into Superior B. near its s. end and almost opposite the U.S. ps. which define the Superior entrance, **93,** 2692. It rises in Moose Lake about 30 m. sw. of Superior; is a crooked stream subject to freshets in the spring, **93,** 2694.

SURVEYS.

Ex. au. act July 13, 1892; made by Maj. Sears (**R.** unfav.), **93,** 2692.

LL-23(b) ALLOUEZ (Allonez) BAY AND NEMADJI RIVER, LAKE SUPERIOR, WIS.

ENGINEERS.

Chief of Engineers. R., 91, 316.

In charge:
Maj. J. B. Quinn. **R., 91,** 2512.
Col. O. M. Poe. **R., 91,** 2513.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2513.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj Quinn, **91,** 2512. Indorsement of Col. Poe (unfav. to Nemadji R.), **91,** 2513.

LL-24(a) BRULE HARBOR, WIS.

ENGINEERS.

Chief of Engineers. R., 12, 973.
In charge. Lt. Col. F. R. Shunk, 1912, **12,** 943.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911 (**R.** to come), **12,** 973.

LL-25(b) IRON RIVER, LAKE SUPERIOR, AND FLAG LAKE AND MOUTH OF FLAG RIVER, WIS.

COMMERCE.

Description of. Unimportant, **95,** 2581, 2582, 2583.

ENGINEERS.

Chief of Engineers. R., 95, 352.
In charge. Maj. C. B. Sears, 1894–95. **R., 95,** 2580.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2581, 2582.
Iron R. and Flag Lake and R. within 6 m. of each other, **95,** 2581.
Mouth of Iron R. on the s. shore of Lake Superior distant from Duluth 29 m. e.; a small stream about 18 m. l., dammed for log storage about 800′ above its mouth, **95,** 2581.
Flag Lake and mouth of Flag R. are located about 34 m. from Duluth e.; R. about 13 m. l.; the lake is a slough of the R. about 1½ m. l., with an average w. of 300′, **95,** 2582.

PRIVATE WORK.

Iron R.: The R. enters Lake Superior bet. 2 rough, round, timber-crib ps. built by a sandst. company, **95,** 2581.
Flag R.: 2 rough timber cribs built at the mouth, by a private company some time previous to ex. of 1894, **95,** 2582.

SURVEY.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Sears (**R.** unfav.), **95,** 2580.

LL-26 PORT WING HARBOR, WIS.

APPROPRIATIONS.

1902,	$25,000,	**02,** 2026.
1905,	19,992,	**05,** 1990.
1907,	2,000,	**07,** 1846.
1909,	*5,000,	**09,** 1917.
1910,	5,000;	**10,** 2070.
1911,	3,000,	**11,** 2274.
1912,	10,000,	**12,** 2464.
Total,	69,992	

COMMERCE.

Description of; increasing the effectiveness of the locality for a H. of refuge for the existing and probable future C., **97,** 2644, 2645.
H. imp. has developed C. of port, **07,** 593.
Increase in extent of C. indicated, **08,** 636, 1913.
Relation of cost of imp. to value of freight handled, **09,** 669; **10,** 742; **11,** 799; **12,** 957.

CONTRACTS.

1903. Hugo & Tims, p. work and dr., prices given, **03,** 1810.
1904. Northern Dredge Co., dr. 15,000 c. y., 17¢. c. y., **04,** 2763.
1905. Whitney Bros. Co., building w. p., **05,** 1990; **06,** 1712.
1907. Zenith Dredge Co., dr. 14,000 c. y., 17¾¢ c. y., **07,** 1846. Whitney Bros. Co., building revet. inner end w. p. and repairs to p., prices given, **08,** 1914.
1909. Northern Dredge & Dock Co., dr., 17¾¢ c. y., **09,** 1917.
1911. Northern Dredge & Dock Co., dr., 13½¢ c. y., **11,** 2274.

ENGINEERS.

Chief of Engineers. R., 97, 393; **00,** 521; **02,** 432; **03,** 468; **04,** 508; **05,** 514; **06,** 566; **07,** 592; **08,** 635; **09,** 667; **10,** 740; **11,** 798; **12,** 955.

In charge:
Maj. C. B. Sears, 1897–. **R., 97,** 2643; **00,** 3631, 3633.
Capt. D. D. Gaillard, 1901–03. **R., 02,** 2026.
Maj. L. H. Beach, 1903. **R., 03,** 1809.
Capt. C. L. Potter, 1903–06. **R., 04,** 2761; (Maj.) **05,** 1989; **06,** 1711.
Maj. G. D. Fitch, 1906–11. **R., 07,** 1845; **08,** 1912; (Lt. Col.) **09,** 1916; **10,** 2069.
Maj. F. R. Shunk, 1911–. **R., 11,** 2273; (Lt. Col.) **12,** 2463.

Assistant. M. W. Lewis. **R., 00,** 3635.

* Allotment.

LEGAL PROCEEDINGS.

Land needed for imp. conveyed to U.S., **0.3,** 1809.

OPERATIONS.

1902-03. 24,333 c. y. dr. under contract; constr. of e. p. commenced, **03,** 1810.
1903-04. East p. completed; wing wall built, **04,** 2762.
1904-05. 15,041 c. y. dr., **05,** 1989.
1905-06. West p. built; addl. st. placed in e. p., **06,** 1711–12.
1906-07. Repairs to ps., **07,** 1845.
1907-08. Wing wall w. p. built; p. repaired; 16,212 c. y. dr. under contract; addl. dr. by time-work, **08,** 1912.
1908-09. 7,015 c. y. dr., **09,** 1916.
1909-10. 17,767 c. y. dr., **10,** 741.
1910-11. 14,919 c. y. dr. for mainten. and 17,366 c. y. for extending turning slip, **11,** 2273.

PHYSICAL CHARACTERISTICS.

Description of; on Flag R., about ¾ m. within entrance of R., which lies on the s. shore of Lake Superior, about 34 m. e. from Duluth, **97,** 2643; **00,** 3632.
Condition of works and d. of w., **03,** 469, 1810; **04,** 509, 2762; **05,** 515, 1989–90; **06,** 567, 1712; **07,** 593, 1845; **08,** 636, 1912–13; **09,** 668, 1916; **10,** 741, 2070; **11,** 798–99, 2273–74; **12,** 956–57, 2464.

PRIVATE WORK.

Citizens of the place, 1896, had expend. some $19,000 in building ps. and dr. bet. them, and for 1,000′ or so inside, **97,** 2644.
Dr. by private enterprise, **02,** 433; **03,** 469; **08,** 1913; **09,** 1916.

PROJECTS.

Maj. Sears, 1899, est. $42,697 for 2 parallel ps. and dr., **00,** 3634.
Act June 13, 1902, au. proj. in accordance with **R.** (H. D. 114, 56th, 1st), which provides for 2 parallel ps. of piling filled in with slabs and topped with large rs.; p. to be 200′ apart and 800′ and 825′ l., resp.; chan. 18′ x 150′ to be dr. bet. ps. and for 500′ along slough; est. cost, $44,992. U.S. to be given clear title, without cost, to all land needed for imp., **02,** 432, 2026. Est. cost increased to $56,539, **08,** 1913.

SURVEYS.

Ex. au. act June 3, 1896; made, 1896, by Maj. Sears (**R.** fav.), **97,** 2643.
Ex. and sur. au. act Mar. 3, 1899; made by Maj. Sears, 1899 (**R.** fav.; see Projects), **99,** 3631.
Maps. **03,** 1810.

LL-28(b) CORNUCOPIA HARBOR, WIS.

COMMERCE.

Small and likely to be. (H. D. 415, 62d, 2d.)

ENGINEERS.

Chief of Engineers. **R.,** **12,** 973.
In charge. Lt. Col. F. R. Shunk, **12,** 943.

PHYSICAL DATA.

H. on s. shore, Lake Superior, 48 m. from Duluth. (H. D. 415, 62d, 2d.)

PRIVATE WORK.

Citizens have tried to make break'r. (H. D. 415, 62d, 2d.)

SURVEY.

Pre. ex. au. act Feb. 27, 1911; **Rs.** by Lt. Col. Shunk, Sept. 26, 1911 (unfav.) (H. D. 415, 62d, 2d) **12,** 973.

LL-30 BAYFIELD HARBOR, WIS.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 206.
In charge. Maj. H. M. Robert, 1880. **R.,** **80,** 1929.
Assistant. L. Y. Schermerhorn. **R.,** **80,** 1929.

SURVEYS.

Au. act Mar. 3, 1879; ex. made by Maj. Robert; nothing found, **79,** 155; **80,** 1929.

LL-32 ASHLAND HARBOR, WIS.

APPROPRIATIONS.

1886,	$22,500,	**86,** 449.
1888,	60,000,	**88,** 1818.
1890,	60,000,	**90,** 2296.
1892,	45,000,	**92,** 2139.
1894,	25,000,	**95,** 2556.
1896,	27,000,	**96,** 2353.
1899,	35,000,	**99,** 2704.
1902,	40,000,	**02,** 2027.
1905,	60,000,	**05,** 1992.
1907,	90,000,	**07,** 1849.
1909,	25,000,	**09,** 1921.
1910,	30,000,	**10,** 2074.
1911,	30,000,	**11,** 2277.
1912,	20,000,	**12,** 2467.
Total,	569,500,	**12,** 2467.

COMMERCE.

Necessity for break'r protection to wharves and ps., **85,** 2011.
Increase in staple exports, **89,** 2016; **90,** 2296.
Description of; probability of increase of; principal shipments, iron ore and lumber, **93,** 2675; **98,** 2241.
Increasing in the e. part of the town, **97,** 2604.
From 1886 to 1899, C. valued at $355,000,000; **00,** 3593.
Great increase since beginning of imp., **10,** 744.
Total cost of imp. amounts to one-eleventh of 1% of value of C. during time of imp.; an. expense of imp. amounted in 1909 to $0.0045 t. on freight, to one-eighth of 1% on value of freight, and to one-fourth of 1% of the savings in rates by water over those by rail, est. to be $1.78 t., or $9,000,000 for year, **10,** 745.

Diagram showing relation of app., t., and value of C., **11,** 2276.
Description of, and beneficial effect of proj. on rates, **11,** 801, 802; **12,** 959.
Traffic, 1911, of port and vicinity, 3,621,279 t. (and logs valued at about $514,752); decrease under 1910 of about 40%, **12,** 2468.

CONTRACTS.

1889. H. Steele, break'r constr., $11.45 running f., **89,** 2017.
1891. H. Steele, break'r constr., $25.95, and brush and st. dike constr., $6.25 running f., **91,** 2501.
1893. H. Steele, p. repairs, $4,500, **94,** 2025.
1895. Ashland Brownstone Co., furnishing st., $4.19 cord. P. F. Ferguson, furnishing slabs, $1.50 cord, **95,** 2556.
1896. A. & D. Sang, st., $4.37 cord, **97,** 2605.
1897. C. S. Barker, dr., 11¢ c. y., **97,** 2605.
1900. Hugo & Tims, break'r extension, $20,976, **00,** 3594.
1903. A. Donald & Co., st. in place on break'r, 85¢ t., **03,** 1812. James Pryor, dr., 24¢ c. y., **03,** 1811.
1905. George Wieland, placing st. on break'r, 79¢ t., **06,** 1714.
1907. Alexander Sang, about 70,000 t. st. in place on break'r, 99¢ t.; Zenith Dredge Co., dr. about 92,000 c. y., at 14¾¢ c. y., **07,** 1849.
1909. Alexander Sang, placing sandst. and granite on break'r, $1.05 t. for sandst. and $2.10 for granite, **09,** 1921.
1910. Alex. Sang, building pierhead; st., $1.25 t.; pierhead complete, excl. of st., $4,218, **11,** 2277.
1911. Zenith Dredge Co., dr., 11½¢ c. y., s. m., **11,** 2277.
1912. Sang & Miller, sandst. core for rubble mound, $1.24 t., and 90¢ t. for r. in place, **12,** 2467.

ENGINEERS.

Chief of Engineers. R., 80, 206; **85,** 307; **86,** 301; **87,** 256, 1960; **88,** 233; **89,** 270; **90,** 244; **91,** 313; **92,** 299; **93,** 340; **94,** 311; **95,** 347; **96,** 303; **97,** 388; **98,** 380; **99,** 451; **00,** 516; **01,** 509; **02,** 433; **03,** 469; **04,** 509; **05,** 515; **06,** 568; **07,** 593; **08,** 637; **09,** 669; **10,** 743, 757; **11,** 800; **12,** 957.

Boards:
Constituted, S. O. No. 35, to report upon proj. for imp. of Ashland H. **R., 87,** 1961.
(Maj. Allen, Capt. Lockwood, and Capt. Marshall.)

In charge:
Lt. Col. Robert, 1880, **80,** 1929.
Lt. Col. Barlow, 1884–86. **R., 85,** 2010, 2012; **86,** 1674.
Capt. C. E. L. B. Davis, 1887–89. **R., 87,** 1957; (Maj.) **88,** 1817.
Maj. J. B. Quinn, 1889–91. **R., 89,** 2015; **90,** 2295.
Capt. W. L. Fisk, 1891–92. **R., 91,** 2500; **92,** 2137.
Maj. C. B. Sears, 1893–1900. **R., 93,** 2674; **94,** 2023; **95,** 2554; **96,** 2352; **97,** 2603; **98,** 2240; **99,** 2703; **00,** 3592.
Capt. D. D. Gaillard, 1901–02. **R., 01,** 2863; **02,** 2027.
Maj. L. H. Beach, 1903. **R., 03,** 1811.
Capt. Chas. L. Potter, 1904–06. **R., 04,** 2763; (Maj.) **05,** 1991; **06,** 1713.
Maj. Graham D. Fitch, 1907–10. **R., 07,** 1847; **08,** 1915; (Lt. Col.) **09,** 1917; **10,** 2071.
Maj. F. R. Shunk, 1911–. **R., 11,** 2275; (Lt. Col.) **12,** 2465.

Assistants:
L. Y. Schermerhorn. **R., 80,** 1930.
H. N. Babcock. **R., 86,** 1676.

OPERATIONS.

1888–89. 100 l. f. of break'r built, **89,** 2015.
1889–90. 4,550 l. f. of break'r built, **90,** 2295.
1890–91. Extension of break'r in progress under contract, **91,** 2500.
1891–92. Break'r completed to 5,680'; breach in Chequamegon Pt. closed by a brush and st. dike 4,200' l.; repairs to old portion of the break'r, **92,** 2138.
1892–94. 600 l. f. of break'r work completed, **93,** 2674; **94,** 2024.
1894–95. Break'r repaired, **95,** 2555.
1896–98. 110,073 c. y. dr. and deposited in break'r, **97,** 2603; **98,** 2240.
1899–00. About 91' shore-arm break'r built under proj. of 1899 before passage of act of 1900 (see Projects). Break'r constr. on new site begun, **00,** 3592.
1900–01. 91 l. f. break'r built on line of old break'r and 842 l. f. built at new location, **01,** 2863.
1902–03. 2,722 t. st. placed in old break'r; 20,833 c. y. dr. from extension of chan., **03,** 1811.
1903–04. 29,277 t. st. placed in old break'r, **04,** 2764.
1905–06. 16,552 t. r. placed on break'r, **06,** 1713.
1906–07. 27,938 t. r. placed on break'r, **07,** 1847.
1907–08. 103,182 c. y. dr., and 35,584 t. st. placed on break'r, **08,** 1915, 1916. Detailed statement of progress of r. revet. from 1903 to 1908, **08,** 1916.
1908–09. 43,116 t. st. placed on break'r, **09,** 1918.
1909–10. 4,466 t. granite riprap used in repairing break'r revet., **10,** 2072.
1910–11. Pierhead crib 18' x 32' x 48' built at w. end of proposed extension of main break'r, with top 2' above l. w., and 350 t. r. placed upon it temporarily and red light installed; 11,704 c. y. dr. material dumped on line of extension; 12,223 c. y. dr. from enlargement of U. S. chan., **11,** 2276.
1911–12. 122,107 c. y. dr., **12,** 2465. Material dr. 1911 dumped on line of break'r extension, **12,** 2465, 2466. Sandst. core for rubble mound commenced, material described, 4,378 t. r. delivered, completing mound for 103', **12,** 2466.

PHYSICAL CHARACTERISTICS.

Described, **80,** 1930; **86,** 1677; **93,** 2674; **98,** 2240.
Turbulence of waters of H. much diminished by constr. of break'r, **93,** 2674; **94,** 2024.
Storms damaging works, **94,** 2024; **95,** 2555; **96,** 2352.
New site for break'r, 1900, rocky, **00,** 3592.
Effectiveness of break'r during storm of Sept., 1905, **06,** 569.
Settlement of riprap due to wave action, **08,** 1917.
Description of, **10,** 743; **11,** 801; **12,** 959.
Table of opening and closing navigation, **11,** 2279.
Settling of p. crib, **12,** 2466, 2467.

PLANS.

By Lt. Col. Barlow, 1885, pile and slab break'r, about 8,000' l., about 2 m. ne. of ore dock, at est. cost of $132,377, and removing, by dr. to 12', shoal in front of Mueller & Ritchie's wharf, at an est. of $10,000, **85,** 2013; **86,** 1675.

PRIVATE (CITY AND RAILROAD) WORK.

H. lines estab. by city of Ashland, **93,** 2674; **94,** 2024; **95,** 2555.
RR. company owning ore docks at the city au. to place dr. material dr. from its docks against break'r, **96,** 2352; **97,** 2604.

PROJECTS.

By BE., 1887, imp. of Ashland H. by closing breach in Chequamegon Pt. with pile revet. 4,300' l., and dr. chan. 18' x 100' in front of and touching principal wharves of city, with semicircular turning-basin of 400' radius; est., $83,540, **87,** 1966; **88,** 1817, 1818. Proj. abandoned, 1889, at request of citizens of Ashland, and new proj. submitted by Maj. Quinn, and approv. by BE. This provided for dr. chan. along ps. 17' x 200', and constr. of 4,650 l. f. of break'r projecting into the B. in such a manner as to protect the wharves from wave action; inner end of break'r to be 1,000' outside of estab. dock line. Est., $247,967.50, **89,** 2015, 2016.
In 1890, after completion of break'r as proj., proj. modified to provide for excavation of chan. along wharves at est. of $103,125, **90,** 2295, 2296; also constr. of 2,320 l. f. of break'r extension, mak-

Comparative d. at mouth of R., 1856 to 1867, **68,** 85.
Oscillation of water surface, **68,** 86.
Description of, **67,** 63; **93,** 2677; **98,** 2242.
Bar formation at entrance, **93,** 2677; **94,** 2026, 2027; **95,** 2557, 2558; **96,** 2355.
Sediment deposits from floods causes redr. every few years, **00,** 3595.
Condition of works, and d., **01,** 510; **10,** 747, 2076; **11,** 803, 2279; **12,** 962.
An. shoaling of chan., **05,** 1994; **06,** 1716; **07,** 596; **09,** 673, 1923.
Cause of shoaling discussed in H. D. 444, 60th, 1st, **09,** 673.
Damage to works by storms, **06,** 1717.
Iceberg, **12,** 2470.

PLANS.

By Maj. Quinn, 1889, dr. bar across chan. entrance; an. cost, $15,000, **89,** 2018.

PRIVATE WORK.

Attempted imp. on part of county of Ontonagon referred to, **68,** 85. Citizens' pile work at the inner end of w. p., **73,** 136. Dr. inside shore line considered local work, **67,** 64.
In 1896 chan. d. to 12′ under joint action of the Diamond Match Co., the town of Ontonagon, and the U. S., **96,** 2355.
Co. au. app. $500 for continuing dr. done by US. Ontonagon Lumber & Cedar Co. expend. about $100 in dr. near their property, **05,** 517, 1993–94.
Private dr. in front of docks, **10,** 2076.

PROJECTS.

By Maj. Wheeler, constr. 2 parallel ps. of cribwork, 250′ apart, 2,160′ and 2,340′ for the respective l. of the w. and e. ps., across present chan. and bar at mouth of R. to the 18′ curve of Lake Superior; est., $292,801. Increased, for dr., to $363,770, **67,** 20, 63, 65; **68,** 27, 87; **86,** 1641. Amount required for completion, $161,170, **79,** 151. Discussion of method of constr. of p. work, and of position of ps., **67,** 63. Aggregate of app., 1867 to 1886, incl., $285,600, **86,** 1642; **87,** 1967. Probable increase of est. due to advance of outer bar, **86,** 1641; **87,** 1967.
Act June 25, 1910, au. further imp. by so-called "smaller plan," which provides for chan. 17′ x 150′ at l. w. in lake, 15′ x 100′ bet. ps., and 2 short chans. 15′ x 75′ from inner end of ps. to nearest principal wharves; est., $15,400, with $8,000 an. mainten., and addl. $1,000 for mainten. of ps. (H. D. 602, 61st, 2d), **10,** 746.

SURVEYS.

Inferred from 1867, **67,** 17.
Minor surs., **93,** 2677; **94,** 2027.
Sur. for 18′ H. of refuge au. act June 6, 1896. Not made, because of obliteration of chief C. of town by fire, **99,** 456.
Pre. ex. au. act June 13, 1902, to determine whether further imp. should be made. **R.** by Capt. Gaillard, Jan. 17, 1903; not considered desirable "at present time" to make further imp. except to maintain d. contemplated by existing proj. (H. D. 235, 58th, 2d), **04,** 518, 2796.
Pre. ex. au. act Mar. 2, 1907, with view to changing course of R. **R.** by Maj. Fitch, Sept. 14, 1907; locality not considered worthy of imp. by US. (H. D. 444, 60th, 1st), **08,** 647.
Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Lt. Col. Fitch, May 27 and Oct. 23, 1909; est. $15,400 (H. D. 602, 61st, 2d), **10,** 758.
Maps. (H. D. 602, 61st, 2d.) Of Ontonagon H. **76,** ii, 322; **88,** 1820; **03,** 1814.

LL-36 EAGLE HARBOR, MICH.

APPROPRIATIONS.

1866,	$65,000,	**68,** 89.
1875,	10,000,	**75,** 41.
1876,	12,000,	**76,** 94.
1878,	8,000,	**78,** 113.
1879,	2,000,	**79,** 151.
Total,	[1] 97,000	

COMMERCE.

Local, **68,** 91; **70,** 91. Increase of, **75,** 41, 188.
Requirements of C. as to H. of refuge, **76,** ii, 328; **77,** 847.
Eagle H. compared with Copper H., **76,** ii, 328.
Distances from Eagle H. to ports in vicinity, **76,** ii, 329.
Unimportant, **77,** 98, 847; **78,** 1133, 1139.
Average length of season of navigation, 198 days, **77,** 850.

CONTRACTS.

1867. D. Quinn, removal of r., $58 c. y., **67,** 57.
1869. G. W. Townsend, removal of r., $40 c. y., **69,** 24, 72.
1870. R. Dunbar, removal of r., **71,** 108.
1878. C. P. McDougall, building and placing cribs, $6,542.48, **79,** 1481.
1885. W. P. Raley, removal of obstr.; unsatisfactory progress of contract, **85,** 1970.

ENGINEERS.

Chief of Engineers. **R.,** **66,** iii, 8; **67,** 20; **68,** 27; **69,** 24; **70,** 33; **71,** 31; **72,** 30; **73,** 31; **74,** 36; **75,** 41; **76,** 94; **77,** 98; **78,** 112; **79,** 151; **80,** 202; **81,** 272; **82,** 267; **83,** 275; **84,** 274; **85,** 297; **86,** 291; **87,** 257; **88,** 233; **89,** 272; **90,** 245; **91,** 315; **92,** 300; **93,** 341; **94,** 312; **95,** 349.

In charge:
Maj. W. F. Raynolds, **66,** ii, 41. **R.** and est. **66,** iv, 83.
Maj. J. B. Wheeler, 1867–70; **67,** 20. **R.,** **68,** 92; **69,** 71, 73.
Capt. J. W. Cuyler, 1870. Temporarily in charge, **70,** 33.
Maj. D. C. Houston, 1870–73. **R.,** **70,** 91; **71,** 108; **72,** 113.
Maj. F. U. Farquhar, 1873–75. **R.,** **73,** 137; **74,** 135.
Maj. H. M. Robert, 1875–83. **R.,** **75,** 187; **76,** ii, 323; **77,** 845; **78,** 1133; **79,** 1480; (Lt. Col.) **80,** 1900; **81,** 2036; **82,** 2115.
Capt. F. A. Hinman, 1883–84. **R.,** **83,** 1632.
Lt. Col. J. W. Barlow, 1884–85. **R.,** **84,** 1828; **85,** 1970.
Capt. C. E. L. B. Davis, 1885–89. **R.,** **86,** 1643; **87,** 1970; (Maj.) **88,** 1821.
Maj. J. B. Quinn, 1889–90. **R.,** **89,** 2020; **90,** 2299.
Capt. W. L. Fisk, 1890–92. **R.,** **91,** 2505; **92,** 2141.
Maj. C. B. Sears, 1893–96. **R.,** **93,** 2679; **94,** 2028; **95,** 2560; **96,** 2357.

Assistants:
H. Bacon, **67,** 20, 60. **R.,** **68,** 89, 93; **69,** 75.
Capt. J. W. Cuyler, **69,** 71.
Louis Y. Schermerhorn, C. E., in local charge from Mar., 1875, to completion of work in 1879, **78,** 1133. **R.,** **76,** ii, 323; **77,** 845, 851; **78,** 1133; **79,** 1481.
J. F. Huston, **77,** 849; **78,** 1140.
C. L. Turner, 1879.

[1] In 1896 the $1,007.23 remaining unspent was returned to the Treas., **96,** 2357.

ESTIMATES. (See Projects.)

History of est., **74,** 135; **77,** 845.

By Maj. Wheeler (r., at $58 c. y.), chan. 80′ w., $184,024, **68,** 28; or for chan. 130′ w., $261,294, **68,** 28. (Bacon's est., $237,321.12, **68,** 92.)

Revised by Maj. Farquhar (r., at $50 c. y.), ($231,570.64 + amount expend., $41,792.72), $273,-362, **74,** 136; **77,** 845.

Revised by Maj. Robert on basis of r. work done (chan. 130′ w.), $58 and $40 c. y. by contract, and $10.83 c. y. by hired labor, with guiding cribs instead of break'r, $97,000, **77,** 98, 845. Est. for guiding cribs, **77,** 848, 849; **78,** 1139. For dr., **77,** 848.

OPERATIONS.

History of, **74,** 135. Proposals opened June 20, 1867; all bids rejected and new called for, **67,** 21.

1867-68. Contract with David Quinn, of Chicago (Aug. 10, 1867), for removal of r., at $58 c. y., **67,** 57. Difficulties, **68,** 91. 100 c. y. of r. removed, **68,** 28, 91. Surface blasting failed, **68,** 91, 94; **69,** 74, 77. Result of Quinn's work, **69,** 75. Causes of his failure, **69,** 75. (See Contracts.)

1868-69. Readvertised Oct., 1868, **69,** 75. Contract with George W. Townsend, of Boston (Jan. 26, 1869), at $40 c. y. During season he removed 546⅓ c. y., **70,** 91, 33. Failed, **70,** 34. Application for extension of time refused, **70,** 91. (See Contracts.)

1869-70. 546⅓ c. y. removed to date, as per reports, **68,** 28, 91; **70,** 91. Sur., Mar., 1870, showed but 470 c. y. had been removed, **70,** 91.

1870-71. Contract entered into with Richard Dunbar, of Washington, D. C., who failed to do anything, **71,** 31, 108. Operations abandoned to await result of work at Hell Gate, N. Y., **71,** 108; **73,** 137.

1875. Proj. approv. for work by hired labor; plant purchased; drilling commenced from platform July 15; blasting began Aug. 13; work suspended Oct. 30, **76,** ii, 325, 327. Description of methods, **76,** ii, 323. Results and deductions therefrom, **76,** ii, 326.

1876. Operations recommenced June 6, **76,** ii, 330. Results and deductions, **77,** 847.

1877. Drilling and blasting renewed May 24. Dr. began June 26, and removed 3,000 c. y. broken r. and 200 c. y. bowlders. Total r. removed by dr. and by hoisting scow (to d. of 14′ below l. w. of 1868, chan. 130′ w.) under last proj., 3,350 c. y., or 5,964 c. y., s. m. Total expend. under proj. to date, $42,940.13. Gross cost per y. in place, $12.82; s. m., $7.20. Net cost (excl. office expenses and market value of plant at close of work) per y. in place, $10.83; s. m., $6.08, **78,** 112, 1137, 1139. Range lights erected by U.S. Lighthouse Board, **78,** 1139.

1879. 3 guiding cribs placed, one on e. side and one on w. side of excavation. Sunk through ice; works closed, **79,** 1480. List of materials used, **79,** 1481. Result of operations: Chan. holding 14′ for a w. of 130′. **79,** 1481.

1880-81. St. filling put into guiding cribs, **81,** 272.

1882-83. Slight repairs made to guiding cribs, **83,** 275.

1884-85. Removal of bowlders from chan., **85,** 1970.

1885-86. Completion of removal of bowlders, **86,** 1644.

1887-90. Proj. completed and no further operations contemplated, **88,** 1821; **89,** 2020; **90,** 2299; **91,** 2505; **92,** 2142.

1894-95. Piers repaired, **95,** 2560.

PHYSICAL CHARACTERISTICS.

Of H., **66,** iv, 82; **68,** 89; **77,** 847.

Difference bet. water levels of 1865 and 1868 of 1′, **68,** 93; of 1868 and 1876, **77,** 849.

General description, **76,** ii, 323.

Meteorological observations, **76,** ii, 329.

Length of season of navigation, 198 days, **77,** 850.

PROJECTS. (See Estimates.)

History of, **74,** 135.

Original, by Maj. Raynolds, removal of r. on bar to 14′ water, 130′ x 260′; 1,803 c. y. of excavation, at $81, and 1,290′ of crib pier 15′ w.; est., $191,-189, **66,** iii, 9, iv, 83, 84; **67,** 256; **68,** 27; or to admit vessels drawing 14′ (d. of chan., 16′) would treble excavation at addl. expense of $292,032, **67,** 256.

Revised by Maj. Wheeler, for a break'r with chan. 14′ x 130′ (3,372 c. y., est., $195,588). For an 80′ chan. and break'r, $184,024.72; for a chan. 130′ w. and break'r, $237,321.12, **68,** 92. (Bacon's est., **68,** 90, 93.)

By Maj. Houston, for 120′ chan., $215,000, **70,** 91.

By Maj. Farquhar, 1873, 130′ chan. and 20′ break'r, by hired labor, $248,000, **73,** 137.

Revised in 1874 (2,843 c. y. of r. work by hired labor, at $50 to complete) and a 30′ break'r, $231,-570 + amount expend., $41,792.72=$273,362.36, **74,** 36; **77,** 845.

By Maj. Robert, guiding cribs instead of break'r, reducing total est. $176,362, and at a total cost for the whole work of $97,000, **77,** 98, 845, 848. [Completed at cost of $93,000.]

The proj. for imp. of this H. was adopted 1866, modified 1868, 1874, and 1878, and completed 1879; cost., $93,000. As finished it consisted in opening a chan. 14′ x 130′ through the rocky reef obstr. entrance to the H., and defining entrance through the reef by a guiding crib on each side of the chan., **79,** 1480; **87,** 1970; **88,** 1821. Maj. Davis considered the work accomplished as fully satisfying the demands of C., **88,** 1821; **91,** 2505.

SURVEYS.

By U. S. Lake Sur. in 1855, **66,** iv, 82. First proj. made on this sur.

By H. Bacon, through ice, Jan., 1868, **68,** 27, 89, 93.

By H. Bacon, Dec., 1868, **69,** 76.

By H. Bacon, Mar., 1870, **70,** 91.

By L. Y. Schermerhorn, Feb., 1876, **77,** 845.

Maps and sketches. **76,** ii, 328; **78,** 1138.

LL-36(b) LAKE SUPERIOR, MICH. (Vicinity of Keweenaw Point.)

ENGINEERS.

Chief of Engineers. **R.,** **06,** 579.

In charge. Maj. Chas. L. Potter, **06,** 558.

SURVEY.

Pre. ex. au. act Mar. 3, 1905, of s. shore of Lake Superior, in vicinity of Keweenaw Pt., to determine whether H. of refuge should be estab. in that locality. **R.,** Maj. Potter, Oct. 14, 1905 (H. D. 158, 59th, 1st) (unfav.), **06,** 579.

LL-38 COPPER HARBOR, MICH.

COMMERCE.

Description of. No local C. (see Physical characteristics), **00,** 3638.

ENGINEERS.

Chief of Engineers. R., 00, 522.
In charge. Maj. C. B. Sears, 1899–1900. **R., 00,** 3636, 3641.
Assistant. M. W. Lewis. **R., 00,** 3639.

PHYSICAL CHARACTERISTICS.

Description of. A snug land-locked H., 3± m. l. and of 1,700′ average w., at the most n. point of the Great Keweenaw Peninsula. About 70% of the total t. passing through the "Soo" Canal passes within a few m., **00,** 3637.

PROJECTS.

Maj. Sears, 1899, est. $2,000 to remove a small shoal, **00,** 3637.

SURVEYS.

Ex. and sur. for 18′ (already existing), au. act Mar. 3, 1899; made by Maj. Sears, 1899 (**R.** fav.; see Projects), **00,** 3636.

LL-40 LAC LA BELLE HARBOR, MICH.

COMMERCE.

Unimportant, **66,** iv, 90.

ENGINEERS.

Chief of Engineers. R., 66, iii, 9, 34, iv, 86; **85,** 307.

In charge:
Maj. W. F. Raynolds, 1866–67. **R., 66,** iv, 85, 86, 90; **67,** 256.
Lt. Col. J. W. Barlow. **R., 85,** 2005, 2007.

LEGISLATION.

By act July 3, 1866, 100,000 acres of land granted to Michigan to aid in constr. of canal; canal to be at least 75′ x 100′, and carrying at least 12′ of w., **66,** iv, 86.

PHYSICAL CHARACTERISTICS.

General characteristics of locality, **66,** iii, 9, iv, 85, 86; **85,** 2006.
Light and unstable nature of the sand to be excavated, **66,** iii, 9, iv, 85, 86.

PLANS.

By Maj. Raynolds, 1866, sheet piling and dr. in canal cut, $92,000 (increased to $250,000 for p. extension and increased d., **67,** 256), **66,** iii, 9, iv, 86.
By Col. Barlow, 1885, repairs to ps. and canal built by a corporate company, and for d. chan. by dr. bet. the ps. and through the canal; est., $25,000. Or for constr. of H. of refuge, providing for a chan. of entrance thereto 18′ d.; est., $114,000, **85,** 2008, 2009.

PRIVATE AND CORPORATE WORK.

(See Plans.)
By the Lac La Belle Harbor Imp. Co., canal 111′ w., with a min. d. of 8½′, excavated, connecting Lake Superior and Lac La Belle, and 2 ps., covering the Lake Superior entrance of the canal, built, the one on the n. side 227′ l., on s. side 440′ l., **66,** ii, 9, iv, 85. Proj. and est. of the company's engineer for completion of the work, dr. to 12′ in cut and extension of n. p. 373′, of the s. p. 196′, **66,** iv, 85. Est., addl., for completion, $22,400, **66,** iv, 85.
To Aug., 1866, $68,100 spent by private enterprise, **66,** iv, 85.

SURVEYS.

Au. act July 5, 1884; made by Col. Barlow, **85,** 2005.
Ex. by Maj. Raynolds, **66,** iv, 85, 86.

LL-41 KEWEENAW WATERWAY, MICH.

Part.	Title.	Period.	Appropriation.
a	Keweenaw Waterway, Mich	1879–1912	$1,750,128.70
b	Keweenaw Waterway, operating and care	1893–1912	299,685.51
	Total		2,049,814.21

Part (a), LL-41 Keweenaw Waterway, Mich. (Waterway from Keweenaw Bay to Lake Superior).

APPROPRIATIONS.

1886,	[1] $10,000.00,	**86,** 456.
1890	[2] 10,000.00	**92,** 2166.
	[3] 350,000.00	**12,** 2474.
	[4] 5,128.70	
1892,	50,000.00,	
1894,	130,000.00,	**95,** 2563.
1896,	50,000.00,	**96,** 2360.
1897,	350,000.00,	**97,** 2611.
1898,	450,000.00,	**98,** 2246.
1900,	110,000.00,	**00,** 3601.
1901,	145,000.00,	**01,** 2873.
1902,	10,000.00,	**02,** 2030.
1905,	45,000.00,	**05,** 1999.
1910,	35,000.00,	**10,** 2082.
Total,	1,750,128.70	(**12,** 2474, does not incl. app. of 1886).

[1] App. for board ex. "or as much as may be necessary."
[2] For mainten. of canals.
[3] For purchase of Portage canals.
[4] H. lines, Portage Lake.

COMMERCE.

National importance of route, **87,** 1977.

Tonnage and freight passing the Sault Ste. Marie and St. Marys Falls Canals from 1881 to 1890, incl., **92,** 2159.

The waterway considered an important link in the chain of lake C. (See references above.)

During 1894, value $28,099,533, **95,** 2562; 1899, $55,000,000, **00,** 3600.

Circular of rules and regulations for operating vessels on canal, **04,** 2769.

Effect of proj. on freights, **06,** 573.

Expense of U.S. operations, benefits to C., etc., **11,** 806.

1911, 919,200± t. and 17,893 passengers; local t., 1,227,414 t.; total cost to U.S. to 1912, one-sixth of 1% of value of local vessel freightage during period of U.S. expend. On local C. alone U.S. work produces saving of $1.92 per t. over RR. rates, or $2,356,635 for 1911. As a H. of refuge, as many as 46 vessels have been tied up at one time, **12,** 964, 965.

CONTRACTS.

1892. Williams, Daugherty & Upham, dr., 25¢ c. y., **92,** 2164.

Details for expend. for operation and mainten., etc. (See each an. report.)

1892-93. J. Pryor, dr., 18½ and 24½¢ c. y.; use of dr. plant, $10 per hour; revet. repairs, $6,581, **93,** 2680; **94,** 2031.

1894. Williams, Daugherty & Upham, dr., 13½, 15, and 20¢ c. y.; use of dr. plant, $10 per hour, **95,** 2565. McKenzie, Somerville & Milberry, p. revet. repairs, $7.45 l. f. A. & D. Sang, p. repairs, timber, st., etc., $8,435.50, **95,** 2566.

1895. Wisconsin Dredge & Dock Co., p. repairs, timber, st., etc., $13,394.96, **95,** 2567. McCurdy & McCurdy, revet. repairs, timber, st., etc., $4,866.26, **95,** 2568. D. S. Blanchard, revet. repairs, timber, $18.50 1,000 f. b. m.; sheet piles, $17 1,000 in place; round piles, 15¢ l. f. in place, **96,** 2361.

1896. J. Pryor, dr., 15 and 24½¢ c. y.; use of plant, $10 per hour ($4,225), **96,** 2361. C. S. Barker, dr., 11 and 15¢ c. y.; use of plant, $9 per hour ($28,000), **97,** 2611.

1897. Powell & Mitchell, p. extension: Norway pine superstr., $39.10 l. f.; white pine superstr., $40 l. f.; if small st. should be used instead of mattresses, 40¢ l. f. to be deducted, **97,** 2612. McCurdy Bros., revet. repairs, $2,500, **98,** 2248.

1898. Porter Bros., p. extension, Norway pine, $280,953.20; white pine, $288,639.60; excl. of stamp sand in place, at 70¢ c. y., **98,** 2247.

1899. Hingston & Woods, w. upper canal by dr., 9 and 11¢ c. y. ($165,000). F. P. Tims, pile revet. work, $60,350, **99,** 2710.

1900. Hugo & Tims, revet. work, $132,273.50, **00,** 3602.

1901. Hugo & Tims, revet. work, unit prices given; Duluth Dredge & Dock Co., dr., prices given, **01,** 2873.

1902. James Pryor, dr., unit prices given; McCallum & McArthur, bldg. watchman's house, $2,437, **02,** 2032.

1909. Northern Dredge & Dock Co., dr., 24½¢ c. y., **09,** 1930.

1911. Powell & Mitchell, work on ps., $50,000, **11,** 2286.

ENCROACHMENTS.

Injury to H. at Hancock and Houghton from sand deposits of the stamp mills, **83,** 1697, 1698.

ENGINEERS.

Chief of Engineers. R., 80, 206; **85,** 332, 2170; **87,** 257, 1973, 1975; **91,** 17; **92,** 302; **93,** 341, 342; **94,** 312; **95,** 349; **96,** 305, 306; **97,** 389, 390; **98,** 382, 383; **99,** 452, 453; **00,** 517, 518; **01,** 511; **02,** 435; **03,** 471; **04,** 512; **05,** 518; **06,** 572, 579; **07,** 597; **08,** 641, 647; **09,** 674; **10,** 748; **11,** 804, 814; **12,** 963.

Boards. Constituted, S. O. No. 112, C. of E., 1886, to **R.** upon limiting shore lines at Portage Lake. **R., 87,** 1972. Also upon the expediency of the acquisition of the Portage Lake and Lake Superior Ship Canal. **R., 87,** 1977. (Col. Abbot, Majs. Ernst and Allen.)

Convened, Houghton, Mich., Dec. 11, 1890, by S. O. No. 40, to report upon estab. of H. lines in Portage Lake. **R., 91,** 2521. **(Col. Poe, Maj. Quinn, and Capt. Marshall.)**

In charge:

Lt. Col. H. M. Robert, 1880–83. **R., 80,** 1925; **83,** 1697.

Lt. Col. O. M. Poe, 1884–85. **R., 85,** 2170.

Capt. C. E. L. B. Davis, 1887. **R., 87,** 1971.

Maj. J. B. Quinn, 1888–91. **R., 89,** 2027; **90,** 2323.

Maj. J. F. Gregory, 1891–92. **R., 92,** 2158.

Maj. C. B. Sears, 1893–1901. **R., 93,** 2680; **94,** 2029; **95,** 2561; **96,** 2357; **97,** 2608; **98,** 2244; **99,** 2707; **00,** 3598.

Maj. D. W. Lockwood, **01,** 505.

Capt. D. D. Gaillard, 1901–03. **R., 01,** 2867; **02,** 2030.

Maj. L. H. Beach, 1903. **R., 03,** 1815.

Capt. Chas. L. Potter, 1903–06. **R., 04,** 2767; (Maj.) **05,** 1996; **06,** 1718.

Maj. G. D. Fitch, 1906–11. **R., 07,** 1853; **08,** 1923; (Lt. Col.) **09,** 1925; **10,** 2078.

Maj. F. R. Shunk, 1911–. **R., 11,** 2282; (Lt. Col.) **12,** 2471.

Assistants:

L. Y. Schiermerhorn. **R., 80,** 1926; **83,** 1698.

G. A. Marr. **R., 87,** 1989. Death of, **05,** 1999.

Lt. H. E. Waterman. **R., 92,** 2166.

LEGAL PROCEEDINGS.

Proceedings against mill owners on Portage Lake for deposit of refuse within H. lines, **88,** 1825; **90,** 2323.

Land purchases, **93,** 2681. Condemnation proceedings for land required, **00,** 3599.

Rules and regulations for use of the canals approved by Sec. of War. Difficulty of enforcing them because of no legal penalty for their violation, one case having been decided against the U. S. in court, **93,** 2682; **94,** 2030; of salutary effect. Copy of the rules, etc., **95,** 2563.

Claim allowed Porter Bros. for sand and gravel, **08,** 1923.

Suit against Porter Bros. for recovery of money illegally paid them, **09,** 1926; suit dismissed, **10,** 2079.

Acquirement of land for 1910 proj. by condemnation, **11,** 2282; **12,** 2472.

LEGISLATION.

Act Sept. 19, 1890, providing for the purchase and operation of the canals, **91,** 17.

OBSTRUCTIONS.

(See Legal proceedings.)

The RR. and wagon br. across Portage Lake bet. Houghton and Hancock an obstr. because of the narrow openings. Recom. made that the pontoon, drawspan, and the central p. be removed entirely, **96,** 2360; **97,** 2610; **98,** 2246.

Wrecked bridge blocking chans., **05,** 1998.

OPERATIONS.

1891-92. 14,300 c. y. dr. from Lake Superior Canal entrance, **92,** 2165. History of the Portage Lake canals, **92,** 2160.

1892-93. Dr. in progress, **93,** 2680.

1893-94. Dr. completed and revet. repaired, **94,** 2029.

1894-95. Dr. and repair of ps. and revet. constr. in progress, **95,** 2561.

1895-96. In connection with preceding year, 168,000 c. y. dr. and other work completed. Bank revet. constr., **96,** 2358. About 40,000 c. y. dr. in mainten., **96,** 2360.

1896-97. 144,100 c. y. dr., plans, etc., prepared for break'r ps. at Lake Superior entrance. **97,** 2609; and 48,000 c. y. dr. in mainten., **97,** 2610.

1897-98. P. extension in progress, break'r p. constr. in progress, 291,380 c. y. dr., and canal revet. repaired, **98,** 2245.

1898-99. Dr. and p. work in progress; misc. work of operating and care of works, **99,** 2708.

1899-00. 3,800 l. f. old pile revet. removed and temporary crib bulkhead built. In connection with preceding year, 2,800 l. f. p. extension built and 883,000 c. y. dr.; 7,452 l. f. revet. constr., 900 l. f. w. p., 330 l. f. crib foundation, and 400 l. f. cribs built; 794,417 c. y. dr. from Lily Pond; misc. work of operating and care of works, **00,** 3599.

1900-01. Work on break'r in progress; 750,034 c. y. dr. under contract; 35,000 c. y. dr. under contract;[1] 11,719 l. f. revet. built, **01,** 2869–2871.

1901-02. Break'r completed; e. side revet. finished; repairs made to revet. injured by vessels; dr. in Lily Pond completed; 170,160 c. y. dr.[2] under contract; 30,940 c. y. dr.[1] under contract; work on w. side revet. started, **02,** 2031–2033.

1902-03. 254,133 c. y. dr. under contract;[2] 2,336 c. y. dr.;[1] watchman's house finished, **03,** 1815, 1816.

1903-04. Dr. completed; repairs to break'r and revet.; gauge readings taken, **04,** 2767–2778.

1904-05. 20,356 c. y. dr. under contract;[1] repairs to ps.; sur. made, **05,** 1997–1998.

1905-06. 132,629 c. y. dr. under contract;[2] 5,359 c. y. dr. under contract;[1] repairs to revet.; pile clusters estab., **06,** 1718–1720.

1906-07. Repairs to cribs by hired labor, **07,** 1855.

1907-08. 8,139 c. y. dr. under contract;[2] 6,950 c. y. dr.;[1] repairs to break'r, **08,** 1923–1925.

1908-09. 8,634 c. y. dr.;[1] repairs to structures, **09,** 1928.

1909-10. 19,655 c. y. dr.;[1] repairs to structures and U.S. tug *Circle*, **10,** 2080–2081.

1910-11. 101,640 c. y. dr.;[1] repairs to structures, **11,** 2283–2284.

1911-12. 21,734 t. granite riprap placed in break'r; repairs to cribs of break'r; sunken tug *Circle* raised, **12,** 2473.

PHYSICAL CHARACTERISTICS.

Navigability of waterway greatly bettered since US. took charge, **93,** 2681.

Bar formation at entrance has to be removed nearly every spring, **95,** 2562; **99,** 2709.

Description of lights, **01,** 2872.

Damage to cribs by storm, **01,** 2870.

Damage to break'r by storm, **02,** 2030.

Complete description of waterway pub. in Bul. No. 14, N. and N. W. Lakes, Apr. 15, 1904, pp. 60–65, **04,** 2767.

Damages to structures by storms and vessels, **05,** 1998.

Itemized statement of damages to revet., 1904–07, **08,** 1926.

Chan. d., **11,** 2283.

Chan. 25 m. l., partly artificial, across Keweenaw Pt., a peninsula on s. shore of Lake Superior, about midway of Sault Ste. Marie and Duluth, **12,** 963.

PRIVATE (CORPORATE) WORK.

Description of company's canal, and its cost as built by the canal company, **85,** 2170; **87,** 1980, 1985.

Condition of the imp., **85,** 2170; **87,** 1982.

Value of the imp., **85,** 2173, 2175; **87,** 1985.

Recom. purchase by U. S., **87,** 1975, 1976, 1988.

Repairs to revet. by owners of vessels causing damage, **06,** 1720.

PROJECTS.

By Maj. Robert, 1880, extension of ps. 330′, to 18′, extension to be parallel to existing ps., but with a w. increase to 400′, the outer ends of ps. to be connected with proposed extension by fender pilings; est., $74,712; by changing detail of constr., $70,994, **80,** 1927, 1928.

By BE., 1886, estab. of limiting shore lines at Portage Lake, **87,** 1972.

Regulations for estab. and mainten. of lines proposed, **87,** 1974. (See Legal proceedings.)

The BE., 1886, recom. that offer of the company to transfer all their rights to the U.S. for $350,000 be accepted, and that the route be made a free waterway; also that a navigable d. of 16′ for a min. w. of 70′ be obtained, by dr., throughout the whole extent of the route, **87,** 1975, 1976, 1988.

Under act Sept. 19, 1890, works purchased by U.S. Control assumed Aug. 3, 1891, **92,** 2158. Act au. expending $10,000 an. for 2 years for preserving and continuing use of the canal, **92,** 2163.

By Maj. Sears, 1892, expending app. of 1892, $50,000, in dr. to 16′ x 70′, and also for repairing revet., **93,** 2680; and for expend. of allotments for mainten. and operation in maintaining d. equal to d. of the Sault Ste. Marie Canal (20′ x 120′), and for misc. work incident to care and mainten., **93,** 2681; **94,** 2029; **95,** 2562; **96,** 2359; **97,** 2610; **98,** 2246. (See each an. **R.**)

Lighting and buoying of waterway transferred to custody of Lighthouse Board in 1894, **95,** 2562.

Act June 3, 1896, au. continuous contracts amounting to $1,065,000, **96,** 2359; **99,** 2707.

DO. recom. necessary imp., **09,** 1927.

Act June 25, 1910, au. H. of refuge near Portage R., embracing dr. basin with mooring pier just within e. entrance of canal, and involving acquisition of considerable tract of land which must be got at "reasonable cost" or condemnation, **12,** 964; est., $210,000, **08,** 647; **10,** 2079.

SURVEYS.

Sur. au. act Mar. 3, 1879, **79,** 155.

Pre. ex. au. act Mar. 3, 1905, to determine whether H. of refuge should be estab. in vicinity. **R.,** Maj. Potter, Oct. 14, 1905 (unfav.) (H. D. 158, 59th, 1st), **06,** 579.

Pre. ex. au. act Mar. 2, 1907, for H. of refuge. **R.,** Maj. Fitch, Aug. 22 and Oct. 30, 1907; est., $210,000 (H. D. 325, 60th, 1st) (see Projects), **08,** 647; **09,** 676.

Pre. ex. au. act June 25, 1910, for enlarging stilling basin at w. end, and increasing size of H. of refuge. **R.,** Col. Fitch, 1910 and 1911; est., $158,000, and $400 an. mainten. (H. D. 40, 62d, 1st), **10,** 749; **11,** 814.

Maps. (H. D. 325, 60th, 1st; H. D. 40, 62d, 1st.) **91,** 2519; **92,** Atlas, 102; **93,** 2682; **96,** 2364; **01,** 2876; **03,** 1817.

Part (b), LL-41 Keweenaw Waterway, Mich. (Waterway from Keweenaw Bay to Lake Superior. Operating and care.)

APPROPRIATIONS.[3]

1893,	$30,910.64,	**93,** 2686.
1894,	11,647.00,	**94,** 2034.
1895,	8,000.00,	**95,** 2570.
1896,	11,500.00,	**96,** 2364.
1897,	8,300.00,	**97,** 2615.
1898,	8,300.00,	**98,** 2251.
1899,	8,300.00,	**99,** 2714.
1900,	8,300.00,	**00,** 3605.
1901,	8,300.00,	**01,** 2876.
1902,	8,500.00,	**02,** 2037.
1903,	9,000.00,	**03,** 1820.
1904,	15,500.00,	**04,** 2774.
1905,	15,000.00,	**05,** 2003.
1906,	8,500.00,	**06,** 1721.
1907,	9,250.00,	**07,** 1857.
1908,	12,900.00,	**08,** 1928.
1909,	12,000.00,	**09,** 1930.
1910,	15,150.00,	**10,** 2083.
1911,	32,946.03,	**11,** 2286.
1912,	57,381.84,	**12,** 2475.
Total,	299,685.51	

[1] Maintenance.
[2] New work.
[3] Expend. under permanent-indefinite app. au. act July 5, 1884, and Mar. 3, 1909, operating and keeping in repair canals and other public works.

LL-44 (b) TORCH LAKE, CHANNEL, LAKE SUPERIOR, MICH.

COMMERCE.

Local, **87,** 2054.

ENGINEERS.

Chief of Engineers. R., 87, 266.

In charge. Capt. C. E. L. B. Davis, 1886. **R., 87,** 2053.

PHYSICAL CHARACTERISTICS.

Dimensions of lake, **87,** 2053.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1886, by Capt. Davis (**R.** unfav.), **87,** 2053.

LL-54 MARQUETTE HARBOR, MICH.

APPROPRIATIONS.

1867,	$85,000,	**67,** 21.
1869,	*26,730,	**69,** 22.
1870,	25,000,	**70,** 34.
1871,	60,000,	**71,** 31.
1872,	50,000,	**72,** 30.
1873,	15,000,	**73,** 32.
1874,	15,000,	**74,** 37.
1875,	15,000,	**75,** 41.
1876,	2,000,	**76,** 94.
1878,	2,000,	**78,** 113.
1879,	1,500,	**79,** 152.
1880,	1,000,	**80,** 1901.
1882,	16,000,	**82,** 2116.
1884,	5,000,	**84,** 1829.
1886,	10,000,	**86,** 448.
1888,	25,000,	**88,** 1831.
1890,	40,000,	**90,** 2302.
1892,	80,000,	**92,** 2144.
1894,	30,000,	**95,** 2572.
1896,	29,000,	**96,** 2366.
1899,	25,000,	**99,** 2716.
1902,	[1] 26,000,	**02,** 2037.
1903,	80,000,	**03,** 1821.
1905,	3,000,	**05,** 2005.
1907,	30,000,	**07,** 1861.
1910,	100,000,	**10,** 2088.
1911,	88,000,	**11,** 2292.
Total,	[1] 885,230	(incl. misc., $885,588.69, **12,** 2480).

COMMERCE.

Benefits of imp. to C., **66,** iv, 78; **67,** 67; **69,** 25; **71,** 31; **75,** 189; **76,** ii, 332, 334.

Effect of fire, 1868; loss, $1,500,000, **68,** 97; **76,** ii, 332.

Local interests, **67,** 66, 67; **70,** 92; **75,** 190; **76,** ii, 331, 334.

Memorial to Cong. requesting protection of H., **76,** ii, 332.

In the 20 years preceding 1897 the port clearances amounted to about $80,000,000, **98,** 2252.

In the 22 years ending 1899 C. valued at $95,000,000, **00,** 3607.

Rapidly increasing, **04,** 2788.

Effect of proj. on rates, **06,** 576.

In 1911, 1,838,000± t., **12,** 968.

CONTRACTS.

1867. W. Ferguson, constr. break'r, **67,** 57, 69; **68,** 95; **69,** 24. P. White, constr. break'r, **67,** 69. Gelly & Weston, framing, **68,** 95; **76,** ii, 333; contract annulled and awarded to W. Ferguson, **68,** 95.

1869. Hart & Jennings, constr. break'r, **69,** 24, 72; **76,** ii, 333; contract extended, **76,** ii, 333.

1870. J. Caldwell, constr. break'r, **71,** 109.

1871. S. Adams, constr. break'r, **71,** 109.

1875. E. Powell, constr. break'r, **75,** 189. H. J. Lutes, constr. break'r, **76,** ii, 330.

1889. Morrison & Hannah, break'r constr., substr. $92.90 and superstr. $17.10 running f., **89,** 2022.

1891. C. Berner, crib break'r constr., $28,080, **91,** 2508.

1892. Powell & Mitchell, extension and repair of break'r., $65,351.50, **93,** 2688.

1894. Same firm, break'r extension, $5,745, **94,** 2036.

1895. Donohue & Anderson, cement warehouse, $1,000, **95,** 2573. Sandusky Portland Cement Co., Portland cement, $2.20 bbl. Milwaukee Cement Co., natural cement, $1.04 bbl. A. & D. Sang, sand, 50¢ c. y.; broken st., $1.58 and $2.25 c. y. Powell & Mitchell, ironware, etc. **95,** 2573.

Itemized expend. for constr. concrete break'r, **96,** 2377; **97,** 2636; **98,** 2257.

1899. W. T. Berthelet, 3,700 bbls. cement, $1.04 bbl. N. D. Hodgkins, 2,800 c. y. broken st., $1.60 c. y. Kelley Island Lime & Transport Co., 800 bbls. cement, $2.35 bbl. Various circular letter contracts. **99,** 2716.

1903. Noah Pelissier, sand, 49¢ c. y.; Alpena Portland Cement Co., Portland cement, prices listed, **03,** 1822.

1904. F. B. Spear & Sons, Portland cement, prices listed, **04,** 2777.

1910. Northern Dredge & Dock Co. ($25,000), dr., 19¢ c. y.; F. L. McDonald, bldg. break'r embankment, $75,000 (annulled), **11,** 2292.

1912. Thos. L. Durocher, bldg. embankment for break'r extension, $70,000, **12,** 2480.

ENCROACHMENTS.

Upon H. area by dock owners, **87,** 1996.

ENGINEERS.

Chief of Engineers. R., 66, iii, 8; **67,** 21; **68,** 28; **69,** 24; **70,** 34; **71,** 31; **72,** 30; **73,** 31; **74,** 37; **75,** 41; **76,** 94; **77,** 98; **78,** 113; **79,** 151; **80,** 202; **81,** 272; **82,** 267; **83,** 275; **84,** 274; **85,** 297; **86,** 291; **87,** 257; **88,** 234; **89,** 272, 366, 2027, 2031, 2038; **90,** 245; **91,** 315; **92,** 300; **93,** 342; **94,** 313; **95,** 350; **96,** 306; **97,** 391; **98,** 383; **99,** 453; **00,** 519; **01,** 512; **02,** 436; **03,** 473; **04,** 514; **05,** 520; **06,** 574; **07,** 599; **08,** 643; **09,** 677; **10,** 750, 757; **11,** 807; **12,** 966.

Boards. Convened, Marquette, Nov. 27, 1888, by S. O. No. 64, to **R.** upon the estab. of H. lines in Marquette H., Mich. **R., 89,** 2032. (Majs. Davis, Allen, and Quinn.)

BERH. reviews Capts. Gaillard and Potter's **Rs.** and recom. expend. of $303,000 as reasonable, **04,** 2790.

In charge:

Maj. W. F. Raynolds, 1866. **R., 66,** iv, 77; **67,** 256.

Maj. J. B. Wheeler, 1866–70. **R., 67,** 66; **68,** 94.

Maj. D. C. Houston, 1870–75. **R., 70,** 92; **71,** 108; **72,** 113; **73,** 195; **74,** 137.

Maj. H. M. Robert, 1875–83. **R., 75,** 189; **76,** ii, 330; **77,** 851; **78,** 1140; **79,** 1482; **80,** 1900; **81,** 2037; **82,** 2115.

Maj. J. W. Barlow, 1883. **83,** 1629.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1633.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1829; **85,** 1971.

* Allotment. [1] $7,500 of this app. allotted to Marquette B. (H. of refuge).

Capt. W. L. Marshall, 1886. **86,** 290.
Capt. C. E. L. B. Davis, 1886–89. **R., 86,** 1645; **87,** 1995; (Maj.) **88,** 1831.
Maj. J. B. Quinn, 1889–91. **R., 89,** 2021, 2027, 2028, 2039; **90,** 2300.
Capt. W. L. Fisk, 1891–92. **R., 91,** 2505; **92,** 2142.
Maj. C. B. Sears, 1893–1901. **R., 93,** 2686; **94,** 2035; **95,** 2571; **96,** 2365; **97,** 2615; **98,** 2252; **99,** 2715; **00,** 3606.
Maj. D. W. Lockwood, **01,** 505.
Capt. D. D. Gaillard, 1901–03. **R., 01,** 2877; **02,** 2037; **04,** 2787.
Maj. L. H. Beach, 1903. **R., 03,** 1820.
Capt. C. L. Potter, 1903–06. **R., 04,** 2774, 2790; (Maj.) **05,** 2003; **06,** 1724.
Maj. G. D. Fitch, 1906–11. **R., 07,** 1860; **08,** 1932; (Lt. Col.) **09,** 1934; **10,** 2087.
Maj. F. R. Shunk, 1911–. **R., 11,** 2290; (Lt. Col.) **12,** 2478.
1st Lt. J. N. Hodges, **12,** 943.

Assistants:
Lt. J. B. Quinn. **R., 67,** 67.
W. H. Hearding. **R., 68,** 94; **74,** 137; **75,** 189.
Capt. J. W. Cuyler. **R., 73,** 195.
R. S. Littlefield, **68,** 95.
C. Coleman. **R., 96,** 2367; **97,** 2618; **98,** 2254.
F. L. Dever. **R., 04,** 2793.

ESTIMATES. (See Projects.)

By Maj. Raynolds, 1866, crib break'r; 1st location, $385,129.58 (the one chosen, **67,** 67), **66,** iii, 8, iv, 81; **76,** ii, 332; 2d location, $279,764.10, **66,** iv, 82.

By Maj. Robert, 1875, extension of break'r 400 l. f. in 33′ of w.; est., $68,000, **75,** 189; **78,** 1140; **79,** 1482. Break'r extended 10′ beyond orig. proposed l. for about $92,000 less than orig. est. cost, **76,** ii, 330; **79,** 1482.

EXPENDITURES.

For repairs to break'r, **76,** ii, 331; **77,** 851; **78,** 113, 1141.

OPERATIONS.[1]

1867–68. 100 l. f. st. p. and 210 l. f. crib p. built; 1 crib sunk through the ice, **68,** 95; **76,** ii, 332.

1868–69. 450 l. f. crib p. and 160 l. f. superstr. built; 3 cribs sunk through the ice; bottom hard and level, **69,** 24, 25; **76,** ii, 332.

1869–70. 200 l. f. crib p. and 450 l. f. superstr. built, **76,** ii, 333.

1870–71. 250 l. f. crib p. and 300 l. f. superstr. built, **70,** 34, 92; **76,** ii, 333.

1871–72. 550 l. f. crib p. and 300 l. f. superstr. built, **72,** 113; **76,** ii, 333.

1872–73. 200 l. f. crib p. and 500 l. f. superstr. built; 741 cords riprap placed; p. supplied with st.; decking begun, **73,** 195; **76,** ii, 333.

1873–74. 150 l. f. superstr. built; 311 cords riprap placed; decking completed except on last 150′ of p.; cribs refilled, **76,** ii, 333.

1874–75. 50 l. f. crib p. and 100 l. f. superstr. built; 333 cords riprap placed; cribs sunk on a st. foundation 7½′ h., **75,** 189; **76,** ii, 333, 334.

1875–76. 50 l. f. superstr. built; 2,059 cords riprap placed; p. riprapped; decking completed by hired labor; minor repairs, **76,** 94, ii, 330.

1876–77. Minor repairs, **77,** 98, 851.

1877–78. Repairs to break'r, **78,** 113, 1140.

1879–80. Repairs to break'r, **80,** 1900.

1880–81. Repairs to break'r, **81,** 2037.

1881–82. Extensive repairs to break'r, **82,** 2116.

1882–83. 1,050 l. f. of break'r repaired and renewed, **83,** 1634.

1883–84. Repairs to break'r, **84,** 1829.

1886–87. 200′ of break'r riprapped; 315′ of superstr. rebuilt; damage to break'r and pierhead light repaired, **87,** 1995.

1887–88. Repairs to break'r made by hired labor, **88,** 1831.

1889–90. 180 l. f. of break'r built, **90,** 2300.

1890–91. Repairs to superstr., **91,** 2506.

1891–92. Break'r extension in progress; repairs to superstr., **92,** 2143.

1892–93. Break'r extension in progress, **93,** 2686.

1893–94. In connection with previous year, 600 l. f. break'r completed, **94,** 2035.

1894–95. In connection with preceding year, 100 l. f. added to break'r, and constr. of concrete break'r begun, **95,** 2571.

1895–96. In connection with preceding year, 470 l. f. concrete break'r built, and cement for the same tested, **96,** 2365, 2376.

1896–97. 390 l. f. concrete break'r built, and the cement used tested, **97,** 2616, 2623, 2627.

1897–98. 140 l. f. break'r completed; cement tested, **98,** 2252, 2269.

1899–00. 500′ of extension to concrete superstr. built, **99,** 2715; **00,** 3606.

1902–03. Work resumed on constr. of superstr. of break'r, repairs made to old plant, 1,200′ track laid, locomotive supply cars purchased, 3,500 sq. f. old superstr. cut down, and setting of concrete blocks commenced, **03,** 1821.

1903–04. Old superstr. removed, footing blocks leveled and set, 680 l. f. concrete foundation prepared, and concrete blocks put in place, **04,** 2774.

1904–05. 820 l. f. concrete superstr., 100′ protection wall, and roadway to life-saving station built, **05,** 2003, 2004.

1905–06. Work on portions of break'r damaged by storms in progress, **06,** 1724.

1906–07. Repairs made to break'r, **07,** 1860.

1907–09. Mainten. of works. (See an. **Rs.**)

1909–10. Repairing damages to break'r caused by storm, and reinforcing concrete superstr., **10,** 2087.

1910–11. 142,335 c. y. dr. (contract); work on extension of break'r begun, **11,** 2291.

1911–12. 5817 t. r. delivered for break'r extension, **12,** 2479.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 109; **76,** ii, 331; **96,** 2365; **97,** 2615; **04,** 2791.

Character of substratum, as determined by borings taken in 1869 on line of p., **76,** ii, 333.

Condition of work and d. of chan., **03,** 473.

Damage to break'r by storms, **05,** 2004; **09,** 1934.

B. 2 m. w. at mouth and 1 m. d., on s. shore of Lake Superior, 158 m. w. of Sault Ste. Marie and 258 m. e. of Duluth, **12,** 966.

PRIVATE WORK.

Pending a reconsideration of the estab. H. lines by the Sec. of War, the Duluth, South Shore & Atlantic Ry. extended its ore dock beyond the estab. lines, **93,** 2687.

Lake Superior & Ishpeming Ry. Co., by permission of Sec. of War, built new dock, **11,** 2294.

PROJECTS. (See Estimates.)

By Maj. Raynolds, 1866, crib break'r, n. side of H., s., 2,000 l. f., in 4 sections of 500′ e., resp. (beginning at shore end), 25, 30, 35, and 40′ in w.; entire structure when completed to be 5′ above the w., filled with ballast and decked, **66,** iv, 79, 80, 82; est., $385,129.58, **66,** iii, 8, iv, 81; **76,** ii, 332. In 1875 the break'r completed to 2,010′ (or 10′ beyond orig. est.); cost, $92,000 less than orig. est., **76,** ii, 330; **79,** 1482; **86,** 291.

By Maj. Robert, 1875, farther extension of break'r 400′; est. (not in addition to orig. est.), $68,000, **75,** 189; **79,** 1482; **86,** 292.

In 1888 Maj. Davis provided for the extension of the break'r for 1,200′; est., $200,000, **88,** 1831.

In 1889 l. of the proj. break'r reduced by Maj. Quinn to 1,000′; cost, $121,000, **89,** 2021.

In 1890 Maj. Quinn proposed the addition of a concrete superstr. to the 2,000 l. f. of break'r built under the proj. of 1866; est., $149,454.36. This,

[1] 1875. Proj. completed; break'r 2,010′ l.; cost of work compared with orig. est. of 1886, **76,** ii, 330; **77,** 851; **79,** 1482. History of operations, **76,** ii, 331. Abstracts of materials used and work done, **67,** 69; **68,** 97; **76,** ii, 331.

together with the cost of break'r extension as proj. in 1889, made a total of $270,454.36 for completion in 1890, **90,** 2301; proj. approved, 1890, for concrete superstr.; est., $232,936.71, **91,** 2506.

On experience in building first 1,000′ of break'r, it was est., 1899, that $100,000 instead of $173,936.71 would be required to complete proj., **99,** 2715.

Act June 13, 1902, au. continuing imp. and mainten., **02,** 2037.

Act June 25, 1910, au. constr. of 1,500′, in se. direction, extension to break'r (H. D. 573, 61st, 2d) consisting of timber cribs on rubble mound embankment, with concrete superstr. (plan No. 2); and also au. dr. of shoal in n. part of H.; est., $489,000, **10,** 751.

Existing proj., 1912, that of 1910, added to crib break'r projecting s. for 3,000′ (est., $506,129.58); concrete superstr. to same ($232,936.71); extension 1500′ SE. of cribs and concrete superstr., and dr. (est., $489,000); grand total, $1,228,066.29, **12,** 967.

SURVEYS.

Marquette H., 1859, by Capt. Meade, **67,** 53, 566.

Ex. and sur. au. act June 13, 1902, for H. of refuge. **R.,** Capt. Gaillard, Jan. 17, and Capt. Potter, Sept. 13, 1903, submitting plan for extending existing break'r 1,500′; est., $303,000 (H. D. 161, 58th, 2d), **04,** 518, 2786, 2790.

Ex. and sur. au. act Mar. 3, 1909. **R.** May 21 and Nov. 13, 1909, by Lt. Col. Fitch, changing plan for constr. of 1,500′ extension to breakw'r, as proposed, 1903, by Capt. Potter; est., $489,000 (H. D. 573, 61st, 2d) (see Projects, 1910). **10,** 757.

Maps. (H. D. 573, 61st, 2d.) Of H., **76,** ii, 330; **87,** 1998; **96,** 2384; **97,** 2626; **98,** 2256; **03,** 1822; **04,** 2776; **10,** 2088; **11,** 2291, 2293.

LL-54(b) PRESQUE ISLE POINT, MARQUETTE BAY, MICH. (Harbor of refuge at.)

APPROPRIATIONS.

1896,	$20,000,	**96,** 2386.
1899,	30,000,	**99,** 2719.
1902,	[1] 7,500,	**02,** 2037.
1905,	1,000,	**05,** 2007.
1910,	2,000,	**10,** 2090.
1911,	2,000,	**11,** 2295.
Total,	62,500	

COMMERCE.

Description of, **96,** 2385; **97,** 2638.

Increasing, but in 1896 it did not appear to the officer in charge that there was any necessity for a H. of refuge, especially as Marquette H., affording an ample and safe refuge place, was only 1½ m. away, but he presumed it was intended for the protection of the ore and C. docks of the Lake Superior & Ishpeming Ry.Co., and the docks of the Dead River Lumber Co., **96,** 2385; **97,** 2638.

At 1899, valued at $3,250,000, **00,** 3609.

Increased greatly, **02,** 437.

Effect on f. rates, **06,** 577.

At 1911, 1,017,174 t., decrease over 1910 of 48%, **12,** 2483.

CONTRACTS.

1897. A. and D. Sang, breakw'r, $15,200, **97,** 2639.

1899. Powell & Mitchell, breakw'r extension, $27,000, **00,** 3609.

1902. Hugo & Tims, timber p. constr., $6,801.30, **03,** 1823.

ENGINEERS.

Chief of Engineers. R., 96, 307; **97,** 391; **98,** 383; **99,** 454; **00,** 519; **01,** 513; **02,** 437; **03,** 474; **04,** 516; **05,** 522; **06,** 576; **07,** 601; **08,** 644; **09,** 679; **10,** 753; **11,** 810; **12,** 969.

In charge:

Maj. C. B. Sears, 1896–1901. **R., 96,** 2385; **97,** 2638; **98,** 2284; **99,** 2718; **00,** 3608.

Maj. D. W. Lockwood, **01,** 505.

Capt. D. D. Gaillard, 1901–03. **R., 01,** 2879; **02,** 039.

Maj. L. H. Beach, 1903. **R., 03,** 1823.

Capt. C. L. Potter, 1903–06. **R., 04,** 2777; (Maj.) **05,** 2006; **06,** 1726.

Maj. G. D. Fitch, 1906–11. **R., 07,** 1862; **08,** 1934; **09,** 1936; **10,** 2089.

Maj. F. R. Shunk, 1911–. **R., 11,** 2294; (Lt. Col.) **12,** 2481.

OPERATIONS.

1896-98. 500 l. f. breakw'r built, **97,** 2638; **98,** 2284.

1899-00. 500 l. f. breakw'r under constr.; **00,** 3608.

1902-03. Timber p. built from breakw'r to shore; revet. constr. along shore 100′, **03,** 1823.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 2385. In Marquette B., which makes in from Lake Superior just n. of Marquette H. proper, and the shore is within the limits of the city of Marquette. B. is protected from n. storms and to some extent from ne. storms, and storms from other directions are infrequent. **96,** 2385.

The effect of the storms of 1897–98 justified the method of breakw'r constr. adopted, **98,** 2284.

Condition of work, **01,** 2879.

PRIVATE WORK.

Ore dock of steel and concrete building, 1912, by Lake Superior & Ishpeming Ry. Co., **12,** 2481.

PROJECTS.

By the Chief of Engineers, 1896, timber and st. breakw'r from Presque Isle Pt. not to exceed 1,000′ l., **96,** 2385, in a general se. direction (see Surveys) **97,** 2638; **98,** 2284.

Act June 13, 1902, au. connecting Presque Isle Breakw'r with shore, **02,** 2039.

SURVEY.

Congress called by resolution of Mar. 20, 1896, for a sur. and est. for a breakw'r. Chief of Engineers reported it would cost from $20,000 to $50,000. **96,** 307.

Maps. **03,** 1823.

LL-57 MUNISING HARBOR, MICH.

COMMERCE.

Receipts and shipments, 1907, 17,000 t., approx.; while Munising H. is a fine one, yet its geographical position is not such as to make it a trans. point for iron ore; timber and timber products may increase for a time, but the eventual exhaustion of standing timber must diminish the export of such products. (See H. D. 479, 60th, 1st.)

ENGINEERS.

Chief of Engineers. R., 08, 648.

In charge. Maj. G. D. Fitch, **08,** 626.

SURVEY.

Pre. ex. au. act Mar. 2, 1907. **R.,** Maj. Fitch, Sept. 21, 1907 (H. D. 479, 60th, 1st) (unfav.), **08,** 648

[1] Allotted from app. for Marquette H., Mich.

LL-63 M'CARGOE COVE, ISLE ROYALE, LAKE SUPERIOR, MICH.

ENGINEERS.

Chief of Engineers. **R., 76,** 93.
In charge. Maj. C. B. Comstock, 1876. **R., 76,** ii, 320.

PLANS.

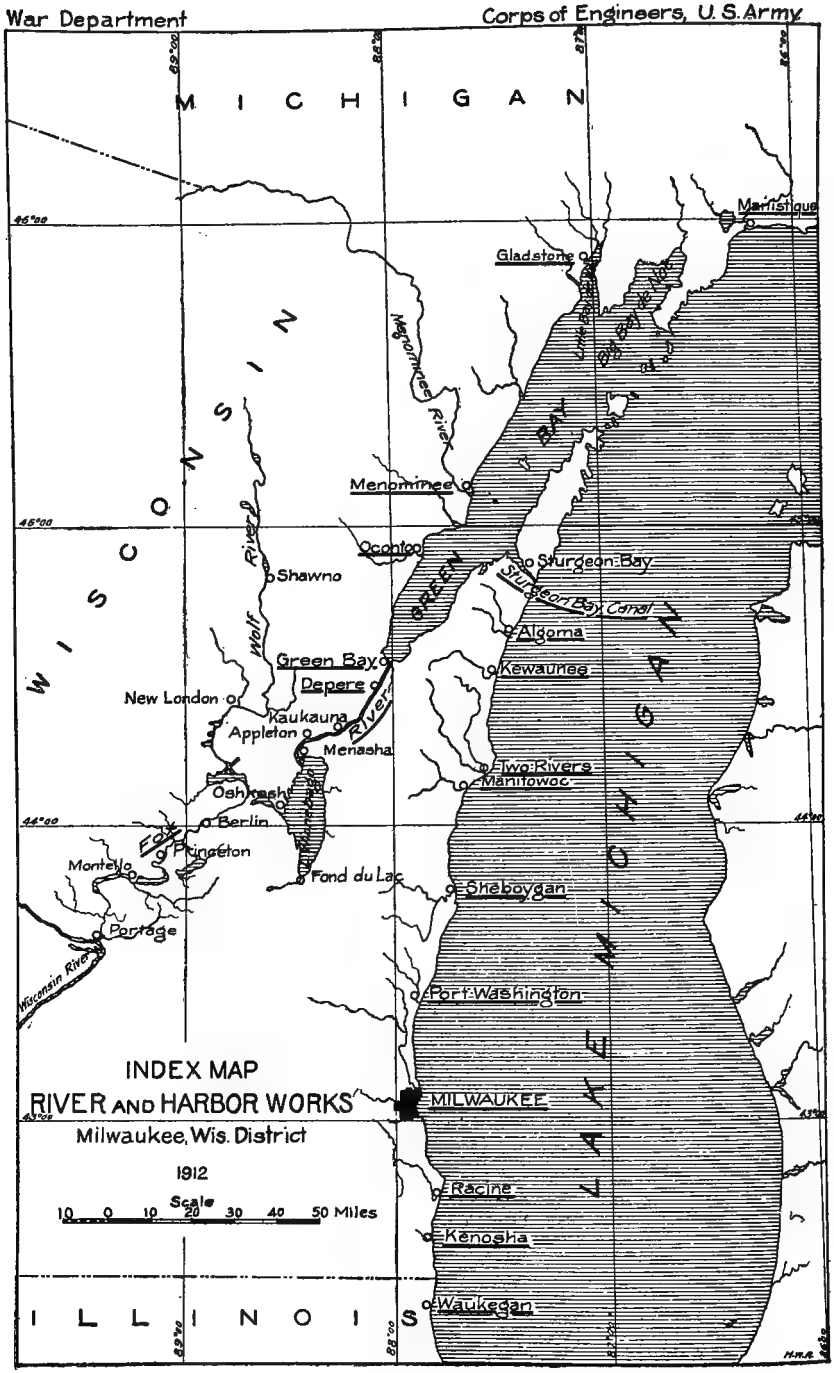
By Maj. Comstock, 1876, excavating part of rocky ledge obstr. entrance, to 15′ at l. w.; est., $45,000, **76,** ii, 320.

SURVEYS.

Locality included in the Lake Sur., 1867, **76,** ii, 320.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

MM.—MILWAUKEE, WIS., DISTRICT.


War Department
Corps of Engineers, U. S. Army
MICHIGAN
WISCONSIN
ILLINOIS
LAKE MICHIGAN
Manistique
Gladstone
Big Bay de Noc
Menominee River
Menominee
Oconto
Sturgeon Bay
Sturgeon Bay Canal
Algoma
Kewaunee
Two Rivers
Manitowoc
Sheboygan
Port Washington
MILWAUKEE
Racine
Kenosha
Waukegan
GREEN BAY
Green Bay
Depere
Shawno
Wolf River
New London
Kaukauna
Appleton
Menasha
Oshkosh
Berlin
Princeton
Montello
Fox
Fond du Lac
Portage
Wisconsin River
INDEX MAP
RIVER AND HARBOR WORKS
Milwaukee, Wis. District
1912
Scale
10 0 10 20 30 40 50 Miles

MM.—MILWAUKEE, WIS., DISTRICT.

In charge of U. S. Engineer Office,
Customhouse, Milwaukee, Wis.

NOTE.—Between the end of the list of waterways on p. 1294 and the beginning of the list below, there are some waterways which are geographically connected with both MM and PP districts. They are listed with the waterways of PP District because in practice it has been found more practical to have them under the engineering care of PP District.

MM 1 Lake Michigan.
MM 2 Manistique R., Mich. (1)
MM 3 Green B., Mich. and Wis. (1)
MM 4 Big Bay de Noc, Mich. (3)
MM 5 Little Bay de Noc Mich. (3)
MM 6 Escanaba R., Mich. (3)
MM 7 Ford R., Mich. (3)
MM 8 Cedar R., Mich. (3)
MM 9 Menominee R., Mich. and Wis. (3)
MM 10 Marinette, Wis. (3)
MM 11 Peshtigo R., Wis. (3)
MM 12 Oconto, Wis. (3)
MM 13 Pensaukee R., Wis. (3)
MM 14 Green Bay H., Wis. (3)
MM 15 Fox R., Wis. (14) (Connecting with Wisconsin R. Dist. KK. See p. 1247.)
MM 16 Wolf R., Wis. (15)
MM 17 Embarrass R., Wis. (16)
MM 18 Little Wolf R., Wis. (16)
MM 19 Waupaca R., Wis. (16)
MM 20 Portage Canal, Wis. (15)
MM 21 Lake Winnebago, Wis. (15).
MM 22 Fond du Lac R., Wis. (21)
MM 23 East R., Wis. (15)
List returns here to Lake Mich. at following (15):
MM 24 Sturgeon B. Canal, Wis. (3) (1)
MM 25 Ahnapee R., Wis. (1)
MM 26 Algoma, Wis. (1)
MM 27 Kewaunee, Wis. (1)
MM 28 E. Twin R., Wis. (1)
MM 29 W. Twin R., Wis. (1)
MM 30 Manitowoc R., Wis. (1)
MM 31 Sheboygan R., Wis. (1)
MM 32 Port Washington, Wis. (1)
MM 33 Milwaukee R., Wis. (1)
MM 34 Menominee R., Wis. (33)
MM 35 Kinnickinnick R., Wis. (33)
MM 36 Root R., Wis. (1)
MM 37 Pike Creek, Wis. (1)
MM 38 Kenosha, Wis. (37)
MM 39 Waukegan H., Ill. (1)

MM-1(a) LAKE MICHIGAN. (Datum planes.)

ENGINEERS.

Chief of Engineers. R., 09, 683; **10,** 758; **11,** 814; **12,** 974.

In charge:
Maj. W. V. Judson, **09,** 683.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, **09,** 683; **10,** 758; **11,** 814; **12,** 974.
Lt. Col. G. A. Zinn, **11,** 814.

DATUM PLANES.

At all Hs. on w. shore of lake. Plane of ref. or datum plane to which all d. are referred is a plane 581.63′ above m. tide at New York City, or m. l. of Lake Michigan for years 1860–1875, **09,** 683; **10,** 758; **11,** 814; **12,** 974.

MM-2(a) MANISTIQUE HARBOR, MICH.

APPROPRIATIONS.

1880,	$5,000,	**80,** 1902.
1881,	1,000,	**81,** 2054.
1905,	25,000,	**05,** 2014.
1907,	25,000,	**07,** 1868.
1910,	150,000,	**10,** 2102.
1911,	138,462,	**11,** 2304.
Total,	344,462	

COMMERCE.

Local, **73,** 254.
Description of; probable material effect on rates, **05,** 525.
In 1911, 278,594 t., **12,** 975.

CONTRACTS.

1881. Chicago Lumbering Co., dr., 15¢ c. y., **81,** 2055.

1908. Greiling Bros., dr., and crib constr., **09,** 1946.
1911. Greiling Bros., bldg. crib breakw'r, crib and pile p., and concrete superstr., **11,** 2304.
1912. Green Stone and Quarrying Co., 4,000 t. st., $1.26 t., **12,** 2493.

ENGINEERS.

Chief of Engineers. **R., 73,** 36; **79,** 155; **80,** 203, 206; **81,** 273; **82,** 268; **83,** 276; **84,** 276; **85,** 299; **86,** 293; **87,** 259; **88,** 235; **89,** 274; **90,** 247; **91,** 317; **92,** 303; **93,** 344; **94,** 315; **95,** 353; **96,** 308; **04,** 536; **05,** 524; **06,** 579; **07,** 604; **08,** 648; **09,** 683; **10,** 758; **11,** 814; **12,** 974.

Boards. BERH. reviews Maj. Warren's reports and recom. imp.; cost, $270,000, **04,** 2878.

In charge:
Maj. D. C. Houston. **R., 73,** 254.
Maj. H. M. Robert, 1879–83. **R., 80,** 1902, 1931; **81,** 2054, 2055, 2057; **82,** 2117, 2118.
Maj. J. W. Barlow, 1883, 1884–86; **83,** 1629. **R.,** (Lt. Col.) **84,** 1832; **85,** 1974.
Capt. F. A. Hinman, 1883–84. **R., 83,** 1637.
Capt. W. L. Marshall, 1886; **86,** 290.
Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1649; **87,** 2001; (Maj.) 88, 1835; **89,** 2042; **90,** 2326; **91,** 2523.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2170; **93,** 2700; **94,** 2042.
Capt. C. F. Palfrey, 1895. **R., 95,** 2592.
Capt. G. A. Zinn, 1896. **R., 96,** 2458.
Maj. J. G. Warren, 1904–05. **R., 04,** 2871; **05,** 2014.
Maj. W. V. Judson, 1905–09. **R., 06,** 1731; **07,** 1867; **08,** 1941.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1945; **10,** 2102; **11,** 2303; **12,** 2491.

Assistants:
J. Pierpont. **R., 73,** 255.
L. Y. Schermerhorn. **R., 80,** 1931.

LEGAL PROCEEDINGS.
Trans. of land to U.S., **06,** 1732; **08,** 648, 1941.

OBSTRUCTIONS.
Damaged p. removed at once, **06,** 1732.

OPERATIONS.
1880-81. 11,780 c. y. dr., **81,** 2054.
1881-87. Operations abandoned for refusal of interests controlling the H. to rectify p. lines, **82,** 2118; **86,** 293; **87,** 2001.
1905-06. Damaged p. removed under contract, **06,** 1732.
1908-09. 14,567 c. y. dr., p. constr. in progress, **09,** 1945.
1909-10. 66,738 c. y. dr., 375 l. f. crib revet. built, and 300 l. f. old p. removed, **10,** 2102.
1910-11. 20,342 c. y. dr. by U.S.; work on building p. and breakw'r in progress, about 20% finished, **11,** 2304.
1911-12. 4 cribs sunk in breakw'r and 250′ concrete superstr. placed thereon; proj. 30% completed, **12,** 2491.

PHYSICAL CHARACTERISTICS.
General, **73,** 255.
Damage to w. p. by storm, **06,** 1732.
H. 65± m. nw. from Charlevoix, Mich., and 97½± m. ne. from Sturgeon B. Canal, **12,** 974.

PLANS. (See Projects.)
By Maj. Houston, 1873, 2 crib ps. extending to 18′ curve, and dr. in chan.; est., $290,000. Probability that an e. p. would not be necessary, and that the scouring action of the current would reduce the dr. **73,** 255.

PRIVATE WORK.
3,000′ slab ps. built, and dr. to 11′ done before US. works, **12,** 974.

PROJECTS. (See Plans and Operations.)
By Maj. Robert, 1879, removal of 20,000 c. y. of sand from bet. ps.; est., $6,000, **80,** 1932.
Act Mar. 3, 1905, au. (a) constr. of p. connecting shore with breakw'r, extending breakw'r 350′ on e. side of H.; (b) constr. of p. 1,200′ bet. w. p. and 17′ contour of lake, w. side; (c) dr. to 19′; est., $270,000 (H. D. 429, 58th, 2d), **04,** 2869; **05,** 525.
Act Mar. 2, 1907, modified existing proj., swinging inner end of proposed w. p. westward, creating a stilling basin; est., $338,462, **08,** 648, 1942.

SURVEYS.
Under direction of Maj. Houston, 1872, by J Pierpont, **73,** 36, 255.
Au. act Mar. 3, 1879; made, 1880, by Maj. Robert, **80,** 1931.
Sur. made, 1890, by Maj. Davis, **90,** 2326.
Pre. ex. and sur. au. act June 13, 1902. **R.,** Maj. Warren, 1902 and 1903; 2 plans presented; ests., $492,000 and $270,000 (H. D. 429, 58th, 2d), **04,** 536, 2869.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 974.
Maps. **81,** 2054; **08,** 1942; **11,** 2304.

MM-5(a) GLADSTONE HARBOR, (Little Bay de Noc), MICH.

APPROPRIATIONS.
1905, $14,000, **05,** 2016.

COMMERCE.
In 1902, 500,000 t., **04,** 2867.
Almost entirely with Lake Erie ports. Local C. insignificant; bulk of business originates elsewhere, simply passing through Gladstone. H. closed during winter months, **04,** 2863; **07,** 605.
Proj. has material effect on controlling freight rates, **06,** 581.
In 1908, 560,000 t., **09,** 685; 1911, 450,000± t., **12,** 2495.

CONTRACTS.
1905. Joseph Wolter, dr. 85,000± c. y., 13¢ c. y., **05,** 2016.

ENGINEERS.
Chief of Engineers. **R., 04,** 536; **05,** 525; **06,** 581; **07,** 605; **08,** 649; **09,** 684; **10,** 759; **11,** 815; **12,** 975.
Boards. BERH. recom. d. of 21′; estab. H. lines and dr. on a line perpendicular to axis of ore dock (ore dock abandoned 1912) through its outer end; est. of $14,000. **R., 04,** 2867, 2868.

In charge:
Maj. J. G. Warren, 1904–05. **R., 04,** 2862; **05,** 2015.
Maj. W. V. Judson, 1906–08. **R., 06,** 1733; **07,** 1869; **08,** 1943.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1947; **10,** 2104; **11,** 2306; **12,** 2494.

OPERATIONS.

1904-05. 17,853 c. y. dr., **05,** 2015.
1905-06. 30,020 c. y. dr.; proj. completed, **06** 1733.

PHYSICAL CHARACTERISTICS.

Natural H., completely landlocked, affording safe mooring place for vessels at all times, **04,** 2862.
Max. draft, 1907, 21′, **07,** 605.
Main. chan. 24′–42′ d.; 74± m. w. of Manistique, Mich., and 62.5± m. n. from Menominee, Mich., **12,** 975.

PROJECT.

Act Mar. 3, 1905, au. proj. for dr. to 21′ below datum of portion obstr. by shoals; est., $14,000 (H. D. 165, 58th, 2d) (see Boards), **05,** 525.

SURVEY.

Pre. ex. and sur. for 18′, au. act June 13, 1902. **Rs.,** Maj. Warren, 1902 and 1903; ests., $36,300 and $14,000 (H. D. 165, 58th, 2d) (see Projects), **04,** 536, 2861.

MM-5(b) WHITEFISH RIVER (Little Bay de Noc) (Noquette), MICH. (Harbor at mouth.)

COMMERCE.

Description of; unimportant, **95,** 2685.

ENGINEERS.

Chief of Engineers. R., 95, 368.
In charge. Capt. C. F. Palfrey, 1894–95. **R., 95,** 2684.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2685.
The Whitefish, Rapid, and Tacoosh Rs.—the former used only for logging, and the latter 2 being small creeks only—empty into Little Bay de Noc through a common chan., which lies bet. 2 long points of shoals extending a long distance out from the w. shore of the B. at Masonville and from e. shore opposite. This chan. is narrow and tortuous, and ex. of 1894 was with view to imp., **95,** 2685.

SURVEY.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Gregory (**R.** unfav.), **95,** 2685.

MM-8 CEDAR RIVER HARBOR, MICH.

APPROPRIATIONS.

1882,	$15,000,	**82,** 2119.
1884,	15,000,	**84,** 1834.
Total,	30,000	

COMMERCE.

Unimportant, **87,** 2004.
Small, **88,** 1836; **91,** 2526; **94,** 2044.

CONTRACTS.

1883. Green Bay Dredging Co., pile p. constr., **83,** 1638.
1884. Green Bay Dredging Co., dr., **85,** 1976. Schwarz & Berner, pile p. constr., **85,** 1976.

ENGINEERS.

Chief of Engineers. R., 81, 279; **82,** 268; **83,** 277; **84,** 276; **85,** 299; **86,** 293; **87,** 259; **88,** 236; **89,** 275; **90,** 248; **91,** 318; **92,** 303; **93,** 345; **94,** 315; **95,** 353; **96,** 309.

In charge:
Maj. H. M. Robert, 1881–83. **R., 82,** 2119, 2120.
Maj. J. W. Barlow, 1883. **R., 83,** 1629.
Capt. F. A. Hinman, 1883–84. **R., 83,** 1637.
Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1833; **85,** 1976.
Capt. W. L. Marshall, 1886. **86,** 290.
Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1650; **87,** 2002; (Maj.) **88,** 1835; **89,** 2043; **90,** 2327; **91,** 2525.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2172; **93,** 2701; **94,** 2043.
Capt. C. F. Palfrey, 1895. **R., 95,** 2593.
Capt. G. A. Zinn, 1896. **R., 96,** 2458.

Assistant. L. Y. Schermerhorn. **R., 82,** 2122; **83,** 1639.

OPERATIONS.

1883-84. 553 l. f. of pile p. built, **84,** 1833.
1884-85. P. constr. in progress; 10,583 c. y. dr. from chan., **85,** 1976.
1885-86. Ps. extended to an aggregate l. of 1,054′, **86,** 1650.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 2120, 2122.
Shoal, front of entrance, **82,** 2119, 2122; **83,** 1639.
In 1894 there was a narrow chan. with a d. of 14′, **94,** 2044.

PROJECTS.

By Maj. Robert, 1881, 2 parallel ps., 200′ apart, extending from the outer ends of existing private ps. to about the 16′ curve in Green B.; dr. of the chan. bet. the ps. to 14′; est., $138,000, **82,** 2121, 2124. Change in direction of ps., **85,** 1976; **92,** 2172.

SURVEYS.

Au. act Mar. 3, 1881; made by Maj. Robert, **82,** 2119.
Sur. made, 1894, by Maj. Gregory, **94,** 2044.
Maps. Mouth of the R., **84,** 1834.

MM-9 MENOMINEE HARBOR AND RIVER, MICH. AND WIS.

Part.	Title.	Period.	Appropriations.
a	Menominee H	1867–1901	$234,650.00
b	Menominee R	1890–1901	114,420.00
c	Menominee H. and R	1902–1912	78,350.00
	Total		[1] 427,420.00

Part (a), MM-9 Menominee Harbor, Mich. and Wis.

APPROPRIATIONS.

1871,	$25,000,	**71,** 32.
1872,	25,000,	**72,** 31.
1873,	25,000,	**73,** 32.
1874,	25,000,	**74,** 37.
1875,	25,000,	**75,** 42.
1876,	8,000,	**76,** 95.
1878,	10,000,	**78,** 113.
1879,	10,000,	**79,** 152.
1880,	10,000,	**80,** 1903.
1881,	12,000,	**81,** 2059.
1882,	15,000,	**82,** 2127.
1884,	10,000,	**84,** 1837.
1886,	3,000,	**86,** 1653.
1888,	9,000,	**88,** 1838.
1894,	10,000,	**95,** 2597.
1896,	7,150,	**96,** 2461.
1899,	5,500,	**99,** 2726.
Total,	234,650	

COMMERCE.

Local interests, **67,** 132, 133; **73,** 197.
Important, **67,** 134; **75,** 193; **76,** ii, 338.
A freight ferry, to ply across Green B. and Lake Michigan, estab., 1894, with a terminus at this place. **95,** 2596.

CONTRACTS.

1871. A. Kirby, materials and labor, **71,** 110.
1873. A. Kirby, materials and labor, **74,** 138.
1874. Menomonee Dredge Co., dr., 25¢ c. y., **74,** 138. Green Bay Dredge & Pile-Driver Co., pile p., **75,** 192.
1875. Menomonee Dredge Co., dr., 14½¢ c. y., **75,** 193; contract extended, **76,** ii, 334.
1877. Truman & Schroeder, material and labor, **77,** 852.
1878. Menomonee Dredge Co., dr., 10¢ c. y., **78,** 1142. Green Bay Dredge & Pile-Driver Co., materials and labor, **79,** 1484.
1880. Green Bay Dredge & Pile Driver Co., p. extension, **80,** 1904. Truman & Cooper, p. extension, **81,** 2060.
1881. Green Bay Dredge & Pile-Driver Co., p. extension, **81,** 2060.
1882. S. M. Stephenson, dr., 10¢ c. y., **83,** 1640. Truman & Cooper, p. extension, substr. and superstr., **83,** 1641.

ENGINEERS.

Chief of Engineers. **R., 67,** 27; **71,** 31; **72,** 31; **73,** 32; **74,** 37; **75,** 41; **76,** 94; **77,** 99; **78,** 113; **79,** 152; **80,** 203; **81,** 273; **82,** 269; **83,** 277; **84,** 277; **85,** 299; **86,** 294; **87,** 260; **88,** 236; **89,** 275, 287; **90,** 248; **91,** 318; **92,** 304; **93,** 345; **94,** 316; **95,** 354; **96,** 309; **97,** 393, 408; **98,** 385; **99,** 456; **00,** 522; **01,** 515.

In charge:
Maj. J. B. Wheeler, 1866–70; **70,** 32. **R., 67,** 132.
Capt. J. W. Cuyler, 1870, temporarily in charge, **70,** 32, 33.
Maj. D. C. Houston, 1870–75. **R., 71,** 109; **72,** 114; **73,** 196; **74,** 138.
Maj. H. M. Robert, 1875–82. **R., 75,** 192; **76,** ii, 334; **77,** 852; **78,** 1141; **79,** 1484; **80,** 1903; **81,** 2058; **82,** 2125.
Maj. J. W. Barlow, 1883. **83,** 1629.
Capt. F. A. Hinman, 1883. **R., 83,** 1640.
Lt. Col. J. W. Barlow, 1884–86. **R.,** *84,* 1835; **85,** 1978.
Capt. W. L. Marshall, 1886, **86,** 290.
Capt. C. E. L. B. Davis, 1886–91. **R., 86,** 1652; **87,** 2004; (Maj.) **88,** 1837; **89,** 2044; **90,** 2328; **91,** 2527.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2173; **93,** 2703; **94,** 2045.
Capt. C. F. Palfrey, 1895. **R., 95,** 2595.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2459; **97,** 2650, 2651; **98,** 2289.
Capt. J. G. Warren, 1899–1901. **R., 99,** 2726; **00,** 3650; (Maj.) **01,** 2908.

Assistants:
W. T. Casgrain. **R., 67,** 132.
Capt. J. W. Cuyler. **R., 72,** 114; **73,** 196.
W. H. Hearding. **R., 74,** 138; **75,** 192.
C. Crossman. **R., 84,** 1837.

EXPENDITURES.

In repairs of s. p., **77,** 853.

OPERATIONS.[2]

1871-72. 1,150 l. f. of pile p. built on the s. p., **72,** 31, 115; **76,** ii, 336.
1872-73. 134 l. f. of pile p. built on the n. and 197′ on s. side, and 133′ of superstr. on the s. p.; 585 of slab p. on n. side built, **73,** 196, 197; **76,** ii, 337.
1873-74. 352 l. f. pile p. on n. side and 720′ on s. side built; also 69′ of superstr. on s. p., **74,** 138; **76,** ii, 337.
1874-75. 128 l. f. of pile p. on n. side and 96′ on. s. side built; 32′ of superstr. built on s. side; also 60,005 c. y. dr.; repairs of ps., **75,** 192; **76,** ii, 337.
1875-76. 93,477 c. y. dr. from chan.; repairs of ps., **76,** ii, 335.
1876-77. 40,584 c. y. dr. from chan., **77,** 852.
1877-78. 150 l. f. of crib p. on n. side and 100′ on s. side built; 3,724 c. y. dr. from chan., **78,** 113, 1142.
1878-79. 150 l. f. of crib p. built on the n. side; also 100′ of superstr. built on s. and 150′ on n. p.; 1,588 c. y. dr. from chan., **79,** 152, 1484.
1879-80. 6 cribs sunk in extension of the n. p. and superstr. built over 3 cribs previously sunk, **80,** 1903.

[1] Inc. misc., $430,934.17, **12,** 2497.
[2] History of operations, **76,** ii, 335. Chan. 14′ x 125′ x 2,800′, **76,** ii, 337. List of material used and work done, with average cost of cribs, **78,** 1142; **79,** 1485.

1880-81. 4 cribs placed in extension of s. p., partial superstr. built over 6 cribs on n. p., and 2,500 c. y. dr. from chan., **81,** 2059.
1881-82. 6 crib substr. placed in extension of s. p.; superstr. built over 4 cribs, **82,** 2125.
1882-83. 3,950 c. y. dr. from chan., **83,** 1640.
1883-84. S. p. extended 200 l. f. and partial superstr. built over 300′ of same; n. p. extended 50 l. f. and outer crib replaced, **84,** 1835.
1884-85. Superstr. completed over 350′ of n. p. and over 700′ of s. p., **85,** 1978.
1886-87. 37,895 c. y. dr., **87,** 2005.
1889-90. 610 l. f. of n. p. rebuilt above the water line, and 1,105 c. y. dr. by hired labor, **90,** 2329.
1890-91. 14,170 c. y. dr., **91,** 2527.
1891-92. Chan. excavation completed, **92,** 2174.
1894-95. 1,309 l. f. s. p. repaired, **95,** 2595, 2596.
1895-96. 13,650 c. y. dr., **96,** 2460.
1896-97. 300 l. f. superstr. of n. p. and 100 l. f. s. p. rebuilt; opening bet. pile and crib ps. closed; minor repairs made, **97,** 2650.
1897-98. 2,374 c. y. dr. and repairs to ps. in progress, **98,** 2290.
1898-99. Minor repairs to s. p., **99,** 2726.
1899-00. Minor repairs to s. p.; about 1,000 c. y. dr., **00,** 3650.
1900-01. 11,734 c. y. dr. (U.S.) and 20′ chan. completed to required dimensions, **01,** 2908.

PHYSICAL CHARACTERISTICS.

General characteristics of Menominee R. and H., **67,** 132; **76,** ii, 335, 338; **97,** 2752.
Depth of water in R. mouth previous to imp., **76,** ii, 335, 336.
Bottom hard, compact sand, **72,** 115; **73,** 197; **76,** ii, 336.
Effect of s. p. on R. current, **72,** 115.
In 1895 there was a tendency to the formation of shoals in the H., **96,** 2460.
H. situated at the mouth of the R. of the same name on the w. shore of Green B., Lake Michigan, **97,** 2752.
Condition of work; water levels, **01,** 2908.

PLANS. (See Projects.)

By W. T. Casgrain, under direction of Maj. Wheeler, to open a chan. across the neck of land bet. Green B. and the Menominee R., and to constr. 2 parallel ps. in a direction due e.; n. p. 1,375 l. f. and s. p. 1,275 l. f.; dr. in chan. and in an inside basin to 12′; est., $252,571, **67,** 27, 134, 135.
In 1884 Lt. Col. Barlow, extension of the ps. to 18′ curve in the lake, dr. bet. the ps., and extensive repairs to existing superstr., increasing the est. to $300,000, **84,** 1835, 1836.

PRIVATE (PRIVATE AND CORPORATE) WORK.

The "gap" (**72,** 115) closed by pile work, **73,** 197; **76,** ii, 337.
Interior dr. and docking by the mill owners in 1874–76–77, **75,** 192; **76,** ii, 335; **77,** 852.
Improper use of ps. by lumber companies, **84,** 1836, 1837; **85,** 300, 1979, 1980; **86,** 1652.

PROJECTS. (See Plans.)

By Maj. Houston, 1871, 2 parallel pile ps. at the mouth of the R., 400′ apart, extending to the 15′ curve in Breen B., **71,** 109; **72,** 115; **76,** ii, 336.
To extend the ps. to the 16′ curve in the B., 1874, and to dr. a chan. 14′ from mouth of R. to the crossing of the ferry above; est., $212,000, **74,** 139; **79,** 1484; **84,** 1835; **86,** 1652.
In 1896 Capt. Zinn est. $19,000 to imp. H. by dr., **97,** 2754.
Consolidation of this work with that of the R. recom., 1899, **99,** 2726.

SURVEYS.

Under direction of Maj. Wheeler, 1867, **67,** 27, 132; **76,** ii, 336.
Ex. by Maj. Houston, 1871, **71,** 109; **76,** ii, 336.
Resur. of chan., **78,** 113, 1142.
Of H. and vicinity, 1881, **81,** 2059.
Au. act Aug. 11, 1888; made, 1889, by Maj. Davis, **89,** 2045.
Sur. for chan. 20′ d. au. act June 3, 1896; made, 1896, by Capt. Zinn (see Projects), **97,** 2751.
Minor surs., **00,** 3650.
Maps. Of H., **76,** ii, 334; **81,** 2060.

Part (b), MM-9 Menominee River, Mich. and Wis.

APPROPRIATIONS.

1890,	$54,000,	**90,** 2329.
1892,	20,500,	**92,** 2176.
1894,	6,000,	**95,** 2600.
1896,	15,000,	**96,** 2464.
1899,	18,920,	**99,** 2730.
Total,	114,420	

COMMERCE.

Important, **00,** 3744.

CONTRACTS.

1890. Truman & Cooper, dr., 10⅝¢ and 11⅝¢ c. y., **91,** 2530.
1896. W. A. Starke, dr. clay, 9¢ c. y.; bowlders and hardpan, 25¢ c. y. ($7,996), **97,** 2653.
1899. E. J. Pryor, dr., 9¢ c. y., $15,480, **99,** 2730.

ENGINEERS.

Chief of Engineers. **R., 90,** 259; **91,** 318; **92,** 304; **93,** 346; **94,** 316; **95,** 354; **96,** 310; **97,** 393; **98,** 385; **99,** 457, 474; **00,** 522, 538; **01,** 515.

In charge:
Maj. C. E. L. B. Davis, 1889–92. **R., 90,** 2394; **91,** 2528.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2175; **93,** 2706; **94,** 2047.
Capt. C. F. Palfrey, 1895. **R., 95,** 2599.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2463; **97,** 2652; **98,** 2291.
Capt. J. G. Warren, 1899–1901. **R., 99,** 2728; **00,** 3653, 3739; (Maj.) **01,** 2909.

Assistant. L. M. Mann. **R., 90,** 2396.

OPERATIONS.

1890-91. 26,058 c. y. dr., **91,** 2529.
1891-92. 126,047 c. y. dr., **92,** 2176.
1892-93. 73,165 c. y. dr., **93,** 2707.
1893-94. 79,330 c. y. dr. and repairs made to dr. plant, **94,** 2048.
1894-95. 19,530 c. y. dr. and dr. plant repaired, **95,** 2600.
1895-96. 6,728 c. y. dr., **96,** 2464.
1896-97. 60,837 c. y. dr., **97,** 2652.
1897-98. 58,583 c. y. dr., **98,** 2291.
1898-99. 19,160 c. y. dr., **99,** 2729.
1899-00. 163,433 c. y. dr., **00,** 3653.
1900-01. 4,756 c. y. dr. (U.S.), **01,** 2910.

PHYSICAL CHARACTERISTICS.

Tendency to the formation of shoals, **96,** 2464.
The materials brought down the stream by freshets make periodical dr. necessary, **98,** 2291.
Annual shoaling, **99,** 2729; **00,** 3653.
Description of. The R. forms the boundary line bet. Michigan and Wisconsin, emptying into Green B., about 50 m. ne. from city of Green B. Menominee, Mich., and Marinette, Wis., are at the mouth, **00,** 3742.
Condition of work, water levels, etc., **01,** 2909.

PROJECTS.

By Maj. Davis, 1889, chan. 16′ x 200′, Green B. to Ludington & Co.'s mill, 2 m.; est., $109,609, **90,** 2396; **91,** 2528. W. of chan. reduced to 100′ for distance of 2,600′, reducing est. to $74,500, **91,** 2530.

In 1892, after expend. of $74,500, it was est. that $10,000 would be required for mainten. of imp. chan., **92,** 2176.

By Capt. Zinn, 1896, to modify proj. to provide for a turning-basin at the w. end of the chan., and also to extend the chan. 425′, with w. of 75′ and d. of 17′, **96,** 2463.

By Capt. Zinn, 1896, for dr. 20′ chan. in the R. (harbor); est., $18,920, **97,** 2751; **99,** 2728.

Consolidation of this work with that for the H. recom., **99,** 2729.

Capt. Warren est., 1899, $60,000, and $7,500 an. for an 18′ chan., but imp. would have to be inside shore line, which might estab. a precedent for like imp. at other places, **00,** 3744.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Maj. Davis, **90,** 2395.

Misc. surs., **93,** 2707; **94,** 2048.

Ex. and sur. from line of the second br., proj. of 1896, up to the w. line of Wells St., for 18′ chan., au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** fav.; see Projects), **00,** 3739.

Maps. **93,** 2706.

Part (c), MM-9 Menominee (and Marinette, Wis.) Harbor and River, Mich. and Wis.

APPROPRIATIONS.

1902,	$50,350,	**02,** 2044.
1907,	5,000,	**07,** 1871.
1909,	4,000,	**09,** 1948.
1910,	10,000,	**10,** 2106.
1912,	9,000,	**12,** 2497.
Total,	78,350	

COMMERCE.

Material effect of imp. on rates, **06,** 582; **12,** 977.

1911, 305,503 t., **12,** 977.

CONTRACTS.

1902. Duluth Dredge & Dock Co., dr., prices listed, **03,** 1835.

ENGINEERS.

Chief of Engineers. **R., 02,** 439; **03,** 475; **04,** 519; **05,** 526; **06,** 581; **07,** 605; **08,** 650, 669; **09,** 685; **10,** 760; **11,** 816; **12,** 976.

In charge:

Maj. J. G. Warren, 1902–05. **R., 02,** 2043; **03,** 1834; **04,** 2810; **05,** 2016.

Maj. W. V. Judson, 1905–09. **R., 06,** 1734; **07,** 1870; **08,** 1943.

Maj. Thos. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1948; **10,** 2105; **11,** 2307; **12,** 2496.

Lt. Col. G. A. Zinn, **11,** 814.

Assistant. 1st Lt. Douglas MacArthur, **08,** 648.

OPERATIONS.

1901-02. 12,086 c. y. dr. (U.S.), **02,** 2044.

1902-03. 134,162 c. y. dr. (contract), **03,** 1834.

1903-04. 23,172 c. y. dr. (contract); 20,481 c. y. dr. (U. S.), completion proj., **04,** 2810.

1904-05. Soundings taken and map prepared, **05,** 2017.

1905-06. 450 l. f. H. p. rebuilt, **06,** 1734.

1906-07. 600 l. f. p. rebuilt, completing 1,050 f., **07,** 1870.

1907-08. Mainten., **08,** 1943.

1908-09. Repairs to plant, and general supervision, **09,** 1948.

1909-10. 26,014 c. y. dr. (U.S.), **10,** 2105.

1910-11. Repairs to 800 l. f. s. H. p., **11,** 2307.

1911-12. 8,389 c. y. dr.; repairs to p., **12,** 2496.

PHYSICAL CHARACTERISTICS.

Condition of work; water levels, **02,** 2045; **03,** 1834; **04,** 519, 2810; **05,** 2017; **06,** 1734; **07,** 1870; **08,** 1944; **09,** 1948; **10,** 2105; **11,** 2307; **12,** 2496.

48± m. ne. from city of Green Bay, and 24± m. w. from Sturgeon B. Canal; orig. no H., **12,** 976.

R. navigable for 2 m. from mouth.

PROJECTS.

Act of June 13, 1902, au. increasing d. of chan. and basin from 17′ to 20′ and enlargement of the basin; est., $60,000, **02,** 2043.

Act Mar. 3, 1905, modifies proj. to save expense and subserve interests of C. by omitting portion of proj. section above and to w. of Ogden St. Br., **05,** 2017; **12,** 977.

SURVEYS.

Ex. for outer breakw'r au. act Mar. 2, 1907. **R.,** Maj. Judson, Apr. 25, 1907 (H. D. 73, 60th, 1st) ("not worthy of imp. in manner proposed"), **08,** 669.

MM-12 OCONTO HARBOR, WIS.

APPROPRIATIONS.

1881,	$10,000,	**81,** 2062.
1882,	15,000,	**82,** 2128.
1884,	15,000,	**84,** 1841.
1886,	8,000,	**86,** 1655.
1888,	20,000,	**88,** 1841.
1892,	3,000,	**92,** 2178.
1894,	3,000,	**95,** 2602.
1896,	4,000,	**96,** 2466.
1899,	15,000,	**99,** 2732.
1902,	3,000,	**02,** 2047.
1910,	75,000,	**10,** 2109.
Total,	171,000 (less $3,269.35 returned to Treas., $167,730.65, **12,** 2499).	

COMMERCE.

Tributary to H., **71,** 121, 122.

C. to be influenced by imp., **80,** 1975, 1976.

Lumber exportation, **80,** 1974.

In 1896 est. 100 acres for anchorage would be sufficient for needs of C. concerned, **96,** 2563.

Benefit from H. imp. entirely local, **00,** 3746.

Believed that proj. has had no material effect in controlling rates, **08,** 651.

No C. by way of H. "at present time," **11,** 818; **12,** 2500.

CONTRACTS.

1882. Green Bay Dredge & Pile Driver Co., slab-pier constr., **83,** 1643.

1884. Schwarz & Berner, p. extension, **85,** 1982.

1887. Leathem & Smith, poles, 9⅜¢ l. f., **87,** 2008. S. D. Kimbark, iron, 3 1/10¢ lb., **87,** 2008. G. Denis, st., $4.24 cord, **87,** 2009. Leathem & Smith, pine timber, $15.43 M b. m., **87,** 2009.

1896. Green Bay Dredge & Pile Driver Co., dr., 8¢ c. y. ($2,960), **97,** 2654.

1899. H. Truman, dr., 12¼¢ c. y. ($2,450), **99,** 2732.

1911. A. F. Bues, dr. 380,000 c. y., 11⅜¢ c. y., **11,** 2311.

ENGINEERS.

Chief of Engineers. **R., 71,** 37; **79,** 157; **80,** 210; **81,** 274, 2062, 2069; **82,** 269; **83,** 278; **84,** 277; **85,** 300; **86,** 294; **87,** 260; **88,** 237; **89,** 286; **90,** 249; **91,** 319; **92,** 305; **93,** 346; **94,** 317; **95,** 355, 368; **96,** 311, 323; **97,** 394; **98,** 386; **99,** 458, 474; **00,** 523, 538; **01,** 516; **02,** 439; **03,** 476; **04,** 520; **05,** 527; **06,** 582; **07,** 607; **08,** 651; **09,** 686; **10,** 761; **11,** 817; **12,** 978.

Boards. BERH. **R.,** Aug. 14, 1903, recom. holding balance available from app., about $3,650, for repairs to s. p., but does not recom. extension of imp., **03,** 1836. (See Surveys.)

In charge:

Maj. D. C. Houston. **R., 71,** 120; (Lt. Col.) 1879–81. **R., 80,** 1973.

Lt. Col. H. M. Robert, 1881–83. **R., 81,** 2061, 2064; **82,** 2128; **83,** 1644.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1642.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1840; **85,** 1982.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1653; **87,** 2006; (Maj.) **88,** 1839; **89,** 2046, 2106; **90,** 2330; **91,** 2531.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2177; **93,** 2708; **94,** 2049.

Capt. C. F. Palfrey, 1895. **R., 95,** 2600, 2681.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2465, 2560; **97,** 2653; **98,** 2292.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2731; **00,** 3654, 3745; (Maj.) **01,** 2910; **02,** 2046; **03,** 1835; **04,** 2812; **05,** 2019.

Maj. W. V. Judson, 1906–08. **R., 06,** 1735; **07,** 1871; **08,** 1945.

Maj. Thos. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1949; **10,** 2108; **11,** 2311; **12,** 2499.

Lt. Col. G. A. Zinn, **11,** 814; **12,** 974.

Assistants:

W. T. Casgrain. **R., 71,** 121.

W. H. Hearding. **R., 80,** 1975.

L. Y. Schermerhorn. **R., 83,** 1647.

T. E. Hutchings. **R., 85,** 1983.

1st Lt. Douglas MacArthur, **08,** 648.

ESTIMATES. (See Plans and Projects.)

By Maj. D. C. Houston, 1871, entire completion, $500,000, **71,** 121.

By W. T. Casgrain, 1871, imp. "present" R. entrance, $557,747.83, **71,** 122; making new chan., $497,887.50, **71,** 122.

LEGISLATION.

By State legislature, au. $30,000 to be raised by a special tax on town property for this imp., **71,** 122.

OPERATIONS.

1882–83. 300 l. f. of slab p. built, **83,** 1643.

1883–84. N. p. extended 1,100′ and s. p. 1,600′; 54,780 c. y. dr. from chan., **84,** 1840.

1884–85. 1,000 l. f. of pile protection completed and p. extension commenced; 56,671 c. y. dr. from chan., **85,** 1982.

1885–86. Protection piling completed; s. p. completed by constr. of 301 l. f. of close pile p.; n. p. extended 503 l. f.; 30,529 c. y. dr.; minor repairs to s. p., **86,** 1653, 1654.

1886–87. 65,661 c. y. dr. from chan. bet. ps.; repairs to s. p., **87,** 2007.

1887–88. 1,200′ of reinforcement piling on chan. side of s. p. built by hired labor, **88,** 1839.

1888–89. 650 l. f. of chan. side of s. p. reinforced with piling; 600 l. f. of opposite side of p. provided with riprap; minor repairs to n. p. by hired labor, **89,** 2046.

1889–90. 197,715 c. y. dr.; repairs to dr. plant; repairs to n. and s. ps. by hired labor, **90,** 2331.

1891–92. Repairs to n. p., **92,** 2177.

1893–94. 17,045 c. y. dr., **94,** 2049.

1895–96. Ps. repaired, **96,** 2465, 2466.

1896–97. 48,060 c. y. dr., **97,** 2654.

1898–99. 3,740 c. y. dr., **99,** 2731.

1899–00. 34,552 c. y. dr.; extensive repairs made to ps., **00,** 3655.

1910–11. Specifications for dr. prepared and contract made, **11,** 818, 2311.

1911–12. 365,832 c. y. dr., **12,** 2499.

PHYSICAL CHARACTERISTICS.

General characteristics of Oconto R., **71,** 121.

Condition of R., 1879, **80,** 1975.

Description of, **95,** 2682; **96,** 2562; **00,** 3746.

Freshets tend to obliterate parts of the chan., **96,** 2465.

H. on the w. shore of Green B., 22 m. s. of Menominee H.; Oconto about 2½ m. from H. entrance; **00,** 3746.

Condition of works and d. of water, **02,** 2046.

PLANS. (See Estimates and Projects.)

By W. T. Casgrain, 1871, (1) new chan. from lower steam mill e. to first bend in the R., and, taking advantage of previous work, extension of ps. to 12′ in Green B.; est., $557,747, **71,** 121, 122. (2) New chan. ne. from the same initial point across to R., thence across marsh to Green B., terminating with ps. extending to 12′ in B.; est., $497,887, **71,** 121, 122.

By Maj. Davis, 1888, excavation of chan. 16′ x 75′ from ps. to Spies's Mills, 6,000′; extension of s. p. 1,100′, and reconstr. and extension of n. p. 1,900′; est., $181,000, **89,** 2107.

PRIVATE (CITY) WORK.

1870. 1,800 l. f. of pile p. to 15′ in Green B., built by town of Oconto; cost, about $30,000, **71,** 122.

Work of imp. by city of Oconto previous to 1880, **81,** 2067.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Robert, 1881, extending slab ps. to 10′ curve by constr. of 4,000 l. f. of slab p. and 500 l. f. of crib p.; dr. chan. from entrance to Oconto, having w. of 100′ and d. of 8′ with 10′ at entrance; est., $125,000, **81,** 2067. Revised in 1883, after resur. of locality, to $150,000, **83,** 1646; **87,** 2007.

In 1896 Capt. Zinn est. $242,605 to imp. H., and about $5,400 each year for mainten., and $171,160 or $300,316 to constr. exterior H., **96,** 2563, 2564.

Act June 25, 1910, au. chan. 16′ x 100′ bet. ps., and extension beyond ps. same d., with min. w. of about 150′ to about the 18′ contour; dr. to be continued up R. about 800′, forming turning basin; est., $75,000 (H. D. 538, 61st, 2d), subject to conditions that city of Oconto donate necessary land, and city and county of Oconto raise $25,000 for revets., etc.; city to build and maintain wharf, warehouse, etc., to be open for public use under reasonable regulations, and to maintain d. of all chans. dr. by U. S. for 5 years, **10,** 761.

SURVEYS.

Au. by act July 11, 1870; made, 1870, by W. T. Casgrain, under direction of Maj. Houston, **70,** 31; **71,** 37, 120.

Au. act Mar. 3, 1879; made, 1879, by Maj. Houston, **79,** 157; **80,** 1973.

Of Oconto R., 1883, bet. mouth and city of Oconto; also of Green B. in vicinity of mouth, **83,** 1643.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Davis, **89,** 2106.

Sur. for H. lines, 1893, **94,** 2050.

Ex. of R. with view to chan. 16′ x 150′ au. act. Aug. 17, 1894, **R.** 1894, by Maj. Gregory (**R.** unfav.), **95,** 2681.

Sur. with plans and est. for imp. and confinement of current in R., mainten. of standard d. of w., to

obtain chan. 16′ d., for extending ps., and for constr. of H. with 16′ d. in Green B. exterior to R. chan., au. act Aug. 17, 1894; **R.,** 1896, by Capt. Zinn (see Projects), **96,** 2560.

Minor surs., **00,** 3655.

Ex. for better access to the H. and for extension of ps. 300′ au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** fav.), **00,** 3745.

R. by BERH., Aug. 14, 1903, required by R. and H. Com., as to advisability of continuing imp. or modifying proj. Board does not think C. warrants further imp.; moreover the Hs. of Menominee and Green B. are in this section, being ample provision for traffic of vicinity (H. D. 34, 61st, 2d).

Pre. ex. au. act Mar. 3, 1905, with view to modification of existing plan and constr. of H. near mouth of R., with d. of 16′ and 18′, resp. **R.** by Maj. Warren, July 6, 1905 (H. D. 161, 59th, 1st) (unfav.), **06,** 599.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Bromwell, May 19 and Nov. 12, 1909; est., $75,000 (H. D. 538, 61st, 2d), under certain specified conditions (see Projects), **10,** 781.

Maps. (H. D. 538, 61st, 2d.) **84,** 1840; **88,** 1840.

MM-13(a) PENSAUKEE HARBOR AND RIVER, WIS.

APPROPRIATIONS.

1882,	$10,000,	**82,** 2129.
1884,	5,000,	**84,** 1843.
1896,	1,000,	**96,** 2469.
Total,	16,000	

COMMERCE.

Local C. interests and statistics, **73,** 250, 251.

In 1898 only about 12 persons, and these engaged in fishing, seemed to be concerned in imp. of H., **98,** 2294.

CONTRACT.

1883. F. B. Gardner, slab-pier constr., **83,** 1650.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 36; **73,** 36; **82,** 270; **83,** 278; **84,** 278; **85,** 301; **86,** 295; **87,** 261; **88,** 237; **89,** 276; **90,** 249; **91,** 319; **92,** 305; **93,** 347; **94,** 318; **95,** 356; **96,** 311; **97,** 395; **98,** 387; **99,** 459.

In charge:

Maj. D. C. Houston. **R.,** **73,** 249.

Lt. Col. H. M. Robert, 1882–83. **R.,** **82,** 2128; **83,** 1651.

Capt. F. A. Hinman, 1883–84. **R.,** **83,** 1650.

Lt. Col. J. W. Barlow, 1884–86. **R.,** **84,** 1842; **85,** 1985.

Capt. C. E. L. B. Davis, 1886–92. **R.,** **86,** 1656; **87,** 2010; (Maj.) **88,** 1841; **89,** 2049; **90,** 2333; **91,** 2533.

Maj. J. F. Gregory, 1892–94. **R.,** **92,** 2179; **93,** 2710; **94,** 2052.

Capt. C. F. Palfrey, 1895. **R.,** **95,** 2602.

Capt. G. A. Zinn, 1896–98. **R.,** **96,** 2468; **97,** 2656; **98,** 2294.

Capt. J. G. Warren, 1899. **R.,** **99,** 2734.

Assistants:

W. J. Bryson. **R.,** **73,** 250.

L. Y. Schermerhorn. **R.,** **82,** 2130.

ESTIMATES. (See Plans.)

By W. J. Bryson, 2 ps. and 9′ chan., $133,852.40; 2 ps. and a 12′ chan., $201,852.31, **73,** 250.

OPERATIONS.

1883-84. 1,300 l. f. of slab p. built, **84,** 1842.

1885-86. Extensive repairs to slab-p. work, **86,** 1656.

1891-92. 600 l. f. of w. end of p. repaired by hired labor, **92,** 2179.

1895-96. P. repaired, **96,** 2468.

1898-99. Pierhead repaired and protected, **99,** 2734.

PHYSICAL CHARACTERISTICS.

General, of Pensaukee R., H., and outside reef, **73,** 249, 251.

Description of, **82,** 2130.

Heavy weather damaging p., **98,** 2294.

PLANS. (See Estimates.)

By W. J. Bryson, extension of existing ps. to 9′ or 12′, **73,** 252.

Maj. Davis, 1890, **R.** no further C. necessity for continuation of imp., **90,** 2333.

PRIVATE AND CORPORATE WORK.

Pile p. filled with slabs, 1,000′ l., to 5′ of water; also 1,500′ of slab p. across the marsh; dr. chan. to 9′ d.; cost, $40,000, **73,** 250, 251.

PROJECTS.

By Lt. Col. Robert, 1882, navigable chan., Green B. into Pensaukee R., by constr. of 2,500 l. f. of slab-p. work, extending to 10′ curve, with dr. to provide chan. of entrance, with available d. of 10′ and w. of 100′; est., $50,000, **82,** 2132; **83,** 1650.

SURVEYS.

Directed by Maj. Houston, made by W. J. Bryson, 1872, **73,** 36, 250.

Ex. au. act Aug. 2, 1882; made by Lt. Col. Robert, **83,** 1651.

MM-14 GREEN BAY HARBOR, WIS.

APPROPRIATIONS.

1866,	$30,500.00,	**66,** iii, 12.
1867,	45,000.00,	**67,** 21; **76,** ii, 340.
1868,	*17,500.00,	**68,** 24.
1869,	*[1] 44,550.00,	**69,** 22, 25; **76,** ii, 341.
1870,	17,500.00,	**70,** 34.
1871,	17,500.00,	**71,** 32.
1873,	20,000.00,	**73,** 32.
1874,	10,000.00,	**74,** 38.
1875,	10,000.00,	**75,** 42.
1876.	8,000.00,	**76,** 95.
1878,	5,000.00,	**78,** 113.
1879,	4,000.00,	**79,** 152.
1880,	6,000.00,	**80,** 1906.
1881,	5,000.00,	**81,** 2070.
1882,	20,000.00,	**82,** 2133.
1884,	10,000.00,	**84,** 1845.
1886,	7,000.00,	**86,** 1659.
1888,	10,000.00,	**88,** 1843.
1890,	10,000.00,	**90,** 2335.
1892,	[2] 25,000.00,	**92,** 2181.
1894,	25,000.00,	**95,** 2604.
1896,	[2] 25,000.00,	**96,** 2470.
1897,	5,000.00,	**98,** 2296.
1899,	28,600.00,	**99,** 2736.
1902,	105,600.00,	**02,** 2048.
1904,	*2,328.39,	**04,** 2815; **12,** 2501.
1905,	10,000.00,	**05,** 2020.
1907,	5,000.00,	**07,** 1873.
1909,	*12,000.00,	**09,** 1951.
1910,	*9,000.00,	**10,** 2110.
1910,	20,000.00,	**10,** 2110.
1912,	32,000.00,	**12,** 2501.
Total,	602,078.39 (incl. misc., $602,130.89, **12,** 2501).	

* Allotment. [1] Called $45,000, **69,** 25. [2] $5,000 of this may be expend. on Fox R. below Depere, Wis.

COMMERCE.

Early C. importance of Green B., **68,** 98; **76,** ii, 339.
Transportation facilities, **66,** iv, 136–138; **73,** 198.
Benefit and importance of the imp. to C., **66,** iii, 35, iv, 135, 136, 138; **67,** 71; **71,** 32; **72,** 116; **76,** ii, 339, 340, 344; **79,** 1487.
Description of, **00,** 3749.
Effect of proj. on rates fav., **05,** 528; **07,** 608; **12,** 981.
Rapidly increasing, **11,** 2312.
Traffic, 1911, 750,000± t., **12,** 2502.

CONTRACTS.

1866. W. S. Smith, dr., 50¢ c. y., **66,** iv, 133; **67,** 57.
1868. Wm. Richardson, dr., **69,** 72.
1869. Wm. Richardson, dr. outfit, 30¢ c. y., **69,** 72; Smoke & Schuette, close piling, $140 per diem, **69,** 25, 72; N. G. Dodge, dr. outfit, $120 per diem, **76,** ii, 341.
1873. A. Conro, dr., 35¢ c. y., **74,** 139; **79,** 1487.
1874. Green Bay Dredge & Driver Co., dr., 24¢ c. y., **75,** 195, 196.
1875. Green Bay Dredge & Driver Co., dr., 20¢ c. y., **75,** 197.
1877. Green Bay Dredge & Driver Co., repairs, **77,** 855; Green Bay Dredge & Driver Co., dr., 12¢ c. y., **78,** 1143.
1878. Green Bay Dredge & Driver Co., dr., 22¢ c. y., **79,** 1486, 1487.
1880. Green Bay Dredge & Pile Driver Co., dr., 26¢ c. y., **80,** 1906.
1881. Green Bay Dredge & Pile Driver Co., dr., 19¢ c. y., **81,** 2070.
1882. N. G. Dodge, dr., 17¢ c. y., **83,** 1654.
1885. Green Bay Dredge & Pile Driver Co., dr., 26¢ c. y., **85,** 1987.
1887. G. Denis, st., $3.74 per cord, **87,** 2012; Shadbolt, Boyd & Co., iron, **87,** 2013; Leathem & Smith, timber, **87,** 2013.
1890. Green Bay Dredge & Pile Driver Co., dr., 24½¢ c. y., **90,** 2334; White & Finch, dr., 18¢ c. y., **91,** 2535.
1892. C. H. Starke, dr., 14¢ c. y. ($16,800), **93,** 2713.
1894. Green Bay Dredge & Pile Driver Co., dr., 9⅝¢ c. y. ($22,000), **95,** 2605.
1896. Racine Dredging Co., dr., 6⅝¢ c. y. ($13,250), **97,** 2659.
1897. A. H. Vogel, dr., 9½¢ c. y. ($4,750), **97,** 2659.
1899. E. J. Pryor, dr., 9¢ c. y. ($18,000), **99,** 2736.
1902. S. O. Dixon, dr., 800,000 c. y., 12¢ c. y., **03,** 1840.
1910. Greiling Bros. Co., dr., 62,500 c. y., 16.9¢ c. y., **10,** 2110.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 12, 35; **67,** 21; **68,** 28; **69,** 25; **70,** 34; **71,** 32; **72,** 31; **73,** 32; **74,** 37; **75,** 42; **76,** 95; **77,** 99; **78,** 113; **79,** 152; **80,** 203; **81,** 274; **82,** 270; **83,** 279; **84,** 278; **85,** 302; **86,** 296; **87,** 261; **88,** 238; **89,** 277; **90,** 250; **91,** 320; **92,** 306; **93,** 347, 359; **94,** 318; **95,** 356; **96,** 312; **97,** 395; **98,** 387; **99,** 459, 474; **00,** 524, 538; **01,** 516; **02,** 440; **03,** 477; **04,** 520; **05,** 528; **06,** 583; **07,** 607; **08,** 652; **09,** 687; **10,** 762; **11,** 819; **12,** 979.

In charge:

Col. J. D. Graham, **66,** iv, 134, 136.
Maj. J. B. Wheeler, 1866–70; **66,** ii, 41. **R., 66,** iv, 91, 98, 133; **67,** 55, 69; **68,** 79, 98; **69,** 72.
Maj. D. C. Houston, 1870–75; **70,** 89. **R., 70,** 92; **71,** 110; **72,** 116; **73,** 198; **74,** 139.
Maj. H. M. Robert, 1875–83. **R., 75,** 195; **76,** ii, 338; **77,** 855; **78,** 1143; **79,** 1486; (Lt. Col.) **80,** 1905; **81,** 2069; **82,** 2133.
Capt. F. A. Hinman, 1883–84. **R., 83,** 1653.
Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1844; **85,** 1987.
Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1658; **87,** 2012; (Maj.) **88,** 1842; **89,** 2049; **90,** 2334; **91,** 2533.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2180; **93,** 2711, 2778; **94,** 2053.
Capt. C. F. Palfrey, 1895. **R., 95,** 2603.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2469; **97,** 2657; **98,** 2295.
Capt. J. G. Warren, 1899–1905. **R., 99,** 2734; **00,** 3657, 3747, 3750; (Maj.) **01,** 2912; **02,** 2047; **03,** 1839; **04,** 2813; **05,** 2019.
Maj. W. V. Judson, 1905–09. **R., 06,** 1736; **07,** 1872; **08,** 1945.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1950; **10,** 2109; **11,** 2311; **12,** 2500.
Lt. Col. G. A. Zinn, **11,** 814.

Assistants:

Lt. J. B. Quinn. **R., 66,** iv, 134; **67,** 69.
W. H. Hearding. **R., 68,** 98; **74,** 139; **75,** 195.
R. S. Littlefield, **68,** 98. **R., 66,** iv, 137.
Capt. J. W. Cuyler. **R., 72,** 116; **73,** 198.
L. Y. Schermerhorn. **R., 78,** 1144; **81,** 2071.
Charles Crosman. **R., 78,** 1146.
1st Lt. Douglas MacArthur, **08,** 648.

ESTIMATES. (See Plans and Projects.)

By Lt. Quinn, dr., $30,500; subsequently increased to $226,187.50, **66,** iv, 135.

EXPENDITURES.

1874–75. For repairs, $2,346.27, **76,** ii, 343.
1876–77. For repairs, $1,626.70, **77,** 855.

OPERATIONS.[1]

1866–67. 1,299 c. y. dr., **66,** iv, 134. 32,294, c. y. dr., **67,** 69.
1867–68. 107,831 c. y. dr.; up to July 30, 1868, 123,090 c. y. had been dr. under W. S. Smith's contract, **68,** 29, 99; **76,** ii, 340.
1868–69. 77,822 c. y. dr.; also given as 52,762 c. y., **69,** 25; **76,** ii, 341.
1869–70. 105,814 c. y. dr.; revet. begun, **70,** 34, 93; **76,** ii, 341.
1870–71. 51,204 c. y. dr.; revet. continued, 700′ l. on each side, **71,** 32; **76,** ii, 342.
1871–72. 45,475 c. y. dr., **72,** 116; **76,** ii, 342.
1873–74. 49,833 c. y. dr., **74,** 139.
1874–75. 29,963 c. y. dr.; repairs to ps. damaged by ice, **75,** 195.
1875–76. 34,459 c. y. dr., **76,** 95, ii, 338.
1876–77. Repairs to ps. damaged by ice, **77,** 99, 856.
1877–78. 39,283 c. y. dr., **78,** 113, 1143.
1878–79. 19,335 c. y. dr., **79,** 152.
1879–80. 12,571 c. y. dr., **80,** 1905.
1880–81. 26,345 c. y. dr., **81,** 2069.
1881–82. 18,002 c. y. dr., **82,** 2133.
1882–83. 43,524 c. y. dr., **83,** 1653.
1883–84. 52,211 c. y. dr., **84,** 1844.
1884–85. 49,402 c. y. dr., **85,** 1987.
1885–86. 11,500 c. y. dr.; 705 l. f. of e. revet. and superstr. repaired, **86,** 1658.
1886–87. Repair of e. revet. at Grassy Isld., **87,** 2012.
1887–88. 620 l. f. of superstr. rebuilt, **88,** 1843.
1889–90. 6,825 c. y. dr. by hired labor, **90,** 2334.
1890–91. 29,737 c. y. dr., **91,** 2534.
1891–92. 15,531 c. y. dr., **92,** 2180.
1892–93. About 50,000 c. y. dr., and from Fox R. below Depere about 41,575 c. y. were dr., **93,** 2712.
1893–94. 84,794 c. y. dr., a small amount of refilling and riprapping done, and from Fox R. 130 c. y., s. m., dr., **94,** 2053, 2054.
1894–95. 48,879 c. y. dr., **95,** 2604.
1895–96. 171,110 c. y. dr., **96,** 2470.
1896–97. 44,610 c. y. dr., and from Fox R. 17,935 c. y. dr., **97,** 2657.
1897–98. 245,216 c. y. dr., and proj. for Green B. H. considered as completed; from Fox R. 26,384 c. y. dr., **98,** 2295, 2296.
1898–99. 3,625 c. y. dr., **99,** 2735.
1899–00. 206,378 c. y. dr., and 4,028 c. y. dr. from Fox R. Chan., **00,** 3657.
1900–01. Repairs to dr. plant; taking soundings and making maps, **01,** 2912.

[1] History of operations, **76,** ii, 339. Comparative costs of dr. from 1866 to 1878, **79,** 1487.

1901-02. 660 l. f. e. revet. at Grassy Isld. rebuilt above water line by hired labor, **02,** 2047.
1902-03. Renewal above water line of e. revet. at Grassy Isld. completed; 147,974 c. y. dr. under contract, **03,** 1839.
1903-04. 671,201 c. y. dr., **04,** 2814.
1904-05. 32,042 c. y. dr. by U.S. plant, **05,** 2019.
1905-06. Repairs to dr. plant, **06,** 1736.
1906-07. W. revet. at Grassy Isld. rebuilt above water line by hired labor, **07,** 1872.
1907-08. 49,369 c. y. dr. by U.S. plant for mainten., **08,** 1946.
1908-09. 43,146 c. y. mainten. dr. by U.S. plant, **09,** 1950.
1909-10. 64,294 c. y. dr. by U.S. plant, and 30,391 c. y. by contract, **10,** 2109.
1910-11. 23,264 c. y. dr. by U.S. plant, and 52,834 c. y. under contract, **11,** 2312.
1911-12. 102,326 c. y. dr., **12,** 2500.

PHYSICAL CHARACTERISTICS.

General, of Fox R. and Green B., **66,** iv, 135.
Security of Green B. H., **67,** 69.
Approaches dangerous, **67,** 70.
Formation of bar at entrance to cut, **68,** 29.
Character of excavated material, **72,** 116.
Variation of w. l., **72,** 31, 116; **76,** ii, 341. Results of such variation, **76,** ii, 341; **79,** 1487.
Permanence of chan. once obtained, discussion of, **78,** 1144.
Table of weekly fluctuations of water surface, **81,** 2071.
Green Bay: In 1892 an ample chan. existed or was in course of constr. under proj. for Green B. H., **93,** 2778.
Formation of shoals in Fox R. below Depere, **98,** 2295; **99,** 2734.
Description of: Green B. H. considered to consist of that part of Green R. bet. Depere and the R. mouth, **00,** 3748.
Condition of works and d. of water, **01,** 2912; **06,** 1736; **12,** 2500.
Shoaling, winds, etc., **12,** 2500.
Consists of 2 imp. chans.—1st, from mouth of Fox R. n. to 21′ contour in Green B. (4 m.); 2d, Fox R. below Depere to s. limits of city of Green B., 4 m. The intervening connecting pool in Fox R. is 25′–40′ d., needing no imp. City of Green B. at head of Green B., and 48± m. sw. from Menominee, Mich., **12,** 980.
Connecting with upper end of the inner chan. at Depere, Wis., Fox R. is navigable by canals and slack-water navigation to Portage, Wis., 156 m., **12,** 980.

PLANS. (See Estimates and Projects.)

By Lt. Quinn, d. the chan., by dr., **66,** iv, 35. Amount of dr. subsequently increased from 122,500 c. y. to 411,250 c. y., as a result of the decrease in the d. of the waters of the B., **66,** iv, 135.
By L. Y. Schermerhorn, chan., mouth of R. to d. w. in the B., dr., to give a w. of 100′, 170′, or 200′ the entire distance, or 200′ part of the distance and 170′ the remainder, **78,** 1145.

PRIVATE WORK.

American Writing Paper Co., under au. of Sec. of War, dr., 1900, 16,975 c. y. to connect its docks at Depere with the chan., **00,** 3657.

PROJECTS. (See Estimates and Plans.)

By Maj. Wheeler (previously recom. by Col. Graham), 1866, dr. chan. from the mouth of Fox R. to d. w. in the B., with a cut through Grassy Isld. Chan., to be 12′ x 200′, and the protection of the sides of the cut through Grassy Isld. (from abrasion by freshets and storms) by sheet piling; est., $155,416.77, **66,** iv, 134, 136; **68,** 28. Discussion of merits, **67,** 70. Subsequently completed by the constr. of close piling, within the orig. est., **74,** 140; **75,** 195.
By Maj. Houston, 1872, dr. cut to w. and d. it to 14′ throughout, 175,000 c. y.; est., $50,000, **72,** 31, 116; **73,** 198; subsequently increased to $75,000, **74,** 38, 140; small an. app. necessary for the mainten. of the chan. by dr., **74,** 141; **75,** 42.
By Maj. Robert, 1876, expend. of the app. of 1876 ($8,000); piling for the protection of the e. p.; est., $2,650; the remainder for dr., **76,** ii, 338. Est. amount required for the completion of the existing proj., $18,000, **79,** 152.
Maj. Robert, 1881, proposed dr. chan. 14′ x 200′, revised datum, mouth of Fox R. to d. w. in Green B., 240,000 c. y.; est., $72,000, **81,** 2070.
In 1892 the existing proj. was modified to increase the chan. d. to 16′ and to extend it to a total l. of 16,500′; est., $91,915, **92,** 2181; **93,** 2711, 2712.
Act of 1892 provided $5,000 from app. for Green B. to be expend. at the discretion of the Sec. of War for imp. of Fox R. below Depere; chan. 13′ x 150′ dr., **93,** 2712; **96,** 2470. Act of 1896 provided an addl. $5,000 in the same manner, and was used to increase d. to 15′, **96,** 2470.
By Capt. Zinn, 1897, modifying existing proj. to provide for increasing the w. of the entrance at the n. end of the chan. 300′, making the total w. 500′, **97,** 2657.
In 1897, on account of the low prices for labor, etc., the est. for completing the work was reduced from $26,915 to $2,200, **97,** 2658.
In 1897 Capt. Zinn est. $30,000 to obtain a chan. 17′ x 150′ in Fox R. below Depère, and in 1898 reduced this est. to $22,000, **98,** 2296.
Capt. Warren est., 1899, $105,600 to dr. a 20′ chan., **00,** 3751.
Au. act June 13, 1902; increasing d. of outer chan. to 20′; est., $105,600, and mainten., **02,** 440.

SURVEYS.

Referred to, 1853, **66,** iv, 135.
Included in Lake Sur., 1865, **66,** iv, 135.
By Maj. Houston, **71,** 110; **72,** 116.
By W. H. Hearding, **74,** 139.
By L. Y. Schermerhorn and C. Crosman, 1877–78. **R.,** **78,** 1144, 1146.
Sur. made, 1881, **81,** 2069.
Sur. made, 1890, by Maj. Davis, **90,** 2334.
Ex. of Green B. Lighthouse to first br. on Fox R., au. act July 13, 1892; made, 1892, by Maj Gregory (**R.** unfav.), **93,** 2778.
Minor surs., **94,** 2053; **99,** 2735; **00,** 3657.
H. lines estab. by Sec. of War, 1894, **95,** 2604.
Ex. and sur. for 20′ chan. from mouth of Fox R. up to city of Green B., au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** fav.), **00,** 3747.
Pre. ex. for constr. of turning-basin in Fox R. at Depere, and securing 20′ chan. from basin to Green B., au. act Mar. 3, 1909. **R.,** Maj. Bromwell, May 7, 1909. Sur. and preparation of est. for turning-basin 17′ d. au. by Sec. of War, June 9, 1909, **09,** 1950.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 980.
Maps. Green B. H., **76,** ii, 338; **78,** 1144; **94,** 2054.

MM-15 FOX AND WISCONSIN RIVERS, WIS.

Part.	Title.	Period.	Appropriations.
a	Fox and Wisconsin Rs. (incl. Wolf R.)	1839–1912	$3,913,920.07
b	Fox R., Wis., locks and dams (operating and care)	1885–1912	1,569,983.17
c	Depere R., Wis	1909–1910	11,500.00
	Total		5,495,403.24

Part (a), MM-15 Fox and Wisconsin Rivers, including Wolf River, Wis.[1]

APPROPRIATIONS.[2]

1839	$2,000.00 (sur.), act Mar. 3.
	[3] 500.00, act Mar. 3.
1866,	*2,000.00 (sur.), **76,** ii, 195.
1867	[4] 40,000.00, **68,** 301, 363; **76,** ii, 195.
	*15,000.00 (sur.), **68,** 301, 363; **76,** ii, 195.
1868,	*22,000.00 (surs.), **76,** ii, 201.
1870,	[4] 100,000.00, **70,** 57; **71,** 37.
1872	[5] 145,000.00, **72,** 35.
	[6] 13,713.97, act June 10.
1873,	300,000.00, **73,** 36, 121, 220.
1874,	300,000.00, **74,** 42.
1875,	500,000.00, **75,** 45, 219.
1876,	270,000.00, **76,** 98, ii, 399.
1878	250,000.00, **78,** 117, 1170.
	[7] 5,310.00, **78,** 183.
1879,	150,000.00, **79,** 156.
1880	125,000.00, **80,** 1952.
	[7] 5,010.00, act June 16.
1881,	125,000.00, **81,** 2135.
1882,	200,000.00, **82,** 2167.
1883,	[8] 2,460.00, act Mar. 3.
1884,	160,000.00, **84,** 1874.
1886	[8] 129,403.10, act Aug. 4.
	56,250.00, **86,** 1689.
1888	[8] 100,024.53, act Feb. 1.
	[8] 1,067.09, act Feb. 1.
	[8] 10,539.25, act Feb. 1.
	[9] 100,000.00, **88,** 1872.
	[8] 15,318.26, act Oct. 19.
1890	100,000.00 } **90,** 2369.
	[10] 156,552.70 }
1892	75,000.00 } **92,** 2217.
	[11] 109,022.33 }
1893,	[8] 30,985.50, act Mar. 3.
1894	37,500.00, **95,** 2660.
	6,263.34, act Aug. 23.
1896	[12] 3,000.00, **97,** 2713.
	37,500.00, **96,** 2527.
1899,	[13] 27,500.00, **99,** 2790.
1902,	70,000.00, **02,** 2079.
1905,	35,000.00, **05,** 2050.
1907,	35,000.00, **07,** 1908.
1909,	*20,000.00, **09,** 1980.
1910,	25,000.00, **10,** 2137.
Total,	3,913,920.07 ($3,884,406.55, **12,** 2529, incl. sales, etc., less $39,000 for early sur. and return to Treas.).

COMMERCE.

Object of the imp., **78,** 1170.

Benefits to C. by the imp., **68,** 52, 353, 357, et seq.; **72,** 141; **73,** 222; **76,** ii, 230; **78,** 1171.

Benefits to local C., **79,** 1532.

List of boats navigating Fox R., 1866, H. Doc. 58, 39th Cong., 2d sess., 93.

Effect of RR. on the navigation and C., **68,** 358, 367.

Cost and receipts of Erie Canal, **73,** 223.

Convention at Oshkosh, June 24, 1874; resolutions of, **74,** 162.

Navigation open on Fox R. from Green Bay to Portage City, **78,** 117, 1169.

Tolls collected on Fox R.:

1872–73	$1,893.27, **73,** 222.
1873–74	1,239.17, **74,** 162.
1874–75	364.96, **75,** 217.
1875–76	385.23, **76,** 98.
1876–77	653.36, **77,** 880.
1877–78	2,168.99, **78,** 1170.
1878–79	2,993.58, **79,** 1533.
1879–80	2,726.08, **80,** 1952.
1880–81	2,336.99, **81,** 2135.
1881–82	2,100.40, **82,** 2167.
1882–83	625.00, **83,** 1714.

Collection of tolls discontinued by act of 1882, **83,** 1714.

Effect of imp. upon rates, **88,** 1872.

C. use of the waterway least at Portage and most at the mouth of the R., **93,** 2759; **94,** 2105.

List of boats navigating the R., **93,** 2765; **94,** 2110; **95,** 2665; **96,** 2533; **97,** 2719; **98,** 2347; **01,** 2955; **02,** 2080; **03,** 1868; **04,** 2850; **05,** 2051; **06,** 1764.

Effect of imp. on rates by rail of greater importance than the traffic on the stream, **95,** 2660, 2665; **96,** 2527.

Much benefited by the constr. of the H. of refuge at Stockbridge, **98,** 2341.

Reduction of rates, **01,** 526.

Benefits to C. very small in comparison with expend., **08,** 1977.

Nature and extent of C. 1910 described, and its unimportance pointed out, **10,** 2136.

170,313 t., 1911, **12,** 1003.

CONTRACTS.

Impracticable on the Wisconsin R. (Commissioner Richardson, 1853), **76,** ii, 217.

1875. C. C. Barker & Sons, locks, annulled for failure to prosecute with energy, **76,** ii, 413. Day & Call, l. and d., abandoned, bankrupt, **76,** ii, 414. Conro, Starke & Co., dr. and repairs of Portage Canal, **76,** ii, 423, 424.

1889. S. A. Harrison, levee constr., $7,306, **90,** 2366.

1899. G. Ryan, towboat, $7,675, **00,** 3714.

1904. The Bucyrus Co., building elevator dr. with auxiliary conveyor, $39,000, **05,** 2050.

DEFENSE.

Naval station in Lake Winnebago, **76,** ii, 230.

DOCUMENTS. (Not published in reports.)

H. Doc. 102, 25th Cong., 3d sess., Pettival's **R.,** Jan., 1838. S. Doc. 318, 26th Cong., 1st sess., Capt. Cram's **R.,** Jan., 1840. H. Doc. 55, 37th Cong., 3d sess., **R.** on imp. company's work, **76,** ii, 223. H. Doc. 58, 39th Cong., 2d sess. H. Doc. 247, 40th Cong., 2d sess., Maj. Warren's **R.** of progress. H. Doc. 185, 42d Cong., 2d sess., **R.** of arbitrators. H. Doc. 176, 42d Cong., 2d sess., **R.** of operations on Wisconsin R. for 1871.

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*Allotment.

[1] Surs.—**R.,** Jan. 18, 1838; Feb. 6, 1838; Apr. 3, 1838; Jan. —, 1840; est., $447,470.18. (H. D. 482, 55th, 2d.)

[2] Statement of app., **76,** ii, 398. Remarks by Maj. Houston on size of app., **73,** 224; **74,** 162. Recom. by Maj. Houston that app. be made for Fox and Wisconsin Rs., **73,** 223.

[3] Pier at n. end of Lake Winnebago.

[4] Wisconsin R.

[5] Purchase price of all rights of Green Bay & Mississippi Canal Co.

[6] Expenses of arbitrating: U. S. v. Green Bay & Mississippi Canal Co.

[7] Compensating commissioners for determining damages done to lands by the imp.

[8] H. D. 482, 55th, 2d.

[9] Below Montello.

[10] Land damages and commissioner's salary.

[11] Flowage damages.

[12] Expense of Gen. Bragg investigating flowage.

[13] $2,500 returned to Treas., **10,** 2137.

ENGINEERS.

Chief of Engineers:

Recom. legislation to secure title to lands for right of way, H. Doc. 74 and S. Doc. 6, 43d Cong., 2d sess.

Orders sur. and proj. for 1st subdivision n. transportation route, **75,** ii, 521.

Transmits Maj. Houston's **R.** on dams at Menasha, **76,** ii, 425.

Transmits Maj. Warren's final **R.,** with remarks, **76,** ii, 189.

Rs., 66, ii, 41, iii, 3; **67,** 35; **68,** 49, 51; **69,** 43; **70,** 57; **71,** 37; **72,** 35; **73,** 35; **74,** 42; **75,** 45; **76,** 92; **77,** 102; **78,** 117; **79,** 156; **80,** 209; **81,** 283; **82,** 278, 279, 2182, 2188, 2193; **83,** 287, 1725, 1731, 1736, 1737; **84,** 287, 1882, 1899; **85,** 310, 2045; **86,** 304; **87,** 270–272; **88,** 245, 247; **89,** 284, 286; **90,** 257, 258; **91,** 328, 329; **92,** 314, 315; **93,** 357, 359; **94,** 329; **95,** 366; **96,** 322; **97,** 406; **98,** 397; **99,** 471; **00,** 536; **01,** 525; **02,** 449; **03,** 489; **04,** 533; **05,** 541; **06,** 597; **07,** 622; **08,** 667; **09,** 704; **10,** 778; **11,** 837; **12,** 1001.

Boards:

Convened, Cincinnati, Ohio, Nov. 3, 1878, and at Baltimore, Md., Feb. 19, 1879, to **R.** on movable dams for the upper Fox R. **R., 79,** 1547. (Majs. Craighill, Houston, and Merrill.)

Convened, New York, Nov. 24, 1879, to **R.** on plan for imp. of Wisconsin R. **R., 80,** 1953. (Cols. Tower and Newton and Majs. Abbot and Houston.)

Convened, Milwaukee, Sept. 1, 1882, by S. O. No. 81, to **R.** upon plan for restoration to natural w. and capacity of lower Fox R. Chan.; also, for mainten. of Lake Winnebago and Little Buttes des Mortes, at their natural heights, by alterations in dams at Menasha and Appleton, **83,** 1725, 1727, 1738. (Lt. Col. Houston and Majs. Robert and Benyaurd.)

Convened, New York, Jan. 5, 1884, to **R.** upon proviso in R. and H. bill of Mar. 1, 1883. **R., 84,** 1900, 1919. (Col. Newton and Lt. Cols. Abbot and Comstock.)

Convened, S. O. No. 98, at Milwaukee, Sept. 17, 1884, to **R.** on constr. of works, purchase of lands, and present d. of w. required in upper and lower Fox, **85,** 2041. (Lt. Cols. Poe, Merrill, and Barlow, and Capt. Marshall.)

Convened, New York, Dec., 1886, to determine practicability of contracting the Wisconsin R. sufficiently to obtain a l w. navigable d. of 4′ or 5′ by low brush dikes and wing dams on the bed of the stream. **R., 87,** 2094. (Cols. Casey and Abbot, Lt. Cols. Comstock, Houston, and McFarland.)

In charge:

Capt. T. J. Cram, orig. sur. and plan, 1839, **75,** 218.

Col. C. Whittlesey, ex. of Wisconsin R. from Portage to sources, 1847, **76,** ii, 220.

Dr. B. F. Schumard, ex. of Wisconsin R. from Portage to mouth, 1849, **76,** ii, 220.

C. R. Alton, chief engineer to State board of public works, 1848–51. **R., 76,** ii, 213.

S. G. Callahan, ex. of Wisconsin R., 1850, **76,** ii, 217.

W. L. Dewitt, ex. of Wisconsin R., 1851, **76,** ii, 216.

J. K. Anderson, chief engineer to State board of public works, 1851, **76,** ii, 214.

J. E. Day, consulting engineer to State board of public works, 1851, **76,** ii, 214.

D. D. Owen, U. S. Geologist, Geol. Sur., 1852, **76,** ii, 219.

Commissioner Wm. Richardson, in charge, 1853. **R., 76,** ii, 217.

C. D. Westbrook, chief engineer, Fox & Wisconsin Imp., Co., 1854. **R., 76,** ii, 221.

D. C. Jenné, chief engineer, Fox & Wisconsin Imp. Co., 1859. **R., 76,** ii, 224, 228.

N. M. Edwards, chief engineer, Green Bay & Mississippi Canal Co., 1866, **76,** ii, 230.

Maj. G. K. Warren:

Sur. and plans, 1866–70, **66,** 41.

Pre. **R.,** H. Doc. 58, 39th Cong., 2d sess., 41; **67,** 260.

R. on sur., **68,** 303, 350, 360, 363; **69,** 187; **70,** 226.

Retained maps at Newport, R. I., **71,** 120.

Final **R.** referred to, **76,** 92.

Final **R., 76,** ii, 189 et seq.

Col. J. N. Macomb, 1870–71. **R., 70,** 292.

Maj. D. C. Houston, work of imp., May, 1871–84. **R., 71,** 120; **72,** 132, 135; **73,** 218; H. Doc. 74, S. Doc. 6, 43d Cong., 2d sess.; **74,** 161; **75,** 216, ii, 521; **76,** ii, 396; **77,** 877; **78,** ii, 1169; **79,** 1531; (Lt. Col.) **80,** 1947; **81,** 2131; **82,** 2165, 2183, 2190, 2194; **83,** 1712, 1726, 1732, 1737; **84,** 1872, 1887, 1925, 1939.

Capt. W. L. Marshall, 1884–89. **R., 84,** 1872; **85,** 2025; **86,** 1686; **87,** 2077, 2097; **88,** 1869, 1878.

Maj. C. E. L. B. Davis, 1889–92. **R., 89,** 2085, 2095; **90,** 2365, 2378; **91,** 2572, 2580.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2213, 2222; **93,** 2758, 2779; **94,** 2103.

Capt. C. F. Palfrey, 1895. **R., 95,** 2657.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2523; **97,** 2709; **98,** 2338. (See below.)

Capt. J. G. Warren, 1899–1905. **R., 99,** 2789; **00,** 3712; (Maj.) **01,** 2953; **02,** 2077; **03,** 1866; **04,** 2846; **05,** 2049.

Maj. W. V. Judson, 1905–09. **R., 06,** 1762; **07,** 1907; **08,** 1976.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1979; **10,** 2135; **11,** 2340; **12,** 2528.

Lt. Col. G. A. Zinn (temp.), 1911–12, **11,** 814; **12,** 974. (See above.)

Assistants:

H. Meriton, dams, Wisconsin R., 1852, **76,** ii, 218.

Capt. C. R. Suter, sur., 1866–68, **66,** 41; **68,** 305. **R.,** H. Doc. 58, 39th Cong., 2d sess., 73.

Capt. S. M. Mansfield, sur., **66,** ii, 41.

J. Z. Osborn, sur., H. Doc. 58, 39th Cong., 2d sess., 73; died in the field, **68,** 361; **69,** 199.

D. W. Wellman, general assist. and in charge of sur.; office work, **69,** 199. **R.** and est., **68,** 35L

E. F. Ellsworth, sur., 1867, **76,** ii, 246.

W. W. Rich, sur., 1867, **68,** 305; **76,** ii, 246.

E. L. Billings, sur., 1867, **76,** ii, 246.

R. L. Dukes, sur., 1867, **69,** 199; **76,** ii, 246.

I. D. McKown, sur., 1867, **76,** ii, 246.

J. P. Cotton, sur., 1867, and **R.** and est., **76,** ii, 297, maps.

J. Blickensderfer, ex. of Fox and Wisconsin Rs., 1869, **76,** ii, 198, 242.

H. C. Long, snag boats. **R., 69,** 203.

Capt. A. M. Miller, **72,** 135.

J. Nader, in charge Wisconsin R. **R., 72,** 132, 141; **73,** 225, 243; **74,** 167.

J. Pierpont, assist. on Fox R. **R., 72,** 148; **78,** 1177; **79,** 1538. Details of locks, **77,** 887.

N. E. Russell, sur. on Fox R.; in charge upper Fox R., **73,** 226, 233; **74,** 164; **75,** 220. Sur. on Fox R., **75,** 222.

W. J. Bryson, in charge upper section Fox R., **73,** 226; **74,** 164; **75,** 220.

L. Martin, in charge lower section Fox R., **73,** 226; **74,** 164; **75,** 220.

N. M. Edwards, in charge Fox R. imp., 1872–74, assist. to Capt. J. G. Lydecker. **R., 73,** 233; **74,** 163.

Capt. J. G. Lydecker, May, 1874, to Apr., 1877, Fox R. **R., 74,** 162; **75,** 219; **76,** ii, 412; **77,** 889.

Lt. F. A. Hinman, July, 1874, to 1883, Wisconsin R. **R., 74,** 166; **75,** 223; **76,** ii, 417, 422; **77,** 890; **78,** 1170; **79,** 1534. Feb., 1876, upper Fox R. **R., 76,** ii, 423; **77,** 888; **78,** 1174; **79,** 1536; (Capt.) **80,** 1961, 1967; **81,** 2167, 2174; **82,** 2174, 2167; **83,** 1714.

H. Liljencrantz, sur. Fox R., **75,** 222; died, **77,** 887.

J. R. Berthelet, jr., overseer, Wisconsin R. **R., 76,** ii, 420.

E. C. Hinman, overseer, Wisconsin R. **R., 76,** ii, 419; **79,** 1536, 1538.

C. A. Fuller, assist. engineer, lower Fox R. **R., 78,** 1179; **79,** 1544; **80,** 1969; **81,** 2144; **82,** 2178; **83,** 1721; **84,** 1874; **85,** 2033; **86,** 1695; **87,** 2081; **88,** 1872; **89,** 2088; **90,** 2369.

J. W. Allen. **R., 83,** 1719; **84,** 1878, 1880; **85,** 2038, 2040.

N. M. Edwards. **R., 83,** 1735.

S. Whitney. **R., 91,** 2572, 2581; **92,** 2217; **93,** 2760; **94,** 2106.

L. M. Mann. **R., 95,** 2662; **96,** 2528; **97,** 2715; **98,** 2349; **99,** 2792; **00,** 3716; **01,** 2956; **03,** 1869; **04,** 2851; **05,** 2052.

1st Lt. Douglas MacArthur, **08,** 648.

ESTIMATES. (See Plans and Projects.)

By—	Year.	For—	Wisconsin River.	Portage Canal.	Fox River.	Fox and Wisconsin Rivers.	References.
Capt. Cram	1840	Improvement			$448,470		**76,** ii, 210.
C. R. Alton	1849	do	$6,000				**76,** ii, 213.
W. L. Dewitt	1851	Improvement in part.	52,264				**76,** ii, 216.
W. Richardson	1853	Improvement	41,372				**76,** ii, 217.
D. C. Jenné	1862	With boats 144 f. long, 6 f. draft.	260,000	$65,000	675,000	$1,000,000	**76,** ii, 229.
Do	1862	With boats 200 f. long, 6 f. draft.				1,250,000	**76,** ii, 229.
Col. Cram	1863	do	315,000	70,000	2,002,384	2,387,384	**76,** ii, 229.
Capt. Suter	1866	Survey	15,000				H. Ex. Doc. 58, 39th Cong., 2d sess., 41.
Maj. Warren	1867	Scraper and dredge boats.	40,000				**67,** 260.
Capt. Suter	1868	4 f. draft	[1] 20,000		484,422		Doc. 58, **68,** Cong., 2d 351; **73,** 2149.
Do	1868	6 f. draft	[1] 40,000		1,308,515		
D. W. Wellman	1868	To 3 f. by wing dams.	427,747				**68,** 354.
Do	1868	To 5 f. by dams and canal.	3,206,790				
Do	1868	To 5-f. canal plan	4,164,270				
H. C. Long	1868	Snag boat and scraper.	30,000				**68,** 327.
Maj. Warren	1868	Experimental work.	50,000				**68,** 52.
Do	1868	Dams, etc., 3 f. draft.	500,000				**68,** 52, 360, 368.
Do	1868	Dams, etc., 4 f. draft.	3,250,000				
Do	1868	Canal, 5 f. draft	4,300,000				
Do	1870 1875	Canal, 4 f. draft	4,000,000				**70,** 226; **76,** ii, 293, 298.
Do	1875	Canal, 5 f. draft	4,165,000				**76,** ii, 298.
Maj. Houston	1872	Improvement of natural channel.	426,044				**72,** 140.
Do	1873	Various plans				2,600,000 to 3,000,000	**73,** 36, 224; **74,** 161.
Do	1873	Maximum est.				5,000,000	
Do	1875	do				4,235,642	**75,** 218.
Do	1875	do	930,705		2,668,400	3,599,105	**75,** ii, 523.
Do	1875	Final estimate				3,745,663	**76,** ii, 398; **78,** 1170.
Do	1875	Canal plan	10,000,000		4,000,000	14,000,000	**75,** 218; **76,** ii, 401.
Do	1875	Survey transportation route.				10,000	**75,** ii, 522.
Do	1876	Canal at Menasha			106,558		**76,** ii, 397, 411.
Do	1876	Enlarging Menasha Canal.			40,000		**76,** ii, 411.
Do	1876	Flowage damages			1,000,000		**76,** ii, 411.
Lt. Hinman	1875	Completion of improvement.	400,743				**75,** 225, 227.

Detailed est., Capt. Suter, l. and d. on Fox R., **76,** ii, 231, 235, 240.

Detailed est., N. M. Edwards, Fox R. works and canal at Portage, **73,** 242.

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1853–59, under corporation management, $728,928.47, **76,** ii, 227.

Jan., 1860–Aug., 1862, $6,585.92, **76,** ii, 228.

1867, $28,000–$1,192,370.22, **76,** ii, 241.

For all surs. under Maj. Warren, $39,000, **76,** ii, 201.

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[1] Per annum.

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1866–67. Sur. by Capt. Suter and Maj. Warren. (See Surveys.)

1867–68. Sur. continued. SS. *Caffrey* attempted to enter R., **69,** 203.

1868–69. Snag boat *Winneconne* purchased ($8,500, **69,** 43; $8,000, **70,** 226; **76,** ii, 242) and set to work, **69,** 43, 190; **70,** 57.

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1870–71. Work suspended, **70,** 292. (See Legislation.)

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1874–75. 118 dams=48,847 l. f. built to date, **75,** 224. Unfav. opinions expressed as to permanence of chan., **75,** 217. Tables of completed dams built, **75,** 224, 227. Grand excursion and resolutions, **75,** 226.

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1877–78. Ex. showed that chan. formed by work of imp. maintained, **78,** 1170, 1171. Soundings taken about once a year since 1875 on upper imp. section, **78,** 1171.

1878–79. Repairs and extension of dams, snagging, bank protection, etc., **79,** 1536. Operations suspended pending action of BE., **79,** 1533.

1879–80. Repairs and extensions to dams bet. Portage City and Wild Cat Bluffs; 5 dams with a total l. of 4,625' built above Prairie du Sac; 530' of dam extension on upper section; brush and st. collected, **80,** 1951.

1880–81. 41 wing dams with a total l. of 19,308' constr. bet. Portage and Rocky Run, **81,** 2133.

1881–82. 7,441 l. f. wing dam constr., **82,** 2166.

1882–83. 9,320 l. f. wing dam constr., **83,** 1713.

1884–85. Repairs to dams, **85,** 2025; **86,** 1686; **87,** 2077.

1885–86. Further efforts to imp. R. by wing dams discontinued, **87,** 2077, 2096.

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1872–73. Works transf. to U.S. from Green Bay & Mississippi Canal Co., Oct. 1, 1872, **73,** 225. Repairs on lower Fox and to levee at Montello; dr.; quarries opened, **73,** 226.

1873–74. Dr. on levels, repairs to old l. and d. on lower Fox, new lock and st. dam, surs. on upper Fox, **74,** 42. Detailed **R.,** **74,** 162.

1874–75. L. and d.; repairs, surs., detailed **Rs.,** **75,** 220.

1875–76. Portage Canal enlargement completed; 2 new locks and 5 new dams; dr.; locks let by contract; contractors failed. **R.,** **76,** ii, 396, 412, 423. Statement of work on canal at Portage, **76,** ii, 423.

1876–77. New locks, dams; dr.; line opened so far as locks are concerned June 1, 1876. **R.,** **77,** 877, 880, 888.

1877–78. New dams, repairing locks, quarrying st., dr., etc., **78,** 1169, 1174. Navigation open from Portage City to Green Bay, **78,** 1169.

1878–79. Dr., repairs of locks, widening Portage Canal, commencement of new lock, and crib dam, retaining wall, etc., **79,** 1538–1547.

1879–80. Lower Fox: Constr. of new lock at Little Chute; constr. of revet. wall of Appleton

[1] History of operations, **87,** 2094. Statement of total expend. on Fox and Wisconsin Rs., **87,** 2108.

Canal, and wasteweir in third level of same; canal banks strengthened and break of Menasha repaired.

Upper Fox: 460,931 c. y. dr.; repairs to Portage guard l. and d. at Eureka, Berlin, White R., and Princeton; snags removed, **80,** 1950.

1880–81. Lower Fox: Completion of new lock at Little Chute; constr. of masonry wall across head of old guard lock; elevation of canal banks; completion of revet. wall of Appleton Canal; constr. of wasteweir in Little Chute Dam; general repairs to l. and d.

Upper Fox: 519,473 c. y. dr.; constr. of lock tender's house at White R.; minor repairs to dams, locks, and canal banks, **81,** 2133.

1881–82. Lower Fox: Constr. of st.-masonry lock at Kaukauna.

Upper Fox: 335,681 c. y. dr.; 800 l. f. of R. bank protected from washing, by piles, brush, and st., **82,** 2165, 2166.

1882–83. Lower Fox: Constr. of retaining wall for canal bank above Kaukauna; constr. of first new lock at Appleton, and alteration of dams at Menasha and Appleton commenced.

Upper Fox: 124,208 c. y. dr.; repairs to locks, dams, and canal banks, **83,** 1713.

1883–84. Lower Fox: Appleton first lock completed; sluice ways and gates built in Appleton Upper Dam; water on bars and in canals d. by dr.; repairs to lock gates, canal embankments, and dams.

Upper Fox: Repairs to lock gates at Ft. Winnebago, Governors Bend, Princeton, Berlin, and Eureka, **84,** 1872.

1884–85. Upper Fox: 74,371 c. y. dr.; boats and drs. repaired, **85,** 2025.

Lower Fox: Repairs to old lock at Menasha and to Appleton fourth and Little Chute first locks; new abutment built and apron begun at Little Kaukauna Dam; repairs to l. and d. and dr. in canals, **85,** 2026.

1885–86. Upper Fox: Old locks at Governors Bend and Montello repaired; 97,596 c. y. dr. from bars in upper Fox; repairs to Eureka Dam.

Lower Fox: Right abutment and 178 l. f. of new dam at Menasha built; 1,506 cords st. blasted and removed from Menasha Chan.; 20,449 c. y. clay dr. from outlet of Lake Winnebago; apron completed and sluice built in Little Kaukauna Dam; repairs to l. and d., **86,** 1687.

1886–87. Upper Fox: Repairs to l. and d. and mainten. of existing d. of navigation by dr.; levee built at White R. Lock, **87,** 2077, 2082, 2087.

Lower Fox: New lock built at the Cedars; De Pere Lock renovated; Menasha Dam and sluice completed; Menasha Chan. d. by r. removal; De Pere Dam completed; new st. abutment built at Rapide Croche Dam, and the injury from h. w. of 1881 repaired, **87,** 2078, 2082, 2084, 2087.

1887–88. 161,747 c. y. dr. from bars on the upper Fox; 63,148 c. y. gravel and sand dr. from chan. on the lower Fox; repair and constr. of l. and d.; repair of boats and drs., **88,** 1870, 1877.

1888–89. 140,882 c. y. dr. from bars on the upper Fox; 10,883 c. y. material dr. from Menasha R.; extensive repairs to dr. plant and tugboats; constr. of Appleton Lower Dam continued; extensive repairs to Rapide Croche and Menasha Locks, **89,** 2085.

1889–90. Levee at Portage built under contract; new lower dam at Appleton completed; 25,000 c. y. dr.; operation, care, and repair of l., d., and canals, **90,** 2366–2376.

1890–91. Constr. of guard gates beyond at head of Kaukauna Canal; head wall and feeder built at head of old first lock at Appleton; brush and st. wing dam built at Portage Levee, **91,** 2573; 38,214 c. y. dr. in lower Fox, Neenah Chan., and mouth of Fond du Lac R., **91,** 2578. Constr. and repair of plant; operation and care of l. and d., **91,** 2580, 2587.

1891–92. Guard gates at head of Kaukauna Canal completed; 3,117 c. y. of r. blasted and removed, and 1,110 c. y. dr. from r. bar at R. outlet of De Pere Lock; 80,145 c. y. dr. at points on the lower Fox; 13,577 c. y. dr. on Fox R., bet. De Pere and Green Bay; buoy constr. and repairs to plant, **92,** 2217, 2219; operation and care of l. and d., **92,** 2222.

Fox and Wisconsin Rivers.

1892–93. Lock to replace an old one built at Portage, Wis.; constr. of chan. at Grignon Rapids in progress; new middle platform built in the combined locks at Little Chute; a part of the Kaukauna Canal bank rebuilt and a part of the bed puddled with clay; 2 new lock houses built, and dr. plant repaired, **93,** 2759.

1893–94. Lock at Portage finished; dr. in Grignon Rapids and in the R. bet. Rapide Croche Dam and Wrightstown Br. completed; wasteweir and culvert constr. at combined lock; wing walls at Kaukauna fourth lock rebuilt; 587 l. f. core wall constr. in the canal banks of the fourth and fifth levels at Kaukauna; and locks, dams, houses, and dr. plant repaired, **94,** 2105.

1894–95. Crib dam at Berlin Lock completed; fourth lock at Appleton rebuilt; wasteweirs for Kaukauna system completed; constr. of dam and straight cut at White R. Lock begun; works, buildings, and plant repaired, **95,** 2659.

1895–96. Crib dam at White R. Lock completed; lock house and warehouse at Appleton Lock completed; H. at Fond du Lac dr., and bar dr. at intersection of Fox R. with Lake Butte des Morts, **96,** 2526.

1896–97. Wasteweir constr. at Kaukauna second lock; roadway built at Appleton first lock; fishways constr. in the Eureka, Berlin, and White R. Dams, and a small amount of dr. done, **97,** 2712.

1897–98. Crib dam and fishway built at Princeton, and old dam removed; old dam at Grand R. removed, and constr. of permanent crib dam begun; H. of refuge dr. at Stockbridge Landing, Lake Winnebago; bars in Wolf R. dr., and snags and other obstr. removed from that R.; scow built, and dr. plant repaired; chans. dr. below Kaukauna fifth and Rapide Croche Locks, and canal above Rapide Croche and Appleton second locks; boring of several wells in progress, **98,** 2341.

1898–99. Permanent crib dam with masonry abutments at Grand R. completed, and old dam removed; fishways built in 3 dams; chan. dr. below Menasha Lock; and misc. work, **99,** 2789.

1899–00. Chan. on the upper Fox dr.; some dr. below Menasha Lock and above Appleton fourth lock; revet. built, ps. repaired at H. of refuge; some dr. and some snag removal on Wolf R.; misc. work (about 275,000 c. y. dr.), **00,** 3712.

1900–01. Dr. upper Fox R., **01,** 2953.

1901–02. Office work and superintendence, **02,** 2077.

1902–03. Imp. Miller Bay, Lake Winnebago, dr. upper Fox R., repairing dr. plant, **03,** 1867.

1903–04. Imp. Miller Bay, Calumet and Stockbridge Hs., Lake Winnebago, and dr. upper Fox R., **04,** 2846.

1904–05. Partial constr. of an elevator dr.; dr. in upper Fox R., **05,** 2049.

1905–06. Completion of elevator dr. and auxiliary scows; dr. upper Fox R.; repairs to Stockbridge H. and Miller Bay Break'r, Lake Winnebago, **06,** 1762.

1906–07. Dr. upper Fox R.; repairs to Stockbridge H.; cleaning Cedars and Kaukauna Canals; dr. Fond du Lac H.; repairs to conveyor dr., **07,** 1907.

1907–08. Constr. of turning basin and warehouse at Appleton; slight repairs to Miller Bay Break'r; commencing constr. of H. at Brotherton; dr. Fond du Lac H. and chan. in upper Fox R.; rebuilding dr. and building new scows, **08,** 1976.

1908–09. Completion of turning basin at Appleton and H. at Brotherton; dr. upper Fox R.; sur. of upper Fox R. and repairs to conveyor dr., **09,** 1979.

1909–10. Repairs to Stockbridge and Brotherton Hs.; dr. upper Fox R. and repairs to conveyor dr., **10,** 2135.

1910–11. Dr. upper Fox R., Stockbridge, Brotherton, and Calumet Hs. and Lake Winne-

bago; minor repairs to break'r at Miller Bay; repairs to plant; sur. of Fox R. from its mouth in Lake Winnebago to foot of Lake Butte des Morts for estab. H. lines; sur. of Wolf R. to determine where dr. and snagging needed, **11,** 2340.

1911-12. 150,911 c. y. dr. near Grand R. Locks; imp. of Wolf R. commenced—snags and overhanging trees removed from mouth of R. to New London, 46.6 m., and 30,316 c. y. dr.; repairs to plant, **12,** 2528.

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One level of the Fox R. imp., that above Menasha, maintained by 2 dams, 1 of them belonging to the US., **98,** 2346.
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1867-69. Operations by Green Bay & Mississippi Canal Co., **76,** ii, 241, 242.
1872. Works transferred to the U.S., as per **R.** of board of arbitrators (H. Doc. 185, 42d Cong., 2d

sess.), which awarded $325,000 to the co. for the property, rights, and franchise, $180,000 being deducted by the Sec. of War for property not needed by the U.S.; $145,000 was app. (June 10, 1872) and paid, **72,** 35; **73,** 219. Co. retained water-power franchise, a source of conflict, **73,** 222; **74,** 163, 166. List of works transf., **79,** 1532.

Results of corporate work summed up, H. Doc. 58, 39th Cong., 2d sess., p. 74.

Fox River Imp. Co.'s works ex. by Maj. Houston, **73,** 219.

RR. brs. modified, **75,** 224, 226; **76,** ii, 423, 424; **77,** 888.

History of early explorations, **76,** ii, 203; of early State and corporate work, **76,** ii, 212, 220.

Neenah & Menasha Waterpower Co. granted permission, 1899, to place 8" flushboards on the Menasha Dam, **99,** 2790; **00,** 3713; **01,** 2953.

Levee at Portage, Wis., raised and strengthened by Wisconsin, under au. of Sec. of War, **05,** 2049.

PROJECTS. (See Estimates and Plans.)

By Maj. Houston, operations on Wisconsin R., **72,** 135. Proj. adopted, at total cost of $3,745,663, **75,** 218; **76,** ii, 398; **78,** 1170.

The permanent works for the imp. of the Fox and Wisconsin Rs. purchased by the U. S. in 1872 from the Green Bay & Mississippi Canal Co. for $145,000, **72,** 35; **73,** 219. The subsequent proj. proposed slack-water navigation of the Fox R. by replacing the temporary structures with permanent works and the constr. of 5 addl. locks on the upper Fox, the imp. of the Wisconsin R. by wing dams and dikes, to obtain 6' for a w. of 100'; est., $3,745,663, **75,** 218; **78,** 1170; **80,** 1952; **87,** 270.

[Existing proj., 1912, that of BE., submitted 1884 and modified 1886, providing for d. and w. Fox R. Chan.; Green Bay to Montello, to 6', and from Montello to Portage to 4', with w. from Lake Winnebago to Montello of 100'; and providing for renovation of 12 old locks; est., $602,000, **12,** 1002.]

By BE., 1884, reconstr. of dam at Menasha, below site of present dam, across full w. of Menasha Chan., and enlargement of Neenah Chan. by dr.; also, purchase of lands and structures, **85,** 2044; **86,** 1689.

BE. of 1886 decided against further attempts to imp. the l. w. navigation of the Wisconsin R. by wing dams, **87,** 2096.

By Capt. Zinn, 1896–97, dr. H. of refuge in Lake Winnebago at Stockbridge, **97,** 2712.

By Capt. Zinn, 1896, removal of snags and other obstr. from Wolf R. bet. New London and Lake Poygan, 47 m., and dr. an 4½' x 80' chan. at medium stage through 5 bars amounting in l. to 2,000', and also for the removal of a wrecked SS., using for the purposes mentioned the app. of $1,500 made in act of 1896, **97,** 2716.

In 1897 Capt. Zinn est. $180,866.48 to complete the imp. of Fox R., **97,** 2714; in 1898, $163,967.52; acquiring control of dam above Menasha recom., **98,** 2346.

Maj. Warren recom., 1904, for reasons given, abandoning and trans. site to city of Portage, Wis., of levee built at that city in 1890 to protect US. works on Fox R. from overflow of Wisconsin R.; also recom. suspension of w. and d. chan. in Fox R. above Montello, Wis., until demands of C. show necessity for imp., **04,** 2848.

Maj. Judson est., 1908, $175,353.36 required to complete existing proj., and that $75,000 in addition to balance available will complete chan., Princeton to Montello, **08,** 668, 1977–78.

Maj. Bromwell recom., 1910, limiting further work on upper Fox R. to mainten. of present d., viz, 6' as far as Princeton Lock, thence to Montello 4', thence to Portage 3', which would meet all requirements of C. and navigation interests. Est. of 1908 for completion of proj. shown by recent soundings to be insufficient, **10,** 2136.

Act June 25, 1910, au. expend., not exceeding $3,000, for imp. Wolf R., **10,** 779.

Act 1912, works on Fox R. embraced 18 st. locks, 2 st. guard locks, 8 composite locks, 13 canals, 16 permanent and 1 temporary dam, and various accessories, such as lock houses, warehouses, dry dock, levees, wasteweirs, culverts, etc. Hs. of Stockbridge, Calumet, Miller Bay, and Brothertown, Lake Winnebago, had been imp.; snags had been removed and bars dr. in Wolf R., making 4' chan. 100' w. to New London, **12,** 1003.

SECRETARY OF WAR.

Au. act July 7, 1870, to adopt such plans for Wisconsin R. as recom. by the Chief of Engineers, **73,** 218.

Action on report of board of arbitrators, **72,** 35.

Concurs in plans for Menasha Canals and requests Atty. Gen. to defend flowage suits, **76,** ii, 425.

Recom. legislation as to title to lands for right of way, H. D. 74, 43d Cong., 2d sess., and S. Doc. 6; 43d Cong., 2d sess.

SURVEYS.

1836. By Mr. Centre, C. E., under directions of Col. Abert, U. S. T. E., entrance to Fox R. **R.,** Apr., 1838, **76,** ii, 208.

1837. By Mr. Pettival, C. E., under Topographical Engineer Bureau, of Fox R. **R.** printed as H. Doc. 102, 25th Cong., 3d sess., **76,** ii, 208.

1839. By Capt. Cram, U. S. T. E., of Fox R. **R.,** S. Doc. 318, 26th Cong., 1st sess., **75,** 218; **76,** ii, 209.

1847. By Col. C. Whittlesey, ex. Wisconsin R. from source to Portage. **R.** in Geological report, Lippincott, Grambo & Co., Philadelphia, 1852, **76,** ii, 220.

1849. By Dr. B. F. Schumard, ex. of Wisconsin R. from Portage to mouth. **R.** in Geological report, Lippincott, Philadelphia, 1852, **76,** ii, 220.

1852. Geological sur. of the Wisconsin by D. D. Owen, U. S. G. **R.,** Lippincott, Philadelphia, 1852, **76,** ii, 219.

1866. Pre. ex. and sur. by Capt. Suter, under direction of Maj. Warren. **R.,** H. Doc. 58, 39th Cong., 2d sess., p. 74, **66,** iii, 35; **67,** 35. No reliable sur. ever made of the Wisconsin R., same document, p. 95. Detailed est. for such a sur., same document, p. 103.

1867. Sur. of Wisconsin R., under direction of Maj. Warren, by Capt. Suter, commenced Aug. 26, **68,** 49. Fully described by Maj. Warren, **76,** ii, 243. Instructions of Maj. Warren for sur., **68,** 303; **76,** ii, 244. Office work by D. W. Wellman. Result of work on sur., **68,** 363; **76,** ii, 247. Est. for addl. sur., $7,500, **68,** 362. Final **R.** by Maj. Warren, **76,** ii, 190. Cost of all surs. under Maj. Warren for this imp., $39,000, **76,** ii, 201.

1874. Sur. under direction of Maj. Houston for n. transportation route to the seaboard, **74,** 161; **75,** ii, 521. Sur. of chan. of Fox R., **74,** 166. Sur. of upper Fox R. completed, **75,** 216; described, **75,** 222; platted, **76,** ii, 398.

1875–78. Soundings taken about once a year on upper imp. section of Wisconsin R., **78,** 1171. Soundings of 1878, **78,** 1172.

Ex. of Wisconsin R., Portage to Merrill; made, 1882, by Lt. Col. Houston, **84,** 1939.

Sur. of Fox R., De Pere to Green Bay; made 1888, by Maj. Davis, **89,** 2086.

Minor surs. and exs., **93,** 2763; **95,** 2659; **96,** 2526; **97,** 2712, 2716.

Ex. as to the necessity and advisability of building a protection wall at Kaukauna, au. act July 13, 1892; made, 1892, by Maj. Gregory (**R.** unfav.), **93.** 2779.

H. at mouth of Fond du Lac sur. in 1894–95, **95,** 2664.

Sur. for a H. of refuge on the e. shore of Lake Winnebago, au. act June 3, 1896; made by Capt. Zinn in 1896 (see Projects), **97,** 2716.

Ex. of Wolf R. for removal of bars and snags below Shawano, au. act June 3, 1896; made, 1896, by Capt. Zinn (see Projects), **97,** 2716.

Congress, 1896, directed that a thorough investigation of the character, limitations, and description of the property and rights of the U.S. in connection with the imp. of Fox and Wisconsin Rs. be made under the direction of the Sec. of War; made by Gen. E. S. Bragg, **R.,** **98,** 2353.

Sur. of land acquired along the R. for which clear title should be obtained in progress, 1900, **00,** 3713.

Sur. of existing works, etc., completed and maps made, **01,** 2953.

Of upper Fox R. from Montello Lock to confluence with Wolf R. Sur. of proposed cut-off above Princeton Lock. Hs. on Lake Winnebago sounded and plotted, **09,** 1979.

Of Fox R., mouth in Lake Winnebago to foot of Lake Butte des Morts, for estab. H. lines, **11,** 2340.

Of Wolf R., from its confluence with Fox R. at Butte des Morts to New London, 47 m., to determine where dr. and dragging operations should be carried on, **11,** 2340.

Maps:

Map and profile of entire route, Warren's **R.,** pl. 1, **76,** ii, 296.

Mouth of Wisconsin R., Warren's **R.,** pl. 2, **76,** ii, 296.

Wisconsin R. in sections, Warren's **R.,** pls. 3–8, **76,** ii, 296.

Portage Canal and parts of Wisconsin and Fox Rs., Warren's **R.,** pl. 9, **76,** ii, 296.

Profiles of stages, Lake Winnebago, etc., Warren's **R.,** pl. 10, **76,** ii, 296.

Sketch map and section, Wisconsin R. and valley (Warren), **76,** ii, 245.

Bars in Wisconsin R. (Warren), **76,** ii, 256.

Former extent of Lake Winnebago (Warren), **76,** ii, 271.

Wisconsin R. canalized (Warren), **76,** ii, 282.

Characteristic sections and plans Wisconsin R. (Warren), **76,** ii, 284.

Route (Warren's **R.,** map cover), **76,** ii, 284.

Canal at Menasha, **76,** ii, 410.

Route (Father Marquette), **76,** ii, 206.

Sketches showing wing dams of 1871–72, **72,** 134.

Method of imp. Wisconsin R., **76,** ii, 408.

Dam and lock details on Fox R., **76,** ii, 416.

View of mouth of Wisconsin R. (Warren's **R.,** map cover), **76,** ii, 296.

Land-office maps very unreliable, H. Doc. 58, 39th Cong., 2d sess., p. 73.

Scale of maps and progress on, **68,** 363; **69,** 191; **76,** ii, 398.

Sur., Wisconsin R., described (Warren), **76,** ii, 247.

90, 2366; **98,** 2348.

Part (b), MM-15 Fox River, Wis., Locks and Dams. (Operating and care.)

APPROPRIATIONS.[1]

1885,	$46,687.40
1886,	42,622.00
1887,	42,061.65
1888,	52,204.77
1889,	48,329.62
1890,	76,874.27
1891,	68,989.00
1892,	55,989.98
1893,	33,551.90
1894,	36,958.24
1895,	40,438.60
1896,	50,225.16
1897,	66,317.49
1898,	62,597.03
1899,	66,959.21
1900,	73,064.65
1901,	66,552.85
1902,	63,550.30
1903,	68,482.59
1904,	50,861.52
1905,	46,427.20
1906,	44,983.29
1907,	104,565.07
1908,	45,171.78
1909,	52,940.17
1910,	55,449.28
1911,	50,921.48
1912,	56,206.67
Total,	1,569,983.17

COMMERCE.

C. of the lower Fox increased by the mainten. of the waters of the waterway at the height of the crests of the various dams, **98,** 2397.

CONTRACTS.

Details of expenses given in each an. **R.**

1899. G. Ryan, hull and cabin for towboat, $5,635, **00,** 3723.

1901. George Ryan, 2 flat scows, $3,950, **02,** 2082.

1910. Albert Luckow and John Coppes, lock master's dwelling, Little Kaukauna Lock, $3,075, **10,** 2144.

ENGINEERS.

Chief of Engineers. R., 93, 358; **94,** 330; **95,** 367; **96,** 323; **97,** 407; **98,** 399; **99,** 473; **00,** 537; **01,** 527; **02,** 451; **03,** 491; **04,** 535; **05,** 543; **06,** 598; **07,** 623; **08,** 669; **09,** 706; **10,** 780; **11,** 839; **12,** 1004.

In charge:

Maj. J. F. Gregory, 1892–94. **R., 93,** 2766; **94,** 2111.

Capt. C. F. Palfrey, 1895. **R., 95,** 2666.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2534; **97,** 2719; **98,** 2395.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2794; **00,** 3721; (Maj.) **01,** 2958; **02,** 2080; **03,** 1870; **04,** 2852; **05,** 2053.

Maj. W. V. Judson, 1905–09. **R., 06,** 1764; **07,** 1909; **08,** 1979.

Maj. T. H. Rees (temp.), 1909, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1981; **10,** 2139; **11,** 2342; **12,** 2531.

Lt. Col. G. A. Zinn (temp.), **11,** 814.

Assistants:

S. Whitney. **R., 93,** 2767; **94,** 2111.

L. M. Mann. **R., 95,** 2666; **96,** 2535; **97,** 2720; **98,** 2396; **99,** 2795; **00,** 3724; **01,** 2959; **02,** 2082; **03,** 1871; **04,** 2853; **05,** 2055.

1st Lt. Douglas MacArthur, **08,** 648.

LEGAL PROCEEDINGS.

Illegal use of water by manufactories on the lower Fox, **96,** 2535.

Enforcement of the rules and regulations of the Sec. of War for navigation and use of locks and canals the means of bringing about more satisfactory conditions for all concerned, **98,** 2396.

Recom. by Maj. Judson, 1906, that provision in R. and H. act June 3, 1896, directing Sec. of War to maintain level of water, be repealed, **06,** 1767.

OBSTRUCTIONS.

The use of the waters of the waterway by manufactories along the banks a cause of low water, **96,** 2535.

OPERATIONS.

1892–1912. Chan. of R. and canals of the system dr., lock houses, locks, dams, canal banks, and dr. plant repaired. (See each an. **R.**)

See tables of dr. from 1894 in each an. **R.**

[1] Expend. under permanent-indefinite app. provided by act July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

PHYSICAL CHARACTERISTICS.

Discharge observations, **96,** 2537; **97,** 2721, 2722, 2750; **98,** 2397.

Hydrograph of Oshkosh water gauge, **98,** 2396.

In 1896–97 the water of the waterway was maintained for the first time at the level of the dam crests, and such mainten. was due to the enforcement of the rules and regulations of the Sec. of War for the regulation of the navigation of the waterway, **97,** 2720.

Horsepowers of each of the U. S. and private dams of the waterway, **97,** 2722, 2723.

Statistics of water power of the lower Fox R., **97,** 2732.

Hydrographs, **99,** 2804; **00,** 3724.

Water stages, R. discharge, etc., **01,** 2960; **02,** 2082; **03,** 1872; **04,** 2854; **05,** 2055.

PRIVATE WORK.

Use of flushboards on Menasha Dam, **01,** 2960; **02,** 2081; **03,** 1870; **04,** 2852; **05,** 2054; **06,** 1767.

Recom. by Maj. Judson, 1906, that license of Neenah & Menasha Water Power Co. to use flushboards be revoked, **06,** 1767.

SURVEYS.

Minor, **96,** 2549; **97,** 2730; **98,** 2401; **99,** 2803; **00,** 3722.

Of U. S. property on Fox R., with maps, **01,** 2968.

Maps. Index, **97,** 2751. (See above.)

Part (c), MM-15 Depere Harbor, Wis.

APPROPRIATIONS.

1910, $11,500, **10,** 2112.

COMMERCE.

Tonnage, 1909, 28,458 t., **10,** 763.

ENGINEERS.

Chief of Engineers. R., 10, 763, 781; **11,** 820; **12,** 981.

In charge. Maj. C. S. Bromwell. **R., 10,** 2112; **11,** 2314; **12,** 2502.

OPERATIONS.

1910-11. 100,876 c. y. dr., completing required d. for turning-basin, **11,** 2314.

PHYSICAL CHARACTERISTICS.

Max. draft about 15′, **10,** 763.

PROJECT.

Act June 25, 1910, au. turning-basin 17′ d. with sufficient area to permit vessels not exceeding 350′ to turn around (H. D. 522, 61st, 2d), **10,** 763.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, for turning-basin, Fox R., and securing chan. 20′ d., turning-basin to city of Green B.; **Rs.,** Maj. Bromwell, May 7 and Nov. 1, 1909; existing chan. ample; est., $11,500 for turning-basin presented (H. D. 522; 61st, 2d), **10,** 781.

Maps. (H. D. 522, 61st, 2d.)

MM-16 WOLF RIVER, WIS.

APPROPRIATION.

1896, [1] $1,500, **97,** 2716.

COMMERCE.

Important, **79,** 1549, 1550.

C. prospective upon imp., **80,** 1981, 1982.

ENGINEERS.

Chief of Engineers. R., 78, 117; **79,** 156, 157; **80,** 210.

In charge:

Maj. D. C. Houston, 1878–80. **R., 79,** 1549; **80,** 1978.

Capt. Zinn. **R.** (Fox R.), **97,** 2716.

Assistants:

J. Pierpont. **R., 79,** 1550; **80,** 1979.

L. M. Mann. **R.** (Fox R.), **97,** 2716.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 1550, 1552, 1553.

Discharge of R., **79,** 1551, 1552.

Obstr., **79,** 1552, 1553.

PLANS. (See Projects.)

By Maj. Houston, 1879, removal of obstr. and constr. of wing dams and dikes for procuring chan. 4½′ d. at l. w., to Shiocton, and 3½′ d. to Semples Br.; est., $35,000, **79,** 1550, 1552, 1553.

By Maj. Houston, 1879, imp. of the R. from Semples Br. to Shawano by excavation of a chan. 80′ w. and 3½′ d. at l. w.; est., $43,500; no great demand for the imp., **80,** 1978, 1981.

PROJECTS. (See Plans.) (See Fox River, Wis.)

Congress provided $1,500, 1896, for removing logs and snags below Shawano. Proj. of Capt. Zinn, 1896, approv., purposed removing obstr. for 47 m., and dr. 4½′ chan. through 5 bars, **97,** 2716.

SURVEYS. (See Projects.)

By J. Pierpont, 1878–79, of Wolf R. from Lake Poygan to Red R., **78,** 117; **79,** 156, 1549.

Au. act Mar. 3, 1879; made, 1879, by Maj. Houston, **80,** 1978.

Maps. Of the R., and profile on center line of chan., **79,** 1552.

MM-19 WAUPACA RIVER, WIS.

ENGINEERS.

Chief of Engineers. R., 11, 839.

In charge. Maj. C. S. Bromwell, **11,** 814.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** Maj. Bromwell, Sept. 12, 1910 (H. D. 20, 62d, 1st) (unfav.), **11,** 839.

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[1] Allotment from app. for Fox R. (See Fox and Wisconsin Rivers.)

MM-21(a) LAKE WINNEBAGO (Fox River), WIS.

APPROPRIATIONS.

1906, *$2,500, **06,** 599.
1906, *1,400, **07,** 624.

Total, 3,900

ENGINEERS.

Chief of Engineers. R., 06, 599; **07,** 624.

In charge:
Maj. J. G. Warren, **06,** 579.
Maj. W. V. Judson, **07,** 604.

PROJECT.

Act Mar. 3, 1905, au. sur. of Lake Winnebago for charting purposes only, **06,** 599.

SURVEYS.

Sur. begun Aug. 21, 1905; completed Sept. 10, 1906; forwarded to US. Lake Sur. Office, Detroit, Mich., for charting and publication, **07,** 624.

MM-21(b) WINNEBAGO LAKE (Fox River), WIS. (Pier at north end.)[1]

MM-21(c) LAKE WINNEBAGO (Fox River), STOCKBRIDGE HARBOR, WIS.

COMMERCE.

Description of; none, **93,** 2782.

ENGINEERS.

Chief of Engineers. R., 93, 359.

In charge:
Maj. J. F. Gregory, 1893. **R., 93,** 2782.
Capt. G. A. Zinn, 1896–98. **R., 98,** 2349.

OPERATIONS.

1897-98. 39,351 c. y. dr., 175 l. f. protection p. built, **98,** 2349.

PHYSICAL CHARACTERISTICS.

Description of; H. situated at mouth of Mud Creek, on e. shore of Lake Winnebago, **93,** 2782.

SURVEY.

Ex. au. act July 13, 1892; made by Maj. Gregory (**R.** unfav.), **93,** 2782.
Maps. **98,** 2348.

MM-21(d) LAKE WINNEBAGO, CALUMET HARBOR, WIS.

COMMERCE.

In 1892 no general C., **93,** 2784.

ENGINEERS.

Chief of Engineers. R., 93, 359.
In charge. Maj. J. F. Gregory, 1892–93. **R., 93,** 2783.

PHYSICAL CHARACTERISTICS.

Description of. H. situated at the mouth of Pique Creek on the e. shore of Lake Winnebago, used at times as a H. of refuge by the smallest light-draft vessels, **93,** 2784.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Maj. Gregory (**R.** unfav.), **93,** 2783.

MM-21(e) LAKE WINNEBAGO (Fox River), HIGHCLIFF HARBOR,, WIS.

ENGINEERS.

Chief of Engineers. R., 10, 781.
In charge. Maj. C. S. Bromwell, **10,** 758.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.,** Maj. Bromwell, Apr. 30, 1909 (unfav.) (H. D. 356, 61st, 2d), **10,** 781.

MM-22 FOND DU LAC RIVER, WIS.

COMMERCE.

Existing and prospective C. importance of the H., **90,** 2393.

ENGINEERS.

Chief of Engineers. R., 89, 287; **90,** 259.
In charge. Maj. C. E. L. B. Davis, 1888. **R., 90,** 2389, 2390.

PLANS.

By Maj. Davis, 1889, chan. 100′ w., Scott St. Br. to the n. ice-house, and 150′ w., thence to the lake, with a d. of 7′; est., $8,000, **90,** 2393.

SURVEYS.

Sur. at mouth au. act Aug. 11, 1888; made, 1889, by Maj. Davis, **90,** 2390.

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* Allotment.
[1] Sur.—**R.,** Jan. 1, 1840. Est., $12,804.12 and $15,119.58. (H. D. 482, 55th, 2d.)

MM-23(a) DETROIT HARBOR, WIS.

ENGINEERS.

Chief of Engineers. R., 11, 839.
In charge. Maj. C. S. Bromwell, **11,** 814.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** Maj. Bromwell, Oct. 26 and Nov. 28, 1910 (unfav.)(H. D. 88, 62d, 1st), **11,** 839.

MM-24 STURGEON BAY AND LAKE MICHIGAN CANAL AND HARBOR OF REFUGE, WIS.

Part.	Title.	Period.	Appropriations.
a	Sturgeon B. and Lake Michigan Canal, Wis.	1886–1901	$166,833.00
b	Sturgeon B. Canal (H. of refuge)	1873–1901	188,500.00
c	Sturgeon B. and Lake Michigan Canal and H. of refuge	1902–1912	272,000.00
d	Operating and care	1893–1912	351,584.42
	Total		978,917.42

Part (a), MM-24 Sturgeon Bay and Lake Michigan Canal, Wis.

APPROPRIATIONS.

1886, [1]$5,000, act Aug. 5, 1886.
1892, [2]81,833, **94,** 2057.
1894, 20,000, **95,** 2608.
1896, 30,000, **96,** 2473.
1899, 30,000, **99,** 2738.

Total, 166,833

COMMERCE.

Act July 13, 1892, made canal free to C. Canal at that time met all the requirements of the C. using it. **93,** 2714.

In 1893 not less than 57 craft, sail and steam, used the canal to obtain a H. of refuge at one time, **94,** 2057.

Increasing, **95,** 2607.

Notwithstanding the C. depression of the period comprised in the time from the purchase of the canal to 1897, at the latter year the C. had been increased 50%, **97,** 2661.

Enormous increase of traffic through the canal since it came under U.S. control, **98,** 2298; **00,** 3660.

Large and important, **01,** 2977.

ENGINEERS.

Chief of Engineers. R., 93, 348; **94,** 319; **95,** 357; **96,** 313; **97,** 396; **98,** 388; **99,** 460; **00,** 525, 539; **01,** 517, 527.

In charge:

Maj. J. F. Gregory, 1892–94. **R., 93,** 2714; **94,** 2056.

Capt. C. F. Palfrey, 1895. **R., 95,** 2606.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2471; **97,** 2660; **98,** 2297.

Capt. J. G. Warren, 1899–1901. **R., 99,** 2737; **00,** 3659; (Maj.) **01,** 2914, 2971, 2973.

LEGAL PROCEEDINGS.

Canal transferred by the canal company to the US. and jurisdiction ceded by Wisconsin in 1893, **93,** 2714.

OPERATIONS.

1892-93. The U.S. assumed control on Apr. 25, 1893, **93,** 2715.

1895-96. N. revet. extended 1,220 l. f.; 989 l. f. of the same excavated by fender piling; 20,088 c. y. excavated; and a house for employees erected, **96,** 2472, 2473.

1896-97. N. revet. extended 555½ l. f., and s. revet. 963 l. f.; 30,420 c. y. dr.; and 150 l. f. guide piling built, **97,** 2660, 2661.

1897-98. N. revet. extended 694 l. f., and s. revet. 1,085 l. f.; and 44,165 c. y. dr., **98,** 2298.

1898-99. About 950 l. f. fender piling removed from in front of n. revet.; 45,707 c. y. dr., **99,** 2738.

1899-00. 687 l. f. revet. built; 122,104 c. y. dr.; plant increased, **00,** 3660.

1900-01. 95,604 c. y. dr., and 2,500 l. f. old revet. removed, **01,** 2914.

PHYSICAL CHARACTERISTICS.

Chan. dimensions, **93,** 2715; **94,** 2056; **95,** 2607; **96,** 2472; **97,** 2660.

Canal gives a more direct waterway from Menominee and other ports in the s. part of Green B. to Chicago and other ports in the s. parts of Lake Mich., **93,** 2715.

Lake Michigan entrance protected by ps. built by the US., **93,** 2715.

Description of, **01,** 2974.

PROJECTS.

Proj. carried out by the canal company, from whom the U.S. obtained control, resulted in an open cut without locks or gates, about 13′ x 100′ at top, bottom w. of 65′, and l. of 7,200′; also dr., in continuation of canal proper, a chan. of same d. in Sturgeon B. for 6,100 l. f., **93,** 2715.

In 1893 Maj. Gregory est. $98,450 to complete revet. of canal, **93,** 2717; **94,** 2057.

By Capt. Zinn, 1896, modifying existing proj. to provide 250′ bet. revet. for w. 1,000′ of canal, and dr. and mainten. of chan. 15′ x 200′ below datum plane of H. imp. from the w. end of canal to d. w. in Sturgeon B.; est., $15,050; and for setting back old revet, when replaced so as to give 160′ bet., **97,** 2660, 2661.

Consolidation of this work with that for the H. of refuge recom., **00,** 3661.

SURVEYS.

Ex. and sur. for 18′ chan., Lake Michigan to Green B., au. act June 6, 1900, **00,** 3660. **R.,** Capt. Warren, June 28 and Nov. 24, 1900; est., $218,000 (H. D. 117, 56th, 2d), **01,** 527, 2970.

[1] Examination. [2] Purchase of canal.

Part (b), MM-24 Sturgeon Bay Canal, Wis. (Harbor of refuge at entrance.)

APPROPRIATIONS.

1873,	$40,000,	**73,** 198.
1874,	10,000,	**74,** 38.
1878,	30,000,	**78,** 114.
1879,	30,000,	**79,** 153.
1880,	10,000,	**80,** 1909.
1881,	10,000,	**81,** 2076.
1882,	20,000,	**82,** 2136.
1884,	10,000,	**84,** 1847.
1886,	5,000,	**86,** 1661.
1890,	3,000,	**90,** 2337.
1892,	5,000,	**93,** 2720.
1894,	5,000,	**95,** 2616.
1896,	5,000,	**96,** 2483.
1899,	5,500,	**99,** 2750.
Total,	188,500	

COMMERCE.

General statement of expected benefits to C. from canal, **72,** 173.

Utility of H. work entirely dependent on completion of canal, **74,** 142; **75,** 197; **78,** 1148.

C. character of canal, **87,** 2034.

Transfer of the canal, at mouth of which is H. of refuge, in 1893 added largely to importance of the H., **93,** 2720.

CONTRACTS.

1873. W. E. Strong, building pile p. **76,** ii, 345.

1874. W. E. Strong, building pile p., **76,** ii, 345.

1878. Truman & Schroeder, building crib p., **79,** 1488.

1880. Truman & Schroeder, p. extension, **80,** 1909. McDonald & Boalt, p. extension, **80,** 1909; **82,** 2138.

1882. Green Bay Dredge & Pile Driver Co., dr., 19¢ c. y., **83,** 1656.

ENGINEERS.

Chief of Engineers. **R., 72,** 35; **73,** 32; **74,** 38; **75,** 42; **76,** 95; **77,** 99; **78,** 114; **79,** 152; **80,** 204; **81,** 275; **82,** 270; **83,** 279; **84,** 279; **85,** 302; **86,** 296; **87,** 262, 2017; **88,** 238; **89,** 277; **90,** 250; **91,** 321; **92,** 306; **93,** 349; **94,** 321; **95,** 358; **96,** 314; **97,** 397; **98,** 389; **99,** 461; **00,** 526; **01,** 518.

Boards:

Convened, Milwaukee, Wis., Dec. 19, 1882, by S. O. No. 51, to report upon cost of constr. Sturgeon B. and Lake Michigan Ship Canal, and by whom constr.; also upon amount of money realized from sale of lands granted by U. S. to aid in constr. of above canal, **83,** 1657. (Lt. Col. Houston and Maj. Robert.)

Constituted by S. O. No. 112, C. of E., 1886, to consider and report upon the expediency and desirability of the acquisition by U. S. of the canal. **R., 87,** 2021–2037. (Lt. Cols. Craighill and Gillespie and Capt. Marshall.)

In charge:

Maj. D. C. Houston, 1873–75. **R., 73,** 198; **74,** 141; **76,** ii, 344.

Maj. H. M. Robert, 1875–83. **R., 75,** 197; **76,** ii, 344; **77,** 856; **78,** 1146, 1150; **79,** 1488; (Lt. Col.) **80,** 1906; **81,** 2075; **82,** 2134.

Lt. Col. J. W. Barlow, 1883; **83,** 1629.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1655.

Lt. Col. Barlow, 1884–86. **R., 84,** 1846; **85,** 1988.

Capt. W. L. Marshall, 1886; **86,** 290.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1660; **87,** 2014; (Maj.) **88,** 1844; **89,** 2051; **90,** 2336; **91,** 2536.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2182; **93,** 2719; **94,** 2062.

Capt. C. F. Palfrey, 1895. **R., 95,** 2614.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2481; **97,** 2671; **98,** 2308.

Capt. J. G. Warren, 1899–1901. **R., 99,** 2749; **00,** 3672; **01,** 2922.

Assistants:

W. T. Casgrain. **R., 72,** 172.

W. H. Hearding. **R., 74,** 141; **75,** 197.

L. Y. Schermerhorn, **79,** 1490. **R., 79,** 1493; **82,** 2136.

ESTIMATES. (See Projects.)

By Maj. Houston, 2 ps., each about 1,200′ l., with dr., $120,000, **72,** 172; **73,** 199; addl. to $40,000 app., **73,** 32. Total increased to $180,000, **74,** 142.

By W. T. Casgrain, canal on Thompson's route of 1867, $726,950, **72,** 174.

By W. T. Casgrain, canal, Casgrain's route, $629,300, **72,** 174; transmitted by Maj. Houston, **72,** 172.

LEGISLATION.

Act Apr. 10, 1866, granted 200,000 acres of public and to Wisconsin to aid State in constr. and completing break'r and H. and ship canal toconnect waters of Green B. with waters of Lake Michigan, to be completed in 3 years. Min. w. of canal 100′, and d. 13′.

Act Mar. 1, 1872, extended time for completion to Apr. 10, 1874.

Act Mar. 3, 1871, directed Sec. of War to cause sur. for ship canal from head of Sturgeon B., Wis., on line "now" opened across the portage * * * to shore of Lake Michigan, with est. for constr. same 13′ x 100′.

Discussion of legislation by U. S. and Wisconsin in regard to canal work, **78,** 1147, 1150. Land-grant appraisement, **78,** 1150. Majority and minority reports of committee on State affairs of Wisconsin Assembly, Feb. 21, 1879, on management of canal company, and reciting history of legislation relating thereto, **79,** 1494.

Act of Wisconsin Legislature Mar. 4, 1879, to secure proper completion of canal, **79,** 1505.

Act of Wisconsin accepting congressional grant of lands for constr. of ship canal, **83,** 1658.

Acts of State relating to canal, **87,** 2024.

OPERATIONS.[1]

1873–74. N. p., 762 l. f. pile p. built; s. p., 762 l. f. pile p. built, **74,** 38, 141.

1874–75. N. p., 32 l. f. pile p. built; s. p., 32 l. f. pile p. built. Reached 14½′ water. Ps. partially refilled, **75,** 197.

1877–78. Ps. partly refilled on outer ends, **78,** 114, 1147.

1878–79. N. p., 4 cribs (200 l. f.) built; s. p., 1 crib (50 l. f.) built; house built at cost of $75, **79,** 1489.

1879–80. 11 cribs built and sunk in extension of n. and s. ps.; crib in n. p. replaced; 2 outer cribs covered with plank and entire work filled and riprapped; 210 l. f. brush revet. placed at inner end of pile ps., **80,** 1906, 1907.

1880–81. 6 cribs built and sunk on detached p. extension; 3 cribs decked and 25 fender piles driven; superstr. nearly completed on n. p.; 1,392 l. f. sheet-pile revet. built by hired labor; 8,164 c. y. dr. in chan., **81,** 2075.

1881–82. 330 l. f. guide piling built; superstr. built over 16 substr. by hired labor; 190 cords riprap placed around piling; 8,883 c. y. dr., **82,** 2134, 2135.

1882–83. 21,368 c. y. dr. from chan. bet. ps.; 1 dr. and 2 dump scows built, **83,** 1655.

1883–84. 51,744 c. y. dr. from H.; 200 l. f. sheet piling, n. p., riprapped; 210 cords st. placed in ps., **84,** 1846.

[1] Lists of materials and prices, **75,** 197; **79,** 1493. Method of building pile p. described, **74,** 141. History of work by Maj. Houston, **76,** ii, 344.

1884-85. Guide piling completed; 350 l. f. superstr. built over s. p.; st. filling in both ps. completed and ps. riprapped and planked, **85,** 1988.
1885-86. 30,940 c. y. dr., **86,** 1660.
1886-87. 42,185 c. y. dr. from H.; extensive repairs made upon ps., **87,** 2015.
Summary of work done at H., **87,** 2016.
1889-90. 7,478 c. y. dr.; 200 l. f. of n. p. and 175 l. f. of s. p. rebuilt by hired labor, **90,** 2337.
1891-92. 13,640 c. y. dr. by hired labor; repairs to bulkheads and sheet piling of n. and s. ps., **92,** 2183.
1892-93. N. and s. ps. and dr. plant repaired and 10,660 c. y. dr., **93,** 2719.
1893-94. Dr. plant repaired and 14,260 c. y. dr., **94,** 2063.
1894-95. 9,025 c. y., s. m., dr and minor repairs made to s. p., **95,** 2616.
1895-96. 42,934 c. y. dr., **96,** 2482.
1896-97. 14,534 c. y. dr. and repairs to s. p. in progress, **97,** 2671.
1897-98. 9,244 c. y. dr., piling renewed on n. side of H., and ps. repaired, **98,** 2308.
1898-99. 9,918 c. y. dr.; ps. repaired, **99,** 2750.
1899-00. 8,016 c. y. dr.; ps. repaired, **00,** 3673.
1900-01. 8,106 c. y. dr., **01,** 2922.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 173, 175.
Results of the first p. work on the shore line, **74,** 142.
Geological formation, **76,** ii, 344.
Unprotected sides of canal will probably cause a reduction in its d., **78,** 1147; **79,** 1493.
Chan. subject to shoaling from material coming from canal, **93,** 2720; **94,** 2063; **95,** 2615; **96,** 2482; **97,** 2671; **99,** 2750.

PRIVATE (CORPORATE) WORK.

Canal company commenced work in 1872, **73,** 199, according to plan indicated in Maj. Houston's report, **72,** 171.
1872-73. Summit cut down from 28′ to 13′ above lake, **73,** 199.
1873-74. One-fourth the work done, **74,** 142.
1874. Suspended work, **75,** 42.
1877. Canal company resumed work, **77,** 99.
1878. Junction effected bet. waters of lake and B., **79,** 1493. Canal became closed, preventing rapid prosecution of H. work, **79,** 1489.
1879. Canal probably permanently opened, **79,** 1490.
Discussion of probable future of canal, its defects, d. relations to U. S. work, **78,** 1147, 1149; **79,** 1493. Land-grant appraisement, **78,** 1150. Current observed in canal; its effect on the banks, **79,** 1490, 1493. **R.** of W. T. Casgrain, chief engineer canal company, on probable work to be done, **78,** 1151. **R.** of John Nader, State inspector, on work of canal company, **78,** 1152. **R.** of committee on State affairs, Wisconsin Assembly, on management of the canal company, **79,** 1494; minority **R.,** **79,** 1499.
BE. convened to ex. and report upon cost of canal, **83,** 1657; **87,** 2021.
Cost of canal as built by canal company, **83,** 1661, 1672; **87,** 2030.
History of canal, **87,** 2019, 2022.

PROJECTS. (See Estimates.)

By Maj. Houston, 1871–74, 2 ps. to protect entrance to canal at Lake Michigan, each p. beginning at a point on the shore line 425′ from axis of canal, extending into lake and narrowing to 235′ at outer ends, each about 1,200′ l. and extending to 18′ curve; also dr. of outer basin to 13′; est., $180,000, **72,** 171; **74,** 141.
In 1879–80 Maj. Robert proposed constr. of 1,392 l. f. of sheet-pile revet. to render existing pile ps. sand tight; w. of H. entrance to 325′ by constr. of 150 l. f. detached p. on each side, with fender piling to connect ends of detached ps. with ends of previous p. extension; also formation of dr. chan. 16′ d., extending from H. entrance to mouth of canal, **80,** 1907, 1908; **83,** 279.
(See also Board of Engineers.)
Consolidation of this work with that of the canal recom., **00,** 3673.

SURVEYS.

For ship canal 13′ x 100′, and est., called for by act Mar. 3, 1871, made by W. T. Casgrain in season of 1871, under orders from Maj. Houston. Map and report destroyed in Chicago fire, Oct. 9 and 10, 1871. **R.** of Maj. Houston, **72,** 35, 171; of W. T. Casgrain, **72,** 172.
Sur. made, 1890, by Maj. Davis, **90,** 2337.

Maps. Sketch showing state of work in 1878, **78,** 1152.
80, 1908; **81,** 2076; **93,** 2720.

Part (c), MM-24 Sturgeon Bay and Lake Michigan Canal and Harbor of Refuge, Wis.

APPROPRIATIONS.

1902,	$44,000,	**02,** 2050.
1903,	178,000,	**03,** 1841.
1905,	50,000,	**05,** 2022.
Total,	272,000	(incl. misc., $284,129.40, **12,** 2504).

COMMERCE.

Proj. has had effect in controlling f. rates, **06,** 585.

CONTRACTS.

1903. Duluth Dredge & Dock Co., dr. 1,500,000 c. y., 9.9¢ c. y., and 3,000 c. y. r., at $5.50 c. y., **03,** 1842.
1908. Rieboldt, Wolter & Co., dr., 11¢ c. y., **08,** 1947.

ENGINEERS.

Chief of Engineers. **R.,** **02,** 441; **03,** 478; **04,** 522; **05,** 529; **06,** 584; **07,** 608; **08,** 653; **09,** 688; **10,** 764; **11,** 820; **12,** 982.

In charge:
Maj. J. G. Warren, 1902–05. **R.,** **02,** 2049; **03,** 1841; **04,** 2815; **05,** 2021.
Maj. W. V. Judson, 1905–09. **R.,** **06,** 1737; **07,** 1874; **08,** 1947.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R.,** **09,** 1951; **10,** 2113; **11,** 2315; **12,** 2503.

OBSTRUCTIONS.

Act Mar. 3, 1905, directs Sec. of War to inquire into removal and relocation of Sturgeon B. Br.; app. $50,000 for this purpose, **05,** 530. Remarks on conditions existing in vicinity of br., **06,** 1737.

OPERATIONS.

1901-02. 28,741 c. y. dr., and 386 l. f. revet. removed, **02,** 2049.
1902-03. 128,149 c. y. dr. under contract, and 40,203 c. y. dr. and 786 l. f. revet. constr. by U.S. plant, **03,** 1841.
1903-04. 1,469,061 c. y. sand, etc., dr., and 3,436.67 c. y. r. removed, **04,** 2816.
1904-05. 49,766 c. y. dr., and n. p. superstr. repaired, **05,** 2021.
1905-06. 1,100 l. f. superstr. on entrance ps. cut down and rebuilt, **06,** 1737.
1906-07. 51,274 c. y. dr. by U.S. plant, **07,** 1874.
1907-08. 186,105 c. y. dr. by U.S. plant and 82,721 c. y. by contract, **08,** 1947.
1909-10. 9,190 c. y. dr. by U.S. plant, **10,** 2113.

PROJECTS.

Act June 13, 1902, provides for mainten. and increasing d. to 21′; est., $222,000, **02,** 441.
Maj. Bromwell recom., 1910, constr. of turning-basin at w. end of canal, **10,** 2113.

Part (d), MM-24 Sturgeon Bay and Lake Michigan Canal, Wis. (Care and operation.)

APPROPRIATIONS.[1]

1893,	$555.26	
1894,	14,579.11	
1895,	11,567.25	
1896,	16,564.12	
1897,	16,280.12	
1898,	15,037.58	
1899,	29,618.86	
1900,	31,018.13	
1901,	29,943.56,	**01,** 2922.
1902,	16,810.21,	**02,** 2056.
1903,	7,345.15,	**03,** 1846.
1904,	16,970.77,	**04,** 2822.
1905,	6,965.43,	**05,** 2027.
1906,	12,994.53,	**06,** 1743.
1907,	23,909.19,	**07,** 1880.
1908,	30,077.13,	**08,** 1954.
1909,	18,496.66,	**09,** 1957.
1910,	24,738.13,	**10,** 2115.
1911,	14,590.74,	**11,** 2318.
1912,	13,522.49,	**12,** 2507.
Total,	351,584.42	

COMMERCE.

Description of, **96,** 2478.

CONTRACTS.

1907. J. G. Newbegin, timber for ps. (prices given), **07,** 1881.

1908. Rieboldt, Wolter & Co., dr., 15¢ c. y., **08,** 1953.

ENGINEERS.

Chief of Engineers. **R., 93,** 349; **94,** 320; **95,** 358; **96,** 313; **97,** 397; **98,** 389; **99,** 461; **00,** 526; **01,** 518; **02,** 442; **03,** 480; **04,** 523; **05,** 530; **06,** 585; **07,** 610; **08,** 654; **09,** 690; **10,** 765; **11,** 822; **12,** 983.

In charge:

Maj. J. F. Gregory, 1893–94. **R., 93,** 2718; **94,** 2058.

Capt. C. F. Palfrey, 1895. **R., 95,** 2612.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2477; **97,** 2666; **98,** 2303.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2743; **00,** 3666; (Maj.) **01,** 2919; **02,** 2054; **03,** 1846; **04,** 2821; **05,** 2026.

Maj. W. V. Judson, 1905–09. **R., 06,** 1742; **07,** 1880; **08,** 1953.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1957; **10,** 2114; **11,** 2317; **12,** 2505.

Assistant. A. N. Dier. **R., 96,** 2477; **97,** 2666; **98,** 2304; **99,** 2744; **00,** 3667.

OPERATIONS.

1893–94. 37,744 c. y. dr., dr. plant and revet. repaired; warehouse and a shelter house constr., **94,** 2058, 2059.

1894–95. 48,945 c. y. dr., riprapping done, revet. repaired and constr., dr. plant repaired, and misc. work performed, **95,** 2612.

1895–96. 31,484 c. y. dr., and work similar to that of previous year performed, **96,** 2477.

1896–97. 28,202 c. y. dr., and work similar to that of previous years performed, **97,** 2667.

1897–98. 35,944 c. y. dr., and work similar to that of previous years performed, **98,** 2305.

1898–99. Renewal and repairs to canal revets. and dr., **99,** 2743.

1899–00. Riprap along H. front repaired; 19,540 c. y. dr., plant enlarged, and misc. work done, **00,** 3666.

1900–01. 14,419 c. y. dr., canal grounds graded, repairs to H. front protection and bldgs., and renewal and repairs of canal revets., **01,** 2919.

1901–02. 33,696 c. y. dr., 475 l. f. revet. rebuilt, st. deposited along H. front, and general repairs to structures and grounds, **02,** 2054.

1902–03. Removal of 234 l. f. s. revet. in progress, minor repairs, etc., **03,** 1846.

1903–04. Revet. work and general repairs, **04,** 2821.

1904–06. Repairs and mainten., **05,** 2027; **06,** 1742.

1906–07. 2,115 c. y. dr., and general repairs and mainten., **07,** 1880.

1907–08. 11,965 c. y. dr., and general mainten. and repairs, **08,** 1953.

1908–09. Piles driven near n. revet., and repairs made to floating plant, bldgs., etc., **09,** 1957.

1909–10. 32,332 c. y. dr., and general repairs made, **10,** 2114.

1910–11. 9,233 c. y. dr., superstr. of 314′ of n. revet. at lake end of canal rebuilt in concrete by hired labor, and launchway pertaining to U. S. life-saving station at Sturgeon B. Canal was rebuilt and provided with concrete retaining walls, **11,** 2317–2318.

1911–12. 23,546 c. y. dr., 150 l. f. revet. rebuilt, and 100′ chan. wall of timber superstr. was cut down and rebuilt, **12,** 2505.

PHYSICAL CHARACTERISTICS.

Condition of chans., **98,** 2304.

SURVEYS.

Minor surs., **97,** 2667; **98,** 2305.

MM-25 AHNAPEE (Algoma) HARBOR AND RIVER, WIS.

APPROPRIATIONS.

1871,	$25,000,	**75,** 198.
1872,	25,000,	**75,** 198.
1875,	25,000,	**75,** 198.
1876,	8,000,	**76,** 96.
1874,	[2] 5,000,	**75,** 43, 201; **76,** ii, 362.
1878,	8,000,	**78,** 114.
1879,	7,000,	**79,** 153.
1880,	7,000,	**80,** 1911.
1881,	8,000,	**81,** 2079.
1882,	12,000,	**82,** 2139.
1884,	15,000,	**84,** 1848.
1886,	15,000,	**86,** 1662.
1888,	$5,000,	**88,** 1847.
1890,	6,000,	**90,** 2339.
1892,	7,000,	**92,** 2185.
1894,	5,000,	**95,** 2619.
1896,	5,000,	**96,** 2485.
1899,	13,000,	**99,** 2752.
1902,	10,000,	**02,** 2058.
1907,	43,000,	**07,** 1882.
1908,	100,000,	**08,** 1955.
Total,	354,000	($349,350.08, incl. receipts of $350.08 and item (2) above, **12,** 2507).

[1] Amount expend. under the permanent indefinite app. provided by act July 5, 1884, for operating and keeping in repair canals and other public works.

[2] Allotted from app. for Two Rivers H., Wis.

COMMERCE.

Importance of the H. as H. of refuge, **71,** 126. Local requirements need but limited expend., **73,** 200; **74,** 143.

C. requirements discussed by BE., **76,** ii, 355.

Limited area of H. inadequate for demands of C., **81,** 2079.

The H. so situated with reference to interior transportation lines that it will always be used solely for local traffic, **96,** 2484.

The importance of the H. less in 1896 than when its imp. began, **97,** 2757.

Steamers enter H. regularly, **09,** 690.

Benefit entirely local, less than 10,000 t. an., **11,** 823.

CONTRACTS.

1871. Roberts & Johnson, pile ps., **71,** 111; **76,** ii, 361.

1872. Joseph Rankin, pile p. (annulled), **73,** 199; **76,** ii, 362.

1875. Green Bay Dredge & Pile Driver Co., crib ps., **75,** 199; **76,** ii, 346.

1877. Truman & Schroeder, crib superstr., **77,** 857, 859; **78,** 1154.

1892. J. M. Borgman, guide piling, 225.6′; actual cost, $2,935.20, **93,** 2722; **94,** 2065.

1908. Thomas H. Smith, large st., $1.19 t.; small st., 98¢ t. Lake Shore Stone Co., sand and broken st., $1.25 c. y. Universal Portland Cement Co., American Portland cement, $1.15 bbl., **08,** 1956.

1911. Rieboldt, Wolter & Co., wooden st. barge, $10,950 chargeable to various H. app., **11,** 2319.

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 39; **71,** 32, 37; **72,** 31; **73,** 32; **74,** 38; **75,** 42; **76,** 95; **77,** 100; **78,** 114; **79,** 153; **80,** 204; **81,** 275; **82,** 271; **83,** 280; **84,** 280; **85,** 303; **86,** 297; **87,** 262; **88,** 239; **89,** 278; **90,** 251; **91,** 321; **92,** 307; **93,** 350; **94,** 321; **95,** 359; **96,** 314; **97,** 398, 408; **98,** 390; **99,** 462; **00,** 527; **01,** 519; **02,** 442; **03,** 480; **04,** 523; **05,** 531; **06,** 585; **07,** 610; **08,** 654; **09,** 690; **10,** 765; **11,** 822; **12,** 984.

Boards. Convened, 1875, directed ex. to ascertain cost of proposed r. excavation, **76,** ii, 346, 354; reported in favor of inner H. proj. of Maj. Robert, **76,** ii, 354.

(Majs. Houston, Robert, Farquhar, Gillespie, and Mansfield.) (See Surveys.)

In charge:

Maj. D. C. Houston, 1870–75. **R., 71,** 125; **72,** 117; **73,** 199; **74,** 143; **76,** ii, 351.

Maj. H. M. Robert, 1875–83. **R., 75,** 198; **76,** ii, 346; **77,** 857; **78,** 1154; **79,** 1505; (Lt. Col.) **80,** 1910; **81,** 2077; **82,** 2139.

Capt. F. A. Hinman. 1883. **R., 83,** 1678.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1847; **85,** 1990; **86,** 1662.

Capt. W. L. Marshall, 1886, **86,** 290.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1662; **87,** 2037; (Maj.) **88,** 1846; **89,** 2053; **90,** 2338; **91,** 2538.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2184; **93,** 2721; **94,** 2064.

Capt. C. F. Palfrey, 1895. **R., 95,** 2617.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2483; **97,** 2672, 2755; **98,** 2310.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2751; **00,** 3674; (Maj.) **01,** 2923; **02,** 2057; **03,** 1847; **04,** 2822; **05,** 2028.

Maj. W. V. Judson, 1906–08. **R., 06,** 1743; **07,** 1881; **08,** 1954.

Maj. Chas. S. Bromwell, 1909–12. **R., 09,** 1958; **10,** 2115; **11,** 2319; **12,** 2507.

Assistants:

Wm. T. Casgrain. **R., 71,** 126.

Capt. J. W. Cuyler. **R., 72,** 117.

William H. Hearding. **R., 73,** 199; **74,** 143; **75,** 198.

E. P. North, **79,** 1509. **R., 76,** ii, 346, 360.

L. Y. Schermerhorn, **78,** 1154. **R., 79,** 1506; **80,** 1911.

C. Crossman. **R., 80,** 1910.

E. A. Cannon. **R., 00,** 3677.

ESTIMATES.

By Maj. Houston, inner H., $1,073,330, **71,** 125, 127. Outer H., $367,568, **71,** 126, 128; $370,000, **74,** 143. For local requirements, $100,000, **73,** 200; **74,** 143.

By Maj. Robert, 1875, completion of modified proj., $95,000; **76,** ii, 346, 359. Detailed est. r. work, **79,** 1509.

LEGAL PROCEEDINGS.

Injunction threatened by claimant of site of r. blasting, **77,** 857. Site deeded to village, **77,** 857; but not recorded, **78,** 1154.

LEGISLATION.

State of Wisconsin, au. tax for imp., **71,** 127.

OPERATIONS.[1]

1871-72. N. pile p. commenced by contract June 30, **71,** 111; **72,** 117; **76,** ii, 361. Difficulties, **72,** 117.

1872-73. S. p. commenced by hired labor, **73,** 199. Extended, **74,** 143. Dr. and scows built, **73,** 200; **74,** 143; **75,** 198.

1873-74. Pile driver built, **74,** 143.

1874-75. Dr. from 50′ chan. and bayou. Filling of s. p., **75,** 198.

1875-76. 7 cribs sunk, s. p. refilled, r. drilled, blasted, and dr., for experimental purposes, **76,** ii, 346. Work under Maj. Robert's proj. for inner H. commenced by E. P. North, 1876. Details of blasting, **76,** ii, 347. Results, will require to be redrilled and blasted, **79,** 1509.

1876-77. Dr. of blasted r., **77,** 857.

1877-78. Dr. of r., 100 cords placed in ps.; 1,100′ plank walk laid, **78,** 114. Superstr. built over 7 cribs sunk in 1875, **78,** 1154. Drilling and blasting recommenced, **78,** 114, 1154.

1878-79. Drilling and blasting, **79,** 153, 1505. Details and cost, **79,** 1508. Condition of H., **79,** 1511.

1879-80. 4,795 c. y. r. removed by U.S. dr.; 620′ pile p. revetted; cost of r. removal by dr., cost of pile p. revet., **80,** 1911, 1914.

1880-81. 10,980 c. y. r. removed by drilling and blasting and use of U.S. dr.; 6,400 c. y. r. removed to adjacent Hs. for p. filling; details of r. removal, **81,** 276, 2077.

1881-82. 2 cribs built with timber from U.S. reservation at Sturgeon B., **82,** 2139.

1882-83. 23,587 c. y. sand and mud and 4,820 c. y. r. removed by hired labor and use of U.S. dr.; 12 cribs built and 9 sunk in extension of ps.; timber used for crib building from U.S. reservation, and r. for crib filling from excavation of interior H.; cost of crib constr. and r. removal, **83,** 280, 1680, 1682. Removal of 1,198,644 f. b. m. timber from U. S. reservation at Sturgeon B., **83,** 1679.

1884-85. 100 l. f. p. extension; 6,413 c. y. r. and 4,478 c. y. sand removed by hired labor and use of US. dr.; 450 l. f. of superstr. built. Cost of r. removal and p. constr.; saving in cost of work by use of timber from U.S. reservation, and r. for crib filling from H. excavation, **85,** 303, 1990, 1991.

1885-86. Removal of 20 c. y. r. from inner H. by U. S. dr., **86,** 1662.

1886-88. No operations from proviso in act Aug. 5, 1886, that wharfage over the U. S. ps. must be made free, **87,** 2038; **88,** 1846.

1888-89. Operations resumed, it being recom. that proviso as to free wharfage be omitted from future app. 3,496 c. y. r. and 19,965 c. y. sand removed from chan.; crib in s. p. reset; 250 l. f. s. p. superstr. built; 150 l. f. n. p. extension completed; work done by hired labor, **89,** 2054.

[1] History of operations, **74,** 143; **76,** ii, 354; **86,** 1662. History of work to 1875, by Maj. Houston, **76,** ii, 361.

1889-90. N. p. extended 50′, and 4,147 c. y. r. and 5,330 c. y. sand removed by blasting and dr.; work done by hired labor, **90,** 2338.
1890-91. 200 l. f. of n. p. superstr. built by hired labor; minor repairs to s. p., **91,** 2539.
1891-92. 352 l. f. of n. pile p. provided with sheet piling; 652 c. y. r. and 28,205 c. y. sand and gravel dr. from chan.; all operations by hired labor, **92,** 2185.
1892-93. S. p. repaired and 2,140 c. y. dr., **93,** 2721.
1893-94. About 112 l. f. of guide piling constr. Minor repairs made to n. p., **94,** 2064.
1894-95. 362 l. f. s. p. rebuilt, **95,** 2617, 2618.
1895-96. 9,750 c. y. dr., **96,** 2484.
1896-97. Dr. plant repaired, **97,** 2672.
1897-98. 12,543 c. y. dr. and ps. repaired, **98,** 2310.
1898-99. 18,548 c. y. dr.; r.-excavating plant built, **99,** 2752.
1899-00. 9,765 c. y. r. excavated (photographs), **00,** 3675.
1900-01. Repairs, dr. plant, **01,** 2924.
1901-02. Minor repairs, s. p., **02,** 2057.
1902-03. With hired labor, U.S. dr. No. 2, 7,010 c. y. removed; ps. completed full l.; d. below datum, 16′ at H. entrance, **03,** 1847.
1904-05. 352 l. f. of n. p. cut down, and new timber superstr. built, cost, $2,298.12; 11,914 c. y. dr. by US. dr. No. 1, 10¢ c. y., **05,** 2028.
1907-08. About 25% of foundation piles driven; plank cribs about 8% and pile p. about 10% complete; plant estab. at Kewaunee, Wis., for building caissons, **08,** 1954.
1908-09. 500 l. f. concrete caisson breakw'r, 728 l. f. pile p., 200 l. f. plank crib built by hired labor removing 550 l. f. of old crib and pile p., and rebuilding 750 l. f. of superstr. on n. p.; 118,000 c. y. dr., at 11.4¢ c. y.; proj. completed with exception of small amount of riprap, **09,** 1958.
1909-10. 1,106 t. st. for riprapping delivered and contract closed; superstr. of breakw'r extended to cover caissons damaged by ice; proj. completed, **10,** 2115, 2116.
1910-11. 2,256 c. y. dr. from entrance, at 21.7¢ c. y.; 14,569 c. y. removed from chan. by U.S. plant, at 12.7¢ c. y.; **11,** 2319.

PHYSICAL CHARACTERISTICS.

Of sand spit at p. foot, **74,** 143.
Description of, **97,** 2756; **12,** 984.
H. at mouth of Wolf or Ahnapee R., on Lake Michigan or e. side of the peninsula proj. bet. Green B. and Lake Michigan; about 120 m. n. of Milwaukee, **97,** 2757.
Variations of level of water surface, **02,** 2057.
Ice damaging works, **09,** 1958.
Chan. bet. ps., and one-half of basin had d. of 16′, **11,** 2319.

PLANS.

W. T. Casgrain, inner H., est., $1,073,330; too costly, **71,** 127.
Maj. Houston, for outer H., **71,** 125.
The two plans compared, **71,** 126.

PRIVATE WORK.

By citizens, constr. of br. ps., also a straight cut through bar at R. mouth, etc., **71,** 126, 127.
Temporary p. built by citizens inside U. S. ps.; to be removed, when so required, at their expense, **74,** 143; **75,** 198.
Neglect of local authorities to preserve imp. made, **82,** 272, 2139, 2140.
Improper use of U.S. ps. by local interests, **85,** 1990 **87,** 2038.
The Merchants Dock Co. built pile p. and erected warehouse thereon, **12,** 2507.

PROJECTS.

Orig. proj., 1870, by Maj. Houston, proposed formation by p. extension and dr., of an outer H. covering mouth of Ahnapee R.; est. cost, $370,000, **71,** 125; **72,** 118; **76,** ii, 351.
In 1873, proj. modified to provide for a small H. at mouth of R., which might be subsequently utilized should the larger outer H. ever be required; est., $100,000, **73,** 200; **74,** 143; **76,** ii, 351.
In 1875 Maj. Robert proposed the extension of the ps., provided for under proj. of 1873, to the 18′ curve in Lake Michigan, and formation of inner H. 100′ w. x 12′ d., from highway br. to mouth of R.; est., in addition to $75,000 already app., $95,000, **76,** ii, 346–359; increased by BE., **76,** ii, 346. Details discussed with est. in light of experience, **79,** 1509.
In 1884 the proj. modified by increasing the w. of entrance to the ps. to 200′, **85,** 1990.
In 1891 the est., 1875, increased by $10,000; and $9,000 est. for completion of existing proj., **91,** 2539. Est. for completion increased, 1892, to $12,000, **92,** 2185.
By Capt. Zinn, 1896, excavating and dr. 13′ chan. 50′ w. up R. for 800′ beyond head of existing chan.; est., $11,594, **97,** 2760; **99,** 2751.
The existing proj., au. Mar. 2, 1907, constr. of outer H. 16′ d.; est., $140,000, $100,000 to be app. under continuing contract authorization; **07,** 610; breakw'r to consist of concrete-steel caissons placed on pile foundation, **08,** 1954. Caissons described, **08,** 1955.

SECRETARY OF WAR.

Approves report of BE., **76,** ii, 354.

SURVEYS.

Directed, act July 11, 1870, **71,** 32. Made by W. T. Casgrain under direction of Maj. Houston, **72,** 125.
By order of BE., **76,** ii, 346.
Sur. au. act June 3, 1896; made by Capt. Zinn (see Projects), **97,** 2755.
R. by BERH., Dec. 28, 1906, required by R. and H. Com. As the C. is of a small and local char., board is of opinion it would not be advisable to further imp. this H., which is at present under imp. (R. and H. Com. D. 20, 61st, 2d.)
Surs. of H. made and map prepared, **01,** 2924; **02,** 2057; **04,** 2822.
Pre. ex. and sur. au. act Mar. 2, 1907, with view to constr. of an outer H. and a chan. 16′ d., **07,** 610, 1881; **08,** 670.
Soundings, 1912, indicated d. of 16′ below datum in chan. bet. ps. and over two-thirds of basin maintained by U. S., **12,** 2507.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 984.
Photographs. (See Operations, 1899–1900.)

Maps of work. **76,** ii, 350; **79,** 1510; **88,** 1846; **03,** 1847; **08,** 1955.

MM-27 KEWAUNEE HARBOR, WIS.[1]

APPROPRIATIONS.

1881,	$5,000,	**81,** 2081.
1882,	12,000,	**82,** 2142.
1884,	18,000,	**84,** 1850.
1886,	10,000,	**86,** 1665.
1888,	10,000,	**88,** 1849.
1890,	20,000,	**90,** 2341.
1892,	30,000,	**92,** 2188.
1894,	20,000,	**95,** 2621.
1896,	25,000,	**96,** 2487.
1899,	$8,800,	**99,** 2755.
1902,	11,000,	**02,** 2059.
1905,	3,000,	**05,** 2030.
1907,	5,000,	**07,** 1883.
1909,	5,000,	**09,** 1960.
1910,	60,000,	**10,** 2117.
1911,	18,000,	**11,** 2321.
1912,	10,000,	**12,** 2510.

Total, 270,800 (incl. misc., $271,392.30, **12,** 2510).

[1] Sur.—**R.,** Nov. 1, 1837; est., $97,195.75. (H. D. 482, 55th, 2d.)

COMMERCE.

Small and local, but the H. connected by a RR. with large trunk lines, **00,** 3757.

Imp. will have material effect on rates, **05,** 532; has actual controlling effect, **12,** 986.

In 1911, 144,000± t., **12,** 986.

CONTRACTS.

1881. Green Bay Dredge & Pile Driver Co., p. extension, **81,** 2081.

1882. Hanson & Scove, pile-p. constr., **83,** 1683.

1884. Schwarz & Berner, pile-p. constr., **85,** 1993.

1886. Schwarz & Berner, p. extension, **87,** 2041.

1888. Knapp & Gillen, constr. of 300 l. f. of pile p., $7,968, **89,** 2057.

1890. J. M. Borgman, p. extension, $9,239, **91,** 2542.

1892. J. M. Borgman, extension of 550 l. f. of p., $21,528.81, **93,** 2725.

1894. McGrath & Anderson, extension of pile ps., 400 l. f.; actual average cost, $36.20 l. f., **95,** 2622; **96,** 2487.

1896. T. J. McGrath, pile-p. extension, 425 l. f.; actual average cost, $37.74 l. f., **97,** 2677; **98,** 2313.

1911. Rieboldt, Wolter & Co., constr. of wooden st. barge, $10,950, **11,** 2321.

ENGINEERS.

Chief of Engineers. R., 73, 36; **80,** 207; **81,** 276, 279; **82,** 272; **83,** 281; **84,** 280; **85,** 303; **86,** 297; **87,** 263; **88,** 239; **89,** 278; **90,** 251; **91,** 322; **92,** 308; **93,** 350; **94,** 322; **95,** 360; **96,** 315; **97,** 399; **98,** 390; **99,** 463, 474; **00,** 528, 538; **01,** 519; **02,** 443; **03,** 481; **04,** 524; **05,** 531; **06,** 586; **07,** 611; **08,** 656, 670; **09,** 691; **10,** 766; **11,** 823; **12,** 985.

In charge:

Lt. Col. H. M. Robert, 1880–83. **R., 81,** 2080, 2082; **82,** 2141.

Maj. J. W. Barlow, 1883. **83,** 274.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1682.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1849; **85,** 1993.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1663; **87,** 2040; (Maj.), **88,** 1848; **89,** 2055; **90,** 2340; **91,** 2540.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2187; **93,** 2724; **94,** 2066.

Capt. C. F. Palfrey, 1895. **R., 95,** 2620.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2486; **97,** 2675; **98,** 2312.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2754; **00,** 3679, 3752, 3755; (Maj.), **01,** 2925; **02,** 2058; **03,** 1848; **04,** 2824; **05,** 2029.

Maj. W. V. Judson, 1905–09. **R., 06,** 1745; **07,** 1883; **08,** 1956.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1959; **10,** 2117; **11,** 2320; **12,** 2509.

Lt. Col. G. A. Zinn, **11,** 814.

Assistants:

L. Y. Schermerhorn. **R., 81,** 2084.

1st Lt. Douglas MacArthur, **08,** 648.

LEGAL PROCEEDINGS.

City of Kewaunee granted, 1896–97, land 120′ x 265′ for a place in which to lay up the U.S. plant during winter, **97,** 2676. Addl. grants of land, **99,** 2754; **00,** 3680.

By deed of gift, 1897, title to the land occupied by the H. ps. deeded to the U.S. by the owner and his wife, **98,** 2313.

OPERATIONS.

1880-81. P. constr. commenced under contract, **81,** 2080.

1881-82. 250 l. f. pile p. built on n. side and 275′ on s. side, **82,** 2141.

1882-83. 100 l. f. revet. pile p. built, **83,** 1683.

1883-84. 350 l. f. n. pile p. built, **84,** 1850.

1884-85. Work on s. pile p. continued, **85,** 1993.

1885-86. S. pile p. extended 500′; 116,976 c. y. dr. from chan. by U.S. dr., **86,** 1664.

1886-87. 100 l. f. p. extension wholly and 150 partially completed; 9,035 c. y. dr., **87,** 2040.

1887-88. N. pile p. extended 200′ under contract, **88,** 1848.

1888-89. 7,280 c. y. dr. from chan. bet. the ps. by hired labor; 100 l. f. of s. pile p. completed under contract, **89,** 2056.

1889-90. 200 l. f. of s. pile p. built under contract; 15 cords st. deposited in breach protection by hired labor, **90,** 2340.

1890-91. 77,790 c. y. dr.; constr. of pile-p. work begun, **91,** 2541.

1891-92. N. p. extended 250′ and s. p. 50′, **92,** 2187.

1892-94. Constr. of pile p. in progress, 27,492 c. y. dr., dr. plant repaired, **93,** 2724; n. p. extended 250 l. f. and s. 300 l. f.; 22,425 c. y. dr.; H. ps. and dr. plant repaired, **94,** 2067.

1894-95. P. extension in progress; dr. plant repaired, **95,** 2620.

1895-96. N. and s. ps. extended 200 l. f. each in connection with previous year; H. ps. and dr. plant repaired, **96,** 2487.

1896-98. Extension of ps. in progress; 74,825 c. y. dr.; frame warehouse built, and 135 l. f. dock built, **97,** 2675, 2676; 200 l. f. n. and 225 l. f. s. p. extended; 25,701 c. y. dr., a scow and ways for building other scows built, and minor repairs made, **98,** 2312, 2313.

1898-99. Plant repaired; 13,609 c. y. dr., **99,** 2754.

1899-00. 21,315 c. y. dr.; plant repaired and increased; 325 l. f. superstr. of ps. rebuilt, **00,** 3679.

1900-01. Dr. plant repaired, **01,** 2925.

1901-02. Minor repairs to ps. and dr. plant, **02,** 2059.

1902-03. 18,185 c. y. dr. by U. S.; repairs to dr. plant, **03,** 1848.

1903-04. Repairs to dr. plant, **04,** 2824.

1904-05. 450 l. f. n. p. and 200 l. f. s. p. cut down and new superstr. built by hired labor, 18,189 c. y. dr. by U.S., at 8.1¢ c. y., **05,** 2029.

1905-06. Grading and seeding grounds adjacent to U.S. warehouse, **06,** 1745.

1906-07. 11,704 c. y. dr. by U.S., at 15.4¢ c. y., storing timber, **07,** 1882.

1907-08. 18,416 c. y. dr. by U.S., **08,** 1956.

1908-09. 12,675 c. y. dr. by U.S.. **09,** 1959.

1909-10. 16,218 c. y. dr.; machine shop and dwelling erected, **10,** 2117.

1910-11. 915′ superstr. built for s. p.; 550′ of n. p. completed, by hired labor; 15,369 c. y. dr. by U.S., **11,** 2320.

1911-12. 19,464 c. y. dr.; repairs to ps., plant, etc., **12,** 2509.

PHYSICAL CHARACTERISTICS.

Chan. subject to constant deterioration from sediment deposits, **97,** 2676; **98,** 2313.

Description of, **00,** 3755.

H. 29± m. n. of Manitowoc, and 26± s. of Sturgeon B. Canal. Orig. no H. and all C. transacted over br. ps., **12,** 985.

PLANS. (See Projects.)

For pile and crib ps. to 18′ w., with revet. of "cut" and dr. 100,000 c. y.; est., $200,000 (not justified by the requirements of C.), **73,** 258.

PRIVATE (CITY AND PRIVATE) WORK.

$8,000 raised in Kewaunee and West Kewaunee to aid in work of imp. **81,** 2080.

Total app. by local au. in aid of imp., **89,** 2056.

5,231 c. y. dr. from inner H. by city of Kewaunee and private parties, **89,** 2056.

Proj., 1900, city declines to constr. revet., **11,** 2321. Condition waived, **12,** 2509.

PROJECTS. (See Plans.)

By Maj. Robert, 1881, 2 parallel pile and crib ps., 1,650′ l. each and 200′ apart, shore line to the 18′ curve, and located where the Kewaunee R. first approaches the lake and turns to the n.; also dr. in the chan. bet. the ps. and interior basin; est., $200,000, **81,** 2083, 2084; **88,** 1848; **91,** 2541; **92,** 2187; **93,** 2724; **97,** 2676.

Capt. Warren, 1899, est. $230,000, and probably $1,500 an. for mainten., to further imp. H., **00,** 3753.

Act June 25, 1910, au. increasing d. of chan. to 20′, and turning-basin of same d., to be formed by cutting away part of the point included bet. old and existing chan., city of Kewaunee to donate all land (see Private work), to hold U.S. free from liability for damages, and constr. revet.; est., $53,690, **10,** 767. Act July 25, 1912, waives condition that city shall build revet., **12,** 2509.

SURVEYS.

Previous sur. by U.S. Lake Sur., 1866, **73,** 259.

Sur. au. act Mar. 3, 1873; made, under direction of Maj. Houston, by J. Pierpont; **R., 73,** 258.

Au. act June 14, 1880; made, 1881, by Maj. Robert, **80,** 207; **81,** 2082.

Minor surs. (See each an. **R.**)

Ex. and sur. for 20′ H. of refuge au. act Mar. 3, 1899; made by Capt. Warren, 1899 (**R.** unfav. to immediate imp.), **00,** 3753.

Pre. ex. for 18′ and 20′, with plan and est., au. act Mar. 2, 1907. **R.,** Maj. Judson, Apr. 12 and July 25, 1907; est., $53,690 (H. D. 324, 60th, 1st), **08,** 670.

R. relative to clause binding city of Kewaunee to build revet. to sustain banks of proposed turning-basin. Remarks by BERH., Maj. Bromwell, mayor of Kewaunee, and C. interest. Opinion is generally expressed that revet. is unnecessary, as banks have never shown any tendency to cave. (R. and H. Com. D. 7, 62d, 2d.)

Maps. (H. D. 324, 60th, 1st.) **81,** 2084; **88,** 848; **93,** 2724; **97,** 2676; **03,** 1849.

1

MM-28(a) TWO RIVERS (East and West Twin Rivers) HARBOR, WIS.

APPROPRIATIONS.[1]

1871,	$25,000,	**71,** 33.
1872,	25,000,	**72,** 32.
1873,	25,000,	**73,** 33.
1874,	10,000,	**74,** 39.
1875,	15,000,	**75,** 43.
1876,	5,000,	**76,** 96.
1878,	10,000,	**78,** 115.
1879,	20,000,	**79,** 154.
1880,	20,000,	**80,** 1915.
1881,	15,000,	**81,** 2090.
1882,	15,000,	**82,** 2144.
1884,	8,000,	**84,** 1852.
1888,	2,500,	**88,** 1851.
1890,	3,000,	**90,** 2342.
1892,	3,000,	**92,** 2190.
1894,	3,000,	**95,** 2625.
1896,	5,000,	**96,** 2490.
1899,	8,000,	**99,** 2757.
1902,	20,000,	**02,** 2061.
1905,	6,600,	**05,** 2032.
1907,	90,000,	**07,** 1885.
1910,	5,000,	**10,** 2119.
1912,	7,500,	**12,** 2512.
Total,	346,600	

COMMERCE.

Local interests, **76,** ii, 364; **00,** 3760.

Benefits from imp., **76,** ii, 366.

Increasing, **95,** 2624.

In 1897 the requirements of C. sufficiently provided for, **97,** 2679.

In 1900, 373,792 t., **01,** 520; in 1903, 108,273 t., **04,** 526; in 1912, 25,140 t., **12,** 988.

Volume of C. benefited small and local, **02,** 444.

Proj. has small effect in controlling rates on coal, **08,** 657.

CONTRACTS.

1871. R. A. Conolly, constr. of ps., **71,** 111; **72,** 118.

1872. J. Rankin, constr. of ps.; annulled, **72,** 118; **73,** 201; **76,** ii, 365.

1875. Hanson & Scove, constr. of ps., **76,** ii, 363.

1877. Truman & Schroeder, constr. of ps., **77,** 860.

1880. Truman & Cooper, p. extension, **81,** 2091.

1881. Knapp & Gillen, p. extension, **81,** 2091.

1882. Truman & Cooper, p. extension, **83,** 1686.

1884. Truman & Cooper, superstr. constr., **85,** 1996.

1894. Eggers & Simono, dr. 19,810 c. y., 12¢ c. y., s. m., **95,** 2624.

1896. Same firm, dr., 9⅜¢ c. y. ($2,812.50), **97,** 2680.

1899. C. Simono, dr., 13¾¢ c. y. ($3,163.50), **99,** 2758.

1903. Frankman Bros. & Morris, constr. of 1,800 l. f. pile revet. (prices given), **03,** 1851.

1907. Greiling Bros., dr. 10,642 c. y. for restoration and mainten., 16¢ c. y., **07,** 1884. August Riebolt and Joseph Wolter, bldg. pile p., removing old p., dr., etc. (materials and labor and quantities and prices given), **08,** 1959.

1911. Riebolt, Wolter & Co., constr. wooden st. barge, $10,950, chargeable to various Hs., **11,** 2324.

ENGINEERS.

Chief of Engineers. R., 71, 32; **72,** 31; **73,** 33; **74,** 38; **75,** 43; **76,** 96; **77,** 100; **78,** 115; **79,** 153; **80,** 205; **81,** 277; **82,** 273; **83,** 281; **84,** 281; **85,** 304; **86,** 298; **87,** 263; **88,** 240; **89,** 279; **90,** 252; **91,** 322; **92,** 308; **93,** 351; **94,** 323; **95,** 360; **96,** 316; **97,** 399; **98,** 391; **99,** 463, 474; **00,** 528, 538; **01,** 520; **02,** 444; **03,** 481; **04,** 525; **05,** 532; **06,** 587, 599, 645; **07,** 612; **08,** 656; **09,** 692; **10,** 768; **11,** 825; **12,** 987.

Boards. R. on wave action (see Surveys), **06,** 645.

In charge:

Maj. D. C. Houston, 1871–75. **R., 71,** 111; **72,** 118; **73,** 200; **74,** 144.

Maj. H. M. Roberts, 1875–83. **R., 75,** 200; **76,** ii, 363; **77,** 860; **78,** 1156; **79,** 1512; (Lt. Col.) **80,** 1914; **81,** 2088; **82,** 2143.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1685.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1851; **85,** 1995.

Capt. W. L. Marshall, 1886; **86,** 290.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1665; **87,** 2043; (Maj.) **88,** 1850; **89,** 2058; **90,** 2342; **91,** 2543.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2189; **93,** 2727; **94,** 2069.

Capt. C. F. Palfrey, 1895. **R., 95,** 2623.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2489; **97,** 2678; **98,** 2315.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2756; **00,** 3681, 3759; (Maj.) **01,** 2927; **02,** 2060; **03,** 1850; **04,** 2826; **05,** 2031.

Maj. W. V. Judson, 1906–08. **R., 06,** 1746; **07,** 1884; **08,** 1958.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1961; **10,** 2119; **11,** 2323; **12,** 2511.

[1] Statements of app., **77,** 860; **78,** 1156; **79,** 1512. Effect of small app. on ultimate cost of work, **73,** 202. Amount trans. to app. for Ahnapee H., Wis., $5,000, **75,** 43, 201.

Assistants:
Capt. J. W. Cuyler. **R., 72,** 118.
W. H. Hearding. **R., 73,** 200; **74,** 144; **75,** 200.
C. Crosman. **R., 79,** 1513.
L. Y. Schermerhorn. **R., 81,** 2091.

ESTIMATES. (See Projects.)

By Maj. Houston, 1870, constr. of ps., and dr. in accordance with proj., $265,588.80, **74,** 144; **75,** 200.

By Maj. Robert, 1879, completion of existing proj., $125,588.80, **79,** 154, 1513.

LEGAL PROCEEDINGS.

Limits defined for lawful deposit of dr. and other material in Lake Michigan in vicinity of Two Rivers approv. by Sec. of War, 1899, **99,** 2757.

OPERATIONS.[1]

1871-72. Imp. begun by constr. of 419 l. f. of pile p. with superstr. on e. and 416 l. f. on w. side of entrance, with 100′ of pile protection at shore end of w. p., **72,** 31, 118; **73,** 200; **76,** ii, 364.

1872-73. 480 l. f. of pile p., without superstr., built in extension of e. p., **73,** 201; **74,** 144. U. S. dr. built (from app. of 1872 for Two Rivers and Ahnapee), **73,** 200; **74,** 144; **76,** ii, 365.

1873-74. 480 l. f. superstr. built on e. p.; 546 l. f. pile p. with superstr., in extension of w. p.; 39,680 c. y. sand removed from chan. alongside of w. p., **74,** 144.

1874-75. 140 l. f. close pile revet. built, from inner end of e. p. toward the shore; 30,706 c. y. sand dr. from chan. bet. ps., **75,** 200.

1875-76. 150 l. f. of crib p. added to each end of pile p. extension; 13,325 c. y. sand dr. from chan. and sites of cribs, **76,** 96, ii, 363.

1876-77. 153 l. f. of pile p. repaired, **77,** 860.

1877-78. 150 l. f. of superstr. built over cribs placed in 1875–76, **78,** 115, 1156.

1878-79. 740 l. f. of double and 562 l. f. of single sand-tight lining placed along pile ps.; 354 l. f. of sand catchment fence built; 250 l. f. of w. p. riprapped, **79,** 153, 1512.

1879-80. 7 cribs built and 1 sunk in extension of n. p.; 49,801 c. y. dr. from chan. bet. ps.; 320 l. f. of double and 446′ of single sheet piling on n. p.; 153 l. f. of pile revet. capped; 208 cords of st. used in p., **80,** 1915.

1880-81. 15 cribs sunk and 4 built in extension of n. p., **81,** 2089.

1881-82. 4 cribs placed in extension of n. p. and 2 in extension of s. p.; 20,594 c. y. dr. from chan.; 14,000 c. y. dr. by city, **82,** 2143, 2144.

1882-83. Partial superstr. built over 500 l. f. of s. p. and 100 l. f. of extension added to same, 26,436 c. y. dr. from R. bet. ps., **83,** 1685.

1884-85. 33,395 c. y. dr. from chan., **85,** 1995.

1885-86. 26,663 c. y. dr. from chan.; 345 l. f. of sand fence built; 41 cords st. filling placed in p., **86,** 1666.

1888-89. 12,772 c. y. dr. by hired labor, **89,** 2058.

1889-90. 75 cords st. used in riprapping, by hired labor, the n. and s. ps., **90,** 2342.

1890-91. Pile bulkheads built by hired labor for protection of n. and s. ps., and repairs made to n. and s. ps., **91,** 2544.

1892-93. S. p. repaired, sand fences repaired, and 370 l. f. built; 16,440 c. y. dr., **93,** 2728.

1893-94. Ps. repaired; 11,765 c. y. dr., **94,** 2069.

1894-95. 19,810 c. y., s. m., dr., and sand catch constr., **95,** 2624.

1895-96. 5,786 c. y. dr., **96,** 2489.

1896-97. 39,545 c. y. dr., **97,** 2679.

1898-99. 10,854 c. y. dr., **99,** 2757.

1899-00. 20,774 c. y. dr., **00,** 3682.

1900-01. Soundings taken in May, 1901, and map of H. prepared, **01,** 2927.

1901-02. 6,198 c. y. removed in July, 1901, by hired labor and U.S. dr. 2; soundings taken in July, 1901, and May, 1902, **02,** 2060.

1902-03. 25,379 c. y. dr. from chan. and from outer bar by hired labor and U. S. dr. plant, **03,** 1850.

1903-04. Pile revets. covering 1,069′ of n. p. and 776′ of s. p. built, of which 374′ was provided with timber superstr., and 1,471′ was of dock constr. Filling and riprapping of n. p. done by hired labor, and U. S. dr. No. 1, **04,** 2826.

1904-05. Minor repairs made to revet. along s. p.; addl. filling deposited behind revet.; work done by hired labor and U. S. dr., 3,600 c. y. cast over; 180 l. f. revet. built, 6,300 c. y. cast over; bar at H. entrance dr. to amount of 7,330 c. y., **05,** 2031.

1905-06. Dr. for restoration of chan. in prog. during May, 1906; 9,235 c. y. material removed. Repairs made to revet. along s. p., and addl. st. filling deposited behind revet., **06,** 1746.

1906-07. 10,642 c. y. dr. in restoration and mainten. of chan.; 975 t. of st. deposited in revet. along s. p., **07,** 1884.

1907-08. Work of removing old p., building pile ps., dr., etc., in progress; rebuilding superstr. on outer end of n. p. begun June 24, 1908, by hired labor, **08,** 1958.

1908-09. New pile p. completed, chan. dr. to 16′; old ps. thoroughly repaired and about three-fourths of stilling basin dr., under contract; 40,862 c. y. removed from chan. and stilling basin; rebuilding superstr., outer end of H. ps., completed Nov. 30, 1908; a portion of old n. p. removed under contract, **09,** 1961.

1909-10. 21,440 c. y. dr. from chan. and stilling basin; small amount of riprap deposited along outer end of new pile p. and inner end of n. revet.; proj. completed, **10,** 2119.

1910-11. 3,948 c. y. removed from bar; 15,760 dr. for restoration of chan. by U. S. plant; minor repairs made to riprap of stilling basin, **11,** 2323.

1911-12. Dr. for removal of bar at H. entrance and for d. chan. bet. ps. completed; 24,803 c. y. removed by U. S. dr. plant; 1,655 t. of rubblest. placed in revet., s. side of chan. **12,** 2512.

PHYSICAL CHARACTERISTICS.

Changes produced in shore line by ps., **72,** 119.

Advance of shore line along w. p., **76,** ii, 365, 366.

Formation of bar at H. mouth, **98,** 2315; **00,** 3682.

Description of. H. on w. shore of Lake Michigan. Nearest H., Manitowoc, 5½ m. southward. **00,** 3760.

Pile ps. very much decayed, and defective below water line, allowing large quantities of sand to pass through them into chan.; crib. ps. require renewal above water line; shoal formation, **01,** 2927.

E. and W. Twin R. have navigable d. of 7′ for distance of 3 m. and 7 m., resp., from H. ps., **03,** 482.

Max. draft June 30, 1905, 12½′, **05,** 533.

Chan. has full proj. d. of 13′ for min. w. of 160′, **07,** 1884.

June 30, 1909, available d. of 16′ in chan., **09,** 1961.

Level of Lake Michigan unusually low, ranging from 1½′ to 2′ below datum, **11,** 2323.

Chan. bet. ps. has d. of at least 16′ for w. of 90′, **12,** 2512.

PRIVATE (CITY) WORK.

1873-74. 190 l. f. dock frontage, pile revet. built by village of Two Rivers, **74,** 144.

14,000 c. y. dr. from inner H. by city of Two Rivers **82,** 2144.

PROJECTS. (See Estimates.)

By Maj. Houston, 1870, 2 parallel ps. 260′ apart extending to 18′ curve in lake, and dr. bet. to 12′; l. of ps., 1,810′ and 1,710′, resp.; est., $265,588.80, **71,** 111; **74,** 144; **75,** 200; **76,** ii, 364; **86,** 1665, 1666.

By Maj. Robert, 1877, sand-tight revet. along pile ps., revet. to consist of sheet piling, secured by wales to ps., **77,** 860; **78,** 1156; **79,** 1512, 1514.

Total amount app., 1871 to 1886, incl., $198,000; est. cost of completing proj., $67,588, **86,** 298.

By Capt. Zinn, 1897, ceasing extension of works of imp., **97,** 2678, 2679.

Act Mar. 2, 1907, au. increasing d. of chan. to 16′, and constr. of stilling basin on n. side of H., $90,000 app., **07,** 612; no part of app. shall be expend. until title to land required shall have been conveyed to

[1] Average cost of cribs, **76,** ii, 363. Average cost of dr., **76,** ii, 363. History of operations of 1875, **76,** ii, 364. Method of driving piles by water jet, **79,** 1514.

U. S. (H. D. 730, 59th, 1st); abstract of title submitted for approv. to Dept. of Justice, **07,** 1884.

Maj. Bromwell recom. an. dr. for mainten. of chan., and addl. st. for riprap and crib filling. Est. for mainten., $10,000, **11,** 2323.

SURVEYS.

By Maj. Houston, 1870, **70,** 32; **71,** 32, 111; **76,** ii, 364.

By Maj. Robert, 1878, ex. and soundings, **78,** 1156.

By Col. Robert, 1881, **81,** 2091.

Minor surs. (See each an. **R.**)

Ex. for better access to H. by extension of ps. or otherwise au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** unfav.), **00,** 3759.

R. of BE. upon wave action as injuriously affecting certain Hs. on Lake Michigan, au. act Mar. 3, 1905. (H. D. 62, 59th, 1st.) **R.** dated July 15, 1905, **06,** 645.

Sur. of H. au. act Mar. 3, 1905, with view to obtaining 16′ and 18′, resp. **R.,** Capt. Judson, Jan. 31, 1906 (H. D. 730, 59th, 1st) (unfav.), **06,** 599.

Reference to ex. and sur. reports, maps or plans and proj. doc., **12,** 987.

Pre. ex. and sur. au. act June 25, 1910, of Two Rivers, Wis., with view to further imp. of H. by constr. of a stilling basin, or otherwise, **12,** 1005.

Maps (H. D. 730, 59th, 1st):
76, ii, 364; **78,** 1156; **81,** 2090; **93,** 2728.

Map showing the condition of H., Nov., 1878, **79,** 1512.

Showing soundings in H., **03,** 1850.

MM-30 MANITOWOC HARBOR, WIS.[1]

APPROPRIATIONS.

1852,	$8,000,	**66,** iii, 35.
1866,	52,000,	**66,** iii, 35.
1867,	45,000,	**67,** 73.
1868,	*17,500,	**69,** 26.
1869,	*17,820,	**69,** 22.
1870,	20,000,	**70,** 35.
1871,	11,000,	**71,** 33.
1873,	20,000,	**73,** 33.
1874,	10,000,	**74,** 39.
1875,	10,000,	**75,** 43.
1876,	8,000,	**76,** 96.
1878,	15,000,	**78,** 115.
1879,	6,500,	**79,** 154.
1880,	7,000,	**80,** 1918.
1881,	4,000,	**81,** 2094.
1882,	10,000,	**82,** 2147.
1884,	15,000,	**84,** 1854.
1886,	15,000,	**86,** 1669.
1888,	8,000,	**88,** 1852.
1890,	8,000,	**90,** 2345.
1892,	28,000,	**92,** 2192.
1894,	20,000,	**95,** 2627.
1896,	44,440,	**96,** 2493.
1899,	3,300,	**99,** 2760.
1902,	45,000,	**02,** 2062.
1905,	110,000,	**05,** 2032.
1907,	100,000,	**07,** 1886.
1908,	270,500,	**08,** 1960.
1910,	17,500,	**10,** 2120.
Total,	946,560 (incl. misc., $946,812.72, **12,** 2513).	

COMMERCE.

Important, **66,** iv, 130; **67,** 73, 74; **68,** 100; **71,** 112; **72,** 120; **73,** 205; **74,** 146; **75,** 205; **76,** ii, 369, 372; **78,** 1160; **79,** 1516; **88,** 1852.

Importance of H. as H. of refuge, **67,** 73; **68,** 100; **77,** 863.

Benefit derived from imp., **80,** 1919.

Importance of the H. increased in 1895–96 by 2 RR. estab. car-ferry service across the lake, with this H. as a terminus, **96,** 2492.

Description of; general C. of the lakes benefited by the facilities offered by the H. during storms, **00,** 3763.

Large, general character, and effect on rates, **05,** 534.

Description of, **01,** 2980.

1911, 1,437,229 t., **12,** 2514.

CONTRACTS.[2]

1866. D. Smoke, p. extension; Hoes & Packard, p. extension; J. Vilas, p. extension, **66,** iv, 130. J. Schuette, dr., **76,** ii, 368.

1868. D. Smoke, p. extension; J. Schuette, dr., **76,** ii, 369.

1869. D. Smoke, p. extension, **76,** ii, 369. J. Schuette, dr., **76,** ii, 370.

1870. D. Smoke, p. extension, **71,** 111; **76,** ii, 370.

1871. R. A. Conolly, p. extension, **71,** 112; **72,** 119.

1872. T. Winidate, guard piles, **73,** 203.

1873. H. Truman, p. extension, **73,** 204.

1874. C. C. Barnes, p. extension, **75,** 204.

1875–76. H. Truman, p. extension, **75,** 205; **77,** 863.

1878. Truman & Schroeder, p. extension, **79,** 1516, 1517.

1881. Truman & Cooper, crib constr., **81,** 2095.

1882. Green Bay Dredge & Pile Driver Co., dr., 22¢ c. y., **83,** 1689.

1886. Truman & Cooper, crib constr., **87,** 2045.

1888. Truman & Cooper, superstr. reconstr. 400′, $3,120.80, **89,** 2061.

1890. Truman & Cooper, 600 l. f. of p. superstr., $4,884, **91,** 2547.

1894. Wisconsin Dredge & Dock Co., break'r, 400 l. f., piles, st., etc., $24,678.13, **95,** 2628. Actual cost, $64.11 l. f., **96,** 2492.

1896. Hausler & Lutz Towing & Dock Co., 500 l. f. crib p. extension, piles, st., etc., $27,633.50, **97,** 2683. Actual cost, $54.75 l. f., **98,** 2317.

1903. Adolph Green, constr. 400′ extension to break'r, prices listed, **03,** 1853.

1906. Greiling Bros., removing old p., and bldg. 1,450 l. f. pile p., prices listed; supple. contract, 1907, modifying contract of 1906, **07,** 1887.

1907. Great Lakes Dredge & Dock Co., moving cribs, building crib break'r, etc., prices listed; Carstens & Earles (Inc.), furn. timber, prices listed, **07,** 1888.

1908. Sturgeon Bay Stone Co., st., prices listed, **09,** 1964.

1909. Ernst Schmidt, dr., 13½¢ c. y., **09,** 1964.

DOCUMENTS. (Not published in reports.)

S. D. 16, 34th, 3d.

ENGINEERS.

Chief of Engineers. R., 66, iii, 12; **67,** 21; **68,** 29; **69,** 25; **70,** 35; **71,** 33; **72,** 32; **73,** 33; **74,** 39; **75,** 43; **76,** 96; **77,** 100; **78,** 115; **79,** 154; **80,** 205; **81,** 277; **82,** 273; **83,** 282; **84,** 282; **85,** 305; **86,** 299; **87,** 264; **88,** 240; **89,** 279; **90,** 252; **91,** 323; **92,** 309; **93,** 352; **94,** 323; **95,** 361; **96,** 316; **97,** 400; **98,** 392; **99,** 464, 474; **00,** 529, 538, 539; **01,** 520, 527; **02,** 444; **03,** 482, 483; **04,** 526; **05,** 533; **06,** 589; **07,** 613; **08,** 658; **09,** 693; **10,** 769; **11,** 826; **12,** 988.

Boards:

BERH. reviews Maj. Warren's **R.;** not desirable to provide either the turning-basin or chan., **03,** 1882.

* Allotment.

[1] Sur.—**R.,** Oct., 1837, est., $82,979.44; Sept. 30, 1857, est., $62,780.94. (H. D. 482, 55th, 2d.)

[2] 1876–77. Informal proposals invited from bidders of previous years, and an agreement concluded with H. Truman for superstr., **77,** 863.

Special, appointed to inquire into wave action affecting this H. (see Surveys),[1] **06,** 645, 1747.

In charge:

Maj. J. D. Graham, T. E., 1854–57. **R.,** S. D. 42, 35th Cong., 1st sess., pp. 2, 73, 175; S. D. 16, 34th Cong., 3d sess.

Maj. J. B. Wheeler, 1866–70. **R., 66,** iv, 129; **67,** 73; **68,** 99.

Maj. D. C. Houston, 1870–75. **R., 70,** 93; **71,** 111; **72,** 119; **73,** 203; **74,** 145.

Maj. H. M. Robert, 1875–83. **R., 75,** 203; **76,** ii, 366; **77,** 863; **78,** 1160; **79,** 1516; **80,** 1917; **81,** 2094; **82,** 2146.

Maj. J. W. Barlow, 1883. **R., 83,** 1629.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1688.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1853; **85,** 1998.

Capt. W. L. Marshall, 1886. **86,** 290.

Capt. C. E. L. B. Davis, 1886–92. **R., 86,** 1667; **87,** 2044; (Maj.) **88,** 1851; **89,** 2060; **90,** 2343; **91,** 2545.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2191; **93,** 2730; **94,** 2072.

Capt. C. F. Palfrey, 1895. **R., 95,** 2626.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2491; **97,** 2681; **98,** 2316.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2759; **00,** 3683, 3761, 3764; **01,** 2928, 2979; **02,** 2062; **03,** 1851, 1881; **04,** 2827; **05,** 2033.

Maj. W. V. Judson, 1905–09. **R., 06,** 1747; **07,** 1886; **08,** 1960.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–1912. **R., 09,** 1962; **10,** 2120; **11,** 2325; **12,** 2513.

Lt. Col. G. A. Zinn, **12,** 974.

Assistants:

Lt. J. B. Quinn. **R., 67,** 73.

W. H. Hearding. **R., 68,** 99; **72,** 119; **73,** 203; **74,** 145; **75,** 203.

L. Y. Schermerhorn. **R., 81,** 2096.

EXPENDITURES.

For repairs of ps., **76,** ii, 367; **77,** 864; **78,** 1161.

OPERATIONS.[2]

1854–55. 64 l. f. n. p. crib built; 160 l. f. s. p. crib built, S. D. 42, 35th Cong., 1st sess., p. 73, **76,** ii, 368.

1866–67. 512 l. f. n. p. crib built; 576 l. f. n. p. superstr. built, **67,** 21, 73; **76,** ii, 368.

1867–68. 288 l. f. n. p. crib built; 288 l. f. n. p. superstr. built; 416 l. f. s. p. crib built; 62,092 c. y. dr. (dr. in chan. and for cribs), **68,** 100; **76,** ii, 369.

1868–69. 64 l. f. n. p. crib built; 320 l. f. s. p. crib built; 416 l. f. s. p. superstr. built; 53,714 c. y. dr. (dr. in chan. and for cribs), **69,** 25; **76,** ii, 369, 370.

1869–70. 128 l. f. n. p. crib built; 64 l. f. n. p. superstr. built; 160 l. f. s. p. crib built; 320 l. f. s. p. superstr. built, **70,** 93; **76,** ii, 370.

1870–71. 128 l. f. n. p. crib built; 128 l. f. n. p. superstr. built; 96 l. f. s. p. crib built; 160 l. f. s. p. superstr. built (64′ close piling), **71,** 33, 111; **76,** ii, 370.

1871–72. 96 l. f. n. p. crib built; 128 l. f. n. p. superstr. built; 96 l. f. s. p. crib built; 96 l. f. s. p. superstr. built; **72,** 32; **76,** ii, 371.

1872–73. 96 l. f. n. p. superstr. built; **96,** l. f. s. p. superstr. built (H. p. extended to 13′; guard piles driven; cribs refilled), **73,** 33, 203; **76,** ii, 371.

1873–74. 100 l. f. n. p. crib built; 100 l. f. s. p. crib built (4 cribs sunk on st. foundations of 25 cords each), **74,** 39, 145; **76,** ii, 372.

1874–75. 100 l. f. n. p. crib built; 100 l. f. n. p. superstr. built; 100 l. f. s. p. crib built; 100 l. f. s. p. superstr. built (1 course of superstr. added; cribs decked with plank; cribs sunk on st. foundations to the chan. faces of both ps.), **75,** 43, 203, 204; **76,** ii, 372.

1875–76. 50 l. f. n. p. crib built; 100 l. f. n. p. superstr. built; 50 l. f. s. p. crib built; 100 l. f. s. p. superstr. built (repairs to ps. by hired labor), **76,** 96, ii, 366, 367.

1876–77. 50 l. f. n. p. superstr. built; 50 l. f. s. p. superstr. built (repairs to ps. by hired labor), **77,** 100, 863.

1877–78. Repairs to ps. by hired labor; 500 l. f. p. decked with plank, **78,** 1161.

1878–79. 150 l. f. n. p. crib built; 150 l. f. s. p. crib built (n. p. 1,620′ l.; s., 1,550′), **79,** 154, 1516.

1879–80. Superstr. over 6 cribs built and half filled with st.; repairs to ps., **80,** 1917.

1880–81. 4 cribs built and placed in extension of ps.; repairs to ps., **81,** 2094.

1881–82. Superstr. built over 4 cribs; filling completed; 8,949 c. y. dr. by city of Manitowoc, **82,** 2146.

1882–83. 38,492 c. y. dr. from bet. ps., **83,** 1688.

1884–85. 5 cribs sunk in extension of n. p. and superstr. built thereon, **85,** 1998.

1885–86. Repairs to n. p., **86,** 1668.

1886–87. 4 cribs sunk in extension of s. p., **87,** 2045.

1887–88. 1 crib sunk, extending s. p. 50′, and 12,250 l. f. of superstr. completed upon s. p., **88,** 1851.

1888–89. 4,490 c. y. dr. by city of Manitowoc and private parties; 30,350 c. y. dr. by hired labor; 400 l. f. of s. p. completed under contract, **89,** 2060.

1890–91. 9,464 c. y. dr.; 400 l. f. of n. p. rebuilt, **91,** 2546.

1891–92. 342 l. f. of n. p. rebuilt; 2,429 c. y. dr., **92,** 2192.

1892–93. 4,173 c. y. dr. and dr. plant repaired, **93,** 2731.

1893–94. 592 l. f. s. p. repaired and minor repairs made, **94,** 2072.

1894–96. Break'r constr. in progress; 43,453 c. y. dr. and dr. plant repaired, **95,** 2627; break'r 400′ l. built; **91,** l. f. of s. and 221 l. f. of n. p. rebuilt, **96,** 2492.

1896–98. P. extension in progress; 37,493 c. y. dr. and dr. plant repaired, **97,** 2681; 500 l. f. of s. p. extended, n. and s. ps. repaired, and dr. plant repaired; 58,669 c. y. dr., **98,** 2317.

1898–99. Dr. plant repaired, **99,** 2759.

1899–00. H. ps. repaired, **00,** 3684.

1900–01. 17,270 c. y. dr.; minor repairs to n. p., **01,** 2928.

1901–02. Minor repairs to p., **02,** 2062.

1902–03. Minor repairs to ps.; 2 cribs 100′ l. each built for 400′ extension to break'r, **03,** 1852.

1903–04. 400′ extension to break'r completed; 10,857 c. y. dr. by U. S.; minor repairs to p., **04,** 2828.

1904–05. Repairs to s. p.; 8,601 c. y. dr., **05,** 533, 2032.

1905–06. Repairs to floating plant, **06,** 589.

1906–07. Repairs to damaged break'r; work on building new break'r and extensions in progress, **07,** 1886.

1907–08. Constr. of break'r in progress; 700′ old n. p. removed, **08,** 1960.

1908–09. Work on break'r and p. constr. completed; 94,789 c. y. dr.; 2 short pile p. built inshore by hired labor, **09,** 1962.

1909–10. 91,766 c. y. dr.; work on sinking of caissons and leveling of rubble mound in progress; floating plant repaired, **10,** 2120.

1910–11. Building concrete superstr. on caisson break'r; entire proj. completed; minor repairs made to outer end n. break'r, **11,** 2325.

PHYSICAL CHARACTERISTICS.

Advance of shore line in the vicinity of ps., **76,** ii, 372.

Scour of Manitowoc R. would keep open a chan. protected from encroachments of sand, **66,** iv, 130.

Lake bed unfav. to the accurate setting of cribs, **73,** 203.

Peculiarities of Hs. along the w. shore of Lake Michigan, **68,** 99.

Description of. Manitowoc, on the w. shore of Lake Michigan, 77 m. n. of Milwaukee. Shelter of the H. sought by many craft. **00,** 3762.

Description of, **01,** 2980.

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[1] H. D. 62, 59th, 1st.

[2] Record of early operations, 1843, **76,** ii, 368. Of app. of 1876, $5,000 was especially allotted for protecting the work, **76,** 36. History of, to 1875, **76,** ii, 366.

H. 75 m. n. of Milwaukee and 55± m. s. of Sturgeon B. Canal; orig. no H.; traffic done at br. ps.; navigable for 1.8 m., **12,** 988.

PLANS. (See Projects.)

By W. H. Hearding, 1873, system of outside break'r covering entrance to H.; objections to plan by Maj. Houston, **73,** 204, 205.

By Maj. Davis, 1890, exterior H. protection of cribwork 400' l., built at an angle of 45° with the line of direction of the ps. and about 600' beyond the lake end of the n. p.; est., $40,000, **90,** 2345.

PRIVATE (CITY, PRIVATE, AND CORPORATE) WORK.

City expend. $20,000 in constr. of dr. outfit, **76,** ii, 368.

Docking within ps., 1870; dr. to 11' for a m. inside e. ends of ps., **71,** 112; **76,** ii, 371.

Dr. to 13', **72,** 120; $15,000 addl. expend. by citizens in dr., **76,** ii, 372.

Dr. done by city and private parties, **89,** 2060.

In 1896 Sec. of War granted permission to the Chicago & Northwestern Ry. Co. to remove 320 l. f. of the shore end of the s. p. to enable them to constr. a car ferry slip, and to constr. 2,000 l. f. of protection cribs along the shore of Lake Michigan to afford protection to the ferry, **97,** 2682.

In 1896-97 city dr. about 273,400 c. y., at cost of $25,940.46, from R., making d. of about 20' from the H. ps. up the R. for about 5,500'. The Manitowoc Terminal Co. also dr. 60,000 c. y. from along its docks, **97,** 2682.

In 1897–98 more dr. by the city was in progress, **98,** 2317.

PROJECTS. (See Plans.)

By Maj. Graham, 1854, extension of parallel ps. (220' apart) to the 12' curve; est., $62,780.94; S. D. 42, 35th Cong., 1st sess.

By Maj. Wheeler, 1866, revising previous proj. and providing for an extension to the 12' curve, by extending the n. p. an addl. 1,140' and the s. p. 1,010', with dr. to 12'; est., $141,747.82, **66,** iv, 129, 131; **69,** 26.

The foregoing est. increased by Maj. Wheeler, 1869, by $31,000, to supply deficiency due to repairs, and increased amount of dr., **69,** 26; **70,** 93.

Revised by Maj. Houston, 1872, extension of the ps. to the 18' curve, requiring 400' on each p.; est., $75,434.72, **72,** 121; **74,** 146; **79,** 1516.

By Maj. Robert, 1879, completion of existing proj., $15,362.54, **79,** 1516.

Orig. proj. of 1866, together with the modifications of 1869, 1872, and 1881, proposed formation of a chan. bet. 2 parallel crib ps. 250' apart bet. the 18½' curve in the lake and d. w. in the R., 14' at the inner end, increasing to 18' at the outer end; est., $308,182.54; **81,** 2094; **86,** 1667; **87,** 2044; **88,** 1852.

In 1890 constr. of an exterior break'r 400' l. proposed, at an est. of $40,000, which, with $12,000 for preservation of ps. and mainten. of chan., increased the total to $348,182, **92,** 2191; **93,** 2730.

By Capt. Zinn, 1896, for 20' chan., by extending s. p. 500' to the 20' contour, and dr. bet. ps.; est., $44,440, **96,** 2491; **97,** 2681.

Capt. Warren est., 1899, $37,000 to extend break'r 400' on a line parallel with s. p., **00,** 3765.

Act June 13, 1902, provided for extending break'r 400'; est., $37,000, and $8,000 an. mainten., **03,** 482; turning-basin, **03,** 1880.

By Maj. Warren, plan for imp. at cost of $285,000, **04,** 2829.

Act Mar. 2, 1907, au. mainten. of 20' chan., reconstr. of H. by removing outer 500' of break'r and nearly all of old parallel ps., and by constr. of new break'rs and ps. in accordance with H. D. 62, 59th Cong., 1st sess., as modified by BERH.; est., $376,000, **12,** 989. Extension of n. break'r, for a s. break'r, and necessary extensions to each break'r, **07,** 613, 1886.

SURVEYS.

Of H., 1853, **76,** ii, 368.

Under direction of Maj. Graham, 1856, S. Ex. D. 42, 35th Cong., 1st sess., p. 73.

Sur. made, 1890, by Maj. Davis, **90,** 2344.

Minor. surs. (See each an. **R.**)

Ex. and sur. for protection of the H. from ne. seas by break'r extension au. act Mar. 3, 1899; made by Capt. Warren, 1899 (**R.** fav.), **00,** 3761.

Act June 6, 1900, called for preliminary ex. and sur. for 20' H. of refuge (unnecessary), **00,** 3684.

Pre. ex. au. act June 6, 1900, for 20' H. of refuge. **R.,** Capt. Warren (H. D. 95, 56th, 2d) (unfav.), **01,** 527, 2980.

Sur. of shoal or reef about 4 m. s. of Manitowoc H., and report, with tracing, showing location, etc., made by Maj. Warren, **03,** 665, 2883.

Sur. au. act June 13, 1902, for constr. 2 or more turning-basins. (See Boards.) **R.,** Maj. Warren, July 13, 1903; est., $103,620, **03,** 483, 1880.

Sur. au. act Mar. 3, 1905, by special BE., to inquire into wave action affecting this H. **R.,** July 15, 1905, recom. constr. of break'r s. of H. entrance (H. D. 62, 59th, 1st), **06,** 645, 1747.

Ex. and sur. au. act Feb. 27, 1911, of H. and R. (**R.** to come), **12,** 1005.

Maps. (H. D. 62, 59th, 1st.) **66,** i; **76,** ii, 366; **88,** 1852; **93,** 2732; **04,** 2828; **06,** 1748; **07,** 1886.

MM-30(b) CENTERVILLE CREEK (Manitowoc Co.) WIS.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 286.

In charge. Maj. C. E. L. B. Davis. **R.,** **89,** 2102.

PLANS.

In 1888 Maj. Davis reported the existing or prospective C. did not warrant the required imp., **89,** 2103.

MM-31(a) SHEBOYGAN HARBOR, WIS.[1]

APPROPRIATIONS.

1852,	$10,000.00,	**66,** iii, 35.
1864,	*10,000.00,	**66,** iii, 35.
1866,	47,598.91,	**66,** iii, 35; **74,** 148.
1867,	8,000.00,	**67,** 22.
1869,	*14,850.00,	**69,** 22.
1870,	15,000.00,	**70,** 35.
1871,	$15,000.00,	**71,** 33.
1872,	18,000.00,	**72,** 22.
1873,	10,000.00,	**73,** 33.
1874,	10,000.00,	**74,** 39.
1875,	12,000.00,	**75,** 43.
1876,	6,000.00,	**76,** 96.
1878,	4,000.00,	**78,** 116.

* Allotment.

[1] Sur.—**R.,** Mar. 25, 1837, est., $84,906.75; Apr. 17, 1854, est., $30,000; Sept. 30, 1857, est., $36,614.55; Sept. 17, 1864, est., $30,000. (H. D. 482, 55th, 2d.)

1879,	$3,000.00,	**79,** 154.
1880,	7,000.00,	**80,** 1921.
1881,	25,000.00,	**81,** 2101.
1882,	30,000.00,	**82,** 2150.
1884,	28,000.00,	**84,** 1857.
1886,	15,000.00,	**86,** 1671.
1888,	15,000.00,	**88,** 1855.
1890,	15,000.00,	**90,** 2347.
1892,	25,000.00,	**92,** 2195.
1894,	25,000.00,	**95,** 2632.
1896,	26,000.00,	**96,** 2497.
1899,	28,400.00,	**99,** 2763.
1900,	52,000.00,	**00,** 3689.
1902,	90,000.00,	**02,** 2065.
1905,	18,000.00,	**05,** 2036.
1907	*3,819.21 / 40,000.00	**07,** 1890.
1909,	5,000.00,	**09,** 1968.
1910,	32,500.00,	**10,** 2123.
1912,	127,000.00,	**12,** 2515.
Total,	791,168.12	(incl. $406.63 misc. rects., $791,574.75, **12,** 2515).

COMMERCE.

Important, **66,** iii, 35, iv, 127; **67,** 75; **68,** 102; **76,** ii, 374.
Importance as a H. of refuge, **66,** 19; **67,** 75, 76.
Early C. and shipping at Sheboygan, **76,** ii, 374.
C. importance of H., **90,** 2347.
Description of, **97,** 2764.
Importance of the place increased by connection with Chicago, Milwaukee & St. Paul Ry. system, **94,** 2075.
Proj. has no material effect in controlling rates, **05,** 534.
Increasing in importance, **10,** 2123.
Large and of general character; in 1911, 661,886 t., **12,** 991.

CONTRACTS.

1852. Mr. Hawley, cribwork, **76,** ii, 376.
1866. Dellingham & Co., materials; Lochlin & Jenkins, materials; Sanger, Ledlic & Corse, materials, labor, and dr., **66,** iv, 127.
1868. L. R. Muzzy, dr., **68,** 30, 102, 103.
1869. S. M. Barrett, materials and labor, **69,** 26; **76,** ii, 377.
1870-71. F. M. Knapp, materials and labor, **71,** 112, 113.
1872. T. Windiate, materials, labor, and dr. (violated, contract annulled), **73,** 206; **76,** ii, 378.
1873. E. Gillen, materials and labor, **73,** 206.
1874. Fox & Howard, dr., **75,** 206.
1881. W. T. Casgrain, p. extension, **81,** 2101.
1882. W. T. Casgrain, p. extension, **82,** 2150.
1883. W. T. Casgrain, crib superstr. constr., **83,** 1691.
1884. C. H. Harmes, dr., 25¢ c. y., **84,** 1855. Truman & Cooper, p. extension, **85,** 2002.
1886. Truman & Cooper, p. extension, **87,** 2049.
1888. Truman & Cooper, 200 l. f. p. extension, $10,656.60, **89,** 2064.
1890. Truman & Cooper, 150 l. f. p. extension, $9,893, **91,** 2550.
1892. D. A. McLeod, 200 l. f. p. extension, piles, st., etc., $14,519.40, **93,** 2736. Actual cost, $64.49 l. f., **94,** 2077.
1894. Wisconsin Dredge & Dock Co., 900 l. f. p. extension, piles, st., etc., $13,429.29, **95,** 2633. Actual cost of work, $16.05 l. f., **96,** 2496.
1900. E. Gillen, crib break'r constr. (lumber, st., piles, ironwork), about $82,000, **00,** 3691.
1903. N. J. Gaylord, constr. 200′ n. p. extension and 600′ s. p. extension (prices given), **03,** 1855.
1906. J. G. Newbegin, lumber (prices given), **07,** 1890.
1907. Carstens & Earles (Inc.), lumber, (prices given); Burk, Smith & Nelson, bldg. 196′ crib break'r (prices given), **07,** 1890.
1910. Ernst Schmidt, dr., 18¢ c. y., **10,** 2122.

ENGINEERS.

Chief of Engineers. R., 66, 5, iii, 12; **67,** 22; **68,** 29; **69,** 26; **70,** 35; **71,** 33; **72,** 32; **73,** 33; **74,** 39; **75,** 43; **76,** 96; **77,** 100; **78,** 115; **79,** 154; **80,** 206; **81,** 278; **82,** 274; **83,** 282; **84,** 282; **85,** 305; **86,** 299; **87,** 265; **88,** 241; **89,** 280; **90,** 253; **91,** 323; **92,** 309; **93,** 352; **94,** 324; **95,** 361; **96,** 317; **97,** 401, 408; **98,** 392, 399; **99,** 465, 473; **00,** 530; **01,** 521; **02,** 445; **03,** 483; **04,** 527; **05,** 534; **06,** 589; **07,** 614; **08,** 659; **09,** 695; **10,** 770; **11,** 827; **12,** 990.

Boards. Board au. act Mar. 3, 1905, to inquire into effect of wave action. **R., July** 15, 1905 (H. D. 62, 59th, 1st), **06,** 645; recom. addl. l. of 200′ to landward end of n. break'r, and, as soon as funds available, constr. of such l. to new s. break'r as may be found necessary, **06,** 1747.

In charge:
Lt. Col. J. Kearney, 1854; **76,** ii, 376.
Maj. J. D. Graham, 1856. **R.,** S. D. **42,** 35th Cong., 1st sess., p. 73.
Lt. Col. T. J. Cram, 1864–65. **R., 66,** 18, 20.
Lt. Col. Sitgreaves, 1865–66; **66,** 20, iv, 91.
Maj. J. B. Wheeler, 1866–70. **R., 66,** iv, 127; **67,** 75; **68,** 101.
Maj. D. C. Houston, 1870–75. **R., 70,** 94; **71,** 112; **72,** 121; **73,** 205; **74,** 146.
Maj. H. M. Robert, 1875–83. **R., 75,** 206; **76,** ii, 372; **77,** 864; **78,** 1162; **79,** 1518; (Lt. Col.) **80,** 1920; **81,** 2098, 2102; **82,** 274, 2149.
Capt. F. A. Hinman, 1883–84. **R., 83,** 1690.
Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1855; **85,** 2001.
Capt. C. E. L. B. Davis, 1886–91. **R., 86,** 1670; **87,** 2047; (Maj.) **88,** 1853; **89,** 2063; **90,** 2346; **91,** 2549.
Col. O. M. Poe, 1889. **R., 89,** 2243.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2194; **93,** 2733; **94,** 2075.
Capt. C. F. Palfrey, 1895. **R., 95,** 2630.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2495; **97,** 2685, 2761; **98,** 2320.
Capt. J. G. Warren, 1899–1905. **R., 99,** 2762, 2812; **00,** 3687; (Maj.) **01,** 2931; **02,** 2063; **03,** 1853; **04,** 2830; **05,** 2034.
Maj. W. V. Judson, 1905–09. **R., 06,** 1748; **07,** 1889; **08,** 1962.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1965; **10,** 2122; **11,** 2326; **12,** 2515.

Assistants:
J. M. Berrien, **76,** ii, 376.
Lts. Center and Rose, **76,** ii, 376.
Lt. J. B. Quinn. **R., 67,** 75.
W. H. Hearding. **R., 68,** 101; **72,** 121; **73,** 205; **74,** 146; **75,** 206.
L. Y. Schermerhorn. **R., 81,** 2104.

ESTIMATES. (See Plans and Projects.)

Est. increased, 1874, on account of limited app., to $22,000, **74,** 148.

LEGAL PROCEEDINGS.

Limits defined for lawful deposit of dr. and other material in Lake Michigan in vicinity of Sheboygan, approv. by Sec. of War, 1899, **99,** 2763.

LEGISLATION.

Subject of H. imp. considered by a county convention, **76,** ii, 375.
H. work au. by Wisconsin, **76,** ii, 376.

OPERATIONS.[1] (See Private work.)

1867-68. N. p., 128 l. f. crib p. and 128 l. f. superstr. built; s. p., 320 l. f. crib p. and 320 l. f. superstr. built; 29,576 c. y. dr., **68,** 30, 102; **76,** ii, 376.

* Allotment.
[1] Condition of work in 1854, **76,** ii, 376. History of work to 1875, **76,** ii, 374. Abstracts of materials and labor, **67,** 77; **68,** 102; **72,** 122; **75,** 207; **76,** ii, 373; **77,** 865; **78,** 1162. 1876, $3,000 allotted for protecting work, **76,** ii, 36.

1868-69. 9,034 c. y. dr.; cribs refilled, **69,** 26; **76,** ii, 376.
1869-70. S. p., 192 l. f. crib p. built; 2 outer cribs damaged and removed, **70,** 35, 94.
1870-71. S. p., 128 l. f. superstr. built; 2 cribs replaced, **71,** 33, 112, 113.
1871-72. N. p., 320 l. f. crib p. built; s. p., 128 l. f. crib p. built, **72,** 32, 121, 122; **76,** ii, 377.
1872-73. N. p., 50 l. f. crib p. built; s. p., 320 l. f. superstr. built; 3,000 c. y. dr.; cribs sunk on st. foundation 4′ h., **73,** 33, 205, 206; **76,** ii, 377.
1873-74. N. p., 288 l. f. superstr. built; s. p., 50 l. f. crib p. and 128 l. f. superstr. built; 2,000 c. y. dr.; repairs to superstr., **74,** 39, 147; **76,** ii, 378.
1874-75. N. p., 40 l. f. crib p. and 50 l. f. superstr. built; s. p., 50 l. f. superstr. built; 40,000 c. y. dr.; chan. 2,000′ l., 15′–16′ d.; repairs, **75,** 43, 206, 207; **76,** ii, 378.
1875-76. Repairs, **76,** ii, 373.
1876-77. N. p., 137 l. f. superstr. built; s. p., 413 l. f. superstr. built; repairs, **77,** 100, 865.
1877-78. N. p., 130 l. f. superstr. built; s. p., 138 l. f. superstr. built; 7,117 c. y. dr.; repairs to superstr.; 260′ walk laid, **78,** 116, 1162.
1878-79. S. p., 358 l. f. superstr. built (repairs), **79,** 154, 1518.
1879-80. 62 l. f. of old superstr. removed and rebuilt; 6,955 c. y. sand dr. from chan. bet. ps., **80,** 1920.
1880-81. 9,456 c. y. dr. on bar and bet. ps., **81,** 2099.
1881-82. 107 l. f. pile p. and 50 l. f. of crib p. built; 11,671 c. y. dr. from bar and chan., **82,** 2149.
1882-83. 250 l. f. crib p. and 24 l. f. pile p. built, with superstr. for same; 5,408 c. y. dr. from chan. through outer bar, **83,** 1690.
1883-84. 250 l. f. cribwork with superstr. for same built and sunk in extension of n. p.; 6,425 c. y. dr. from chan., **84,** 1856.
1884-85. Crib constr. commenced under Truman & Cooper's contract; 35,882 c. y. dr. from chan.; 300 l. f. of n. p. riprapped, **85,** 2001.
1885-86. S. p. extended 350′; 95′ of superstr. built, **86,** 1670.
1886-87. 10,075 c. y. removed by U.S. dr., **87,** 2048.
1887-88. N. p. extended 200′; 14,485 c. y. dr., **88,** 1854.
1888-89. S. p. extension begun under contract; 20,150 c. y. dr. by hired labor, **89,** 2063.
1889-90. 200 l. f. s. p. extension completed under contract; 150 l. f. shore end of s. p. rebuilt above water line by hired labor, and minor repairs made to n. and s. ps., **90,** 2347.
1890-91. 25,325 c. y. dr.; 62 cords of st. used in refilling s. p., **91,** 2549.
1891-92. N. p. extended 150′; 17,030 c. y. dr. by hired labor, **92,** 2194.
1892-94. Extension of n. and s. ps. in progress, 39,490 c. y. dr., sand fences repaired, minor repairs made to ps., and dr. plant repaired, **93,** 2734. N. and s. ps. extended 100′ each, and ps. strengthened, **94,** 2075.
1894-96. P. extension in progress, 42,892 c. y. dr., and dr. plant repaired, **95,** 2631. S. p. extended 900 l. f., minor repairs made, and 30,491 c. y. dr., **96,** 2496.
1896-97. 44,239 c. y. dr., 1,200 l. f. old p. removed, about 100 l. f. pile p. built, and warehouse constr., **97,** 2685.
1897-98. 46,699 c. y. dr.; 3,000 c. y. st. filling dr. from old p. and used as filling for new p. and for riprapping; several wrecks, discovered during dr., removed; 228 l. f. pile p. built; 200 l. f. superstr. of n. p. rebuilt; both ps. repaired, and dr. plant repaired, **98,** 2320.
1898-99. 23,706 c. y. dr.; minor repairs made to ps. and to plant, **99,** 2763.
1899-00. St. foundation of break'r about completed, and crib constr. in progress; 12,095 c. y. dr., **00,** 3688.
1900-01. 20,047 c. y. dr., 600′ break'r built, repairs to H. p., **01,** 2931.
1901-02. 1,057 c. y. removed from chan.; minor repairs to p. and dr. plant, **02,** 2064.
1902-03. 12,230 c. y. dr., 120 l. f. of n. p. removed 3 cribs 100′ l. built, **03,** 1853.
1903-04. 32,277 c. y. removed from chan., repairs to n. p., 560′ n. p. removed, 400′ built on p. extension, **04,** 2830.
1904-05. 22,138 c. y. dr., p. extension work completed; work on sheet-pile revet. n. p. in progress, **05,** 2034.
1905-06. 6,543 c. y. dr.; minor repairs to p.; sheet-pile revet. work in progress, **06,** 1748.
1906-07. 16,368 c. y. dr.; minor repairs to break'r, **07,** 1889.
1907-08. 7,622 c. y. dr.; minor repairs to decking of break'r; work on 196′ extension of break'r in progress, **08,** 1962.
1908-09. 28,303 c. y. dr.; 196′ extension to break'r completed, **09,** 1965.
1909-10. 19,986 c. y. dr.; minor repairs to break'r by hired labor, **10,** 2122.
1910-11. 12,619 c. y. dr.; repairs to H. p., **11,** 2326.
1911-12. 15,157 c. y. dr.; inshore portion of superstr. of s. p. rebuilt, **12,** 2515.

PHYSICAL CHARACTERISTICS.

General characteristics of Sheboygan R., **76,** ii, 374.
Character of lake bed a source of difficulty in placing and retaining cribs in position and keeping open chan., **71,** 113; **72,** 122; **73,** 206; **74,** 148; **76,** ii, 377.
Description of, **97,** 2762; **99,** 2813.
H. at mouth of the R. of same name on w. shore of Lake Michigan, **97,** 2762; and about 50 m. n. of Milwaukee, the nearest Hs. being also 25 m. distant n. and s., **97,** 2764.
Bar formation, **00,** 3688.
Condition of imp., depths, etc., **01,** 2931; **02,** 2064; **03,** 1854; **04,** 2831; **05,** 2034; **06,** 1748; **07,** 1889; **08,** 1963; **09,** 1965; **10,** 2122; **11,** 2326; **12,** 2515.

PLAN. (See Estimates and Projects.)

By J. M. Berrien, 1838, plan of imp.; est., $89,900, **76,** ii, 376.

PRIVATE (CITY AND COUNTY, AND PRIVATE) WORK.

App. by city and county of Sheboygan for H. imp., aggregating $55,000, expend. under direction of H. commissioners, **76,** ii, 376.
1852. 450 l. f. crib p. completed on n. p. and 150 l. f. on s. p., **76,** ii, 376.
1854. 100 l. f. crib p. completed on s. p., **76,** ii, 376.
1860. 100 l. f. superstr. on n. p.; 96 l. f. cribwork completed on s. p., **76,** ii, 376. County of Sheboygan furnished dr. for L. R. Muzzy, U.S. contractor for dr., **68,** 30, 102, 103.
1878. Expense of towing dr. and dump scows paid by city of Sheboygan, **78,** 1162.
Owners of property adjacent to that transf. to U.S. by city of Sheboygan for w. chan., constr. 935 l. f. revet on line of new p., **97,** 2685.
Repairs to break'r, damaged by SS. *Hendrick S. Holden*, paid for by owner of vessel, **06,** 1748.
Description of, **12,** 990.

PROJECTS. (See Estimates and Plans.)

By Col. Cram, 1866, extension of ps. to 12′, requiring 120′ on n. and 320′ on s. p., and removal by dr. of all material to 12′; est., $44,188, **66,** 19, 24. iii, 12, 67, 75.
Revised by Maj. Wheeler, 1866, according to prices of contract made for this work, $54,956.83, **66,** iv, 127, 129; **74,** 148.
By Maj. Wheeler, 1867, extend ps. about 200′ (across bar lying in front of entrance) to 12′ curve; also dr. bet. ps.; est., $49,000, **67,** 22; **68,** 29; **74,** 148; **76,** ii, 372.
By Maj. Houston, 1873, completion of superstr., protection of p. heads, with dr. in chan. to obtain 16′; est., $20,000, **73,** 33, 206; **81,** 2105. (Total amount app., 1852 to 1880, incl., $190,448.91.)
In 1852 and 1864, $20,000 app., applied in extension of work undertaken by city of Sheboygan, **76,** ii, 374; **81,** 2105.

By Lt. Col. Robert, 1881, extension of ps. to 20′ curve in Lake Michigan, by constr. of 1,085 l. f. of pile p. and 900 l. f. of crib p.; also excavation of chan. 18′ x 200′ at outer end, decreasing to 14′ at shore line; est., $150,000, **81,** 2104, 2108. Increased, 1884, to $195,000, **84,** 1856; **87,** 2047; **91,** 2549.

By Maj. Gregory, 1894, constr. 1,200 l. f. pile p., beginning at shore line, to obtain uniform entrance w.; removal of inner section of s. p. and docks adjacent thereto, and dr. area inclosed by line of old s. p. to adjoining docks and line of new pile p. prolonged to Sheboygan R., to 19′, **96,** 2495.

In 1897 Capt. Zinn reduced est. of cost for completing work of imp. from $55,900 to $26,600, **97,** 2685.

By Capt. Zinn, 1897, 21′ chan. by p. extension; est., $75,000, **97,** 2764; **99,** 2763.

By Capt. Zinn, 1899, 700′ crib break'r on pile foundation (changed later to st. foundation) in front of H. mouth; est., $77,000, **99,** 2762, 2814; **00,** 3688.

Maj. Warren recom. addl. app. be made to extend break'r 100′, and complete adopted proj.; est., $11,714, **01,** 2932.

"Existing" proj. provides for break'r 700′ l., or extending both H. p., and for chan. 21′ d.; est., $152,000 (H. D. 327, 54th, 2d, and H. D. 53 55th, 3d), **02,** 445.

Maj. W. V. Judson recom. extension of n. break'r. **R.,** Dec. 13, 1906; est., $253,000 (Com. D. 3, 59th, 2d), **09,** 1966.

Act July 25, 1912, modified proj. of 1907, to postpone constr. of s. break'r, **12,** 990.

SURVEYS.

By Lts. Center and Rose and J. M. Berrien, 1836 **76,** ii, 376.

By Maj. Graham, 1856, S. D. 42, 35th Cong., 1st sess., p. 74.

Ex. by Lt. Col. Cram, 1864, **66,** 13; **76,** ii, 376.

Of H., 1881, **81,** 2102.

Sur., 1890, by Maj. Davis, **90,** 2347.

Sur. with view to obtaining 21′ au. act June 3, 1896; made, 1897, by Capt. Zinn (see Projects), **97,** 2761.

Minor sur. (See each an. **R.**)

Sur. for ascertaining best method, and expense of preventing injurious effect of ne. seas, au. joint resol. June 8, 1898; made, 1898, by Capt. Zinn (**R.** fav.; see Projects), **99,** 2812.

Maps. (H. D. 62, 59th, 1st.) **76,** ii, 372, 375; **81,** 2104; **88,** 1854; **93,** 2734; **97,** 2764; **03,** 1854; **09,** 1968.

MM-31(b) STONE HAVEN HARBOR, WIS.

ENGINEERS.

Chief of Engineers. **R., 04,** 536, 2913.

Boards. BERH. **R.** that it is not desirable to undertake imp., **04,** 2915.

In charge. Maj. J. G. Warren, 1904. **R., 04,** 2913.

PHYSICAL CHARACTERISTICS.

Stone Haven located on w. shore of Lake Michigan, about 8 m. n. of Port Washington, Wis. Village of Belgium, about 2½ m. w., nearest RR. shipping point. Lake bottom in vicinity is generally a thin layer of sand overlying limestone r. **04,** 2914.

SURVEY.

Pre. ex. au. act June 13, 1902, with view to imp. same by constr. of ps. or otherwise, etc. **R.** by Maj. Warren, July 21, 1902[1] (unfav.), **04,** 536.

MM-32 PORT WASHINGTON (Ozaukee) HARBOR, WIS.

APPROPRIATIONS.

1870,	$15,000,	**70,** 39.
1871,	15,000,	**71,** 34.
1872,	15,000,	**72,** 32.
1873,	15,000,	**73,** 34.
1874,	10,000,	**74,** 39.
1875,	10,000,	**75,** 44.
1876,	8,000,	**76,** 97.
1878,	5,000,	**78,** 116, 1164.
1879,	7,500,	**79,** 155, 1521.
1880,	20,000,	**80,** 1923.
1881,	17,000,	**81,** 2110.
1882,	17,000,	**82,** 2152.
1884,	10,000,	**84,** 1859.
1886,	5,000,	**86,** 1673.
1888,	5,000,	**88,** 1857.
1890,	3,000,	**90,** 2350.
1892,	6,500,	**92,** 2197.
1894,	5,000,	**95,** 2636.
1896,	5,500,	**96,** 2500.
1899,	4,400,	**99,** 2766.
1902,	6,000,	**02,** 2066.
1909,	*4,000,	**09,** 1969.
1910,	30,000,	**10,** 2125.
1912,	2,500,	**12,** 2517.
Total,	241,400	(incl. misc., $241,468.25, **12,** 2517).

COMMERCE.

C. importance of Port Washington, **70,** 119, 120; **71,** 114; **72,** 123; **73,** 207; **76,** ii, 382, 384.

Local business monopolized by br. p. owners previous to imp. of H., **76,** ii, 381.

Description of, local, **00,** 3766.

Small, and of local character, **03,** 484.

Description of, **04,** 2901, 2903.

Believed that proj. has no effect in controlling rates, **05,** 535; except on coal for local consumption, **06,** 590.

Proj. has considerable effect on rates, **09,** 697.

1911, 10,362 t., **12,** 993.

CONTRACTS.

1870. A. Conro, dr. and accessories, $150 per day, **71,** 114; **76,** ii, 381.

1871. A. Conro, materials and labor, **71,** 114; **72,** 123.

1872. A. Conro, dr. and accessories, $15 per hour, **73,** 207; **76,** ii, 382.

1873. A. Conro, materials and labor, **73,** 207; **74,** 149.

1874. A. Conro, dr. and accessories, $125 per day, **75,** 209; **76,** ii, 383.

1875. A. Conro, dr., 34.6¢ c. y., **76,** ii, 379.

1880. Knapp & Gillen, p. extension, **80,** 1923. Truman & Cooper, p. extension, **81,** 2111.

1881. Truman & Cooper, p. extension, **81,** 2111.

1882. Truman & Cooper, superstr. constr., **83,** 1695.

1883. Rand & Burger, dr. hull and scows, **83,** 1694.

* Allotment.

[1] H. D. 218, 58th, 2d.

1884. Truman & Cooper, p. extension, **85,** 2004.

1886. Truman & Cooper, p. extension and superstr. constr., **87,** 2052.

1892. Wisconsin Dredge & Dock Co., 100 l. f. crib-p. extension—timber, st., etc.—actual cost, $58.11 l. f. ($5,811.88), **93,** 2739, 2740.

1910. A. F. Bues, dr. sand and mud, 17½¢ c. y., and hardpan and bowlders, 34¾¢ c. y., **11,** 2329.

1911. Rieboldt, Wolter & Co., constr. wooden st. barge, $10,950, chargeable to various H. app., **11,** 2330.

ENGINEERS.

Chief of Engineers. R., 69, 29; **70,** 39; **71,** 34; **72,** 32; **73,** 33; **74,** 39; **75,** 43; **76,** 97; **77,** 101; **78,** 116; **79,** 154; **80,** 206; **81,** 278; **82,** 274; **83,** 283; **84,** 283; **85,** 306; **86,** 300; **87,** 265; **88,** 242; **89,** 281; **90,** 253; **91,** 324; **92,** 310; **93,** 353; **94,** 325; **95,** 362; **96,** 317; **97,** 401; **98,** 393; **99,** 466, 474; **00,** 531, 539; **01,** 521; **02,** 445; **03,** 484; **04,** 528, 536, 2899; **05,** 535; **06,** 590; **07,** 616; **08,** 660; **09,** 697; **10,** 771, 781; **11,** 829; **12,** 992.

Boards:

At an early day a plan of imp. submitted to BE. for extending 2 parallel ps. to 10′ curve, and excavation of an interior or R. basin, **76,** ii, 381.

BERH. (See Surveys.)

In charge:

Maj. J. B. Wheeler, 1870. **R., 70,** 119.

Maj. D. C. Houston, 1870–75. **R., 71,** 113; **72,** 123; **73,** 207; **74,** 149.

Maj. H. M. Robert, 1875–83. **R., 75,** 209; **76,** ii, 379; **77,** 866; **78,** 1163; **79,** 1519; **80,** 1922; **81,** 2109; **82,** 2151.

Capt. F. A. Hinman, 1883–84. **R., 83,** 1693.

Lt. Col. J. W. Barlow, 1884–86. **R., 84,** 1858; **85,** 2003.

Capt. C. E. L. B. Davis, 1886–91. **R., 86,** 1672; **87,** 2050; (Maj.) **88,** 1856; **89,** 2065; **90,** 2349; **91,** 2551.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2196; **93,** 2738; **94,** 2079.

Capt. C. F. Palfrey, 1895. **R., 95,** 2634.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2498; **97,** 2687; **98,** 2322.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2765; **00,** 3692, 3766; (Maj.) **01,** 2934; **02,** 2065; **03,** 1855; **04,** 2833, 2899; **05,** 2036.

Maj. W. V. Judson, 1905–09. **R., 06,** 1750; **07,** 1892; **08,** 1965.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1969; **10,** 2124; **11,** 2329; **12,** 2517.

Assistants:

W. T. Casgrain. **R., 70,** 119, 120.

W. H. Hearding. **R., 72,** 123; **73,** 207; **74,** 149; **75,** 209.

ESTIMATES. (See Plans and Projects.)

By Maj. Wheeler, 1869, exterior or outer H. similar to that at Chicago; est., about $900,000, **70,** 119.

By Maj. Wheeler, 1870, parallel ps. to 14′, excavation and revet. of R. basin, and dr. to 14′; est., $154,527.17, **70,** 120, 121, 122.

By Maj. Robert, 1876, excavation, to 13′, of n. basin 200′ x 700′; est., $27,000, **76,** ii, 380; **77,** 866.

LEGISLATION.

Legislation by State for levy of a tax of $15,000 on property in town of Port Washington, to be applied to H. imp., **71,** 113; **76,** ii, 381.

OPERATIONS.

Abstracts of materials and labor, **71,** 114; **72,** 123; **74,** 149; **75,** 209; **77,** 867.

1870-71. Dr. in R. and basin, **71,** 113.

1871-72. N. p., 320 l. f. crib p. and 320 l. f. superstr. built; s. p., 320 l. f. crib p. and 320 l. f. superstr. built, dr. in chan. and for cribs, **72,** 32, 123; **76,** ii, 382.

1872-73. 14,002 c. y. dr. (cost of dr. c. y., 49.11¢), **73,** 33, 207; **76,** ii, 382.

1873-74. N. p., 100 l. f. crib p. and 100 l. f. superstr. built; s. p., 100 l. f. crib p. and 100 l. f. superstr. built; 206 l. f. pile dock and revet.; 13,992 c. y. dr. (cost of dr. c. y., 56½¢), **74,** 39, 149; **76,** ii, 383.

1874-75. 200 l. f. pile dock and revet. and 19,831 c. y. dr. (cost of dr. c. y., 36.21¢), **75,** 43, 209.

1875-76. 24,287 c. y. dr., repairs (cost of dr. c. y., 34.6¢), **76,** 97, ii, 379.

1876-77. Repairs, **77,** 101, 866.

1877-78. 50,477 c. y. dr. (cost c. y., 12.35¢), **78,** 116, 1163; **79,** 1520.

1878-79. 58,393 c. y. dr. (average cost of dr. c. y., 11.17¢); repairs of dr., **79,** 154, 1520.

1879-80. 3,410 c. y. sand dr. from bet. ps.; 2 cribs built and sunk in extension of n. p.; s. p. superstr. partly refilled; breach in s. embankment of w. basin repaired by city of Port Washington, **80,** 1922.

1880-81. 6 cribs built and 3 sunk in extension of n. p., **81,** 2109.

1881-82. 11 cribs built and sunk, 4 in extension of n. and 7 in extension of s. p.; 49,063 c. y. dr. from n. basin and from chan.; 86 piles removed from basin entrance, **82,** 2151.

1882-83. One crib sunk in s. p. extension; partial superstr. built over 14 crib superstrs., **83,** 1693.

1884-85. 350 l. f. n. and 250 l. f. s. p. superstr. completed; 16,513 c. y. dr. from chan., **85,** 2003.

1885-86. 27,194 c. y. dr. from H.; 3 outer cribs of n. and s. ps. protected with 74 cords of riprap, **86,** 1672.

1886-87. One 50′ crib sunk in extension of n. p., **87,** 2051.

1887-88. 50 l. f. of superstr. built upon crib No. 17, n. p., **88,** 1857.

1888-89. 3,510 c. y. dr. by hired labor, **89,** 2066.

1889-90. 25,525 c. y. dr., and repairs to n. p. made by hired labor, **90,** 2349.

1890-91. 9,485 c. y. dr. from entrance chan. and basins, **91,** 2551.

1891-92. 14,360 c. y. dr.; 40 cords of st. used in refilling p. heads, **92,** 2197.

1892-93. S. p. extended 100 l. f., **93,** 2738.

1893-94. N. p. repaired, **94,** 2079.

1894-95. 11,110 c. y. dr., **95,** 2635.

1895-96. 30,873 c. y. dr., **96,** 2499.

1896-98. 370 l. f. of n. and 320 l. f. of s. p. repaired, and minor repairs made, **97,** 2687; **98,** 2322.

1898-99. Ps. repaired; 6,928 c. y. dr., **99,** 2765.

1899-00. 8,068 c. y. dr., **00,** 3693.

1900-01. 9,231 c. y. dr. by U. S. plant, **01,** 2934.

1902-03. 10,291 c. y. dr.; plant repaired, **03,** 1855–1856.

1905-06. 10,709 c. y. dr., **06,** 1750.

1906-07. Outer 100′ n. p. rebuilt above water, **07,** 1892.

1907-08. 4,056 c. y. dr. under contract, **08,** 1965.

1909-10. 13,606 c. y. dr. by U. S. plant, **10,** 2124.

1910-11. 3,384 c. y. dr. to restore 13′ d., and ps. repaired by U. S. plant. Under 18′ proj. 79,189 c. y. sand and mud and 22,967 c. y. bowlders and hardpan dr. by contract, **11,** 2329.

1911-12. N. p. repaired; 8,037 c. y. dr. by U. S. plant to restore 18′ d., **12,** 2517.

PHYSICAL CHARACTERISTICS.

Physical characteristics of Sauk R., **70,** 119, 120; **76,** ii, 381.

Small amount of shore drift, **70,** 120.

Bottom of lake hard clay, mixed with bowlders and gravel, fav. for cribwork, **71,** 114; **72,** 123; **76,** ii, 382.

Description of, **00,** 3767.

Large deposits in the chan. an., **00,** 3693.

A small R., Sauk R., empties into Lake Michigan at this place. The volume of its discharge is insignificant, but a dike and revet. has been constr. to keep from the H. the material it brings down during freshets, **96,** 2499.

Description of, **04,** 2900, 2902.

Condition of work and d. of w., **01,** 522, 2934; **02,** 2065–2066 **03,** 484, 1856; **05,** 2036; **06,** 590, 1750; **08,**

661, 1965; **09,** 1969; **10,** 772, 2125; **11,** 829, 2329; **12,** 993, 2517.

Damage by storm, 1911, **12,** 2517.

PLANS. (See Estimates and Projects.)

Submitted to BE., previous to 1869, for 2 parallel ps. 200′ apart, from shore line to 10′ of water; also excavation of an interior or R. basin, 200′ x 600′, **76,** ii, 381.

By Maj. Wheeler, 1870, outer H. similar to that at Chicago; est., $900,000; not recom., **70,** 119.

PRIVATE AND CORPORATE WORK.

$15,000 raised by taxation for H. imp., **71,** 113; **76,** ii, 381. Agreement of citizens with Albert Conro for dr. for cribs, **71,** 114; **72,** 123; **76,** ii, 383. Docking of R. basin, **74,** 149; **76,** ii, 382.

PROJECTS. (See Estimates and Projects.)

By Maj. Wheeler, 1869, 2 parallel crib ps., 200′ apart, extending to 14′ of water, and excavation and revet. of a w. R. basin, **70,** 119; est., $154,527.17, **70,** 119. Proj. chiefly based on the old plan submitted to BE., **76,** ii, 381.

By Maj. Houston, 1870, modifying foregoing as follows: Direction of ps. changed, w. bet. ps. reduced to 150′; inside basin 200′ x 600′, dr. to 13′, **73,** 207; **76,** ii, 380, 381.

By Maj. Robert, 1876, excavate to 13′ a basin on n. side of chan., 200′ x 700′; est., $27,000, **76,** ii, 380; **77,** 866; **78,** 1163; **79,** 1519.

Total est. of proj. of 1869, with modifications of 1870 and 1876, $181,500, **77,** 866; **83,** 1693; **87,** 2050.

Act June 25, 1910, au. increasing d. in chan. and basins to 18′ below datum, in accordance with plan (H. D. 306, 61st, 2d); est., $30,000, with $2,500 an. mainten., **10,** 772.

SURVEYS.

An early sur., **76,** ii, 381.

Resur. au., **69,** 29; **76,** ii, 381; made, under direction of Maj. Wheeler, by W. T. Casgrain, 1869, **70,** 119.

By Maj. Robert, 1878, **79,** 1519.

Ex. for 15′ chan. by extension of ps. 300′ and protection of same by breakw'r, au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** unfav.), **00,** 3766.

Pre. ex. au. act June 13, 1902. **R.,** by Maj. Warren, Jan. 13, 1903. (H. D. 227, 58th, 2d.) Reviewed by BERH. Further imp. not advisable at "present" time, **04,** 536, 2899–2903.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Bromwell, May 25 and Sept. 14, 1909, resp. Plan for imp. involving experimental dr. to d. 18′ in chan. and basins at est. cost of $30,000 presented (H. D. 306, 61st, 2d) (see Projects), **10,** 781.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 992.

Maps:
76, ii, 380; **78,** 1164; **81,** 2110; **93,** 2740; **03,** 1856.
Plat of the H., Nov., 1878, **79,** 1520.

MM-33 MILWAUKEE, WIS.

Part.	Title.	Period.	Appropriations.
a	Milwaukee H., Wis.	1836–1901	$440,087.45
b	Milwaukee B. (H. of refuge)	1880–1901	959,387.91
c	Milwaukee H. (incl. H. of refuge)	1902–1912	974,500.00
d	Milwaukee (inner) H., Wis.	1904–1912	100,000.00
	Total		2,473,975.36

Part (a), MM-33 Milwaukee Harbor, Wis.[1]

APPROPRIATIONS.

1836,	$400.00	(sur.), act July 4.
1843,	30,000.00	**66,** iii, 35; **76,** ii, 386.
1844,	20,000.00	
1852,	15,000.00	
1853,	163.94	
1864,	15,000.00	**66,** iii, 35.
1866,	48,283.51	
1869,	*35,640.00,	**69,** 22.
1870,	40,000.00,	**70,** 36.
1871,	38,000.00,	**71,** 34.
1873,	10,000.00,	**73,** 34.
1874,	10,000.00,	**74,** 40.
1875,	25,000.00,	**75,** 44.
1876,	26,000.00,	**76,** 36, 97.
1878,	15,000.00,	**78,** 116.
1879,	7,500.00,	**79,** 155.
1880,	10,000.00,	**80,** 1935.
1881,	8,000.00,	**81,** 2125.
1882,	10,000.00,	**82,** 2158.
1888,	10,000.00,	**88,** 1863.
1890	6,100.00,	act Mar. 17.
	6,000.00,	**90,** 2355.
1892,	14,000.00,	**92,** 2202.
1894,	7,000.00,	**95,** 2643.
1896,	7,000.00,	**96,** 2507.
1899,	26,000.00,	**99,** 2772.
Total,	440,087.45	

COMMERCE.

C. importance of Milwaukee, **66,** iv, 126; **67,** 78, 79; **68,** 103; **73,** 209; **74,** 150; **79,** 1525.

Early imp. consisted of br. ps., **76,** ii, 385.

H. of refuge, importance as, **66,** iv, 126; **67,** 78; **73,** 209.

RRs. and shipping, **66,** iv, 126; **77,** 870.

Benefit of imp., **80,** 1935.

Increasing, **95,** 2641.

CONTRACTS.

1867. V. Kuhlman, materials, **67,** 57; **76,** ii, 388.

1868. C. H. Starke, materials and labor, **76,** ii, 388. E. W. Diercks, materials, **76,** ii, 388.

1870. Hasbrouck & Conro, materials and labor, **71,** 34, 115.

1871. H. Starke, materials and labor, **71,** 115; **72,** 124.

1873. A. Conro, dr., **73,** 209.

1874. A. Conro, dr., 28¾¢ c. y., **75,** 211.

1875. A. Conro, dr., materials and labor, **75,** 212.

1879. Stark, Smith & Co., dr., 19¾¢ c. y., **80,** 1935.

1880. Stark, Smith & Co., dr., 23¢ c. y., **81,** 2125.

1881. Stark & Smith, pile protection, superstr., and repairs, **81,** 2125.

* Allotment.

[1] Sur.—**R.,** Feb. 4, 1837, est., $92,183.54; May 28, 1843; Aug. 2, 1864, est., $15,000. (H. D. 482, 55th, 2d.)

1886. H. B. Herr & Co., superstr. reconstr., **87,** 2062.
1889. W. T. Casgrain, reconstr. of 400 l. f. of superstr., $7,263.20, **89,** 2074.
1890. C. H. Starke, dr., 25¢ c. y., **90,** 2354.
1891. C. H. Starke, dr., 18¢ c. y., **92,** 2202.
1892. C. H. Starke, building superstr. and repairing ps., timber, etc., $10,049.10, **93,** 2746.
1894. Wisconsin Dredge & Dock Co., dr., 11.8¢ c. y. ($5,000), **95,** 2644.
1896. W. A. Starke, dr., 14½¢ c. y. ($1,740), **97,** 2694.
1899. A. F. Bues, dr., 14.4¢ c. y. ($14,400), **99,** 2773.

DOCUMENTS. (Not published in reports.)
S. Ex. D. 16, 34th Cong., 3d sess.

ENGINEERS.
Chief of Engineers. R., 66, 5, iii, 12; **67,** 22; **68,** 30; **69,** 26; **70,** 35; **71,** 34; **72,** 33; **73,** 34; **74,** 40; **75,** 44; **76,** 97, ii, 386; **77,** 101; **78,** 116; **79,** 155; **80,** 207, 210; **81,** 280; **82,** 276; **83,** 284; **84,** 285; **85,** 308; **86,** 302; **87,** 267; **88,** 243; **89,** 282; **90,** 254; **91,** 325; **92,** 311; **93,** 354; **94,** 326; **95,** 363; **96,** 319; **97,** 403, 408; **98,** 394; **99,** 467; **00,** 532, 539; **01,** 523, 527.

Board. Directed (1854) to revise plan for imp. of H., **76,** ii, 386.

In charge:
Lt. Col. J. Kearney, 1854; **76,** ii, 386.
Maj. J. D. Graham, 1856–64. **R.,** S. Ex. D. 42, 35th Cong., 1st sess., p. 63.
Lt. Col. T. J. Cram, 1864. **R., 66,** 17.
Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 126; **67,** 78; **68,** 103.
Maj. D. C. Houston, 1870–84. **R., 70,** 94; **71,** 115; **72,** 124; **73,** 208; **74,** 150; **75,** 211; **76,** ii, 385; **77,** 869; **78,** 1165; **79,** 1523; (Lt. Col.) **80,** 1933; **81,** 2124; **82,** 2158; **83,** 1705.
Capt. W. L. Marshall, 1884–89. **R., 84,** 1866; **85,** 2018; **86,** 1680; **87,** 2061; **88,** 1862.
Maj. C. E. L. B. Davis, 1889–92. **R., 89,** 2072; **90,** 2353; **91,** 2560.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2201; **93,** 2744; **94,** 2091.
Capt. C. F. Palfrey, 1895. **R., 95,** 2640.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2506; **97,** 2692, 2765; **98,** 2325.
Capt. J. G. Warren, 1899–1901. **R., 99,** 2770; **00,** 3697; (Maj.) **01,** 2939, 2981.

Assistants:
H. W. Gunnison. **R.,** S. Ex. D. 42, 35th Cong., 1st sess., p. 66.
Capt. D. P. Heap, **67,** 78.
Wm. H. Hearding. **R., 68,** 103; **72,** 124; **73,** 208; **74,** 150; **77,** 870; **78,** 1166; **79,** 1524; **80,** 1934; **81,** 2124; **82,** 2158; **83,** 1706; **84,** 1866; **85,** 2019; **87,** 2063; **88,** 1863.
J. A. B. Tomkins. **R., 95,** 2642.

EXPENDITURES.
In repairs, 1864–65, $2,171.27, **66,** 18. Total cost, 1854, of p. extension 600′ to each p., and of repairing damages caused by collisions, $161,923.17, **74,** 152.

FINANCIAL STATEMENTS.
Relative to the work of Messrs. Hasbrouck & Conro., contractors with the city of Milwaukee, **76,** ii, 387.

LEGAL PROCEEDINGS.
Limits defined for lawful deposit of dr. or other material in Lake Michigan in vicinity of Milwaukee approv. by Sec. of War, 1899, **99,** 2771.

LEGISLATION.
City empowered by Wisconsin to levy a tax on city property for H. imp., **76,** ii, 386.

OPERATIONS.
1845 or **1846.** Ps. to 10′ of water; dr. at old R. mouth, **76,** ii, 385.
North Cut:
1854–58. 1,388 l. f. n. p. crib built; 1,296 l. f. s. p. crib built; 75,966 c. y. dr. (by the city of Milwaukee and the U. S.). (See Private and corporate work.) S. Ex. D. 42, 35th Cong., 1st sess., pp. 63–65, **76,** ii, 386, 387.
1864–65. Repairs to ps.; sand-tight filling, **66,** 18.
1866–67. Refilling cribs, **67,** 22, 78, 80.
1867–68. Refilling cribs, **68,** 104.
1868–69. 200 l. f. n. p. crib built; 100 l. f. s. p. crib built; dr. in chan., **69,** 26; **76,** ii, 388.
1869–70. 50 l. f. n. p. crib built; 150 l. f. s. p. crib built; slight repairs, **70,** 35, 36, 94; **76,** ii, 388.
1870–71. Slight repairs, **71,** 34, 115.
1871–72. 350 l. f. n. p. crib built; 300 l. f. n. p. superstr. built; 350 l. f. s. p. crib built; slight repairs, **72,** 33, 124; **76,** 389.
1872–73. 160 l. f. n. p. superstr. built; 400 l. f. s. p. superstr. built; guard piles driven; repairs to p. heads and superstr., **73,** 34, 208; **76,** ii, 389.
1873–74. Dr. bet. ps., **74,** 40, 150.
1874–75. 29,825 c. y. dr.; dr. bet. ps.; repairs, **75,** 44, 211.
1875–76. 400 l. f. n. p. superstr. built (masonry); p. heads built, **76,** 97, ii, 385.
1876–77. 160 l. f. n. p. superstr. built (masonry); 800 l. f. s. p. superstr. built; 560 l. f. pile and timber protection, **77,** 101, 869.
1877–78. 98 l. f. n. p. superstr. built (masonry); 331 l. f. s. p. superstr. built; 260 l. f. pile protection; repairs, **78,** 116, 1166.
1878–79. 393 l. f. n. p. superstr. built (masonry), **79,** 155, 1524.
1879–80. 30,000 c. y. dr., **80,** 1934.
1880–81. 24,917 c. y. dr., **81,** 2124.
1881–82. Pile protection driven along 1,131 l. f. of inner p. section; repairs to pile protection and superstr., **82,** 2158, 2159.
1883–84. Repairs to ps., **84,** 1866.
1886–87. 270 l. f. of n. p. superstr. rebuilt, **87,** 2062.
1887–88. 336 l. f. of superstr. rebuilt, **88,** 1863.
1888–89. 340 l. f. of outer section of s. p. rebuilt, **89,** 2073.
1889–90. 60 l. f. of n. p. superstr. built; 22,224 c. y. dr., **90,** 2354.
1891–92. 25,896 c. y. dr. from the chan. bet. the ps.; repairs to n. p., **92,** 2201.
1892–93. 200 l. f. superstr. of s. p. renewed, n. and s. ps. repaired, and piles driven for protection of n. p., **93,** 2745.
1894–95. 33,414 c. y. dr. and minor repairs made, **95,** 2641.
1896–97. 14,272 c. y. dr. and 407 l. f. s. p. rebuilt, **97,** 2692.
1898–99. Ps. repaired; 53,381 c. y. dr.; some old piling removed, **99,** 2771.
1899–00. 28,801 c. y. dr.; minor repairs to s. p., **00,** 3698.

PHYSICAL CHARACTERISTICS.
General characteristics of Milwaukee R. and tributaries, **76,** ii, 385; **95,** 2642; **97,** 2765.
Character of material dr. in North Cut, S. Ex. D. 42, 35th, 1st, pp. 70, 71.
Encroachment on the entrance, 1867, by a bar from the n., **67,** 22; which became so formidable in 1869 that extension of the ps. was necessitated, **68,** 30; **76,** ii, 388.
Effect of R. freshets, **76,** ii, 385.
Shoaling of entrance, **79,** 1524.
Chan. maintained with less dr. than at many other Hs. on Lake Michigan, **93,** 2745; **94,** 2092.
Water-level observations, **96,** 2506; **97,** 2692; **98,** 2326.
H. assumed to be the artificial chan., together with the parts built for its protection, extending from d. w. in Lake Michigan to d. w. in Milwaukee R., to which the artificial chan. gives entrance, **97,** 2765.
Condition of works, **01,** 2939.
Description of, **01,** 2982.

PLANS. (See Projects.)
By Lts. Center and Rose, 1836, imp. entrance by opening the "North or Straight Cut" at a point

about 3,000′ n. of the natural mouth, **76,** ii, 385, 387; **79,** 1523.

By Maj. Graham, 1857, repairs to ps. and dr. at old entrance; est., $48,283; withdrawn with the consent of the Chief of Engineers, **66,** 5, iv, 126.

PRIVATE (CITY) WORK.

$50,000 raised, 1855, by taxation of property in the city of Milwaukee; placed at the disposal of the U. S., for local H. imp. in conjunction with $15,000 app. 1852 by U. S., **76,** ii, 386, 387.

H. built mainly by the city authorities, 1854–57, **69,** 26.

Expend. by the city, 1855–70, $445,971.20, **76,** ii, 387; **79,** 1523.

PROJECTS. (See Plans; Private (city) work.)

By Maj. Graham, 1856, dr. through the Straight Cut (defined by parallel ps. 260′ apart and extending to 12′), **76,** ii, 386, S. Ex. D. 42, 35th, 1st, p. 63.

By Col. Cram, 1865, rendering the ps. sand tight by brush, slab, and st. filling; est., $3,750, **66,** 18.

By Maj. Wheeler, 1867, extension of the ps. each 300′; est., $65,872.82, **67,** 22, 79; **74,** 151.

By Maj. Wheeler, 1868, to extend the ps. 400′ or to 15′; est., $80,000, **68,** 30; **69,** 27.

By Maj. Houston, 1874, cut-st. superstr. on 2,240 l. f. of p.; est., $300,000, **74,** 40, 151.

Foregoing modified, 1875, for dry masonry; est., $120,000, **75,** 211; **76,** ii, 385. Owing to limited app. st. superstr. was limited to the n. p. and a superstr. of wood built on the s. p., **77,** 869.

In 1874 a st. superstr. for a part of the n. p. was adopted, **74,** 151; **75,** 211; **77,** 869. Since that date the proj. completed by chan. 18′ d. with an aggregate of app. from 1852 to 1882 of $313,587.45, and expend. of the city amounting to $321,355.66, **82,** 276.

In 1889 Maj. Davis est. $20,000 as the amount required to rebuild the s. p. superstr. and to repair the n. p., **89,** 2073.

By Capt. Zinn, 1896, for 21′ chan., with min. w. bet. ps. of 200′, and w. outside pierheads of 600′; est., $12,000, and $3,000± an. mainten., **97,** 2767; **99,** 2770.

Capt. Warren recom., 1899, that the entire superstr. of the n. p., because of the disintegration of the concrete (photographs), be rebuilt of concrete monoliths, **99,** 2772.

Maj. Warren recom., 1901, the constr. of a SS. for sur. and inspection work; est., $30,000, **01,** 2940.

SURVEYS.

By Lts. Center and Rose, 1836, **76,** ii, 385.
1864. **66,** 17.
Soundings, 1867. **68,** 103; **76,** ii, 388.
Soundings, 1873. **76,** ii, 390.
Soundings bet. H. ps., **83,** 1706.
Sur. for 21′ au. act June 3, 1896; made, 1896, by Capt. Zinn (see Projects), **97,** 2765.
Ex. for necessary enlargement and satisfactory protection of H. au. act June 6, 1900, **00,** 3698.
Ex. au. act June 6, 1900, for necessary enlargement and suitable protection for H. **R.,** Capt. Warren, Aug. 6, 1900 (H. D. 86, 56th, 2d) (unfav.), **01,** 527, 2981.
Maps. **66,** i; **78,** 1166; **84,** 1866; **93,** 2746; **95,** 2644. (Photographs. See Projects, 1899.)

Part (b), MM-33 Milwaukee Bay, Wis. (Harbor of refuge.)[1]

APPROPRIATIONS.

1881,	$100,000.00,	**81,** 2115.
1882,	100,000.00,	**82,** 2156.
1884,	85,000.00,	**84,** 1864.
1886,	60,000.00,	**86,** 1680.
1888,	70,000.00,	**88,** 1860.
1890,	80,000.00,	**90,** 2353.
1892,	75,000.00,	**92,** 2200.
1894,	45,000.00,	**95,** 2639.
1896,	20,000.00,	**96,** 2505.
1897	168,737.91,	**97,** 2090.
1899,	50,000.00,	**99,** 2769.
1900,	105,650.00,	**00,** 3696.
Total,	959,387.91	

COMMERCE.

Extent of C. to be benefited by imp., and necessity for H. of refuge, **81,** 2119.

CONTRACTS.

1881. J. W. Dennis, crib constr., **81,** 2115.
1882. C. H. Starke, crib constr., **83,** 1704.
1884. C. H. Starke, crib constr., **85,** 2017.
1886. H. B. Herr, crib constr., **87,** 2056.
1888. C. H. Starke, 400 l. f. breakw'r constr., $43,992.28, **89,** 2069.
1890. C. H. Starke, 400 l. f. of breakw'r extension and superstr., $52,711, **91,** 2559.
1892. D. A. McLeod, breakw'r extension and superstr. constr., $65,951.51. Supple. contract made increasing amount of proposed work. **93,** 2742, 2744.
1894. H. B. Herr & Co., 400 l. f. p. extension—timber, st., etc.—$29,738, **95,** 2639. Actual cost, $96.75 l. f., **96,** 2503.
1897. Knapp & Gillen, building 1,600 l. f. breakw'r extension—timber, st., etc.—$149,770, **97,** 2691.
1899. R. B. Rice, breakw'r extension—lumber, st., ironwork—$135,135, **99,** 2770.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 210; **81,** 280, 2120; **82,** 275; **83,** 284; **84,** 284; **85,** 307; **86,** 301; **87,** 266; **88,** 242; **89,** 281; **90,** 254; **91,** 325; **92,** 311; **93,** 353; **94,** 325; **95,** 363; **96,** 318; **97,** 402; **98,** 393; **99,** 466; **00,** 531; **01,** 522.

Boards. Convened, Milwaukee, Wis., Apr. 20, 1881, by S. O. No. 2, C. of E., to **R.** upon proj. for H. of refuge, Milwaukee B., **81,** 2122. (Majs. Comstock, Weitzel, and Robert.).

In charge:

Lt. Col. D. C. Houston, 1880–84. **R.,** **81,** 2113, 2123; **82,** 2155; **83,** 1703.
Capt. W. L. Marshall, 1884–89. **R.,** **84,** 1863; **85,** 2015; **86,** 1679; **87,** 2055, 2060; **88,** 1859.
Maj. C. E. L. B. Davis, 1889–92. **R.,** **89,** 2067; **90,** 2351; **91,** 2553.
Maj. J. F. Gregory, 1892–94. **R.,** **92,** 2199; **93,** 2741; **94,** 2081.
Capt. C. F. Palfrey, 1895. **R.,** **95,** 2637.
Capt. G. A. Zinn, 1896–98. **R.,** **96,** 2502; **97,** 2689; **98,** 2324.
Capt. J. G. Warren, 1899–1901. **R.,** **99,** 2767; **00,** 3695; (Maj.) **01,** 2936.

Assistants:

W. H. Hearding. **R.,** **81,** 2114; **82,** 2156; **83,** 1704; **84,** 1864; **85,** 2017; **87,** 2058; **88,** 1861.
Lt. C. H. McKinstry. **R.,** **94,** 2083.
C. Crossman. **R.,** **96,** 2505.

OPERATIONS.

1881–82. 800 l. f. cribwork built and sunk in constr. of n. arm of breakw'r, **82,** 2157.
1882–83. 200 l. f. cribwork sunk, completing J. W. Dennis's contract for 1,600 l. f. substr.; 550 l. f. crib substr. sunk under Starke's contract, **83,** 1705.
1883–84. 300 l. f. cribwork sunk in extension of n. arm of breakw'r and 850 l. f. superstr. built, **84,** 1864.

[1] Act June 13, 1902, consolidated Milwaukee H. and H. of refuge. [See MM-33(c).]

1884-85. 600 l. f. cribwork built and placed in extension of breakw'r, **85,** 2017.
1885-86. 1 crib placed in extension of break'r; 1,600 l. f. superstr. built, **86,** 1679.
1886-87. 5 cribs placed upon st. foundation in extension of e. break'r, **87,** 2056. Injury to break'r from ice, **87,** 2056, 2058.
1887-88. 100 l. f. substr. and 400 l. f. superstr. completed, **88,** 1860.
1888-89. 50 l. f. break'r extension built under contract, **89,** 2068.
1889-90. Main arm of break'r extended 200'; also 225 l. f. superstr. built, **90,** 2351.
1890-91. Repair and extension of break'r, **91,** 2554.
1891-92. 525 l. f. break'r extension completed, **92,** 2199.
1892-93. Break'r extension, superstr. constr., and renewal in progress, **93,** 2742.
1893-94. Cribs overturned by storm of previous year replaced; 400 l. f. new superstr. built; 1,500 l. f. old superstr. repaired and strengthened; and outer arm of break'r strengthened, **94,** 2082.
1894-95. Constr. of cribs in progress, **95,** 2638.
1895-96. In connection with previous year, 4 cribs constr., aggregating 400 l. f. Decking of n. arm repaired, **96,** 2503.
1896-97. Break'r extension in progress, and shore arm of break'r repaired, **97,** 2689, 2690.
1897-98. In connection with previous year, 15 cribs, each 100' l., built in extension of break'r in progress. Repairs made to break'r, **98,** 2324.
1898-99. 1,700' of crib break'r extension in progress last year completed; minor repairs made to works; preparation made for constr. of substr. and superstr. to complete existing proj.; schooner engaged for part of year as temporary lighthouse, **99,** 2767.
1899-00. Break'r constr. in progress (photographs); minor repairs made to works, **00,** 3695.
1900-01. Constr. of break'r completed; minor repairs to works, **01,** 2936.

PHYSICAL CHARACTERISTICS.

Shore accretions, **93,** 2743; **94,** 2082; **95,** 2638; **96,** 2503.
Anchorage area, **93,** 2743.
Storms damaging works, **93,** 2742; **94,** 2082; **99,** 2768.
Condition of works and soundings, **01,** 2936.

PROJECTS.

By Col. Houston, 1880, H. of refuge in Milwaukee B. by an artificial H. inclosing a part of Lake Michigan within an outer break'r of cribwork upon a random st. foundation; est., $800,000, **81,** 2117, 2119, 2121. Recom. of BE., **81,** 2121, 2122.
Plan of Capt. Marshall for a concrete superstr. faced with cast iron, **87,** 2060. Approv. for trial by BE., **87,** 2061.
In 1889 it was recom. that the execution of the concrete superstr. be suspended, and that the works be continued according to the plan previously followed. Approv., **89,** 2068.
In 1895–96 Capt. Zinn est. $155,650 to complete the existing proj., the extra cost being due to the mainten. of a lightship at the end of the break'r and to repair of the works where damaged by storms during the constr. of the whole work, **96,** 2504; **97,** 2690; **98,** 2325.
Renewal of superstr. of break'r with concrete instead of timber recom., 1899, **99,** 2769.
An opening in break'r, 400' w., creates a shoal by action of carrying sand into H. Recom. that same be closed, making break'r continous; suggestion to extend break'r 1,000', **01,** 2937.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Houston, **81,** 2116.
Maps. **83,** 1704; **84,** 1864, 1866; **85,** 2016; **97,** 2690; **99,** 2768 (photographs). (See Operations, 1900.)

Part (c), MM-33 Milwaukee Harbor, Wis. (Including harbor of refuge.)[1]

APPROPRIATIONS.

1902,	$232,500,	**02,** 2068.
1905,	150,000,	**05,** 2040.
1907,	200,000,	**07,** 1894.
1908,	392,000,	**08,** 1968.
Total,	974,500	

COMMERCE.

Large and of general character. Imp. has effect in controlling rates, **05,** 536.
Importance of port, **06,** 592.
Diagram showing relation to freight and app., **11,** 2332.
1911, 7,600,000± t. (4,860,000 t. coal); ferries connect several RR. systems. Fav. effect of H. on C. is felt through several States to westward, **12,** 995.

CONTRACTS.

1903. W. H. Gillen, constr. of superstr. on break'r and p., **03,** 1859.
1904. J. E. Hathaway & Co., driving pile foundation for boathouse, $854.84, **04,** 2835.
1905. W. H. Gillen, constr. of 1,100' break'r and 600' n. H. p. concrete superstr.; prices listed, **05,** 2041.
1906. J. G. Newbegin, lumber, prices given, **07,** 1896.
1907. Carstens & Earles, lumber, prices given; W. H. Gillen, constr. of concrete superstr. on break'r, prices given; Edw. Gillen Dock, Dredge & Constr. Co., extension of break'r, prices given, **07,** 1896.
1909. W. H. Gillen, reconstr. of s. p., prices given; Manitowoc Dry Dock Co., constr. of sur. and inspection boat, $39,000, **09,** 1970–71.
1910. W. H. Gillen, driving and cutting piles, $9 each, **10,** 2127.
1912. McCormick Lumber Co., timber and plank, $9.50 M ft., **12,** 2519.

ENGINEERS.

Chief of Engineers. R., 02, 446; **03,** 485; **04,** 529, 536; **05,** 535; **06,** 591; **07,** 616; **08,** 661; **09,** 698; **10,** 772; **11,** 830; **12,** 993.

Boards. BERH. approves Maj. Warren's plan for constr. turning-basin and enlarging H. facilities, **04,** 2891.

In charge:
Maj. J. G. Warren, 1902–05. **R., 02,** 2069; **03,** 1857; **04,** 2834, 2888; **05,** 2041.
Maj. W. V. Judson, 1905–09. **R., 06,** 1751; **07,** 1893; **08,** 1966.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1970; **10,** 2126; **11,** 2331; **12,** 2518.
Lt. Col. G. A. Zinn, **11,** 814.

OPERATIONS.

1901-02. Repairs made to decking of break'r, **02,** 2067.
1902-03. 1,621 c. y. dr. (US.); work on n. p. and break'r in progress, **03,** 1857.

[1] Act June 13, 1902, consolidated Milwaukee H. and H. of refuge.

1903-04. 2,100 l. f. break'r superstr. completed, also 67 foundation blocks made for H. p. superstr.; steam launch and boathouse for same constr., **04,** 2834.

1904-05. 250 l. f. break'r and 1,050 l. f. n. p. superstr. built, completing proj.; work on new proj. for constr. of concrete superstr. on break'r and p. in progress, **05,** 2038.

1905-06. 5,972 c. y. dr. (U. S.); 175′ superstr. on break'r and 600′ n. H. p. superstr. built; minor repairs to office building; damages by storm repaired, **06,** 1751.

1906-07. 925 l. f. superstr. built on break'r, completing proj.; minor repairs to s. H. p.; work on 3,800 l. f. of break'r superstr. in progress; work of extending 980′ break'r in progress, **07,** 1893.

1907-08. 1,940 l. f. superstr. built; 75% s. foundation in place on extension, **08,** 1966.

1908-09. Bldg. of concrete break'r superstr. completed; work on crib extension in progress; all cribs sunk and 80% superstr. built; constr. of new s. p. in progress; steel sur. and inspection boat built, **09,** 1971.

1909-10. Work on extension of break'r completed; 14 caissons sunk in place; pile p. completed; portion of old s. p. removed in constr. of new s. p., **10,** 2126.

1910-11. 72,905 c. y. dr. (contract); work on s. p. completed; repairs to plant, **11,** 2331.

1911-12. Repairs and supervision of plant, **12,** 2518.

PHYSICAL CHARACTERISTICS.

Condition of works, **02,** 2067; **03,** 1857; **04,** 2835; **05,** 2038; **06,** 1752; **07,** 1894; **08,** 1967; **09,** 1971; **10,** 2126; **11,** 2331.

Damage by storms, **06,** 1751.

Orig. d. at mouth of R., 4½′; no H. existed. Milwaukee 85 m. n. of Chicago, Ill., and 85± m. w. of Grand Haven, Mich.

PROJECTS.

Act June 13, 1902, au. concrete superstr. on 2,350′ of break'r and 1,050′ on n. H. p., **03,** 485.

Act Mar. 3, 1905, au. concrete superstr. on 1,100′ of break'r and 600′ on n. H. p., **05,** 536.

Act Mar. 2, 1907, au. mainten. of 21′ chan., rebuilding s. p., building 3,800′ concrete superstr. on break'r and extension of 1,000′; est., $592,000, **07,** 617.

SURVEYS.

Pre. ex. and sur. of H. for imp. and enlargement, and constr. of turning-basins, au. act June 13, 1902. **R.,** Maj. Warren, 1902 and 1903; est., $318,581 (H. D. 120, 58th, 2d), **04,** 536, 2888.

Maps:
H. entrance and H. of refuge, **03,** 1858.
Soundings and work to be done; soft-coal diagram, **06,** 1754.
Of H., **11,** 2332.

Part (d), MM-33 Milwaukee (Inner) Harbor, Wis.

APPROPRIATIONS.

1905, $100,000, **05,** 2042.

COMMERCE.

Description of, **04,** 2888.
See other parts.
Proj. should have material effect in controlling rates, **12,** 996.

ENGINEERS.

Chief of Engineers. R., 04, 536; **05,** 536; **06,** 593; **07,** 618; **08,** 663; **09,** 699; **10,** 774, 781; **11,** 831; **12,** 995.

Board. BERH. approv. Maj. Warren's plan for turning-basins to enlarge H., **04,** 2891.

In charge:
Maj. J. G. Warren, 1904–06. **R., 05,** 2042.
Maj. W. V. Judson, 1906–09. **R., 06,** 1756; **07,** 1897; **08,** 1969.
Maj. Thos. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1972; **10,** 2129; **11,** 2333; **12,** 2521.
Lt. Col. G. A. Zinn, **12,** 974.

PHYSICAL CHARACTERISTICS.

Description of, **04,** 2893.
Condition of work; water levels, **05,** 538, 2042; **12** 2521.
Orig. condition not definitely known; Rs. of H. dr. to 21′ by city of Milwaukee, **12,** 995. (See Part A.)
Milwaukee R. navigable 2¾ m.; Menominee, 2± m.; Kinnickinnick, 2¼± m., **12,** 996.

PROJECTS.

Act Mar. 3, 1905, au. excavation of 4 turning-basins in the Menominee R., and of chans. (1) Menominee R., 100′ w. to mouth, 150′ w. to H. entrance, (2) Kinnickinnick R., 100′ to 150′ w. from mouth to uppermost turning-basin in R. (all chans. to be 21′ d.) on condition that city donate necessary land, revet or dock all turning-basins and chans., and alter or rebuild brs. to permit passage of largest vessels; est., $318,581, **05,** 537; **12,** 995.

Act June 30, 1906, au. Sec. of War to modify proj. by omitting turning-basin in Kinnickinnick R., **06,** 593; act May 28, 1908, au. Sec. of War in his discretion, to proceed with Kinnickinnick R. work as soon as city complies with condition relating to this particular locality, **12,** 995.

Act June 25, 1910, modifies existing proj. by w. chan. along Jones Isld. and dr. off of certain points in Menominee R., but conditions of 1905 proj. to be complied with by city, **10,** 2129; **12,** 996.

At 1912, no work on proj. had been done, pending full compliance by city with condition named above, **12,** 996.

SURVEYS.

Ex. and sur. of H. for enlargement and constr. of turning-basins, au. act June 13, 1902, also of R. at mouth of H. **R.,** Maj. Warren, 1902 and 1903; est., $318,581 (H. D. 120, 58th, 2d), **04,** 536, 2888.

Ex. and sur. au. act Mar. 3, 1909, for outer H. **R.,** Maj. Bromwell, May 12, Oct. 9, and Dec. 11, 1909, submits plan, involving modification of existing proj. for inner H.; est., $345,000 (H. D. 667, 61st, 2d) (see Engineers) **10,** 781.

Maps.(H. D. 667, 61st, 2d.)

MM-33(e) MILWAUKEE AND ROCK RIVER CANAL, WIS.

APPROPRIATIONS.

July 1, 1864, $225,276.83.
Of this amount $76,492.77 was paid to the canal company and $148,784.06 to Wisconsin, which aided the building of the canal. (Treas. Doc. 373, 1882.)

MM-35(a) SOUTH MILWAUKEE HARBOR, WIS.

APPROPRIATION.

1896, $5,000, **96,** 2510.

COMMERCE.

H. such that it was of little value to C. before imp., **98,** 2329; of no benefit to general C., **00,** 3701.

In 1904, none, **04,** 2906; **06,** 594.

CONTRACTS.

1896. P. W. Galloway, extending n. p. 185 l. f. timber, st., etc.; total, $4,509.43, **97,** 2697. Actual cost, $23.61 l. f., **98,** 2329.

ENGINEERS.

Chief of Engineers. R., 95, 364; **96,** 320; **97,** 403; **98,** 395; **99,** 468; **00,** 533; **01,** 523; **02,** 447; **03,** 486; **04,** 530, 536; **05,** 538; **06,** 594.

Board. BERH. reviews Maj. Warren's **R.;** imp. not justified by demands of existing C., **04,** 2912.

In charge:

Capt. C. F. Palfrey, 1895. **R., 95,** 2642.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2509; **97,** 2696; **98,** 2328.

Capt. J. G. Warren, 1899–1905. **R., 99,** 2775; **00,** 3701; (Maj.) **01,** 2942; **02,** 2070; **03,** 1860; **04,** 2838, 2905; **05,** 2043.

Maj. W. V. Judson, 1905–06. **R., 06,** 1756.

Assistant. J. A. B. Tomkins. **R., 95,** 2642.

OPERATIONS.

1897–98. N. p. extended 185 l. f., **98,** 2329.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2642; **04,** 2905.

H. on w. shore of Lake Michigan, about 9 m. s. of Milwaukee H., and at the mouth of Oak Creek, a small stream about 20 m. l. N. and s. of the creek the shore is very bold. Only slight protection is given from n. and ne. gales, but a point extending e. into the lake protects the H. from s. gales. 18′ is obtained 1,200′ from the shore, **95,** 2642. Orig. d. at mouth varied from 3′ to absolute closure, **96,** 2509.

Chan. dimensions, **96,** 2510; **97,** 2696.

Shoaling, **96,** 2510; **97,** 2696.

Water-level observations, **95,** 2643.

PRIVATE (CORPORATE) WORK.

Description of work done by South Milwaukee Co. before U.S. undertook imp., **95,** 2642.

2 ps., s. 300′ l. and the n. 600′ l., built by South Milwaukee Co., clear opening bet., 200′, **95,** 2642.

PROJECTS.

In 1894 est. it would cost $138,000 to constr. proper H. entrance, **95,** 2643; by dr. and maintain. chan. 18′ x 200′ bet. ps. extending from the shore line to the 21′ contour in Lake Michigan, the least distance bet. the ps. to be 250′, the plan of imp. au., **96,** 2510.

SURVEYS.

Sur. au. act Aug. 17, 1894; made, 1894, by Maj. Gregory (see Projects), **95,** 2641.

Sur. au. act June 13, 1902, for modification of existing plan, and constr. of H. suitable for C. **R.,** Maj. Warren, 1903; 2 plans; ests., $620,000 and $300,000; inadvisable to constr. H. "at present time" (H. D. 116, 58th, 2d), **04,** 530, 536, 2903.

Maps. **95,** 2644.

MM-36(a) RACINE HARBOR, WIS.[1]

APPROPRIATIONS.

1844,	$12,500.00	**66,** iii, 35.
1852,	10,000.00	
1864,	3,600.00	
1866,	23,910.00	
1867,	45,000.00,	**67,** 22.
1869,	*22,275.00,	**69,** 22.
1870,	10,000.00,	**70,** 36.
1871,	10,000.00,	**71,** 34.
1873,	20,000.00,	**73,** 34.
1874,	10,000.00,	**74,** 40.
1875,	10,000.00,	**75,** 44.
1876,	8,000.00,	**76,** 97.
1878,	10,000.00,	**78,** 116.
1879,	6,000.00,	**79,** 156.
1880,	6,000.00,	**80,** 1938.
1881,	6,000.00,	**81,** 2127.
1882,	7,000.00,	**82,** 2160.
1884,	7,000.00,	**84,** 1868.
1886,	10,000.00,	**86,** 1683.
1888,	10,000.00,	**88,** 1865.
1890,	17,500.00,	**90,** 2358.
1892,	25,000.00,	**92,** 2205.
1894,	20,000.00,	**95,** 2647.
1896,	27,000.00,	**96,** 2514.
1899,	50,000.00,	**99,** 2778.
1900,	67,650.00,	**00,** 3704.
1902,	20,000.00,	**02,** 2072.
1905,	30,000.00,	**05,** 2044.
1905,	6,284.67,	**05,** 2044.
1907,	50,000.00,	**07,** 1902.
1909,	5,000.00,	**09,** 1975.
1910,	243,000.00,	**10,** 2130.
Total,	808,719.67	(incl. misc., $809,135.82, **12,** 2522.)

COMMERCE.

Of Racine and Milwaukee compared, **67,** 80.

Important, **67,** 80; **68,** 107; **76,** ii, 391; **79,** 1528.

General and local C. benefited by H., **81,** 2127.

Racine a manu. place, and in C. ranking next to Milwaukee. Connected by rail with n., s., and w. **97,** 2771.

Importance of imp., **06,** 595.

Proj. has effect in controlling rates, **09,** 701.

Net registered t., 1911, 1,112,294 t., and 7,500 passengers, **12,** 2523.

CONTRACTS.

1866. Sanger, Ledlie & Corse, materials, labor, and dr., **66,** iv, 122, 123; **67,** 82, 83.

1867. F. M. Danaher, materials and labor; Ledlie & Corse, materials; R. N. Gore, materials, **67,** 82.

1870. F. M. Knapp, materials and labor, **71,** 116.

1871. F. M. Knapp, materials and labor, **71,** 116.

1873. F. M. Knapp, materials and labor, **73,** 210; Racine Dredging Co., dr., **74,** 152.

1874. F. M. Knapp, materials and labor, **75,** 213.

1875. F. M. Knapp, materials and labor, **75,** 213; Albert Conro, dr., **75,** 214.

1878. Chicago Dock & Dredging Co., materials and labor, **79,** 1527.

1879. Knapp & Gillen, p. extension, **80,** 1938.

1881. Knapp & Gillen, superstr. constr., **81,** 2127.

1884. G. H. Sager, superstr. reconstr., **85,** 2020.

1886. S. O. Dixon, dr., 22½¢ c. y., **86,** 1683; H. B. Herr & Co., superstr. reconstr., **87,** 2070.

* Allotment.

[1] Sur.—**R.,** Nov. 1, 1837, est., $63,038.38; Feb., 1840, est., $48,623.56; 1843, est., $30,352; Apr. 20, 1854, est., $18,956.30; Dec. 31, 1855, est., $17,422.73; Sept. 14, 1864, est., $3,600. (H. D. 482, 55th, 2d.)

1890. C. H. Starke, dr., 25¢ c. y., **90,** 2357.
1891. S. O. Dixon, dr., 19½¢ c. y., **91,** 2563; H. Truman and G. Cooper, 200 l. f. of p. extension, $13,219.20, **91,** 2564.
1892. D. A. McLeod, 250 l. f. p. extension (timber, st., etc.), $19,442.65, **93,** 2750. Actual cost for n. p., $88.80 l. f.; for s. p., $52.80 l. f., **94,** 2095.
1894. Knapp & Gillen, 250 l. f. extension of ps., timber, st., etc.; bid, 150 l. f., $9,140.60, **95,** 2648. Actual cost for n. p., $72.94; for s. p., $41.64, **96,** 2512.
1896. Racine Dredge Co., dr., 11¼¢ c. y (($2,-812.50). Knapp & Gillen, 250 l. f. p. extension, timber, st., etc.; aggregate bid, $11,434.20, **97,** 2700. Actual cost l. f., $43.36, **97,** 2699.
1899. S. O. Dixon, removing old dike, $6,650; dr., 8.8¢ c. y. ($17,600). R. B. Rice, breakw'r and p. extension (lumber, st., piles, ironwork), $68,915, **99,** 2779.
1904. Bennett & Schnorbach, moving 2 cribs at s. end of breakw'r, prices given, **04,** 2840.
1905. Great Lakes Towing & Dock Co., dr., 11.924 c. y., 20¢ c. y., **05,** 2043. Bennett & Schnorback, repairs to damaged p., $1,549.09, **05,** 2044.
1907. Leathem & Smith Towing & Wrecking Co., 2,124 t. s., $1.29 t.; S. O. Dixon, dr., 23¢ c. y., **07,** 1898. Somerville Bros., furn. and delivering lumber, prices given, **07,** 1902.
1908. P. W. Galloway, bldg. 196′ crib breakw'r, prices given, **08,** 1972. Great Lakes Dredge & Dock Co., dr., 18.6¢ c. y., **08,** 1970, 1971.
1910. Greiling Bros. Co., reinforced caissons and removing old p., prices given, **11,** 2335.
1911. Riebolt, Wolter & Co., constr. of wooden st. barge, $10,950, **11,** 2335.
1912. Greiling Bros. Co., dr., 17.8¢ c. y., **12,** 2522.

ENGINEERS.

Chief of Engineers. R., 66, 5, iii, 11; **67,** 22, 26; **68,** 30; **69,** 27; **70,** 36; **71,** 34; **72,** 33; **73,** 34; **74,** 40; **75,** 44; **76,** 97; **77,** 102; **78,** 116; **79,** 155; **80,** 207; **81,** 281; **82,** 276; **83,** 285; **84,** 285; **85,** 308; **86,** 302; **87,** 268; **88,** 244; **89,** 282, 286; **90,** 255; **91,** 326; **92,** 312; **93,** 355; **94,** 326; **95,** 364; **96,** 320; **97,** 404, 409; **98,** 395; **99,** 468, 473; **00,** 533; **01,** 523; **02,** 447; **03,** 486, 665; **04,** 530; **05,** 538; **06,** 594, 645; **07,** 619; **08,** 664; **09,** 700; **10,** 775; **11,** 833; **12,** 997.

Boards:
Recom. extension of the ps. (see Estimates), **76,** ii, 391.
Board appointed pursuance of act Mar. 3, 1905. **R.,** July 15, 1905, on wave action affecting H. at Racine, Wis., printed in H. D. 62, 59th Cong., 1st sess., **06,** 645, 1757.

In charge:
Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th Cong., 1st sess.
Col. T. J. Cram, 1864–65. **R., 66,** 16.
Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 121; **67,** 80; **68,** 107.
Maj. D. C. Houston, 1870–84. **R., 70,** 95; **71,** 116; **72,** 126; **73,** 210; **74,** 152; **75,** 212; **76,** ii, 390; **77,** 871; **78,** 1167; **79,** 1526; (Lt. Col.) **80,** 1935; **81,** 2126; **82,** 2159; **83,** 1707.
Capt. W. L. Marshall, 1874–88. **R., 84,** 1867; **85,** 2019; **86,** 1682; **87,** 2069; **88,** 1865.
Maj. C. E. L. B. Davis, 1889–92. **R., 89,** 2076, 2108; **90,** 2356; **91,** 2562.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2204; **93,** 2748; **94,** 2094.
Capt. C. F. Palfrey, 1895. **R., 95,** 2645.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2511; **97,** 2698, 2768; **98,** 2330.
Capt. J. G. Warren, 1899–1905. **R., 99,** 2776, 2815; **00,** 3702; (Maj.) **01,** 2942; **02,** 2071; **03,** 1861, 2883; **04,** 2841; **05,** 2043.
Maj. W. V. Judson, 1905–09. **R., 06,** 1757; **07,** 1898; **08,** 1969.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1973; **10,** 2129; **11,** 2334; **12,** 2521.

Assistants:
Capt. D. B. Heap. **R., 67,** 80.
Wm. H. Hearding. **R., 68,** 107; **72,** 126; **73,** 210; **74,** 152; **77,** 871; **78,** 1167; **79,** 1527; **80,** 1936; **81,** 2126; **82,** 2160; **83,** 1708; **84,** 1868; **85** 2021; **87,** 2071.
W. T. Casgrain, in charge of sur. of Racine Reef, **67,** 124.

ESTIMATES. (See Plans and Projects.)

By BE., Lt. Col. J. B. Kearney, president, 1854, addl. for completion, $18,956.30, **76,** ii, 391.
By Maj. Graham, p. extension and dr., $17,422.73, S. D. 42, 35th Cong., 1st sess., pp. 63, 175.
By Col. Cram, 1864–65, extension of ps. and dr., $23,910, **66,** 17, 24.
By Maj. Wheeler, 1866, extend s. p. as proj. by Col. Cram, $22,833.36; addl. for dr. and further extension, $85,249.12; total, $108,082.48, **66,** iv, 122, 123; **74,** 153.
By Capt. Heap, extending s. p. to l. equal with n. p., $42,817.32, **67,** 81.
By Maj. Houston, 1870, completion, $40,000, **70,** 95. 1872. Extension n. p., $20,000, **72,** 127. 1873. Completion of ps., $15,000, **73,** 211; **74,** 153. 1876. To replace old superstr., $15,000, **76,** 390. 1877. Extension n. p., $14,000, **77,** 871; **79,** 156.

EXPENDITURES.

1866. On repairs to previous work, $3,860.79, **66,** 17.

LEGAL PROCEEDINGS.

Limits defined for lawful deposit of dr. and other material in Lake Michigan in vicinity of Racine approv. by Sec. of War, 1899, **99,** 2777.
Land to be removed under proj. of 1899 given to the U.S. by city, **99,** 2777.

OPERATIONS.[1] (See Private work.)

1854–55. N. p., 64 l. f. crib p. and 64 l. f. superstr. built; dr. in chan., S. D. 42, 35th Cong., 1st sess., p. 62.
1857–58. S. p., 220 l. f. crib p. and 220 l. f. superstr. built, S. D. 42, 35th Cong., 1st sess., p. 62.
1864–65. Repairing and securing former work, **66,** 16, 17.
1866–67. N. p., 800 l. f. crib p. built (previous to 1867); s. p., 256 l. f. crib p. built (also 600 l. f. built previous to 1867); 5,962 c. y. dr., **67,** 80, 83.
1867–68. N. p., 288 l. f. crib p. and 160 l. f. superstr. built; s. p., 256 l. f. superstr. built; 6,912 c. y. dr.; a new crib, replacing one lost in a storm, sunk, **68,** 30, 107, 108; **76,** ii, 391.
1868–69. N. p., 32 l. f. crib p. and 128 l. f. superstr. built; dr. and repairs to s. p., **69,** 27; **76,** ii, 391.
1869–70. N. p., 32 l. f. superstr. built; s. p., 288 l. f. superstr. built; 288 l. f. superstr. s. p. rebuilt, **70,** 36, 95; **76,** ii, 391.
1870–71. S. p., 128 l. f. crib p. built; repairs to ps., **71,** 34, 116; **76,** ii, 391.
1871–72. S. p., 128 l. f. crib p. built; uneven settlement of cribs; repairs to ps., **72,** 33, 126; **76,** ii, 392.
1872–73. S. p., 256 l. f. superstr. built; dr. in chan.; repairs to ps., **73,** 34, 210; **76,** ii, 392.
1873–74. N. p., 100 l. f. crib p. built; 16,773 c. y. dr.; dr. in chan.; repairs to ps., **74,** 40, 152; **76,** ii, 392.
1874–75. N. p., 50 l. f. crib p. and 100 l. f. superstr. built; dr. in chan.; repairs to ps., **75,** 44, 212.
1875–76. N. p., 50 l. f. superstr. built; chan. dr. to 15′ of water, **76,** 97, ii, 390; **77,** 871.
1876–77. Repairs to ps., **77,** 102, 871.
1877–78. 600 l. f. old superstr. replaced, **78,** 116, 1167.
1878–79. N. p., 50 l. f. crib p. built; 17,000 c. y. dr., **79,** 155, 1527.
1879–80. 25,931 c. y. dr. from chan. bet. ps.; one 50′ crib sunk in extension of n. p. and superstr built over same, **80,** 1936.
1880–81. 50 l. f. of cribwork added to n. p. and damages to p. by collision repaired, **81,** 2126.
1881–82. 50 l. f. superstr. built; 7,757 c. y. dr. from bet. ps., **82,** 2160.
1882–83. Repairs to crib at e. end of s. p., **83,** 1708.

[1] History of operations to 1875, **76,** ii, 391; to 1879, **79,** 1526.

1883-84. 17,466 c. y. dr. from bet. ps.; repairs to e. end of n. p., **84,** 1868.

1884-85. 340 l. f. of n. p. superstr. cut down and rebuilt, **85,** 2021.

1885-86. Dr. bet. ps. continued under S. O. Dixon's contract, **86,** 1682.

1886-87. Dr. completed under Dixon's contract; 745 l. f. of s. p. superstr. rebuilt, **87,** 2070.

1888-89. 36,356 c. y. dr., **89,** 2076.

1889-90. 9,627 c. y. dr., **90,** 2357.

1890-91. 4,089 c. y. dr. from chan. bet. ps.; extension of s. p. in progress, **91,** 2563.

1891-92. 10,194 c. y. dr.; s. p. extension completed and superstr. built thereon, **92,** 2205.

1892-93. 15,047 c. y. dr., **93,** 2748.

1893-94. N. p. extended 150′ and s. p. 100 l. f.; old outer end of n. p. required, and 8,964 c. y. dr., **94,** 2095.

1894-96. In connection with previous year n. p. extended 150 and s. p. 100 l. f.; 21,371 c. y. dr.; n. and s. ps. repaired; sand fences built, **95,** 2646; **96,** 2512, 2513.

1896-97. 29,639 c. y. dr.; s. p. extended 250 l. f.; 281 l. f. sand catches constr. and ps. repaired, **97,** 2698, 2699.

1897-98. 284 l. f. revet. built, 5,998 c. y. dr., and minor repairs made to ps., **98,** 2330, 2331.

1898-99. Minor repairs to n. p.; sheet piling of s. p. in progress, **99,** 2777.

1899-00. 78,552 c. y. dr.; 800 l. f. old p. and dike removed and some st. transferred; s. p. extended 300′ by 3 cribs; work in progress on breakw'r; 647 l. f. s. p. provided with sheet piling and part of s. p. rebuilt; minor repairs made to both ps.; wrecked barge of contractor removed and part of cargo placed in works, partly defraying cost of wreck removal, **00,** 3703.

1900-01. 113,478 c. y. dr.; transfer of 152.8 cords st.; tearing out 200 l. f. old p. and dock; all work completed on this contract. 5 cribs (100′ l. each) built and placed, and 600′ breakw'r superstr. built; s. p. extended 300′; proj. completed. 520 l. f. n. p. rebuilt, 500 l. f. plank walk renewed, and minor repairs made to both ps., **01,** 2942.

1901-02. Repairs to H. ps. and breakw'r made, dr. for restoration of chan. d. commenced, **02,** 2071.

1902-03. 2,608 c. y. dr.; minor repairs to H. p. and protection piling, **03,** 1861.

1903-04. Work in progress on moving 2 cribs, **04,** 2839.

1904-05. 11,924 c. y. dr., moving 2 cribs, and repairs made to p. damaged by vessel, **05,** 2043.

1905-06. 27,200 c. y. dr., work of moving cribs completed, 298 l. f. old crib p. removed and rebuilt with piles, **06,** 1757.

1906-07. 19,505 c. y. dr., and st. deposited along breakw'r, **07,** 1898.

1907-08. 39,138 c. y. dr., 196′ breakw'r extended, and minor repairs made to st. p. and breakwater, **08,** 1970.

1908-09. 28,762 c. y. dr., work on breakw'r extension in progress, and minor repairs to breakw'r, **09,** 1973.

1909-10. 16,184 c. y. dr.; repairs to breakw'r, **10,** 2129.

1910-11. 24,876 c. y. dr., work on building n. breakw'r in progress, 3 caissons being launched, **11,** 2334.

1911-12. Work on building concrete caissons, pile p., removing old p. in progress, **12,** 2521.

PHYSICAL CHARACTERISTICS.

Root R., **67,** 81.

Sunken reef 2 m. off entrance to H., dangerous to coasting vessels, **67,** 26, 81, 124.

Principal trouble at H. caused by the convergent ps., **77,** 871.

Shoaling of water on n. side of ps. since 1870, about 3′; d. of water on s. side increased, **77,** 871, 872.

Shore abrasion bet. Racine and Kenosha, **77,** 872

Description of, **97,** 2769; **99,** 2815.

Shoal formation, **93,** 2748; **95,** 2647; **96,** 2512, 2513; **98,** 2331.

Current observations, **98,** 2331.

H. at mouth of Root R. on w. shore of Lake Michigan, 62 m. n. of Chicago and 23 s. of Milwaukee, **97,** 2769. Nearest H. on n. Milwaukee and on s. Kenosha, **97,** 2771.

Soundings and condition of works, **01,** 2942; **06,** 1757; **12,** 2522.

Description of, with recom. for imp., **07,** 1900.

PRIVATE WORK.

220 l. f. crib p. work by citizens of Racine in 1856–57. Character of work inferior in quality and efficiency to previous work by the U. S., S. D. 42, 35th Cong., 1st sess., pp. 62, 63.

PROJECTS. (See Estimates.)

Orig. proj., 1843, proposed entrance by extension of 2 ps. from mouth of the R., with dr. bet. ps., to give chan. 12′ d. (S. D. 42, 35th Cong., 1st sess., p. 62.) Modifications of this proj. have been to secure increased chan. d. up to 16′, **66,** 17, iv, 121; **67,** 22, **72,** 127; **77,** 102, 871.

By BE., 1854, extension of ps., approv. by Sec. of War, **76,** ii, 391.

By Maj. Graham, 1857, extension of ps. (S. D. 42, 35th Cong., 1st sess., p. 62.)

By Col. Cram, 1865, extension of s. p., pierheads for both ps., and dr. to 12′, **66,** 17, iv, 121.

By Maj. Wheeler, 1865, after extending s. p. as proj. by Col. Cram, to extend both ps. to 15′; dr. bet. ps. to 12′; est., $108,082, **66,** iii, 11, iv, 122. 1867. For a 14′ chan. instead of one of 12′, **67,** 22. 1868. To extend the s. to an equal distance with n. p.; **68,** 30.

By Maj. Houston, 1872, extend the n. p. beyond s. p. 150′, prevent the accretion of shore drift at H. mouth, **72,** 33, 127. 1877. Extension of n. p. at least 100 l. f., the extension of 150′ proj., and subsequently completed in 1872, being deemed insufficient to accomplish purpose intended, **77,** 102, 871.

Total amount app., 1844 to 1886, incl., $237,285. Est. amount required for completion of proj., $25,000, **86,** 303; **87,** 2071.

In 1889 Maj. Davis proposed extension of n. p. 300′ and s. p. 500′. in order to prevent deposition of sand at H. entrance; est., $66,550, which, together with the $15,450 required for completion of the prior proj., made total of $82,000 for completion of projs. for imp. of H., **89,** 2077; **92,** 2204.

By Capt. Zinn, 1897, constr. 900 l. f. sheet piling, and dr. to maintain chan., **97,** 2698.

By Capt. Zinn, 1897, au. act 1899, 21′ chan., by extending ps. and dr.; est., $50,000 (see Legal proceedings), **97,** 2771.

By Capt. Warren, 1899, break'r 30′ x 600′; est., $66,000, **99,** 2777.

Maj. Warren recom., 1901, renewal of 740′ s. p., 300′ sheet piling, decaying, **01,** 2943.

Act June 13, 1902, au. resetting of 2 cribs, s. end of break'r, **03,** 487.

Act Mar. 2, 1907, au. mainten. of 21′ chan., extension of n. break'r, and constr. of s. break'r, **07,** 1900.

Maj. Judson recom. procuring proper dr. plant, **07,** 1900.

Maj. Bromwell, 1909, submits est. for bldg. n. break'r with concrete caissons and pile p., dr., etc., $243,000, **09,** 1973. Au. act June 25, 1910, **10,** 775.

SECRETARY OF WAR.

Approv. plan of imp. involving p. extension submitted by BE., **76,** ii, 391.

SURVEYS.

1865, **66,** 18.

Sur. of Racine Reef, directed by Maj. Wheeler; made by W. T. Casgrain, **67,** 124, 125.

Directed by Maj. Houston, **77,** 871.

Soundings taken, **78,** 1167.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Davis, **89,** 2108.

Sur. with view to chan. 21′ d. au. act June 3, 1896; made, 1897, by Capt. Zinn (**R.** fav.; see Projects), **97,** 2768.

Complete hydrographic sur. made, 1897–98, **98,** 2331.

Sur. to ascertain best plan for protecting against ne. seas au. joint resol. of Jan. 10, 1899; made by Capt. Warren, 1899 (**R.** fav.; see Projects), **99,** 2815.

Reef located and marked by Maj. Warren. Sur. in progress under direction of Maj. W. L. Fisk, in charge of sur. on Northern and Northwestern Lakes,[1] **03,** 665, 2883.

Sur. for protection against ne. storms, au. act June 13, 1902; ample information at hand; sur. ordered not made, **03,** 487.

As to wave action affecting Hs., ex. by BE., printed in H. D. 62, 59th Cong., 1st sess.; **R.,** July 15, 1905, **06,** 645, 1757.

Maps. **66,** No. 14; **83,** 1707; **84,** 1869; **85,** 2020; **93,** 2750; **97,** 2770; **98,** 2332; **03,** 1862; **05,** 2044; **09,** 1974. (Photographs of H. before and during imp., **00,** 3704.)

MM-38 KENOSHA (Southport) HARBOR, WIS.[2]

APPROPRIATIONS.

1844,	$12,500.00	**66,** iii, 35.
1845,	15,000.00	
1852,	10,000.00	
1866,	75,461.41	
1869,	*5,346.00,	**69,** 27.
1870,	10,000.00,	**70,** 36.
1871,	10,000.00,	**71,** 35.
1872,	10,000.00,	**72,** 33.
1874,	10,000.00,	**74,** 40.
1875,	15,000.00,	**75,** 45, 164.
1876,	8,000.00,	**76,** 98, 142.
1878,	8,000.00,	**78,** 117.
1879,	5,000.00,	**79,** 156.
1880,	5,000.00,	**80,** 1940.
1881,	5,000.00,	**81,** 2129.
1882,	6,000.00,	**82,** 2161.
1884,	5,000.00,	**84,** 1870.
1886,	5,000.00,	**86,** 1684.
1888,	7,500.00,	**88,** 1866.
1890,	17,500.00,	**90,** 2361.
1892,	15,000.00,	**92,** 2208.
1894,	15,000.00,	**95,** 2651.
1896,	24,000.00,	**96,** 2518.
1899,	50,000.00,	**99,** 2782.
1900,	135,000.00,	**00,** 3707.
1902,	5,000.00,	**02,** 2074.
1905,	5,000.00,	**05,** 2046.
1907,	22,000.00,	**07,** 1903.
1909,	10,000.00,	**09,** 1976.
1910,	12,500.00,	**10,** 2132.
1911,	11,000.00,	**11,** 2336.
1912,	15,000.00,	**12,** 2524.

Total, 564,807.41 (incl. misc., $564,969.42, **12,** 2524).

COMMERCE.

Importance as a H. of refuge, **76,** ii, 393.
Important, **68,** 109; **76,** ii, 396; **79,** 1531.
C. importance of Kenosha, **67,** 83; **72,** 128; **73,** 212.
RR. interests, **73,** 212; **76,** ii, 396.
The H. No. 13 in the list of Hs. along the w. shore of Lake Michigan in C., **97,** 2784.
Description of, **00,** 3768.
Effect of imp. on rates fav., **09,** 703; **12,** 999.
In 1911, 81,000± t.; chiefly local, **12,** 2525.

CONTRACTS.

1866. Sanger, Ledlie & Corse, materials and labor, **66,** iv, 118; **67,** 58. Parker, Stebbins & Ackerman, dr., 37¢ c. y., **66,** iv, 118; **67,** 58, 85; **76,** ii, 394.

1871. R. A. Conolly, close piling and repairs **71,** 116; **72,** 128.

1872. F. M. Knapp, materials and labor, **73,** 211; **76,** ii, 395.

1874. F. M. Knapp, materials and labor, **75,** 215; **79,** ii, 395.

1875. A. Conro, dr., 20¢ c. y., **75,** 215. Knapp & Gillen, materials and labor, **75,** 216.

1878. Chicago Dredging & Dock Co., p. extension, **76,** 1530.

1879. Knapp & Gillen, p. extension, **80,** 1940.

1881. Knapp & Gillen, p. extension, **81,** 2129.

1882. Knapp & Gillen, removal and reconstr. of superstr., **83,** 1709.

1884. G. H. Sager, reconstr. of superstr., **85,** 2022.

1886. H. B. Herr & Co., superstr. reconstr., **87,** 2072.

1888. C. H. Starke, dr., 19¢ c. y., **89,** 2081.

1889. S. O. Dixon, dr., 17¢ c. y., **90,** 2360.

1890. H. Cooper and G. Truman, p. extension, $9,812, **91,** 2567.

1892. Knapp & Gillen, 150 l. f. p. extension—timber, st., etc.—$13,002, **93,** 2753. Actual cost, $94.78 l. f. for n. p., incl. some superstr.; and $65.64 l. f. for s. p., **94,** 2098.

1894. H. B. Herr & Co., 150 l. f. p. extension—timber, st., etc.—$7,809, **95,** 2652. Actual cost, $68.30 l. f. for n. p. and $43.83 for s. p., **96,** 2517.

1896. Racine Dredge Co., dr., 8⅞ c. y., $3,915, **97,** 2704. McArthur Bros. Co., 250 l. f. p. extension—timber, st., etc.—$12,375.50, **97,** 2705. Actual cost, $49.53 l. f., **98,** 2334.

1899. J. Cape & Sons, pile p. extension, $19,251.34. S. O. Dixon, removing and depositing st., $15,000; moving cribs, $7,000; dr., 6.9¢ c. y. ($24,840). R. B. Rice, break'r and crib extension, $85,695.50, **99,** 2783.

1907. J. G. Newbegin, lumber for constr. of ps. and break'r, $12.95 M ft. b. m., **07,** 1904. P. W. Galloway, building 196′ of crib break'r, prices given, **08,** 1974.

1911. Rieboldt, Wolter & Co., constr. of wooden st. barge, $10,950, **11,** 2337.

1912. Greiling Bros. Co., dr. (15,000 c. y.), 17.8¢ c. y., **12,** 2525.

ENGINEERS.

Chief of Engineers. R., 66, 5, iii, 11; **67,** 22; **68,** 31; **69,** 27; **70,** 36; **71,** 34; **72,** 33; **73,** 34; **74,** 40; **75,** 44; **76,** 97; **77,** 102; **78,** 117; **79,** 156; **80,** 208; **81,** 282; **82,** 277; **83,** 285; **84,** 286; **85,** 309; **86,** 303; **87,** 268; **88,** 244; **89,** 283, 286; **90,** 256; **91,** 326; **92,** 312; **93,** 355; **94,** 327; **95,** 365; **96,** 320; **97,** 404, 409; **98,** 396; **99,** 469, 473, 474; **00,** 534, 539; **01,** 524; **02,** 448; **03,** 488; **04,** 531; **05,** 539; **06,** 595, 645; **07,** 620; **08,** 665; **09,** 702; **10,** 776; **11,** 834; **12,** 998.

R. of Col. J. J. Abert, Corps of Topographical Engineers, 1854, **76,** ii, 394.

Boards. Report of a BE., 1854, referred to. Difference of opinion bet. board and Maj. Graham as to the dr. within R., **76,** ii, 394.

Created act Mar. 3, 1905, to inquire into effect of wave action on H., **05,** 2046. **R.,** July 15, 1905, printed in H. D. 62, 59th Cong., 1st sess. Recom. addition of 200′ to landward end of break'r, **06,** 645, 1759.

In charge:

Maj. J. D. Graham, 1855–57. **R.,** S. Ex. D. 42, 35th Cong., 1st sess., p. 61.

Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 118; **67,** 83; **68,** 108.

Maj. D. C. Houston, 1870–84. **R.,** 70, 95; **71,** 116; **72,** 127; **73,** 211; **74,** 153; **75,** 214; **76,** ii, 393; **77,** 873; **78,** 1168; **79,** 1529; (Lt. Col.) **80,** 1938; **81,** 2128; **82,** 2161; **83,** 1708.

Capt. W. L. Marshall, 1884–89. **R., 84,** 1869; **85,** 2021; **86,** 1684; **87,** 2072; **88,** 1866.

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* Allotment.

[1] See Northern and Northwestern Lakes, Bull. 13, Supple. No. 4, Aug. 14, 1903.

[2] Sur.—**R.,** Dec. 1, 1837, est., $90,703, $101, 897.15; 1844, est., $50,592; July 18, 1854, est., $24,128.78; Sept. 30, 1857, est., $58,047.24. (H. D. 482, 55th, 2d.)

Maj. C. E. L. B. Davis, 1889–92. **R., 89,** 2079, 2103; **90,** 2360; **91,** 2565.
Maj. J. F. Gregory, 1892–94. **R., 92,** 2207; **93;** 2751; **94,** 2097.
Capt. C. F. Palfrey, 1895. **R., 95,** 2649.
Capt. G. A. Zinn, 1896–98. **R., 96,** 2516; **97,** 2702, 2772; **98,** 2333.
Capt. J. G. Warren, 1899–1905. **R., 99,** 2781, 2817; **00,** 3706, 3767; (Maj.) **01,** 2945; **02,** 2073; **03,** 1863; **04,** 2841; **05,** 2045.
Maj. W. V. Judson, 1905–09. **R., 06,** 1759; **07,** 1903; **08,** 1972.
Maj. T. H. Rees, **09,** 683.
Maj. C. S. Bromwell, 1909–12. **R., 09,** 1975; **10,** 2131; **11,** 2336; **12,** 2523.
Lt. Col. G. A. Zinn, **11,** 814.

Assistants:
Capt. D. P. Heap. **R., 67,** 83; **68,** 108.
W. H. Hearding, **72,** 127; **73,** 211; **74,** 153. **R., 77,** 874; **78,** 1168; **79,** 1530; **80,** 1939; **81,** 2128; **82,** 2162; **83,** 1709; **84,** 1870; **85,** 2022; **87,** 2073.
1st Lt. Douglass MacArthur, **08,** 648.

ESTIMATES. (See also Plans and Projects.)

By BE., 1854, est. of already-approv. plans would cover expend. under Maj. Graham's plans, **76,** ii, 394.
By Maj. Graham, 1857, addl. for completion, $58,047.24, S. Ex. D. 42, 35th Cong., 1st sess., pp. 61, 175, $75,461.41, **66,** 5.
By Maj. Wheeler, 1866, dr. in chan. and extension of ps., $55,150.42, **66,** iv, 118, 119.
By Capt. Heap, 1867, p. extension, $47,905.74, **67,** 84.
By Maj. Wheeler, 1867, repairs and dr., $55,000, **67,** 22, 23; **68,** 31; **69,** 27.
By Capt. Heap, 1868, repairs and p. extension, $70,000, **68,** 109.
By Maj. Houston, 1870, repairs to superstr. and dr., $45,000; addl. for extending each p. 224′ $95,000, **70,** 96.
For dr. in 1873–74, $15,000, **72,** 128; **73,** 212.
P. extension, repairs and dr., $30,000, **74,** 155.
For completion of existing proj., $80,000; this amount provided for probable p. extension for 20 years, but does not include any repairs which might be necessary in the meantime, **77,** 874. Orig. est. probably the app. of 1866, increased by the est., 1868, viz, $145,461.41, **74,** 155. For completion of existing proj., $67,000, **79,** 156. For mainten. of H. an an. sum of $8,000, **79,** 1530.

LEGAL PROCEEDINGS.

Limits defined for lawful deposit of dr. or other material in Lake Michigan in vicinity of Kenosha approv. by Sec. of War, 1899, **99,** 2781.
Land required under proj. of 1899 given to U. S. Part of this land not needed proposed to be returned to orig. owners, **99,** 2782.

OPERATIONS.[1]

1854–55. Probable dr. in front of ps., and repairs of old work, **76,** ii, 394.
1866–67. S. p., 352 l. f. crib p. built; 40,050 c. y. dr.; n. p. 970′ l., s. p. 800′ l., **67,** 22, 86; **76,** ii, 394; **79,** 1529.
1867–68. N. p., 192 l. f. crib p. built; s. p. 352 l. f. superstr. built; 68,420 c. y. dr., **68,** 31, 109; **76,** ii, 394.
1868–69. Displaced crib joined to main p. by pile work, **69,** 27, 28; **76,** ii, 394.
1869–70. End crib of n. p. removed by storm, **70,** 36, 95; **76,** ii, 394, 395.
1870–71. N. p., 552 l. f. superstr. built; 552 l. f. old superstr. s. p. replaced; repairs, **71,** 34, 35, 116; **76,** ii, 395.
1871–72. N. p., 100 l. f. superstr. built; cribs refilled; displaced crib protected, **72,** 33, 128; **76,** ii, 395.
1872–73. N. p., 50 l. f. crib p. built; 412 l. f. superstr. built; 361 l. f. old superstr. n. p. replaced, **73,** 34, 211; **76,** ii, 395.
1873–74. N. p., 50 l. f. superstr. built, **74,** 40, 153.
1874–75. N. p., 50 l. f. crib p. built; 430 l. f. superstr. built; 430 l. f. superstr. on n. p. replaced, **75,** 44, 214.
1875–76. N. p., 50 l. f. crib p. built; chan. dr., **76,** 97, ii, 393.
1876–77. N. p., 100 l. f. superstr. built; repairs of ps., **77,** 102, 873.
1877–78. S. p., 9,919 c. y. dr., **78,** 117, 1168.
1878–79. N. p., 100 l. f. crib p. built; total l. of n. p., 1,450′; total l. of s. p., 1,306′, **79,** 156, 1530.
1879–80. Crib 16½′ x 24′ x 50′ sunk upon st. foundation in extension of n. p.; 100 l. f. superstr. built; 14′ chan. dr. bet. ps. by city authorities, **80,** 1939.
1881–82. Crib 16½′ x 24′ x 50′ sunk in extension of n. p.; 26 cords riprap placed along n. face of crib, **82,** 2162.
1882–83. Superstr. upen 2 cribs built up and latter decked over; n. wall timbers built up 7½′, **83,** 1709.
1883–84. Double row of sheet piling 170′ l., driven along s. face of s. p.; 20 cords of st. placed in cribs and around end of p.; repairs to s. p., **84,** 1870.
1884–85. 355 l. f. superstr. and outer section of s. p. removed and rebuilt, **85,** 2022.
1886–87. 408 l. f. of s. p. superstr. cut down and rebuilt under contract, **87,** 2072.
1887–88. 49 piles driven along chan. face of inner section of s. p., and 7,272 c. y. sand dr. from the chan., **88,** 1866.
1888–89. 24,893 c. y. dr., **89,** 2080.
1889–90. 5,248 c. y. dr., **90,** 2360.
1890–91. 20,918 c. y. dr.; 3 cribs built in extension of s. p., **91,** 2566.
1891–92. 3 cribs sunk, filled, and decked, extending the s. p. 150′; 8,640 c. y. dr., **92,** 2207.
1892–93. 10,197 c. y. dr., and extension of ps. in progress, **93,** 2752.
1893–94. 2,354 c. y. dr., and in connection with preceding year n. p. extended 100′ and s. p. 50′, **94,** 2098.
1894–95. P. extension in progress, **95,** 2650.
1895–96. In connection with preceding year, n. p. extended 50′ and s. p. 150′; 10,751 c. y. dr., **96,** 2516, 2517.
1896–98. 68,350 c. y. dr., 2 wrecks removed, extension of s. p. in progress, and chan. face of s. p. revet., **97,** 2703; s. p. extended 250 l. f., and minor repairs made to ps., **98,** 2333.
1898–99. Minor repairs; sheet piling of s. p. in progress, **99,** 2781.
1899–00. 200,779 c. y. dr.; 1,006 cords st. transferred, removing about two-thirds of old n. p.; removal of 3 cribs in progress; break'r under constr.; about 925 l. f. pile p. built; part of s. p. provided with sheet piling (photographs), **00,** 3707.
1900–01. 180,793 c. y. dr.; moving 3 cribs from old p. and placing in new p.; transferring 1,952 cords of st.; removing 1,500′ of old p.; 362 l. f. of p. superstr. rebuilt; minor repairs to decking and plank walk of s. p., **01,** 2945.
1901–02. Minor repairs to break'r and s. p.; 146 cords st. deposited along ps., **02,** 2073.
1906–07. 3,650 c. y. dr., **07,** 1903.
1907–08. Work on extension of break'r begun, foundation partly riprapped, constr. of crib under way; 20,854 c. y. dr., **08,** 1972.
1908–09. 27,620 c. y. dr. and work on break'r extension continued, **09,** 1975.
1909–10. 8,883 c. y. dr.; work on extension of break'r completed, **10,** 2131.
1910–11. 24,951 c. y. dr., **11,** 2336.
1911–12. Contract entered into for dr., **12,** 2525.

PHYSICAL CHARACTERISTICS.

General, of Pike Creek, **76,** ii, 393.
Little or no current or scouring force in R., **72,** 128; **76,** ii, 393.
Character of lake bed unfav. to the proper settlement of cribs, **73,** 211.

[1] **1867.** Crib lost after having been paid for, **74,** 155.
1871. One crib broken and lost, **74,** 155; **75,** 214. These accidents assumed to be due to the manner in which the cribs were bolted, **76,** ii, 395.
1872. Chan. bet. ps., 9½′ x 150′ x 1,200′ below mean lake level, **72,** 128. Abstracts of materials used and work done, **67,** 85, 86; **68,** 109; **72,** 128.

Advance of shore line, **76,** ii, 394; **77,** 874.
Description of, **97,** 2773; **99,** 2817; **00,** 3768.
Shoaling, **93,** 2752; **94,** 2098; **95,** 2650; **96,** 2517; **97,** 2778.
Lake currents and their effects on lake Hs., **97,** 2775.
H. at the mouth of Pike Creek on the w. shore of Lake Michigan; orig. no H., **97,** 2773.
Deterioration of structures, **11,** 2336.
Condition of imp., **12,** 2524.

PLANS. (See Estimates and Projects.)

By Capt. Heap, 1867, on completion of the proj. of 1866, to further extend the ps. 224 l. f. each, **67,** 83; **68,** 109.

PRIVATE WORK.

In 1852, **76,** ii, 394.
Dr. in chan. in 1873–74, **74,** 154.
Docking, **77,** 875.
146′ of s. p. built by citizens, **79,** 1530.

PROJECTS. (See Estimates and Plans.)

By BE., **76,** ii, 394.
By Maj. Graham, 1857, extension of ps. and sand barrier, with dr. to 13′ in chan. and basins to give required capacity for a H. of refuge, S. Ex. D. 42, 35th Cong., 1st sess., p. 175.
By Maj. Wheeler, 1866, p. extension and dr. to 12′ (16′), **66,** iv, 118; **67,** 83.
Dr. in chan., 1870, **72,** 128.
P. extension and dr. to 16′, **73,** 34, 212.
From 1844 to 1879, incl., $194,307.41 had been app. for p. extension, dr., and repairs, **80,** 208.
By Maj. Houston, 1879, completion of Maj. Wheeler's proj. of 1866 for chan. of 12′ and navigable w. by p. extension and dr., $67,000, **79,** 156; **80,** 1938.
By Maj. Davis, 1889, extension of n. p. 300′ and s. p. 600′, to prevent the forming of a bar at the H. entrance; est., $82,000, **89,** 2080; making total est. $149,000, **92,** 2208.
By Capt. Zinn, 1897, extending s. p. 525′; removing and rebuilding n. p. from shore to shore to 21′ contour, to obtain entrance w. of 250′, and increasing d. in chan. and basin to 21′ and 20′, resp., and w. chan. bet. ps.; est., $125,000, **97,** 2783.
By Capt. Warren, 1899, for 600′ break'r (6 cribs), 30′ w. on a pile foundation; est., $66,000, **99,** 2818.
Act June 13, 1902, au. change in location and direction of break'r, **02,** 448.
Existing proj., amended May 31, 1906, au. extension of 100′ shoreward to break'r, **06,** 1759.
Up to 1907, following is summary of proj.: Orig., 1852, was for 13′ bet. ps. 150′ apart; modified as follows: 1866, 16′; 1889, n. p. extension, 300′; s. p., 600′; 1890, dr. in "The Basin"; 1899, s. p. extension, increasing w. bet. ps. to 250′ by rebuilding n. p., building 600′ to break'r, and increasing d. in chan. and basin to 21′ and 20′, resp.; 1902, extension of break'r 100′ shoreward. Orig. proj. done 1900, with exception of 1902 work. Total expend., incl. mainten., $475,815.37, **12,** 998.
Existing proj., au. act Mar. 2, 1907, provides for mainten. of 21′ entrance chan., 20′ basin, and existing works, and for an extension of 200′ to the landward end of the break'r; est., $22,000, **07,** 620

SECRETARY OF WAR.

Plan of BE., 1854–55, conditionally approv., **76,** ii, 394.

SURVEYS.

By Maj. Graham, 1855. See Map, **66,** No. 6.
By Maj. Graham, 1857, S. Ex. D. 42, 35th Cong., 1st sess., p. 61.
By Maj. Wheeler, 1867, **79,** 1529.
Directed by Maj. Houston and made by W. H. Hearding, **77,** 874. Soundings taken, 1878, **78,** 1168.
Ex. for H. of refuge au. act Aug. 11, 1888; made, 1888, by Maj. Davis (**R.** unfav.), **89,** 2103.
Sur. for 21′ and a basin of 20′ au. act June 3, 1896; made, 1897, by Capt. Zinn (see Projects), **97,** 2772.
Sur. for best plan to prevent injurious action of ne. seas au. by joint resol. of Jan. 10, 1899; made by Capt. Warren, 1899 (**R.** fav.; see Projects), **99,** 2817.
Ex. for enlargement of basin au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** recom. that nothing be done until completion of proj.), **00,** 3768.
Maps. **66,** No. 6; **78,** 1168; **84,** 1870; **85,** 2022; **93,** 2752; **97,** 2784; **03,** 1863. (Photographs of works), **00,** 3708.

MM-39 WAUKEGAN HARBOR, ILL.[1]

APPROPRIATIONS.

1852,	$15,000,	act Aug. 30.
1880,	15,000,	**80,** 1942.
1881,	15,000,	**81,** 2130.
1882,	20,000,	**82,** 2163.
1884,	20,000,	**84,** 1871.
1886,	20,000,	**86,** 1686.
1888,	25,000,	**88,** 1868.
1890,	35,000,	**90,** 2364.
1892,	25,000,	**92,** 2212.
1894,	20,000,	**95,** 2656.
1896,	20,000,	**96,** 2522.
1899,	5,500,	**99,** 2787.
1902,	100,000,	**02,** 2076.
1903,	240,000,	**03,** 1865.
1904,	5,000,	**04,** 2845.
1905,	30,000,	**05,** 2048.
1907,	50,000,	**07,** 1906.
1909,	*5,000,	**09,** 1978.
1910,	10,000,	**10,** 2134.
1911,	10,000,	**11,** 2338.
1912,	5,000,	**12,** 2527.
Total,	690,500	(incl. misc., $690,796.76, **12,** 2527).

COMMERCE.

Local C. does not warrant any expend. by U. S. on imp., **73,** 247.
Benefits to C. by constr. of H. of refuge, **73,** 247, 249.
Importance of, increasing, **93,** 2756; **94,** 2101; **95,** 2654.
Faith in a large increase in the C. shown by enterprise of city and private persons in increasing H. d., **99,** 2787.
Description of, **00,** 3775.
General, and rapidly increasing, **03,** 489.
Imp. has had considerable effect in controlling rates, **10,** 778.
1911, 213,925 t., **12,** 1001.
H. of great convenience to general C., being terminus of Elgin, Joliet & Eastern Ry., known as the Chicago Outer Belt Line. H. in close connection with all rys. entering Chicago, **12,** 1001.

CONTRACTS.

1881. Knapp & Gillen, p. constr., **81,** 2131.
1888. Green Bay Dredge & Pile Driver Co., dr., 12¢ c. y., **89,** 2084.
1890. J. M. Laurie, st. ballast, $7 cord; G. Kirk & Son, pine plank, $19.50 M f.; Cairo Lumber Co., oak timber, $24.50 M f.; Chicago Forge & Bolt Co., rods, bolts, and spike, 2¼¢ lb.; F. Bairstow, coal, $4.25 t., **91,** 2570.
1892. Green Bay Dredge & Pile Driver Co., dr., 13⅜¢ c. y., **92,** 2212. Knapp & Gillen, 376 l. f. p. extension, timber, st., etc., $17,167.50, **93,** 2757. Actual cost, n. p., $69.20; s. p., $39.53 l. f., **94,** 2101.
1894. H. B. Herr & Co., 241 l. f. p. extension, timber, st., etc., $9,995.21, **95,** 2656. Actual cost, $39.79 and $44.12 l. f., **96,** 2521.

* Allotment.
[1] Sur.—**R.,** Dec. 31, 1855. Est., $137,966.10. (H. D. 482, 55th, 2d.)

1896. Illinois Dredging Co., dr., 8¢ c. y. ($9,760), **97,** 2708.

1903. Hausler & Lutz Towing Co., constr. 1,000′ n. p. extension, 1,400′ s. p. extension, and 588′ breakw'r (prices given); Lydon & Drews Co., constr. 770′ pile revet., removing 935′ old p., and dr. 337,000 c. y. sand, mud, etc., and 25,000 c. y. hardpan and bowlders (prices given), **03,** 1865.

1907. F. E. Worden, 296,784 f. b. m., timber and plank for repairing ps. (prices given), **07,** 1906.

1908. Adolph Green, building pile p., removing old p., and dr. (prices given), **08,** 1975. Great Lakes Dredge & Dock Co., hire of dr. plant, $21.50 per hour, **08,** 1976.

1912. Greiling Bros. Co., dr. 20,000 c. y., 17.8¢ c. y., **12,** 2527.

DOCUMENTS. (Not published in reports.)

S. D. 16, 34th Cong., 1st sess.

ENGINEERS.

Chief of Engineers. R., 66, 7; **79,** 157; **80,** 208, 210; **81,** 282; **82,** 277; **83,** 286; **84,** 286; **85,** 309; **86,** 303; **87,** 269; **88,** 245; **89,** 284; **90,** 256; **91,** 327; **92,** 313; **93,** 356; **94,** 328; **95,** 365; **96,** 321; **97,** 405; **98,** 396; **99,** 470, 474; **00,** 535, 539; **01,** 524; **02,** 449; **03,** 488; **04,** 532; **05,** 540; **06,** 596; **07,** 621; **08,** 666; **09,** 703; **10,** 777; **11,** 836; **12,** 1000.

In charge:

Maj. J. D. Graham, T. E., 1857. **R.,** S. D. 16, 34th Cong., 3d sess., p. 140; S. D. 42, 35th Cong., 1st sess., p. 61.

Maj. D. C. Houston, 1872–82; charged with ex. of H., **72,** 36; **73,** 36; **79,** 157. **R., 73,** 247; (Lt. Col.) **80,** 1940, 1942, 1946; **81,** 2129; **82,** 2163; **83,** 1710.

Capt. W. L. Marshall, 1884–89. **R., 84,** 1871; **85,** 2023; **86,** 1685; **87,** 2074; **88,** 1867.

Maj. C. E. L. B. Davis, 1889–92. **R., 89,** 2081; **90,** 2361; **91,** 2568.

Maj. J. F. Gregory, 1892–94. **R., 92,** 2209; **93,** 2754; **94,** 2100.

Capt. C. F. Palfrey, 1895. **R., 95,** 2653.

Capt. G. A. Zinn, 1896–98. **R., 96,** 2519; **97,** 2706; **98,** 2336.

Capt. J. G. Warren, 1899–05. **R., 99,** 2786; **00,** 3709, 3769, 3772; (Maj.) **01,** 2951; **02,** 2075; **03,** 1864; **04,** 2843; **05,** 2047.

Maj. W. V. Judson, 1905–09. **R., 06,** 1760; **07,** 1905; **08,** 1974.

Maj. T. H. Rees, **09,** 683.

Maj. C. S. Bromwell, 1909–12. **R., 09,** 1977; **10,** 2133; **11,** 2337; **12,** 2526.

Assistants:

W. J. Bryson. **R., 73,** 248.

W. H. Hearding. **R., 80,** 1944; **82,** 2164; **83,** 1711; **84,** 1871; **85,** 2024; **87,** 2076; **88,** 1868.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, breakw'r, $137,966.10, S. D. 42, 35th Cong., 1st sess., pp. 61, 175.

By Maj. Houston, pile ps. and dr., $75,000, **73,** 248; breakw'r and dr., $817,850, **73,** 248.

LEGISLATION.

Bill introduced in Congress for the transfer of some U. S. land not needed for H. purposes to the city of Waukegan in 1896–97. A part of this land was once given by the city to the U. S., and another part formed by accretions. **97,** 2707. Transfer made under lease, containing certain restrictions, in 1897, **98,** 2337.

OPERATIONS.

1855. One crib 30′ l. and 25′ w. placed in line of proposed breakw'r, afterward carried away during a storm; since then nothing done, **73,** 247.

1881–82. 260 l. f. pile p. built and breach in same repaired, **82,** 2164.

1882–83. 224 l. f. pile p. built, **83,** 1712.

1883–84. 226 l. f. pile p. built, **84,** 1871.

1884–85. 298 l. f. pile p. built, **85,** 2023.

1885–86. Pile p. extended 32 l. f., **86,** 1685.

1886–87. 209 l. f. of n. p. and 96′ of s. p. built, **87,** 2074, 2076. Injury to work by gale, **87,** 2076.

1887–88. 71 l. f. of s. p. completed and p. filling replaced by hired labor, **88,** 1867.

1888–89. 177 l. f. of s. p. built by hired labor; 17,805 c. y. dr. under contract, **89,** 2083.

1889–90. 63,069 c. y. dr.; 60 cds. st. placed in s. p., **90,** 2360.

1890–91. N. p. extension in progress; 192 l. f. built, **91,** 2570.

1891–92. 200 l. f. of n. p. extension built; 304 l. f. of sand fence built; 9,715 c. y. dr., **92,** 2211.

1892–93. 50,292 c. y. dr., and p. extension in progress, **93,** 2756.

1893–94. N. p. extended 216 l. f. and s. p. 160 l. f., **94,** 2101.

1894–96. P. extension in progress; **95,** 2654; s. p. extended 240 l. f., ps. repaired, and sand fences constr., **96,** 2521.

1896–97. 128,862 c. y. dr., and repair of n. p. in progress, **97,** 2707.

1897–98. 58,249 c. y. dr.; 38 l. f. sea wall revet. constr.; shore line of H. riprapped for 360 l. f.; n. pile p. repaired, and repair of s. p. in progress, **98,** 2337.

1898–99. Over 200 l. f. s. p. repaired; bulkheads for protection of p. ends of both ps. built; minor repairs made to works, **99,** 2787.

1901–02. 261 l. f. superstr. s. p. rebuilt, and 192 l. f. sand fence built by hired labor, **02,** 2075.

1902–03. 7,056 c. y. dr. by U. S. and 19,666 c. y. by contract; pre. arrangements made for beginning work on ps., **03,** 1864.

1903–04. 1,000′ n. p. and 600′ s. p. extended, **04,** 2843.

1904–05. 800′ s. p. extended, break'r built and superstr. placed; 1,097 l. f. n. p. removed, 882 l. f. sheet-pile revet. built, and 280,900 c. y. sand, mud, etc., and 20,216 c. y. hardpan and bowlders dr., **05,** 2047.

1905–06. 5,004 c. y. dr. by U. S. plant, **06,** 1760.

1906–07. 240 l. f. timber superstr. placed on s. p., 1,125 l. f. pile p. constr. by hired labor, and 9,129 c. y. dr. by U. S. plant, **07,** 1905.

1907–08. 6,426 c. y. dr. under contract, and work on building pile p. and removing old p. in progress, **08,** 1974.

1908–09. 14,866 c. y. dr. and p. work in progress, **09,** 1977.

1909–10. 33,823 c. y. dr., work of building pile p. and removing old p. completed, 19,630 c. y. dr. by U. S. plant, and minor repairs made to break'r, **10,** 2133.

1910–11. Repairs to break'r and H. ps., **11,** 2337.

1911–12. 7,791 c. y. dr., and st. deposited in and around break'rs and H. p., **12,** 2526.

PHYSICAL CHARACTERISTICS.

General, of Waukegan R. and H.; advance of shore line; shoaling offshore, **73,** 247, 248.

Description of, on w. shore of Lake Michigan, 35 m. n. of Chicago and 50 m. s. of Milwaukee, **00,** 3770.

Shoaling of chan. dr. by city, **00,** 3710.

PLANS. (See Estimates and Projects.)

By Maj. Graham, 1855, break'r parallel to shore line, protecting heads of the br. ps., 1,380′ l.; est., $137,966.10, S. D. 42, 35th Cong., 1st sess., pp. 61, 175, **73,** 247.

By Maj. Houston, 1873, H. sufficient for local purposes, pile p. and excavation of basin; est., $75,000, **73,** 248. To afford H. of refuge, a rectangular system of outside break'rs, with entrance 500′ w.; est., $817,850, **73,** 248.

PRIVATE (CITY AND CORPORATE) WORK.

Br. p. 700′ l. to 12′ water, built in 1855; much dilapidated in 1873, **73,** 249.

Slip from n. end of dr. basin (outer) opened by private persons, and believed to be of much value in increasing usefulness of H., 1895–96, **96,** 2521.

In 1898 Waukegan dr. chan. bet. ps. 60′ w. and 18′ d., **98,** 2337; **99,** 2786. Redr. by dock company, 1900; 36,650 c. y. being removed, **00,** 3710.

Description of, **00,** 3770.

26,357 c. y. dr. by city and private parties, **01,** 2951.

PROJECTS. (See Estimates and Plans.)

In 1855, under app. of $15,000 of 1852, one crib placed in line of proposed break'r, which was subsequently destroyed, **73,** 247; **80,** 1942.

By Lt. Col. Houston, 1879, formation of H. of refuge at Waukegan by 2,590 l. f. of pile-p. constr., inclosing basin of 16 acres and a dock front of 1,260′, the basin to be dr. to 12′, with ultimate formation of inner basin; est., $110,000, **80,** 1943, 1946. Increased $50,000 in 1883, **83,** 1711.

From 1880 to 1886, incl., $90,000 app., when it was est. $71,000 required to complete proj., **87,** 2075.

In 1889 Maj. Davis proposed extension of both ps. 500′ farther into lake, at est. of $75,000; this, together with $71,000, amount est. 1887 for completion of proj., makes $146,000 for completion of imp., **89,** 2083, 2084; **92,** 2209.

By Capt. Zinn, 1896, modifying existing proj. to provide connecting n. and s. arms of n. p. by revet. work to revet. of a private company; for dr. H. entrance to 13′ and H. to same d., with w. of 300′, beginning at n. boundary of U. S. land; and riprapping new H. shore line with heavy st. for about 400′, beginning at s. p., **97,** 2706.

Capt. Warren est., 1899, $345,000 for 20′ chan. 235′ w. at entrance, **00,** 3770.

Act June 13, 1902, au. extending n. p. 1,000′, s. p. 1,400′, building 600′ break'r, increasing H. w. and d. of chan. to 20′, **02,** 2075.

SURVEYS.

Directed by Maj. Graham, 1855, S. D. 42, 35th Cong., 1st sess., p. 3, **73,** 247.

Ex. by Maj. Houston, 1873, **73,** 248.

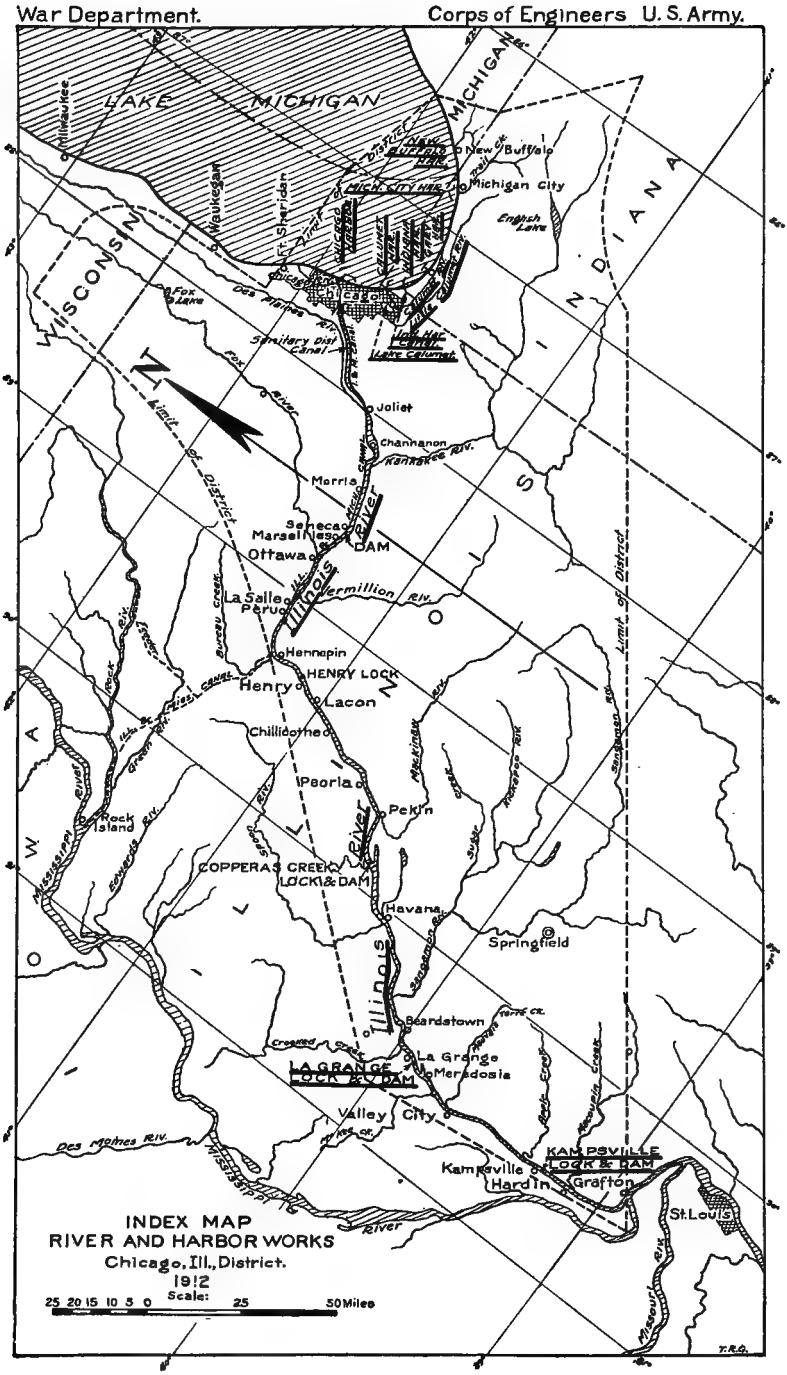
Au. act Mar. 3, 1879, **79,** 157; made, 1879, by Maj. Houston, **80,** 1942.

Ex. and sur. for 20′ chan. 300′ w. au. act Mar. 3, 1899; made, 1899, by Capt. Warren (**R.** partly fav.), **00,** 3769.

Maps. **83,** 1710; **84,** 1871; **85,** 2023; **89,** 2084; **05,** 2048; **06,** 1760.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

NN.—CHICAGO, ILL., DISTRICT.


War Department.
Corps of Engineers U. S. Army.
LAKE MICHIGAN
MICHIGAN
WISCONSIN
INDIANA
ILLINOIS
IOWA
Milwaukee
Waukegan
Ft. Sheridan
New Buffalo
Michigan City
English Lake
Chicago
Fox Lake
Des Plaines Riv.
Sanitary Dist Canal
Lake Calumet
Joliet
Channanon
Kankakee Riv.
Morris
Seneca
Marseilles
Ottawa
DAM
La Salle
Peru
Vermillion Riv.
Hennepin
HENRY LOCK
Henry
Lacon
Chillicothe
Peoria
Pekin
Rock Island
COPPERAS CREEK LOCK & DAM
Havana
Springfield
Beardstown
La Grange
Meredosia
LA GRANGE LOCK & DAM
Valley City
Des Moines Riv.
KAMPSVILLE LOCK & DAM
Kampsville
Hardin
Grafton
St. Louis
Mississippi River
Missouri Riv.
Limit of District
INDEX MAP
RIVER AND HARBOR WORKS
Chicago, Ill., District.
1912
Scale:
25 20 15 10 5 0 25 50 Miles
T.R.G.

NN.—CHICAGO, ILL., DISTRICT.

In charge of U. S. Engineer Office,
Federal Bldg., Chicago, Ill.

MISSISSIPPI TRIBUTARIES.

NN 1 [1] **Illinois R., Ill. (Trib. to Miss. R. at Grafton, Ill. (1) (See JJ)**
NN 2 Sangamon R., Ill. (1) (See JJ)
NN 3 Mackinaw R., Ill. (1) (See JJ)
NN 4 Vermilion R., Ill. (1) (See JJ)
NN 5 Mazon R., Ill. (1) (See JJ)
NN 6 Kankakee R., Ill. (1) (See JJ)
NN 7 Des Plaines R., Ill (1) (See JJ)
NN 8 Du Page R., Ill. (1) (See JJ)
NN 9 Fox R., Ill. (1) (See JJ)
NN 10 Little Vermilion R., Ill. (1) (See JJ)
NN 11 Spoon R., Ill. (1) (See JJ)
NN 12 Illinois and Michigan Canal (1) (and Miss R., near Rock Island, Ill.) (See p. 1235)

LAKE MICHIGAN WATERS.

NN 13 Lake Michigan.
NN 14 Chicago H., Ill. (13)
NN 15 Chicago R., Ill. (14)
NN 16 Chicago Sanitary and Ship Canal, Ill. (13)
NN 17 Calumet H., Ill. (13)
NN 18 Calumet R., Ill. (17)
NN 19 Lake Calumet, Ill. (18)
NN 20 Wolf Lake, Ill. and Ind. (13, 18)
NN 21 Little Calumet R., Ill. (19)
NN 22 Indiana H., Ind. (13)
NN 23 Michigan City H., Ind. (13)
NN 24 Trail Creek, Ind. (13)
NN 25 New Buffalo H., Mich. (13)

NN-1 ILLINOIS RIVER, ILL.

Part.	Title.	Period.	Appropriations.
a	Illinois R., Ill.	1852–1912	$2,286,650.00
b	Ill. and Mich. Canal—Acquisition and enlargement of	1882–1887	
c	Illinois and Des Plaines Rs., Ill.	1882–1912	175,000.00
d	Illinois R., Ill. (operating and care)	1890–1912	277,356.16
	Total		2,739,006.16

NN-1 (Part a) ILLINOIS RIVER, ILL.[2]

APPROPRIATIONS.[3]

1852, $30,000, **66,** iii, 35; **79,** 1569.
1867, [4] 20,000, **67,** 270.
1868, 84,150, **67,** 54; **70,** 60; **79,** 1575.
1870, 100,000, **70,** 60.
1873, 100,000, **73,** 53.
1874, 75,000, **74,** 60.
1875, 75,000, **75,** 65.
1876, 40,000, **76,** 84.
1878, 75,000, **78,** 119, 1192.
1879, 40,000, **79,** 159, 1571.
1880, 110,000, **80,** 1994.
1881, 250,000, **81,** 2181.
1882, 175,000, **82,** 2246.
1884, 100,000, **84,** 1949.
1886, 112,500, **86,** 1706.
1888, 200,000, **88,** 1891.
1890, 200,000, **90,** 2410.
1892, 100,000, **92,** 2259.
1894, 35,000, **95,** 2717.
1896, $40,000, **96,** 2599.
1899, 100,000, **99,** 2844.
1902, 75,000, **02,** 2114.
1907, [5] 100,000, **07,** 1933.
1910, 30,000, **10,** 2163.
1912, 20,000, **12,** 2558.

Total, 2,286,650, **12,** 2558, and H. D. 482, 55th, 2d.

COMMERCE. (See Defense.)

Work demanded by interests of, **68,** 371.
Value of imp. to, **68,** 452; **71,** 278.
Importance of the imp., **87,** 2122.
C. advantages of a waterway bet. the Great Lakes and the Mississippi R., **90,** 2454.
List of merchant SS. navigating the Mississippi and its tributaries, with drafts from 7′ to 9′ and less, **90,** 2538, 2540.

[1] See footnote 2 on p. 1234.
[2] Sur.—**R.,** Feb. 14, 1868; est., $12,745, and $4,245 an. mainten. (H. D. 482, 55th, 2d.)
[3] Statement of reversions to U. S. Treas., **72,** 312; statement of total applied to js. and dr., **76,** 679; **79,** 1576, 1584.
[4] Allotted from Western and Northwestern Rs.
[5] $50,000 for imp. below Copperas Creek, and $50,000 for imp. from Copperas Creek to La Salle, the first app. for latter section.

Lockages and t. passing La Grange Lock, 1892, **92,** 2296, 2297.

Since the completion of the locks, a steady increase in the number of passages of boats and in t., **95,** 2716; **97,** 2816; **98,** 2437.

500,000± t. an., **95,** 2717; **96,** 2599.

T., 1896, such that less than one-tenth cent per m. paid for the mainten. of the works, though the practicable d. only 4′, **96,** 2598, 2599.

Since constr. of the La Grange Lock, 1889, traffic increased 200%, up to 1899, **99,** 481.

Importance of, **07,** 1936.

See Physical Characteristics.

Effect on rates such that were R. closed to navigation rates would unquestionably rise on adjacent RRs., and volume of freight affected would be large, **12,** 1022.

CONTRACTS.[1]

1869. F. D. Van Wagenen, dr. bet. the town of Henry and Copperas Creek, **70,** 322; completed July, 1871, **72,** 311.

1870. J. T. Hayden (expend. of app. of 1870, $100,000), dr. and constr. of dams bet. Copperas Creek and mouth of R., **71,** 277, 282; **72,** 311; completed July, 1872, **72,** 311.

1873. W. Johnson, foundation for the lock near Copperas Creek, delay and tardiness of, **74,** 317, 318, 322. Allotment exhausted and contract completed (Sept., 1874), **75,** 467, 469, 475.

1874. W. Johnson (expend. of allot., $20,000, from app. of 1873), hire of dr. and equipment, $12 per hour, to restore chans. of 1871–72, **74,** 319; completion of, Aug., 1874, **75,** 469. G. Williams (expend. of app. of 1874, $75,000), dr., constr. of dams, js., and repairs, **75,** 470, 475; contract extended; completed Oct., 1875, **75,** 470, 475; **76,** 676, 683.

1875. W. Patrick (expend. of app. of 1875, $75,000), dr., constr. of dams and js., **75,** 471, 475; **76,** 676; contract extended to Oct., 1876, **76,** 683; completed, **77,** 546, 549; renewed with, Oct., 1876 (for expend. of allot. of $10,000 from app. of 1876, $40,000), on same terms as preceding contract; completed Oct., 1876, **77,** 546, 549, 553.

1877. H. S. Brown (expend. of balance of app. of 1876), dr., constr. of dams and js., **77,** 546, 549, 553; extended to June, 1878, **78,** 1197.

1884. Sanger & Moody, st., **84,** 1950.

1886. Sanger & Moody, lock st., **87,** 2124.

1887. Williams, White & Co., lock-gate iron, **87,** 2124.

1891. Sanger & Moody, furnishing and delivering st., **92,** 2261.

1892. Russell Wheel & Foundry Co., iron and steel lock-gate fittings, $9,850.65; H. B. Wyeth, yellow-pine timber, $19 M f. b. m.; A. R. Beck Lumber Co., pine lumber, $18.70, and pine plank, $16.95 M f. b. m., **92,** 2260.

1904. Marsh & Bingham Co., lumber, **04,** 2953.

DEFENSE.

Imp. required to pass gunboats from Mississippi R. to lakes, **68,** 442. Naval and military considerations fav. imp., **68,** 450; **70,** 304; **79,** 1573.

DOCUMENTS. (Not printed in reports.)

H. D. 16, 40th Cong., 1st sess., **67,** 37, 269; **79,** 1573.

ENGINEERS.

Chief of Engineers. R., 67, 37; **68,** 54; **69,** 46; **70,** 60; **71,** 54; **72,** 50; **73,** 53; **74,** 60; **75,** 64; **76,** 83; **77,** 85; **78,** 119; **79,** 158, 1584; **80,** 211, 212; **81,** 286; **82,** 281; **83,** 289; **84,** 290; **85,** 313; **86,** 308; **87,** 274; **88,** 249; **89,** 289; **90,** 261; **91,** 332; **92,** 318, 319; **93,** 362; **94,** 334; **95,** 372; **96,** 327; **97,** 415, 421; **98,** 404; **99,** 480; **00,** 545; **01,** 531; **02,** 454; **03,** 495; **04,** 541; **05,** 548; **06,** 609; **07,** 635; **08,** 682; **09,** 718; **10,** 796; **11,** 853; **12,** 1020.

Boards. Organization of; sur. and ex. under direction of, 1867, **67,** 270. Plan of imp.; recom. the w. and d. of existing canal from Bridgeport to Lake Joliet; thence by R. (except at Grand Rapids) to mouth, **68,** 440; **79,** 1574, 1576. (Lt. Col. Wilson and W. Gooding, U. S. C. E.)

In charge:

Lt. Col. J. H. Wilson, 1866–70; **67,** 273. **R., 66,** ii, 41; **67,** 269; **68,** 389, 438; **69,** 217; **70,** 303; **71,** 264.

Col. J. N. Macomb, 1870–77. **R., 71,** 258; **72,** 281; **73,** 437; **74,** 317; **75,** 467; **76,** 674; **77,** 546.

Capt. G. J. Lydecker, 1877–82; **78,** 1190. **R., 78,** 1190; **79,** 1569, 1572; (Maj.) **80,** 1990, 1995; **81,** 2174.

Maj. W. H. H. Benyaurd, 1882–86. **R., 82,** 2245; **83,** 1751; **84,** 1948; **85,** 2052; **86,** 1705.

Maj. T. H. Handbury, 1886–87. **R., 87,** 2119.

Capt. W. L. Marshall, 1888–99. **R., 88,** 1889; **89,** 2120; **90,** 2407, 2419, 2454, 2574; **91,** 2611, 2630; **92,** 2255, 2294; **93,** 2822; **94,** 2150; (Maj.) **95,** 2714; **96,** 2597; **97,** 2815. 2882; **98,** 2436; **99,** 2841.

Maj. J. H. Willard, 1899–1903. **R., 00,** 3798; **01,** 3006; **02,** 2113; (Lt. Col.) **03,** 1915.

Maj. C. S. Riché, 1903–05. **R., 04,** 2951.

Lt. Col. W. H. Bixby, 1905–06. **R., 05,** 2137.

Maj. C. S. Riché, 1906–10. **R., 06,** 1781; **07,** 1935; **08,** 2003; **09,** 2005.

Maj. Chas. Keller, 1910–11. **R., 10,** 2163.

Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2366; **12,** 2554.

Assistants:

Capt. P. C. Hains, **66,** ii, 41.

J. Worral, **67,** 270. **R., 68,** 459.

G. B. Griffin, **67,** 270; **68,** 389.

G. A. Keefer, **67,** 270; **68,** 389; **69,** 217.

L. L. Nichols, **67,** 270; **68,** 389.

R. E. McNath, **67,** 271; **68,** 389. **R., 69,** 219; **70,** 313; **71,** 271; **72,** 311.

I. D. McKown, **70,** 320.

R. A. Brown, **72,** 315. **R., 74,** 318; **75,** 468; **76,** 675; **77,** 548.

H. A. Ulffers, **68,** 389; **69,** 217, 219; **71,** 265.

W. Hormuth, **69,** 219.

S. T. Abert, **68,** 449; **79,** 1572.

G. B. Hegardt. **R., 88,** 1892.

W. M. Childs. **R., 89,** 2126; **90,** 2410; **91,** 2626, 2631.

L. L. Wheeler. **R., 89,** 2127; **90,** 2456.

C. V. Brainard. **R., 92,** 2261, 2295; **93,** 2825; **94,** 2153; **95,** 2721; **96,** 2600; **97,** 2817; **98,** 2438; **99,** 2845; **00,** 3800; **01,** 3009; **02,** 1917; **04,** 2953.

J. R. Fuller. **R., 05,** 2139.

ESTIMATES. (See Plans and Projects.)

By S. T. Abert, imp. La Salle to mouth, by dr. and wing dams, to give available d. of 4′, $1,528,450, **68,** 449; **79,** 1573. For d. of 6′, by drawing a supply from Lake Michigan, more than $38,000,000, **68,** 450, 453.

By BE., w. and d. canal to Lake Joliet, thence the imp. of R. by l. and d., $18,217,242, **68,** 390, 453, 467; **79,** 1574, 1577. Details of, **68,** 456.

Of cost of completion of modified proj. of 1870, formation of chan. (4′ x 150′) by dr. and wing dams, $391,912, less app. of 1870, $100,000, $291,912, **71,** 279.

Of cost of completion, $350,000; cause for increase, **72,** 281, 314. Of cost of lock foundation at Copperas Creek, $72,479, **74,** 319.

Of cost of completion (dr. and wing dams), $120,000.

By Capt. G. J. Lydecker, 1879, chan. 4½′ x 200′ by dr. and wing dams, $250,000, **79,** 158, 1571.

LEGAL PROCEEDINGS.

Complaints of obstr. brs.; public hearing held; Sec. of War grants au. to lower dams at Kampsville and La Grange, **04,** 2952.

Rental of U. S. marine ways to private firms, **06,** 1782.

Public hearing held requiring drainage commissioners; petition to close entrance to Spring Lake, **11,** 2166.

LEGISLATION.

Act of Congress, June 23, 1866, under which W. Gooding was appointed to cooperate with officer in

[1] Operations under contract from 1869 to 1878, **79,** 1581. Objections to laws regulating, **68,** 391.
Proposals: For dr., hire of dr. and equipment, constr. of brush dams, js., riprap, and training walls, **70,** 221, **71,** 281; **75,** 474; **77,** 553. For lock foundation at Copperas Creek, **74,** 322.

charge, **67,** 37, 270. Action recom. providing for early commencement of work, **67,** 271. Possible effect of adoption of new constitution by State, **70,** 304. Constr. of l. and d. at Henry au. by General Assembly of Illinois, **69,** 46, 218. Recom. that Illinois R. be included with Mississippi R. in act providing for sheer booms and prs., **77,** 561.

Chicago drainage and waterways laws, **89,** 2134; **90,** 2449, 2550.

OBSTRUCTIONS. (See Physical data.)

Highway brs., **04,** 2951.

Chicago, Burlington & Quincy RR. br. above La Salle does not give enough headroom for boats going to State Park, 5 m. above La Salle. On complaint of rivers and lakes commission, Ill., hearing held, 1912; br. ordered altered.

Fixed dam 24 m. above La Salle, **12,** 1021.

Many wagon and RR. brs. across R.; at Peoria large distilleries discharge into R., all requiring continued modification, **12,** 1522.

OPERATIONS.[1]

1859. Former dr., effect of, **69,** 218. Order in which imp. should be made (under proj. of BE., 1867), **68,** 452.

1869-70. Dr. on bars to give 7′ bet. Henry and Copperas Creek after the proposed dam at Henry shall have been built, **70,** 60, 303, 313.

1870-71. Dr.; constr. of js. to obtain at least 4′; chan. way prepared bet. Henry and Copperas Creek for 7′ when dam shall have been constr., **71,** 54, 274.

1871-72. Continuation of operations of previous year, **72,** 50, 281, 311. Illinois undertakes the building of l. and d. and the U. S. to prepare R. bed, to afford (when dams are built) 7′ d., **73,** 437.

1873-74. Constr. of foundations for lock at Copperas Creek and continuation of dr. at points where most required, **74,** 60, 317.

1874-75. Lock foundations turned over to Illinois for completion of lock; constr. of l.-w. chan. by dr. and wing dams, **75,** 65, 467, 471.

1875-76. Continuation of dr. and wing dams, **76,** 84, 675, 677, 687.

1876-77. Continuation of dr., building low dams and js., and restoration of chan., **77,** 85, 546, 551, 554.

1877-78. Dr. by contract on worst bars to give a chan. 4′ d., **78,** 119, 1190, 1193, 1196. Cost of work by contract and hired labor discussed, **78,** 1191, 1192, 1195; **79,** 1569. Plan of dams and js. built, **78,** 1194. Permanence of imp. made, **78,** 1194.

1878-79. Operations limited to constr. of dr., 2 dump scows, 2 deck scows, quarter boat, towboat, and steam scow, in preparation for doing the work by hired labor, **79,** 159, 1569, 1580.

1879-80. 110,237 c. y. dr. at Pearl Shoals, Fishers Isld., Atwells, and Silver Creek Bars; 5,858 l. f. brush and st. dams built at above localities; 84 snags removed, **80,** 1991, 1992.

1880-81. 89,501 c. y. dr. at Atwells and Hurricane Isld. Bars; work on Kampsville Lock commenced, **81,** 2174.

1882-83. Cofferdam and lock foundation constr. and lockpit excavation commenced at La Grange; lockpit and cofferdam constr. at Kampsville continued, **83,** 1751, 1752.

1883-84. Foundation of La Grange Lock completed and lock walls commenced; foundation of Kampsville Lock completed, **84,** 1948, 1949.

1884-85. Work upon lock walls at La Grange continued; e. dam abutment completed, **85,** 2052.

1885-86. Lock walls at La Grange completed, **86,** 1705.

1886-87. Progress upon work at La Grange and Kampsville Locks, **87,** 2120.

1887-88. Lock at La Grange completed; 2,881 c. y. cut st. delivered; 26,061 c. y. dr. from chan., **88,** 1890.

1888-89. La Grange Dam begun; 1,284 c. y. cut st. and 2,300 c. y. backing st. received from Kampsville Lock, **89,** 2122.

1889-90. La Grange Lock and Dam completed; work continued upon the Kampsville Lock and Dam, **90,** 2408.

1890-91. Repairs to La Grange Lock and Dam; preparations for laying up Kampsville Lock; repairs to plant, **91,** 2612.

1891-92. 212 l. f. of revet. and an ice breaker built at La Grange Lock and Dam, and 12,500 c. y. dr. from lock approaches; 9,000 c. y. dr. at Kampsville Lock site; 1,170 l. f. of trestle completed; 10,145 c. y. masonry laid in lock walls; 27,479 c. y. dr. above and below lock pit, **92,** 2257. Operation and care of La Grange Lock and Dam, **92,** 2294.

1892-93. 500 c. y. riprap deposited below La Grange Lock and Dam, and dr. to maintain approaches. The Kampsville Lock and Dam completed, involving, among other work, the dr. of 31,614 c. y. Repairs made to the Kampsville Lock and Dam, **93,** 2824.

1893-94. Kampsville Dam fully completed; lock opened to navigation, **94,** 2151.

1894-95. 102,836 c. y. dr., 270 snags removed, 2 lock houses constr., and repairs made to plant, **95,** 2714. Two new dumping scows constr., **95,** 2715.

1895-96. 82,000 c. y. dr., **96,** 2597.

1896-97. Repairs and renewal of plant made, and 51,631 c. y. dr., **97,** 2816.

1897-98. 112,048 c. y. dr., and plant repaired, **98,** 2436.

1898-99. 17,183 c. y. dr.; revet. at Kampsville Lock partly filled; plant repaired, **99,** 2842.

1899-00. 307,043 c. y. dr.; 8,500 c. y. earth placed on grounds at Kampsville Lock, and 3,710 c. y. earth placed on grounds at La Grange Lock; plant repaired and enlarged, **00,** 3799.

1900-01. 337,081 c. y. dr., and plant overhauled and repaired, **01,** 3007.

1901-02. 110,452 c. y. dr.; snags, etc., removed, **02,** 2113.

1903-04. Repairs to fleet, **04,** 2952.

1904-05. 120 snags removed, **05,** 2137.

1905-06. Repairs to fleet; inspection of R., etc., **06,** 1781.

1906-07. Repairs to fleet; inspection trips, etc., **07,** 1935.

1907-08. Repairs to fleet; 3 new dump scows built; inspection of R.; removing snags, and general mainten., **08,** 2004.

1908-09. General repairs to fleet, dr., snagging, etc., **09,** 2005.

1909-10. 32,392 c. y. dr. below Copperas Creek and 45,949 bet. Copperas Creek and La Salle; 27 snags removed; repairs made to plant, **10,** 2165.

1910-11. 2,800 c. y. dr. and 27 snags removed below Copperas Creek and 97,746 c. y. bet. Copperas Creek and La Salle, **11,** 2367.

1911-12. 26,691 c. y. dr., 10 snags removed, and new barge built below Copperas Creek, and 14,198 c. y. dr. bet. Copperas Creek and La Salle, **12,** 2556.

PHYSICAL CHARACTERISTICS.

Of valley of Des Plaines, **68,** 442, 460.

Porous character of Illinois R. bed and banks **69,** 254.

Character of l. and d. foundations, **69,** 254.

Action of h. w. in R. and tributaries, **72,** 313.

Stage of water during 1875–76, **76,** 684.

Illinois R. formerly outlet of Lake Michigan, **68,** 442; **75,** 396.

Discharge, **68,** 444, 448; **79,** 1578.

Discharges of Illinois R. and Illinois & Michigan Canal, **89,** 2132, 2133; **90,** 2409, 2443. On Illinois R. at Ottawa, Ill., **90,** 2536. At Kampsville, 1891, **92,** 2263.

Gauge readings on the Illinois R. at Kampsville from 1881 to 1889, **90,** 2414. Above Copperas

[1] History of previous operations, **79,** 1569, 1572, 1581. Difficulties of using ordinary dump scows, and remedy for, **70,** 315. Cost of dr. in 1870–71 (24⅝ c. c. y.), **71,** 272. Operations suspended (1872) for lack of funds, **72,** 281. Superiority of Osgood dr. over Morris & Cumings, **72,** 311. Order in which bars should be removed, **72,** 314. Dr. done by hired equipment, 1874, **74,** 319. Present relief aimed at, **74,** 320. Details of lock foundation at Copperas Creek, **75,** 469. Satisfactory character of, **75,** 467. Satisfactory results from low dams and training walls, **76,** 674, 677. Injury done by storms to improved chan., **77,** 548.

Creek Dam, Illinois, from 1879 to 1890, **90,** 2520. Below Copperas Creek Dam, Illinois, from 1879 to 1890, **90,** 2526. At La Grange, from 1883 to 1890, **90,** 2532. At Copperas Creek and La Grange and Kampsville Locks, 1891, **92,** 2267, 2269.

Overflow stage of Illinois R., **90,** 2443.

Effects of definite increased discharge upon chan. d., **90,** 2444.

Average length of time that the dams upon the Illinois are necessary for navigation, **90,** 2446.

Influence of dams upon flood heights and upon flowage of lands, **90,** 2447.

Borings upon proposed routes bet. Chicago and Sag Br., **90,** 2461, 2482.

Elevations of h. w. bet. Joliet and La Salle, **90,** 2515.

Lake Michigan water levels from 1860 to 1890, **90,** 2517, 2518.

In 1897 the only navigable connection of the Illinois R. and Lake Michigan was the Illinois & Michigan Canal, which extended from Chicago R., about 5 m. above its mouth, to La Salle, **97,** 2883.

Gauge readings. (See end of each report from 1892, inclusive.)

Description of routes for extension of navigation from Illinois and Des Plaines Rs. to Lake Michigan, **97,** 2883.

Amount of water to be pumped into the Illinois R. by the city of Chicago, and description of its probable effect, **95,** 2715.

Chans. dr. in the R. found to be permanent, **95,** 2716.

The capacity of the canal about 20% below that of the enlarged Erie Canal of New York, **96,** 2598.

The clearing and use of bottom lands in the vicinity of the R., and the leveeing of the lands, increasing, **97,** 2816; **98,** 2437.

The chan. of the R. fast becoming, 1899, one of the best tributaries of the Mississippi, **99,** 481.

Discharge probably to be augmented by Chicago Sanitary Canal, **99,** 2842.

Extremely l. w., 1899, **00,** 3798.

Complaints concerning dumping of refuse in R., **06,** 1781.

Formed by junction of Kankakee and Des Plaines Rs., about 50 m. above La Salle; flows sw. into Miss. R., at Grafton, Ill., 36± m. above St. Louis, Mo., 273 m. l.

U.S. proj. section—La Salle to mouth, 223 m.—divided into 2 parts: (a) Below Copperas Creek, gen. imp. 137 m., and (b) Copperas Creek to La Salle, 86 m. La Salle head of navigation, **12,** 1020.

Navigation bet. Chicago and Miss. R. is via Ill. & Mich. Canal, from Joliet (terminus of Chicago Sanitary & Ship Canal) to the Ill. R. at La Salle. (Bulletin 21 (1912), p. 179, U.S. L. Sur. O., Detroit. Mich.)

PLANS. (See Estimates and Projects.)

For connection of Illinois R. with Lake Michigan, via Kankakee and Des Plaines Rs., not feasible, **68,** 441.

Entrance to Lake Michigan via Calumet R. not feasible from lack of proper harborage at Calumet, **68,** 441, 460.

Route via Fox R. considered impracticable from lack of water supply and cost of imp., **68,** 441, 466.

Imp. from La Salle to mouth by dr. and wing dams would give an available navigation of not more than 4′; not considered to meet requirements, **68,** 449, 465.

Drawing a supply from Lake Michigan to give requisite d. in Illinois impracticable at any reasonable cost, **68,** 449, 465; **79,** 1573, 1574.

Obtaining 7′ in Illinois R. by a system of dams, with open chutes or passes, less in area than the navigable cut proposed to be made from Lake Michigan; plan largely experimental, **68,** 465.

By Capt. Marshall, 1890, excavation of a canal from Lake Michigan to Sag Br.; w. of canal to be 160′; est., by the Chicago route, for 14′, $10,689,591; for 8′, $8,791,056; for 14′, by the Sag route, $8,501,041; for 8′ d., $5,793,303, **90,** 2419, 2422, 2425, 2428, 2429, 2430, 2431.

Total est. for the 2 projs. from Lake Michigan through to La Salle: For 14′, via Chicago route, $48,282,763; via Sag route, $46,094,213; for 8′, via Chicago route, $26,883,153; via Sag route, $23,885,400, **90,** 2433.

Comparative advantages of the 2 routes from Sag Br. to Lake Michigan, **90,** 2435.

Detailed **R.** upon surs. and est. for the above proposed waterways, **90,** 2456.

PRIVATE (CORPORATE AND STATE) WORK.

Michigan & Illinois Canal (see Projects), present location of, **68,** 442; dimensions of; condition of, **68,** 443; history and cost, **68,** 454; capacity of, **68,** 455. Constr., by Illinois, of l. and d. at Henry, **73,** 437; **79,** 1576. Conjoint action bet. Illinois and US., **79,** 1576.

Probable removal of State works because of augmented discharge of the R. due to Chicago Sanitary Canal, **99,** 2842.

Illinois, at 1912, aided by U. S., had executed part of the general proj. by constr. of l. and d. at Henry and Copperas Creek, completing, except dr., that part of proj. bet. La Salle and mouth of Copperas Creek, 86 m., over which section Illinois collects tolls, **12,** 1021.

PROJECTS. (See Estimates and Plans.)

Previous to 1866, mainten. of l.-w. chan. from La Salle to mouth by dr., **69,** 218.

BE., 1867, w. and d. present (Michigan & Illinois) canal from Bridgeport (s. branch Chicago R.) to Lake Joliet, except bet. Summit and the Sag (11½ m.), where independent canal will be built; thence by imp. of Illinois R. by l. and d., except passage of Grand Rapids by independent canal. Canal 6′ x 160′; locks, 7′ x 75′ x 356′; d. of slack-water imp., 6′, **68,** 390, 440; **79,** 1574, 1576. Discussion of location, **68,** 443, 461; **69,** 252. Slack-water navigation compared with canal, **68,** 446. Est., $18,217,242, **68,** 390, 453, 467.

The State of Illinois having directed constr. of l. and d. at Henry, **69,** 46, 218; and contemplating another at Copperas Creek, **69,** 46, 218; Lt. Col. Wilson, 1870, proposed, until l. and d. for slack-water navigation be completed, to confine expend. to removal of worst bars and formation of chan. (by dr. and wing dams) from Henry to mouth 4′ x 150′, **70,** 60, 304; **71,** 54, 275, 278; **72,** 281, 314; **79,** 1575, 1579. Objections, **79,** 1577.

Proj. for expend. of available funds, 1873, putting in lock bottom and foundation at Copperas Creek, and such dr. as would best relieve the immediate wants of navigation, **73,** 437; **74,** 60, 317.

Projs. for continuing imp., 1874–77, by dr.; constr. of wing dams and training walls to secure 4′, **74,** 320; **75,** 65, 467; **76,** 83, 674; **77,** 85, 546.

Dr. by hired labor, 1878, with dr. especially adapted to the work, **78,** 1191; and constr. wing dams by hired labor, **78,** 1192, 1195; **79,** 1570, 1580.

History of past projs. reviewed by Capt. Lydecker, **79,** 1579. Disadvantages of existing d. and l. at Copperas Creek and Henry, **79,** 1579.

Previous to 1880 efforts on the part of the U. S. for the imp. consisted in the constr. of wing dams and dikes, dr. through the worst bars, and the constr. of the foundation of the Copperas Creek Lock, Illinois undertaking the building of l. and d. and the U. S. the imp. of the R. bed, **71,** 247; **73,** 437; **74,** 320; **75,** 467; **86,** 308.

The amount thus expended from 1868 to June 30, 1880, was $550,450, **80,** 1994, 1999; **86,** 308.

Act June 14, 1880, required that $100,000 of the $110,000 app. should be applied to the constr. of l. and d., **80,** 211; **81,** 2174.

The proj. of 1880 proposed extension of slack-water navigation 100 m. by the constr. of l. and d. at La Grange and Kampsville, and the dr. of the R. chan. where needed bet. Copperas Creek Dam and mouth of R. to obtain a l.-w. d. of 7′, **81,** 2176, 2177. Est. cost of the 2 l. and d., $680,000, for dr., brush dams, and shore protection, $270,850, **81,** 2177, 2181; **82,** 2246.

In 1883 the est. for l. and d. was increased to $850,000, **83,** 1753.

In 1887 it was est. $587,500 would be required to complete the proj., **87,** 2124. Increased in 1889 by $25,000, **89,** 2126.

In 1895 Maj. Marshall est. $397,000 addl. for dr., **95,** 2716; and in 1897 $75,000 to make necessary surs. and preparations of plans for the extension of navigation from Illinois R. to Lake Michigan, **97,** 2887.

Probable necessity for lowering dam crests because of augmented discharge due to Chicago Sanitary Canal, and consequent reduction of lift for locks, **99,** 2842.

Act Mar. 2, 1907, au. securing and maintaining 7′, Copperas Creek to La Salle, **07,** 1937; the first app. for this section, **12,** 1022.

SURVEYS.

In progress, **66,** iii, 35.

Below La Salle completed in 1866; **R.** transmitted and printed in H. Doc. 16, 40th Cong., 1st sess., **67,** 37.

$20,000 set apart for sur. of Illinois R. from app. for "Surveys of Western and Northwestern rivers," **67,** 270.

Bet. La Salle and Chicago in progress, 1867, **67,** 271. Completed Dec., 1867, **68,** 390, 439. Results of, **68,** 440. Careful nature of, **68,** 466. Previous sur. consulted, **68,** 439.

Sur. for sites of l. and d., 1869, **69,** 253, 254. Gaugings, results of, **69,** 253. Borings; results of, and method of making, **69,** 254.

Resur. of R. bed, 1870, **70,** 303. Hoffman's sounding machine used, **70,** 318; **72,** 315. Efficiency and saving of, **70,** 319. Method of using, **70,** 320.

Obstr. sur., 1874; list of, **74,** 319.

Resur. of bars, 1876, **76,** 678; 1877, **77,** 551.

History of early sur., **79,** 1573.

Au. act Mar. 3, 1879; made, 1880, by Maj. Lydecker, **80,** 1995.

Sur. for waterway bet. Lake Michigan and the Mississippi R. au. act Aug. 11, 1888; made, 1889, by Capt. Marshall, **89,** 2121, 2123, 2127.

Sur. of Illinois R., from La Salle to the Mississippi, with view to ascertaining lands subject to overflow by the constr. of a waterway bet. Lake Michigan and the Mississippi, au. act Sept. 19, 1890; made, 1891, by Capt. Marshall, **91,** 2661.

Ex. upper Illinois R., and also Des Plaines R., Ill., for extension of navigation from Illinois R. to Lake Michigan at or near the city of Chicago, au. act June 3, 1896; made by Maj. Marshall, 1897 (**R.** fav.), **97,** 2882.

Pre. ex. and sur. au. act June 25, 1910, Illinois R. bet. Hurricane Isld. and Calhoun Co., for purpose of providing suitable chan. (**R.** to come), **12,** 1025.

Maps:

85, 2054; **87,** 2124; **89,** 2122, 2134, 2140.

Of Illinois R. at Bath Chute Bar and Fisher Isld. Bar, **78,** 1194.

Of Illinois and Des Plaines Rs., **11,** 2368.

Part (b), NN-1 Illinois and Michigan Canal. (Acquisition and enlargement of.)[1]

COMMERCE.

Relation of the canal to C., **87,** 2130–2137, 2145.

Statement of canal traffic, **87,** 2148.

Rates of toll, **87,** 2156.

ENGINEERS.

Chief of Engineers. **R.,** **83,** 289; **84,** 291; **85,** 314; **86,** 309; **87,** 275, 2127.

Boards. Of 1886, to ex. and **R.** upon the Illinois and Michigan Canal, and its acquisition. **R.,** **87,** 2128–2160. (Lt. Cols. Comstock and Poe and Maj. Post.)

In charge:

Maj. W. H. H. Benyaurd, 1883–85. **R.,** **83,** 1761; **84,** 1950; **85,** 2056.

Maj. T. H. Handbury, 1886. **R.,** **86,** 1716.

LEGISLATION.

Acts relative to Illinois and Michigan Canal, **87,** 2161.

PLANS.

By Maj. Benyaurd, 1882, enlarging the canal bet. Chicago and La Salle to w. of 80′ at w. l., and d. of 7′; locks 30′ w. x 170′ l.; est., $2,298,919, **83,** 1762, 1774, 1779, 1788; **86,** 1713.

History and description of canal, **87,** 2128, 2141.

Orig. cost of canal, $9,513,021, **87,** 2147, 2167.

Conclusions of BE. of 1886 in relation to acquisition and enlargement of canal, **87,** 2160.

SURVEY.

Au. act Aug. 2, 1882, **83,** 290; made by Maj. Benyaurd, 1883, **83,** 1754.

Part(c), NN–1 Illinois and Des Plaines Rivers, Ill. (Including survey for 14-foot waterway from Lockport, Ill., to St. Louis, Mo.)

APPROPRIATIONS.

$175,000,[2] **04,** 2931.

ENGINEERS.

Chief of Engineers. **R.,** **84,** 291; **99,** 485; **00,** 549; **01,** 534; **03,** 494; **04,** 540; **05,** 548; **06,** 607; **07,** 634; **08,** 862; **09,** 908; **10,** 1014; **11,** 1073; **12,** 1287.

Boards:

Convened, Chicago, Ill., Apr. 10 and 11, 1899, under S. O. No. 14, dated Mar. 12, 1899 (for object, see Surveys), and reconvened Nov. 22, under S. O. No. 59, dated Nov. 11, 1899, and subsequently under S. O. No. 12, dated Mar. 12, 1900. (Col. J. W. Barlow, Majs. J. H. Willard and C. McD. Townsend.)

Board submits final **R.,** with est. of cost on 7′ and 8′ projs. (see Surveys), **01,** 3049.

Act June 6, 1900, au. board to make sur. and est. for chans. 10′, 12′, and 14′. Submits est., $30,000,000, but feel C. does not warrant such a large expend. (see Surveys), **01,** 3058. Convened, Chicago, Ill., Aug. 14, 1902, by S. O. No. 19, to **R.** upon sur. for waterway, 14′ d., Lockport, Ill., by way of Illinois and Des Plaines Rs., to mouth of Illinois R., thence by way of Mississippi R. to St. Louis, Mo. (Col. O. H. Ernst, Lt. Col. Chas. J. Allen, and Maj. Thos. L. Casey), **03,** 1904. Maj. Jas. L. Lusk replaces Lt. Col. Chas. J. Allen, retired, **04,** 2931. Lt. Col. W. H. Bixby replaces Maj. Lusk, relieved on account of sickness, **05,** 2118. Board submits **R.,** Aug. 26, 1905, on 14′ waterway, Lockport, Ill., to St. Louis, Mo.,[3] **06,** 607, 1780.

[1] Illinois and Lake Michigan Canal via Illinois R., Ill. Sur.—**R.,** June 23, 1834; est. (Des Plaines and Illinois Rs.), $4,299,439.81. (H. D. 482, 55th, 2d.) See also "Illinois and Mississippi Canal," a connection from Hennepen, Ill., going toward Rock Island, Ill., on p 1235.

[2] Survey.

[3] H. D. 263, 59th, 1st.

Act Mar. 2, 1907, appoints commission to examine Mississippi R. below St. Louis, and **R.** on practicability and desirability of constr. and maintaining a chan. of 14′, St. Louis to mouth of R., by open chan. or canals. Commission also required to consider sur. of proposed waterway from Chicago to St. Louis previously reported upon, and any water power which may be created in section of Mississippi below St. Louis, as well as from Chicago to St. Louis, Mo. (Col. W. H. Bixby, Lt. Col. J. G. Warren, Maj. Henry B. Richardson, Mr. Howard P. Ritter, Capt. G. R. Lukesh), **07,** 634, 1933, 2567; **08,** 862. **R.** submitted Mar. 20, 1909,[1] **09,** 908.

Act June 25, 1910, appoints board to consider and **R.** upon feasibility of waterway from Lockport, Ill., by way of Illinois and Des Plaines Rs. to mouth of Illinois R. App. of $1,000,000 made with provision that same shall not be available until plans are submitted and proj. is au. by Congress (Brig. Gen. W. H. Bixby, Col. C. McD. Townsend, Maj. Chas. Keller, Maj. J. B. Cavanaugh, Mr. John Bogart), **10,** 1014. **R.,** 1910 and 1911,[2] **11,** 1073; **12,** 1287.

In charge:
Maj. W. H. H. Benyaurd, 1882–84. **R., 84,** 1957, 1958.
Maj. W. L. Marshall, 1899. **R., 99,** 2890.
Maj. J. H. Willard, 1899. **R., 00,** 3855.
Maj. J. H. Willard. **R., 01,** 3048.
Col. O. H. Ernst. **R., 03,** 1904; **04,** 2931.
Lt. Col. W. H. Bixby. **R., 05,** 2118; **06,** 1780; **07,** 1933.

Mississippi River Commission:
Rs., 03, Supp. 7, 68, 167; **04,** Supp. 11, 53; **05,** Supp. 10, 41; **06,** 794, 2510; **07,** 812, 2657; **08,** 862; **09,** 908.

Assistants:
G. Y. Wisner. **R., 84,** 1960.
F. M. Towar. **R., 99,** 2891.
J. A. Seddon. **R., 00,** 3856, 3862; **01,** 3052 to 3058.
J. W. Woermann. **R., 03,** 1906; **04,** 2931; **05,** 2119.
A. T. Morrow. **R., 03,** Supp. 167.

OPERATIONS.

1898-99. Preparations made for putting sur. party at work, **99,** 2890.

For data concerning details of 14′ waterway, Lockport, Ill., to St. Louis, Mo., sur., giving information relative to the necessary field work, incl. physical data, triangulations, precise levels, topography, hypsometry, test borings, discharge measurements, maps, etc., see pages of **Rs.** of assistant engineers in an. reports. (See Assistants.)

PHYSICAL CHARACTERISTICS.

Route described, **84,** 1958, 1960.

Description of route recom. for sur., **99,** 2891; routes sur., **00,** 3858.

General instructions for field work, topography, hydrography, levels, etc., **03,** 1910.

Gauge readings, **04,** 2939; **05,** 2132.

PLANS.

By Maj. Benyaurd, 1884, slack-water navigation accomplished by l. and d.; est., $1,975,446 to $3,433,562, **84,** 1959, 1964.

PROJECTS.

BE. est., 1900, that the provisional cost of an 8′ chan. would be $10,400,000, and that 10% less than this would be the cost of a 7′ chan., **00,** 3861.

Act June 13, 1902, provided $200,000 for a sur. from Lockport, Ill., to St. Louis, Mo., for a waterway of 14′ ($175,000 for section Illinois and Des Plaines Rs., $25,000 for Mississippi R. Com.). Route as follows: From Lockport, Ill., by way of Illinois and Des Plaines Rs. to mouth of Illinois R.; and from mouth of Illinois R., by way of Mississippi R. to St. Louis, Mo. Section from mouth of Illinois R. by way of Mississippi R. to St. Louis, Mo., is in charge of Mississippi R. Com., **03,** 494, 638, 1904, Supp. 6, 68, 167.

SURVEYS.

Au. bet. La Salle and Joliet by act Aug. 2, 1882; made by Maj. Benyaurd, **84,** 1958.

Sur. for extension of navigation from Illinois R. to Lake Michigan at or near Chicago, with est. for 7′ and 8′ chans., au. act Mar. 3, 1899, **99,** 2891; made, 1899–1900, by board. (Special **R.** made on the Illinois Canal in connection with this sur.) Pre. **R., 00,** 3856. Final **R.** submitted by board Nov. 17, 1900, on 7′ and 8′ proj. with est of cost: 7′, $7,317,977; 8′, $8,653,247, **01,** 534, 3048.[3] Detailed, cost of locks on 7′ and 8′ projs., giving dimensions, etc., **01,** 3055.

Act June 6, 1900, au. sur. and ex. for 10′, 12′, and 14′ chan. Made by BE. **R.,** Nov. 18, 1900. Est. for 14′, $30,000,000. C. does not warrant this large expend., **01,** 534, 3058.[4] Est. in detail for 14′ waterway, Illinois R. to Lake Michigan, **01,** 3064.

Act June 13, 1902, au. ex. from Lockport, Ill., to mouth of Illinois R., thence to St. Louis, Mo., **03,** 494, 1904 (see also Supp. Mississippi R. Com., pp. 7, 68, 167); **04,** 541, 2931, Supp. 11, 53; **05,** 548, 2118, Supp. 10, 41. (See Board of Engineers.)[5] Summary of field work for 14′ waterway, Lockport, Ill., to St. Louis, Mo., **03,** 1907.

Act Mar. 2, 1907, au. consideration, by a commission, of sur. heretofore made, incl. questions of water power and drainage of lands, **07,** 635, 1933; **08,** 862. Board reports Mar. 20, 1909,[5] **09,** 908.

Act June 25, 1910, appoints board to consider and **R.** upon waterway from Lockport, Ill., to mouth of Illinois R., **10,** 1014. **Rs.,** Nov. 1, 1910, and Jan. 23, 1911,[2] **11,** 1073; **12,** 1287.

Estab. of bench marks, **03,** 1908.

Work prosecuted by Miss. R. Com. in connection with this sur., **03,** Supp. 7, 68, 167; **04,** Supp. 11, 53.

Part(d), NN–1 Illinois River, Ill., Locks and Dams. (Operating and care.)

APPROPRIATIONS.[6]

1890,	$7,176.96
1891,	9,275.03
1892,	8,004.06
1893,	4,709.11
1894,	14,500.73
1895,	13,988.69
1896,	14,382.03
1897,	20,007.74
1898,	13,567.68
1899,	$13,380.00
1900,	12,225.15
1901,	9,654.97, **01,** 3011; **12,** 1023.
1902,	12,080.05, **02,** 2115.
1903,	11,411.46, **03,** 1917.
1904,	10,476.94, **04,** 2955; **12,** 1023.
1905,	11,237.31, **05,** 2142.
1906,	13,333.77, **06,** 1784.
1907,	13,060.13, **07,** 1939.
1908,	13,314.56, **08,** 2007.

[1] H. D. 50, 61st, 1st.
[2] H. D. 1061 and 1374, 61st, 3d.
[3] H. D. 112, 56th, 2d.
[4] H. D. 220, 56th, 2d.
[5] H. D. 437, 59th, 2d.
[6] Expend. under permanent indefinite app. provided by acts July 5, 1884, and Mar. 3, 1909, for operating and keeping in repair canals and other public works.

1909, $13,544.59, **09,** 2008.
1910, 14,840.21, **10,** 2169.
1911, 11,761.27, **11,** 2370.
1912, 11,396.72, **12,** 2560.

Total, 277,356.16, **12,** 1023, 1024.

COMMERCE.

Lockages: La Grange Lock only, increasing, **93,** 2830. Both locks increasing, but t. less, **94,** 2159; increasing, **95,** 2723; decrease, **96,** 2605; increase at La Grange, decrease of passages at Kampsville, but increased t., **97,** 2822; increase, **98,** 2442.

Largely increased, 1901, over past years, **01,** 3011.

Decrease in t., 1906, over previous years, **06,** 1783.

See Illinois R.

ENGINEERS.

Chief of Engineers. R., 93, 364; **94,** 335; **95,** 373; **96,** 328; **97,** 417; **98,** 406; **99,** 482; **00,** 546; **01,** 531; **02,** 455; **03,** 496; **04,** 542; **05,** 549; **06,** 610; **07,** 637; **08,** 683; **09,** 720; **10,** 798; **11,** 854; **12,** 1023.

In charge:

Capt. W. L. Marshall, 1893–99. **R., 93,** 2830; **94,** 2159; (Maj.) **95,** 2723; **96,** 2605; **97,** 2822; **98,** 2442; **99,** 2849.

Maj. J. H. Willard, 1899–1903. **R., 00,** 3805; **01,** 3010; **02,** 2115; **03,** 1917.

Maj. C. S. Riché, 1903–05. **R., 04,** 2954.

Lt. Col. W. H. Bixby, 1905–06. **R., 05,** 2141.

Maj. C. S. Riché, 1906–10. **R., 06,** 1783; **07,** 1938; **08,** 2006; **09,** 2008.

Maj. Chas. Keller, 1910–11. **R., 10,** 2166.

Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2370; **12,** 2558.

Assistants:

C. V. Brainard. **R., 93,** 2831; **94,** 2161; **95,** 2724; **96,** 2606; **97,** 2823; **98,** 2445; **99,** 2852; **00,** 3808; **01,** 3012; **02,** 2116; **03,** 1919; **04,** 2956.

J. R. Fuller. **R., 05,** 2143.

OPERATIONS.

1892-93. Approaches to La Grange Lock kept dr., and necessary repairs made, **93,** 2830.

1893-94. Headbay platform of La Grange Lock repaired and strengthened. 500 c. y. st. placed below dam to protect against scour. Drain built at Kampsville Lock. Approaches to both locks kept dr., **94,** 2159.

1894-95. 150 l. f. pile revet. built at Kampsville Lock, and 140 c. y. riprap placed back of revet. below the dam abutment. Misc. work and repairs performed, **95,** 2723.

1895-96. Necessary repairs made. Fishways constr. at both locks. 8,807 c. y. dr. from entrance to Kampsville Lock. Repair of plant commenced, **96,** 2605.

1896-97. Over 20,000 c. y. dr. from approaches. Repair of plant in progress. Misc. work of repair and mainten. done, **97,** 2822.

1897-98. About 6,000 c. y. filling placed. Repairs made to plant. Misc. work of mainten. and repair performed, **98,** 2442.

1898-99. 3,021 c. y. dr. from La Grange Lock, and about 2,500 c. y. dr. from Kampsville Lock. Misc. work, **99,** 2849.

1899-00. Ordinary work of mainten., etc., **00,** 3805.

1900-01. Mainten. and repairs at both locks **01,** 3010.

1901-02. Mainten. and repairs, **02,** 2115.

1902-03. Mainten. and repairs, **03,** 1917.

1903-04. 929 c. y. dr. from entrance to La Grange Lock; 1,742 c. y. dr. from entrance to Kampsville Lock, **04,** 2954.

1904-05. Revet. at La Grange Lock rebuilt, and windmill and tank erected; general repairs to works at Kampsville Lock, **05,** 2141.

1905-06. Dr., repairs, etc., at La Grange Lock; 6,930 c. y. dr. at Kampsville Lock, **06,** 1783.

1906-07. 3,010 c. y. dr. at La Grange; 6,157 c. y. dr. at Kampsville, **07,** 1939.

1907-08. Repairs to lock gates at Kampsville, **08,** 2007.

1908-09. Work of rebuilding lock gates at Kampsville completed; repairs to structures at both locks, **09,** 2008.

1909-10. Harvest of ice, repairs to lock gates, etc., at La Grange Lock; general repairs to works at Kampsville Lock, **10,** 2167.

1910-11. Repairs to machinery and structures at both locks, **11,** 2370.

1911-12. Revet. above land wall, La Grange Lock, repaired and riprapped; minor repairs completed; 300 c. y. removed from around Kampsville Lock gates; repairs made to supt.'s house, and lawn was kept mowed, **12,** 2558.

PRIVATE WORK.

Sec. of War granted permission, 1904, to sanitary district of Chicago to lower dams 2', **04,** 2956. Work on dam at Kampsville commenced 1905 and completed 1906, **05,** 2141; **06,** 1783. Lowering of dam at La Grange in progress, **07,** 1939.

NN-2 SANGAMON RIVER, ILL.

ENGINEERS.

Chief of Engineers. R., 84, 291.

In charge. Maj. W. H. H. Benyaurd. **R., 84,** 1952.

OBSTRUCTIONS.

Brs. without draws, **84,** 1954.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 1955.

PLANS.

By Maj. Benyaurd, 1884, removing natural obstr., closing outlets, and rectifying the chan. at bends, mouth to Petersburgh, to be navigable at or above a 4' stage; est., $60,000, **84,** 1957.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Maj. Benyaurd, **84,** 1952.

NN-5(a) FARM CREEK, ILL.

COMMERCE.

Unimportant, **87,** 2171.

ENGINEERS.

Chief of Engineers. R., 87, 277.

In charge. Maj. T. H. Handbury, 1886. **R., 87,** 2171.

PHYSICAL CHARACTERISTICS.

Description, an insignificant "river," 12 m. long, in Fond du Lac and Washington Townships, Tazewell Co., Ill., **87,** 2171.

SURVEYS.

Ex. for changing course au. act Aug. 5, 1886; made, 1886, by Maj. Handbury (**R.** unfav.), **87,** 2171.

NN-6 KANKAKEE RIVER, ILL. AND IND.

COMMERCE.

Small, **85,** 1646.

ENGINEERS.

Chief of Engineers. R., 78, 109; **79,** 148, 149; **80,** 199; **84,** 269; **85,** 257.

In charge:
Maj. J. A. Smith, 1879–84. **R., 79,** 1455; **80,** 1844; **84,** 1766.
Capt. J. C. Post, 1884–85. **R., 85,** 1645.

Assistants:
J. Worrall, C. E., **79,** 1455.
A. L. Duvall. **R., 85,** 1647.

PHYSICAL CHARACTERISTICS.

Reclamation of lands, **79,** 1457.
Description of r. forming bed of R., **84,** 1766.
Description of, **79,** 1456–1460; **84,** 1767; **85,** 1647.

PLANS.

By J. Worrall, 1867, slack-water navigation, mouth to Momence, 47.5 m.; locks 5′ x 17′ x 100; est., $950,000, **79,** 1456.

By Maj. Smith, 1879, in Indiana, w., d., and straightening for about 150 m.; est., $150,000, **79,** 1458.

By Maj. Smith, 1880, mouth to Momence, slack-water navigation, 3 masonry locks, lift of 12′, 63,000 l. f. canal, constr. and repair of dams, and removing reefs and similar obstr.; est., $550,000, **80,** 1844, 1846.

In 1882 Maj. Smith reported that the R. could be imp. only with slack-water system; not a public necessity, **84,** 1767, 1768.

In 1884 Capt. Post reported the R. unworthy of imp., **85,** 1647.

PRIVATE (CORPORATE AND STATE) WORK.

1847. Kankakee Co. connected the Illinois & Michigan Canals and completed 21 m. of slack-water navigation, **79,** 1455, 1456.

Canal feeder and dam constr. by Illinois, **79,** 1455.

SURVEYS.

By J. Worrall, 1867, **68,** 459, 466, etc.; **79,** 1455.
Ex. completed by Maj. Smith, **78,** 109; **79,** 148, 1455.
Sur. by Maj. Smith, **79,** 149.
Au. act Mar. 3, 1879; made, 1879, by Maj. Smith, **80,** 1844.
Ex. au. acts Aug. 2, 1882, and July 5, 1884 (see Plans), **84,** 1766; **85,** 1645.

NN-14 CHICAGO HARBOR, ILL.[1]

APPROPRIATIONS.

1833,	$25,000, **66,** iii, 35.
1834,	32,801, **66,** iii, 35.
1835,	32,800, **66,** iii, 35.
1836,	32,000, **66,** iii, 35.
1837,	40,000, **66,** iii, 35.
1838,	30,000, **66,** iii, 35.
1843–44,	25,000, **66,** iii, 35.
1844,	30,000, **66,** iii, 35.
1852,	20,000, **66,** iii, 35.
1864,	*25,000, **66,** 15, 16; iii, 35.
1866,	88,704, **66,** iii, 11, 35; iv, 91, 114.
1868,	*35,000, **68,** 31; **69,** 28.
1869,	*29,700, **69,** 22.
1870,	[2] 100,000, **70,** 37; **71,** 35.
1871,	100,000, **71,** 35, 117.
1872,	90,000, **72,** 34, 130.
1873,	90,000, **73,** 35.
1874,	75,000, **74,** 41, 156.
1875,	78,000, **75,** 45, 231.
1876,	5,000, **76,** 99; **77,** 103.
1878,	75,000, **78,** 118, 1185.
1879,	75,000, **79,** 157, 1560.
1880,	145,000, **80,** 1986.
1881,	150,000, **81,** 2160.
1882,	200,000, **82,** 2206.
1884,	100,000, **84,** 1945.
1886,	75,000, **86,** 1703.
1888,	200,000, **88,** 1888.
1890,	100,000, **90,** 2402.
1892,	72,000, **92,** 2339.
1894,	[3] 80,000, **95,** 2697.
1899,	100,000, **99,** 2824.
1905,	200,000, **05,** 2067.
1907,	[4] 250,000, **07,** 1919.
1910,	240,000, **10,** 2146.
1912	350,000 / 240,000 **12,** 2538.
Total,	3,636,005 (incl. sales, less transfers, etc., $3,419,845.52, **12,** 2538).

COMMERCE. (See Chicago River.)

Requirements discussed, **79,** 1562.
Area of outer H., **82,** 2204; **83,** 1742; **84,** 1944.
Collisions with exterior break'r, **83,** 1742; **84,** 1944.
Decreased from 8,000,000 t., 1892, to 4,025,000 t., 1908; H. works necessary to prevent further loss; an imp. H. of great use in controlling rates, **10,** 782; **12,** 1007.
Tonnage, 1911, 4,026,000 t., **12,** 2540.

CONTRACTS.

1866. J. M. Corse, cribs and dr., **66,** iv, 114; **67,** 58, 90, 91; **68,** 111.
1870. Illinois Central RR. Co., labor and material, **70,** 99. Fox & Howard, break'r, **71,** 117.
1871. Illinois Central RR. Co., break'r, **71,** 117.
1873. Fitzsimmons & Connell, break'r, **73,** 213.
1875. W. L. Smith, extension of n. p., **76,** ii, 433. I. D. Vandecar, removal of wreck, **76,** ii, 433.
1878. Fitzsimmons & Connell, dr., **79,** 1560.
1879. G. Hannahs, materials, **79,** 1560. G. Hannahs, timber and piles, **80,** 1984, 1986.
1880. Chicago Dredging & Dock Co., dr., 21½¢ c. y., **81,** 2161.
1881. G. Hannahs, timber, **81,** 2161. Shumway, Bergess & Co., driftbolts, **81,** 2161.
1882. W. E. Hutchinson, timber, **82,** 2206. G. Hannahs, timber, **82,** 2206. Beckford, Knox & Co., timber, **82,** 2206.
1883. A. H. Petrie & Co., timber, **83,** 1745. A. S. Packard, timber, **83,** 1745. Green Bay Dredging Co., dr., 17¾¢ c. y., **83,** 1745. Singer & Talcott Stone Co., st., **83,** 1745.
1884. Chicago Dredging & Dock Co., dr., 23½¢ c. y., **85,** 2050. C. E. Mitchell, timber, **85,** 2050. Leatham & Smith, **85,** 2050.
1888. F. R. Crane, dr., 13½¢ c. y., **89,** 2112. The Fitzsimmons & Connell Co., break'r constr., $118,117.87, **89,** 2112.

* Allotment.
[1] Sur.—**R.,** Feb. 24, 1830, est., $59,722.24; Dec. 31, 1855, est., $138,516,68; Nov. 15, 1856, indefinite; Sept. 30, 1857, est., $174,450.74; Nov. 15, 1858, $219,342.96; Aug. 2, 1864, est., indefinite; June 30, 1865, est., $88,604. (H. D. 482, 55th, 2d.)
[2] $50,000 addl. app. for H. of refuge, Chicago, intended for and applied to imp. of mouth of Calumet R., **71,** 117.
[3] $25,000 to be used at the discretion of the Sec. of War to imp. R. up to the forks.
[4] $193,000 of this amount trans. to Chicago R., **09,** 708.

1891. Kimball & Cobb Stone Co., superstr. reconstr., $85,335.38, **91,** 2599.

1892. Wisconsin Dredge & Dock Co., rebuilding superstr. (timber, ironwork, st., piles, etc.), $37,856.77, **93,** 2801. Green's Dredging Co., dr., 14¢ c. y., $4,767.84, **93,** 2802.

1894. The Fitz Simons & Connell Co., rebuilding and repair of superstr. (pine timber, ironwork, st., etc.), $56,528.16, **95,** 2698.

1896. Illinois Dredging Co., dr., 14¢ c. y., $2,800, **96,** 2576.

1899. Chicago Star Constr. & Dredging Co., dr., 7¢.; removing and furnishing piles, iron dr. chain, and st. (est. total of contract, $73,788.70), **99,** 2825. Dr. annulled by supple. contract (see Legal proceedings), **00,** 3780.

1901. Lyden & Drews Co., dr., 7.45¢ c. y., **01,** 2991.

1905. Great Lakes Dredge & Dock Co., dr., 10.5¢ c. y., **06,** 1773.

1906. Jackson & Corbett Co., removing old superstr. of n. p. and replacing with concrete, unit prices, **07,** 1920.

1908. Great Lakes Dredge & Dock Co., constr. pile protection p.; Fitz Simons & Connell Co., dr., 22½¢ c. y., **08,** 1988.

1912. Great Lakes Dredge & Dock Co., dr. about 68,000 c. y., at 24½¢ c. y., **12,** 2537, 2539.

DOCUMENTS. (Not printed in reports.)

R. of Maj. Graham for 1855–56, S. D. 16, 34th Cong., 3d sess. For 1857, S. D. 42, 35th Cong., 1st sess. **R.** of Lt. Col. Cram, Aug. 23, 1864, **66,** 16.

Letter of Maj. Houston, describing manner of sinking cribs, Oct. 28, 1874, **75,** 228.

ENGINEERS.

Chief of Engineers. **R.,** **66,** 5, ii, 37, 41, iii, 11, 35, iv, 110; **67,** 20, 23, 98, 252; **68,** 31; **69,** 22, 23, 28; **70,** 37; **71,** 35; **72,** 33, 159, 164, 170; **73,** 34; **74,** 40; **75,** 45; **76,** 98; **77,** 103; **78,** 117; **79,** 157; **80,** 210, 212; **81,** 285, 287, 2161; **82,** 280, 2209; **83,** 288; **84,** 289; **85,** 312; **86,** 306; **87,** 272; **88,** 247; **89,** 287; **90,** 259; **91,** 329, 426; **92,** 315; **93,** 359; **94,** 331; **95,** 368; **96,** 324; **97,** 409; **98,** 400; **99,** 474; **00,** 540; **01,** 528; **02,** 451; **03,** 491; **04,** 537; **05,** 543; **06,** 600; **07,** 624; **08,** 670; **09,** 706; **10,** 781; **11,** 840; **12,** 1005.

Boards:

Convened, Chicago, Jan. 18, 1870. Made a personal ex. of the H., and adjourned to meet at Milwaukee following day, **71,** 123. Met pursuant to adjournment, and unanimously approv. plan by Maj. Wheeler for break'r for an outer H. **R.,** **70,** 124. (Col. Macomb, Lt. Col. Raynolds, and Majs. Wheeler, Weitzel, and McFarland.) See **R.** of Board of 1871, **82,** 2237, 2340.

Convened July 28, 1878. After full discussion, approv. plan submitted by Capt. Lydecker for modifications in break'r for outer H. and constr. of break'r n. and e. of the "present" n. p. **R.,** **79,** 1561. (Majs. Houston, Robert, Smith, and Mansfield, and Capt. Lydecker.)

Convened Jan., 1881, to ex. and report on Maj. Lydecker's plan and location for exterior break'r. **R.,** **81,** 2162. (Cols. Tower and Newton and Lt. Col. Abbott.) (See Projects.)

Constituted by S. O. No. 31, C. of E., 1882, to consider and report upon plans by Illinois Central RR. for docks and wharves fronting outer H. **R.,** **82,** 2234. Recom. of board, **82,** 2237. (Lt. Cols. Parke and Comstock and Maj. Weitzel.)

Convened, Chicago, Sept. 17, 1890, by S. O. No. 61, to report upon the estab. of H. lines in Chicago H. **R.,** **91,** 2661. (Col. Poe, Maj. Davis, and Capt. Marshall.)

In charge:

Lt. J. D. Webster, 1848–54. **76,** ii, 433.

Lt. Col. J. D. Graham, 1856–64. **76,** ii, 433.

Lt. Col. T. J. Cram, 1864. **R.,** **66,** 12, 14, 24.

Lt. Col. L. Sitgreaves, 1865. **66,** 20, iv, 91.

Maj. J. B. Wheeler, 1866–70. **R.,** **66,** iv, 91, 114; **67,** 55, 58, 86–92, 257; **68,** 79, 110; **69,** 73.

Special on plan for a break'r for an outer H., **70,** 79.

Maj. W. E. Merrill, 1870, **70,** 99.

Maj. D. C. Houston, 1870–74. **R.,** **70,** 89, 96; **71,** 117; **72,** 129; **73,** 215; **74,** 155.

Special, proposing modified cross section and st. foundations for cribs, **72,** 160, 165; notes on wave motion, etc., **72,** 168.

Maj. G. L. Gillespie, 1874–76. **R.,** **75,** 228; **76,** ii, 426.

Capt. G. J. Lydecker, 1877–82. **R.,** **77,** 893; **78,** 1183; **79,** 1555; (Maj.) **80,** 1983; **81,** 2151.

Special, Nov. 4, 1878, to president B.E., submitting modifications in plan of outer H. and a break'r n. and e. of the n. p., **79,** 1562.

Maj. W. H. H. Benyaurd, 1882–86. **R.,** **82,** 2203, 2207; **83,** 1741; **84,** 1943; **85,** 2047; **86,** 1701.

Maj. T. Handbury, 1886–87. **R.,** **87,** 2109.

Capt. W. L. Marshall, 1888–99. **R.,** **88,** 1886; **89,** 2110; **90,** 2399; **91,** 2596; **92,** 2237; **93,** 2791; **94,** 2127; (Maj.) **95,** 2693; **96,** 2571; **97,** 2790; **98,** 2415; **99,** 2821.

Maj. J. H. Willard, 1899–1901. **R.,** **00,** 3779; **01,** 2987.

Lt. Col. O. H. Ernst, 1902–04. **R.,** **02,** 2093; (Col.) **03,** 1887; **04,** 2917.

Lt. Col. W. H. Bixby, 1905–08. **R.,** **05,** 2065; **06,** 1771; **07,** 1917; (Col.) **08,** 1985.

Maj. Thos. H. Rees, 1909–10. **R.,** **09,** 1987; **10,** 2145.

Lt. Col. G. A. Zinn, 1911–. **R.,** **11,** 2347; **12,** 2537.

Maj. Chas. S. Bromwell, **11,** 840.

Assistants:

Lt. A. Mackenzie, **66,** iv, 91.

Capt. D. P. Heap. **R.,** **67,** 86; **68,** 110.

W. T. Casgrain, **67,** 119.

E. S. Chesbrough, **70,** 99.

W. H. Hearding. St. foundations for cribs, **72,** 161.

Lt. F. A. Hinman. **R.,** **73,** 213; **74,** 155.

R. S. Littlefield. **R.** on extension of n. p., **73,** 214; **74,** 155.

J. Pierpont, **74,** 155.

J. C. Almy. **R.,** **89,** 2113.

G. A. M. Liljencrantz. **R.,** **90,** 2402; **91,** 2599; **92,** 2240; **93,** 2802; **94,** 2131; **95,** 2698; **96,** 2577; **97,** 2792; **98,** 2418; **99,** 2825; **00,** 3783; **01,** 2991; **02,** 2096; **03,** 1890; **04,** 2919; **05,** 2068.

Navigation of Chicago R., **93,** 2805.

ESTIMATES. (See Projects.)

By Lt. Col. Graham, 1857, to complete the work, $174,450.74, S. D. 42, 35th Cong., 1st sess.

By Lt. Col. Cram, 1864, extension of both ps. $88,704, **66,** 5, 16, 24.

By Maj. Wheeler, extension of n. p.; aggregate, $86,744.65; details for one crib, $4,572.35, **66,** iv, 115; 14′ chan., $2,500, **67,** 258, 259; extension of s. p., $48,000, **68,** 31; to complete the work, $45,000, **69,** 28, 73; enlargement of H. facilities by break'r, $900,000, **70,** 102; **74,** 156.

By Maj. Houston, completion of s. p., $75,000, **70,** 96; extension of n. p., $78,000, **74,** 156.

By Maj. Gillespie, dr., $5,000, **75,** 45, 230; aggregate for proposed imp., $150,000, **76,** 99, ii, 431.

By Capt. Lydecker, completion of existing proj., **77,** 894; $250,000, **78,** 1185; $600,000 addl. to complete outer H. as modified, and constr. break'r n. and e. of n. p., 1 m. in l., **79,** 158, 1566.

LEGAL PROCEEDINGS.

Encroachment of RRs. upon area of outer H., **82,** 2207–2240; **87,** 2110.

Ownership and control of submerged lands in the outer basin decided to be in the State and the city, **95,** 2694.

Title to several slips and docks in possession of Illinois Central RR. Co., **99,** 2822.

City of Chicago, 1899–1900, under old laws for the first time enforced, preventing all dumping in Lake Michigan within 8 m. of shore line bet. n. limits of city and Indiana State line, thus violating agreement to permit such dumping, and thereby compelling annulment of contract for dr., **00,** 3780.

LEGISLATION.

Act May 28, 1908, made any or all of balance for Chicago H. available for Chicago R., **08,** 1987.

Act June 23, 1910 (Public, No. 245) made it unlawful to dump dr. material or refuse of any kind into Lake Michigan, near Chicago, within 8 m. from shore, **10,** 2146.

OPERATIONS. (See also Private work.)

History of, **76,** ii, 433; **79,** 1555. Suspended since 1852, **66,** 5.

1866. Delayed to enable the city to perform the work proposed, viz, extension of the n. p., **66,** ii, 37.

1867. Extension of n. p. in progress, 11,628′ of timber framed, **67,** 90.

1868. 96′ of n. p. extension completed, and 3,152 c. y. of dr., **68,** 111.

1869. N. p. completed, ending in 23′ of water; extension of s. p. 600′ under contract and in progress, **69,** 28.

1870. S. p. extension continued; built to water surface, l. of 1,224′, **70,** 37, 96. Break'r for outer H. commenced, 256 l. f. built to water surface, **70,** 37.

1871. 29 cribs, equal to 1,450 l. f., placed in break'r and completed to water surface, **71,** 35, 117.

1872. Extended 1,100′, 2,250 l. f. completed to date, **72,** 33, 129.

1873. Extended 800′, now 3,050′ l., **73,** 34, 213.

1874. Extension of break'r 1,100′ and repairs, **74,** 40, 155.

1875. Break'r extended 150 l. f., 1,400′ of superstr. built, pile protection to n. end of break'r in progress, 100′ added to n. H. p., repairs to n. and s. H. ps., and wreck removed, **75,** 45, 228, 229.

1876. By hired labor, 1,250′ of superstr. for break'r, 1,000′ of pile protection at the n. end of break'r, 2 cribs sunk in extension of n. p., and repairs to n. and s. ps.; by contract, 10 cribs added to n. H. p. and superstr. nearly completed over the entire extension of 600′; also, removal of a schooner wreck, **76,** 98, ii, 426.

1877. Superstr. over 600′ of n. p. completed, and pile protection to pierhead built, pile protection to break'r extended 292′, and repairs, **77,** 103, 893.

1878. Slight repairs only, **78,** 1183.

1879-80. Break'r extended 800′ by hired labor, 88,758 c. y. dr. by contract, **79,** 157, 1556; 974 piles driven for crib foundation, 1,900 l. f. of crib-p. superstr. placed in extension of s. break'r, and 2,300 l. f. of superstr. built; undue settlement of last 4 cribs placed; work mainly done by hired labor and purchase in open market, **80,** 1984.

1880-81. 87 piles driven for crib foundations, 300 l. f. of crib substr. and 1,100 l. f. superstr. placed in s. break'r, thereby completing the proposed s. break'r, with l. of 3,000 l. f., **81,** 2151; 72,158 c. y. dr. in outer H., **81,** 2152; **82,** 2204.

1881-82. 136,287 c. y. dr. from outer H., **82,** 2204; 1,536 l. f. of exterior break'r built, **82,** 2204; **83,** 1742.

1882-83. 900 l. f. exterior break'r built, **83,** 1742.

1883-84. 800 l. f. of exterior break'r built and 100 l. f. repaired, **84,** 1944; 65,758 c. y. dr. from outer H., **84,** 1945.

1884-85. 700 l. f. of exterior break'r built, incl. 100 l. f. destroyed in 1881, with extensive repairs to cribs, **85,** 2048; settlement of cribs, **85,** 2048; dr. in progress in outer H., **85,** 2049.

1885-86. Injury to s. break'r from gales, **86,** 1702.

1886-87. Repairs to break'r, **87,** 2112.

1887-88. 95 l. f. of concrete superstr. laid; 400 l. f. of substr. laid in extension of the exterior break'r, **88,** 1887.

1888-89. 400 l. f. superstr. built over outer extremity of exterior break'r; substr. of exterior break'r extended 408′; 4 cribs built to repair gap in s. break'r; 25,282 c. y. dr., **89,** 2110.

1889-90. 748 l. f. substr. and 1,156 l. f. superstr. built at exterior break'r; 5 cribs placed in s. break'r gap, **90,** 2400.

1890-91. 1,700 l. f. of e. break'r superstr. rebuilt, **91,** 2597.

1891-92. Superstr. over e. break'r completed; superstr. built over n. p. and repairs made to same, **92,** 2238.

1892-93. Over 3,000′ superstr. at outer basin in course of reconstr., **93,** 2793; over 34,056 c. y. dr. from chan. entrance to H., **93,** 2794.

1893-94. Superstr. being rebuilt last year completed, **94,** 2129.

1894-95. Rebuilding of superstr. of exterior break'r and repairs in progress, **95,** 2695.

1895-96. In connection with preceding year, 2,200 l. f. of superstr. of exterior break'r rebuilt, **96,** 2573.

1897-98. Misc. repairs made to ps. at entrance by persons responsible for damage to the same, **98,** 2417.

1899-00. E. and s. break'rs filled with st., **00,** 3780.

1900-01. 200,256 c. y. dr., **01,** 2992.

1901-02. 625,752 c. y. dr. from outer basin, **02,** 2094.

1902-03. 327,136 c. y. dr.; chan. completed 21′ d. from Pine St. to lake, over bar at H. entrance, and over an anchorage area 1,150′ x 3,000′; decking of n. p. repaired, **03,** 1888.

1903-04. Reported shoal area opposite Thirtieth St. removed, **04,** 2920.

1905-06. 338,318 c. y. dr. from outer basin, **06,** 1771.

1906-07. 506,699 c. y. dr. from outer basin; 400′ old superstr. n. p. removed and replaced with concrete, new crib sunk, piles driven, and 77 concrete blocks made, **07,** 1917.

1907-08. 12,090 c. y. dr. from outer basin, completing contract; total removed from outer basin, 857,107 c. y.; work continued on concrete superstr. of n. p.; work about 89% completed; 300′ of p. for protection of lifeboats begun; 15,327 c. y. dr. from main entrance to H. up to Rush St., **08,** 1985, 1986.

1908-09. Concrete superstr. of n. p. completed; pile p. to protect life-saving station completed at cost of $4,901.48, one-half of which was paid by U.S. Life-Saving Service; chan. from lake to Rush St. completed; damages repaired at n. end of e. break'r; 35 cords st. dumped in angle of protection p., **09,** 1987.

1909-10. Damages to ps. by vessels and storms repaired, **10,** 2145.

1910-11. Slight repairs to superstr. over n. p. made; SS. *City of Benton Harbor* of the Graham & Morton Line ran into s. clump of piles at outer end of p. and broke it down; SS. also broke 20 l. f. of pile protection in front of p.; company acknowledged responsibility for having damage repaired, **11,** 2348.

1911-12. 36,778 c. y. dr. under contract; 2,400 l. f. of decking, torn off exterior break'r, replaced by hired labor, **12,** 2538.

PHYSICAL CHARACTERISTICS.

Described, **66,** iv, 93, 114.

Gauge readings at Chicago R., **93,** 2805; **94,** 2137; **95,** 2700; **97,** 2793; **98,** 2421; **99,** 2826; **00,** 3784.

Shoaling at entrance to outer basin, **06,** 1772.

Chan. shoaled to 21′, **12,** 2538.

Depths referred to l. w. 1847 (Chicago city datum), which is 579.94′ above mean tide, New York H. Max. draft carried m. l. w., 20′; oscillation average less than 1′ daily, **12,** 1005.

PRIVATE (CITY AND CORPORATE) WORK.

1864-65. Good results obtained by work done by the city, **66,** 15.

$75,000 app. by city for dr. and p. extension; 437½′ built in extension of n. p., **66,** 15.

Imp. by Chicago Dock & Canal Co., **67,** 23, 86, 91, 92; **68,** 31, 110.

Encroachment of RR. on H. areas, **82,** 2207.

Under au. of Sec. of War, 1895, city constr. bulkhead along dock line and filled in the area shoreward of the bulkhead for a public park, **99,** 2822.

Pile cluster replaced at w. end of n. p. by Northern Michigan Transpor. Co., **10,** 2145.

PROJECTS. (See Estimates.)

By Lt. Col. Cram, repairs and extension of the n. and s. ps., **66,** 16; modified by Maj. Wheeler, giving increased w. to cribs, dr. and extending the n. p. only, **66,** iv, 114; **67,** 86. Chan. for

vessels drawing 14′, **67,** 258, 259. Extension of the s. H. p., **68,** 111; **69,** 28. Outer H. formed by a break'r inclosing about 275 acres, **70,** 101; **74,** 156.

By Maj. Houston, modification of cross section of break'r and st. foundations for the cribs, **72,** 33. Extension of the break'r instead of building the p., **72,** 129. Extension of the n. H. p., **73,** 214.

By Maj. Gillespie, extension of break'r s. 1,000′, chan. to connect the outer H. with R., and repairs, **76,** 99, ii, 431.

BE. approv. and recom. adoption of proj. by Capt. Lydecker for modifications in break'r for outer H. and constr. of a new break'r n. and e. of n. p., **79,** 1561, 1562.

Work for imp. of H. commenced by U. S. under its first app., 1833, and continued at irregular intervals to 1864, thereafter more regularly to 1870. Bet. 1833 and 1870 proj. formation of chan. of entrance to mouth of R. bet. 2 ps. extending into the lake, and bet. which a chan. of about 14′ was obtained. Amount app., 1833–69, incl., $446,005, **76,** ii, 433; **79,** 1555. Bet. 1870 and 1876 addl. extensions made to the n. and s. ps., **70,** 96; **76,** ii, 426, 435. In 1870 the proj. for outer H. adopted, contemplating constr. of e. break'r 4,000′, about 3,300′ from shore, and a se. break'r about 3,000′ l., protected area being about 455 acres, of which 185 acres were reserved for ps. and slips, and 270 acres, with a d. dr. to 16′, for harborage, **70,** 101, 124; **76,** ii, 435; **79,** 1555; **86,** 1702.

In 1878 proj. further modified by addl. break'r about 5,400′ l., to be placed n. and e. of H. entrance, **79,** 1561; **81,** 2153, 2162; **86,** 306. Amount app., 1870–86, incl., $1,358,000; in 1886 est. $240,000 required to complete existing proj., **86,** 1703; **87,** 2113.

In 1888 est. for completion of existing proj., incl. superstr. constr. over e. break'r in the outer H., completion of exterior break'r and outer basin, and dr. at H. entrance, increased to $372,000, **88,** 1887; **91,** 2599.

By Capt. Marshall, 1893, rebuilding superstr. over the ps. in the outer basin, cost to be paid from part of 1892 app., **93,** 2793; and for dr. chan. entrance to Chicago R. to w. varying from 200′ to 250′, and to d. of 16½′, **93,** 2794.

Act Mar. 3, 1899, modified proj. of 1870 by providing for dr. an outer basin and H. entrance to 20′ d., l. w., **97,** 2791; **99,** 2822.

Proj. modified, 1903, by providing for replacing superstr. of n. p. with concrete, etc.; est., $85,000, **03,** 1888; au. act Mar. 3, 1905, **06,** 600.

Lt. Col. Zinn recom. that superstr. over the outer 1,225′ of s. p. be rebuilt of concrete; est., $65,000, **11,** 2348.

Act July 25, 1912, au. extension and constr. of exterior break'r, provided city of Chicago undertake imp. work contemplated by it (H. D. 710, 62d, 2d), **12,** 1007.

SURVEYS.

By Lt. Col. Graham, 1858, **70,** 99.

By Lt. Col. Cram, 1865, **66,** 16.

By Col. Raynolds, 1865, **67,** 119; by Mr. Chesbrough, **70,** 99.

By Maj. Wheeler, 1869, **70,** 99.

Under direction of Lt. Hanman, by J. Pierpont and R. S. Littlefield, 1873, **74,** 155.

By Maj. Gillespie, **76,** 98; ii, 428.

By Capt. Lydecker, 1878, **79,** 1566.

Of Chicago R. and n. and s. branches au. act June 14, 1880, **80,** 212.

Sur. of H. 1882, **83,** 1743.

Sur. of H. and its approaches made, 1892–93, by Capt. Marshall, **93,** 2794.

Of s. entrance to outer basin, **06,** 1772.

Of chans. and basins, **07,** 1919.

Act Mar. 3, 1909, au. ex. and sur. of Hs. and Rs. of Chicago and vicinity. **R.,** 1909 and 1911, by Maj. Thos. H. Rees and Lt. Col. Zinn; est., $1,211,195 (H. D. 710, 62d, 2d), **10,** 783; **12,** 1024.

H. line changed by au. of Sec. of War, Apr. 16, 1906, **06,** 1772.

Cong. docs., etc., relating to exs., surs., plans, etc., **06,** 600; **12,** 1006.

Maps:
66, 78, 1184; **80,** 1984; **81,** 2158; **82,** 2206; **83,** 1744; **84,** 1944; **85,** 2050; **86,** 1702; **87,** 2112; **90,** 2402; **91,** 2599; **92,** Atlas, 104; **94,** 2134; **95,** 2700; **96,** 2578; **98,** 2418; **03,** 1888.

Sketch of the H., June 30, 1879, followed by plan of angle-crib and plan of crib on pile foundation, **79,** 1560.

NN-15 CHICAGO RIVER, ILL.

APPROPRIATIONS.

1896,	$50,000,	**96,** 2576.
1897,	113,000,	**97,** 2798.
1898,	400,000,	**98,** 2423.
1900,	62,000,	**00,** 3785.
1902,	306,457,	**02,** 2099.
1907,	300,000,	**07,** 1924.
1909	5,000,	**09,** 1994.
1909	[1] 193,000,	**09,** 1994.
1910,	175,000,	**10,** 2150.
1911,	34,000,	**11,** 2353.
1912,	28,000,	**12,** 2543.
Total,	1,666,457	(incl. $25,000, act Aug. 18, 1884, for Chicago H., and sales, etc., $1,692,277.31, **12,** 2543).

COMMERCE. (See Chicago H.)

Important, **81,** 2165.

Description of, **96,** 2574.

About 11,000,000 t. an., 1896, **96,** 2574.

List giving dimensions and tonnage of SS. navigating the R., **97,** 2796.

The R. and its branches the most active and important nontidal stream of its length in the U. S., **00,** 3870.

Decreasing for prior 10 years on account of 16′ chan. only; greater d. impossible until tunnels are removed, **02,** 2098.

An imp. R. of great use in controlling rates, **10,** 786.

C. development greatly retarded by center-p. brs. in the R.

A good deal of C. gone since 1897 to Calumet R., **12,** 1010.

CONTRACTS.

1896. Green's Dredging Co., dr., 10.9¢ c. y.; removing piles, $1 each; removing old dock work, 50¢ c. y. ($50,193.54), **97,** 2799. Lydon & Drews Co., dr., 9.7¢ c. y.; removing old piles, $1 each; removing old dock work, 13¢ c. y. ($82,438.45), **97,** 2799.

1899. Lydon & Drews Co., dr., 16.9¢ c. y. ($39,125.50); constr. 4,782 l. f. dikes (piles, timber, ironwork). Est., entire contract, $86,737.67, **99,** 2828.

1905. Chicago & Great Lakes Dredge & Dock Co., dr., 12¾¢ c. y.; dock constr. at unit prices, **05,** 2071.

1908. Great Lakes Dredge & Dock Co., dock constr. at unit prices; Fitz Simmons & Connell Co., dr., 22½¢ c. y.; Great Lakes Dredge & Dock Co., dr. and r. excavation at unit prices, **08,** 1992, 1993. Great Lakes Dredge & Dock Co., dr. and r. excavation in South Fork, South Branch, and dr. in North Branch; est., $162,985, **09,** 1991, 1992.

1909. Fitz Simmons & Connell Co., redr. North Branch turning-basin, 17¢ c. y.; Great

[1] Trans. from Chicago H., 1907 app.

Lakes Dredge & Dock Co., redr. South Branch turning-basin, 17½¢ c. y., **10,** 2150.

1910. Great Lakes Dredge & Dock Co., dr., 35¢ c. y.; r. excavation, $5.35 c. y., in North Branch, **10,** 2151. Great Lakes Dredge & Dock Co., dr., 35¢ c. y., s. m.; and r. excavation, $5.40 and $3.95 c. y., p. m., **11,** 2353.

1912. Great Lakes Dredge & Dock Co., dr. ($45,570), 21¢ c. y., s. m., **12,** 2544.

ENGINEERS.

Chief of Engineers. R., 80, 212; **93,** 359; **98,** 401; **99,** 476, 485; **00,** 541, 550; **01,** 529; **02,** 452; **03,** 492; **04,** 537; **05,** 544, 2073; **06,** 601, 608; **07,** 626; **08,** 672; **09,** 708; **10,** 783, 796; **11,** 842, 855; **12,** 1008, 1024.

In charge:

Maj. G. J. Lydecker, 1880. **R., 81,** 2165, 2167.

Maj. W. L. Marshall, 1897–99. **R., 97,** 2793; **98,** 2421; **99,** 2826.

Maj. J. H. Willard, 1899–1901. **R., 00,** 3784, 3863, 3865; **01,** 2992.

Lt. Col. O. H. Ernst, 1902–04. **R., 02,** 2097; (Col.) **03,** 1892; **04,** 2920.

Lt. Col. W. H. Bixby, 1905–08. **R., 05,** 2069; **06,** 1773; **07,** 1921; (Col.) **08,** 1989.

Maj. Thos. H. Rees, 1909–10. **R., 09,** 1990; **10,** 2147.

Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2350; **12,** 2540.

Assistant. G. A. M. Liljencrantz. **R., 97,** 2800; **98,** 2424; **99,** 2830; **00,** 3786; **01,** 2994; **02,** 2099; **03,** 1894; **04,** 2922; **05,** 2071.

LEGAL PROCEEDINGS.

Title secured to nearly all the land needed for R. w., **99,** 2828; **00,** 542.

Sec. of War granted permission to Chicago Sanitary District to connect its artificial-drainage canal with the R. subject to the after action of Congress, **99,** 477.

Local requirements connected with dumping into Lake Michigan, **00,** 3867.

Six tracts of land required for North Branch turning-basin, and 16 for South Branch turning-basin in process of acquirement, **03,** 1892; **04,** 2921.

Notices served, Sept. 30, 1904, upon owners and lessees of tunnels under Chicago R., requiring their alteration to give least d. over them of 22′, alterations to be completed by Apr. 15, 1906, **05,** 2069, 2074.

U. S. Supreme Court decision of Mar. 12, 1906, with references to franchises of st. ry. cos.; application for rehearing; Sec. of War, Apr. 27, 1906, granted extension of time limit to July 1, 1906, for commencement of tunnel alterations, **06,** 1774.

As result of petitions from navigation interests relating to obstr. character of center-p. brs. owned by city of Chicago, War Dept. ordered removal of brs. at Fuller, Lake, and Indiana Sts. to allow d. of 22′ and 23′, giving permission to replace these brs. with certain types, of adequate clearances, within time limit, **09,** 1992, 1993.

OBSTRUCTIONS. (See Physical characteristics.)

Sewage and other such waste material deposited in the R., **99,** 2827; **00,** 3868.

Obstr. brs. and tunnels, **00,** 3866.

Imp. more or less obstr. by people, city, and other au., **00,** 3868.

Act Apr. 27, 1904, declared tunnels under R. unreasonable obstr. to navigation and made it duty of Sec. of War to order owners to alter them, **04,** 2921.

R. of Col. O. H. Ernst, on ex. of, and proposed plans for removal of tunnels under R., **05,** 2074; **R.** of public hearing, **05,** 2081; 2109.

Complaints in regard to certain brs. obstr. navigation (see Legal proceedings), **09,** 1992.

Complaints by vessel men of unreasonable delays at some of brs. across R.; believe War Dept. should adopt regulations governing operation of brs., **11,** 2351.

Complaints of individuals and corporations representing navigation interests, that St. Charles Air Line Br. should be declared an obstr. to navigation, and ordered removed, **11,** 2352.

"Recently" dr. chans. becoming rapidly shoaled by operations of Sanitary District, and by city sewage; no evidence this would be remedied in near future, **12,** 2541.

Brs., removal ordered, constr. of, etc., **12,** 2541.

Regulation governing br. operation, similar to those governing Calumet R., recom., **12,** 2541.

Old docks, decayed, ordered rebuilt by U. S. engineers, to prevent material behind them running into R., **12,** 2543.

OPERATIONS.

1895-96. 24,755 c. y. dr., **96,** 2574.

1896-97. 507,576 c. y. dr., **97,** 2795.

1897-98. 854,352 c. y. dr., **98,** 2422.

1898-99. 25,598 c. y. dr. from South Branch; 392,791 c. y. dr. from North Branch; w. and docking off the R. begun (maps), **99,** 2827.

1899-00. 93,591 c. y. dr. from North Branch, **00,** 3785.

1900-01. 59,803 c. y. removed in constr. of docks and 1,596 l. f. docks built, **01,** 2995.

1901-02. Tracts Nos. 2 and 8 acquired and dock imp. completed; 106,848 c. y. land and old dock removed, and 4,893 l. f. dock constr. under contract at cost of $20.05 l. f. of dock, **02,** 2099, 2100.

1904-05. All old docks removed from site of North Branch turning-basin, and 275,111 c. y. dr., **05,** 2072.

1905-06. 132,127 c. y. dr. from, and 343 l. f. dock built, at North Branch basin, and 295,275 c. y. dr. from, and 261 l. f. dock built at South Branch basin; North Branch basin completed, **06,** 1774.

1906-07. 34,006 c. y. dr., and 543 l. f. dock built at South Branch basin, completing contract; cost of both North and South Branch basins, $454,858.61, **07,** 1921.

1907-08. 120 piles driven under contract No. 1; 3,075 c. y. material dr. under contract No. 2, and 21,378 under contract No. 3, **08,** 1989.

1908-09. Contract No. 1 completed; total l. of dock built, 484′, at cost of $10,041.61. Contract No. 2 completed; total amount dr., 171,529 c. y., at cost of $38,594.03. Contract No. 3 completed, 591,335 c. y. having been removed from North Branch canal and North Branch, and 124,551 c. y. soft material, 23,783 c. y. r. and 3,195 c. y. hardpan having been removed from South Fork, South Branch, at total cost of $233,766.32. Under contract No. 4, 168,092 c. y. dr. from North Branch and 66,565 c. y. from South Fork, South Branch, **09,** 1991.

1909-10. 15,464 c. y. soft material and 14,882 c. y. r. and hardpan removed from South Fork, South Branch, and 410,823 c. y. removed from North Branch; North Branch turning-basin completed, 87,974 c. y. removed; South Branch turning-basin completed, 114,237 c. y. removed; 9,390 c. y. overlying material and 6,262 c. y. r. removed from North Branch; work completed, **10,** 2148.

1910-11. Work of r. removal in North Branch, vicinity of Fullerton Ave., in progress; proj. practically completed, **11,** 843, 2350.

1911-12. 31,406 c. y. soft material and 29,752.06 c. y. r. removed from North Branch under contract of Oct. 24, 1911; 40,862 c. y. dr. up to the N. Halstead St. Br., and 1,528 c. y. from w. draw of St. Charles Air Line Br., under contract of Apr. 26, 1912, **12,** 2540.

PHYSICAL CHARACTERISTICS. (See Obstructions.)

Description of, **81,** 2165, 2167; **93,** 2794; **96,** 2573; **97,** 2794.

R. the inner H. of Chicago, **97,** 2793.

Narrow stream about 16 m. l., lined with wharves and warehouses, and obstr. by numerous brs. Into it flows the sewage of Chicago. **93,** 2794.

List of brs., crossing it, and its branches, **93,** 2807.

Tunnels under the R. absolutely limit the draft of vessels, and the br. draws, docks, and bends absolutely limit the l. and beam, **97,** 2795.

Table showing how far vessels of certain dimensions can navigate the R. and its branches, **97,** 2797.

Shoaling: Deposits of solid material brought into the stream, **00,** 3785, 3867; **12,** 1009.

Depths throughout proj. portion of R., **11,** 844; **12,** 1009.

At 1912, water level varies 6.5′, an average of less than 1′ a day. The R. has a current from the lake toward Sanitary District Canal varying from 0 up to about 3 m. an hour, according to diversion and seiches, **12,** 1010.

Current observation in progress, **12,** 1010.

PLANS. (See Projects.)

Maj. Lydecker, 1880, est. formation of dr. chan. 17′ x 175′, mouth to junction of North and South Branches, would cost about $27,750, and, for that part of North Branch above the junction, to make chan. 15′ x 200′ would cost about $285,000; but reported that such imp. should be made by and at the cost of the private and local interests involved, **81,** 2165, 2168.

PRIVATE (CITY) WORK.

In 1895 Sec. of War permitted Chicago to fill in a part of the outer basin for public park, **96,** 2572.

South Branch dr. d. by Sanitary District of Chicago, **00,** 3785.

Sanitary District of Chicago, dr. 476,344 c. y. and building 5,078 l. f. new dock, and brs., **03,** 1892.

Sanitary District of Chicago removed 197,611 c. y. and built 1,248 l. f. wooden dock, and 3,275 c. y. concrete dock, **04,** 2921.

Sanitary District of Chicago, securing 26′ chan. 200′ w. through South Branch, for 5 m.; wreck of schooner *Winslow* removed at expense of city of Chicago, **05,** 2070.

Work by Sanitary District of Chicago continued, **06,** 1775.

Chicago Union Traction Co., at expense of traction company and city of Chicago, completed removal of tunnel under main branch of R. at La Salle St., and continued work on removal of tunnels at Washington and Van Buren Sts., **07,** 1922; **08,** 1990.

100,000 c. y. material removed, and 500 l. f. crib built; Dearborn St. Br. completed by Sanitary District of Chicago, **08,** 1991.

Sanitary District of Chicago removed 14,638 c. y. from North Shore Canal and North and South Branches, and 52,000 c. f. from w. side of R. bet. 12th and 16th Sts., **09,** 1992.

Sanitary District of Chicago removed 110,280 c. y. from South Branch, and 57,826 c. y. from South Fork of South Branch, **10,** 2149.

Sanitary District of Chicago dr. 406,000 c. y., which resulted in chan. 26′ x 200′ through South Branch of R., mouth to Chicago Drainage Canal entrance, except at a majority of the br. draws, **11,** 2350, 2351. North Shore Canal completed and opened Nov., 1910, **11,** 2351.

Sanitary District of Chicago removed 151,043 c. y. from South Branch, removed land, old docks, and foundation piles, constr. new docks, etc., **12,** 2541.

PROJECTS. (See Plans.)

By Capt. Marshall, 1893, dr. R. from mouth to stock yards on the South Branch, and to Belmont Ave. on North Branch, as far as might be permitted by existing docks and wharves, to permit passage of vessels drawing 16′; and acquiring title to and cutting away of certain obstr. bends and projecting docks, narrowing and obstr. the chan.; est., $700,000; est. an. cost of mainten., $80,000 to $120,000, **93,** 2800. Adopted by Congress, 1896, continuous contract system, **96,** 2574; **97,** 2794. Est. an. cost for mainten., 1898, $35,000 to $50,000, **98,** 2422.

By Maj. Marshall, 1896, dr. R. near the Illinois Central and Rush St. Brs. to 8′, **96,** 2573, 2574.

Stability of structures along the R., **00,** 3866.

Maj. Marshall est., 1899, $500,000 to $810,600 for 21′ chan. (see Surveys, 1899), **00,** 3870.

Act June 13, 1902, au. turning-basins, one on South and one on North Branch, dr. to 20′ draft; est., $500,000, **02,** 2098; **06,** 601.

Act Mar. 2, 1907, au. imp. and mainten. by certain dr. in main R., North Branch (incl. canal), South Fork of South Branch, and excavating hardpan and r. in North Branch and South Fork; est., $810,600, **08,** 672; **12,** 1009.

Recom. that U. S. redr. R. to 21′, and mainten. be undertaken by city of Chicago and Sanitary District; approv. by Dept., **12,** 2541.

SURVEYS.

Au. act June 14, 1880, **80,** 212; made by Maj. Lydecker, 1880, **81,** 2165.

In 1892 Congress directed that a **R.** should be submitted showing what imp. should be made by the U. S., an est. to accompany it. **R.** submitted by Capt. Marshall, 1893 (see Projects), **93,** 2794.

Ex. of the R. up to the forks made, 1895–96, by Capt. Marshall, **96,** 2573.

Ex. and sur. for est. of cost of 21′ chan. from mouth to stock yards on South Branch and to Belmont Ave. on North Branch, as far as permitted by existing docks and wharves, au. act Mar. 3, 1899; made, 1899, by Maj. Marshall (**R.** fav. on some conditions), **00,** 3863.

Pre. ex. and sur., West Fork of South Branch of Chicago R., for 21′ chan., made. **R.,** July 7 and Dec. 12, 1905, by Lt. Col. Bixby; imp. by U. S. inadvisable (H. D. 700, 59th, 1st), **06,** 608.

Made at various br. crossings, **09,** 1992.

Ex. West Fork of South Branch, for chan. 21′ x 100′, au. act Mar. 3, 1909; made by Maj. Rees (**R.** unfav.) (H. D. 392, 61st, 2d), **10,** 796.

Ex. and sur. au. act June 25 1910, West Fork of South Branch. **R.** submitted 1910; public hearing by BERH. Sept. 20, 1911, to be submitted to Congress, **12,** 1011, 1025.

Ex. and sur. au. act Mar. 3, 1909, of Chicago R., in connection with various Rs. and Hs. in vicinity of Chicago; **R.,** Maj. Rees, Aug. 28, 1909, and Lt. Col. Zinn, Oct. 7, 1911; est. for general imp., $1,211,195 (H. D. 710, 62d, 2d), **10,** 796; **11,** 855; **12,** 1024.

Cong. docs., etc., relating to exs., surs., plans, etc., **76,** 435; **02,** 2097; **06,** 601; **12,** 1008; Bull. 21 (1912), U. S. Lake Sur. Office, Detroit, Mich.

Maps. **97,** 2798; **99,** 2832; **03,** 1892.

NN-17 CALUMET HARBOR, ILL.[1]

APPROPRIATIONS.

1870,	[2] $50,000, **71,** 36, 117.
1871,	50,000, **71,** 36.
1872,	40,000, **72,** 34.
1873,	40,000, **73,** 35.
1874,	25,000, **74,** 41.
1875,	25,000, **75,** 46.
1876,	20,000, **76,** 99, 142.
1878,	15,000, **78,** 118.
1879,	12,000, **79,** 158.
1880,	20,000, **80,** 1989.
1881,	$30,000, **81,** 2171.
1882,	35,000, **82,** 2242.
1884,	20,000, **84,** 1947.
1886,	10,000, **86,** 1704.
1888,	20,400, **88,** 1889.
1890,	20,000, **90,** 2405.
1892,	15,000, **92,** 2246.
1894,	15,000, **95,** 2703.
1896,	75,000, **96,** 2582.
1899,	150,000, **99,** 2835.
1900,	185,350, **00,** 2790.

[1] Sur.—**R.,** Dec. 1, 1836, est., $142,213.38. 1845 (map; no report). May 15, 1850; est., $115,445. (H. D. 482, 55th, 2d.)

[2] App. for H. of refuge at Chicago, Ill.

1901,	$255,000,	**01,** 2999.
1902,	215,000,	**02,** 2104.
1903,	204,480,	**03,** 1898.
1907,	20,000,	**07,** 1925.
1910,	30,000,	**10,** 2152.

Total, 1,597,230 (incl. sales, $1,537,231, **12,** 2545).

COMMERCE.

As H. of refuge, **70,** 104; **76,** ii, 441.
Objections to imp. H., **70,** 105.
Benefits of imp., **73,** 215, 216; **76,** ii, 443, 444.
Local mfg. interests, **73,** 215; **75,** 233; **76,** ii, 443.
Advantages to be derived from imp., **80,** 1989.
Increase in mfg. interests and tonnage from imp., **90,** 2404.
Rapidly increasing, **93,** 2810; increase thought phenomenal, **95,** 2702; **96,** 2581.
The average size of vessels seeking the port in 1894–95 greater than at any other port in the world, **95,** 2773.
The existence of this imp. H. is claimed to save at least 50¢ t. over Chicago R. rates, and more over the usual Calumet RR. rates, **06,** 604.
Receipts and shipments of freight have increased during decade by about 3,000,000 t., **11,** 2355.
More new mfg. plants are occupying R. banks, **11,** 849.
Tonnage, 1902, 4,454,000; 1906, 5,291,000; 1909, 6,155,000; 1911, 6,608,000 t., **12,** 2546.
H. works fully entitled to half the credit of all the C. developed by the combined R. and H. imp. since 1870.

CONTRACTS.

1874. W. S. Carkin, dr., 17½¢ c. y., **75,** 231.
1875. R. M. Steel, materials and labor, **75,** 232; **76,** ii, 438. John H. Gutches, dr., **75,** 232; **76,** ii, 438.
1879. Culbert Bros., p., **80,** 1987; completed, **80,** 1987.
1880. G. Hannahs, p. extension, **81,** 2172; completed, **81,** 2169. O. B. Green, dr., 25¢ c. y., **81,** 2171; completed, **81,** 2169.
1881. Chicago Dredging & Dock Co., dr., 28½¢ c. y., **81,** 2172; completed, **81,** 2172.
1883. Walsh & Hannahs, p. extension, **83,** 1748; extended, **83,** 1748; completed, **84,** 1946. Calumet & Chicago Canal Dock Co., dr., 17½¢ c. y., **83,** 1748; extended, **83,** 1748; completed, **84,** 1946.
1886. H. B. Herr & Co., p. extension, **87,** 2118.
1888. H. B. Herr & Co., p. extension, $8,954.70, **89,** 2118.
1890. W. A. McGillis & Co., dr., 13½¢ c. y., **91,** 2602.
1892. Wisconsin Dredge & Dock Co., cribwork, piling, etc., $13,507.93, **93,** 2811.
1894. Fitz Simons & Connell Co., rebuilding superstr. of ps. (timber, ironwork, st., etc.), $7,419.30, **95,** 2705.
1896. N. G. Dodge & Son, dr., 17.5¢ c. y. ($4,812.50), **96,** 2583.
1897. Hausler & Lutz Towing & Dock Co., p. extension (timber, piles, ironwork, etc.), $36,438.73, **97,** 2806. Lydon & Drews Co., dr., 9¢ c. y. ($14,400), **97,** 2805. G. Cooper, rebuilding superstr. (timber, st., ironwork, etc.), $4,128.20, **97,** 2807.
1899. Hausler & Lutz Towing & Dock Co., break'r (timber, piles, ironwork, st., dr.), $350,451.88, **99,** 2836.
1902. Lydon & Drews Co., dr. area sheltered by break'r and chan. bet. ps.; Hausler & Lutz Towing & Dock Co., rebuilding dock along part of n. p., **02,** 2104. Gillen & Gillen, repairing damage to break'r caused by SS. *Matoa;* cost, $7,160; Gillen & Gillen, break'r extension, **03,** 1897, 1898.
1904. Chicago & Great Lakes Dredge & Dock Co., laying new superstr. and decking s. p., **05,** 2111.
1905. Great Lakes Dredge & Dock Co., rebuilding 300′ of p. superstr., **06,** 1778.
1908. Cullen-Friestedt Co., repairs to break'r, **08,** 1994.
1912. Great Lakes Dredge & Dock Co., dr. in the amount of $37,845, at 21¾¢ c. y., s. m., **12,** 2545.

ENGINEERS.

Chief of Engineers. **R., 70,** 37, 123, 124; **71,** 35; **72,** 34; **73,** 35; **74,** 41; **75,** 46; **76,** 99; **77,** 103; **78,** 118; **79,** 158; **80,** 211; **81,** 286; **82,** 280; **83,** 288, 1748; **84,** 290; **85,** 313; **86,** 307; **87,** 273; **88,** 248; **89,** 288; **90,** 260; **91,** 330; **92,** 316; **93,** 361; **94,** 332; **95,** 369, 376; **96,** 325; **97,** 412; **98,** 402; **99,** 477; **00,** 542; **01,** 529; **02,** 453; **03,** 493; **04,** 538; **05,** 545; **06,** 603; **07,** 628; **08,** 674; **09,** 711; **10,** 787; **11,** 845, 855; **12,** 1011, 1024.

Boards:

Board reports that the imp. of Calumet R. would not afford the relief needed by the crowded C. of Chicago, and therefore recom. no plan for this purpose, **70,** 125; **76,** ii, 442. (Col. Macomb, Lt. Col. Raynolds, and Majs. Wheeler, Weitzel, and McFarland.)
Convened by S. O. No. 84, Corps of Engineers, 1882, Lt. Col. Houston, Majs. Smith and Benyaurd, **83,** 1748. (See Projects.)

In charge:

Maj. J. B. Wheeler, 1870. **R., 70,** 104.
Maj. W. E. Merrill, in temporary charge, 1870, **76,** ii, 442.
Maj. D. C. Houston, 1870–74. **R., 71,** 117; **72,** 130; **73,** 215; **74,** 159.
Maj. G. L. Gillespie, 1874–77. **R., 75,** 231; **76,** ii, 438.
Capt. G. J. Lydecker, 1877–81. **R., 77,** 894; **78,** 1185; **79,** 1567; (Maj.) **80,** 1986; **81,** 2168.
Maj. W. H. H. Benyaurd, 1882–86. **R., 82,** 2240; **83,** 1745; **84,** 1946; **85,** 2051; **86,** 1704.
Maj. T. H. Handbury, 1886–87. **R., 87,** 2117.
Capt. W. L. Marshall, 1888–99. **R., 88,** 1888; **89,** 2116; **90,** 2404; **91,** 2602; **92,** 2245; **93,** 2810; **94,** 2138; (Maj.) **95,** 2701, 2771; **96,** 2580; **97,** 2801; **98,** 2425; **99,** 2833.
Maj. J. H. Willard, 1899–1901. **R., 00,** 3788; **01,** 2995.
Lt. Col. O. H. Ernst, 1902–04. **R., 02,** 2101; (Col.) **03,** 1896; **04,** 2924.
Lt. Col. W. H. Bixby, 1905–08. **R., 05,** 2109; **06,** 1776; **07,** 1924; (Col.) **08,** 1993.
Maj. Thos. H. Rees, 1909–10. **R., 09,** 1995; **10,** 2151.
Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2353; **12,** 2544.

Assistants:

Capt. D. P. Heap, **70,** 104.
Lt. F. A. Hinman. **R., 73,** 215; **74,** 159.
G. A. M. Liljencrantz. **R., 82,** 2243; **89,** 2118; **90,** 2405; **91,** 2604; **92,** 2247; **93,** 2812; **94,** 2140; **95,** 2703; **96,** 2588; **97,** 2807; **98,** 2429; **99,** 2837; **00,** 3791; **01,** 3000; **02,** 2105; **03,** 1899; **04,** 2927; **05,** 2112.

ESTIMATES. (See Plans and Projects.)

By Maj. Wheeler, completion, $299,875.52, **70,** 105, 107; **76,** ii, 441.
By Capt. D. P. Heap, completion, $695,000, **70,** 105, 107; **76,** ii, 441.
By Capt. Lydecker, an. repairs, $5,000, **79,** 1569.

LEGAL PROCEEDINGS.

On Dec. 9, 1902, SS. *Matoa* ran into new break'r, making a break 18′ x 36′; claim against owners (Pittsburg Steamship Co.) entered by U. S. dist. atty., **03,** 1897.

LEGISLATION.

Act recom. by BE., 1882, for protection of chan. in Calumet R., **83,** 1750.
Act June 23, 1910, made unlawful to dump dr. material or refuse of any kind whatever into Lake Michigan, near Chicago, within 8 m. from shore, **10,** 2152.

OPERATIONS.[1]

1870–71. 320 l. f. n. crib p. built; 192 l. f. s. crib p. built; 184 l. f. s. pile p. built; cribs built at Chicago for this work, **71,** 35, 118; **76,** ii, 443.

[1] History of operations to 1875, **76,** ii, 441. June, 1875, l. of n. p., incl. pile work, 2,869 l. f.; l. of s. p., incl. revet., 1,214 l. f., **75,** 232.
Abstracts of materials used and work done, **75,** 232; **76,** ii, 438; **79,** 1567. Total l. of ps., 4,260′; total dr. given as 280,000 c. y., **79,** 1568.

1871-72. 384 l. f. n. crib p. built; 320 l. f. n. p. superstr. built; 256 l. f. s. crib p. built; 475 l. f. s. pile p. built, **72,** 34, 130; **76,** ii, 443.

1872-73. 464 l. f. n. crib p. built; 228 l. f. s. crib p. built; 570 l. f. s. pile p. built; 384 l. f. s. p. superstr. built; 49,700 c. y. dr., **73,** 35, 215; **76,** ii, 443.

1873-74. 200 l. f. n. crib p. built; 384 l. f. n. p. superstr. built; 200 l. f. s. crib p. built; 228 l. f. s. p. superstr. built; 37,465 c. y. dr., **74,** 41, 159; **76,** ii, 443.

1874-75. 150 l. f. n. crib p. built; 350 l. f. n. p. superstr. built; 100 l. f. s. crib p. built; 300 l. f. s. p. superstr. built; 49,874 c. y. dr., **75,** 46, 231.

1875-76. 150 l. f. n. p. superstr. built; 200 l. f. s. crib p. built; 100 l. f. s. p. superstr. built; 34,496 c. y. dr.; repairs, crib work by contract, superstr. by hired labor, **76,** 99, ii, 438.

1876-77. 13,886 c. y. dr., **77,** 103, 895.

1877-78. 150 l. f. n. crib p. built; cribs sunk on pile foundation; cribs on s. p. refilled, **78,** 118, 1185.

1878-79. 200 l. f. n. crib p. built; 200 l. f. n. p. superstr. built; repairs, **79,** 1567.

1879-80. 200 l. f. p. extension, repairs to ps., and dr. through bar at entrance to H., **80,** 1987.

1880-81. 250 l. f. crib p. built; 14,547 c. y. dr.; minor repairs to ps., **81,** 2169.

1882-83. 11,007 c. y. dr., 200′ of cribwork completed and piles driven for p. foundation, **83,** 1745.

1883-84. P. extension and dr.; 247 cords st. purchased for refilling p., **84,** 1946.

1884-85. S. p. extended 200 l. f.; repair of 748′ of plank revet., **85,** 2051.

1886-87. S. p. extended 150′. Total work done since 1870: N. p. extended 3,640′; s. p., 1,870′; 384,376 c. y. dr., **87,** 2117.

1888-89. N. p. completed to 3,640′; s. p. to 2,020′, **89,** 2117.

1890-91. 29,088 c. y. dr., **91,** 2602.

1891-92. 57,930 c. y. dr., **92,** 2246.

1892-93. 1,600 l. f. of superstr. of ps., etc., being rebuilt, **93,** 2810.

1893-94. Works of preceding year completed, **94,** 2138.

1894-95. Repair of 1,600 l. f. of superstr. of n. and s. ps. in progress, **95,** 2701.

1895-96. Work of preceding years completed, **96,** 2580; and 5,200 c. y. dr., **96,** 2581.

1896-97. 227,225 c. y. dr.; s. p. extended 800 l. f., **97,** 2802, 2803; and rebuilding of 500 l. f. of n. p. commenced, **97,** 2803.

1897-98. Superstr. of n. p. repairs commenced last year completed, **98,** 2426.

1899-00. Outer breakw'r under constr. (drawings), **00,** 3789.

1900-01. 2,200′ foundation prepared, 19 cribs constr., 24 cribs sunk and filled with st., 1,700′ superstr. built, and 2,529 l. f. ice guard placed, **01,** 3000.

1901-02. Constr. of breakw'r continued, and 327,978 c. y. dr., **02,** 2105.

1902-03. Breakw'r completed, 905,233 c. y. dr., breakw'r extension continued, and rebuilding of dock at n. p. completed, **03,** 1896, 1897.

1903-04. Breakw'r constr. and dr. continued, **04,** 2924.

1904-05. SE. breakw'r extension completed at cost of $276,030.87, and rebuilding of superstr. of inner 1,200′ s. p. begun, **05,** 2109.

1905-06. Rebuilding superstr. of s. p. completed; 2 pile clusters placed at end of n. p.; all proj. work completed, **06,** 1776.

1907-08. Repairs to breakw'r commenced, **08,** 1993.

1908-09. Repairs to breakw'r completed, **09,** 1995.

1909-10. Damages done by storms repaired by hired labor, **10,** 2151.

1910-11. Work consisted in mainten., **11,** 846.

1911-12. 28,771 c. y. dr. under contract repairs made to breakw'r by replacing decking, **12,** 2544.

PHYSICAL CHARACTERISTICS.

General, of Calumet R. and tributaries, **70,** 104, 105; **95,** 2771; **96,** 2584.

Rocky reef 1½ m. n. of ps. and 2,800′ from shore, **70,** 105.

Advance of shore line 600′ on n. side of the n. p. and a recession of 180′ alongside s. p. since 1870 **75,** 233; and from 1875 to 1877 further advance on the n. side of 200′ and a further recession of 70′ on the s. side, **77,** 895.

Corresponding movement of the d. w. lines, **77,** 895.

Average an. advance of shore line n. of ps., 115′, 1870 to 1877, **77,** 895.

Calumet larger than the Chicago R., **76,** ii, 441.

H. one of the Hs. of the port of Chicago, **96,** 2584.

Drifting sand causing shoals, **96,** 2580; **00,** 3789.

Violent and unusual oscillations of lake levels, **03,** 1897; w. l. has total variation of about 6.5′ from highest known to lowest known w., and an average of less than 1′ oscillation per day, **12,** 1013.

Considerable damage done to breakw'r by severe storms of winter and spring of 1908, causing several breaks, **08,** 1993.

Max. draft at m. l. w., 20′, **11,** 846.

Shoaling, **11,** 2353.

900′ of n. p. are in dilapidated condition and need rebuilding, **12,** 1012.

H. 12½ m. s. of Chicago—known on Great Lakes as South Chicago H., **12,** 1011.

PLANS. (See Projects.)

By Capt. Heap, 1869, ps. and dr. to 18′; est., $695,000, **70,** 107. Proj. of Maj. Wheeler and plan of Capt. Heap compared, **70,** 105; **76,** ii, 441.

PRIVATE (CORPORATE) WORK.

Imp. by Calumet & Chicago Canal & Dock Co., **71,** 117.

Contractor for dr. and revet., Charles Mears, **71,** 117, 118.

In 1895–96 Illinois Steel Co. dr. practicable 19′ chan. to its slip, **96,** 2581; and did more work of this character in following year, **97,** 2803.

Illinois Steel Co. dumped, under special permit, heavy blocks of slag along n. side of break'r, forming valuable protection, **02,** 2105.

Sec. of War granted permission to the Illinois Steel Co. to constr. and maintain bulkheads, and fill solid behind the same in Lake Michigan, n. of the mouth of Calumet R., subject to conditions; permission also granted the Iroquois Iron Co., Mar. 11, 1910, to do similar work, **10,** 2152; **11,** 2354.

PROJECTS.

By Maj. Wheeler, 1869, 2 parallel ps., 300′ apart; dr. to 13½′ in chan.; est., $299,875. Conditions of recom., **70,** 104, 107; **76,** ii, 441, 442. Approv. by Chief of Engineers and adopted, **71,** 117.

By Maj. Wheeler, 1870, forming H. by extension of 2 parallel ps. 300′ apart, and extended to at least the 12′ curve; est., $300,000, **70,** 104, 107; **71,** 117; **76,** ii, 441, 442. Modified subsequently to provide a chan. of entrance 16′ x 300′, **80,** 211, 1988; **86,** 307.

By Maj. Gillespie, 1875, to extend n. p. to 18′ curve, and the s. p. to 12′ curve; dr. in chan., **75,** 232; **76,** ii, 438; **77,** 895.

By BE., 1882, for dr. chan. in Calumet R., 16′ x 200′, from Lake Michigan to fork at Calumet Lake; est., $225,000, **83,** 1750. (Lt. Col. Houston and Majs. Smith and Benyaurd.) Approv. by Chief of Engineers, **83,** 1748. In 1886, $392,000 having been app., $11,400 est. for completion of existing proj., **86,** 307.

In 1888 Capt. Marshall est. for completion of chan. 16′ x 300′ bet. ps., and reconstr. of n. and s. p. superstr., at total of $43,500, **88,** 1889. Increased in 1889 to $47,000, **89,** 2117; and in 1890 to $67,000, **90,** 2405.

By Capt. Marshall, 1892, rebuilding part of superstr. and revet. of ps., for 1,600 l. f., **93,** 2810.

In 1895 Capt. Marshall est. $154,550 to further imp. H., **95,** 2773; by extending the n. p. 500 l. f. and the s. p. 1,200 l. f., dr. bet. them to 20′; plan au. by Congress, **96,** 2580.

In 1896 Capt. Marshall est. $1,134,830 to imp. the outer H., **96,** 2588.

Congress, 1899, placed the proj. under continuous contract, **99,** 2834.

By Maj. Marshall, 1899, constr. exterior break'r first, and for postponing dr. until the area to be dr. should be sheltered, **99,** 2834.

Act June 13, 1902, au. modification of first and second items of proj., enlarged by act 1899, by substituting for the detached break'r an extension

in a se. direction of the first break'r for a distance not to exceed 2,500', **03,** 1896.

For repairs and mainten., approv. Mar. 23, 1907, **07,** 1925.

At 1912, proj. aimed as follows: (a) For 4,400' break'r to 32' curve; (b) extension of this break'r 2,500' l. in a se. direction from end of 1st; (c) anchorage area sheltered by break'r dr. to 21'; (d) s. p. at R. mouth extended 800'; (e) R. dr. 21' x 200' for 2 m. from mouth; (f) mainten., **12,** 1012.

SURVEYS.

By Lt. Allen, 1836, **70,** 105; **76,** ii, 441.

By Capt. McClellan, 1845, **70,** 105; **76,** ii, 441.

Directed by Maj. Wheeler; made, 1869, by Capt. Heap, **70,** 104; **76,** ii, 441.

Directed by Maj. Houston; made, 1873, by Lt. Hinman, **73,** 215.

Directed by Capt. Lydecker, 1878–79, **79,** 1568.

Local sur. made, **80,** 1987.

Sur. of bar at mouth of Calumet R., **82,** 2240.

Misc. sur., **93,** 2810.

Sur. of H. for such addl. imp. as might be required au. act Aug. 17, 1894. **R.** by Capt. Marshall, 1895 (see Projects), **95,** 2771; addl. **R.,** 1896 (see Projects), **96,** 2583.

Of basin sheltered by break'r, **07,** 1924.

Ex., Calumet Bar, also called Rockefeller Shoal, showed that bar consisted of fine sand; as it is located at approach to H., and as vessels have grounded thereon, it should be removed by dr.; this has not been included in any proj., **11,** 2354.

Ex. and sur., au. act Mar. 3, 1909, for this H. with others in the neighborhood of Chicago, made. **R.,** Aug. 28, 1909, by Maj. Rees, and Oct. 7, 1911, by Col. Zinn, with total est. $1,211,195 (H. D. 710, 62d, 2d), **11,** 855; **12,** 1024.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1012.

Maps. Sketch of H., June 30, 1879, **79,** 1568.

80. 1988; **83,** 1746; **84,** 1946; **85,** 2051; **89,** 2116; **90,** 2404; **91,** 2605; **92,** Atlas, 105, 106; **95,** 2704, 2772; **96,** 2588; **97,** 2808; **98,** 2430.

Drawings, outer break'r, **99,** 2834.

Of proposed H. of refuge, **02,** 2102.

Of Calumet H., **03,** 1896.

NN-18 CALUMET RIVER (Including "Grand" Calumet River), ILL. AND IND.

APPROPRIATIONS.

1884,	[1] $50,000,	**84,** 1948.
1886,	30,000,	**86,** 1708.
1888,	50,000,	**88,** 1896.
1890,	50,000,	**90,** 2578.
1892,	75,000,	**92,** 2252.
1894,	45,000,	**95,** 2708.
1896,	50,000,	**96,** 2593.
1899,	60,000,	**99,** 2840.
1902,	75,000,	**02,** 2109.
1904,	*[2] 43,000,	**04,** 2929.
1905,	100,000,	**05,** 2115.
1906,	156,000,	**06,** 1779.
1907,	191,500 / 20,000	**07,** 1929.
1908,	140,000,	**08,** 1998.
1909,	30,000,	**09,** 1998.
1910,	98,000,	**10,** 2155.
1911,	10,000,	**11,** 2358.

Total, 1,273,500 (incl. sales, $1,272,221.44, **12,** 2548).

COMMERCE. (See Calumet H.)

Vast C. interested in, and to be affected by, imp., **82,** 2248.

Description of mfg. enterprises interested, **82,** 2255; **85,** 2062.

Description of, **93,** 2849; **95,** 2708.

Increasing, **95,** 2708; **10,** 792.

Imp. of R. followed by a remarkable development of C., **99,** 479, 2839.

Traffic, 1911, 7,000,000 t., **12,** 1016. New mfg. plants steadily occupying banks as fast as 20' d. carried upstream, **12,** 1016.

CONTRACTS.

1887. S. O. Dixon, dr., 11¢ c. y., **88,** 1898.

1888. W. A. McGillis & Co., dr., 11¾¢ c. y., **89,** 2143.

1889. Burdick & McMahon, dr., 22¢ c. y., **89,** 2143.

1890. Wheeler & Russell, dr., 12¼¢ c. y., **91,** 2607.

1892. Wisconsin Dredge & Dock Co., dr., 13.7¢ c. y. ($12,330). Sheboygan Dredge & Dock Co., dr., 10.7¢ c. y. ($42,800). **93,** 2818.

1894. W. A. McGillis & Co., dr., 16½¢ c. y. McMahon & Montgomery Co., dr., 12.9¢ c. y. (annulled by supple. agreement, **95,** 2707). **95,** 2709

1896. C. E. Mitchell & Co., dr., 13¼¢ c. y. ($42,400), **97,** 2812.

1899. Fitz Simons & Connell Co., dr., 16¢ c. y. ($40,000), **99,** 2840.

1903. Griffith, McDermott & Watt Co., dr., 14½¢ c. y., **03,** 1902, 1903.

1904. Fitz Simons & Connell Co., dr., 22½¢ c. y., p. m., **05,** 2115.

1905. Great Lakes Dredge & Dock Co., dr., 20¢ c. y., s. m., r. excavation, $2.25 c. y., p. m.; Great Lakes Dredge & Dock Co., dr., 22¢ c. y., p. m., **05,** 2115.

1907. Great Lakes Dredge & Dock Co., dr., 19¾¢ c. y., **07,** 1929.

1908. Great Lakes Dredge & Dock Co., dr., 22.9¢ and 11.45¢ c. y., **08,** 1998. Great Lakes Dredge & Dock Co., excavating turning-basin, 12½¢ c. y., s. m., **09,** 1998.

1910. Great Lakes Dredge & Dock Co., dr., 22.8¢ and 23.5¢ c. y. for material deposited on shore, and 27¢ and 27.5¢ c. y. for material deposited in lake, **10,** 2155.

ENGINEERS.

Chief of Engineers. R., 81, 287; **82,** 282; **84,** 290, 291; **85,** 314, 315; **86,** 308; **87,** 275, 277; **88,** 250; **89,** 290, 293; **90,** 262; **91,** 331; **92,** 317; **93,** 361, 366; **94,** 333; **95,** 370; **96,** 326; **97,** 414; **98,** 403; **99,** 478; **00,** 544; **01,** 530; **02,** 453; **03,** 494; **04,** 539, 541, 2945; **05,** 546; **06,** 604; **07,** 629; **08,** 675; **09,** 713; **10,** 789; **11,** 847, 855; **12,** 1011, 1024.

Boards:

Convened, Chicago, Oct. 6, 1882, by S. O. No. 84, C. E., to report upon proposed imp. of Calumet R., **83,** 1748 (Lt. Col. Houston and Majs. Smith and Benyaurd).

BERH. **R.,** ex. of Calumet R. reviewed, **04,** 2945.

In charge:

Maj. W. H. H. Benyaurd, 1881–86. **R., 82,** 2247; **83,** 1745; **84,** 1947, 1951; **85,** 2055, 2057, 2059; **86,** 1707; **87,** 2172.

Maj. T. Handbury, 1886–87. **R., 87,** 2167.

* Allotment.

[1] Proviso to act states that no part of the app. shall be expend. until the right of way should be conveyed to the U. S. free of cost.

[2] Of this amount $1,281.02 deposited to credit of Treas., U. S., **05,** 2114.

Capt. W. L. Marshall, 1888–99. **R., 88,** 1896; **89,** 2142, 2151, 2158; **90,** 2576; **91,** 2606; **92,** 2249; **93,** 2815; **94,** 2143; (Maj.) **95,** 2706; **96,** 2590; **97,** 2810; **98,** 2430; **99,** 2838.

Maj. J. H. Willard, 1899–1901. **R., 00,** 3792; **01,** 3001.

Lt. Col. O. H. Ernst, 1902–04. **R., 02,** 2107; (Col.) **03,** 1901; **04,** 2928, 2943, 2948.

Lt. Col. W. H. Bixby, 1905–08. **R., 05,** 2113; **06,** 1778; **07,** 1926; (Col.) **08,** 1995.

Maj. Thos. H. Rees, 1909–10. **R., 09,** 1997; **10,** 2153.

Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2355; **12,** 2546.

Assistant. G. A. M. Liljencrantz. **R., 82,** 2251; **85,** 2061; **89,** 2145, 2153; **90,** 2578; **91,** 2609; **92,** 2252; **93,** 2818; **94,** 2146; **95,** 2709; **96,** 2594; **97,** 2813; **98,** 2433; **99,** 2840; **00,** 3795; **01,** 3005; **02,** 2109; **03,** 1903; **04,** 2930; **05,** 2116.

LEGAL PROCEEDINGS.

Right of way and releases from claims for damages secured by the U. S., **99,** 2838. (See note to title.)

U. S. v. The Sanitary Commission of Chicago in U. S. circuit court, wherein the latter seeks to reverse the flow of Calumet R. so as to cause the water to flow through drainage canal, **07,** 631; **08,** 677; permit given for this work by Sec. of War, June 30, 1910, under certain conditions, **10,** 2154; still pending, **12,** 1015.

Deeds tendered U. S. for the isld. in Calumet R. near 93d St., site to be used for turning-basin, **08,** 1996.

Acquisition of land for w. R. and for turning-basin progressing slowly, **11,** 848; **12,** 2547.

OBSTRUCTIONS.

3 brs., belonging to the Baltimore & Ohio, the Pennsylvania, and the Lake Shore RRs., resp., obstr., **97,** 2811.

Petition presented by navigation interests, Apr., 1908, asking for straightening of those RR. brs. near 106th St., crossing the R. at an angle, and impeding navigation; decision pending, **08,** 1996; public hearing Oct. 29, 1909; notice issued by Sec. of War, requiring removal, and certain changes in reconstr., **10,** 2154. Action taken in each case brought only temporary relief, **12,** 2547.

Brs. across streams, au. relating to, **12,** 2547.

OPERATIONS.

1887–88. 76,804 c. y. dr., **88,** 1897.

1888–89. 34,523 c. y. dr., **89,** 2143.

1889–90. 354,017 c. y. dr., **90,** 2576.

1890–91. 72,111 c. y. dr., **91,** 2607.

1891–92. 293,608 c. y. dr., **92,** 2249.

1892–94. 513,442 c. y. dr., **93,** 2816; **94,** 2144.

1894–95. Over 171,668 c. y. dr., **95,** 2707.

1895–96. 22,451 c. y. dr., **96,** 2594.

1896–97. 222,400 c. y. dr., **97,** 2811.

1897–98. 98,718 c. y. dr., **98,** 2432.

1899–00. 179,655 c. y. dr. (drawing), **00,** 3794.

1901–02. 133,629 c. y. dr.; funds exhausted and contract closed, **01,** 3005.

1902–03. Bids invited for dr., considered excessive and rejected; work readvertised and contract awarded, **03,** 1901.

1903–04. 150,204 c. y. dr., **04,** 2928.

1904–05. 370,251 c. y. dr., and 175,651 c. y. removed in restoring 21′ chan. bet. 106th St. and mouth of R., **05,** 2113.

1905–06. 32,359 c. y. overlying material and 3,848 c. y. r. removed; 48,546 c. y. removed in redr. shoals, **06,** 1779.

1906–07. Work of r. removal continued and 1,380 c. y. dr.; contract 72% completed; progress of work delayed by flinty character of r.; 31,000 c. y. material dr.; borings made at 114th St. and the Forks, **07,** 1927.

1907–08. 21,882 c. y. r. and 25,063 c. y. soft material removed; contract completed at cost of $150,567.30; work of dr. from 114th to 122d and to 124th Sts. completed, 445,621 c. y. being total removed at cost of $82,472.62; dr. work begun bet. 124th St. and the Forks, **08,** 1995, 1996.

1908–09. 257,648 c. y. removed bet. 124th St. and Forks; 219,387 c. y. removed in excavating turning-basin, at cost of $27,423.38, **09,** 1997.

1909–10. 234,335 c. y. removed bet. 124th St. and Forks, and contract closed on account of lack of funds; 85,214 c. y. dr. at and near Forks and below Forks, **10,** 2153.

1910–11. Chan. dr. to full d. and w. up to point 550′ above Western Indiana RR. br.; total l. of chan. dr., 10,175′, with 400′ below turning-basin, and about 80% of turning-basin completed, **11,** 2356.

1911–12. 232,878 c. y. dr., completing contract, **12,** 2546.

PHYSICAL CHARACTERISTICS.

Description of Grand Calumet, **89,** 2153.

Description of, **93,** 2816, 2846; **97,** 2811.

Chan. subject to considerable deterioration by filling with refuse, etc., **94,** 2144; **98,** 2432.

In 1895 impossible for contractors for dr. above the Forks to get and maintain the necessary d. long enough to have it measured and received on account of the inflow of sewage matter, etc., which filled the chan. immediately, **96,** 2592.

In 1896 chan. bet. Forks and Hammond rapidly filling, and in a worse condition than whem imp. of it began, **96,** 2592; **99,** 2839; **00,** 3793.

Table showing redr. necessary. **00,** 3797.

General description of, above the Forks, **02,** 2107.

Expend. secured chan. 21′ d. from R. mouth to "Forks," incl. turning-basin No. 5, except at the sites of the Calumet Western and Western Indian RR. brs. and that of the Torrence Ave. pontoon br.; thence about 5′ d. with 50′ w. to Hammond, Ind., **12,** 1015.

R. forms the inner H. of Calumet H. About 8 m. from Lake Michigan is the "Junction," where R. divides into Little Calumet and Grand Calumet Rs. The 21′ proj. extends up R. to "Forks" (entrance to Lake Calumet), 6.18 m. from mouth. G. Calumet R. is a lagoon 18 m. l. Lake Calumet R. is a very crooked stream 60 m. l., with 8′ to old st. dam at Blue Isld., Ill., 7.14 m. from Junction, **12,** 1013.

PLANS.

By Capt. Marshall, 1889, 16′ x 200′ chan. mouth to above the Forks; est., $1,000,000, **89,** 2158, 2159.

PRIVATE WORK.

Canal to Lake Calumet.

Imp. made by Hyde Park (town), **85,** 2058.

PROJECTS.

By BE., 1882, imp. of the lower section of Calumet R., Lake Michigan to the Forks, 6½ m., by dr. 16′ x 200′; est., $225,000, **83,** 1748, 1749, 1750; **86,** 308.

In 1885 Maj. Benyaurd proposed extension of the imp. chan., Forks to a point half a mile e. of Hammond, at addl. cost of $200,000, **85,** 2061; making the entire est. $425,000, **87,** 2167, 2170.

By Capt. Marshall, 1889, dr. Calumet R. to secure chan. from mouth to one-half mile e. of Hammond, 16′ x 200′ throughout; est., $1,000,000, or $870,000 for completion, **89,** 2144; **91,** 2608.

Congress allowed app. of 1896 to be expended for securing d. of 20′ for 2 m. above mouth of R. by dr., **96,** 2593.

Congress, 1899, confined work under app. of 1899 to that part of the R. bet. mouth and the Forks, **99,** 479.

Act June 13, 1902, au. for continuing imp. $75,000, and provided for dr. to 20′ from such existing d. up to 122d St.; to 16′, 122d St. up to forks of R.; to d. of 10′ from the Forks up to a point one-half m. above Hammond; and that ex. be made for chans. of various d. bet. mouth and a point one-half m. above Hammond; est. for chans. from 122d St. to the Forks, $498,822.50, with $10,000 an. for mainten.; est. for chan. from the Forks to one-half m. above Hammond, $65,000 an. expend. in maintaining one dr. outfit, **02,** 2107.

Because of excessive bids for dr., incl. r. removal, proj. of 1902 modified, eliminating r. removal; and

d. fixed by the r. at 112th St. (14′) accepted as limiting d. for chan. above that point; a 20′ chan. proposed from mouth to a short distance above Cummings Slip, **03,** 1901.

For restoring 20′ chan. bet. mouth and 106th St., au. June 11, 1904, **04,** 2928.

Act Mar. 3, 1905, au. chan. 20′ x 200′, mouth to 122d St., 16′ x 200′, 122d St. to the Forks, with 5 turning-basins; est., $662,480.50, and $10,000 an. mainten.; to acquire land for chan. 200′ w. from the Forks to a point one-half m. above Hammond, by deeds, free of charge to U. S., and to acquire in a similar way lands necessary for 5 turning-basins below the Forks, **05,** 2114; **06,** 605.

Proj. au. act Mar. 3, 1905, modified by act June 25, 1910, to permit use of turning-basins above No. 1, of such shape and dimensions as would enable a vessel 650′ l. to turn with ease (H. D. 172, 58th, 2d), and that it should be further modified to provide navigable d. of 20′ from 122d St. to the forks of the R.; and a turning-basin at the Forks having a similar d. and a water-surface diameter of 750′ (H. D. 349, 60th, 1st), **10,** 790; au. obtained to increase est. cost of proj. by $95,000 on account of dimensions of turning-basins Nos. 1 and 5 having been enlarged, **12,** 1015.

SURVEYS.

Sur. au. act Congress June 10, 1872, assigned to Maj. D. C. Houston, and made under his direction by W. J. Bryson, **72,** 36; **73,** 36. **R., 73,** 252, 253.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Marshall (**R.** unfav.), **89,** 2151.

Ex. Grand Calumet au. act Aug. 11, 1888; made, 1889, by Capt. Marshall, **89,** 2158.

Au. act Mar. 3, 1881; made, 1882, by Maj. Lydecker, **82,** 2247; **84,** 1951.

Ex. Little Calumet R. au. act Aug. 2, 1882; made, 1882, by Maj. Lydecker (**R.** unfav.), **84,** 1952.

Ex. for a ship canal from Calumet R. to Lake Calumet au. act July 5, 1884; made, 1884, by Maj. Benyaurd (**R.** unfav.), **85,** 2057.

Ex., Lake Calumet to Blue Isld., au. act Aug. 5, 1886; made by Maj. Benyaurd (**R.** unfav.), **87,** 2172.

Ex., Forks to Hammond, an. act July 5, 1884; made by Maj. Benyaurd, **85,** 2059.

Sur. made, 1889, by Capt. Marshall, **89,** 2147.

Ex. for an outer H. at the mouth of the R. au. act July 13, 1892; **R.** (fav.) submitted, 1893, by Capt. Marshall, **93,** 2846.

Made by A. T. Grohmann from H. to 106th St.; and of r. area developed at 111th St., **02,** 2109.

Au. act June 13, 1902; made by Col. Ernst, 1903; est., $662,480.50, and $10,000 an. mainten. (H. D. 57, 58th, 2d), **04,** 541.

Au. act Mar. 2, 1907, for 20′ from 122d St. to Forks; made, 1907, by Lt. Col. Bixby; est., $78,000 (H. D. 349, 60th, 1st), **08,** 681.

Estab. of chan. lines, **07,** 1928.

Ex. and sur. au. act Mar. 3, 1909, R. with others in the neighborhood of Chicago, made; and **R.,** 1909, by Maj. Rees, and 1911, by Col. Zinn; est., $1,211,195 (H. D. 710, 62d, 2d), **11,** 855; **12,** 1024.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1044.

Maps. **82,** 2251; **89,** 2142; **90,** 2578; **91,** 2610; **92,** Atlas, 107, 108; **93,** 2848; **94,** 2148; **95,** 2712; **96,** 2596; **97,** 2814; **98,** 2434; **03,** 1902.

Drawings. (See Operations for 1900.)

NN-18(b) LAKE MICHIGAN TO CALUMET RIVER, ILL. (Canal.)

ENGINEERS.

Chief of Engineers. R., 88, 293.

In charge. Capt. W. L. Marshall, 1888. **R., 89,** 2154.

Assistant. G. A. M. Liljencrantz. **R., 89,** 2156.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2156.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Marshall (**R.** unfav.), **89,** 2154.

NN-18(c) BERRY LAKE, IND.

ENGINEERS.

Chief of Engineers. R., 89, 293.

In charge. Capt. W. L. Marshall, 1889. **R., 89,** 2157.

PHYSICAL CHARACTERISTICS.

Description of; not connected with Lake Michigan; separated by land one-fourth m. w., in sections 16, 17, 20, and 21 of township 37 n., range 99 of 2d principal meridian, **89,** 2156, 2157.

SURVEYS.

Ex. for H. of refuge au. act Aug. 11, 1888; made, 1889, by Capt. Marshall (**R.** unfav.), **89,** 2157.

NN-20 WOLF LAKE AND RIVER, ILL. AND IND. (Wolf Lake Cut; Wolf Lake Outlet.)

APPROPRIATION.

1896, $8,000, act June 3, 1896.

COMMERCE.

Important; discussion as to, **75,** 242.

H. of Calumet only 3 m. distant, **75,** 242.

Not important, 1896–97, **97,** 2889.

ENGINEERS.

Chief of Engineers. R., 75, 46; **80,** 212; **85,** 314; **93,** 366; **97,** 421.

In charge:

Maj. G. L. Gillespie. **R., 75,** 241.

Maj. G. J. Lydecker, 1879. **R., 80,** 1999.

Maj. W. H. H. Benyaurd. **R., 85,** 2056.

Capt. W. L. Marshall, 1893–98. **R., 93,** 2850; (Maj.) **97,** 2887.

Assistant. G. A. M. Liljencrantz. **R., 93,** 2853; **97,** 2890.

LEGAL PROCEEDINGS.

In 1892–93 private persons were arguing in the U. S. circuit court their claim to ownership of parts of the lake in Illinois, **93,** 2853.

PHYSICAL CHARACTERISTICS.

Description of, **75,** 241 (Wolf, George, and Deer Lakes); **85,** 2056; **93,** 2851; **97,** 2889.

No H. at Wolf R. R. and lake in 1890 considered as not being navigable waters of the U. S. Ownership of the whole or parts of the lake claimed by private persons in 1893. Lake one of a series of depressions in the low marshy ground in vicinity of Calumet R. **93,** 2852; **97,** 2889.

PLANS. (See Projects.)

By Maj. Gillespie, cut 1,000′ l. connecting 15′ curve of Lake Michigan and of Wolf Lake. N. p., 1,800 l. f. l., extending to 18′ curve in Lake Michigan; s. p., 1,200′ l., extending to 12′ of water in Lake Michigan; also revet. of cut; est., $249,150. **75,** 242.

By Maj. Lydecker, 1880, imp. of Wolf Lake Outlet into Lake Michigan by excavation of chan. from shore to d. w. in latter, and constr. of ps. for protection of chan. Est., for first plan, $156,000; for modification of same, $162,000. Maj. Lydecker prefers second plan, but states that there is no occasion for a H. of refuge at this place and that C. does not warrant imp. **80,** 2000.

PROJECTS. (See Plans.)

Maj. Marshall, 1896, est. $1,395,042 to properly imp. R. for navigation in connection with Lake Michigan, **97,** 2889.

SURVEYS. (H. D. 482, 55th, 2d.)

Ex., 1873. **R.,** unfav.

Sur. (see Plans), 1874.

Resur. of outlet to Wolf Lake au. act Mar. 3, 1879; made, 1880, by Maj. Lydecker, **80,** 1999.

Ex. Wolf Lake au. act July 5, 1884; made, 1884, by Maj. W. H. H. Benyaurd (**R.** unfav.), **85,** 2056.

Ex. of Wolf R. and H. to determine whether Wolf R. and Lake were navigable waterways of the U. S. or covered in whole or in part by private ownership, au. act July 13, 1892; made by Capt. Marshall (**R.** unfav. to U. S. work), **93,** 2850.

Sur. of lake and R. with reference to their navigation in connection with Lake Michigan au. act June 3, 1896; made same year by Maj. Marshall (**R.** unfav.; see Projects), **97,** 2887.

Maps. **80,** 2000.

NN-22 INDIANA HARBOR, IND.

APPROPRIATIONS.

1910,	$62,000,	**10,** 2156.
1912,	25,000,	**12,** 2550.
Total,	87,000	

COMMERCE.

Area about 24 sq. m. contiguous, with 50,000± pop. and an increasing number of large industries (steel, chemical, and railroad) valued at many millions and employing over 10,000 persons. (H. D. 1113, 60th, 2d.)

At 1912 no C. data available, but information from industries located on waterway indicates large tonnage will develop on completion of imp., giving decreased rates, **12,** 1018.

CONTRACTS.

Great Lakes Dredge & Dock Co., dr. ($55,940); prices given, **11,** 2361.

ENGINEERS.

Chief of Engineers. R., 06, 608; **08,** 682; **09,** 718; **10,** 792; **11,** 849; **12,** 1016, 1024.

Boards. BERH. **Rs.** concurring in recom. of DO. that it is to the public interest for US. to take over the privately begun H. (H. D. 1113, 60th, 2d.)

In charge:

Lt. Col. W. H. Bixby, **06,** 600; **08,** 670; **09,** 706.

Maj. T. H. Rees, 1910. **R., 10,** 2156.

Lt. Col. G. A. Zinn, 1911–. **R., 11,** 2358; **12,** 2549.

LEGAL PROCEEDINGS.

No part of app. of $62,000 to be expend. until Sec. of War is satisfied that the channelway of outer or inner H. shall have been deeded to and accepted by U. S. Deeds covering channelway 300′ w. for outer H. and 200′ w. for inner H. recorded Aug. 15, 1889; no evidence that they were accepted by U. S. Deeds and maps brought down to date tendered by parties interested for acceptance by U. S., **10,** 2156. Title to right of way, incl. turning-basin, vested to U. S., 1910, **11,** 850; **12,** 1017.

OBSTRUCTIONS.

Sec. of War au. constr. of 4 RR. and 4 highway brs., **11,** 2360; **12,** 2550.

OPERATIONS.

1910–11. 77,592 c. y. dr. from chan. in lake; 70% of chan. bet. ps. d., **11,** 2359.

1911–12. 57,182 c. y. dr. from bet. ps.; work completed Aug. 11, 1911. Dr. in lake amounted to 177,181 c. y., and material dumped 8 m. from shore. Work through bars at approach to H. completed Nov. 23, 1911. Lighthouse Dept. placed 2 range lights, 1 on each p., and 10 buoys to replace the orig. spar buoys, **12,** 2549, 2550.

PHYSICAL CHARACTERISTICS.

H. 6.5 m. se. of Calumet H., Ill., begun by private enterprise (see Private work), which built parallel ps. 300′ apart and dr. 21′ chan. bet. Both ps. extend landward from shore line of 1901 about 500′, where the chan. is contracted to 65′, the clear w. of span of 5 RR. brs. at that point. There is also an inner H. 200′ w. which extends from these RR. crossings 1½ m. in a sw. direction, thence 2 m. s. to Grand Calumet R. From the bend in this chan. there is proposed a branch canal 1½ m. l. to connect with Lake George. At a point 1.1± m. from the lake is a turning-basin 400′± sq., **12,** 1017. (See also U. S. L. S. Bulletin 21 of 1912, pp. 186–188.)

Shoaling, **11,** 2359.

Description of; bars at mouth, **12,** 1016.

PRIVATE WORK.

The East Chicago Co. dr. 77,592 c. y., d. chan. from H. to Grand Calumet R., and branch to Lake George, **12,** 2550.

PROJECTS.

Act June 25, 1910, au. completion and mainten. of 22′ x 300′ chan. in outer H., w. and d. to be gradually increased from ends of ps. out to d. w. in the lake and an inner H. or canal to extend finally to Calumet R. on s. with branch canal to Lake George on w; est., $62,000, and $5,000 an. mainten. for 3 yrs. after completion (H. D. 1113, 60th, 2d), **10,** 2156.

Proposed, 1912, that U. S. take over inner chan. and assume mainten. as fast as private interests shall complete chan. and equip it with suitable draws, **12,** 1017.

L. and w. chan. (see Lake Survey under Surveys) and cutting through bars est. to increase cost $35,000, **12,** 1017.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905, to ascertain what imp. required in the chans. affording access to H., and for protection of chans. and H. **R.,** Lt. Col. Bixby, Dec. 8, 1905 (unfav.) (H. D. 721, 59th, 1st), **06,** 608.

Pre. ex. and sur. au. act Mar. 2, 1907, to determine if imp. of H. be advisable (H. D. 1113, 60th,

2d). **R.,** Col. Bixby, Nov. 14, 1907, and Aug. 28 and Sept. 23, 1908, with plan and est., $62,000, **08,** 682; **09,** 718.

Lake Survey Office. sur. locality as part of s. end of Lake Michigan; result, 1902, disclosed good reason for change in direction of entrance chan. and greater d. and w. than was considered in est. and proj. above, **12,** 1017.

Pre. ex. and sur. au. act Feb. 27, 1911, for break'r to protect entrance to H. **R.,** Lt. Col. Zinn, July 25, 1911, and Jan. 25, 1912; est., $1,033,200, 1st constr.; and constr. of shore connections for both break'rs at addl. cost of $310,000, subject to certain conditions (H. D. 690, 62d, 2d), **12,** 1024.

Map (H. D. 690, 62d, 2d). **11,** 2360.

NN-22(b) GARY HARBOR, IND.

COMMERCE.

New town of Gary constr. by Indiana Steel Co. (U. S. Steel Co.), for a large plant; production to be about 2,000,000 t. steel an. Expected that other large concerns will also locate there (H. D. 955, 60th, 1st).

ENGINEERS.

Chief of Engineers. R., 08, 681.

Boards. BERH. concurs in opinions on necessity for building a break'r, but as this is a H. benefit linked so peculiarly with one large business it might not be general (H. D. 955, 60th, 2d).

In charge. Lt. Col. W. H. Bixby, **08,** 670.

SURVEY.

Pre. ex. and sur. au. act Mar. 2, 1907, to see if break'r be necessary. **Rs.,** Lt. Col. Bixby, 1907 and 1908; est., $1,140,000 (H. D. 955, 60th, 1st), **08,** 681.

Maps. (H. D. 955, 60th, 1st.)

NN-22(c) CITY WEST HARBOR, IND.

SURVEY.

R., Feb. 8, 1838; est., $150,000 (H. D. 482, 55th, 2d).

NN-23 MICHIGAN CITY HARBOR, IND.[1]

APPROPRIATIONS.

Inner and outer harbors:

1836,	$20,000.00	
1837,	30,000.00	
1838,	60,733.59	**66,** iii, 35; **96,** 2677.
1844,	25,000.00	
1852,	20,000.00	
1855,	470.33	(claim), act Mar. 2.
1866,[2]	75,000.00	
1868,	*25,000.00,	**68,** 24; **69,** 29.
1869,	*31,185.00,	**69,** 22, 29.
1902,	63,000.00,	**02,** 2139.
1905,	45,000.00,	**05,** 2159.
1907,	60,000.00,	**07,** 1931.
1909,	*49,500.00,	**09,** 2001.
1909,	20,000.00,	**09,** 2001.
1910,	*12,200.00,	**10,** 2159.
1910,	65,500.00,	**10,** 2159.
1911,	23,000.00,	**11,** 2364.
1912,	10,000.00,	**12,** 2553.
Total,	635,588.92	

Outer harbor:

1870,	$25,000.00,	**70,** 38.
1871,	15,000.00,	**71,** 36.
1872,	50,000.00,	**72,** 34.
1873,	50,000.00,	**73,** 35.
1874,	50,000.00,	**74,** 41.
1875,	50,000.00,	**75,** 46.
1876,	35,000.00,	**76,** 99.
1878,	*2,500.00,	**78,** 119.
1878,	50,000.00,	**78,** 119.
1879,	40,000.00,	**79,** 160.
1880,	$40,000.00,	**80,** 2005.
1881,	20,000.00,	**81,** 2185.
1882,	60,000.00,	**83,** 1801.
1884,	40,000.00,	**85,** 2089.
1886,	54,375.00,	**86,** 1775.
1888,	90,000.00,	**88,** 1920.
1890,	50,000.00,	**90,** 2665.
1892,	30,000.00,	**92,** 2367.
1894,	20,000.00,	**95,** 2781.
1896,	70,000.00,	**96,** 2677.
1900,	195,000.00,	**00,** 3876.
Total,	1,036,875.00	

Inner harbor:

1878,	$25,000.00,	**78,** 119, 1189.
1880,	15,000.00,	**80,** 2006.
1881,	25,000.00,	**81,** 2195.
1882,	20,000.00,	**83,** 1802.
1884,	10,000.00,	**85,** 2090.
1886,	1,875.00,	**86,** 1776.
1888,	5,000.00,	**88,** 1921.
1890,	7,500.00,	**90,** 2666.
1892.	15,000.00,	**92,** 2368.
1895,	10,000.00,	**95,** 2777.
1896,	10,000.00,	**96,** 2675.
1899,	7,500.00,	**99,** 2897.
Total,	151,875.00	

Grand total, 1,824,338.92 (incl. misc., $1,828,468.92, **12,** 2553).

* Allotments.

[1] Sur.—**R.,** Jan. 19, 1835. (H. D. 482, 55th, 2d.)

[2] App. 1866 to be available when it was shown that $100,000 had been expend. by Michigan City Harbor Co., **67,** 23, 96.

COMMERCE.

Important, **67,** 93, 98; **68,** 115; **70,** 97, 108; **76,** ii, 445, 451; **77,** 898; **79,** 1589.

C. advantages of Michigan City, **70,** 108.

Vessels wrecked at or near Michigan City, **82,** 2269.

Increase in C. receipts, **82,** 2272.

In 1895 the importance of H. as a H. of refuge well recognized, **95,** 2780.

Up to 1898 the an. benefits to C. by the large expend. on this work important, **98,** 2491.

Rates reduced by imp., **06,** 615; **12,** 1019.

Passenger travel steadily increasing; city rapidly growing, **08,** 680; **12,** 1018.

1911, 27,000± t., mainly lumber and salt.

CONTRACTS.

1867. F. A. Slater, timber and framing, **67,** 23; contract annulled, **68,** 112. Chapin & Wells, bolts and spikes, **67,** 23. J. D. Dolan, st. and brush, **67,** 23.

1868. J. D. Dolan, timber and framing, **68,** 112.

1872. Fox & Howard, p. extension, **73,** 216.

1873. J. H. Ledlie, p. extension, **73,** 216.

1874. Culbert & Hopkins, building pile breakwater, **75,** 234; work transferred to e. p. of outer basin, **75,** 237.

1875. Culbert & Hopkins, building crib breakw'r, **75,** 235; **76,** ii, 447.

1879. U. Culbert & Co., dr., **79,** 1594. A. S. Packard, timber, **80,** 2005.

1881. U. Culbert, dr., 18¢ c. y., **81,** 2193.

1883. A. H. Petrie & Co., timber, **83,** 1799. Haskell & Barker Car Co., iron, **83,** 1799.

1886. J. M. Allmendinger, oak timber; A. H. Petrie, p. timber and plank; S. D. Kimbark, iron; Leathern & Smith, piles, and Chicago & Lemont Stone Co., st., **87,** 2205.

1889. H. B. Herr & Co., outer H. breakw'r constr., $69,239.17, **89,** 2200.

1890. H. B. Herr & Co., white pine timber, $17.90 M f. b. m., **90,** 2666. Parkhurst & Wilkinson drift bolts and spikes, 2¼¢ to 2¾¢ lb.; E. G. Crosby, timber, $18.50 M f. b. m.; J. S. Hopper & Sons, plank, $13 M f. b. m., **91,** 2708.

1892. Wisconsin Dredge & Dock Co., p. constr., $24,669.22; **93,** 2863.

1897. W. A. Starke, dr., 13¢ c. y.; transfer of plant, $2 per m., **97,** 2897.

1898. W. A. Starke, dr., 14¢ c. y., **98,** 2493.

1899. Green's Dredging Co., 15¢ c. y., **99,** 2900.

1900. Stebbings & Wenzell, breakw'r constr. (dr., piles, timber, ironwork, st.), $267,029.43, **00,** 3877. Green's Dredging Co., dr. inner H., 16½¢ c. y., **00,** 3878.

1901. S. O. Dixon, dr., 8¢ c. y., **01,** 3077. Stebbings & Wenzell, supple., for breakw'r constr., use of pine in place of hemlock timber, etc., kind of material, prices, etc., listed, **03,** 1936.

1903. Robt. Millen & Co., repairs of ps., etc., prices listed; The Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1936.

1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y., **05,** 2160.

1905-06. Great Lakes Dredge & Dock Co. (2 contracts), dr., 10.9¢ and 17¢ c. y., **06,** 1794.

1907. Greiling Bros., dr., 21½¢ c. y.; Century Fuel Co., coal, prices listed, **07,** 1932.

1908. Great Lakes Dredge & Dock Co., dr. ($4,900), **08,** 2001.

1909. Standard Construction Co., p. constr. and removal, $58,400; Greal Lakes Dredge & Dock Co., placing crib outer break'r (about $17,600), st. filling and riprap ($3,200), and repairs to outer break'r, etc. ($17,400), **09,** 2001.

1910. Great Lakes Dredge & Dock Co., dr. ($10,915), **10,** 2160. Great Lakes Dredge & Dock Co., repairs to old e. break'r ($6,105.80); The Fitz Simons & Connell Co., concrete superstr. ($16,492.50), constr. of pile p. ($2,500), **11,** 2365.

1911. The Fitz Simons & Connell Co., dr. ($11,122), **11,** 2365. Great Lakes Dredge & Dock Co., timber superstr. and pile protection ($26,968), **12,** 2558.

DEFENSE.

Plan for roadstead, for armed vessels, and for general C. of the lakes, S. D. 42, 35th, 1st, p. 175.

DOCUMENTS.

S. D. 16, 34th, 3d. **R.** of Maj. Graham, 1856, S. D. 42, 35th, 1st, p. 74.

ENGINEERS.

Chief of Engineers. R., 66, ii, 41, iii, 35; **67,** 23, 26; **68,** 32; **69,** 22, 28; **70,** 37; **71,** 36; **72,** 34; **73,** 35; **74,** 41; **75,** 46; **76,** 99; **77,** 104; **78,** 118; **79,** 160; **80,** 212; **81,** 287; **82,** 282, 2262, 2270; **83,** 290; **84,** 292; **85,** 322; **86,** 316; **87,** 284; **88,** 258; **89,** 304; **90,** 273; **91,** 344; **92,** 330; **93,** 366; **94,** 337; **95,** 376; **96,** 332; **97,** 421; **98,** 409; **99,** 486; **00,** 550; **01,** 534; **02,** 457; **03,** 498; **04,** 544; **05,** 553; **06,** 613; **07,** 632; **08,** 678; **09,** 716; **10,** 793; **11,** 851; **12,** 1018.

Boards:

Mentioned, S. D. 42, 35th, 1st, p. 74.

Convened, Milwaukee, Jan. 19, 1870. Decided outer H. not justified by local C., but that H. of refuge was necessary, and this best supplied by constr. of outer H. (See Projects.) **R., 70,** 124. (Col. Macomb, Lt. Col. Raynolds, and Majs. Wheeler, Weitzel, and McFarland.)

Convened, Chicago, Jan. 5, 1875. Recom. plan for constr. of break'r by cribwork in preference to pilework. **R., 75,** 238. (Majs. Weitzel, Houston, and Gillespie.)

Convened July 24, 1878. Recom. plan (see Projects) for constr. of a crib break'r on bearing piles, strengthened on the lake side by vertical timbers; also recom. extension of e. p. of the outer H. **R., 79,** 1588. (Majs. Houston, Robert, Smith, and Mansfield, and Capt. Lydecker.)

Convened, Michigan City, July 6, 1880, by S. O. No. 83, C. of E., to **R.** upon imp. of Michigan City H. **R., 81,** 2187. (Majs. Houston, Robert, Smith, and Lydecker.)

Convened, Milwaukee, Wis., May 22, 1882, by S. O. No. 19, C. of E., to **R.** upon proj. by Maj. Smith, for break'r and completion of outer H. **R., 82,** 2264. (Majs. Houston, Robert, Smith, and Lydecker.)

Convened, Chicago, Ill., Mar. 4, 1897, by S. O. No. 8, to ex. and **R.** on a proposed proj. for imp. of the H. **R., 97,** 2903. (Lt. Col. Lydecker, Maj. Marshall, Capt. Townsend.)

In charge:

Lt. Col. J. D. Graham, 1856–57. **R.,** S. D. 42, 35th, 1st, p. 74.

Maj. J. B. Wheeler, 1866–70; **66,** ii, 41. **R., 67,** 93, 96, 100; **68,** 111, 115; **70,** 107.

Capt. J. W. Cuyler, 1870; **70,** 33.

Maj. W. E. Merrill, 1870; **70,** 89; **76,** ii, 450.

Maj. D. C. Houston, 1870–74; **70,** 32. **R., 70,** 97; **71,** 119; **72,** 130; **73,** 216; **74,** 160.

Maj. G. L. Gillespie, 1874–77. **R., 75,** 234; **76,** ii, 444.

Capt. G. J. Lydecker, 1877–79. **R., 77,** 896; **78,** 1187.

Maj. J. A. Smith, 1878–85. **R., 79,** 1587; **80,** 2003; **81,** 2183, 2186, 2190; **82,** 2257, 2260, 2263, 2267; **83,** 1797; **84,** 1965.

Capt. D. W. Lockwood, 1885–87. **R., 85,** 2088; **86,** 1774; **87,** 2202.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1919.

Maj. W. Ludlow, 1889–93. **R., 89,** 2197; **90,** 2662; **91,** 2706; **92,** 2365; **93,** 2858.

Lt. Col. G. J. Lydecker, 1893–96, 1898. **R., 94,** 2188; **95,** 2776; **96,** 2674; **98,** 2489.

Capt. C. McD. Townsend, 1897. **R., 97,** 2895.

Capt. C. Harding, 1899–1901. **R., 99,** 2895; **00,** 3873.

Capt. Chas. Keller, 1901–03. **R., 01,** 3074; **02,** 2137.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–07. **R., 03,** 1931; (Col.) **04,** 2969; **05,** 2156; **06,** 1791.

Lt. Col. W. H. Bixby, 1907–08. **R., 07,** 1930; (Col.) **08,** 1999.

Maj. T. H. Rees, 1908–10. **R., 09,** 1994; **10,** 2157.

Maj. C. S. Bromwell, **10,** 840.

Lt. Col. G. A. Zinn, 1910–. **R., 11,** 2361; **12,** 2551.

Assistants:

Capt. A. Mackenzie. **R., 67,** 97.

Capt. D. P. Heap. **R., 67,** 93, 96; **68,** 111; **70,** 17.

Lt. F. A. Hinman. **R., 73,** 216; **74,** 160.
R. S. Littlefield, **77,** 897.
F. W. Lehnartz. **R., 01,** 3076; **02,** 2137.
G. A. M. Liljencrantz. **R., 10,** 2158.

ESTIMATES. (See Plans and Projects.)

By Capt. Heap, break'r and dr., $578,500 and $512,900, **70,** 110.

By Maj. Smith, dr. and filling ps., $69,175, **79,** 1590, 1592.

LEGAL PROCEEDINGS.

Land deeded to U. S. by city, **06,** 1792.

Negotiations under way with Michigan City officials for trans. of land to U. S. free of cost, **08,** 1999, 2000.

Land deeded to U. S. by Michigan City au., **10,** 2157.

LEGISLATION.

Indiana Legislature allows city to build revet. and assess property benefited, **05,** 554.

Public resol. No. 23, approv. May 13, 1905, au. use of unexpend. balance heretofore app. to be used for rebuilding w. revet. upon new alignment, **08,** 1999.

OBSTRUCTIONS.

R. blocked by fallen highway br., **10,** 2159.

OPERATIONS.

Mention of former operations, **67,** 98.

1866-67. 9,235 c. y. dr.; 1,135 l. f. e. and 995 l. f. w. p. extension built (length previous to 1866), **67,** 96, 98.

1867-68. 38,684 c. y. dr., **68,** 32, 114.

1868-69. 111,080 c. y. dr.; 96 l. f. e. and 256 l. f. w. p. extension built; 708' sheath piling, **69,** 28.

1869-70. Ps. built to 12'; sheath piling completed, **70,** 37, 97.

1870-71. Some dr., **71,** 36, 119.

1871-72. 70,000 c. y. dr., **72,** 34, 130.

1872-73. 18,585 c. y. dr.; 1,226 l. f. pilework e. break'r built; 723 l. f. bridged, **73,** 216.

1873-74. W. p. extended to line of proposed break'r; 503' bridged, **74,** 41, 160.

1874-75. 50 l. f. crib and 45 l. f. pilework built on outer break'r, and 520 l. f. pilework built on e. break'r, **75,** 46, 234; **76,** ii, 444.

1875-76. 600 l. f. crib built on outer break'r, and 296 l. f. pilework built on e. break'r (repairs), **76,** ii, 444.

1876-77. One course superstr. built over 12 cribs; repairs, **77,** 104, 896.

1877-78. 4 courses superstr. laid; cribs displaced by gales; repairs, **78,** 118, 1187, 1188.

1878-79. 64,119 c. y. dr.; 50 l. f. crib built on outer break'r; superstr. finished, 550', **79,** 160, 1588, 1591, 1593, 1594.

1879-80. Outer H.: 6 cribs sunk in extension of break'r and 300 l. f. superstr. built; also repairs to ps., **80,** 2003. Inner H.: 77,287 c. y. dr., **80,** 2006.

1880-81. Outer H.: Break'r extended 150' on pile foundation; 5,924 c. y. dr., **81,** 2183. Inner H.: 58,224 c. y. dr. by city, **81,** 2193.

1881-82. Outer H.: Break'r extended 200 l. f.; extensive repairs to ps.; st. scows built and cribs framed, **82,** 2257, 2258, 2259. Inner H.: 62,189 c. y. dr., **82,** 2270.

1882-83. Outer H.: 150 l. f. cribwork built; 6,504 c. y. dr.; repairs to plant, break'r, and p., **83,** 1798. Inner H.: 111,590 c. y. dr., **83,** 1802.

1883-84. Outer H.: 100 l. f. cribwork, with superstr. added to e. break'r; ps. and break'r repaired, **84,** 1965, 1966. Inner H.: 116,465 c. y. dr., **84,** 1969.

1884-85. Outer H.: End wall of w. H. p. rebuilt; 1 crib sunk in extension of new break'r p.; 18,370 c. y. dr., **85,** 2088. Inner H.: 21,890 c. y. dr., **85,** 2089.

1885-86. Outer H.: 50 l. f. cribwork, with superstr. placed in extension of break'r p.; break in s. wall repaired; 2 new courses of superstr. added to w. p.; extensive repairs to plant, **86,** 1774. Inner H.: 27,205 c. y. dr., **86,** 1776.

1886-87. Repairs to w. p., **87,** 2202.

1887-88. Outer H.: 542 l. f. of pile portion of w. p. rebuilt, entire w. p. filling replaced, and general repairs to break'r. Inner H.: 4,510 c. y. dr., **88,** 1919, 1920.

1888-89. Outer H.: Outer end of w. p. decked over; "Breakwater Pier" completed by constr. and placing of 150 l. f. of cribwork. Inner H.: 64,085 c. y. dr., **89,** 2199, 2201.

1889-90. Outer H.: 500 l. f. of new break'r work built; repairs to prior break'r constr. Inner H.: 24,740 c. y. dr., **90,** 2665, 2666.

1890-91. Outer H.: Reconstr. of the 3 outer cribs of the break'r p. completed; repairs to outer 535' of the w. pile p.; leveling up of outer break'r superstr., **91,** 2706.

1891-92. Outer H.: Repairs to break'r; superstr. completed over the 500' of cribwork in the outer break'r, **92,** 2366. Inner H.: Repairs to dr. plant; 84,893 c. y. dr., **92,** 2368.

1892-93. Outer break'r repaired, **93,** 2859; 61,940 c. y. dr. from inner H., and repairs made to U. S. dr. plant, **93,** 2861, 2862.

1893-94. Inner H.: Repairs made to w. pile p., and 27,231 c. y. dr., **94,** 2188. Outer H.: Extension of exterior break'r in progress, **94,** 2190.

1894-95. Inner H.: 25,582 c. y. dr., **95,** 2776. Outer H.: Extension of exterior break'r in progress, and some repairs made, **95,** 2777, 2779.

1895-96. Inner H.: 27,321 c. y. dr., and ps. repaired, **96,** 2674. Outer H.: Extension of exterior break'r completed, **96,** 2676; older portions of break'r repaired, **96,** 2676.

1896-97. Inner H.: Minor repairs to ps., and mainten. of plant, **97,** 2896. Outer H.: Break'r repaired, **97,** 2897.

1897-98. Inner H.: 55,534 c. y. dr., **98,** 2490.

1898-99. 18,771 c. y. dr. from inner H., and repairs made to break'r of outer H., **99,** 2896.

1899-00. 3,253 c. y. dr., and w. p. repaired at inner H.; work in progress on break'rs at outer H., **00,** 3874.

1900-01. 24,862 c. y. dr. from nner H., and work continued on break'r in outer H., **01,** 3075.

1901-02. Work on break'r n progress, **02,** 2137.

1902-03. Extension of break'r completed; work on constr. of detached break'r in progress; repairs made to entrance ps., **03,** 1933.

1903-04. Constr. of break'r completed; work in progress on repairs to entrance ps.; 4,342 c. y. dr., **04,** 2972.

1904-05. Repair work to entrance p. completed; 10,227 c. y. dr., **05,** 2156.

1905-06. 176,753 c. y. dr. (contract); 11,435 c. y. dr. (U. S.); timbers, logs, snags, etc., removed, **06,** 1792.

1906-07. 11,772 c. y. dr. (U. S.); 850 c. y. dr. (contract), **07,** 1930.

1907-08. 17,027 c. y. dr. (U. S.); 9,088 c. y. dr. (contract); repairs to p., **08,** 1999.

1908-09. Repairs to p. and breakw'r completed; work on p. constr. and placing crib at end of breakw'r in progress; st. placed around p.; 2,488 c. y. dr. (contract), **09,** 2000.

1909-10. 600 l. f. p. built; 500 l. f. old p. removed; crib sunk at end of outer breakw'r; overturned crib removed; 566.3 cords st. placed in outer breakw'r; 33,678 c. y. dr. (contract), **10,** 2157.

1910-11. 128,769 c. y. dr. (contract); constr. of new p. and removal of old p. completed; work on concrete superstr. in progress; repairs to damaged p.; 125 l. f. pile p. built; 4,194 c. y. dr. (U. S.), **11,** 2364.

1911-12. 85,136 c. y. dr.; concrete superstr. work completed; pile p. constr.; work on superstr. in progress, **12,** 2551.

PHYSICAL CHARACTERISTICS.

Character of lake bed, **67,** 93, 95; **75,** 235.

Record of rise and fall of Lake Michigan, **67,** 100.

Formation of bars, **71,** 119; **75,** 235; **79,** 1593.

Description of, **97,** 2900.

Condition of works; water levels, **01,** 3074; **02,** 2137; **03,** 1933; **04,** 2972; **05,** 2157; **06,** 1793; **07,** 1930; **08,** 2000; **09,** 2000; **10,** 2158; **11,** 2364;

Damage to works by storms, **04,** 2972; **06,** 1793; **09,** 2000.

H. 32± m. e. of Calumet H., or S. Chicago, and 38± m. se. from Chicago R., **12,** 1018; head of navigation upper turning-basin, 2 m. from end of w. p., **12,** 1020.

PLANS. (See Estimates and Projects.)

By Capt. Heap, making 2 outer Hs. of basins with breakw'rs and dr.; 1st plan, 3,200′ of p. work; 2d plan, 2,950′, **70,** 109, 110.

By Maj. Smith, dr., and refilling cribs with st., **79,** 1590, 1593.

By Maj. Smith, 1882, modification in the constr. of the remaining 166 inner f. of the e. end of the breakw'r and also the constr. of an outer breakw'r nw. of the existing H. entrance, **82,** 2260–2264.

PRIVATE (PRIVATE, CITY, AND CORPORATE) WORK.

$100,526.03 expend. by Michigan City Harbor Co., p. constr., dr., etc., **67,** 23, 93, 96, 100.

Chan. protected by repairs put upon the old ps. by citizens, **72,** 130.

Banks of chan. of the inner H. protected by revet. built by the direction of the city, **79,** 1593.

W. p. repaired by owner of abutting property, **01,** 3074.

Gas pipe under chan. and telephone cable placed by private corporations, **05,** 2158.

Chicago, Lake Shore & South Bend Ry. obtained permission from Sec. of War for dr. chan. and constr. of water intake therein, **11,** 2364.

Dock built by city in continuation s. of w. U. S. p., along w. bank of lower turning-basin completed 1912, but no dock had been built along e. bank, which should be done to prevent sand running into H. chan. (ownership of land needed in litigation), **12,** 2552.

PROJECTS. (See Estimates and Plans.)

Work commenced by U. S. in 1836. Bet. this date and 1852 $156,203.92 app., including relief claims, applied to dr., crib constr. at the entrance, and the commencement of a breakw'r covering the entrance. **67,** 98; **76,** ii, 447; S. D. 42, 35th, 1st, pp. 74, 175.

By BE., 1857, breakw'r, est. $384,376.50, S. D. 42, 35th, 1st, pp. 74, 175.

By Maj. Wheeler, extension of e. p. 288′, w. p. 320′, and dr. bet. them to 12′; est., $52,577.40, **67,** 95, 97. Modified to extend e. p. 242′ and w. p. 498′, **69,** 28. An. dr., est., $10,000, **68,** 32. Sheath piling 1,350′ and dr. to give chan. 12′ x 100′ x 1,350′; est., $35,422.50, **68,** 112, 115, 117.

By Maj. Houston, dr. chan. up to the RR. br. 200′ x 1,800′; also for general dr.; est., $40,000, **70,** 97.

By BE., 1870, outer H., to consist of, 1st, crib breakw'r, parallel with and a portion perpendicular to the shore, in all 1,700 l. f.; 2s, 320′ of e. breakw'r perpendicular to the shore; 3d, 416′ of e. breakw'r adjoining the shore; also for the purchase of a dr. outfit and for dr.; est., $324,421.40, subsequently increased by Capt. Lydecker to $355,000, **70,** 125; **76,** 449; **77,** 898. Modified by Maj. Houston, to consist of a pile breakw'r in place of cribwork, **72,** 130; **75,** 236.

By BE., 1875, a breakw'r of cribwork 1,400′ l.; also completion of shore end of the e. p. of the outer basin; est., $163,613.07, subsequently increased by Maj. Gillespie $25,104.04, **75,** 239, 240; **76,** ii, 445. Modified in 1878 to have the cribs rest upon a foundation of bearing piles; est. completion, $117,000. Approv. (see Boards of Engineers, 1878). **79,** 1589, 1590.

By Maj. Smith, dr. inner H. to give chan. 15′ x 120′ x 2,700′; est. $50,000, **79,** 1593.

In 1880 BE. recom. extension of a p. 400′ l. from the w. end of breakw'r, at right angles thereto, and a 2d p. 300′ l. and 300′ to the w., the w. extension to be connected with the outer end of the existing w. p. by fender piling; also the removal of the old e. (R.) p. to 1,100′ s. of the inner face of the breakw'r, and the extension of the breakw'r e. to close the opening proposed at the ne. angle of the H. in 1877, **81,** 2188; **82,** 2263.

The BE. of 1882 approv. Maj. Smith's plan for a masonry and concrete superstr. on the remaining e. 166 inner f., to be built in completion of the breakw'r; also the plan for an exterior breakw'r 2,000′ l. and covering the entrance to the H. from n. and ne. gales, with the ultimate removal of about 500′ of the existing w. p. at H. entrance, **82,** 2264, 2266, 2270.

Bet. 1880 and 1886, incl., $224,375 was app. for the outer and $71,875 for the inner H., when it was est. that $395,625 would be required for the completion of the former and $3,125 for the latter, **86,** 317; increased to $8,125 in 1888, **88,** 1921; est. for completion of outer H. increased by $24,000 in 1889, **89,** 2200.

A BE., 1897, est. that it would cost $282,150 to imp. the H., **97,** 2904.

Act Mar. 3, 1899, provided for carrying on work by continuing contract, and permitted the Sec. of War to modify the proj. at his discretion. Sec. of War, as recom. by the BE. of 1897, modified, 1899, the proj. to provide for extending the break'r p. by 600′ and constr. new detached break'r 1,500′ l., the existing detached break'r to be removed; est., $282,150, **97,** 2903; **00,** 551. To comply with provision of act au. continuous contract, 100′, on account of price of constr. being higher than orig. est., was deducted from proj. l. of 1,500′ break'r (drawings), **00,** 3875.

Citizens of Michigan City request constr. of new p. and w. of H., **04,** 2973.

Act Mar. 3, 1905, au. turning-basin in inner H., **05,** 2158.

Aug. 15, 1908, War Dept. approved proj. for w. inner H. entrance, redr. inner H. chan., upper end inner H., completion of exterior break'r, repair, mainten., and supervision to get 15′ below Lake Sur. standard l. w., with w. and l. in inner H. 120′–150′ bet. docks where estab. by city, and from Lake Erie & Western RR. br. downstream to Lake Michigan, 10,500, ± including 2 turning-basins and with 225′± bet. lake ps.; est., $180,000, **09,** 716.

Act June 25, 1910, au. repair and mainten. of old abandoned p. and break'r structures, **11,** 852.

Recom., 1912, that chan. d. should be at least 18′ to accommodate boats, **12,** 1018.

SURVEYS.

By Mr. Bowes, 1852, **67,** 100.
By Capt. Mackenzie, **67,** 26, 96. **R., 67,** 97.
By Maj. Smith, 1878, **79,** 1593.
Minor surs., **99,** 2896.

Maps:
Of Michigan City H., **78,** 1188; **79,** 1592.
Sketches of crib for break'r, **79,** 1588; **80,** 2006; **81,** 2188; **82,** 2270; **90,** 2666; **96,** 2676; **97,** 2904; (drawings), **00,** 3878.

NN-24 LAKE MICHIGAN TO WABASH RIVER, IND. AND OHIO. (Canal.)[1]

APPROPRIATION.

1875 (sur.), $2,000, act Mar. 3.

COMMERCE.

Importance of a C. canal compared with the importance of a drainage canal, **76,** ii, 461–463.

ENGINEERS.

Chief of Engineers. R., 76, 99.

In charge:
Capt. H. Stansbury, 1831, **76,** ii, 455.
Maj. G. L. Gillespie, 1875. **R., 76,** ii, 454.

Assistant. G. Crocker. **R.** (extract), **76,** ii, 461.

[1] Sur.—**R.,** Oct. 17, 1831; est., $1,860,468.07 and $1,895,904.88. (H. D. 482, 55th, 2d.)

PHYSICAL CHARACTERISTICS.

General description of Wabash and Kankakee Rs., **76,** ii, 454, 458, 461.

PLANS.

By Capt. Stansbury, 1831, canal with 37 locks, 157 m. and 716 y. l., 40′ w. at surface, 28′ w. at bottom, 4′ d., and fed by waters from Devils Lake and Yellow R.; est., $2,000,000. Maj. Gillespie's est., $3,941,869.70, **76,** ii, 455, 456.

By Maj. Gillespie: (1) Canal, via Trail Creek, Michigan City, Ind., route, 118 m. and 213 y. l., with 44 locks, summit level of 5 m. in l. and 170′ above Lake Michigan, fed by the lakes n. of La Porte, Ind.; est., $3,446,479.02, **76,** ii, 457, 458, 459; (2) canal via Coffee Creek route, with a summit level, by a 30′ cutting, 175′ above Lake Michigan, requiring 17 locks, impracticability shown, **76,** ii, 459; (3) canal, via Wolf Lake route, from Grand Calumet R., but having an inferior water supply, **76,** ii, 460; (4) canal via St. Joseph and Kankakee route, 148 m. and 2,062 y. l., and requiring 32 locks; est., $3,945,791.60, **76,** ii, 460, 461. Superiority of St. Joseph and Kankakee route, **76,** ii, 460, 461.

PRIVATE (CORPORATE) WORK.

1870-71. Kankakee Valley Drainage Co. organized; considerable draining done, **76,** ii, 460, 462.

SURVEYS.

By Capt. Stansbury, 1831, **76,** ii, 455.
Ex. by Maj. Gillespie, 1875. **R., 76,** ii, 454.

NN-25 NEW BUFFALO HARBOR, MICH.[1]

APPROPRIATIONS.

1852,	$8,000,	**66,** iii, 35.
1867,	60,000,	**67,** 23; **69,** 29.
1870,	5,000,	**70,** 38.
1872,	5,000,	**72,** 34.
1882,	5,000,	**82,** 283.
Total,	83,000	

COMMERCE.

Considered as a H. of refuge, S. D. 42, 35th, 1st, pp. 76, 77.

Local requirements insignificant, **71,** 120; **73,** 35, 218; **74,** 41; **75,** 241; **76,** ii, 451.

Objections to further imp., **73,** 35, 218; **74,** 41; **77,** 899.

CONTRACTS.

1867. Carkin & Kimball, material and labor, and dr., **67,** 103. R. N. Gere, materials, **67,** 58, 103.

1871. R. A. Conolly, materials and labor, **71,** 36, 120.

DOCUMENTS. (Not published in reports.)

H. D. 251, 25th, 2d; S. D. 1, 33d, 1st, part 3; S. D. 16, 34th, 3d. Containing records of operations previous to 1866.

ENGINEERS.

Chief of Engineers. R., 66, 7, iii, 14, 35; **67,** 23; **68,** 32; **69,** 29; **70,** 38; **71,** 36; **72,** 34; **73,** 35; **74,** 41; **75,** 46; **76,** 99; **77,** 104; **78,** 119; **79,** 161; **80,** 213; **81,** 289; **82,** 283; **83,** 291; **84,** 293; **85,** 322; **10,** 796.

Boards:

Recom. (1853) ps. to 10′ water, each 300′ l. and 300′ apart. S. D. 1, 33d, 1st, pp. 213, 214; S. D. 42, 35th, 1st, p. 75.

Convened, Buffalo, N. Y., Jan. 22, 1868; reported in favor of abandoning the imp. for reasons stated. **R., 68,** 223. (Cols. Cram and Macomb, Lt. Cols. Raynolds, Newton, and Blunt, Maj. Wheeler, and Capt. Harwood.)

In charge:

Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st, p. 74.

Maj. J. B. Wheeler, 1866–70. **R., 67,** 102; **68,** 117.

Maj. W. E. Merrill in temporary charge, Feb. to Mar., 1870, **76,** ii, 442.

Maj. D. C. Houston, 1870–74. **R., 70,** 97; **71,** 119; **72,** 131; **73,** 217.

Maj. G. L. Gillespie, 1874–77. **R., 75,** 241; **76,** ii, 451.

Capt. G. J. Lydecker, 1877–79. **R., 77,** 899; **78,** 1189.

Maj. J. A. Smith, 1879–84. **R., 79,** 1596; **80,** 2006; **81,** 2195; **82,** 2272, 2273, 2278; **83,** 1803; **84,** 1969.

Capt. D. W. Lockwood, 1885. **R., 85,** 2087.

Maj. T. H. Rees, **10,** 781.

Assistants:

Lt. D. P. Heap, 1866–69. **R., 67,** 102; **68,** 117.

O. L. Petitdidier. **R., 82,** 2276.

Capt. J. A. Manning. **R., 84,** 1970.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, 1857, 1st, for local use, $98,113.47; 2d, for general H. of refuge, $167,607.79, the dr. by U. S. apparatus; S. D. 42, 35th, 1st, pp. 76, 80, 175.

By Maj. J. B. Wheeler, 1866, revised est. of Maj. Graham's 2d plan, $384,020, **66,** iii, 14, 35, iv, 154, 155.

By Lt. Heap, ps. and dr., $108,587.60, **67,** 102.

By BE., and by Capt. Heap. For permanent completion with $3,000 to $8,000 addl. an. for dr., $500,000; **68,** 118, 223; **72,** 131; **76,** ii, 452; **77,** 899.

By Maj. Houston, for completion, $125,000, **70,** 38, 98.

EXPENDITURES.

1857. Remainder of former app. expend., S. D. 42, 35th, 1st, p. 74.

OPERATIONS.[2]

1866-67. Dr. in cut, 11,250 c. y. dr., **67,** 103; **72,** 131.

1867-68. Dr. in cut, 70,563 c. y. dr., **68,** 32, 118; **72,** 131.

1868-69. Dr. in cut, **69,** 29.

1869-70. Dam built across natural R. mouth, **70,** 38, 97; **76,** ii, 453.

1870-71. Pile p. begun, **71,** 36, 119.

1871-72. 301 l. f. pile p. nearly completed, **72,** 34, 131.

1881-82. Outer p. section removed to l. w. level; oak piling replaced in position and 20 new piles driven; new timber superstr. completed; repairs to other portions of p., **82,** 2273.

1883-84. E. entrance p. extended 100 l. f. by close piling and crib superstr., **84,** 1969, 1970.

1884-85. P. extension completed, **85,** 2087.

PHYSICAL CHARACTERISTICS.

General, of Galien R., S. D. 42, 35th, 1st, pp. 74, 75.

Changes in position of outlet of R., **66,** iii, 14, iv, 153.

Shore drift, **68,** 118, 223; **69,** 29; **76,** ii, 453.

[1] Sur.—**R.,** Aug. 10, 1854; est., $46,805.25. (H. D. 482, 55th, 2d.)
[2] Dilapidated condition of the work in 1877, **77,** 899.

PLANS. (See Estimates and Projects.)

BE., 1853, confined to commencement of the work, final opinion reserved. Recom. 2 parallel ps. to 10′ of water, 300′ apart, and each 700′ l., S. D. 42, 35th, 1st, pp. 75, 76.

By Maj. Graham, 1857, (1) H. of refuge for the largest class of lake vessels; 2 parallel ps. 300′ apart; through cut from Lake Michigan to Lake Pottawatomie; dr. to 13′; revet. of cut, S. D. 42, 35th, 1st, pp. 75, 175; (2) H. suitable to the local trade and the smaller class of lake vessels; 2 parallel ps. 300′ apart, each 600′ l., and dr. a chan. and basin, S. D. 42, 35th, 1st, pp. 75, 80, 175. Indorsed by Maj. Wheeler in 1866, **66,** iv, 154; **76,** ii, 451, 452.

By Capt. Heap, 1867, a plan very similar to Maj. Graham's first plan, **67,** 102; **76,** ii, 452.

By Maj. Houston, ps., revet., and dr., **70,** 98; **76,** ii, 453.

By Maj. Smith, 1881, H. of refuge with 3,500 l. f. of breakw'r and 3,000 l. f. of ps. from shore. Est., $800,000, or if covered with superstr. and parapet of masonry, $970,000, **82,** 2275. Or, by d. a part of the swamp and creek and connecting the H. thus made with the lake by a chan. 300′ w., protected by ps. Est., $650,000, **82,** 2276.

By Maj. Smith, 1881, H. imp., by extending e. p. 500′ and w. p. 600′; also 1,000 l. f. of chan. revet. and dr. Est., $150,500, **82,** 2279.

PROJECTS.

The orig. proj., adopted 1857, proposed a chan. 12′ x 200′ through the sand bank bet. Lake Michigan and Lake Pottawatomie, **67,** 102. The proj. was partly carried out in 1868, when a BE. recom. its abandonment, **68,** 223; **85,** 322.

By Maj. Houston, 1871, pile p. on n. side of chan., this work being preliminary to probable future work, **71,** 36, 120.

SURVEYS.

By Lts. Berrien and Rose, 1835, S. D. 42, 35th, 1st, p. 75.

By Maj. Graham, 1857, S. D. 42, 35th, 1st, pp. 74, 79; **66,** iv, 153.

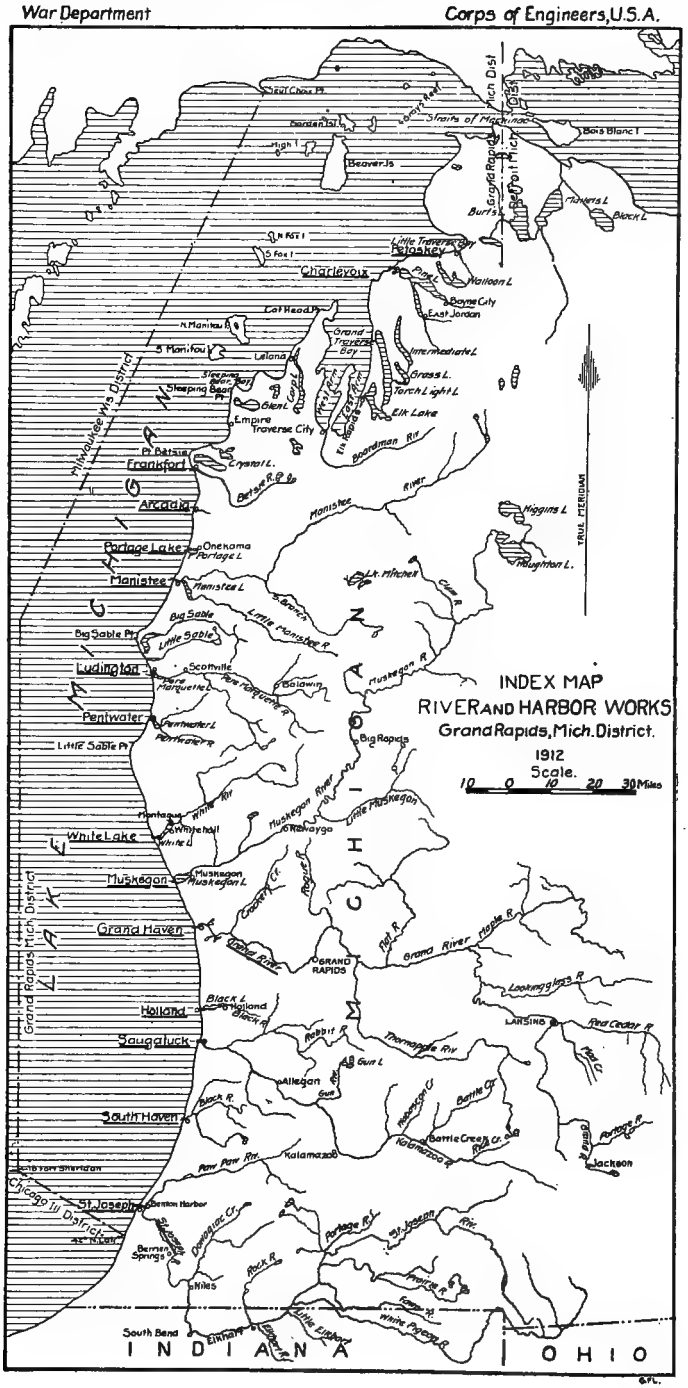
By Maj. J. B. Wheeler, 1866, **66,** iii, 14, iv, 155.

Au. act Mar. 3, 1881; made, 1881, by Maj. Smith, **82,** 2273.

Ex. au. act Mar. 3, 1909. **R.,** Maj. Rees, June 12, 1909 (H. D. 310, 61st, 2d) (unfav.), **10,** 796.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

OO—GRAND RAPIDS, MICH., DISTRICT.


War Department
Corps of Engineers, U.S.A.
INDEX MAP
RIVER AND HARBOR WORKS
Grand Rapids, Mich. District.
1912
Scale.
10 0 10 20 30 Miles
TRUE MERIDIAN
Mich Dist
Detroit Mich Dist
Grand Rapids Mich District
Milwaukee Wis District
Chicago Ill District
LAKE MICHIGAN
INDIANA
OHIO
Sault Choix Pt
Gordon Isl
High I
Beaver Is
Straits of Mackinac
Bois Blanc I
Grand Rapids
Burts L
Mullets L
Black L
N Fox I
S Fox I
Little Traverse Bay
Petoskey
Charlevoix
Pine L
Walloon L
Boyne City
East Jordan
Cat Head Pt
N Manitou I
S Manitou I
Lelana
Grand Traverse Bay
Intermediate L
Grass L
Torch Light L
Elk Lake
Sleeping Bear Bay
Sleeping Bear Pt
Glen L
Empire
Traverse City
Boardman Riv
Pt Betsie
Frankfort
Crystal L
Betsie R
Arcadia
Manistee River
Higgins L
Houghton L
Portage Lake
Onekama
Portage L
Manistee
Manistee L
Lk. Mitchell
Clam R
Big Sable
Little Sable
Big Sable Pt
Little Manistee R
Ludington
Scottville
Pere Marquette L
Pere Marquette R
Balawin
Muskegon R
Pentwater
Pentwater L
Pentwater R
Little Sable Pt
Big Rapids
Little Muskegon
Montague
White Riv
Whitehall
White L
White Lake
Muskegon River
Kewayga
Muskegon
Muskegon L
Crockery Cr
Rogue R
Grand Haven
Grand River
Flat R
Grand River
Maple R
GRAND RAPIDS
Lookingglass R
Holland
Black L
Holland
Black R
Saugatuck
Rabbit R
Thornapple Riv
LANSING
Red Cedar R
Mud Cr
Gun L
Allegan
Gun
Black R
South Haven
Battle Cr
Battle Creek
Kalamazoo R
Kalamazoo
Portage R
Jackson
Paw Paw Riv
Chicago Ill District
St Joseph
Benton Harbor
Bernen Springs
Dowagiac Cr
Portage R
St Joseph Riv
Rock R
Niles
Prairie R
Fawn R
White Pigeon R
South Bend
Elkhart
Little Elkhart
G.F.L.

OO.—GRAND RAPIDS, MICH., DISTRICT.

In charge of U. S. Engineer Office,
Grand Rapids, Mich.

OO 1 Lake Michigan.
OO 2 St. Joseph H., Mich. (1)
OO 3 St. Joseph R., Mich. and Ind. (1)
OO 4 Elkhart R., Ind. (3)
OO 5 Little Elkhart R., Ind. (3)
OO 6 White Pigeon R., Mich., Ind., and Ohio (3)
OO 7 Fawn R., Mich., Ind., and Ohio (3)
OO 8 Prairie R., Mich. (3)
OO 9 Portage, Mich. (going down, No. 3) (3)
OO 10 Rock R., Mich. and Ind. (3)
OO 11 Dowagiac R., Mich. (3)
OO 12 Paw Paw R., Mich. (3)
OO 13 South Haven, Mich. (1)
OO 14 Black R., Mich. (1)
OO 15 Kalamazoo R., Mich. (1)
OO 16 Swan Cr., Mich. (15)
OO 17 Rice Cr., Mich. (going down, No. 15) (15)
OO 18 Battle Cr., Mich. (15)
OO 19 Gun R., Mich. (15)
OO 20 Rabbit R., Mich. (15)
OO 21 Saugatuck H., Mich. (15) (1)
OO 22 Holland H., Mich. (1)
OO 23 Black R., Mich. (22)
OO 24 Grand Haven, Mich. (1)
OO 25 Grand R., Mich. (24)
OO 26 Bass R., Mich. (25)
OO 27 Thomapple R., Mich. (25)
OO 28 Portage R., Mich. (going down, No. 25) (25)
OO 29 Red Cedar R., Mich. (25)
OO 30 Lookingglass R., Mich. (25)
OO 31 Maple R., Mich. (25)
OO 32 Flat R., Mich. (25)
OO 33 Rogue R., Mich. (25)
OO 34 Crockery Cr., Mich. (25)
OO 35 Muskegon H., Mich. (1)
OO 36 Muskegon R., Mich. (35)
OO 37 Little Muskegon R., Mich. (36)
OO 38 Clam R., Mich. (36)
OO 39 White Lake H., Mich. (1)
OO 40 White R., Mich. (39)
OO 41 Pentwater H., Mich. (1)
OO 42 Pentwater R., Mich. (41)
OO 43 Ludington H., Mich. (1)
OO 44 Pere Marquette R., Mich. (43)
OO 45 Little Sable R., Mich. (1)
OO 46 Big Sable R., Mich. (1)
OO 47 Manistee H., Mich. (1)
OO 48 Manistee R., Mich. (47)
OO 49 Little Manistee R., Mich. (48)
OO 50 South Br., Manistee R., Mich. (48)
OO 51 Portage Lake, Mich. (1)
OO 52 Arcadia H., Mich. (1)
OO 53 Frankfort H., Mich. (1)
OO 54 Betsie R., Mich. (53)
OO 55 Grand Traverse B., Mich. (1)
OO 56 Traverse City, Mich. (55)
OO 57 Boardman R., Mich. (56)
OO 58 Charlevoix H., Mich. (1)
OO 59 Pine R., Mich. (58)
OO 60 Pine Lake, Mich. (59)
OO 61 Little Traverse B., Mich. (1)
OO 62 Petoskey, Mich. (61)
OO 63 Cross Village, Mich. (1)
OO 64 [1] **Straits of Mackinac, Mich. (1) (Lake Huron).**

OO-1(a) LAKE MICHIGAN (East Shore).

(U. S. dredge *Gen. G. G. Meade*, formerly *Gen. Gillespie*.)

ENGINEERS.

Chief of Engineers. **R., 09,** 753; **10,** 830; **11,** 885; **12,** 1056.

In charge:

Maj. Chas. Keller, 1909. **R., 09,** 2056.

Maj. C. S. Riché, 1910–. **R., 10,** 2217; (Lt. Col.) **11,** 2414; **12,** 2611.

OPERATIONS.

1908-09. The work of the seagoing suction dr. *Gen. Gillespie* was closely supervised and verified since Mar. 1, 1909. From Mar. 19 to June 30, 1909, the total amount dr. was 189,737 c. y., at average unit cost of $0.07618 c. y., **09,** 2056–57. Name changed to *Gen. G. G. Meade*, **09,** 753.

1909-10. 486,102 c. y. dr. from Hs. on e. shore of Lake Michigan by dr. *Gen. Meade*, **10,** 2456–57.

1910-11. 464,380 c. y. dr., **11,** 2414. Au. granted to change from coal to oil fuel; oil plant installed, **11,** 2414.

1911-12. Repairs to U.S. dr. *Gen. Meade* completed, after dr. 484,566 c. y. from Hs. on e. shore of lake, **12,** 2612.

[1] See note p. 1297.

PHYSICAL CHARACTERISTICS.

The Hs., for dr. of which the seagoing suction dr. was constr., are not deep enough, and the distance bet. the extreme Hs. is too large for the dr.; these circumstances affect the final cost of dr. unfav., **09,** 2056.

Details of boat, **10,** 2217.

Average capacity of dr. under all circumstances, 2,600 c. y. per day; max. capacity, 4,000 c. y. per day of 8 hours, **10,** 2218.

Great advantage of dr. *Meade* is the ability to work on entrance bars, Lake Michigan, in nearly all seasons, **12,** 1057.

Saving in expense through use of oil fuel, **12,** 2612.

OO-1(b) LAKE MICHIGAN, MICH. AND WIS. (Effect of wave action.)

ENGINEERS.

Chief of Engineers. R., 06, 645.
Boards. BE., **06,** 645.
In charge. Col. M. B. Adams, **06,** 613.

SURVEY.

Ex. au. act Mar. 3, 1905, for BE. to inquire into effect of wave action as injuriously affecting Hs. at Ludington, Mich., Manitowoc, Two Rivers, Racine, Kenosha, and Sheboygan, Wis., and to **R.** what plan of imp. is desirable to overcome wave action, and as to use of cement or other permanent substance in future constr. and repair of ps. in said Hs. and others similarly situated. **R.,** BE., July 15, 1905 (H. D. 62, 59th, 1st), **06,** 645.

R. by Maj. Judson, Dec. 13, 1906, and BERH., giving detailed ests. of imp. Hs. of Lake Michigan against effect of wave action, as follows:

Two Rivers H., Wis.	$10,000
Manitowoc H., Wis.	514,000
Sheboygan H., Wis.	253,000
Racine H., Wis.	225,000
Kenosha H., Wis.	35,000

BERH. recom. adoption of proj. for Manitowoc H., Wis., but that work at other Hs. be postponed until efficiency of work at this H. is demonstrated. (R. and H. C., 3, 59th, 2d.)

Maps. (H. D. 62, 59th, 1st.)

OO-1(c) LAKE MICHIGAN. (Water levels.)

ENGINEERS.

Chief of Engineers. R., 02, 457; **03,** 498; **04,** 544; **05,** 553; **06,** 613; **07,** 640; **08,** 687; **09,** 723; **10,** 801; **11,** 856; **12,** 1025.

In charge:
Capt. Chas. Keller, **02,** 457; **03,** 498.
Col. M. B. Adams, **04,** 544; **05,** 553; **06,** 613; **07,** 640; **08,** 686; **09,** 723.
Maj. Chas. Keller, **10,** 801.
Lt. Col. C. S. Riché, **11,** 856; **12,** 1025.

PHYSICAL CHARACTERISTICS.

Level of lake surface of all Hs. e. coast of Lake Michigan varies considerably from time to time; max. height is from 0.5′ to 1′ below m. l. w., obtaining from end of June to middle of Aug.; lowest stage bet. 1.5′ to 2′ below m. l. l. and obtains from early in Nov. to early in Apr., **02,** 457; **03,** 498; **04,** 544; **05,** 553; **06,** 613; **07,** 640; **08,** 687; **09,** 723; **10,** 801; **11,** 856; **12,** 1025.

Mean level for 1911 was about 1.4′ lower than average for past 51 years and is lower than any year since 1897, drop in levels during 1909, 1910 having been 0.87, and during 1911, 0.35′; still falling rapidly. Equal drop per year for 1 or 2 more years will cause serious trouble in all lake Hs. from Superior to Ontario, incl., **11,** 856.

Proj. depths in an. **Rs.** are actual depths of water in the various Hs. on e. shore of lake unless otherwise stated, **12,** 1025.

OO-2 ST. JOSEPH HARBOR AND RIVER, MICH.

Part.	Title.	Period.	Appropriations.
a	St. Joseph H. (Benton H.), Mich.	1836–1901	$835,063
b	St. Joseph R., Mich.	1880–1896	5,500
c	St. Joseph H. and R., Mich.	1902–1912	85,500
	Total		926,063

(Total, incl. misc. and less 80¢ carried to surplus fund, $927,218.25, **12,** 2564.)

Part (a), OO-2 St. Joseph Harbor (Benton Harbor), Mich.[1]

APPROPRIATIONS.

1836,	$20,000	**66,** iii, 35.
1837,	15,000	
1838,	51,113	
1843,	25,000	
1844,	20,000	
1852,	10,000	
1864,	15,000	
1866,	6,000	
1867,	23,000,	act Mar. 2.
1867,	*7,500,	**68,** 32; **76,** ii, 517.
1870,	[2] 14,500,	**70,** 44.
1871,	10,000,	**71,** 42.
1872,	3,000,	**72,** 39.
1874,	2,000,	**74,** 45.
1875,	35,000,	**75,** 50.
1876,	12,000,	**76,** 36, 103.
1878,	12,000,	**78,** 124.
1879,	6,000,	**79,** 166.
1880,	8,000,	**80,** 2032.
1881,	10,000,	**81,** 2239.
1882,	12,000,	**82,** 2321.
1884,	15,000,	**84,** 1994.
1886,	10,000,	**86,** 1772.
1888,	12,000,	**88,** 1918.
1890,	20,000,	**90,** 2660.
1892,	[3] 59,000,	**92,** 2361.
1894,	30,000,	**95,** 2785.
1896,	30,000,	**96,** 2681.
1899,	50,000,	**99,** 2903.
1900,	253,950,	**00,** 3881.
1901,	38,000,	**01,** 3081.
Total,	835,063	

COMMERCE.

H. of refuge, S. D. 42, 35th, 1st, p. 84; **66,** 20; **67,** 104; **68,** 119; **75,** 264; **76,** ii, 519.

RR. br. a detriment to the H., **74,** 195; **75,** 264; **76,** ii, 317.

Modification of the existing form of the RR. br. recom. by BE., **76,** ii, 317.

Imp. of the H., S. D. 42, 35th, 1st, pp. 82, 84; **66,** iv, 111; **67,** 103, 104.

Benefits of imp., **66,** 20; **68,** 119; **75,** 262; **76,** ii, 103, 516.

Shipping interests, **67,** 104; **68,** 119.

In 1897 C. rapidly increasing, **98,** 2497.

Benton Transit Co. estab., **01,** 538.

CONTRACTS.

1866. Hasbrouck & Conro, materials, **66,** iv, 113; **67,** 58; **68,** 119.

1870. R. A. Conolly, materials and labor, **71,** 155. C. Fitzsimmons, st., **71,** 155, 156. Messrs. Pierce & Whaling, iron, **71,** 155, 156.

1871. R. A. Conolly, materials and labor, **71,** 157. Parkhurst & Wilkinson, iron, **71,** 157.

1875. Hughes & Williams, materials and labor, **75,** 262.

1876. C. Hopkins, material and labor, **77,** 919.

1878. N. S. Gere, p. extension, **79,** 1631.

1879. Dewar & Corlett, p. extension, **80,** 2032.

1886. Deming & Oliver, materials for scow constr., **86,** 1773. Leathern & Smith, plank; S. D. Kimbark, iron; T. W. Kirby, st.; A. H. Petries, pine timber; and J. M. Allmendinger, piles, **87,** 2201.

1889. J. M. Allmendinger, pile and timber wing dam, $2,895, **89,** 2196.

1891. F. A. Hagen, st., $2.25 cord; E. G. Crosby, pine timber, $18 M f. b. m.; J. M. Allmendinger, pine piles, 15¢ l. f.; white pine plank, $16 M f. b. m.; and brush, $2.75 cord; E. B. Mather, bolts and spikes, 3¼¢ lb., **91,** 2704.

1892. E. G. Crosby, p. constr., $36,697.32, **93,** 2868.

1897. Wm. A. Starke, dr., **97,** 2908. Eslow & Munroe, p. repair, $4,353.55, **97,** 2908.

1899. Greens Dredging Co., dr.; J. M. Allmendinger, p. repairs (cutting down old work, timber, ironwork, st.), $17,228.40, **99,** 2904.

1900. Lydon & Drews Co., p. extension (dr., piles, timber, ironwork, st.), $258,554.38; Greens Dredging Co., dr., **00,** 3882.

1901. S. O. Dixon, dr., 8¢ c. y., **01,** 3081.

DOCUMENTS. (Not published in reports.)

S. D. 16, 34th, 3d; H. D. 160, 43d, 2d.

ENGINEERS.

Chief of Engineers. R., 66, 2, 5, iii, 11, 35, iv, 110; **67,** 24; **68,** 32; **69,** 33; **70,** 44; **71,** 41; **72,** 39; **73,** 39; **74,** 45; **75,** 50; **76,** 92, 103; **77,** 109; **78,** 124; **79,** 166, 167; **80,** 218; **81,** 296; **82,** 291; **83,** 298; **84,** 300; **85,** 321; **86,** 316; **87,** 284; **88,** 257; **89,** 303; **90,** 272; **91,** 343; **92,** 329; **93,** 368; **94,** 339; **95,** 377; **96,** 333; **97,** 423; **98,** 410; **99,** 488; **00,** 552; **01,** 537.

Boards. To ex. the H., 1875, and the constr. of the RR. br. across H., and report whether the br. materially affects the C. of the H.; and, if so, in what manner its constr. might be modified. Board recom., in place of s. draw, a swinging br. with clear openings of 75′, **76,** 92, ii, 316. **R., 76,** ii, 316. (Majs. Houston, Gillespie, and Mansfield.)

In charge:

Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, pp. 82, 175.

Lt. Col. T. J. Cram, 1864–65. **R., 66,** 19.

Col. Sitgreaves, 1865; **66,** 20.

Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 110; **67,** 103; **68,** 119.

Capt. F. U. Farquhar, 1869–72. **R., 69,** 97; **70,** 143; **71,** 155; **72,** 183.

Capt. S. M. Mansfield, 1872–79. **R., 72,** 194; **73,** 281; **74,** 194; **75,** 261; **76,** ii, 516; **77,** 919; **78,** 1214; **79,** 1631.

Maj. F. Harwood, 1880–82. **R., 80,** 2030; **81,** 2238.

Maj. D. P. Heap, 1882–83. **R., 82,** 2318.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1832; **84,** 1993; **85,** 2086; **86,** 1771; **87,** 2200.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1917.

Maj. W. Ludlow, 1889–93. **R., 89,** 2194; **90,** 2658; **91,** 2702; **92,** 2357, 2362; **93,** 2864.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2192; **95,** 2782; **96,** 2678; **98,** 2494.

Capt. C. McD. Townsend, 1897. **R., 97,** 2905.

Capt. C. Harding, 1899–01. **R., 99,** 2901; **00,** 3879.

Capt. Chas. Keller, 1901. **R., 01,** 3079.

Assistants:

Lt. D. P. Heap. **R., 67,** 103; **68,** 119.

S. C. B. Carpenter, **67,** 104.

F. W. Lehnartz. **R., 01,** 3079.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, 1857, repairs and dr., $97,633.91, S. D. 42, 35th, 1st, pp. 83, 175.

By Lt. Col. Cram, 1864, repairs and p. extension, $7,500, **66,** 5, 19.

By Maj. Wheeler, 1866, addl. for completion, $28,459.84, **66,** iii, 11, iv, 111, 112; **76,** ii, 517.

By Capt. Heap, 1867, crib p., $77,000, **67,** 104; **74,** 194.

By Capt. Farquhar, 1869, completion, $116,666, **69,** 34, 97, 98; **74,** 194; **76,** ii, 518.

By Maj. Mansfield, 1875, p. extension and R. work, $50,215.47, **75,** 262, 265; $42,127.11, **75,** 263.

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* Allotment.

[1] Sur.—**R.** Sept. 13, 1864; est., $27,000. (H. D. 482, 55th, 2d.)

[2] Part of $15,000; $500 allotted to Grand Haven, **70,** 44.

[3] Part of $60,000; $1,000 allotted to St. Joseph R.

For completion of R. and H. work, 1876, in addition to app. of 1876, $16,320.26, **76,** 103, ii, 517. For completion, 1879, of existing proj., $13,216.71, **79,** 166.

LEGISLATION.

Resol. of the legislature of Michigan, Apr., 1875, asking the Sec. of War to cause an ex. of the H., **76,** ii, 316.

OBSTRUCTIONS.

In 1893 public hearing was held relating to alleged obstr. of navigation of the Paw Paw by brs. of the Chicago & West Michigan and the Cleveland, Cincinnati, Chicago & St. Louis Rys., **93,** 2867.

OPERATIONS.[1]

1864–65. Repairs, **66,** 20.

1866–67. N. p. 409 l. f. superstr. built; s. p., 200 l. f. superstr. built; 409 l. f. old superstr. replaced on n. p. and 200 l. f. on s. p.; **67,** 24; **76,** ii, 518, 520.

1867–68. S. p., 200 l. f. pile p. built; **68,** 32; **76.** ii, 520.

1870–71. S. p. extension completed, **71,** 41; **74,** 195.

1871–72. S. p., 416 l. f. pile p. built; repairs to the n. p., **72,** 39, 183; **76,** ii, 518, 520.

1872–73. Pile protection for pierhead; repairs, **73,** 39, 281; **74,** 195.

1874–75. Wing dam begun; repairs, **75,** 50, 261.

1875–76. N. p., 300 l. f. crib p. built; R., 528 l. f. wing dam built, **76,** 103, ii, 516, 518.

1876–77. N. p., 50 l. f. crib p. built; n. p. riprapped, **70,** 109, 919.

1877–78. N. p., 50 l. f. superstr. built; p. leveled and refilled, **78,** 124, 1214.

1878–79. N. p., 50 l. f. crib p. built; 6,740 c. y. dr., **79,** 166, 1631.

1879–80. P. extension under Gere's contract completed; dr. on outer bar completed; wing dam completed at mouth of Benton H. canal, **80,** 2030.

1880–81. N. p. extended 50′; 27,137 c. y. dr. in Benton H. chan., **81,** 2238.

1881–82. D. and revetting Benton H. chan. commenced, **82,** 2320.

1882–83. 180 l. f. of s. p. repaired and refilled, 700 l. f. of sand fence built on n. side of chan., and 760 on s. side, **83,** 1832.

1885–86. Breaks in the n. p. repaired, **86,** 1771.

1886–87. Repairs to pile revet. and plant, and renewal of s. p. superstr. commenced, **87,** 2200.

1887–88. Filling in pile revet. renewed; 476 l. f. of old r. filling and superstr. renewed; 14,850 c. y. dr., **88,** 1918.

1888–89. 176 l. f. of wing dam built; 24,840 c. y. dr., **89,** 2195.

1889–90. Repairs to n. p.; 11,905 c. y. dr., **90,** 2659.

1890–91. 27,000 c. y. dr., **91,** 2703.

1891–92. 57,520 c. y. dr.; repairs to n. revet. completed, and incomplete portion of s. p. superstr. finished, **92,** 2359.

1892–93. 89,044 c. y. dr., repairs made to dr. plant, and to chan. wall of the n. p.; extension of n. p. by cribwork in progress, and gauge readings made, **93,** 2865, 2866.

1893–94. Extension of n. p. completed, and break in n. p. repaired, **94,** 2193. 17,935 c. y. dr., **94,** 2194.

1894–95. Temporary repairs made to n. p., and 91,213 c. y. dr., **95,** 2783.

1895–96. Rebuilding of part of n. p. in progress, and 58,933 c. y. dr., **96,** 2680.

1896–97. Rebuilding of n. p. continued, and 105,241 c. y. dr., **97,** 2906.

1897–98. 35,542 c. y. dr., and rebuilding of n. p. completed, **98,** 2494.

1898–99. 34,096 c. y. dr.; s. p. repaired temporarily and permanent repairs begun (drawings), **99,** 2901.

1899–00. Extensive repairs made to part of s. p.; preparations made for p. extension, and 27,884 c. y. dr. (drawings), **00,** 3879–.

1900–01. 26,767 c. y. dr., repairs to n. p. completed, and work on n. and s. p. extension in progress, **01,** 3079.

PHYSICAL CHARACTERISTICS.

General, of St. Joseph R., **67,** 103; **76,** ii, 519; **77,** 920.

Shore drift, **75,** 264; **76,** ii, 520.

Description of, **93,** 2864; **97,** 2906; **98,** 2496.

Condition of work; water levels, **01,** 3080.

Breaks in chan. wall caused by collision of SS., **01,** 3080.

PLANS. (See Estimates and Projects.)

By Col. Cram, 1865, extension of s. p. 200 l. f., **66,** 19.

By Capt. Heap, 1867–68, s. p. extension: (1) By cribwork; (2) by pilework; pilework recom. on the score of economy; 1st plan approved, **67,** 24; **74,** 194.

PRIVATE (CORPORATE AND PRIVATE) WORK.

Dr. begun in 1891 by the Chicago & W. Michigan Ry. through its drawbr. completed in 1892, **93,** 2866.

Description of dock work done by private parties in 1894–95, **94,** 2194; **95,** 2783.

In 1894 the Cincinnati, Cleveland, Chicago & St. Louis Ry. Co. satisfactorily completed the rebuilding of 300 l. f. wing dam au. act 1892, **94,** 2194.

PROJECTS. (See Estimates and Plans.)

By Maj. Graham, 1857, repairs and dr., S. D. 42, 35th, 1st, pp. 83, 84, 175.

By Lt. Col. Cram, 1864–65, repairs, etc., **66,** 19, iv, 110.

By Maj. Wheeler, 1866, extension of the s. p. 200′, with repairs to both ps.; est., $28,459.84, **66,** iii, 11, iv, 111, 112; **76,** ii, 517; **79,** 1633. 1867. Extension of s. p. 700′; est., $77,000, **67,** 104; **74,** 194; **76,** ii, 518.

By Capt. Farquhar, 1869, extension of the n. p. 940′ and the s. p. 928′; est., $116,600, **67,** 34, 97; **74,** 195; **76,** ii, 518.

By Maj. Mansfield, 1875, extension of the n. p. N. 78° W. (previous direction having been N. 37½° W.) for a distance of 400′; est., $42,215.47, **75,** 265; **76,** ii, 518.

1836 to 1865, incl., $156,113 app., **66,** iii, 35. Proj. 1866 and 1874 proposed chan. of entrance not less than 16′ d., **66,** iv, 111, 112; **75,** 265; **76,** ii, 518.

1880, proj. modified by the imp. of Benton H. Chan. to 12′. together with the revet. of the n. bank for 2,500′, **80,** 2031.

Est., 1886, $41,015 required to complete proj., **86,** 316; **87,** 2201.

In 1891 Maj. Ludlow proposed reconstr. of 370′ of old cribwork in the n. p., refilling n. revet., minor repairs to ps. and wing wall, and dr. and extension of n. p. 120′; est., $145,000, **92,** 2360.

By Capt. Townsend, 1897, necessary repairs to existing ps.; extension of n. p. to 20′ contour and of s. p. to 18′ contour; dr. at H. entrance and in front of city for 150′; to 18′, and of Benton H. Canal, and a turning-basin at R. mouth to 15′; est., $380,000, **98,** 2498; (H. D. 307, 55th, 2d). (With map), Act 1899 placed work under continuous contract. **99,** 2901.

SURVEYS.

By Maj. Graham, 1856, S. D. 42, 35th, 1st, p. 82.

By Maj. Raynolds, 1863, **76,** ii, 519.

By Col. Cram, 1865, **66,** 20.

By Capt. Farquhar, 1869–71, **76,** ii, 520, 521.

[1] Statement of condition of the work in 1857, S. D. 42, 35th, 1st, p. 82. Statement of condition of the work in 1867, **67,** 103; **68,** 119. Inference from old maps, plans, etc., that the total amount app., 1836 to 1866, expend. on 1,100 l. f. of n. p. and on 212 l. f. of s. p., **74,** 194; **76,** ii, 519. History of operations, 1866–74, **74,** 194; 1866–75, **76,** ii, 519; to 1878, **79,** 1632. Cribs lost, **76,** ii, 516; **77,** 109, 919. Abstracts of materials used and work done, **72,** 183; **79,** 1631.

By Maj. Mansfield, 1874, **74,** 45; **76,** ii, 521.
By Maj. Mansfield, 1875, **75,** 261, 264; **76,** ii, 316.
Au. act Mar. 3, 1879, of St. Joseph R., incl. chan. to Benton H.; assigned to Maj. Mansfield, 1879, **79,** 167.
Sur. to correct errors in existing maps made, 1893, by Maj. Ludlow, **93,** 2866.

Resur. from entrance to the upper limit of interior navigation at Benton H. made, 1894, by Lt. Col. Lydecker, **94,** 2194.

Maps:
Of H., **66,** i. **82,** 2318, 2320; **83,** 1832.
Drawings. (See Operations for 1899 and 1900.)

Part (b), OO-2 St. Joseph River, Mich.[1]

APPROPRIATIONS.

1888,	$2,500,	**89,** 2197.
1890,	1,000,	**90,** 2662.
1892,	[2] 1,000,	**93,** 2870.
1894,	500,	**95,** 2787.
1896,	500,	**96,** 2683.
Total,	5,500	

ENGINEERS.

Chief of Engineers. R., 80, 221; **88,** 258; **89,** 304; **90,** 273; **91,** 343; **92,** 330; **93,** 369; **94,** 340; **95,** 378; **96,** 334; **97,** 424; **98,** 411; **99,** 489; **00,** 553; **01,** 538.

In charge:
Maj. F. Harwood, 1879–80. **R., 80,** 2049.
Maj. W. Ludlow, 1888–93. **R., 89,** 2196; **90,** 2662; **91,** 2705; **92,** 2363; **93,** 2870.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2197; **95,** 2786; **96,** 2682; **98,** 2499.
Capt. C. McD. Townsend, 1897. **R., 97,** 2909.
Capt. C. Harding, 1899–1901. **R., 99,** 2905; **00,** 3883.
Capt. Chas. Keller. **R., 01,** 3083.

Assistant. J. A. Mitchell. **R.; 80,** 2050.

OPERATIONS.

1889–90. 400 l. f. of log, brush, and st. dam built by hired labor, **90,** 2661.
1890–91. 4 wing dams built, **91,** 2706.
1891–92. 4 wing dams built and 318 snags and 7 bowlders removed, **92,** 2364.
1893–94. Dams constr. and repaired, and repairs made to a training dike, **94,** 2197.
1894–95. Dams constr. and repairs at the various shoals, and obstr. removed, **95,** 2786.
1895–96. Dams constr. and repaired and obstr. removed, **96,** 2683.
1897–98. Dams constr. and repaired and obstr. removed, **98,** 2500.
1898–99. Wing dams repaired and a few snags removed, **99,** 2905.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 2051.
In 1895 the lower part only of the R., about 25 m. l., in use for C. purposes, **95,** 2786.

PLANS.

By Maj. Harwood, 1880, imp. of St. Joseph R. bet. St. Joseph and Berrien Springs, 15 m., to give 4′ slackwater navigation, with 8 dams and 11 locks, with the elevation of brs., and raising dams at South Bend and Mishawaka; est., $634,331.
Maj. Harwood considers cost of imp. not commensurate with C. to be benefited, **80,** 2054.

PROJECTS.

By Maj. Harwood, 1880, imp. of R., mouth to Berrien Springs, with wing dams, dr., and removal of snags and other obstr.; est., $11,300, **88,** 258.
By Maj. Ludlow, 1889, d. of 3′–4′, St. Joseph to Berrien Springs, 25 m., by removal of snags and bowlders, and the constr. of wing dams, **92,** 2363.

SURVEY.

Au. act Mar. 3, 1879; made, 1880, by Maj. Harwood, **80,** 2049.

Part (c), OO-2 St. Joseph Harbor and River, Mich.

APPROPRIATIONS.

1902,	[3] $24,000,	**02,** 2144.
1905,	[4] 15,000,	**05,** 2163.
1907,	[4] 15,000,	**07,** 1949.
1907,	[5] 1,000,	**07,** 1949.
1909,	[4] 15,000,	**09,** 2020.
1912,	[4] 15,000,	**12,** 2564.
1912,	[5] 500,	**12,** 2564.
Total,	85,500	(incl. misc., $86,656.05, **12,** 2564).

COMMERCE.

Traffic shows continuous growth, **02,** 460.
Decrease in C. and passengers over previous years, **08,** 2032.
Increase over 1908, **10,** 2180; 1911, 183,163 t., **12,** 2565.

CONTRACTS.

1903. Chicago & Great Lakes Dredging Co., repairs to ps., prices given; Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1941.
1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 2980.
1907. Century Fuel Co., coal, prices given, **07,** 1949.
1908. S. P. Bennett Fuel & Ice Co., coal, prices given; The Fitz Simmons & Connell Co., dr., 23¢ c. y., **08,** 2031.
1909. Green Stone & Quarrying Co., st., $8.70 cord, **09,** 2021.
1910. Century Fuel Co., coal, prices given, **10,** 2179.
1911. Indian Refining Co., oil, prices given; Johnson & Rasch, st., prices given, **11,** 2376.
1912. Indian Refining Co., oil, 3.04¢ gal., **12,** 2565.

ENGINEERS.

Chief of Engineers. R., 02, 460; **03,** 501; **04,** 547; **05,** 556; **06,** 616; **07,** 640; **08,** 687; **09,** 723; **10,** 802; **11,** 856; **12,** 1025, 1058.

In charge:
Capt. Chas. Keller, 1901–03. **R., 02,** 2141.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1937; (Col.) **04,** 2976; **05,** 2161; **06,** 1795; **07,** 1947; **08,** 2029.
Maj. Chas. Keller, 1909–10. **R., 09,** 2019.
Maj. C. S. Riché, 1910–1912. **R., 10,** 2177; (Lt. Col.) **11,** 2373; **12,** 2561.

[1] Sur.—**R.** Feb. 5, 1835. (H. D. 482, 55th, 2d.)
[2] Allotted from app. for St. Joseph H.
[3] St. Joseph H., $23,250, and St. Joseph R., $750.
[4] St. Joseph H.
[5] St. Joseph R.

OPERATIONS.

1901-02. 277,047 c. y. dr. from H., 3 cribs in n. p. and 10 cribs in s. p. sunk, 89 foundation piles driven, and repairs made to break in n. p., **02,** 2141.

1902-03. (H.) 7 cribs sunk in n. p., 7 cribs sunk in s. p., and refilling n. and s. p. in progress **03,** 1938.

1903-04. (H.) Work on extension of n. and s. p. completed, repairs to ps. completed, and 44,572 c. y. dr., **04,** 2976.

1904-05. 35,170 c. y. dr. from H. Snags removed from R. and one wing dam built by hired labor, **05,** 2162.

1905-06. 77,380 c. y. dr. by U. S. plant from H., **06,** 1795.

1906-07. 56,427 c. y. dr. from H. New dam built in R. across chan. at Twin Springs Isld., **07,** 1948.

1907-08. 11,760 c. y. dr. from H., **08,** 2030.

1908-09. 51,905 c. y. dr. from H., and repairs made to n. and s. p., **09,** 2019.

1909-10. (H.) St. filling placed in n. and s. p., 14,364 c. y. dr. from shoal, 30,766 c. y. dr. at expense of U. S. Lighthouse Estab. (repairs to ps. paid for by owners of vessels which damaged p.), **10,** 2177.

1910-11. (H.) Repairs made to s. p. and n. p., and st. placed around outer portions of both ps., **11,** 2373.

1911-12. (H.) Repairs to damaged p., st. filling placed, 4,966 c. y. dr. from bar. Dams built in R. to close chan. and concentrate flow, and snags and leaning trees removed, **12,** 2561.

PHYSICAL CHARACTERISTICS.

Condition of work; soundings, **02,** 2143; **03,** 1938; **04,** 548; 2978; **05,** 2161; **06,** 1795; **07,** 1947; **08,** 2020; **10,** 2178; **11,** 2374.

Damages to ps. by vessels colliding, **10,** 802.

PRIVATE WORK.

Dr. by Graham & Morton Trans. Co. in H., and Ind., Ill. & Iowa RR. Co. in R., **03,** 1938.

Sec. of War au. constr. of br. to replace old Napier Br. Further gives au. to renew viaduct over Morrison Chan. and Mich. Central RR. in city of St. Joseph, **05,** 2163.

SURVEYS.

Pre. ex. au. act Feb. 27, 1911, of H., with view to further imp. by removal of shoal, and securing increased d. and w. of chan. below Pere Marquette RR., **R.** by Lt. Col. Riché, Sept. 8, 1911 (H. D. 629, 62d, 2d) (unfav.), **12,** 1058.

Maps. (H. D. 629, 62d, 2d.)

OO-13 SOUTH HAVEN HARBOR, MICH.[1]

APPROPRIATIONS.

1867,	$43,000,	**67,** 24.
1870,	10,000,	**70,** 43.
1871,	15,000,	**71,** 41.
1872,	12,000,	**72,** 39.
1873,	20,000,	**73,** 39.
1874,	10,000,	**74,** 45.
1875,	10,000,	**75,** 50.
1876,	10,000,	**76,** 36, 103.
1878,	12,000,	**78,** 123.
1879,	7,500,	**79,** 166.
1880,	5,000,	**80,** 2029.
1881,	5,000,	**81,** 2236.
1882,	10,000,	**82,** 2317.
1884,	7,500,	**84,** 1993.
1886,	5,000,	**86,** 1771.
1888,	10,000,	**88,** 1917.
1890,	15,000,	**90,** 2657.
1892,	10,000,	**92,** 2356.
1894,	20,000,	**95,** 2789.
1896,	15,000,	**96,** 2685.
1899,	45,000,	**99,** 2908.
1901,	*1,000,	**01,** 3086.
1902,	*2,300,	**02,** 2148.
1902,	12,000,	**02,** 2148.
1904,	*5,000,	**04,** 2983.
1905,	50,000,	**05,** 2168.
1907,	40,000,	**07,** 1951.
1910,	50,000,	**10,** 2181.
1912,	3,000,	**12,** 2568.
1912,	40,000,	**12,** 2568.
Total,	500,300 (incl. $2,256.51 misc., $502,556.51, **12,** 2568).	

COMMERCE.

H. of refuge; importance as, **67,** 105; **69,** 97; **70,** 142.

Lumbering and agricultural interests, **66,** iv, 149, 150.

Justification of imp., **66,** iv, 149, 150.

Benefits of imp. more local than general, **68,** 120; **76,** ii, 515.

407,289 t. in 1900; daily passenger and freight line bet. South Haven and Chicago estab., **01,** 539.

Increasing rapidly, **06,** 620.

Water-borne C. about 73% local and 27% through traffic, 19,244 t. in 1911, **12,** 1030.

CONTRACTS.

1867. G. Eastman, materials; R. N. Gere, materials; G. Hannahs, labor, **67,** 105.

1870. G. Hannahs, timber; G. P. Adams, st., **71,** 153.

1871. G. Hannahs, materials and labor; Pierce & Whaling, materials, **71,** 153.

1872. J. Caldwell, materials and labor, **73,** 279, 280.

1873. W. Nicolls, materials and labor, **73,** 279, 280.

1874. A. Dodge, revet., and dr., 23¢ to 30¢ c. y., **75,** 259, 260.

1875. Squier & White, revet. and dr., 35¢ to 80¢ c. y., **75,** 259, 261.

1878. N. Stanton Gere, revet. and dr., 12½¢ c. y., **79,** 1627, 1630.

1880. Squier & White, dr., 25¢ c. y., **80,** 2028.

1882. Squier & White, dr., 19¢ c. y., **83,** 1831.

1887. H. B. Herr & Co., crib constr., **87,** 2199.

1889. Weimar, Rath & Gaylord, crib constr. upon pile foundation, $5,837, **89,** 2193.

1891. F. A. Hagen, st., $2.24 cord; Parkhurst & Wilkinson, tie rods, bolts, and spikes, 2¾¢ lb.; Gaylord & Wing, white pine timber and plank, $18 and $16 M f. b. m.; J. M. Allmendinger, Norway pine piles, 12½¢ l. f., **91,** 2701.

1893. E. D. Weimer, furnishing and delivering lumber for repairs to p.—pine timber, $19.75; pine planking, $20 1,000 f., **93,** 2873.

1897. N. J. Gaylord, p. extension, $13,323.66, **97,** 2912.

1898. W. A. Starke, dr., **98,** 2502.

1899. Greens Dredging Co., dr. N. J. Gaylord, cribwork and p. repairs (removal of old work, dr., piles, timber, ironwork, st. and sand filling)-$21,598.66, **99,** 2909.

* Allotment.

[1] Sur.—**R.** Feb. 7, 1837; est., $58,788.64. (H. D. 482, 55th, 2d.) At mouth of Black (formerly called South Black) R. For physical characteristics of the R., which is about 80 m. l., see Ex. Doc. No. 56, **66,** ii, 149. Distinct from Black R., the tributary of St. Clair R.

1900. Greens Dredging Co., dr. Smith & Nelson, extension and repair of p. (removing old work, dr., piles, timber, ironwork, st. filling), **$22,537.33, 00,** 3886.

1901. Samuel O. Dixon, dr., 13¢ c. y., **01,** 3086.

1902. S. O. Dixon, dr., 18½¢ c. y., **02,** 2148.

1903. The Lydon & Drews Co., dr., 16½¢ c. y.; Nelson J. Gaylord, repairs to n. p. (prices given), **03,** 1944.

1904. Samuel O. Dixon, dr., 17½¢ c. y., **04,** 2983.

1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y., **05,** 2168.

1907. Greiling Bros., dr., 21½¢ c. y., **07,** 1951. Century Fuel Co., coal (prices given), **07,** 1952.

1908. S. P. Bennett Fuel & Ice Co., coal (prices given), **08,** 2034. The Fitz Simons & Connell Co., dr., 18¢ c. y., **08,** 2035.

1909. Thos. H. Smith, st., prices given; S. P. Bennett Fuel & Ice Co., coal (prices given), **09,** 2023.

1910. Century Fuel Co., coal (prices given), **10,** 2182.

1911. Indian Refining Co., crude oil, 2.7¢ gal.; fuel oil, 2.4¢ gal., **11,** 2378. Great Lakes Dredge & Dock Co., dr., 13½¢ c. y., s. m.; 18¢ c. y., p. m. Robt. Love & Son, repair of ps. (prices given), **11,** 2379.

1912. Greiling Bros., dr., 13¢ c. y., s. m.; Burk, Smith & Nelson, extension of ps. (prices given); Indian Refining Co., oil, 3.24¢ gal., **12,** 2559.

DOCUMENTS. (Not published in reports.)

S. D. 16, 34th, 3d.

ENGINEERS.

Chief of Engineers. R., 66, iii, 14, 35; **67,** 24; **68,** 32; **69,** 33; **70,** 43; **71,** 41; **72,** 39; **73,** 39; **74,** 45; **75,** 49; **76,** 102; **77,** 109; **78,** 123; **79,** 165; **80,** 218; **81,** 296; **82,** 290; **83,** 298; **84,** 299; **85,** 321; **86,** 315; **87,** 283; **88,** 257; **89,** 302; **90,** 272; **91,** 342; **92,** 328; **93,** 370; **94,** 341; **95,** 379; **96,** 334; **97,** 424, 434; **98,** 412; **99,** 490; **00,** 554; **01,** 538; **02,** 462; **03,** 503; **04,** 550–571, 3056, 3061; **05,** 559; **06,** 619; **07,** 643; **08,** 690; **09,** 726; **10,** 804; **11,** 859; **12,** 1028.

Boards. BERH. concurs in Capt. Keller's recom. for a 16′ chan., but is of opinion that prior to further imp. proper dock lines should be estab., bulkheads built along lines of riparian owners, and property lying on chan. side of these lines should be deeded to U. S. free of cost, **04,** 1360, 1361, 1362.

In charge:

Maj. J. D. Graham, 1855–57. **R.,** S. D. 42, 35th, 1st, p. 95.

Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 148, 155; **67,** 105; **68,** 120.

Capt. F. U. Farquhar, 1869–72. **R., 69,** 97; **70,** 142; **71,** 153; **72,** 183.

Capt S M. Mansfield, 1872–80. **R., 72,** 193; **73,** 279; **74,** 192; **75,** 259; **76,** ii, 511; **77,** 918; **78,** 1213; **79,** 1627; (Maj.) **80,** 2007.

Maj. F. Harwood, 1880–82. **R., 80,** 2028; **81,** 2235.

Maj. D. P. Heap, 1882–83. **R., 82,** 2317.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1830; **84,** 1991; **85,** 2085; **86,** 1770; **87,** 2198.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1916.

Maj. W. Ludlow, 1889–93. **R., 89,** 2191; **90,** 2656; **91,** 2700; **92,** 2353; **93,** 2870.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2198; **95,** 2787; **96,** 2684; **98,** 2501.

Capt. C. McD. Townsend, 1897. **R., 97,** 2910, 2948.

Capt. C. Harding, 1899–1900. **R., 99,** 2906; **00,** 3884.

Capt. Chas. Keller, 1901–03. **R., 01,** 3084; **02,** 2146; **04,** 3057, 3065.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1942; **04,** 2981; **05,** 2165; (Col.) **06,** 1797; **07,** 1950; **08,** 2032.

Maj. Chas. Keller, 1909–10. **R., 09,** 2022.

Maj. C. S. Riche, 1910–1912. **R., 10,** 2180; (Lt. Col.) **11,** 2377; **12,** 2566.

Assistants:

J. R. Mayer, S. D. 42, 35th, 1st, p. 96.

W. T. Casgrain. **R., 66,** iv, 149.

Lt. D. P. Heap. **R., 67,** 105; **68,** 120.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, 1857, ps. and dr., $39,180.61, S. D. 42, 35th, 1st, pp. 98, 175.

By Maj. Wheeler, 1866, completion, $128,288.47, **66,** iii, 35, iv, 148; **74,** 192; **76,** ii, 514.

By W. T. Casgrain, ps. to outer bar, $66,693.90; to outer bar with dr., $120,300; over outer bar, $186,994, **66,** iv, 153.

By Capt. Farquhar, 1869, ps., dr., and removal of old work, $82,000, **69,** 79; revised est., $84,000, **70,** 43, 142.

Revet. and dr., 1871, $44,138.33, **71,** 41, 154.

By Maj. Mansfield, 1875, p. extension and continuing revet. and dr., $80,000, **75,** 260; **76,** ii, 513, 514. Amount of est. to 1877, $202,000, **77,** 918; **78,** 1214. For completion of existing proj., $52,500, **79,** 166.

Hearing held relative to revet. being built on riparian property; petition of Thos. L. Wilkinson, **06,** 619.

OPERATIONS.[1]

1866–67. N. side, 288 l. f. crib p. built, **67,** 106; **74,** 192.

1867–68. N. side, 128 l. f. crib p. built; s. side, 256 l. f. crib p. built, **68,** 121; **74,** 192.

1868–69. N. side, 256 l. f. crib p. and 257 l. f. superstr. built; crib lost from n. p. replaced, **69,** 33, 97; **74,** 192.

1869–70. Damage to cribs from running ice, **70,** 43, 142; **74,** 192.

1870–71. N. side, 30. l. f. crib p. built; s. side, 50 l. f. crib p. built; pierhead built by hired labor; repairs to n. p., **71,** 41, 153; **74,** 192; **76,** ii, 515.

1871–72. N. side, 100 l. f. crib p. built; s. side, 50 l. f. crib p. built; 26,102 c. y. dr. (nearly completed by US. dr.), **72,** 39, 183, 193; **76,** ii, 513.

1872–73. N. side, 50 l. f. crib p. built; repairs to superstr.; dr. by U. S. apparatus, **74,** 45, 193; **73,** 39, 279.

1873–74. N. side, 100 l. f. crib p. built; s. side, 50 l. f. crib p. built; displaced crib resunk, **74,** 45, 193; **76,** ii, 515.

1874–75. N. side, 100 l. f. superstr. built; s. side, 50 l. f. superstr. built, **75,** 49, 259.

1875–76. N. side, 525 l. f. pile revet. built, **76,** 102, ii, 511.

1876–77. 53,326 c. y. dr.; repairs to n. and s. revet., **77,** 109, 918.

1877–78. 22,510 c. y. dr.; 316′ revet. completed; slab dock removed, **78,** 123, 1213.

1878–79. 33,854 c. y. dr.; repairs; 461′ revet. completed, **79,** 165, 1627.

1880–81. 11,571 c. y. dr. from chan. bet. lake and inner H.; extensive repairs to plant, **81,** 2235, 2236.

1881–82. 661 l. f. of plank-beam revet. and 534 l. f. of catch-sand fence built, **82,** 2317.

1882–83. Repairs to s. p. revet., and plank-beam wall, 85 l. f. plank-beam revet. and 592 l. f. sand fence built on n. side; 17,449 c. y. dr. from "middle ground," **83,** 183.

1883–84. 1,905 c. y. dr. from chan. bet. ps., **84,** 1992.

1884–85. 447 l. f. of n. p. and 210 l. f. of s. p. repaired, **85,** 2085.

1885–86. 29,865 c. y. dr. from chan. bet. ps., **86,** 1770.

[1] N. p., 600′ cribwork, 986′ pilework; s. p., 502′ cribwork, 316′ pilework, **79,** 1628. Cribs damaged, lost, or displaced, **69,** 33, 97; **72,** 183; **73,** 279; **74,** 192; **76,** ii, 512. Breach of 90 l. f. in s. p. during winter of 1876–77, **77,** 109, 918. Extraordinary settlement of p., **70,** 142; **76,** ii, 512. 1877. 200 cords of st. washed out of ps., **78,** 1213.

1886-87. Site dr. and foundation piles driven for 50 l. f. of cribwork and 14 courses of same built, **87,** 2198.

1887-88. S. p. extended 50′ under contract 1,750 c. y. dr., **88,** 1916.

1888-89. 6,000 c. y. dr., **89,** 2192.

1889-90. 24,960 c. y. removed by U. S. dr.; 4,390 c. y. dr. by citizens of South Haven; repairs to n. and s. ps., **90,** 2656.

1890-91. Repairs to outer crib of n. p. in progress, **91,** 2700.

1891-92. 11,670 c. y. dr. from chan.; repairs to outer crib of n. p. completed; double sheet piling driven along 520′ of rear wall of n. pile revet.; 460 l. f. of n. plank beam changed to sheet-pile revet.; 192 l. f. of sand fence built, **92,** 2354.

1892-93. Outer part of n. p. decked over; 462 l. f. n. plank-beam revet. converted into sheet-pile revet.; rebuilding of 356 l. f. of old cribwork in s. p. in progress, **93,** 2871. A tool house built, soundings made, gauge readings taken, and 15,690 c. y. dr., **93,** 2872.

1893-94. Part of s. p. rebuilt and 31,758 c. y. dr., **94,** 2198.

1895-96. 30,715 c. y. dr., **96,** 2684.

1896-97. Parts of the n. and s. p. rebuilt, **97,** 2911.

1897-98. Extension of 300′ to s. p. in course of constr., **98,** 2501; and 13,766 c. y. dr., **98,** 2502.

1898-99. 20,711 c. y. dr.; extension of s. p. in progress and p. temporarily repaired; preparations made for permanent repair of s. p. (drawings), **99,** 2907.

1899-00. 13,390 c. y. dr.; about 1,004′ of s. p. repaired and end protected by 50′ crib; extension of n. p. in progress, **00,** 3884.

1900-01. Extension of n. p. by 2 cribs, each 16½′ x 24′ x 100′, capped with 6′ superstr., and repair of 254′ of this p. adjoining the new work. Contract completed, **01,** 3084.

1901-02. 26,718 c. y. dr., **02,** 2146.

1902-03. 33,384 c. y. dr., outer end n. p. and s. revet. repaired, **03,** 1942.

1903-04. 56,012 c. y. dr., damages to s. p. repaired, **04,** 2981–82.

1904-05. 22,148 c. y. dr., **05,** 2166.

1905-06. 7,913 c. y. dr., **06,** 1797.

1906-07. 55,647 c. y. dr. by U. S., 26,321 c. y. dr. by contract, st. placed in ps., **07,** 1950.

1907-08. 84,190 c. y. dr. by U. S., 11,826 c. y. dr. under contract, **08,** 2032, 2033.

1908-09. 17,586 c. y. dr. by U. S., **09,** 2022.

1909-10. 78,745 c. y. dr. by U. S., 372.63 cords st. placed in p. under contract, **10,** 2180.

1910-11. 59,630 c. y. dr. by U. S., 559 t. st. placed in p. under contract (mainten.), 107,475 c. y. dr. under contract (new work), **11,** 2378.

1911-12. New work: 67,429 c. y. dr., repairs to ps., work on p. constr. in progress. Maintenance: 16,846 c. y. dr. by U. S., 10,447 c. y. dr. under contract, repairs to ps. and revet., **12,** 2566–67.

PHYSICAL CHARACTERISTICS. (See note to title of work.)

General, of South R., **66,** iii, 14, iv, 148, 149.
Lake bed around and bet. ps. generally blue clay, **66,** iv, 151; **69,** 97.
Treacherous sands, **74,** 193.
Advance of shore line, **76,** ii, 514.
Result of soundings in 1879, **79,** 1628.
Description of, **93,** 2870; **04,** 550. 3057.
Storms damaging works, **99,** 2907.
Condition of works, **01,** 3085; **02,** 2147; **03,** 1942; **04,** 2982; **05,** 2166.
Damage to ps. and revet., **02,** 2147; **03,** 1943; **04,** 2983.

PLANS. (See Projects.)

By W. J. Casgrain: (1) Extension of both H. ps. to 12′ curve, and dr. chan. across exterior bar; est., $120,300; (2) extension of both H. ps. over outer bar to 12′ curve; est., $186,994. First plan adopted, and appears under Projects. **66,** iv, 152; **74,** 192.

PRIVATE AND CORPORATE WORK.

Pierwork and close-pile revet. built previous to 1866 by citizens of South Haven; p. light supported by private subscriptions; expend. by local au. in imp. bet. $18,000 and $20,000, **66,** iv, 148, 149; **68,** 120; **74,** 192; **76,** ii, 514.

Dr. done by citizens of South Haven, **90,** 2656.

Sec. of War granted George Hannah permission to occupy 800′ of s. revet. at inner end, upon condition that he maintain this portion in good repair, **02,** 2147.

Conditions imposed on city by au. proj. having been fulfilled, contract for dr. entered into, **11,** 2377.

Cost of repairs to damaged portions of revet. reimbursed by Bonding Co. for party responsible for damages, **12,** 2567.

PROJECTS. (See Estimates and Plans.)

By Maj. Graham, 2 parallel crib ps. 180′ apart; dr. to 8′; est., $39,180, S. D. 42, 35th, 1st, pp. 98, 175.

Orig. proj. by Maj. Wheeler, 1866, proposed extension of 2 parallel ps. 120′ apart from mouth of R. to 12′ curve in lake, protection of R. banks by sheet-pile revet., and dr. a chan. 12′ d. bet. ps. and across outer bars; est., $128,288, **66,** iv, 148; **74,** 192; **76,** ii, 513; **79,** 1628.

By Capt. Farquhar, 1869, p. extension; dr. in chan.; removal of old slab p., **69,** 97; **74,** 192; **76,** ii, 512. Renewed, 1870, **70,** 43, 142; **74,** 1892, 1871. In lieu of already recom. proj., to widen, deepen, and revet chan. Renewed, 1872–73, **72,** 193; **76,** ii, 513.

By Maj. Mansfield, 1875, 400 l. f. revet. on n. side and an extension of ps. for 300 l. f.; est., $80,000, **75,** 260; **76,** ii, 513.

In 1879 the proj. modified, increasing chan. to 14′, **79,** 1628; **81,** 2236.

Total amount app., 1867 to 1886, incl., $182,000. Amount est. to complete proj., 1886, $77,500, **86,** 316; **87,** 2199; **92,** 2356.

In 1897 Capt. Townsend est. $108,500 to imp. H, **97,** 2949; (H. D. 279, 54th, 2d, with map.)

By Capt Harding, 1899, applying part of app. of 1899 to extending n. p. 200′, **99,** 2907.

Act Mar. 3, 1905, au. proj. as per H. D. 119, 58th, 2d, and provided that none of the $50,000 app. shall be used, except for mainten. of existing chans., until proper dock lines shall have been estab., and suitable bulkheads built along these lines by city or riparian owners, and property lying on chan. side of these lines shall have been deeded to U. S., **05,** 559.

$10,000 of 1905 app. made immediately available to secure 16′ chan. by resol. June 29, 1906, **06,** 619.

Col. Adams recom. extension of both ps. 500′ each to properly maintain an 18′ chan., **08,** 2033.

SURVEYS.

Directed by Maj. Graham, made by J. R. Mayer, 1856 (S. D. 42, 35th, 1st, p. 96).

Directed by Maj. Wheeler, made by W. T. Casgrain, 1866, **66,** iii, 14, iv, 148; **74,** 192; **76,** ii, 514.

By Maj. Wheeler, 1868, **76,** ii, 514.

By Capt. Farquhar, 1869, **76,** ii, 514.

By Capt. Farquhar, 1870–71, **76,** ii, 515.

Sur. au. act June 3, 1896; made, 1897, by Capt. Townsend (see Projects), **97,** 2948.

Ex. and sur., with view to obtaining 18′, au. act June 13, 1902. **R.** by Capt. Keller, Oct. 15, 1902, and Jan. 10, 1903, with plan for imp.; est., $279,370, and $10,000 an. mainten. (H. D. 119, 58th, 2d), with map **04,** 571, 3057.

Maps. **80,** 2028; **84,** 1992.
Drawings. (See Operations, 1899.)

OO-15 SAUGATUCK HARBOR AND KALAMAZOO RIVER, MICH.

Part.	Title.	Period.	Appropriations.
a	Kalamazoo R., Mich.	1895–1901	$15,000
b	Saugatuck H., Mich.	1867–1901	181,939
c	Saugatuck H. and Kalamazoo R., Mich.	1902–1912	354,000
	Total		550,939

Part (a), OO-15 Kalamazoo River (Harbor), Mich.

APPROPRIATIONS.

1896, $5,000, **97,** 2915.
1899, 10,000, **99,** 2913.

Total, 15,000

COMMERCE.

Description of, **95,** 2844.
Important only from Lake Michigan to Saugatuck, **95,** 2843.

ENGINEERS.

Chief of Engineers. **R., 95,** 396; **96,** 356; **97,** 426; **98,** 414, 424; **99,** 491, 492; **00,** 555, 556; **01,** 541.

In charge:
Lt. Col. G. J. Lydecker, 1895–96, 1898. **R., 95,** 2841; **96,** 2739; **98,** 2506, 2537.
Capt. C. McD. Townsend, 1897. **R., 97,** 2915.
Capt. C. Harding, 1899–1901. **R., 99,** 2910, 2912; **00,** 3887, 3890.
Capt. Chas. Keller, 1901. **R., 01,** 3090.

Assistants:
B. H. Muehle. **R., 95,** 2843.
G. W. Bunker. **R., 98,** 2539.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2842; **96,** 2741; **98,** 2538.
Borings, **98,** 2540.
Gauge readings, **98,** 2544.
Discharge observations, **98,** 2542.

PROJECTS.

In 1896 Lt. Col. Lydecker est. $172,645 or $146,300 to imp. the R., **96,** 2742.
By Lt. Col. Lydecker, 1896, making a new cut through to Lake Michigan to obtain entrance chan. of 12′; est., $150,000, **97,** 2915.
In 1897 Capt. Townsend est. $5,000 to $100,000 to imp. R., Saugatuck to New Richmond, by 4 different projs., **98,** 2537.
Capt. Harding, 1900, est. at least $200,000, because of the rise in prices and labor, to complete proj. of 1896, **00,** 3890.

SURVEYS.

Ex. of R., mouth to Kalamazoo, au. act Aug. 17, 1894; made, 1894, by Lt. Col. Lydecker (**R.** unfav., mouth to Saugatuck; fav., above Saugatuck), **95,** 2841.
Sur., Lake Michigan to Saugatuck, au. by resol. of Feb. 13, 1895; made by Lt. Col. Lydecker, 1896 (see Projects), **96,** 2739.
Sur., Saugatuck to New Richmond, au. act June 3, 1896; made, 1897, by Capt. Townsend (see Projects), **98,** 2537.

Part (b), OO-15 Saugatuck Harbor, Mich.

APPROPRIATIONS.

1868, *$23,900, **69,** 33.
1869, *6,039, **69,** 22.
1870, 10,000, **70,** 43.
1871, 10,000, **71,** 41.
1872, 15,000, **72,** 38.
1873, 10,000, **73,** 39.
1874, 10,000, **74,** 45.
1875, 10,000, **75,** 49.
1876, 3,000, **76,** 36, 102.
1878, 2,500, **78,** 123.
1879, 5,000, **79,** 165.
1880, 5,000, **80,** 2028.
1881, 5,000, **81,** 2034.
1882, 8,000, **82,** 2315.
1884, 4,000, **84,** 1991.
1886, 8,000, **86,** 1770.
1888, 5,000, **88,** 1915.
1892, 5,000, **92,** 2353.
1894, 12,000, **95,** 2792.
1896, 10,000, **96,** 2689.
1899, 7,000, **99,** 2911.
1900, *2,500, **00,** 556.
1901, *5,000, **01,** 3089.

Total, 181,939

COMMERCE.

Considered as a H. of refuge, **67,** 27, 130; **75,** 258; **76,** ii, 509.
Benefits of imp., **67,** 130.
Justification of imp., **67,** 130; **76,** ii, 509.
Local interests, **67,** 128, 129; **77,** 917; **79,** 1626.
Present and future C. prospects of Saugatuck, **89,** 2203, 2204.
H. would be the shipping point for a large fruit area if reliable navigation were afforded, **93,** 2875; **94,** 2201; **95,** 2790; **96,** 2687.
Shipments of fruit the chief C., **00,** 3887.

CONTRACTS.

1869. R. A. Conolly, materials and labor; expired Oct. 31; extended to Aug. 30, 1870, **70,** 140.
1871. F. L. Tebel, materials and labor, **71,** 152. Parkhurst & Wilkinson, materials, **71,** 152.
1873. J. Roost, materials and labor, **73,** 276; annulled and the work done by hired labor, **74,** 45, 191.
1874. Coats & Geer, materials and labor, **75,** 256.
1880. I. F. Geer, revet. constr., **81,** 2234.
1887. I. F. Geer, brush, $2.90 cord. S. Bedford, timber, pile, and st. Kelly, Maus & Co., iron, **87,** 2197.

* Allotment.

1889. Geer & Crawford, white pine timber, $18.85 M f. b. m. Parkhurst & Wilkinson, drift-bolts, 2¢ lb., **89,** 2190.
1897-98. W. A. Starke, dr., **97,** 2915; **98,** 2505.
1899-00. Greens Dredging Co., dr., **99,** 2911; **00,** 3887.
1901. S. O. Dixon, dr., 13¢ c. y., **01,** 3089.

ENGINEERS.

Chief of Engineers. **R.,** **67,** 17, 26; **69,** 33; **70,** 43; **71,** 41; **72,** 38; **73,** 39; **74,** 45; **75,** 49; **76,** 102; **77,** 108; **78,** 123; **79,** 165; **80,** 217; **81,** 295; **82,** 290; **83,** 297; **84,** 299; **85,** 321; **86,** 315; **87,** 283; **88,** 256; **89,** 302, 306; **90,** 271; **91,** 342; **92,** 328; **93,** 370; **94,** 341; **95,** 379; **96,** 335, 336, 350; **97,** 425; **98,** 413; **99,** 491, 492; **00,** 555, 556; **01,** 540.

Boards:
To consider proj. of imp. as proposed by Capt. Farquhar. Board recom. plan proposed, viz, 2,700 l. f. of revet. for the protection of the left bank of the R. from abrasion, **69,** 96, 99, 100; **74,** 190. (Lt. Col. Woodruff, Maj. Wheeler, and Capt. Farquhar.)
To ex. H. and recom. modification, if any, of plan of imp. Board recom. injured portions of revet. be restored and that the R. side of revet. be protected by brush and st., **75,** 258; **76,** ii, 509, 510. (Majs. Houston, Wilson, and Mansfield.)

In charge:
Maj. J. D. Graham, 1855–57; **67,** 17; **76,** ii, 508. **R.,** S. D. 42, 35th, 1st, pp. 99, 175.
Capt. F. U. Farquhar, 1869–72. **R.,** **69,** 96; **70,** 140; **71,** 151; **72,** 182.
Capt. S. M. Mansfield, 1872–80. **R.,** **72,** 191; **73,** 276; **74,** 190; **75,** 256; **76,** ii, 506; **77,** 917; **78,** 1212; **79,** 1625; (Maj.) **80,** 2007.
Maj. F. Harwood, 1880–82. **R.,** **80,** 2027; **81,** 2233.
Maj. D. P. Heap, 1882–83. **R.,** **82,** 2314.
Capt. D. W. Lockwood, 1883–87. **R.,** **83,** 1828; **84,** 1989; **85,** 2084; **86,** 1769; **87,** 2196.
Maj. S. M. Mansfield, 1888–89. **R.,** **88,** 1914.
Maj. W. Ludlow, 1889–93. **R.,** **89,** 2189, 2202; **90,** 2654; **91,** 2699; **92,** 2350; **93,** 2874.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R.,** **94,** 2201; **95,** 2790; **96,** 2686. 2739; **98,** 2504.
Capt. C. McD. Townsend, 1897. **R.,** **97,** 2913.
Capt. C. Harding, 1899–1901. **R.,** **99,** 2910, 2912; **00,** 3887, 3890.
Capt. Chas. Keller, 1901. **R.,** **01,** 3090.

Assistants:
W. T. Casgrain. **R.,** **67,** 128.
W. B. Gaw. **R.,** **73,** 277.
J. R. Mayer, S. D. 42, 35th, 1st, p. 96.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, 1857, ps., revet., and dr., $64,099.63, S. D. 42, 35th, 1st, pp. 100, 175.
By Maj. Wheeler, 1869, ps., dr. in chan. and B., and repairs to old work, $203,295.80, **67,** 132; **74,** 190, 191; **76,** ii, 507, 509.
By Capt. Farquhar, 1869 (see Board of Engineers), revet., p. extension, and dr., $86,398.48, **69,** 100; **71,** 41, 152; **72,** 38, 192; **74,** 190; protection of old slab p., $6,000, **70,** 141; **74,** 190; **76,** ii, 507.
By BE., 1875, protection of revet., $10,000, **75,** 259.
By Maj. Mansfield, 1877, addl. for completion of existing proj., $38,458.74, **77,** 108, 917; $39,058.74, **79,** 165, 1626.

OPERATIONS.

1867-68. Repairs,[1] **69,** 100.
1869-70. 1,200 l. f. s. side pile revet. built, **70,** 141; **74,** 190; **76,** ii, 508, 510.
1870-71. Minor repairs; revet. on left side completed to e. end of slab p., **71,** 41, 151; **74,** 190; **76,** ii, 510.
1871-72. 365 l. f. built for protection of slab p.; 11,233 c. y. dr., **72,** 38, 182; **74,** 190; **76,** ii, 508.
1872-73. 280 l. f. s. side pile p., built; repairs to old work; pile protection completed, **73,** 39, 276; **74,** 190; **76,** ii, 511.
1873-74. Wing dam built in R., 243 l. f., **75,** 45, 191.
1874-75. 400 l. f. n. side pile p. built by hired labor, **75,** 49, 256; **76,** ii, 508, 511.
1875-76. 334 l. f. n. side pile revet. built; repairs to s. p.,[1] **76,** ii, 506, 508.
1876-77. Repairs to old work; decking, **77,** 108, 917.
1877-78. St. lightered from s. to n. p., **78,** 123, 1212.
1878-79. General repairs, **79,** 165, 1625.
1880-81. 520′ of pile and edging revet. built; 10,818 c. y. sand dr. from lower reach of revet., **81,** 2233.
1881-82. 673 l. f. pile and edging revet. built; cut 12′ x 24′ x 1,560′ dr. through sand deposit, **82,** 2315.
1882-83. Minor repairs to s. p., **83,** 1828.
1883-84. 175 piles removed from pile dike above the bend; 33,890 c. y. material dr. from bar at entrance and chan. bet. the ps., **84,** 1990.
1884-85. Repairs to s. p., pierhead beacon, and inner work, **85,** 2084.
1887-88. Superstr. reconstr. by hired labor completed, **88,** 1915.
1889-90. 25,594 c. y. dr., **90,** 2655.
1890-91. 6,615 c. y. dr., **91,** 2699.
1892-93. 47,820 c. y. dr., and gauge readings made, **93,** 2875, 2876.
1893-94. 17,706 c. y. dr., **94,** 2201.
1894-95. 40,000 c. y. dr., **95,** 2790.
1895-96. 19,000 c. y. dr., **96,** 2687.
1896-97. 108,388 c. y. dr., **97,** 2914.
1897-98. 24,553 c. y. dr., **98,** 2504.
1898-99. 11,518 c. y. dr., **99,** 2910.
1899-00. Dr., **00,** 3887.
1900-01. 36,416 c. y. dr. under contract, **01,** 3088.

PHYSICAL CHARACTERISTICS.[1]

General, of Kalamazoo R., **67,** 128, 130; **69,** 100; **73,** 278; **76,** ii, 508, 509, 510.
Description of, **89,** 2189; **93,** 2874; **96,** 2687.
In 1894, on account of shoaling, H. practically closed to navigation, **94,** 2201. In 1896 boats that were in the H. detained by l. d. until a temporary chan. could be made, **96,** 2687.
Saugatuck and Douglas practically without an outlet, 1900, to Lake Michigan, **00,** 3887.

PLANS. (See Estimates and Projects.)

By Capt. Farquhar, 1869, revet., p. extension, close piling, and dr., **69,** 100.
Maj. Ludlow reported, after an ex. in 1888, that H. was not worthy of imp. to the extent of obtaining a chan. of navigable w., with a min. d. of 15′ and reconstr. ps., as recom. by BE., **89,** 2204.

PRIVATE (CORPORATE AND PRIVATE) WORK.

Well-constructed slab p. built by a company of manufacturers and shippers with a subscribed capital of $30,000, **67,** 130; **69,** 33, 190; **74,** 190; **76,** ii, 509. Repairs to, extension of, and protection of n. p., **69,** 100; **76,** ii, 509.
Attempt by citizens of Saugatuck to scour through bar at chan. mouth, **90,** 2655.

PROJECTS.

By Maj. Graham, 1857, parallel crib ps. 250′ apart; close piling within R.; dr. to 8′ in chan., S. D. 42, 35th, 1st, p. 100.
By Maj. Wheeler, 1867, parallel crib p. extension to 12′; dr. in chan. and B.; est., $203,295.80, **67,** 27, 130, 132; **74,** 190; **76,** ii, 509.
By Capt. Farquhar, 1869, pile revet. on s. side 2,700′ l.; also 1,600′ on n. side, 770′ close piling, 192′ cribwork, and dr.; est., $86,398, **69,** 96, 100; **74,** 190; **76,** ii, 507. Approv. by BE., **69,** 101; **76,** ii, 510.

[1] Damages by R. freshet, **69,** 99, 100; **76,** ii, 509.

To secure old slab p., 1870, by a facing and backing of pilework, **70,** 43, 141; **76,** ii, 507. Dr. outfit to be paid for from the app. for this and other Hs.; for the imp. of same, **69,** 85.

By Capt. Mansfield, 1873, wing dam within R., **73,** 277; **74,** 191.

Defects, 1875, of present plan of imp.; discussion of various projs., **75,** 258, 259.

Recom. of BE., 1875, provided for the extensive repair of revet. already built, **75,** 258; **76,** ii, 509; **87,** 2196; **91,** 2699.

Lt. Col. Lydecker est., 1894, $260,000 to further imp. H., with an an. cost of $3,000 for mainten., **94,** 2203.

By Lt. Col. Lydecker, 1896, abandoning the lower part of the R., and making new cut through to Lake Michigan to provide an entrance chan. with 12′ (see Kalamazoo River), **96,** 2688.

By congress, 1899, keeping the old route open until the proposed new one could be estab., **99,** 492.

SURVEYS.

By Maj. Graham, 1856, S. D. 42, 35th, 1st, p. 95.
By Maj. Wheeler, 1867–68, **69,** 101; **76,** ii, 508.
By Capt. Farquhar, 1869–71, **69,** 101; **76,** ii, 510.
By Capt. Mansfield, 1872, 1876, **76,** ii, 511.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Ludlow, **89,** 2202.

Sur. made, 1894, by Lt. Col. Lydecker, **94,** 2201; and an ex. made in 1895 and 1896, by Lt. Col. Lydecker, **95,** 2790; **96,** 2687.

Part (c), OO-15 Saugatuck Harbor and Kalamazoo River, Mich.

APPROPRIATIONS.

1902,	$15,000,	**02,** 2151.
1903,	100,000,	**03,** 1947.
1904,	*5,300,	**04,** 2984.
1905,	75,000,	**05,** 2173.
1907	*4,700	**07,** 1954.
	*10,000	
	75,000	
1909,	10,000,	**09,** 2024.
1910,	20,000,	**10,** 2184.
1911,	30,000,	**11,** 2381.
1912,	9,000,	**12,** 2571.
Total,	354,000	

COMMERCE.

In 1911, 16,560 t. coal, lumber, salt, etc., **12,** 2572.

CONTRACTS.

1902. S. O. Dixon, dr., 20¢ c. y., **03,** 1948.

1903. The Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1948. Burk, Smith & Nelson, constr. of p. (prices given), **04,** 2988.

1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 2988.

1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y.; Great Lakes Dredge & Dock Co., dr., 9½¢ c. y., **05,** 2174. Leathem & Smith Towing & Wrecking Co., st. in place, $6.87½ cord, **06,** 1802.

1906. Great Lakes Dredge & Dock Co., dr., 16.9¢ c. y., s. m., **06,** 1802. Bennett-Schnorbach Co., constr. sheet-pile revet. (prices given), **07,** 1956.

1907. Greiling Bros., dr., 15.8¢ c. y., **07,** 1955. Robt. Love, repairing s. p. and constr. revet. (prices given), **08,** 2038.

1909. The Green Stone & Quarrying Co., st. in place, $13 cord, **09,** 2025. John Smith, dr., 16½¢ c. y., **10,** 2184.

1911. Great Lakes Dredge & Dock Co., dr., 20¢ c. y., p. m., **11,** 2381; and dr. at 17½¢ c. y., s. m., and 20¢ c. y., p. m., **12,** 2571.

ENGINEERS.

Chief of Engineers. **R., 02,** 462; **03,** 504; **04,** 551; **05,** 560; **06,** 620; **07,** 645; **08,** 691; **09,** 728; **10,** 806, 831; **11,** 861; **12,** 1031.

In charge:
Capt. Chas. Keller, 1901–03. **R., 02,** 2149.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1945; (Col.) **04,** 2984; **05,** 2169; **06,** 1799; **07,** 1952; **08,** 2035.
Maj. Chas. Keller, 1908–09. **R., 09,** 2024.
Maj. C. S. Riché, 1910–1912. **R., 10,** 2183; (Lt. Col.) **11,** 2380; **12,** 2570.

LEGAL PROCEEDINGS.

Projecting land deeded to U. S. for removal, to secure better chan., **11,** 2380.

OPERATIONS.

1901–02. 15,151 c. y. dr. under contract, **02,** 2149.

1902–03. 31,129 c. y. dr., **03,** 1945.

1903–04. 48,155 c. y. dr.; piles driven, and work on new p. begun, **04,** 2984.

1904–05. 40,313 c. y. dr., and work continued on constr. of p., **05,** 2169.

1905–06. 293,305 c. y. dr., and work continued on new p., **06,** 1799.

1906–07. Dr. in new chan., and work in progress on p.; opening up new chan. bet. Kalamazoo R. and Lake Michigan, **07,** 1952.

1907–08. Dr., repairing p., and continuing work on new p., **08,** 2035.

1908–09. Dr. and work on p., **09,** 2024.

1909–10. Dr. and repairs to p., **10,** 2183.

1910–11. 6,766 c. y. dr., **11,** 2380.

1911–12. 203,854 c. y. dr. by contract (new work), and 36,153 c. y. dr. by U. S. plant for mainten., **12,** 2570.

PHYSICAL CHARACTERISTICS.

Effect of storms on constr. work, **05,** 2169.
Depths in chan., **07,** 1954.

PRIVATE WORK.

The Chicago & South Haven Line dr. cut through shoals to imp. their approach to dock, **07,** 1954.

PROJECTS.

Act June 25, 1910, modified proj. to provide 16′ x 90′; est., $36,000, **11,** 862.

SURVEYS.

Pre. ex. au. act Mar. 3, 1909, with view to securing increased d. to town of Douglas. **R.** by Maj. Riché, July 13, 1909, and Jan. 5, 1910; est., $36,000 (H. D. 635, 61st, 2d), **10,** 831.

* Allotment.

OO-22 HOLLAND (Black Lake) HARBOR, MICH.[1]

APPROPRIATIONS.

1852, $8,000.00, S. D. 42, 35th, 1st, p. 58.
1866, 55,615.31, **66,** iii, 10.
1867, 51,000.00, **67,** 106; **70,** 146.
1870, 10,000.00, **70,** 43.
1871, 10,000.00, **71,** 41.
1872, 10,000.00, **72,** 38.
1873, 12,000.00, **73,** 39.
1874, 15,000.00, **74,** 45.
1875, 15,000.00, **75,** 49.
1876, 15,000.00, **76,** 102.
1878, 10,000.00, **78,** 123.
1879, 6,000.00, **79,** 165.
1880, 6,000.00, **80,** 2026.
1881, 6,000.00, **81,** 2231.
1882, 10,000.00, **82,** 2312.
1884, 15,000.00, **84,** 1989.
1886, 5,000.00, **86,** 1769.
1888, 5,000.00, **88,** 1914.
1890, 10,000.00, **90,** 2653.
1892, 5,000.00, **92,** 2350.
1894, 15,000.00, **95,** 2794.
1896, 10,000.00, **96,** 2692.
1899, 37,500.00, **99,** 2915.
1901, *1,000.00, **01,** 3093.
1902, *3,200.00, **02,** 2153.
1902, 73,000.00, **02,** 2153.
1905, 65,000.00, **05,** 2178.
1906, *10,000.00, **06,** 1806.
1906, 70,000.00, **06,** 1806.
1907, 178,452.00, **07,** 1958.
1910, 12,000.00, **10,** 2186.
1911, 16,000.00, **11,** 2383.

Total, 770,767.31 (incl. misc., less $1.19 carried to surplus, $772,049.77, **12,** 2573).

COMMERCE.

Importance as H. of refuge, S. D. 42, 35th, 1st, p. 87; **66,** iv, 108; **67,** 107.
C. interests, 1857, S. D. 42, 35th, 1st, p. 87.
Justification of imp., **66,** iv, 107.
Benefits of imp., **67,** 107; **68,** 121.
Requirements of C., **75,** 49.
Discussion of local C. interests, **77,** 915.
Rapidly increasing, **97,** 2951; **08,** 731.
Important, **03,** 507.
In 1911, 145,801 t.; 56,295 passengers, **12,** 1034.
Passenger business, 1912, of Grand Rapids, Holland & Chicago Electric Ry., connecting with line of steamers, especially important; freight traffic profitable, **12,** 1034.

CONTRACTS.

1866. J. Roost, materials, **67,** 58, 108; **68,** 122. L. N. Kimball, materials, **67,** 58, 108; **68,** 122. J. H. Ledlie, materials, **67,** 58, 108; **68,** 122. J. E. Miller, labor and dr., **67,** 58, 108; **68,** 122.
1869. T. S. White, materials and labor, **69,** 95.
1870. W. B. Johnson, materials, **71,** 148, 150. J. Roost, materials, **71,** 148, 150. Pierce & Whaling, materials, **71,** 148, 150.
1871. U. Culbert & Co., materials and labor, **71,** 148, 150. Pierce & Whaling, materials, **71,** 148, 150.
1872. J. Roost, materials, **73,** 276. Culbert & Hopkins, materials and labor, **73,** 276.
1874. Jan Van Dyk & Co., materials and labor, **75,** 255.
1875. T. L. Rosser, materials and labor, **75,** 255.
1876. Squier & White, materials, labor, and dr., **77,** 914.
1878. N. S. Gere, materials and labor, **79,** 1622.
1879. Squier & White, dr., **79,** 1622.
1882. Dewar & Wing, crib constr., **83,** 1826. Contract modified to repair of ps., **83,** 1827.
1891. E. G. Crosby, timber, $18 M f., and brush, $4 cord. Gaylord & Wing, hemlock lumber, $12 M f. G. W. Crouter, bolts and nails, 3.4¢ lb., **91,** 2698.
1897. Green's Dredging Co., dr., **97,** 2918.
1898. W. Starke, dr., **98,** 2506.
1899. Green's Dredging Co., dr. R. Love, p. repairs (removing old work, piles, timber, ironwork, st.), $24,004.17, **99,** 2916.
1900. Green's Dredging Co., dr., **00,** 3894.
1901. Samuel O. Dixon, dr., 18¢ c. y., **01,** 3094.
1902. Samuel O. Dixon, dr., 18½¢ c. y., **02,** 2154.
1903. Lydon & Drews Co., dr., 16¾¢ c. y., **03,** 1950. Robert Love & Co., repair of ps., $23,306, **03,** 1950.
1904. Samuel O. Dixon, dr., 17½¢ c. y., **04,** 2993.
1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17¼¢ c. y., **05,** 2179. Macdonald & Beauvais, extending ps.; prices given, **06,** 1803.
1906. Bennett, Schnorbach Co., repairing p.; prices given, **07,** 1959.
1907. Century Fuel Co., coal for dr. boat; prices given, **07,** 1959. Macdonald & Beauvais, extension of ps., supple. contract; prices given, **07,** 1959. Bennett, Schnorbach Co., repairing ps.; prices given, **08,** 2041.
1908. Leathem & Smith Towing & Wrecking Co., st., $7.97 cord; S. P. Bennett Fuel & Ice Co., coal for dr. boat; prices given, **08,** 2041. Columbian Cons. Co., repairs to p.; prices given, **08,** 2042.
1909. S. P. Bennett Fuel & Ice Co., fuel; prices given, **10,** 2187. Johnson & Rasch, furnishing and placing riprap, $3.25 t., **10,** 2187.
1910. Century Fuel Co., coal; prices given, **10,** 2187.
1911. Indian Refining Co., fuel oil for dr.; prices given, **11,** 2383.
1912. Indian Refining Co., fuel oil for dr.; prices given, **12,** 2573.

DOCUMENTS. (Not published in reports.)

S. D. 20, 31st, 1st.
S. D. 1, 34th, 1st.

ENGINEERS.

Chief of Engineers. R., 66, 5, iii, 10; **67,** 24, 103; **68,** 33; **69,** 32, 105; **70,** 42; **71,** 40; **72,** 38; **73,** 38; **74,** 44; **75,** 49; **76,** 102; **77,** 108; **78,** 122; **79,** 164; **80,** 217; **81,** 295; **82,** 289; **83,** 297; **84,** 298; **85,** 320; **86,** 314; **87,** 282; **88,** 256; **89,** 301; **90,** 271; **91,** 341; **92,** 327; **93,** 371; **94,** 343; **95,** 380; **96,** 336; **97,** 426, 435; **98,** 414; **99,** 492; **00,** 557; **01,** 541; **02,** 464; **03,** 506; **04,** 553; **05,** 563; **06,** 623; **07,** 649; **08,** 695; **09,** 730; **10,** 808; **11,** 863; **12,** 1033.

Boards. 1869. For the consideration of certain structures for H. imp. on Lake Michigan; opinions and recom., **69,** 104, 105. (Lt. Col. Raynolds, Majs. Wheeler and McFarland, and Capt. Farquhar.)

In charge:

Maj. J. D. Graham, 1855–57. **R.,** S. D. 42, 35th, 1st, p. 84.
Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 104; **67,** 106; **68,** 121.
Maj. F. U. Farquhar, 1869–72. **R., 69,** 94, 98; **70,** 138, 145; **71,** 148; **72,** 181.
Maj. S. M. Mansfield, 1872–80. **R., 72,** 191; **73,** 274; **74,** 187; **75,** 255; **76,** ii, 500; **77,** 914; **78,** 1211; **79,** 1622.
Maj. F. Harwood, 1880–82. **R., 80,** 2026; **81,** 2030.
Maj. D. P. Heap, 1882–83. **R., 82,** 2312.
Capt. D. W. Lockwood, 1883–87. **R., 83,** 1826; **84,** 1987; **85,** 2083; **86,** 1768; **87,** 2194.
Maj. S. M. Mansfield, 1888–89. **R., 88,** 1913.
Maj. Wm. Ludlow, 1889–93. **R., 89,** 2187; **90,** 2652; **91,** 2696; **92,** 2348; **93,** 2877.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2206; **95,** 2793; **96,** 2690; **98,** 2506.
Capt. C. McD. Townsend, 1897. **R., 97,** 2916, 2950.
Capt. C. Harding, 1899–1901. **R., 99,** 2913; **00,** 3891.

* Allotment.

[1] Sur.—**R.,** Oct. 24, 1849; est., $116,018.08. (H. D. 482, 55th, 2d.)

Capt. Chas. Keller, 1901–03. **R., 01,** 3093; **02,** 2152.
Lt. Col. M. B. Adams, 1903–08. **R., 03,** 1949; **04,** 2989; **05,** 2176; **06,** 1803; **07,** 1956; **08,** 2038.
Maj. Chas. Keller, 1908–10. **R., 09,** 2026.
Maj. C. S. Riché, 1910–1912. **R., 10,** 2185; **11,** 2382; (Lt. Col.) **12,** 2573.

Assistants:
J. R. Rowes. **R.,** S. D. 20, 31st, 1st.
Capt. A. Mackenzie. **R., 66,** iv, 105; **67,** 106; **68,** 121.
F. W. Lehnartz. **R., 00,** 3892.

ESTIMATES. (See Plans and Projects.)

By J. R. Rowes, 1849, through cut and parallel ps. to 20′ in Lake Michigan, $105,225.78, S. D. 42, 35th, 1st, p. 84; **66,** iv, 104.
By Maj. Graham, 1857, ps., close piling, pile wharfing, excavation, and dr., $128,343.02, S. D. 42, 35th, 1st, p. 86; **66,** iv, 104.
By Maj. Wheeler, 1866, completion of present chan., $106,238.04, **66,** iv, 105, 107. 109; **70,** 145; **74,** 187.
By Lt. Mackenzie, 1866, imp. at the point recom. by Maj. Graham, $242,272.75, **66,** iv, 107, 109.
By Maj. Farquhar, 1870, revet. and dr., $30,801.75, **70,** 42, 43, 139; **74,** 188.
Extension of ps., revet., and dr., $100,480.65, **70,** 148.
By Maj. Mansfield, 1873, p. extension, $50,000, **73,** 275; **74,** 188, 189; **76,** ii, 501.
P. extension and repairs, $16,033.80, **76,** ii, 500.
P. extension, $32,000, **77,** 914.
Completion, $37,833.40, **79,** 165.

OPERATIONS.[1]

Operations suspended from 1852 to 1866, **66,** 5.
1867-68. N. side, 224 l. f. crib p. built; s. side, 128 l. f. crib p. built; 104,595 c. y. dr.; cribs sunk in gap; crib displaced, **68,** 33, 121; **74,** 188; **76,** ii, 503.
1868-69. N. side, 32 l. f. crib p. and 32 l. f. superstr. built; s. side, 160 l. f. crib p. and 160 l. f. superstr. built, **69,** 32. 94; **74,** 188; **76,** ii, 503.
1869-70. N. side, 575 l. f. pilework built; s. side, 32 l. f. crib p. and 32 l. f. superstr. built; repairs to ps., **70,** 42, 138; **74,** 188; **76,** ii, 503.
1870-71. N. side, 32 l. f. crib p. built; s. side, 100 l. f. crib p. built; s. p. extended inward to prevent breach, **71,** 40, 148; **74,** 188; **76,** ii, 503.
1871-72. N. side, 320 l. f. pilework and 32 l. f. superstr. built; s. side, 320 l. f. pilework and 100 l. f. superstr. built; protection to n. pierhead built, **72,** 38, 181; **74,** 188; **76,** ii, 504.
1872-73. N. side, 200 l. f. pilework built; s. side, 200 l. f. pilework built; 32,526 c. y. dr.; repairs to both ps., **73,** 39, 275; **74,** 188.
1873-74. S. side, 418 l. f. pilework built, **74,** 44, 189.
1874-75. N. side, 50 l. f. crib p. and 50 l. f. superstr. built; s. side, 100 l. f. crib p. and 100 l. f. superstr. built, **75,** 49, 255.
1875-76. N. side, 100 l. f. crib p. and 100 l. f. superstr. built; s. side, 50 l. f. crib p. and 50 l. f. superstr. built, **76,** 102, ii, 500.
1876-77. 14,297 c. y. dr.; minor repairs, **77,** 108, 914.
1877-78. S. side, 50 l. f. crib p. built; 35,775 c. y. dr.; 700′ revet. repaired, **78,** 122, 1211.
1878-79. 15,000 c. y. dr.; 3 cribs built but not sunk; repairs, **79,** 164, 1622.
1879-80. 2 cribs placed in extension of n. and s. ps., **80,** 2026.
1880-81. Constr. sand-catch fences and repair of ps. by hired labor; 1,560 c. y. sand dr. from entrance chan. by U. S. dr., **81,** 2231.
1881-82. 1,042 l. f. sand-catch fence built and repair of ps. by hired labor; 9,330 c. y. dr. from chan. by U. S. dr., **82,** 2312.
1882-83. Repair of ps., **83,** 1827.
1883-84. 460 l. f. superstr. n. p. rebuilt by hired labor. Material furnished under contract with Dewar & Wing, **84,** 1988.
1884-85. Repairs to ps. by hired labor, **85,** 2083.
1885-86. Repairs to ps. by hired labor, **86,** 1769.
1887-88. Constr. of superstr. by hired labor commenced, **88,** 1914.
1888-89. Repairs to ps. and sand fences, **89,** 2187.
1889-90. 17,526 c. y. dr., **90,** 2652.
1890-91. 17,500 c. y. dr., **91,** 2697.
1891-92. Repairs to ps. and revets. and constr. of sand fence, **92,** 2348.
1892-93. 15,587 c. y. dr. and gauge readings made for the adjustment of the different gauges at the Hs. of Lakes Michigan and Huron, **93,** 2877.
1893-94. 12,584 c. y. dr., **94,** 2206.
1894-95. 13,997 c. y. dr., an old wreck removed, and repairs made to s. p., **95,** 2793.
1895-96. 24,733 c. y. dr., 84 c. y. st. removed, and 456 l. f. old ps. repaired, **96,** 2691.
1896-97. Over 10,571 c. y. dr., **97,** 2917.
1897-98. 12,088 c. y. dr. and 203 l. f. n. p. rebuilt, **98,** 2506.
1898-99. 17,061 c. y. dr., **99,** 2913.
1899-00. 1,513′ of H. ps. and revets. repaired; 28,392 c. y. dr., **00,** 3892.
1900-01. 30,702 c. y. dr., **01,** 3092.
1901-02. 17,300 c. y. dr., **02,** 2152.
1902-03. 35,571 c. y. dr., **03,** 1949.
1903-04. 34,194 c. y. dr.; repairs to ps., **04,** 2989.
1904-05. 29,386 c. y. dr.; repairs to ps., **05,** 2175.
1905-06. Dr.; work on new ps. begun; repairs to damaged ps.; removing snags, **06,** 1803.
1906-07. Repairing and building extension to ps.; 61,081 c. y. dr., **07,** 1956.
1907-08. Work on ps. continued; 59,205 c. y. dr., **08,** 2038.
1908-09. 99,846 c. y. dr.; work on ps., **09,** 2026.
1909-10. 17,538 c. y. dr.; work on ps.; placing riprap along lake face and converging ps., **10,** 2185.
1910-11. 73,119 c. y. dr.; repairs to ps., **11,** 2383.
1911-12. 18,594 c. y. dr., **12,** 2573.

PHYSICAL CHARACTERISTICS.

General characteristics of Black Lake, **70,** 145; **76,** ii, 502, 503, 506; **77,** 915.
Bed of marsh clay, **66,** iv, 106.
Sand drift, **73,** 275.
Scour of sand bet. ps., **74,** 189.
Advance of shore line, **76,** ii, 505.
Description of, **93,** 2877; **97,** 2950.
Damages to structures by storms, **06,** 1804; **12,** 1033.
Damages and loss of lives by storm in 1906, **07,** 1957.
Injury to p., **10,** 2186.
H. 7± m. from Saugatuck on the s. and 20 m. from Grand Haven on n., **12,** 1033.

PLANS. (See Estimates.)

By J. R. Rowes, 1849, through cut dr. to 10′ joining Black Lake with Lake Michigan; parallel ps. to 20′ in Lake Michigan. Auxiliary br. p. in constr. permanent work. General plan approv. by BE., 1853, and recom. by Maj. Graham; est., $105,225.78, **66,** iv, 104; but afterwards modified,

[1] L. of ps. constr., Aug., 1867, to June, 1879, **79,** 1623.
Temporary pile wharfing built, 1852, to cover and protect possible subsequent work, but was mostly destroyed by storms before any permanent p. work had been begun, S. D. 42, 35th, 1st, p. 85. Damages to cribs and ps., **68,** 121; **69,** 33; **70,** 146. Artificial foundations for cribs, **66,** iv, 105, 106; **67,** 106; **68,** 121; **69,** 99; **70,** 145; **76,** ii, 503. Sand-tight backing for pile revet. work, **74,** 189; **76,** ii, 505. Dr. with a steam tug, cost per c. y., 30¢, **73,** 275; **74,** 188; **76,** ii, 505. History of operations, **70,** 146; **74,** 188; **76,** ii, 500, 502; **79,** 1624. Remarks on work, **76,** ii, 505.
Abstracts of materials used and work done, **67,** 107; **68,** 122; **70,** 139; **71,** 149; **72,** 181. Revet. rendered tight against sand, **79,** 1662.

limiting p. extension to 10′ instead of 20′, S. D. 42, 35th, 1st, pp. 84, 86.

By Capt. Farquhar, 1869, protection of displaced portion of s. p. by enrockment and close piling, **69,** 98.

By Maj. Mansfield, repairs, **79,** 1623.

PRIVATE WORK.

H. imp. by citizens of the village of Holland (about 1860, **70,** 145) in opening a new outlet for the waters of Black Lake at the most n. of the 2 sites proposed by Maj. Graham, but not the one recom. by them. Poor condition of the work in 1866, **66,** iv, 104, 105; **70,** 145; **74,** 184; **76,** ii, 502. Expend. in imp. by H. commissioners of Holland, $30,000, **66,** iii, 10, iv, 106.

Dr. carried on by the citizens of Holland, **90,** 2652.

Cost of repairs to ps. damaged by vessel of Graham & Morton Trans. Co. reimbursed by owners, **11,** 2383.

PROJECTS. (See Estimates.)

By Maj. Graham, 1857, 2 parallel crib ps. to 12′, and a through cut connecting Black Lake with Lake Michigan, revetted with close piling; the whole to be dr. to 12′; est., $128,343, S. D. 42, 35th, 1st, pp. 85, 89, 175; **66,** iv, 104.

By Maj. Wheeler, 1866, continuing the imp. begun by the citizens of Holland. P. extension to 12′ in Lake Michigan. Close piling to 12′ in Black Lake. Sheathing in cut. Dr. to 12′ in chan.; est., $106,238.04, **66,** iv, 104, 106; **67,** 24, 106; **68,** 33, 121; **70,** 145; **74,** 187; **76,** ii, 503. Reasons governing choice of site for imp. H. entrance, **66,** iv, 104, 106; **67,** 106.

By Capt. Farquhar, 1869, repairs to old n. and s. brush ps. Protection p. to sand hill, **69,** 98. Approv. and recom. by BE., **70,** 146.

By BE., 1869, protection of portion of the s. p. lately built by an enrockment, **69,** 104. Dr. at head of cut, **69,** 94; **70,** 146; approv. by Chief of Engineers, **69,** 105; **70,** 146. Manner of constr. of pile p. proposed for this and other works on Lake Michigan approv. with certain provisos, **69,** 104, 105.

By Capt. Farquhar, 1869, to apply $4,000 from app. of this H. toward purchase of a dr. outfit for use at this and neighboring Hs., **69,** 85.

By Maj. Farquhar, 1870, further p. extension, to depend on the relative cost each year of dr. and p. building, **70,** 42, 139; **76,** ii, 503.

By Maj. Mansfield, 1873, p. extension, **74,** 188; **76,** ii, 501, 506. 1876, extension of s. p. and repairs to old work, **76,** 102, ii, 500. 1877, crib p. extension, **77,** 108, 914.

Projects of 1866 and 1873 proposed chan. of entrance of navigable w. and not less than 12′ d., by p. extension and dr. Est., 1866, $106,238.04, **66,** iv, 104; **83,** 1827. From 1852 to 1884, $238,673.23 had been expend.; resulted in obtaining chan. of entrance 9′ d., **84,** 1988, 1989.

In 1883 Capt. Lockwood proposed placing an addl. crib 50′ l. at outer end of each p., and completing repairs to the ps.; est., $35,000, **84,** 1989.

In 1891 Maj. Ludlow proposed completion of the imp. by p. extension, repairs, and dr.; est., $45,000, **91,** 2697.

By Capt. Townsend, 1897, extending n. p. 800′ and s. p. 700′, and dr. 16′ chan.; and also repair of existing structures; est., $240,000, **97,** 2950; (drawings), **99,** 2916.

Modified plan, 1905, by Col. M. B. Adams, to extend p. and w. entrance to 300′ (see map), **05,** 2176.

SURVEYS.

By Maj. Graham, 1856, S. D. 42, 35th, 1st, p. 84.

By Maj. Wheeler, 1866; made by Lt. Mackenzie, **66,** iv, 104, 105; **67,** 106; **76,** ii, 502.

By Maj. Wheeler, 1868, **76,** ii, 503.

By Maj. Farquhar, 1869, 1870, 1871. **76,** ii, 504.

By Maj. Mansfield, 1874, **76,** ii, 505.

Soundings taken, 1877, **78,** 1211.

Sur. for d. of 16′ au. act June 3, 1896; made, 1897, by Capt. Townsend (see Projects), **97,** 2950.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1033.

Maps. **66,** No. 5. Showing p. extensions, **05,** 2177.

OO-23 (a) PIGEON RIVER, MICH.

ENGINEERS,

Chief of Engineers. R., 10, 831.

In Charge: Maj. Chas. Keller, **10,** 801.

SURVEY.

Pre. ex., au. act Mar. 3, 1909, **R.,** by Maj. Keller, Sept. 21, 1909 (unfav.), (H. D. 413, 61st, 2d), **10,** 831.

OO-24 GRAND HAVEN HARBOR, MICH.[1]

APPROPRIATIONS.

1852,	[2] $2,000.00,	**66,** iii, 34; **74,** 184.
1866,	65,000.00,	**66,** iii, 10, 34.
1867,	40,000.00,	**67,** 108; **74,** 187.
1869,	*1,866.15,	**69,** 22; **74,** 187.
1869,	*[3] 500.00,	**70,** 42.
1870,	10,000.00,	**70,** 42.
	*[4] 1,885.00,	**70,** 40, 129.
1871,	6,000.00,	**71,** 40.
1872,	15,000.00,	**72,** 38.
1873,	75,000.00,	**73,** 38.
1874,	50,000.00,	**74,** 44.
1876,	15,000.00,	**76,** 102.
1878,	15,000.00,	**78,** 122.
1879,	9,000.00,	**79,** 164.
1880,	50,000.00,	**80,** 2023.
1881,	50,000.00,	**81,** 2222.
1882,	40,000.00,	**82,** 2309.
1884,	50,000.00,	**84,** 1986.
1886,	30,000.00,	**86,** 1766.
1888,	25,000.00,	**88,** 1912.
1890,	$75,000.00,	**90,** 2647.
1892,	90,000.00,	**92,** 2340.
1894,	25,000.00,	**95,** 2798.
1896,	20,000.00,	**96,** 2695.
1899,	10,000.00,	**99,** 2919.
1902,	10,000.00,	**02,** 2157.
1902,	*10,000.00,	**04,** 2998.
1904,	*20,000.00,	**04,** 2998.
1905,	*30,000.00,	**05,** 2182.
1905,	30,000.00,	**05,** 2183.
1907,	50,000.00,	**07,** 1961.
1909,	*100,000.00,	**09,** 2031.
1910,	10,000.00,	**10,** 2190.
1911,	34,000.00,	**11,** 2386.
Total,	1,065,251.15	(incl. receipts from sales, etc., and $1,885 allotted, 1870, from Frankfort H., Mich., $1,070,828.07, **12,** 2576).

* Allotment.

[1] Sur.—**R.,** Dec. 15, 1849; est., $140,175.63. (H. D. 482, 55th, 2d.)

[2] S. Ex. D. 42, 35th, 1st, p. 92.

[3] Allotted from St. Josephs H.

[4] Allotted from Frankfort H., Mich.

COMMERCE.

H. of refuge, importance as, **67,** 109; **68,** 122; **75,** 253; **76,** ii, 495.

Importance, S. Ex. D. 42, 35th, 1st, p. 89; **67,** 109.

C. importance of H., S. Ex. D. 42, 35th, 1st, pp. 89, 90; S. Ex. D. 16, 34th, 3d, pp. 207, 209, 243, 251, 383, 394; **68,** 122; **69,** 93; **70,** 138; **71,** 147; **76,** ii, 496; **79,** 164, 1619.

Lumber interests, **67,** 108; **69,** 93; **76,** ii, 496; **80,** 2021.

Losses to shipping occasioned by forming of bar across H. mouth, **80,** 2019, 2020.

Importance of, **02,** 466.

Greater d. required in H. than provided by proj., which depends on proj. d. of Grand R., **08,** 2043.

Rates to Chicago by vessel about 14% lower than by rail, **09,** 733.

Increase in water-borne C., 1900–09. Local rates to Chicago 15% lower than by rail, **10,** 811.

In 1911, 641,816 t., **12,** 1035.

H. of considerable importance for years; w. terminus of Detroit, Grand Haven & Milwaukee branch of Grand Trunk RR., in connection with which is run throughout year 2 lines of SS. to Milwaukee, and one of these operating 2 large car ferries. There are other traffic lines.

Water traffic is 99±% through traffic; 156,000± t., 1900; 642,000± t., 1911.

Local rates to Chicago 15% lower than rail. Passengers, 1911, 78,738, **12,** 1035.

CONTRACTS.

1866. H. Squier, materials and labor, **66,** iv, 100.

1867. J. H. Ledlie, materials and labor, **67,** 109. R. A. Conolly, materials and labor, **67,** 109.

1868. R. A. Conolly, contractor, overpaid by mistake; 2 claims made; 1 disallowed, **68,** 124. Alleged frauds of P. A. Woolley and others, **68,** 124.

1869. Squier & White, materials and labor, **69,** 93.

1870. T. S. White, materials and labor, **71,** 146. Pierce & Whaling, materials, **71,** 146. G. P. Adams & Bro., materials, **71,** 146.

1872. T. S. White, materials and labor, **73,** 272, 274.

1873. Squier & White, materials and labor, **73,** 273, 274.

1874. Squier & White, materials and labor, **75,** 254.

1876. James Caldwell,[1] materials and labor, **77,** 913.

1878. Henry S. Dale, materials and labor, **79,** 1618, 1621.

1880. H. S. Dale, p. extension, canceled, **80,** 2019. Squier & White, revet. constr., **81,** 2222.

1881. J. W. Dennis, pile foundation, **81,** 2222.

1882. Gillen & Kirby, p. constr. and dr., the latter at 40¢ c. y., **83,** 1825.

1884. H. B. Herr, p. constr., **85,** 2080.

1886. T. W. Kirby, st. and edgings, **86,** 1767. Kelly, Maus & Co., iron, 2¼¢ lb., **86,** 1767. Cutler & Savidge Lumber Co., timber, **86,** 1767.

1889. Hagen & English, st., $7.90 cord, **89,** 2186. T. W. Kirby, edgings, $1.20 cord. Cutler & Savidge Lumber Co., timber, $16.75 1,000 f. b. m.; and plank, $13.50 1,000 f. b. m., **89,** 2186. Parkhurst & Wilkinson, driftbolts, 2.05¢ lb., **89,** 2186. C. Berner, p. constr., $14,956, **89,** 2186.

1890. E. G. Crosby, timber crib constr., $23,418, **91,** 2695. E. G. Crosby, pine piles, 10¢ l. f., and white pine timber, $17 M f.; Gaylord & Wing, white pine plank, $15 M f.; Parkhurst & Wilkinson, tie rods, 3¢ lb.; F. A. Hagen, st., $2.24 cord, **91,** 2695.

1892. Truman & Cooper, extension and repair of s. p., $2,047, **92,** 2345. Wisconsin Dredging & Dock Co., p. constr.; aggregate of bid, $47,947.05, **93,** 2883.

1893. E. D. Weimer, pine timber, $25.25 1,000′; oak timber, $31 1,000′, **93,** 2884. Parkhurst & Wilkinson, driftbolts, 2 1/16¢ lb.; screw, 2⅞¢ lb., **93,** 2884.

1899. Green & Wenzell, p. repairs (removing old work, timber, ironwork, st.), $8,185.66, **99,** 2919. Green's Dredging Co., dr., **99,** 2920.

1900. Green's Dredging Co., dr., **00,** 3898.

1901. S. O. Dixon, dr., 13¢ c. y., **01,** 3097.

1903. Robert Millen & Co., repair of n. p.; prices given, **03,** 1955.

1904. Chicago & Great Lakes Dredge & Dock Co., dr., 16.9¢ c. y., **04,** 2998. Robert Love, repair of s. p., prices given, **05,** 2183.

1905. Leathem & Smith Towing & Wrecking Co., 1,312 cords st. filling, $5.90 cord, **06,** 1810.

1907. Century Fuel Co., coal (prices given), **07,** 1961.

1908. S. P. Bennett Fuel & Ice Co., coal (prices given), **08,** 2044. The Green Stone & Quarrying Co., st. (prices given); Burk, Smith & Nelson, repair of s. p. (prices given), **09,** 2032.

1909. S. P. Bennett Fuel & Ice Co., coal (prices given), **09,** 2031.

1910. Century Fuel Co., coal (prices given), **10,** 2190. J. E. Hathaway & Co., repair of s. revet. (prices given), **10,** 2191.

1911. Robert Love & Son, repairs to n. revet. (prices given); Leathem D. Smith, furnishing and placing st., 8,000 t., $1.26 t.; Indian Refining Co., crude or fuel oil—crude, 2.7¢ gal.; fuel oil, 2.4¢ gal., **11,** 2387.

1912. Indian Refining Co., fuel oil for dr. *Meade*, 3.24¢ gal., **12,** 2577.

DOCUMENTS. (Not published in reports.) S. D. 16, 34th, 3d.

ENGINEERS.

Chief of Engineers. **R., 66,** 5, iii, 10, 34, iv, 98; **67,** 24; **68,** 33; **69,** 32; **70,** 42; **71,** 40; **72,** 37; **73,** 38; **74,** 44; **75,** 48; **76,** 101, ii, 497; **77,** 107; **78,** 122; **79,** 164; **80,** 217, 2023; **81,** 294; **82,** 288; **83,** 296; **84,** 297; **85,** 319; **86,** 314; **87,** 281; **88,** 255; **89,** 300; **90,** 270; **91,** 340; **92,** 326; **93,** 372; **94,** 343; **95,** 381; **96,** 337; **97,** 427; **98,** 415; **99,** 494; **00,** 557; **01,** 542; **02,** 465; **03,** 508; **04,** 555; **05,** 563; **06,** 625; **07,** 649; **08,** 695; **09,** 732; **10,** 810, 832; **11,** 864; **12,** 1034, 1058.

In charge:

Maj. J. D. Graham, 1855–57. **R.,** S. D. 42, 35th, 1st, p. 89.

Maj. J. B. Wheeler, 1866–69, **76,** ii, 497, 498. **R., 66,** iv, 91, 99; **67,** 108; **68,** 122.

Capt. F. U. Farquhar, 1869–72. **R., 69,** 93; **70,** 137; **71,** 146; **72,** 181.

Capt. S. M. Mansfield, 1872–80. **R., 72,** 189; **73,** 272; **74,** 184; **75,** 252; **76,** ii, 493; **77,** 912; **78,** 1208; **79,** 1618; (Maj.) **80,** 2019.

Maj. F. Harwood, 1880–82. **R., 80,** 2019, 2024; **81,** 2219.

Maj. D. P. Heap, 1882–83. **R., 82,** 2307.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1822; **84,** 1984; **85,** 2079; **86,** 1766; **87,** 2191.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1911.

Maj. W. Ludlow, 1889–93. **R., 89,** 2184; **90,** 2646, 2648; **91,** 2692; **92,** 2340, 2346; **93,** 2879.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2208; **95,** 2795; **96,** 2693; **98,** 2509.

Capt. C. McD. Townsend, 1897. **R., 97,** 2918.

Capt. C. Harding, 1899–01. **R., 99,** 2917; **00,** 3895.

Capt. Chas. Keller, 1901–03. **R., 01,** 3095; **02,** 2155.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1952; (Col.) **04,** 2993; **05,** 2179; **06,** 1807; **07,** 1960; **08,** 2042.

Maj. Chas. Keller, 1909–10. **R., 09,** 2030.

Maj. C. S. Riché, 1910–12. **R., 10,** 2188; (Lt. Col.) **11,** 2384; **12,** 2574.

Assistants:

J. R. Rowes, S. D. 20, 31st, 1st.

Lt. A. Mackenzie. **R., 66,** iv, 100; **67,** 108; **68,** 122.

J. F. Sanders, **68,** 124.

S. C. Mower, **79,** 1618. **R., 75,** 253; **78,** 1209.

J. Macfie. **R., 79,** 1621.

F. W. Lehnartz. **R., 00,** 3896; **02,** 2155.

ESTIMATES. (See Plans and Projects.)

By Asst. Rowes, 1849, sheath piling, $21,950, S. Ex. D. 42, 35th, 1st, p. 91.

[1] Contract extended, **78,** 1208.

By Maj. Graham, 1857, extension of ps. to 12′ of w., dr. and revet., $160,185.60, S. Ex. D. 42, 35th, 1st, pp. 92, 95, 175; **66,** iv, 99.

By Maj. Wheeler, 1866, repairs to RR. p., sheet piling, and extension of s. p., $105,111.21, **66,** iv, 99, 100; **74,** 184.

By Lt. Mackenzie, 1866, completion, $352,770.47, **66,** iv, 101; **76,** ii, 494.

N. p. extension, 1867, $200,000, **67,** 108; **68,** 123; **69,** 32, 93; **70,** 138; **71,** 40, 147; **72,** 38; **74,** 184; **76,** ii, 494.

Revised by Maj. Wheeler, 1867, completion, $200,111.21, **68,** 33.

By Capt. Mansfield, 1872, completion, $233,300, **72,** 190; **74,** 185; **76,** ii, 495.

Extension of n. p. and pile revet., 1875, $51,000, **75,** 254; **76,** ii, 495.

Completion of existing proj., 1879, $20,148.96, **79,** 164, 1619.

LEGAL PROCEEDINGS.

U. S. dist. atty. requested to take steps to secure reimbursement for damage to ps. by SS. in 1902, **02,** 2156. Cost of repairs refunded by owners, **03,** 1953.

Condemnation proceedings instituted to acquire possession of RR. lands bordering upon basin back of inner portion of s. p., to be used for storage and repair purposes, **10,** 811; **12,** 1035.

OPERATIONS.[1]

1866-67. S. side, 192 l. f. crib p. and 500 l. f. pile revet. built (repairs to old work), **67,** 24, 108; **74,** 184; **76,** ii, 498.

1867-68. S. side, 100 l. f. crib p., 1,943 l. f. pile revet., and 192 l. f. superstr. built (repairs to old work), **68,** 33, 123, 126; **74,** 184; **76,** ii, 498.

1868-69. S. side, 100 l. f. crib p. built (repairs to old work), **69,** 32, 93; **74,** 184; **76,** ii, 498.

1869-70. S. side, 32 l. f. crib p. built (repairs to old work), **70,** 42, 137; **74,** 184; **76,** ii, 499.

1870-71. Repairs to old work, **71,** 40, 146; **74,** 185; **76,** ii, 499.

1871-72. Repairs to old work, **72,** 37, 181, 189; **74,** 185; **76,** ii, 499.

1872-73. S. side, 700 l. f. pile revet. built (repairs to old work), **73,** 38, 272; **76,** ii, 499.

1873-74. N. side, 1,506 l. f. pile revet. built; 45,488 c. y. dr., **74,** 185; **76,** ii, 499.

1874-75. N. side, 300 l. f. crib p. and 600 l. f. pile revet. built. S. side, 500 l. f. pile revet. built; 13,530 c. y. dr., **75,** 48, 252; **76,** ii, 499.

1875-76. N. side, 300 l. f. superstr. built (work unfinished at date of last an. R. completed), **76,** 101, ii, 493.

1876-77. Damages repaired; pierheads riprapped, **77,** 107, 912.

1877-78. N. side, 150 l. f. crib p. and 150 l. f. superstr. built (cribs riprapped; repairs), **78,** 122, 1208.

1878-79. N. side, 150 l. f. crib p. built (repairs; willows planted), **79,** 164, 1618, 1620.

1879-80. Chan. through bar at H. mouth redr.; superstr. on n. p. extension completed, **80,** 2019.

1880-81. Work commenced upon pile and slab revet. and s. p. extension; extensive repairs to ps. and revet. by day labor; wreck of schooner *Catchpole* removed; 5,910 l. f. catch-sand fence built, **81,** 2220, 2221.

1881-82. 1,633 l. f. pile revet. completed and reinforced by anchor ps.; pile foundation for 3 cribs driven and cribs placed; 6,470 l. f. catch-sand fence built; portions of n. and s. revets. refilled by hired labor, **82,** 2307, 2308.

1882-83. 3 cribs placed in extension of s. p., riprap placed along chan. face, and sheet piling along s. face of same; 100 l. f. of cribwork, with superstr., placed in extension of s. p.; repairs, by day labor, to pile p. and n. and s. revet.; 16 oak-timber aprons placed bet. piles and cuts; 1,960 l. f. catch-sand fence built, **83,** 1822, 1823, 1824.

1883-84. 700 l. f. superstr. on s. p. rebuilt, **84,** 1985.

1884-85. 710 l. f. s. p. and 2 outer cribs refilled and redecked; also 802 l. f. revet. repaired, by hired labor, **85,** 2079.

1885-86. S. p. extended by 200 l. f. cribwork; breaches in pierhead and revet. repaired, **86,** 1766.

1886-87. Completion of new superstr. to n. p.; repairs to ps.; progress on cribs for s. p. extension, **87,** 2191.

1887-88. S. p. extended 52′ and n. p. 150′ under contract; repairs to s. p. by hired labor, **88,** 1912.

1888-89. Extensive repairs to s. p. revet.; 100 l. f. cribwork built, **89,** 2184.

1889-90. N. p. extended 150′; 2,388 l. f. of s. p. revet. repaired; 600 l. f. sand fence built, **90,** 2647.

1890-91. 6,000 c. y. dr.; constr. of cribwork for p. extension begun; repairs to plant, **91,** 2694.

1891-92. Constr. of crib in extension of s. p.; sunken end of s. p. rebuilt, and repairs made to timber and filling of n. and s. ps., **92,** 2342.

1892-93. Repairs made to s. revet., **93,** 2880; and extension of n. and s. ps. in progress, **93,** 2881. Repairs made to U. S. dr. plant, **93,** 2881.

1893-94. P. extension in progress, and repairs made, **94,** 2209.

1894-95. P. extension completed, and general repairs made, **95,** 2796.

1895-96. S. p. repaired, **96,** 2694.

1896-97. Repairs made to s. p. and storehouse, and 8,320 c. y. dr., **97,** 2919.

1897-98. 40,942 c. y. dr., and ps. repaired, **98,** 2509.

1898-99. Minor repairs made to works, **99,** 2917.

1899-00. Repairs of works, **00,** 3896.

1900-01. Minor repairs to s. p., **01,** 3095.

1901-02. Slight repairs to s. p.; attempt made to remove shoal at entrance by scouring with SS. propeller, **02,** 2155.

1902-03. 14,533 c. y. dr. by U. S. plant; repairs to ps., **03,** 1952.

1903-04. Repairs to s. revet. and p., 480 cords riprap used; n. p. repaired; 76,577 c. y. dr. under contract; other repairs to works, **04,** 2994–95.

1904-05. Riprapping s. revet., 233.7 cords riprap placed, **05,** 2179. Further extensive repairs to s. p. by removing damaged portion, sinking new cribs, etc., 2,192 cords riprap and 367 cords brush placed; 23,423 c. y. dr. by contract, **05,** 2180. 23,949 c. y. dr. by U. S. plant, **05,** 2181.

1905-06. 70,060 c. y. dr. by U. S. plant; repairs to ps., **06,** 1807–09.

1906-07. 11,552 c. y. dr. by U. S. plant; repairs to ps., **07,** 1960.

1907-08. 19,289 c. y. dr.; repairs to ps., **08,** 2043.

1908-09. 34,221 c. y. dr.; repairs to ps., **09,** 2030.

1909-10. 32,637 c. y. dr.; repairs to ps.; sunken scow removed by U. S. plant, **10,** 2188–89.

1910-11. Repairs to ps.; 55,288 c. y. dr., **11,** 2384–85. U. S. warehouse moved, **11,** 2386.

1911-12. Repairs to n. revet. completed; removal of old s. p. and filling st. in new s. p. continued; 64,143 c. y. dr.; repairs to s. p., **12,** 2575.

PHYSICAL CHARACTERISTICS.

General characteristics of Grand R., **76,** ii, 496.

Shore accretion rapid, **66,** iv, 99; **74,** 186.

Beneficial effects of the n. p. in maintaining a suitable d. of H. chan., **74,** 186.

Bar across entrance to H. usually forms in the fall, **74,** 185; **75,** 253; **76,** ii, 493; **78,** 122, 1209; **79,** 164, 1618.

Description of, **89,** 2184, 2185.

Memoranda of soundings, 1844–66. Advance of shore line, **76,** ii, 496, 500.

The zero of the water gauge at the H. raised in 1894 0.28′ to make it conform to the new plane of

[1] Operations suspended since 1852, **66,** 5. During the month of June, 1866, 309 l. f. of the RR. pile p. burned, **66,** iv, 100; **76,** ii, 498.

Damage to the n. p. by a colliding vessel in 1875, **76,** ii, 493, 494. Dr. with a steam wrecking tug, **76,** ii, 493. Chan. 400′ w., and available for any class of lake vessels, **76,** ii, 499; **77,** 107.

Histories of the operations, **74,** 184; **76,** ii, 496; **79,** 1620.

reference estab. for the Hs. of Lakes Michigan and Huron, **94,** 2209.

Gauge readings, **96,** 2695; **97,** 2919; **99,** 2917; **00,** 3897; **01,** 3096; **02,** 2157; **03,** 1954.

Shoal formation helped by sand blown in from adjoining dunes, **99,** 494.

Chan. d., **99,** 2917.

Damage to works by vessels, **01,** 3096; **02,** 2156; **03,** 1953; **04,** 2996; **06,** 1809.

Condition of works and d. available, **01,** 3095; **02,** 2156; **03,** 1953; **04,** 2995; **05,** 2181; **06,** 1807, 1809, 1810; **07,** 1960; **08,** 2043; **09,** 2030; **10,** 2189; **11,** 2385; **12,** 2575, 2576.

Sand blown into chan. from dunes, due to deterioration of sand fences, **02,** 2156.

Damage by flood, 1904, **04,** 555, 2994–95.

An. formation of bar at entrance to H., **04,** 556.

Settlement of repaired portion of s. p., **05,** 564.

At mouth of Grand R.—largest R. in Michigan—is 20 m. n. of Holland H., and 12 m. s. of Muskegon H., **12,** 1034.

PLANS. (See Estimates and Projects.)

By Lt. A. Mackenzie, 1866, extension of n. p. from a point 50′ n. of Maj. Graham's proposed p., **66,** iv, 101; **67,** 108; **76,** ii, 494, 496.

By Asst. Mower, 1875, pile revet., **75,** 253.

Extending n. p. to 18′, 1878, and breakw'r n. connected with pierhead, **78,** 1209.

By Maj. Ludlow, 1890, extension of n. bank revet.; repairing ps. and extending same 200′ and 300′, resp.; est., $74,200, **90,** 2651.

PRIVATE (CORPORATE) WORK.

Br. p. built by the Detroit & Milwaukee RR. Co. on the s. side of entrance, and with a direction 11° more w. than proposed by Maj. Graham, **66,** iv, 99; **76,** ii, 496, 498. Pile revet., **66,** iv, 100.

Dr. by SS. Co., 1877, **78,** 122, 1209.

Material for repairing s. p., damaged, 1900, by SS., furnished by owners, **01,** 3095.

Cost of repairs to ps. damaged by SS. refunded by owners, **03,** 1953.

PROJECTS. (See Estimates and Plans.)

By J. R. Rowes, 1849, sheath piling within R., approv. by BE., S. D. 42, 35th, 1st, pp. 89, 91.

By Maj. Graham, 1857, 2 parallel crib ps. 400′ apart to 12′ of w.; sheath piling on s. side of R.; dr. to 12′, S. D. 42, 35th, 1st, pp. 91, 95, 175; **66,** iv, 99; **74,** 184; **76,** ii, 496. App. of 1866 based on this plan, and should be applied in accordance therewith, unless modifications be necessitated by the work of the RR. Co., **66,** iv, 99.

By Maj. Wheeler, 1866, revised in 1867, 2 parallel cribwork ps., 2,208 and 608′ l., resp., to afford a chan. of entrance of navigable w. and not less than 18′ d.; est., $352,770.47, **66,** iv, 100; **76,** ii, 494; **80,** 217, 2033.

By Maj. Wheeler, 1867, n. p. extension to 12′, 200′ chan., **67,** 24; **68,** 33; **69,** 32, 93; **72,** 38. Recom. renewed, **70,** 138; **71,** 147; **74,** 184.

By Maj. Mansfield, 1875, extension of n. p.; pile revet. and riprap, **75,** 49, 254. Recom. renewed, **76,** ii, 494. Recom. as to pile revet. renewed, **77,** 913.

Résumé of plans and projs., 1866–76, **76,** ii, 494.

Maj. Harwood proposed, 1880, the extension of ps. to 18′, beach protection, and repairs to existing works; est., $365,600, **80,** 2024.

SURVEYS.

Capt. Williams, 1844, **76,** ii, 496.

Col. Abert, 1849, **76,** ii, 496.

Maj. Graham, 1856, S. Ex. D. 42, 34th, 1st, **76,** ii, 496.

Maj. Raynolds, 1865, **66,** iv, 99; **67,** 108.

Capt. Farquhar, 1869, **76,** ii, 498.

Capt. Farquhar, 1870, **76,** ii, 498.

Maj. Mansfield, **74,** 186; **76,** ii, 499.

Resur. made in 1882, **82,** 2308.

Sur. of bar at head of ps., 1884, **84,** 1984.

Sur. au. act Mar. 3, 1909. **R.** delayed pending pledges by local au. that public dock and transfer facilities would be provided, **10,** 811, 832.

Pre. ex. and sur. au. act Feb. 27, 1911, to e. end of Fulton St., and incl. chan. into Spring Lake (**R.** to come), **12,** 1058.

Maps. **82,** 2310; **84,** 1984; **90,** 2650.

OO-25 GRAND RIVER (below Grand Rapids), MICH.

APPROPRIATIONS.

1881,	$10,000,	**81,** 2225.
1882,	15,000,	**82,** 2312.
1884,	25,000,	**84,** 1987.
1896,	50,000,	**97,** 2922.
1899,	75,000,	**99,** 2927.
1902,	150,000,	**02,** 2161.
1905,	100,000,	**05,** 2187.
1907,	88,000,	**07,** 1966.
Total,	513,000	(incl. misc., $513,616.15, **12,** 2579).

COMMERCE.

Packet service maintained bet. Grand Rapids and Grand Haven, **01,** 3099; discontinued, 1901, and imp. chan. not in C. use at end of fiscal year, **02,** 2160.

C. purely prospective; little benefit will be derived until imp. is completed, **02,** 467; **12,** 1037.

Extent of imp. required to accommodate probable C., **04,** 3005–3006.

Two new boats put in operation, 1906, and freight-handling facilities installed at Grand Rapids, **06,** 628.

Steamer service discontinued in Sept., 1907. Upper 23 m. of imp. used only by gasoline launch pleasure boats, **08,** 2048–2049.

Imp. has no effect on rates, **09,** 736.

In 1911, 50,000 t., **12,** 2580.

No C. on 17.5 m. imp. R., Grand Rapids to Lamond; bet. Lamont and Grand Haven (21 m.) small side-wheel SS. in operation; below Bass R. 3 small tugs tow gravel to Grand Haven; improbable that imp. will fav. affect rates, because of better facilities of various contiguous rail lines, **12,** 1037, 1038.

CONTRACTS.

1882. Squier & White, dr., $6 per hour, **83,** 1826.

1885. R. Finch, dr., 25¢ c. y., **85,** 2082.

1903. Thomas Johnston, steel hull and cabin for suction dr., $21,000; and steam plant for dr., $8,000, **04,** 3002.

1907. Century Fuel Co., coal (prices given), **07,** 1966.

1908. S. P. Bennett Fuel & Ice Co., coal (prices given), **08,** 2049.

1909. S. P. Bennett Fuel & Ice Co., coal (prices given), **09,** 2035.

1910. Century Fuel Co., coal (prices given), **10,** 2194.

ENGINEERS.

Chief of Engineers. R., 80, 221; **81,** 294, 300; **82,** 289; **83,** 296; **84,** 298; **85,** 320; **86,** 314; **87,** 282, 286; **89,** 306; **91,** 345; **97,** 428; **98,** 416; **99,** 495; **00,** 558; **01,** 544; **02,** 466; **03,** 509; **04,** 557; **05,** 565; **06,** 627; **07,** 650; **08,** 697; **09,** 734; **10,** 812; **11,** 866; **12,** 1036.

Boards:

Convened, New York City, to ex. and **R.** on proj. for imp. of Grand R. **R., 90,** 2618. (Cols. Abbot, Comstock, and Houston, and Lt. Col. Gillespie.)

BERH. called upon, Apr. 25, 1903, by H. Com. on R. and H., for **R.** as to advisability of continuing or modifying proj., **03,** 510. **R.,** Nov. 11, 1903, advises modification of proj. (see Projects) (H. D. 216, 58th, 2d), **04,** 558, 3003.

BE. **R.** on regulating floods (see Surveys), **08,** 715.

In charge:

Maj. F. Harwood, 1880–82. **R., 81,** 2224, 2225.

Maj. D. P. Heap, 1882–84. **R., 82,** 2311; **83,** 1825.

Capt. D. W. Lockwood, 1884–87. **R., 84,** 1986; **85,** 2081; **86,** 1767; **87,** 2193, 2206.

Lt. Col. S. M. Mansfield, 1888. **R., 89,** 2206.

Maj. W. Ludlow, 1890. **R., 90,** 2676.

Capt. C. McD. Townsend, 1897. **R., 97,** 2921.

Lt. Col. G. J. Lydecker, 1898. **R., 98,** 2511.

Capt. C. Harding, 1899–1901. **R., 99,** 2920; **00,** 3899.

Capt. Chas. Keller, 1901–03. **R., 01,** 3098; **02,** 2159.

Maj. J. G. Warren (temp.), **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1956; (Col.) **04,** 2999; **05,** 2184; **06,** 1811; **07,** 1963; **08,** 2045.

Maj. Chas. Keller, 1909–10. **R., 09,** 2033.

Maj. C. S. Riché, 1910–1912. **R., 10,** 2192; (Lt. Col.) **11,** 2389; **12,** 2578.

Assistant. G. W. Bunker. **R., 99,** 2922; **00,** 3902; **01,** 3100.

LEGAL PROCEEDINGS.

Purchase of land from Pere Marquette RR. Co., bordering basin back of inner portion of s. p. at Grand Haven, completed, and deed executed, May 16, 1911, **12,** 2579.

Acquisition of adjacent land of Pa. RR. Co. still in hands of dist. atty. $5,892.40 expend. on account of land, **12,** 2579.

OPERATIONS.

1881-82. 7,267 c. y. dr.; 2 lighters built, **82,** 2311.

1882-83. 6,172 c. y. bowlders and 1,035 c. y. clay dr., **83,** 1826.

1883-84. 18,029 c. y. dr., **84,** 1987.

1884-85. 14,112 c. y. dr., **85,** 2081.

1885-86. 60,176 c. y. sand, gravel, and clay, and 1,707 c. y. bowlders removed; cleaning the chan. to a point 8 m. below mouth of Ganoes Canal at Grand Rapids, **86,** 1767.

1886-87. 6,158 c. y. dr. from vicinity of Haires Bar, **87,** 2194.

1896-97. 14,035 c. y. dr., **97,** 2921.

1897-98. 147,170 c. y. dr., **98,** 2511.

1898-99. Plant repaired and modified; 61,882 c. y. dr.; experimental contraction works built (drawings), **99,** 2921.

1899-00. 88,170 c. y. dr.; 12,622′ training walls constr. (drawings and photographs), **00,** 3899.

1900-01. 72,037 c. y. dr. by U. S. plant; 40,468 l. f. training walls built, **01,** 3098.

1901-02. 40,442 l. f. training wall built; 36,939 l. f. old walls repaired, **02,** 2159.

1902-03. 67,679 c. y. dr.; 11,059 l. f. new walls built; repairs made to old walls; plant repaired, **03,** 1956–57.

1903-04. 121,514 c. y. dr.; new suction dr. built and put in operation; 12,443 l. f. new walls built, **04,** 2999, 3000.

1904-05. 619,259 c. y. dr.; 3,459 l. f. training walls completed; old walls repaired, **05,** 2185.

1905-06. 491,228 c. y. dr.; 8,495 l. f. new walls built; repairs to old walls; 632 snags removed; work of converting dr. *Saginaw* into a derrick conveyor and rebuilding tug *Gillmore* in progress, **06,** 1811–13.

1906-07. 526 snags removed; repairs to training walls; rebuilding of tug *Gillmore* and conveyor *Saginaw* completed, **07,** 1964–1965.

1907-08. 315,718 c. y. dr., 370 snags removed; repairing walls, **08,** 2047.

1908-09. 284,048 c. y. dr., 365 snags removed, and 21,980 l. f. walls repaired, **09,** 2033–2034.

1909-10. 80,331 c. y. dr. and 40 snags removed, **10,** 2192–2193.

1910-11. 45,171 c. y. dr. and 86 snags removed, **11,** 2390.

1911-12. Repairs to floating plant, **12,** 2579. Approv. proj. 96% completed, **12,** 1037.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 2511.

Soundings of several bars before and after dr., 1899, **99,** 2926.

Effect of training walls, **01,** 3101–02.

Work delayed by h. w. due to long and frequent rains, **03,** 1957; **04,** 2999, 3000; **05,** 2184; **06,** 1812.

R. discharge, **04,** 3000.

Shoaling of completed chan. due to loose sand deposited behind training walls being carried into chan. during h. w., **10,** 2193; **12,** 1037.

Unusual l. w., July, 1910, **11,** 2389.

Buoys marking training walls and lower shoals submerged on account of high stage of water, **12,** 2578.

PROJECTS.

By Maj. Harwood, 1881, excavation of chan. 100′ x 4′ l. w., Grand Rapids to d. w.; est., $25,000, **81,** 2224. Increased by Maj. Heap, in 1882, to $35,000, **82,** 2311, 2312.

In 1896 Congress au. dr. chan. 10′ x 100′, Grand Haven to Grand Rapids, 38 m.; est., $670,500, **97,** 2921.

Contraction works, experiments with, details of cost, constr., etc. (drawings and photographs), **99,** 2921, 2924; **00,** 3900.

Act June 13, 1902, extended upper limit of imp. to Fulton St., Grand Rapids, **02,** 2160.

Proj. may be said to have been modified by act June 13, 1902, and cost increased to not less than $774,000, **03,** 510.

BERH., in **R.** of Nov. 11, 1903, recom. modification of proj. for securing and maintaining a 6′ x 100′ chan. from Fulton St., Grand Rapids, to Grand Haven, Mich.; est., $327,000 in addition to plant and funds on hand, and $20,000 an. mainten. (H. D. 216, 58th, 2d), **04,** 3003; au. act Mar. 3, 1905, provided that no portion of the app. should be used in providing a turning-basin in city of Grand Rapids, **05,** 566; total est., existing proj., $601,791.40, **12,** 1036.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Maj. Harwood, **81,** 2225.

Special surs. to cover localities embracing shoals, **85,** 2081.

Ex. au. act Aug. 5, 1886; made by Capt. Lockwood (**R.** unfav.), **87,** 2206.

Ex., Grand Rapids to Lake Michigan, au. act Aug. 11, 1888; made, 1888, by Lt. Col. Mansfield (**R.** unfav.), **89,** 2206.

Sur. below Grand Rapids, act Sept. 19, 1890, by Maj. Ludlow, **92,** 2372.

From 1896–98, such sur. work as was thought necessary to preserve previous surs., made by Lt. Col. Lydecker and Capt. Townsend, **98,** 2512.

R., May 29, 1907, by a BE., with view to regulation of floods in interest of navigation, made in compliance with act Mar. 2, 1907 (H. D. 72, 60th 1st), **08,** 715.

Cong. docs., etc., relating to exs., surs., plans, etc., **10,** 1037.

Drawings and photographs. (See Operations, 1899, 1900.)

OO-34 (b) LAKE HARBOR, MICH.

ENGINEERS.

Chief of Engineers. **R., 06,** 644.

In charge. Col. M. B. Adams. **R., 06,** 644.

SURVEYS.

Pre. ex. au. Mar. 3, 1905. **R.,** Col. Adams, Sept. 28, 1905 (unfav.), **06,** 644 (H. D. 156, 59th, 1st).

OO-35 MUSKEGON HARBOR, MICH.

APPROPRIATIONS.

1867, $59,000, **68,** 34, 127; **74,** 183; **76,** ii, 488.
1870, 10,000, **70,** 42.
1871, 15,000, **71,** 40.
1872, 10,000, **72,** 37.
1874, 10,000, **74,** 44.
1875, 25,000, **75,** 48.
1876, 15,000, **76,** 101.
1879, 5,000, **79,** 164.
1880, 7,500, **80,** 2018.
1881, 20,000, **81,** 2218.
1882, 25,000, **82,** 2306.
1884, 20,000, **84,** 1984.
1886, 12,500, **86,** 1765.
1888, 45,000, **88,** 1911.
1890, 50,000, **90,** 2637.
1892, 75,000, **92,** 2337.
1894, 30,000, **95,** 2801.
1896, 30,000, **96,** 2698.
1899, 60,000, **99,** 2929.
1901, *2,500, **01,** 3105; **08,** 2052.
1902 { *3,000, **02,** 2164; **08,** 2052.
1902 { 75,000, **02,** 2164.
1905, 100,000, **05,** 2190.
1907, 75,000, **07,** 1968.
1909, *22,000, **09,** 2038.
1910, 70,000, **10,** 2196.
1911, 10,000, **11,** 2393.

Total, 881,500 (incl. misc., $881,623.67, **12,** 2581).

COMMERCE.

Importance of H., **66,** iv, 146; **76,** ii, 490.
Benefits of imp., **68,** 127.
Lumber interests, **66,** iv, 145, 146, 147; **67,** 110; **68,** 127; **76,** ii, 490.
For 1911, 114,000 t., of which 75% was local and 25% through traffic, **12,** 1039.
2 lines of SS. navigate the H., doing substantial business, **12,** 1039.

CONTRACTS.

1867. G. Eastman, materials; Ledlie & Corse, materials; R. N. Gere, materials; Heber Squier, labor, **67,** 59, 111.
1869. Hasbrouck & Conro, materials; G. D. Jennings, materials and labor, **69,** 91, 92.
1870. T. S. White, materials and labor, **70,** 135, 136.
1871. C. Fitzsimmons, materials, **71,** 145; C. W. Diercks, materials, **72,** 180.
1872. Bird & Mickle, materials and labor, **73,** 271, 272.
1874. Culbert & Hopkins, materials and labor, **75,** 251.
1875. T. L. Rosser & Co., materials and labor, **75,** 251, 252.
1876. Culbert & Hopkins, materials and labor, **77,** 911.
1878. R. M. Steel, materials and labor, **79,** 1615, 1617.
1879. Dewar & Corlett, materials and labor, **80,** 2018.
1881. J. W. Dennis, p. constr., **81,** 2218.
1882. Gillen & Kirby, p. constr. and dr., the latter 40¢ c. y., **83,** 1822. McGraft & Montgomery, timber, **83,** 1820. J. B. Smith & Co., cedar bark, **83,** 1820. Michigan Barge Co., st., **83,** 1820. Keepers & Riddell, iron, **83,** 1820.
1884. H. B. Herr, p. extension, **85,** 2078.
1886. T. W. Kirby, st., $8.15 cord, **86,** 1765. Kelley, Maus & Co., iron, **86,** 1765. A. H. Petrie, timber, **86,** 1765.
1887. Schwarz & Berner, p. constr., **87,** 2191.
1889. C. Berner, p. constr., $25,142, **89,** 2183. S. Bedford, pine timber, $18 M f. b. m.; pine piles, 15¢l. f. Geer & Crawford, edgings, $2 cord, **89,** 2183. Chicago & Lemont Stone Co., st., $8.24 cord, **89,** 2183.
1890. E. G. Crosby, driftbolts, 2½¢ lb.; and edgings, $1.50 cord, **90,** 2638.
1891. Gaylord & Wing, reconstr. of outer crib, $3,825; E. G. Crosby, removal and renewal of 320 l. f. of n. p., $22,750; E. G. Crosby, piles, timber, and plank, 10¢ l. f., $15 to $17 M f. b. m., **91,** 2690.
1893. E. G. Crosby, p. constr., $49,103.77, **93,** 2889.
1895. Crosby & Co., dr., **95,** 2800.
1896. W. A. Starke, dr. Hs. on e. shore of Lake Michigan, 11½¢ c. y.; transfer of plant, $2 m., **96,** 2698. W. McIvor & W. A. Butterfield, p. repairs, $8,954.03, **96,** 2699.
1897. Green Bay Dredging Co., dr., **97,** 2793. R. B. Rice, p. extension, $15,431.30, **97,** 2925.
1898. A. Green, p. repairs, $2,797.11, **98,** 2517.
1899. Green's Dredging Co., dr.; Smith & Nelson, p. repairs (removing old work, piles, timber, ironwork, st., sand filling), $10,617.62, **99,** 2930.
1900. McLeod & Newcombe, p. extension (dr., piles, timber, ironwork, st.), $36,898.36; Green's Dredging Co., dr., **00,** 3908.
1901. Samuel O. Dixon, dr., 13¢ c. y., **01,** 3106.
1902. Samuel O. Dixon, dr., 18½¢ c. y., **02,** 2165. Robert Love, revet. bank s. side of chan. and repair of s. p., **03,** 1962.
1903. Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1962.
1904. Samuel O. Dixon, dr., 17½¢ c. y., **04,** 3011.
1905. Robert Love, constr. and repair of ps., **06,** 1815.
1907. Nelson J. Gaylord, repairing s. p., **07,** 1969. Century Fuel Co., coal, $2.85 to $3.25 t., **07,** 1969. Greiling Bros., dr., 17¾¢ c. y., s. m., **08,** 2053.
1908. S. P. Bennett Fuel & Ice Co., coal, $2,80 to $3.20 t., **08,** 2052. Burk, Smith & Nelson constr. of sheet-pile revet., **08,** 2053.
1909. Samuel O. Dixon, dr., 14½¢ c. y., **09,** 2038. Burk, Smith & Nelson, repairing n. p.; Burk, Smith & Nelson, repairing s. p.; S. P. Bennett Fuel & Ice Co., coal, $2.65 to $3.10 t., **10,** 2197.
1910. Century Fuel Co., coal, $2.85 to $3.23 t., **10,** 2197.
1911. Adolph F. Bues, dr. about 128,000 c. y. from Lake Michigan to Muskegon Lake, 15½¢ c. y.; Robert Love & Son, dr. for crib foundation, and material for extension and repair of n. revet. (prices given), **11,** 2393. Indian Refining Co., fuel oil for U. S. dr. *Meade* (prices given), **11,** 2394.
1912. Indian Refining Co., fuel oil for U. S. dr. *Meade*, 3.24¢ gal., **12,** 2582.

DOCUMENTS. (Not published in reports.)
S. D. 20, 31st, 1st.

ENGINEERS.

Chief of Engineers. R., 66, 1, 7, 8, iii, 13, 34; **67,** 24; **68,** 34; **69,** 32; **70,** 42; **71,** 40; **72,** 37; **73,** 38; **74,** 44; **75,** 48; **76,** 101; **77,** 107; **78,** 122; **79,** 163; **80,** 216; **81,** 293; **82,** 288; **83,** 295; **84,** 297; **85,** 319; **86,** 313; **87,** 281; **88,** 255; **89,** 299; **90,** 269, 2639; **91,** 340; **92,** 325; **93,** 373; **94,** 345; **95,** 382; **96,** 338; **97,** 428; **98,** 417; **99,** 496; **00,** 559, 569; **01,** 545, 553, 1331, 1333; **02,** 467; **03,** 510; **04,** 558; **05,** 567; **06,** 629; **07,** 652; **08,** 699; **09,** 736; **10,** 814, 831; **11,** 869; **12,** 1038.

In charge:
Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 140, 145, 155; **67,** 110; **68,** 127. Extract from R., **76,** ii, 490.
Capt. F. U. Farquhar, 1869–72. **R., 69,** 91; **70,** 135; **71,** 145; **72,** 180.
Capt. S. M. Mansfield, 1872–80. **R., 72,** 189; **73,** 270; **74,** 182; **75,** 251; **76,** ii, 487; **77,** 911; **78,** 1207; **79,** 1615. Extracts from **R., 76,** ii, 492; (Maj.) **80,** 2007.
Maj. F. Harwood, 1880–82. **R., 80,** 2017; **81,** 2216.
Maj. D. P. Heap, 1882–83. **R., 82,** 2305.
Capt. D. W. Lockwood, 1883–87. **R., 83,** 1820; **84,** 1983; **85,** 2077; **86,** 1764; **87,** 2189.
Maj. S. M. Mansfield, 1888–89. **R., 88,** 1910.

* Allotment.

Maj. W. Ludlow, 1889–93. **R., 89,** 2181, 2644; **90,** 2636; **91,** 2689; **92,** 2333, 2338; **93,** 2885.
Lt. Col. G. J. Lydecker, 1894–98. **R., 94,** 2211; **95,** 2799; **96,** 2696; **98,** 2515.
Capt. C. McD. Townsend, 1897. **R., 97,** 2923.
Capt. C. Harding, 1899–1901. **R., 99,** 2928; **00,** 3905.
Capt. Charles Keller, 1901–02. **R., 01,** 3103; **02,** 2162.
Lt. Col. M. B. Adams, 1903–08. **R., 03,** 1958; (Col.) **04,** 3007; **05,** 2187; **06,** 1814; **07,** 1967; **08,** 2050.
Maj. Charles Keller, 1909. **R., 09,** 2036.
Maj. C. S. Riché, 1910–12. **R., 10,** 2195; (Lt. Col.) **11,** 2392; **12,** 2580.

Assistants:
J. R. Bowes, **66,** iv, 145.
Capt. A. Mackenzie. **R., 67,** 110; **68,** 127.

ESTIMATES. (See Plans and Projects.)

By J. R. Bowes, 1849, ps., $118,456.34, **66,** 8, iv, 145; **76,** ii, 490.
By Maj. Wheeler, 1866, p. extension, $58,450, **66,** iii, 14, iv, 146, 155; **67,** 110; **68,** 127; **74,** 182; **76,** ii, 490.
Renewal of superstr., 1867, slab p., $64,000, **67,** 25; **74,** 182; **76,** ii, 488.
By Capt. Mansfield, 1873, p. extension, $56,000, **73,** 38, 271; **74,** 183; **75,** 251; **76,** ii, 488.
Addl. for completion, 1876, $8,898.04, **76,** 101, ii, 489; **77,** 912; **78,** 122, 1208. Recapitulation of, 1866–74, **74,** 182; **76,** ii, 488. For completion of existing proj., $19,901.75, **79,** 164, 1616.

EXPENDITURES.

For repairs, 1869–76, $7,486.76; list of repairs, **76,** ii, 489.

LEGAL PROCEEDINGS.

Title secured to land necessary for proj. imp., **06,** 1814.

OPERATIONS.[1]

1867-68. N. side, 192 l. f. crib p. built; s. side, 192 l. f. crib p. built; triangular crib placed in an angle bet. old and new work, **68,** 34, 127; **74,** 182; **76,** ii, 491.
1868-69. N. side, 64 l. f. crib p. and 256 l. f. superstr. built; s. side, 32 l. f. crib p. and 224 l. f. superstr. built, **69,** 32, 91; **74,** 182.
1869-70. N. side, 320 l. f. crib p. built; repairs to s. p., **70,** 42, 135; **74,** 183; **76,** ii, 491.
1870-71. N. side, 64 l. f. crib p. and 320 l. f. superstr. built; repairs to both ps., **71,** 40, 145; **76,** ii, 491.
1871-72. N. side, 30 l. f. crib p. and 64 l. f. superstr. built; s. side, 34 l. f. pile p. built; repairs by hired labor, **72,** 37, 180; **74,** 183; **76,** ii, 492.
1872-73. N. side, 30 l. f. superstr. built; repairs, **73,** 38, 271; **74,** 183; **76,** ii, 492.
1873-74. N. side, 250 l. f. pile p. built; s. side, 350 l. f. pile p. built; old slab ps. converted into pile p., **74,** 183; **76,** ii, 492.
1874-75. N. side, 135 l. f. pile p. built; s. side, 50 l. f. crib p. and 50 l. f. superstr. built; 135′ pile revet. rebuilt, **75,** 48, 251.
1875-76. S. side, 150 l. f. crib p. and 150 l. f. superstr. built, **76,** 101, ii, 487.
1876-77. Repairs, **77,** 107, 911.
1877-78. S. side, 100 l. f. crib p. and 100 l. f. superstr. built; repairs, **78,** 122, 1207.
1878-79. Repairs, **79,** 163, 1616.
1879-80. N. p. extended 50′, **80,** 2017.
1880-81. Repairs to ps. and constr. of catch-sand fences, **81,** 2216.
1881-82. 150 l. f. cribwork in extension of n. p., **82,** 2305.
1882-83. Break in end of s. p. repaired; 115 l. f. superstr. rebuilt on pile p.; 3 cribs completed to the 16th course, **83,** 1821.
1883-84. 100 l. f. cribwork sunk in extension of detached portion of n. p.; 250 l. f. s. p. superstr. rebuilt, **84,** 1983.
1884-85. Superstr. on detached portion of n. p. built; 100 l. f. cribwork in extension of detached portion of n. p., **85,** 2077.
1885-86. Breaks in s. pierhead and chan. wall repaired; pilework refilled, **86,** 1764.
1886-87. End of old n. p. repaired by hired labor; crib constr. in extension of n. p. commenced, **87,** 2189.
1887-88. Repairs to old n. p. completed by hired labor; displaced crib in n. detached p. replaced under contract, **88,** 1910.
1889-90. S. p. extended 250 l. f.; outer cribs riprapped; 292 l. f. n. p. and 380′ of s. p. rebuilt; 9,610 c. y. dr., **90,** 2637.
1890-91. 320 l. f. of n. p. removed and rebuilt; sunken crib of n. p. raised; 5,910 c. y. dr. by hired labor, **91,** 2336.
1892-93. Extension and repair of n. and s. ps. and extension of n. revet. toward Muskegon Lake in progress, **93,** 2886. Inner end of old n. revet. strengthened and 13,855 c. y. dr. Gauge readings taken, **93,** 2887.
1893-94. P. extension and extension of the n. revet. completed; minor repairs made to old s. pile p.; 36,414 c. y. dr., **94,** 2213.
1894-95. General repairs made and 10,708 c. y. dr., **95,** 2800.
1895-96. 11,913 c. y. dr., **96,** 2697.
1896-97. 27,259 c. y. dr., **97,** 2923. 323 l. f. superstr. on n. p. rebuilt and part of n. and s. p. faced with sheet piling; minor repairs made; constr. of 200 l. f. of extension to the s. p. in progress, **97,** 2924.
1897-98. 2,521 c. y. dr., and 200 l. f. extension to s. p. completed; about 250 l. f. old cribwork on s. p. repaired, **98,** 2515.
1898-99. 21,316 c. y. dr. for chan. mainten.; completion of p. repairs (drawings), **99,** 2928.
1899-00. 15,413 c. y. dr.; 694′ revet. repaired; p. extension in progress, **00,** 3905.
1900-01. 17,334 c. y. dr.; 200′ cribwork sunk for n. p. extension, and superstr. started; new cribwork on n. p. damaged by SS. *State of Michigan;* n. revet. strengthened, **01,** 3103, 3104.
1901-02. 200′ extension to n. p. and 100′ extension to s. p. completed; 20,117 c. y. dr., **02,** 2162, 2163.
1902-03. 26,958 c. y. dr.; work on revet. of s. bank and repairs to s. p. commenced, **03,** 1959.
1903-04. 8,350 c. y. dr.; constr. of 2 new sections of revet., aggregating 2,313′, on s. bank, and rebuilding about 300′ of s. p. completed; damage done to s. p. by SS. *F. & P. M. No. 1* repaired and cost collected from owners, **04,** 3007, 3008.
1904-05. 153 cords st. placed in s. p.; 21,875 c. y. dr.; s. p. damaged by SS. *Charles H. Hackley* repaired and cost placed in hands of U. S. atty. for collection; s. p. damaged by SS. *Naomi* repaired by owners, **05,** 2187, 2188.
1905-06. 65,002 c. y. dr. by U. S. dr. *Gen. Gillespie;* work commenced on removal of 328′ section of old n. p. to new location and constr. of new section 1,672′ l.; substr. for new s. revet., 308′ l., completed, and superstr. begun; s. p. damaged by SS. *Iowa,* **06,** 1814, 1815.
1906-07. New s. revet., 308′ l., completed; removal of section of n. p. to new position completed; 488′ of new section completed and remaining 1,182′ almost completed; 138 cords st. placed in old ps.; 20,517 c. y. dr., **07,** 1967.
1907-08. 2,000′ of new n. p. completed; extensive repairs made to 630′ section of s. p., incl. repairs to cribwork; new superstr. throughout and riprap in front; e. end of s. revet. strengthened with 33 piles; 15,328 c. y. dr. by U. S. dr. *Gen. Gillespie,* and 88,461 c. y. dr. under contract, **08,** 2050, 2051.
1908-09. Constr. of 1,200′ n. revet. practically completed; 93,091 c. y. dr. under contract; 167,344

[1] Condition of the H., **76,** ii, 493. Damages to ps. by colliding vessels, **71,** 145; **76,** ii, 491. Old slab p. breached; closed by pilework, **72,** 180. 310′ n. slab p. burned nearly to water surface, **73,** 271, 272. Half of a crib carried away by ice, **70,** 136. Histories of operations to 1874, **74,** 182; **76,** ii, 489; **79,** 1616.

c. y. dr. by U. S. dr. *Gen. Gillespie;* narrow chan. of 20′ d. secured, **09,** 2036, 2037.

1909-10. 114,962 c. y. dr. under contract; 23,910 c. y. dr. by U. S. dr. *Meade;* about 350′ superstr. of n. p. rebuilt; 71 anchor piles driven to strengthen s. sheet-pile revet., **10,** 2195, 2196.

1910-11. U. S. dr. *Meade* removed 20,292 c. y. from bet. ps. and on the outer bar; sheet piles driven and strengthened; tie rods tightened; 3,500 c. y. dr. by contract; work on extension of n. revet., **11,** 2392.

1911-12. 149,960 c. y. dr. by contract from chan. bet. the ps. from Lake Michigan to Muskegon Lake; n. revet. completed and repairs to damaged e. end of revet. in progress; 32,270 c. y. dr. by U. S. dr. *Meade* from entrance bar in Lake Michigan; making of temporary repairs to damaged outer end of s. p. begun, and work was abandoned in Nov., 1911, on account of severe storms, **12,** 2581.

PHYSICAL CHARACTERISTICS.

General, of Muskegon Lake and R., **66,** 8, iii, 13, iv, 145, 146; **76,** ii, 490.

Shifting bar at entrance of H., **66,** iv, 145; **73,** 271; **76,** ii, 490.

Difficulty in entering H. owing to a combination of lake and R. currents, **73,** 271; **76,** ii, 492.

Lake bed unstable sand, **73,** 271.

In 1894 the zero of the water gauge at the H. raised 0.02′ to make it conform to the new plane of reference estab. for Lakes Michigan and Huron, **94,** 2213.

Shoaling in winters, **00,** 3905.

Weather conditions made it very difficult to dr. on entrance bar in Lake Michigan, **12,** 2580, 2581.

D. bet. ps. 22′ and on bar 20.5′, **12,** 2580, 2581.

Ice in Muskegon Lake, **12,** 2580, 2581.

Severe storms in winter of 1911, **12,** 2580–81.

PLANS. (See Estimates and Projects.)

By J. R. Bowes, 1849, 2 parallel ps., 360′ apart, **36,** 8; **76,** ii, 490.

By Maj. Mansfield, extension of n. p. 250′, **79,** 1616.

PRIVATE (CITY) WORK.

Two converging slab ps., the s. projecting 350′ beyond the n. These ps. did not conform in constr. or direction to those recom. by Asst. Bowes, 1849 (see Plans). In 1865 the pierheads were in 14′ of w., **66,** iv, 146.

About 300 l. f. of old slab and log dock just inside of the U. S. revet. on the s. side of the chan. was repaired by the city of Muskegon at its own expense, **94,** 2213.

PROJECTS. (See Estimates and Plans.)

By Maj. Wheeler, 1866, extension of the H. ps. with cribwork to 17′ of w.; est., $58,450, **66,** iv, 145, 146; **67,** 24, 110; **68,** 34, 127; **74,** 182; **76,** ii, 488, 490; **79,** 1617. 1867, crib superstr. on old slab ps.; est., $64,000, **67,** 25; **68,** 34; **71,** 145; **76,** ii, 488.

Amended in 1879 to $168,901.75, **79,** 1616; **81,** 2217; **86,** 1765; **87,** 2190. Modified in 1880 to increase the w. of entrance from 190′ to 300′ by a detached n. p., **86,** 1764; **87,** 2189. From 1867 to 1884, incl., $221,500 had been app., when it was est. that $113,625 would be required to complete proj., **84,** 1984.

In 1890, after a further expend. of $107,500, $30,000 est. as required for completion, **90,** 2637; **91,** 2690.

By Capt. Mansfield, extension s. p.; est., $56,000, **73,** 38, 271; **76,** ii, 488. Recapitulation of projs., 1866 to 1874, **74,** 182; **76,** ii, 488, 489.

By Maj. Ludlow, 1892, extending both ps. 800′ to the 20′ curve in the lake; excavation of a chan. 18′ x 75′ from the lake into the H., and bank revet.; est., $260,000, **92,** 2336.

Act Mar. 3, 1899, provided that any part of the app. of that year could be used to prevent erosion and to preserve the chan. bet. Lake Michigan and Lake Muskegon, **99,** 2929.

Est. cost of proj., $260,000; increased, 1899, by $17,600, **00,** 560.

By Capt. Harding, 1900, for digging and protecting chan. bet. Lake Muskegon and Lake Michigan 20′ x 300′; est., $380,000 (H. D. 104, 56th, 2d), **01,** 3132; au. act June 13, 1902, **02,** 467.

SURVEYS.

1849. By Col. Abert, T. E., **76,** ii, 489.

1866. By Maj. Wheeler, **76,** ii, 489.

1869-70-71. By Capt. Farquhar, **76,** ii, 491.

Soundings, 1847, **76,** ii, 489; 1866, **76,** ii, 489, 490; 1868–69–70–71, **76,** ii, 491.

Ex. and sur. for 20′ chan. au. act June 6, 1900 **00,** 3907.

Au. act June 6, 1900, for chan. 20′ x 300′ w. bet. Lake Muskegon and Lake Michigan. **R.,** Capt. Harding (H. D. 104, 56th, 2d), **01,** 3131.

Au. act Mar. 3, 1909, for modification in exist. proj. **R.,** Capt. Keller (H. D. 210, 61st, 2d) (unfav.), **10,** 831.

For soundings made each year, see an. reports.

Maps:
Plat of soundings, **79,** 1616.
82, 2306; **84,** 1984; **90,** 2644.

OO-36 MUSKEGON RIVER, MICH.

COMMERCE.

Description of. Logging business formerly large but nearly ended, 1900, **00,** 3926.

ENGINEERS.

Chief of Engineers. R., 99, 505; **00,** 569.

In charge. Capt. C. Harding, 1899. **R., 00,** 2934.

Assistant. L. W. Goddard. **R., 00,** 3936.

PHYSICAL CHARACTERISTICS.

Description of. About 190 m. l.; empties into Muskegon Lake at city of Muskegon, thence flows into Lake Michigan. Head of navigation about 33 m. from mouth, **00,** 3935.

PRIVATE (STATE AND CORPORATE) WORK.

Outline of work done by State and by a private company, **00,** 3935.

SURVEYS.

Ex. from head of Muskegon Lake to Newaygo for a 5′ chan. au. act Mar. 3, 1899; made by Capt. Harding, 1899 (**R.** unfav.), **00,** 3934.

OO-39 WHITE LAKE HARBOR (White River Harbor), MICH.

APPROPRIATIONS.

1867, $57,000, **67,** 25.
1869, *44,550, **69,** 22.
1870, 20,000, **70,** 41.
1871, 20,000, **71,** 39.
1872, 10,000, **72,** 37.
1873, 7,000, **73,** 38.
1874, 10,000, **74,** 44.
1875, 10,000, **75,** 48.
1876, 5,000, **76,** 36, 101; **77,** 107, 910.
1878, 12,000, **78,** 122, 1207.
1879, 7,500, **79,** 163.
1880, 5,000, **80,** 2017.
1881, 7,500, **81,** 2215.
1882, 12,000, **82,** 2302.
1884, 10,000, **84,** 1982.
1886, 10,000, **86,** 1763.
1888, 10,000, **88,** 1901.
1890, 17,000, **90,** 2635.
1892, 5,000, **92,** 2333.
1894, 5,000, **95,** 2803.
1896, 5,000, **96,** 2700.
1899, 35,000, **99,** 2932.
1902, *15,000, **02,** 2168.
1905, *8,000, **05,** 2194.
1907, 10,000, **07,** 1972.
1909, 16,000, **09,** 2041.

Total, 373,550 (incl. $1,151.30 misc., $374,701.30, **12,** 2584).

COMMERCE.

H. of refuge, importance as, **66,** iv, 144; **76,** ii, 484.
C. importance of H., **66,** iv, 144; **68,** 129; **76,** ii, 484.
Benefits of imp., **66,** iii, 34; **68,** 128.
Lumbering and mfg. interests., **66,** iv, 144.
Of slight importance; constantly diminishing, **02,** 2167.
Not sufficient to warrant continuance of imp., and H. should be abandoned, **09,** 739, 2040.

CONTRACTS.

1867. T. S. White, materials. Carkin & Kimball, materials and labor. R. N. Gere, materials. Fox & Howard, dr., 28¢ c. y., **67,** 59, 112.
1871. C. Fitzsimmons, materials, **71,** 144.
1873. Agreement with E. C. Cook & Bro., materials, **73,** 269.
1875. T. L. Rosser & Co., materials and labor, **75,** 250.
1878. Chicago Dock & Dredging Co., materials and labor; J. Corlett, p. extension, **79,** 1613.
1879. J. S. McCoughey, materials and labor for cribwork, **80,** 2017.
1881. J. Corlett, p. constr., **81,** 2215.
1883. T. R. Lyon, timber, **83,** 1819. Keepers & Riddell, iron, **83,** 1819. Michigan Barge Co., st., **83,** 1819. J. B. Smith & Co., cedar bark, **83,** 1819.
1887. S. Bedford, timber, and Kelley, Maus & Co., iron, **87,** 2189.
1889. Stephen Bedford, white pine timber, $21 M f. b. m., **89,** 2180. Geer & Crawford, edgings, $2.50 cord, **89,** 2180. Chicago & Lemont Stone Co., st., $8.24 cord, **89,** 2180. Parkhurst & Williamson, driftbolts, 2¢ lb., **89,** 2180.
1890. E. G. Crosby, edgings, $2 cord, **90,** 2635.
1891. Gaylord & Wing, white pine plank, $15 M f.; G. W. Crouter, spike, 3¢ lb.; E. G. Crosby, edgings, $2 cord; and F. A. Hagen, st., $2.24 cord, **91,** 2688.
1896. W. A. Starke, dr., **97,** 2927.
1899. Green's Dredging Co., dr. P. P. Schnorbach, p. repairs (removing old work, piles, timber, ironwork, st.), $8,922.13. Smith & Nelson, p. extension and repair (dr., piles, lumber, ironwork, st. filling), $26,747.56, **00,** 3912.
1902. S. O. Dixon, dr., 20¢ c. y., **03,** 1966.
1903. Lydon & Drews Co., dr., 16½¢ c. y., Burk, Smith & Nelson, repair of p. (prices given), **03,** 1966.
1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 3016.
1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y., **05,** 2195.
1906. Great Lakes Dredge & Dock Co., dr., 17¢ c. y., **06,** 1818.
1907. Greiling Bros., dr., 21½¢ c. y., **07,** 1972.
1908. Leathem & Smith Towing & Wrecking Co., refilling parts of p. with st. (prices given), **09,** 2041.
1909. S. O. Dixon, dr., 25¢ c. y., **10,** 2200, Indian Refining Co., crude oil, 2.9¢; and fuel oil. 2.6¢ gal., **11,** 2396.
1912. Indian Refining Co., oil, 3.44¢ gal., **12,** 2585.

ENGINEERS.

Chief of Engineers. R., 66, iii, 13, 34; **67,** 25; **68,** 34; **69,** 31; **70,** 41; **71,** 39; **72,** 37; **73,** 38; **74,** 43; **75,** 48; **76,** 101; **77,** 106; **78,** 121; **79,** 163; **80,** 216; **81,** 293; **82,** 287; **83,** 295; **84,** 296; **85,** 318; **86,** 313; **87,** 280; **88,** 254; **89,** 298; **90,** 268; **91,** 339; **92,** 325; **93,** 374; **94,** 346; **95,** 383; **96,** 338; **97,** 429; **98,** 417; **99,** 497; **00,** 560; **01,** 546; **02,** 468; **03,** 512; **04,** 561; **05,** 569; **06,** 631; **07,** 654; **08,** 701; **09,** 738; **10,** 816, 831; **11,** 870; **12,** 1040, 1058.

In charge:

Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 143; **67,** 111; **68,** 128. Extract from **R., 76,** ii, 484.
Capt. F. U. Farquhar, 1869–72. **R., 69,** 90; **70,** 133; **71,** 143; **72,** 179.
Capt. S. M. Mansfield, 1872–79. **R., 72,** 188; **73,** 269; **74,** 180; **75,** 250; **76,** ii, 481; **77,** 910; **78,** 1206; **79,** 1613.
Maj. F. Harwood, 1880–82. **R., 80,** 2016; **81,** 2213.
Maj. D. P. Heap, 1882–83. **R., 82,** 2302.
Capt. D. W. Lockwood, 1883–87. **R., 83,** 1818; **84,** 1981; **85,** 2076; **86,** 1762; **87,** 2187.
Maj. S. M. Mansfield, 1888–89. **R., 88,** 1908.
Maj. W. Ludlow, 1889–93. **R., 89,** 2179; **90,** 2634; **91,** 2687; **92,** 2331; **93,** 2890.
Lt. Col. G. J. Lydecker, 1894–98. **R., 94,** 2215; **95,** 2802; **96,** 2699; **98,** 2518.
Capt. C. McD. Townsend, 1897. **R., 97,** 2926.
Capt. C. Harding, 1899–1901. **R., 99,** 2931; **00,** 3909.
Capt. Chas. Keller, 1901–03. **R., 01,** 3107; **02,** 2166.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1963; (Col.) **04,** 3012; **05,** 2191; **06,** 1816; **07,** 1970; **08,** 2054.
Maj. Chas. Keller, 1909. **R., 09,** 2039.
Maj. C. S. Riché, 1910–12. **R., 10,** 2198 (Lt. Col.) **11,** 2395; **12,** 2583.

Assistants:

Capt. A. Mackenzie. **R., 67,** 111; **68,** 128.
F. W. Lehnartz. **R., 00,** 3909; **01,** 3107.

ESTIMATES. (See Plans and Projects.)

By Maj. Wheeler, 1866, revetted cut, $170,530.80, **66,** 13, iv, 144, 145, 155; **67,** 25, 111; **68,** 129; **74,** 181, 182; **76,** ii, 482, 484.
By Capt. Farquhar, addl. for completion, $50,000, **69,** 91; **76,** ii, 482. Addl. for dr., $10,000, **71,** 39, 144; **76,** ii, 482.
By Capt. Mansfield, 1873, p. extension, dr., and repairs, $58,000, **73,** 38, 270; **76,** ii, 483. For completion, $49,525.60, **74,** 44; **76,** ii, 483. Addl. to complete proj., $34,525.60, **76,** 101, ii, 483, 484; $31,891.56, **76,** ii, 482; **77,** 107, 910; $17,391.56, **79,** 163.

* Allotment.

OPERATIONS.[1]

1867-68. 105,377 c. y dr.; 1,000 l. f. pile revet. built; connection bet. White Lake and Lake Michigan made, **68,** 34, 128; **74,** 181; **76,** ii, 485.

1868-69. H. in bad condition; a few piles driven, **69,** 31, 90; **74,** 181.

1869-70. N. side, 600 l. f. pile p. and 600 l. f. superstr. built; s. side, 852 l. f. pile p. and 852 l. f. superstr. built; 64,067 c. y. dr.; dr. outfit bought; pile driver built; 110′ pile revet. built, **70,** 41, 133; **74,** 181; **76,** ii, 485.

1870-71. N. side, 256 l. f. pile p. and 256 l. f. superstr. built, **71,** 39, 143; **74,** 181.

1871-72. N. side, 200 l. f. pile p. and 200 l. f. superstr. built; s. side, 96 l. f. pile p. and 68 l. f. superstr. built; work by hired labor, **72,** 37, 179; **74,** 181.

1872-73. S. side, 28 l. f. superstr. built; 20,680 c. y. dr.; dr. at 16½¢ c. y. by U. S. apparatus; repairs by hired labor, **73,** 38, 269; **74,** 181; **76,** ii, 483.

1873-74. Repairs, **74,** 181, 182.

1874-75. 13,570 c. y. dr.; repairs, **75,** 48, 250; **76,** ii, 483.

1875-76. S. side, 150 l. f. crib p. and 150 l. f. superstr. built; sand fences and sheath piling built by hired labor, **76,** 101, ii, 481.

1876-77. 12,480 c. y. dr.; repairs; wreck removed, **77,** 106, 910.

1877-78. 8,580 c. y. dr.; repairs, **78,** 121, 1206.

1878-79. S. side, 50 l. f. crib p. and 50 l. f. superstr. built; 9,150 c. y. dr.; repairs, **79,** 163, 1613.

1879-80. S. p. extended 100′, **80,** 2016.

1880-81. S. p. extended 100′ and 200 l. f. superstr. built over same; 4,486 c. y. dr. from chan., **81,** 2213, 2214.

1881-82. One crib and brush mattress foundation for bulkhead sunk, **82,** 2302.

1882-83. Inner crib in s. p. leveled up; piles driven for s. wall foundation of second crib, **83,** 1819.

1883-84. 3 cribs at end of s. p. superstr., **84,** 1981.

1884-85. 752 l. f. of s. p. pile revet. rebuilt, **85,** 2076.

1885-86. 45 l. f. of outer section n. p. cut down and rebuilt with superstr., **86,** 1763.

1886-87. Superstr. placed on 459 l. f. of old pile-p. revet., **87,** 2188.

1887-88. 300 l. f. of old n. p. superstr. removed; 4,190 c. y. dr. from H., **88,** 1909.

1888-89. 6,343 c. y. sand dr., **89,** 2179.

1889-90. 714 l. f. sand fence built; 6,313 c. y dr., **90,** 2634.

1890-91. Repairs and new superstr. to 377 l. f. of s. p.; repairs to outer end of n. p., **91,** 2687.

1891-92. Repairs to ps. and superstr. constr. continued, **92,** 2332.

1892-93. Repairs to ps. and revet. completed and water-gauge readings taken, **93,** 2891.

1893-94. 14,216 c. y. dr., **94,** 2216.

1894-95. Slight repairs made to s. p., **95,** 2802.

1896-97. 32,979 c. y. dr., **97,** 2927.

1899-00. 9,296 c. y. dr.; s. p. repaired; p. extension and repair in progress, **00,** 2909.

1900-01. N. p. extended 200′, s. p. 100′; crib of s. p. repaired; 5,802 c. y. excavated, **01,** 546, 3107.

1902-03. 12,455 c. y. dr.; repairs to ps., **03,** 1963.

1903-04. Repairs to ps. and 12,359 c. y. dr., **04,** 3012.

1904-05. 15,429 c. y. dr., **05,** 2191.

1905-06. 23,763 c. y. dr., **06,** 1817.

1906-07. 844 c. y. dr., **07,** 1970.

1907-08. 68,873 c. y. dr. by U. S. plant, **08,** 2054.

1909-10. Refilling parts of ps. with st., 11,335 c. y. dr. under contract, **10,** 2198–99.

1910-11. 55,518 c. y. dr. by U. S. plant, **11,** 2395.

1911-12. 37,926 c. y. dr. by U. S. plant, **12,** 2583–84.

PHYSICAL CHARACTERISTICS.

Lake Michigan; R. currents in general, **76,** ii, 487.

General characteristics of White R. and Lake, **66,** iii, 13, iv, 143, 144; **67,** 112; **73,** 270; **76,** ii, 484.

Advance of shore line from sur. of 1871 to 1873, 202 l. f. on the n. side and 26 l. f. on the s. side of H. ps., **73,** 270.

Description of the locality, **90,** 2634.

An. shoaling, **00,** 3910.

Condition of works and d. of water, **01,** 546, 3107–08; **02,** 469, 2166; **03,** 512, 1963; **04,** 561, 3012–13; **05,** 569, 2191–92; **06,** 632, 1817; **07,** 655, 1970; **08,** 702, 2054; **09,** 739, 2039–40; **10,** 817, 2199; **11,** 871, 2395; **12,** 1041, 2583.

PRIVATE AND CORPORATE WORK.

Two parallel slab ps., 125′ apart, of unequal l., chan. carrying 5′ of water. No imp. at this point recom.; entrance blocked by wreck, **66,** iii, 13, iv, 143, 144; **76,** ii, 484.

PROJECTS. (See Estimates and Plans.)

By Maj. Wheeler, 1866, cut 1,200′ s. of old entrance, 200′ w., connecting 12′ curves in Lake Michigan and White Lake, sheet-pile protection and crib ps.; est., $170,530.80, **66,** iii, 13, iv, 144, 145; **67,** 111; **68,** 34; **74,** 180; **76,** ii, 482.

By Capt. Mansfield, 1873, p. extension, dr., and repairs, **73,** 38, 270; **76,** ii, 486, 487. Résumé of plans and proj., **76,** ii, 482.

By Capt. Lockwood, 1884, extension of s. p. 200′ and n. p. 250′, and dr. bet. ps.; est., $104,225, **84,** 1982. 1867 to 1886, incl., $247,550 app.

In 1887 est. $84,225 required to complete proj., **87,** 2188.

Approv. proj., modified to provide for addl. extensions of 50′ to n. p. and 100′ to s. p.; amended est. of cost, $353,550, **01,** 546; also for creation and mainten. of chan. 12′ d. bet. ps. and revets., about 184′ apart, **02,** 468.

Revised proj., act Mar. 2, 1907, provides for 16′ d. and 200′ w. bet. ps. and revets., **07,** 654.

DO., with concurrence of BERH recom., 1909, that further app. be discontinued; radical imp. or mainten. of present work economically unjustifiable (see Commerce), **09,** 739, 2040.

SURVEYS.

Directed by Maj. Wheeler, made by Asst. Casgrain, 1866, **67,** 111; **76,** ii, 484.

By Maj. Wheeler, 1868, **76,** ii, 485.

By Capt. Farquhar, 1869, **76,** ii, 485.

By Maj. Mansfield, 1871, **76,** ii, 485, 486.

Sur., 1894, by Lt. Col. Lydecker, **94,** 2216.

Act Mar. 3, 1909, au. pre. ex., with view to providing 20′ entrance chan. and a turning-basin. **R.** by Maj. Keller, June 4, 1909 (H. D. 323, 61st, 2d) (unfav.), **10,** 831. R. reex. by BERH (R. and H. Com. D. 11, 61st, 2d), **11,** 871.

Act Feb. 27, 1911, provides for pre. ex., **11,** 871; **12,** 1058.

Maps. **82,** 2304; **84,** 1982.

[1] Contract work compared with work by hired labor, **69,** 90; **70,** 134. Piles, cost of driving, **70,** 134; **71,** 143. Damages to the n. pile p. by a colliding vessel, **77,** 910. History of the work to 1875, **76,** ii, 484; to 1874, **74,** 181; to 1878, **79,** 1614.

OO-39(b) LAKE MICHIGAN TO STONEY LAKE, MICH. (Channel.)

COMMERCE.

Description of interests that would probably be benefited. Probable C. purely local, **00,** 3940.

ENGINEERS.

Chief of Engineers. R., 99, 505; **00,** 569.
In charge. Capt. C. Harding, 1899–01. **R., 00,** 3939.
Assistant. L. W. Goddard. **R., 00,** 3940.

PHYSICAL CHARACTERISTICS.

Description of; Stoney Lake, about 1½ m. l., e. and w., and from 900′ to 1,800′ w., with d. varying from 15′–51′. Its outlet into Lake Michigan is Stoney Creek, about seven-eighths m. l., sometimes closed at the mouth by sand drifts; in Oceana Co., Mich., 13½ m. n. of White Lake H. and 17½ m. s. of Pentwater H., **00,** 3939.

SURVEY.

Ex. of the chan. from Lake Michigan to Stoney Lake au. act Mar. 3, 1899; made, 1899, by Capt. Harding (**R.** unfav.), **00,** 3939.

OO-41 PENTWATER HARBOR, MICH.

APPROPRIATIONS.

1867,	$55,000,	**67,** 25.
1869,	*17,820,	**69,** 22.
1870,	10,000,	**70,** 41.
1871,	10,000,	**71,** 39.
1872,	30,000,	**72,** 37.
1873,	20,000,	**73,** 37.
1876,	10,000,	**76,** 101.
1878,	10,000,	**78,** 121, 1206.
1879,	6,000,	**79,** 63, 1611.
1880,	4,000,	**80,** 2015.
1881,	10,000,	**81,** 2212.
1882,	10,000,	**82,** 2301.
1884,	15,000,	**84,** 1980.
1886,	10,000,	**86,** 1762.
1888,	8,000,	**88,** 1908.
1890,	8,000,	**90,** 2632.
1892,	5,000,	**92,** 2330.
1894,	5,000,	**95,** 2805.
1896,	5,000,	**96,** 2702.
1899,	25,000,	**99,** 2935.
1902,	*20,000,	**02,** 2168.
1905,	*12,000,	**05,** 2194.
1907,	10,000,	**07,** 1972.
1909,	*16,000,	**09,** 2041.
1909,	*3,000,	**12,** 2584.
Total,	334,820	

COMMERCE.

Importance of H., **68,** 130.
Benefits of imp., **67,** 113; **68,** 130.
C. importance of H., never great, has for some years steadily diminished, **03,** 513.
Imp. reported to have materially reduced rates by water, and secured corresponding reduction in RR. rates, **06,** 633.
Expend. by U. S. unjustifiably great, in proportion to amount of C., **09,** 740, 2041.

CONTRACTS.

1867. P. M. Danahar, materials, **67,** 59, 114. T. J. Van Wagoner, materials, **67,** 59, 114. P. N. Gere, materials, **67,** 59, 114. Hasbrouck & Conro, labor, **67,** 59, 114.
1869. R. Rogers, materials and labor, **69,** 89. C. Fitzsimmons, materials and labor, **69,** 89.
1870. G. P. Adams & Bro., st., **71,** 140, 141.
1871. Hurley & Corlett, materials and labor, **71,** 140, 143. T. S. White, dr., **71,** 140, 143. Pierce & Whaling, materials, **71,** 140, 143. G. P. Adams & Bro., st., **71,** 140, 143.
1872. T. S. White, material and labor, **73,** 267.
1876. Squier & White, material and labor, **77,** 907, 908.
1877. Squier & White, dr., removal of old slab p. and building revet., **78,** 1205.
1878. Squier & White, dr., removal of old slab p., and building revet., **79,** 1609.
1879. Squier & White, dr., 25¢ c. y., and pile revet. constr., **80,** 2015.
1881. Squier & White, dr., 24¢ c. y., **81,** 2212. J. Corlett, p. constr., **81,** 2212.
1882. Squier & White, dr., 23¢ c. y., **83,** 1818. T. H. Smith, p. extension, **83,** 1817.
1887. C. E. Mitchell, crib-p. constr., **87,** 2187.
1889. S. Bedford, white pine timber, $21 M f. b. m.; Geer & Crawford, edgings, $3 cord; Chicago & Lemont Stone Co., st., $8.24 cord; Parkhurst & Wilkinson, driftbolts, $2.05 lb., **89,** 2177. Weimer, Rath & Gaylord, break'r constr., $5,239.62; R. Finch, dr., 17¢ c. y., **89,** 2178.
1890. Geer & Crawford, edgings, $3 cord, **90,** 2633.
1891. Sands & Maxwell Lumber Co., white pine timber, $18 M f. b. m.; white pine plank, $14 M f. b. m.; and edgings, $3 cord; Parkhurst & Wilkinson, bolts and spikes, 2¼¢ and 2¾¢ lb.; F. A. Hagan, st., $2.24 cord, **91,** 2686.
1896. W. A. Starke, dr., **96,** 2702.
1897. Green Bay Dredging & Pile Driving Co., dr., **97,** 2929. N. J. Gaylord, p. repairs, $4,020.59, **98,** 2521.
1899. Green's Dredging Co., dr., **99,** 2935. Smith & Nelson, p. repairs (removing old work, piles, timber, ironwork, st.), $16,421.42. Green's Dredging Co., dr., **00,** 3915.
1902. S. O. Dixon, dr., 20¢ c. y., **03,** 1965.
1903. Burk, Smith & Nelson, repairing n. p., prices given; Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1966.
1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 3015.
1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y., **05,** 2195.
1906. Great Lakes Dredge & Dock Co., dr., 17¢ c. y., **06,** 1818.
1909. S. O. Dixon, dr., 25¢ c. y.; Muskegon Dock & Dredging Co., repairs to ps., prices given, **10,** 2200.
1911. Indian Refining Co., crude oil, 2.9¢ gal. and fuel oil, 2.6¢ gal., **11,** 2396.
1912. Indian Refining Co., oil, 3.44¢ gal., **12,** 2585.

DOCUMENTS. (Not published in reports.)

H. D. 70, 39th, 2d.

ENGINEERS.

Chief of Engineers. R., H. D. 70, 39th, 2d, **67,** 25; **68,** 34; **69,** 31; **70,** 41; **71,** 39; **72,** 37; **73,** 37; **74,** 43; **75,** 48; **76,** 101; **77,** 106; **78,** 121; **79,** 63; **80,** 215; **81,** 292; **82,** 287; **83,** 294; **84,** 296; **85,** 318; **86,** 312; **87,** 280; **88,** 254; **89,** 297; **90,** 268; **91,** 339; **92,** 324; **93,** 375; **94,** 347; **95,** 383; **96,** 339; **97,** 430; **98,** 418; **99,** 498; **00,** 561; **01,** 547; **02,** 469; **03,** 512; **04,** 560; **05,** 570; **06,** 632, 645; **07,** 655, 667; **08,** 702; **09,** 740; **10,** 817; **11,** 871; **12,** 1041, 1058.

* Allotment.

Board:
Convened July 20, 1882, Grand Rapids, Mich., by S. O. 65, C. E., 1882, to **R.** upon modification of crib superstr. as proposed by Maj. Heap, **R., 83,** 1811. (Majs. Houston, Smith, and Benyaurd.)

In charge:
Maj. J. B. Wheeler, 1867–69. **R., 67,** 112; **68,** 130.
Capt. F. U. Farquhar, 1869–72. **69,** 89, 101; **70,** 132; **71,** 140; **72,** 179.
Capt. S. M. Mansfield, 1872–80. **R., 72,** 187; **73,** 267; **74,** 179; **75,** 249; **76,** ii, 478; **77,** 907; **78,** 1205; **79,** 1609; (Maj.) **80,** 214.
Maj. F. Harwood, 1880–82. **R., 80,** 2014; **81,** 2211.
Maj. D. P. Heap, 1882–83. **R., 82,** 2301.
Capt. D. W. Lockwood, 1883–87. **R., 83,** 1817; **84,** 1978; **85,** 2075; **86,** 1762; **87,** 2186.
Maj. S. M. Mansfield, 1888–89. **R., 88,** 1907.
Maj. W. Ludlow, 1889–93. **R., 89,** 2176; **90,** 2631; **91,** 2684; **92,** 2328; **93,** 2894.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2218; **95,** 2804; **96,** 2701; **98,** 2520.
Capt. C. McD. Townsend, 1897. **R., 97,** 2928.
Capt. C. Harding, 1899–1900. **R., 99,** 2933; **00,** 3913.
Capt. Chas. Keller, 1901–03. **R., 01,** 3110; **02,** 2166.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1963 (Col.) **04,** 3012; **05,** 2192; **06,** 1817; **07,** 1970; **08,** 2054.
Maj. Chas. Keller, 1909–10. **R., 09,** 2040.
Maj. C. S. Riché, 1910–12. **R., 10,** 2199; (Lt. Col.) **11,** 2395; **12,** 2584.

Assistants:
Capt. A. Mackenzie. **R., 67,** 112; **68,** 130.
F. W. Lehnartz. **R., 00,** 3913.

ESTIMATES. (See Projects.)

By Capt. Mackenzie, $327,713.40, **67,** 25, 113; **68,** 130; **74,** 179, 180; **76,** ii, 478; **77,** 908. Modified, **78,** 1205; **79,** 1610.
By Maj. Wheeler, dr., $40,000, **69,** 31, 89; **70,** 41, 133; **74,** 179.
By Capt. Farquhar, repairs and revet., $54,780, **71,** 141; **72,** 187.
By Capt. Mansfield, addl. for completion, $24,780, **72,** 37, 187. Removal of old and constr. of new revet. on n. side, and p. extension, $49,200, **75,** 48, 249.

OPERATIONS.[1]

1867-68. S. side, 320 l. f. crib p. built; 15,944 c. y. dr.; cribs built at Ludington and towed to Pentwater; work poorly done, **68,** 34, 130; **74,** 179; **76,** ii, 479.
1868-69. S. side, 256 l. f. crib p. built; 22,632 c. y. dr., **69,** 31, 89; **74,** 179; **76,** ii, 479.
1869-70. N. side, 160 l. f. crib p. and 440 l. f. pile p. built; s. side, 32 l. f. crib p. built; repairs; efficiency of n. p., **70,** 41, 132, 133; **74,** 180; **76,** ii, 480.
1870-71. 450 l. f. superstr. completed; repairs, **71,** 39, 140; **74,** 180; **76,** ii, 480.
1871-72. N. side, 30 l. f. crib p. built, **72,** 37, 179; **74,** 180; **76,** ii, 480.
1872-73. S. side, 1,042 l. f. pile p. built; 62,882 c. y. dr.; 1,382′ old p. removed and dr. to 12′; w. increased, **73,** 37, 267; **74,** 180; **76,** ii, 481.
1873-74. N. side, 100 l. f. crib p. built; s. side, 95 l. f. pile p. built; 100′ superstr. n. p.; revet. completed, **74,** 43, 180; **76,** ii, 481.
1874-75. 3,190 c. y. dr.; dr. by U.S. dr., **75,** 48, 249.
1875-76. Repairs by hired labor, **76,** 101, ii, 478.
1876-77. 7,230 c. y. dr.; repairs by hired labor, **77,** 106, 907.
1877-78. N. side, 552 l. f. pile p. built; 15,901 c. y. dr.; pierheads reballasted; 68 cords st. used; repairs, **78,** 121, 1205; **79,** 1611.
1878-79. N. side, 600 l. f. pile p. built; 18,022 c. y. dr.; repairs, **79,** 63, 1609.
1880-81. 1,528 l. f. catch-sand fence built; ps. and revet. repaired; 20,000 c. y. dr., **81,** 2211.
1881-82. 50 l. f. of cribwork sunk in extension of n. p.; 19,478 c. y. dr. from chan., **82,** 2301.
1882-83. 50 l. f. of superstr. built; repairs to pier work; dr. under Squier & White's contract continued, **83,** 1817.
1883-84. 12,838 c. y. dr. from bet. ps.; damage to n. p. end repaired, **84,** 1979, 1980.
1884-85. 106 l. f. of filling removed and replaced; 150′ of revet. backing overhauled and repaired; 1 crib sunk in extension of n. p.; filling placed in interval bet. s. p. cribs, **85,** 2075.
1885-86. Extensive repairs to n. and s. ps., **86,** 1763.
1886-87. One 50′ crib placed on pile foundation in extension of s. p., **87,** 2186.
1887-88. 50′ p. extension under contract completed, **88,** 1907.
1889-90. 9,917 c. y. dr.; 612 l. f. sand fence built; repairs to ps., **90,** 2632.
1890-91. 7,200 c. y. dr. from chan. bet. ps.; 270 l. f. of s. revet. rebuilt; repairs to n. p. and s. revet., **91,** 2685.
1891-92. Repairs to s. revet. completed, **92,** 2329.
1892-93. 11,674 c. y. dr. and gauge readings made, **93,** 2894.
1893-94. 14,575 c. y. dr., **94,** 2218.
1894-95. Few repairs made to old ps., **95,** 2804.
1895-96. 22,932 c. y. dr., **96,** 2702.
1896-97. 16,675 c. y. dr., **97,** 2928.
1897-98. Rebuilding of 440 l. f. of n. p. in progress, **98,** 2520.
1898-99. Work of last year completed; 11,394 c. y. dr., **99,** 2933.
1899-00. 30,147 c. y. dr.; 1,819′ of ps. repaired, **00,** 3913.
1902-03. 18,614 c. y. dr., **03,** 1963.
1903-04. Repairs to n. p.; 11,337 c. y. dr., **04,** 3012.
1904-05. 15,852 c. y. dr., **05,** 2192.
1905-06. 11,496 c. y. dr., **06,** 1817.
1906-07. 17,405 c. y. dr. under contract, and 59,730 c. y. dr. by U.S. plant, **07,** 1970.
1907-08. 66,354 c. y. dr. by U.S. plant, **08,** 2054.
1909-10. 14,415 c. y. dr. under contract, and 30,588 c. y. by U. S. plant, **10,** 2199.
1910-11. Repairs to ps. by contract, **11,** 2395.
1911-12. 58,541 c. y. dr. by U.S. plant, **12,** 2584.

PHYSICAL CHARACTERISTICS.

General, of Pentwater H., **68,** 130; **76,** ii, 479.
Cause of shoaling of chan., **72,** 179.
Advance and recession of shore line, **76,** ii, 480, 481.
Effect of denuding the sand hills, **73,** 267.
Peculiarities of the Hs. of Frankfort and Pentwater, **76,** ii, 481.
Description of, **90,** 2631.
Condition of works and d. of water, **02,** 469,2166; **03,** 513, 1963; **04,** 560, 3012–13; **05,** 570, 2192; **06,** 632–33, 1817; **07,** 655–56, 1970; **08,** 702, 2054; **09,** 740, 2040; **10,** 818, 2199; **11,** 872, 2396; **12,** 1042, 2584.
Available d. shown by soundings, May 28–31, 1904, **04,** 3013.

PRIVATE (CORPORATE) WORK.

Previous to 1868. Br. p. on the n. side filled with slabs; also repairs, **68,** 130. Very irregular and inferior work, **68,** 130. Dr., **69,** 31; **76,** ii, 480. 250 l. f. substantial dock, joining U. S. revet.,

[1] 1868–69. Work damaged by storms, **69,** 31, 90.
1870–71. S. p. breached, **71,** 39. Bad condition of H., **71,** 140.
1874. N. p. breached, **75,** 249.
1875. Ps. damaged by colliding SS., **76,** ii, 478. List of repairs made, **76,** ii, 478.

built by the Chicago & Michigan Lake Shore RR. Co., 1873, **73,** 267; **76,** ii, 481.

In 1894–95 old wreck in chan. struck by vessel belonging to Sands & Maxwell removed by them, **95,** 2804.

PROJECTS. (See Estimates.)

By Maj. Wheeler, extension of n. and s. ps. for 1,280′; abandonment of old slab p. recom., **67,** 112, 113; **68,** 130. Modified to increase w. of "present" outlet from 76′ to 150′, close piling 2,120 l. f., and 2,560 l. f. pierwork, utilizing portion of old work; also, dr. to 12′; est., $327,713.40, **67,** 25, 113; **68,** 34, 130; **74,** 179; **76,** ii, 478, 479. Recom. of removal of old s. slab p. renewed, **69,** 31, 89; **70,** 41, 133; **74,** 179, 180.

By Capt. Farquhar, 1871, w. chan. and new revet., **71,** 39, 140, 141.

By Maj. Mansfield, 1875, removal of old n. slab revet., 1,500 l. f., replacing it with pile revet., **75,** 48, 249; **76,** ii, 478; **77,** 907.

For dr., 1876, and repairs, **76,** ii, 478. Résumé of plans and projs., **74,** 179. Comparison of finished work with that first proj., **76,** ii, 478, 481.

Orig. est. of 1866 amended, 1873, to $192,020, **78,** 1205; **87,** 2186.

In 1884 Capt. Lockwood considered that completion of imp. would require constr. of 300 l. f. of pier work, dr. at entrance and bet. ps., and repairs; est., $70,000, **84,** 1980.

In 1892 Maj. Ludlow proposed addition of 4 cribs to s. p. (in completion of the existing proj.), and reconstr. of 521′ of n. p., 619′ of s. p., and 417′ of s. revet., 1,830 l. f. of sheet piling for n. p. and s. revet., and dr.; est., $53,000, **92,** 2330.

Approv. proj., 1899, provided for further extending 200′ of s. j., **99,** 2934; est., $22,000, **00,** 3914.

Revised proj. (act Mar. 2, 1907) for d. of 16′ and w. of 150′ bet. ps. and revets., **07,** 655.

The DO., with concurrence of BERH., recom., 1909, that further apps. be discontinued; H. has outlived its usefulness (see Commerce), **09,** 741, 2041.

SURVEYS.

By Maj. Raynolds, 1866, **76,** ii, 479.

By Capt. Farquhar, 1869–70–71, **76,** ii, 480. Memoranda of soundings, **76,** ii, 479, 481.

Surs. of the waterway bet. the ps. made, 1894, by Lt. Col. Lydecker, **94,** 2218.

Pre. ex. and sur. au. act Mar. 3, 1905, with view to obtaining 16′. **R.** by Col. Adams, Nov. 8, 1905, presents plan for enlarging existing proj. to extent of providing 16′ when mainten. dr. in H. be undertaken (H. D. 181, 59th, 2d), **06,** 645; **07,** 667. **R.** reviewed by BERH. (see Boards) (R. and H. Com. D. 11, 61st, 2d), **11,** 872.

Act Feb. 27, 1911, au. pre. ex. of this H., **11,** 872; **12,** 1058. (**R.** to come.)

Maps. **82,** 2302; **84,** 1980.

OO-43 LUDINGTON (Pere Marquette) HARBOR, MICH.

APPROPRIATIONS.

1867,	$50,000,	**67,** 25.
1869,	*31,185,	**69,** 22.
1870,	10,000,	**70,** 41.
1871,	10,000,	**71,** 39.
1872,	10,000,	**72,** 37.
1873,	25,000,	**73,** 37.
1874,	20,000,	**74,** 43.
1875,	10,000,	**75,** 47.
1876,	10,000,	**76,** 101.
1878,	15,000,	**78,** 121, 1205.
1879,	5,000,	**79,** 162, 1608.
1880,	8,000,	**80,** 2014.
1881,	10,000,	**81,** 2209.
1882,	12,000,	**82,** 2291.
1884,	10,000,	**84,** 1978.
1886,	56,250,	**86,** 1761.
1888,	60,000,	**88,** 1906.
1892,	5,000,	**92,** 2327.
1894,	6,000,	**95,** 2807.
1896,	25,000,	**96,** 2705.
1899,	25,000,	**99,** 2938.
1902,	75,000,	**02,** 2170.
1903,	165,000,	**03,** 1968.
1905,	10,000,	**05,** 2198.
1907,	100,000,	**07,** 1975.
1908,	20,000,	**08,** 2058.
1909,	208,000,	**09,** 2044.
1910,	310,000,	**10,** 2202.
1911,	229,087,	**11,** 2400.
1912,	51,500,	**12,** 2589.
Total,	1,582,022	(incl. misc., less amt. carried to surplus fund, $1,582,127.81, **12,** 589).

COMMERCE.

Importance as H. of refuge, **68,** 132; **69,** 88; **70,** 40, 131; **76,** ii, 476.

Benefits of imp., **68,** 132; **75,** 47; **76,** ii, 477.

Vessels lost bet. Big and Little Point Sable, bet. 1848 and 1881, **82,** 2300.

In 1897 the H. had large local C., and was an important link in a line for moving freight to and from the Northwest and the Atlantic seaboard, **97,** 2952.

1911, 1,866,000± t.; 44,000 pass. Local rates to Chicago 27% less than by RR. Terminus of car-ferry lines. Imp. has produced traffic which otherwise could not have existed. H., by providing shorter route, reduces congestion usually found on RRs. of s. end of Lake Michigan. Rates have been materially reduced by new route, **12,** 1045.

CONTRACTS.

1867. P. M. Danaher, materials, **70,** 41. Ledlie & Corse, materials; R. N. Gere, materials; Hasbrouck & Conro, labor and dr., **67,** 115.

1869. P. M. Danaher, materials and labor, **69,** 88.

1870. Pierce & Whaling, materials and labor; D. Dewar, matorials and labor, **71,** 137, 138, 139.

1872. Dodge & Squier, materials and labor, **73,** 265, 266.

1873. W. Nicolls, materials and labor, **73,** 265.

1876. D. Dewar, materials and labor, **77,** 906, 907.

1877. D. Dewar, materials and labor, **78,** 1203.

1878. N. S. Gere,[1] materials and labor, **79,** 1606, 1609.

1879. Dewar & Corlett, materials and labor, **80,** 2014. D. Dewar, p. extension, superstr., and dr., **81,** 2208.

1881. D. Dewar, p. constr. and dr., **82,** 2291.

1882. T. H. Smith, dr., 29¢ c. y., **83,** 1816.

1883. C. E. Mitchell, crib constr., **85,** 2074.

1889. Truman & Cooper, p. constr., $52,417.97; pile-p. constr., $55,568.16, **89,** 2175.

1896. W. A. Starke, dr., **97,** 2931.

1897. W. Brownrigg, p. repairs, $8,851.31, **97,** 2703.

1899. Green's Dredging Co., dr.; N. J. Gaylord, p. repairs (removing old work, piles, lumber, ironwork, st.), $14,777.35, **99,** 2938.

1900. Green's Dredging Co., dr.. **00,** 3918.

1901. Samuel O. Dixon, dr., 18¢ c. y., **01,** 3115.

1902. T. J. Bennett & Co., extension and repair of ps., prices listed; S. O. Dixon, dr., 20¢ c. y., **03,** 1969.

1903. The Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1969.

1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 3021.

1906. N. J. Gaylord, repair of s. p., prices listed, **07,** 1975.

1907. Century Fuel Co., coal for U. S. dr. *Gillespie*, prices listed, **07,** 1975. L. E. Schnor-

* Allotment.

[1] Contract extended, **79,** 1606.

bach & Co., constr. of break'r, prices listed, **08,** 2059.

1908. S. P. Bennett Fuel & Ice Co., coal for U. S. dr. *Gillespie*, prices listed; N. J. Gaylord, repairs to inner end of n. p., **08,** 2059. Bennett-Schnorbach Co., st., $9 cord, **09,** 2045.

1909. S. P. Bennett Fuel Co., coal, prices listed, **09,** 2044.

1910. Century Fuel Co., coal for U. S. dr. *Meade*, prices listed, **10,** 2205. T. H. Smith, st., $2.46 t., **11,** 2401.

1911. Indian Refining Co., oil for U. S. dr. *Meade*, prices listed, **11,** 2400. Leathem D. Smith, st., prices listed, **12,** 2589.

1912. Indian Refining Co., oil, 3.44¢ gal., **12,** 2589. G. W. Bunker Co., removing ps. and constr. break'r, prices listed, **12,** 2590.

ENGINEERS.

Chief of Engineers. R., 67, 25; **68,** 35; **69,** 30; **70,** 40; **71,** 38; **72,** 36; **73,** 37; **74,** 43; **75,** 47; **76,** 100; **77,** 106; **78,** 121; **79,** 162; **80,** 215; **81,** 292; **82,** 286, 2292; **83,** 294; **84,** 295, 301; **85,** 317, 324, 2090; **86,** 312; **87,** 279; **88,** 253; **89,** 296; **90,** 267, 2625; **91,** 338; **92,** 324; **93,** 375; **94,** 348; **95,** 384; **96,** 340; **97,** 430, 435; **98,** 418; **99,** 499; **00,** 562; **01,** 548; **02,** 470; **03,** 514; **04,** 562; **05,** 571; **06,** 634; **07,** 657; **08,** 704; **09,** 742; **10,** 819; **11,** 873; **12,** 1043.

Boards:

Convened, S. O. No. 181, C. of E., 1884, to **R.** upon a plan with est. for H. of refuge at Ludington, Mich., **85,** 2073. (Lt. Cols. Poe and Barlow and Capt. Lockwood.)

Constituted by act Mar. 3, 1905, to inquire into effect of wave action on H., **05,** 2197. **R.,** July 15, 1905 (H. D. 62, 59th, 1st), recom. estab. of expansion basin in advance of pierheads; est., $260,000, **06,** 645, 1820.

BERH. **R.,** Dec. 22, 1906; est. of adopted proj., $839,087 (H. Com. D. 3, 59th, 2d).

In charge:

Maj. J. B. Wheeler, 1867–68. **R., 67,** 114; **68,** 131.

Capt. F. U. Farquhar, 1869–72. **R., 69,** 88; **70,** 131; **71,** 137; **72,** 178.

Capt. S. M. Mansfield, 1872–79. **R., 72,** 186; **73,** 265; **74,** 178; **75,** 247; **76,** ii, 474; **77,** ii, 906; **78,** 1203; **79,** 1606.

Maj. F. Harwood, 1880–82. **R., 80,** 2013; **81,** 2208; **82,** 2293.

Maj. D. P. Heap, 1882–83. **R., 82,** 2290.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1815; **84,** 1977; **85,** 2072, 2091; **86,** 1761; **87,** 2184.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1905.

Maj. W. Ludlow, 1889–93. **R., 89,** 2173; **90,** 2621, 2628; **91,** 2682; **92,** 2326; **93,** 2895.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2220; **95,** 2806; **96,** 2703; **98,** 2522.

Capt. C. McD. Townsend, 1897. **R., 97,** 2930, 2951.

Capt. C. Harding, 1899–1901. **R., 99,** 2936; **00,** 3916.

Capt. Chas. Keller, 1901–03. **R., 01,** 3112; **02,** 2168.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1966; (Col.) **04,** 3016; **05,** 2195; **06,** 1819; **07,** 1974; **08,** 2057.

Maj. Chas. Keller, 1909–10. **R., 09,** 2042.

Maj. C. S. Riché, 1910–12. **R., 10,** 2202; (Lt. Col.) **11,** 2398; **12,** 2587.

Assistant. Capt. A. Mackenzie. **R., 68,** 131.

ESTIMATES. (See Plans and Projects.)

By Maj. Wheeler, $270,682.16, **67,** 25, 114; **68,** 35, 131; **74,** 178, 179; **76,** ii, 474, 475; **77,** 906. For new cut, $269,136.49, **67,** 25; **74,** 178; **76,** ii, 475. For removal of old s. slab p. and constr. of revet., $52,000, **69,** 88; **70,** 40, 131; **74,** 178. Modified, $35,440, **71,** 138.

By Capt. Mansfield, p. extension, $40,000, **72,** 36, 187. Addl., $36,000, **75,** 247, 248. For completion, $17,602.07, **79,** 162, 1607.

OBSTRUCTIONS.

Grounded ss. released by U. S. dr., **09,** 2043.

OPERATIONS.

1867–68. N. p., 64 l. f. crib built; s. p., 544 l. f. crib built; 8,900 c. y. dr.; damages to ps., **68,** 35, 131, 132; **74,** 178; **76,** ii, 476.

1868–69. N. p., 128 l. f. crib built; s. p., 25 l. f. crib built; 544 l. f. superstr., **69,** 30, 88; **74,** 178; **76,** ii, 476.

1869–70. N. p., 384 l. f. crib built; superstr. built, **70,** 40, 131; **74,** 178; **76,** ii, 476.

1870–71. 384′ superstr.; both ps. reballasted, **71,** 38, 137; **74,** 178; **76,** ii, 476.

1871–72. N. p., 30 l. f. crib built; s. p., 135 l. f. pile revet. built; dr. by U. S. dr.; removal of old s. p. begun, **72,** 36, 178; **74,** 178; **76,** ii, 477.

1872–73. Removal of old s. p., dr., and constr. of revet., **73,** 37, 265; **74,** 178; **76,** ii, 477.

1873–74. S. p., 250 l. f. crib built; 6,520 c. y. dr.; 1 crib lost from s. p., **74,** 43, 178, 179; **76,** ii, 477.

1874–75. S. p., 50 l. f. crib and 560 l. f. pile revet. built; 38,351 c. y. dr.; 300′ superstr., slab p. removed, crib replaced, and dr., **75,** 47, 247, 248.

1875–76. N. p., 100 l. f. crib built; 31,750 c. y. dr.; repairs to s. pierhead and dr., **76,** 100, ii, 474.

1876–77. Repairs, **77,** 106, 906.

1877–78. S. p., 100 l. f. crib built; 6,000 c. y. dr.; repairs to both ps., **78,** 121, 1203.

1878–79. N. p., 100 l. f. crib built; s. p., 50 l. f. crib built; 18,720 c. y. dr.; repairs to dr., **79,** 162, 1606.

1879–80. 100 l. f. cribwork placed in p. extension, **80,** 2013.

1880–81. 122 cords st. used in refilling s. p.; ps. and revet. made sand-tight; s. p. extended 50′, **81,** 2208.

1881–82. 30′ x 50′ crib sunk in prolongation of s. p.; 150 l. f. superstr. built; 5,000 c. y. sand dr. from bar at mouth of chan., **82,** 2290.

1882–83. Outer end of s. p. repaired; 100 l. f. superstr. built; 4,020 c. y. dr. from chan., **83,** 1815.

1883–84. 10,338 c. y. dr. from bet. ps.; n. side of s. p. repaired, **84,** 1977.

1884–85. S. p. extended 50′ and part of superstr. for same built, **85,** 2073.

1885–86. 9,990 c. y. dr. from bet. ps., **86,** 1761.

1887–88. 3,780 c. y. dr. from chan., **88,** 1906.

1888–89. 4 cribs for the n. p. begun, **89,** 2174.

1889–90. 500 l. f. of cribwork added to n. p.; 17,018 c. y. sand dr.; 400 l. f. of cribwork added to n. p.; 592 l. f. of sand fence built upon s. beach, **90,** 2621.

1890–91. Repairs to n. p., **91,** 2683.

1891–92. 19,397 c. y. sand dr. by hired labor, **92,** 2326.

1892–93. Gauge readings made, **93,** 2896.

1893–94. 13,802 c. y. dr. and repairs made to s. p., **94,** 2221.

1894–95. 26,489 c. y. dr., **95,** 2806.

1895–96. General repairs made and 7,812 c. y. dr., **96,** 2704.

1896–97. 58,827 c. y. dr. and parts of n. and s. ps. reconstr., **97,** 2931.

1897–98. 510 l. f. old ps. rebuilt, **98,** 2522.

1898–99. 18,262 c. y. dr., **99,** 2936.

1899–00. 23,026 c. y. dr.; p. repairs in progress (drawings, **99,** 2938), **00,** 3916.

1900–01. 12,976 c. y. dr.; work on repair of ps. completed, **01,** 3113.

1901–02. 19,964 c. y. dr., **02,** 2169.

1902–03. 24,804 c. y. dr.; work on extension and repairs to p. begun, **03,** 1966.

1903–04. 24,246 c. y. dr.; work on extension and repairs to p. and revet., **04,** 3018.

1904–05. 20,417 c. y. dr. by U. S.; work on extension of p., and repairs to p. and revet. completed Sept. 3, 1904, **05,** 2195.

1905–06. 31,308 c. y. dr., **06,** 635, 1819.

1906–07. Old revet., inner end s. p., repaired and extended by a wall of close piles backed with brush and st., **07,** 1974.

1907–08. 24,173 c. y. dr.; work on constr. of break'r commenced, **08,** 2057.

1908–09. 14,830 c. y. dr.; constr. of break'r in progress; repairing damage to n. p.; filling vacancies in s. p. with st., **09,** 2043.

1909-10. 31,460 c. y. dr.; work on break'r continued and repairs made to portions damaged by storms, **10,** 2203.

1910-11. 25,879 c. y. dr.; constr. of break'r completed; repairs made to structures, **11,** 2398.

1911-12. 43,128 c. y. dr. by U. S. (mainten.); riprap and st. placed in break'r; removing p.; repairs to lake face s. break'r completed, **12,** 2587.

PHYSICAL CHARACTERISTICS.

Serious blocking of H. mouth, **73,** 265.
Advance of n. shore line, **73,** 265.
Similarity bet. Ludington and Frankfort Hs., **76,** ii, 474.
Description of, **97,** 2952.
Shoaling, **99,** 2937; **00,** 3916.
Damages to p. by Pere Marquette RR. Co.'s car ferries, **05,** 2196; **06,** 1819; **12,** 2588.
Damages to structures by storms, **10,** 2202.
H. is outlet of Pere Marquette R., which expands into Pere Marquette Lake before emptying into Lake Michigan; 11½ m. from Pentwater H. on s., and 24 m. from Manistee H. on n., **12,** 1043.
An. dr. necessary, **12,** 1044.

PLANS. (See Estimates and Projects.)

By Maj. J. B. Wheeler, new cut at a point about a mile distant from the old entrance, **67,** 25.
By Capt. Lockwood, H. of refuge through the constr. of an outer break'r; est., $861,260, **85,** 2091, 2029.

PROJECTS. (See Engineers, Estimates and Plans.)

By Maj. Wheeler, 1866, 2 parallel crib ps. 200′ apart, extending into the lake 450′ on the n. side and 640′ on the s. side; repairs to old n. slab p.; removal of old s. slab p.; close piling in s. side of crib and dr. to 12′, **67,** 25, 114; **68,** 131; **69,** 88; **70,** 40, 131; **74,** 178; **76,** ii, 474. Est. amended in 1879, $213,787, **80,** 2014; **85,** 2074.
By Capt. S. M. Mansfield, extension, by cribwork, of both ps. to 12′ of water, 250′ each, **72,** 36, 187; **76,** ii, 477. Extension of both ps. 150 l. f., **75,** 47. P. extension to 16′ of water, **79,** 162, 1607.
By Capt. Lockwood, 1884, forming H. of refuge by w. to 400′ the entrance to Pere Marquette Lake by constr. of a new s. p. and dr. chan. to 18′; est., $419,185, **84,** 2001; **85,** 2093. Recom. by BE., 1884, **85,** 2093. Land adj. to s. p. deeded to U. S. to widen H., **89,** vi, 2174.
In 1890 proj. amended by Maj. Ludlow, with approval of the Chief of Engineers, to retain the s. p. in its position as indicated in the proj. of 1866, **90,** 2622.
By Capt. Townsend, 1897, 700′ extension of n. p., and 300′ extension of s. p., dr. and repairs; est., $210,000, **97,** 2952; **99,** 2938.
Act Mar. 2, 1907, provides $100,000 for the constr. of an exterior stilling basin, to be formed by 2 break'rs, each 1,800′ l., 400′ apart at outer ends, and diverging at an angle of 90°, the inner ends to be connected with the shore by suitable structures, and for an interior 18′ chan. protected by ps. and revet.; for removal of lakeward ends of the 2 inside ps. and for dr. area in basin; est., $839,087, **12,** 1043. Est. increased by $51,500, due to settlement of st., **07,** 658, 1974. (H. D. 62, 59th, 1st, reviewed by R. and H. Com. D. 46, 61st, 2d.)

SURVEYS.

By Maj. W. F. Raynolds, 1866, **67,** 114.
By Maj. J. B. Wheeler, 1868, **76,** ii, 476.
By Capt. F. U. Farquhar, 1869–70–71, **76,** ii, 476; **73,** 265.
Memoranda of soundings, **76,** ii, 475, 476, 477.
For H. of refuge, **82,** 2290.
Minor sur., 1894, by Lt. Col. Lydecker, **94,** 2221.
Sur. au. act June 3, 1896; made by Capt. Townsend, 1897 (see Projects), **97,** 2951.

Maps. (H. D. 62, 59th, 1st, reviewed by R. and H. Com. D. 46, 61st, 2d.)
82, 2292; **84,** 1977; **90,** 2630; **11,** 2400.
In H. D. 273, 54th, 2d.
Drawings. (See Operations, 1900.)

OO-47 MANISTEE HARBOR, MICH.

APPROPRIATIONS.

1867,	$60,000,	**67,** 26.
1870,	20,000,	**70,** 40; **71,** 136.
1871,	9,000,	**71,** 136.
1872,	10,000,	**72,** 36.
1873,	10,000,	**73,** 37.
1874,	10,000,	**74,** 43.
1875,	25,000,	**75,** 47.
1876,	14,000,	**76,** 100.
1878,	15,000,	**78,** 120, 1203.
1879,	10,000,	**79,** 162, 1605, 1606.
1880,	10,000,	**80,** 2012.
1881,	10,000,	**81,** 2206.
1882,	15,000,	**82,** 2288.
1884,	10,000,	**84,** 1976.
1886,	10,000,	**86,** 1760.
1888,	10,000,	**88,** 1905.
1890,	50,000,	**90,** 2617.
1892,	50,000,	**92,** 2325.
1894,	12,000,	**95,** 2810.
1896,	15,000,	**96,** 2708.
1899,	20,000,	**99,** 2941.
1902,	42,000,	**02,** 2172.
1905,	10,000,	**05,** 2201.
1907,	25,000,	**07,** 1977.
1910,	33,000,	**10,** 2207.
1911,	10,000,	**11,** 2403.
1912,	150,000,	**12,** 2593.
Total,	665,000	(incl. misc., $665,024.87, **12,** 2593).

COMMERCE.

Importance as H. of refuge, **67,** 116; **68,** 133; **76,** ii, 471.
Important, **66,** iv, 142; **76,** ii, 471.
Lumber industry slowly diminishing, **02,** 472.
Description of, with list of SS. lines, **05,** 573.
Amount and effect on rates, **09,** 745.
1911, 320,820 t., a decrease of 22,903 t. compared with 1910; C. derived principally from salt and lumber industries, **12,** 2595.

CONTRACTS.

1867. Gelly & Weston, materials; G. Eastman, materials; R. N. Gere, materials; H. Starke, labor, **67,** 59, 115, 117.
1869. J. D. Jennings, materials and labor; Hasbrouck & Conro, materials, **69,** 87.
1871. C. S. Stevens, materials, **71,** 135, 137; annulled, **71,** 137; **73,** 263. C. Fitzsimmons, materials; Pierce & Whaling, materials, **71,** 135, 137. R. P. Thurber, materials, **71,** 135, 137; annulled, **71,** 137; **73,** 263.
1872. Bird & Mickle, materials and labor, **73,** 263.
1873. Squier & White, materials and labor, **73,** 263; extended, **73,** 263.
1875. Dewar & Butler, materials and labor; R. M. Steele, materials and labor, **75,** 245, 247.
1877. Squier & White, dr. and revet., **77,** 904.
1878. Squier & White, dr., **78,** 1202. N. S. Gere, materials and labor, **79,** 1603, 1606.
1879. H. S. Dale, p. extension, dr., 18½¢ c. y., **80,** 2012.
1881. D. Dewar, p. constr., **81,** 2206. Carkin, Stickney & Cram, p. constr., **81,** 2206.
1882. Green Bay Dredge & Pile Driver Co., dr., 23¢ c. y., **83,** 1814. Dewar & Wing, p. extension, **83,** 1814.
1884. D. Dewar, crib constr., **85,** 2072.
1886. D. Drake, edgings, **86,** 1760. S. Bedford, materials, **86,** 1760.
1889. C. Berner, p. constr., $9,331.02, **89,** 2172.

1890. Truman & Cooper, dr., 14¢ c. y., **91,** 2680.

1891. C. H. Starke, dr., 14½¢ c. y.; Gaylord & Wing, white pine timber and plank, $17 M f. b. m.; S. Bedford, plank, $14.50 M f. b. m.; G. W. Crouter, bolts and spikes, 3¢ lb.; F. A. Hagen, st., $2.24 cord, **91,** 2681.

1892. Wisconsin Dredging & Dock Co., p. constr., $25,597.15, **93,** 2901.

1893. L. E. Allen, white pine timber, $17.90 1,000′ ($3,329.83), **93,** 2901. Parkhurst & Wilkinson, driftbolts, 2½¢ lb. ($331.50), **93,** 2902.

1896. N. J. Gaylord, p. repairs, $6,325.13, **96,** 2709. W. A. Starke, dr., **97,** 2934.

1897. Green Bay Dredging Co., dr., **98,** 2525.

1899. Green's Dredging Co., dr., **00,** 3921.

1900. W. Brownrigg, extension and repair of ps. (removing old work, dr., piles, timber, ironwork, st. filling, and riprap), $13,818.62. Green's Dredging Co., dr., **00,** 3921.

1901. S. O. Dixon, dr., 18¢ c. y., **01,** 3118. N. J. Gaylord, repair of p., prices listed, **02,** 2173.

1902. T. J. Bennett & Co., extension of s. p., prices listed, **03,** 1972.

1903. The Lydon & Drew Co., dr., 16½¢ c. y., **03,** 1972.

1904. S. O. Dixon, dr., 17½¢ c. y., **04,** 3024.

1906. Great Lakes Dredge & Dock Co., dr., 17¢ c. y., **06,** 1824.

1907. Greiling Bros., dr., 21½¢ c. y.; Century Fuel Co., coal, prices listed, **07,** 1978.

1908. Greiling Bros., dr., 20½¢ c. y.; S. P. Bennett Fuel & Ice Co., coal, prices listed, **08,** 2062. Bennett, Schnorbach Co., st., $9 cord, **09,** 2048.

1909. S. P. Bennett Fuel & Ice Co., coal, prices listed; Robert Love, repair of n. p., prices listed, **09,** 2047, 2048.

1910. Century Fuel Co., coal, prices listed, **11,** 2404.

1911. Indian Refining Co., oil, prices listed; Greiling Bros. Co., dr., 19.75¢ c. y., **11,** 2404.

1912. Greiling Bros. Co., dr., 15¢ c. y.; Indian Refining Co., oil, 3.44¢ gal., **12,** 2594.

ENGINEERS.

Chief of Engineers. **R., 66,** iii, 13, 34; **67,** 25; **68,** 35; **69,** 30; **70,** 40; **71,** 38; **72,** 36; **73,** 37; **74,** 43; **75,** 47; **76,** 100; **77,** 105; **78,** 120; **79,** 162; **80,** 215; **81,** 291; **82,** 286; **83,** 293; **84,** 295; **85,** 316; **86,** 311; **87,** 279; **88,** 253; **89,** 296; **90,** 266; **91,** 338; **92,** 323; **93,** 376; **94,** 342; **95,** 385; **96,** 340; **97,** 431; **98,** 419; **99,** 500; **00,** 563; **01,** 549; **02,** 471; **03,** 516; **04,** 563; **05,** 572; **06,** 636, 644; **07,** 659; **08,** 706; **09,** 744; **10,** 822, 831; **11,** 876; **12,** 1046, 1058.

In charge:

Maj. J. B. Wheeler, 1866–68. **R., 66,** iv, 142; **67,** 115; **68,** 133.

Capt. F. U. Farquhar, 1869–72. **R., 69,** 87; **70,** 129; **71,** 135; **72,** 177.

Capt. S. M. Mansfield, 1872–80. **R., 72,** 185; **73,** 262; **74,** 176; **75,** 245; **76,** ii, 468; **77,** 904; **78,** 1202; **79,** 1603; (Maj.) **80,** 214.

Maj. F. Harwood, 1880–82. **R., 80,** 2011; **81,** 2205.

Maj. D. P. Heap, 1882–83. **R., 82,** 2287.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1813; **84,** 1976; **85,** 2071; **86,** 1759; **87,** 2182.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1904.

Maj. Wm. Ludlow, 1889–93. **R., 89,** 2171; **90,** 2616, 2618; **91,** 2678; **92,** 2322; **93,** 2897.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2223; **95,** 2808; **96,** 2706; **98,** 2525.

Capt. C. McD. Townsend, 1897. **R., 97,** 2933.

Capt. C. Harding, 1899–1901. **R., 99,** 2939; **00,** 3919.

Capt. Chas. Keller, 1901–03. **R., 01,** 3116; **02,** 2171.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1970; (Col.) **04,** 3024; **05,** 2199; **06,** 1823; **07,** 1976; **08,** 2060.

Maj. Chas. Keller, 1909–10. **R., 09,** 2046.

Maj.C. S. Riché, 1910–12. **R., 10,** 2206; (Lt. Col.) **11,** 2403; **12,** 2591.

Assistants:

Capt. A. Mackenzie. **R., 67,** 115; **68,** 133.

F. W. Lehnartz. **R., 01,** 3116; **02,** 2171.

ESTIMATES. (See Plans and Projects.

By Maj. Wheeler, $180,949, **66,** iii, 13, 34, iv, 143, 155; **67,** 115; **68,** 133; **74,** 176; **76,** ii, 469.

By Capt. Farquhar, p. extension and revet., $79,000, **69,** 30, 88; **70,** 40; **74,** 176; **76,** ii, 469. Pile revet., $13,812.50, **71,** 136.

By Capt. Mansfield, dr. and revet., $15,948, **72,** 186. P. extension, $112,000, **73,** 37, 263; **74,** 43, 177; **76,** ii, 469; **77,** 904. Dr. and pile revet., $13,771, **75,** 47; **76,** ii, 469; **77,** 904. Increasing height of s. p., $1,200, **76,** ii, 469.

EXPENDITURES.

In repairs, 1867–76, total, $3,150.66, **76,** ii, 470.

OBSTRUCTIONS.

R., 1894, crossed by 3 brs. bet. Lakes Michigan and Manistee; the last-built br. constr. by the city of Manistee under permission of the Sec. of War, on condition that the city should move back certain docks to the dock-head line, and that a 14½′ chan. should be dr. through the s. draw. Conditions were not complied with at the expiration of the time limit, **94,** 2226.

OPERATIONS.[1]

1867–68. 320 l. f. n. p. crib built; 128 l. f. s. p. crib built; 18,326 c. y. dr.; 320 l. f. of superstr. n. p., **68,** 35, 134; **74,** 176; **76,** ii, 472.

1868–69. 96 l. f. n. p. crib built; 256 l. f. s. p. crib built, **69,** 30, 87; **74,** 176; **76,** ii, 472.

1869–70. 64 l. f. n. p. crib built; 96 l. f. s. p. crib built, **70,** 40, 129, 130; **76,** ii, 472.

1870–71. Repairs to old n. slab p.; superstr. built by hired labor, **71,** 38, 135; **74,** 176; **76,** ii, 472.

1871–72. 158 l. f. n. p. crib built; 158 l. f. s. p. crib built; 115 l. f. s. p. superstr. built, **72,** 36, 177, 185; **74,** 177; **76,** ii, 473.

1872–73. 600 l. f. n. p. pile revet. built; dr., **73,** 37, 262, 263; **74,** 177; **76,** ii, 473.

1873–74. 355 l. f. s. p. pile revet. built, **74,** 43, 177; **76,** ii, 473.

1874–75. 318 l. f. n. p. pile revet. built; 140 l. f. s. p. pile revet. built; repairs by hired labor, **75,** 47, 245, 246; **76,** ii, 473.

1875–76. 150 l. f. n. p. crib built; 150 l. f. s. p. crib built; 150 l. f. superstr. n. p.; cribs on s. p. decked, **76,** 100, ii, 468.

1876–77. 450 l. f. s. p. superstr. built; s. p. increased in height, **77,** 105, 904; **79,** 1605.

1877–78. 420 l. f. s. p. pile revet. built; 48, 610 c. y. dr.; cribs reballasted; slabs removed, **78,** 120, 1202.

1878–79. 100 l. f. n. p. crib built; 100 l. f. s. p. crib built; scow load of brick sunk in chan; st. washed out of cribs, **79,** 162, 1603.

1879–80. 3 cribs framed and dr. in progress, **80,** 2011.

1880–81. 3 cribs sunk and 11,260 c. y. dr., **81,** 2205.

1881–82. 2 cribs constr.; 3 cribs in n. p. extension leveled; superstr. placed thereon; sand fence built along outer face of s. p. at beach line; superstr. to n. p. extension completed; 10,019 c. y. dr., **82,** 2288.

1882–83. Dr. and p. extension continued, **83,** 1813.

1883–84. S. p. extended 50 l. f. and 14,002 c. y. dr., **84,** 1976.

1884–85. Repairs ps. damaged by collision, **85,** 2071.

1885–86. S. p. extended 50′, **86,** 1760. Condition of imp., **86,** 1759.

1886–87. Portions of n. and s. p. cribwork renewed, **87,** 2183.

[1] Timber belonging to the U. S. burned in 1870, **72,** 177; **74,** 176; **76,** ii, 463. 100 l. f. of slab p. washed away, **67,** 115.

115 l. f. of superstr. burned, **73,** 263. Abstracts of work done and material used, **72,** 177. History of operations, **74,** 176; **76,** ii, 470.

1887-88. S. p. extended 50′, **88,** 1905.
1888-89. Constr. of 2 cribs begun under contract, **89,** 2171.
1889-90. S. p. extended 100′; repairs to n. p., **90,** 2616.
1890-91. 57,800 c. y. dr.; crib constr. in progress, **91,** 2678.
1891-92. 40,784 c. y. dr.; 200 l. f. of n. p. extension completed; 764 l. f. of n. revet. rebuilt; repairs to n. p., **92,** 2323.
1892-93. Extension of n. p. in progress, **93,** 2898, and repairs made to ps. and revet., **93,** 2899; 24,970 c. y. dr. and gauge readings made, **93,** 2900.
1893-94. N. p. extension completed, **94,** 2224; general repairs made to old structures and 45,798 c. y. dr., **94,** 2225.
1895-96. General repairs made, **96,** 2707.
1896-97. Parts of n. and s. ps. rebuilt, **97,** 2904.
1897-98. 11,664 c. y. dr., **98,** 2525.
1898-99. 11,891 c. y. dr., **99,** 2939.
1899-00. 27,639 c. y. dr.; extension and repair of s. p. and repair of n. p. in progress, **00,** 3919.
1900-01. S. p. extended 100′; renewing superstr. in parts of both ps., **01,** 3116.
1901-02. Rebuilding 253.8 l. f. superstr. on n. p. and 101.5 l. f. on s. p., **02,** 2171.
1902-03. Work on extension of s. p. 150′ in progress, **03,** 1970.
1903-04. 15,083 c. y. dr.; constr. of crib for 150′ p. extension completed, **04,** 3021.
1904-05. 14,513 c. y. dr. (contract); 150′ p. extension completed; repairs made to damaged n. p., **05,** 2200.
1905-06. 68,222 c. y. dr. (U. S.), **06,** 1823.
1906-07. 6,447 c. y. dr. (U. S.); 29,250 c. y. dr. (contract); repairs to n. p. and to decking of both ps., **07,** 1976.
1907-08. 32,520 c. y. dr. (contract); repairs made to superstr., n. p., **08,** 2061.
1908-09. 7,140 c. y. dr. (contract); 22,080 c. y. dr. (U. S.); repairs to p., **09,** 2046.
1909-10. 73,374 c. y. dr. (U. S.); 1,698 c. y. dr. (contract); repairs to n. p., **10,** 2206.
1910-11. 86,652 c. y. dr. (U. S.); 13,646 c. y. dr. (contract), **11,** 2403.
1911-12. 62,387 c. y. dr. (contract), and 28,547 c. y. dr. (U. S.) for new constr.; 3,962 c. y. dr. (contract), and 17,731 c. y. dr. (U. S.) for mainten.; repairs to n. p., **12,** 2592.

PHYSICAL CHARACTERISTICS.

Soundings, **66,** iv, 142; **67,** 115; **76,** ii, 470, 471, 472, 473; **79,** 1605.
General, Manistee H. and R., **66,** iv, 142; **67,** 116; **68,** 133; **76,** ii, 470.
Damages to ps. by collisions of barges and vessels, **03,** 1970; **04,** 3022; **06,** 1823; **07,** 1977.
Damage to n. p. by storms, **12,** 2593.
24± m. from Ludington H. on s. and 8 m. from Portage Lake H. on n. Orig. condition, see 1st paragraph of Private work, **12,** 1046.

PLANS. (See Estimates and Projects.)

By Maj. Ludlow, 1889, extension of the n. p. 550′ to 18′ curve in the lake, and the s. p. 350′ to the 14′ curve; also for dr. 15′ chan. bet. the ps.; est., $115,000, **90,** 2619.

PRIVATE (CITY AND CORPORATE) WORK. (See Obstructions.)

Diverging slab ps. built, **66,** iii, 13, iv, 143; **76,** ii, 471.
Dr. in chan. bet. Lakes Michigan and Manistee; dr. owned by town, **73,** 263; **74,** 177; **76,** ii, 472.
In 1893 the Manistee & Northeastern RR. Co. given permission by the Sec. of War to rebuild a part of the n. revet. and to build a dock on the n. bank of the Manistee R., **93,** 2900, on agreement to keep the revet. in repair, **94,** 2226. No disposition on the part of RR. Co. to make repairs as agreed, **99,** 2940.
Private Co. granted permission to use part of s. p. on condition that part occupied would be repaired when needing repair, **00,** 3919.
Slight repairs to revet. by Manistee & Northeastern RR. Co., **04,** 3022.
Repairs by U. S. to n. p., one-half cost to be paid by U. S. and other half by owners of colliding vessels, **05,** 2200.
Sec. of War grants permission to Mich. State Telephone Co. to lay a cable across R., **06,** 1823.

PROJECTS. (See Estimates and Plans.)

By Maj. Wheeler, parallel extension of ps. by cribwork to 12′, 1,000 l. f. each, **66,** iii, 13, iv, 142, 143; **76,** ii, 471. Extension of both ps. 960′; to cut off point of old slab p.; also to cut down slab work to water surface and build crib superstr. thereon; dr. to 12′, **67,** 25, 115; **68,** 35, 133; **76,** ii, 469, 471. Modification of the above (which was based on the sur. of 1866) caused by the destruction of 100 l. f. of n. p., **67,** 25, 26, 115.
P. extension and revet., 1869, **69,** 30, 88; **74,** 176; **76,** ii, 469.
For 850′ of pile revet. on the n. side of chan., **71,** 136.
By Capt. Mansfield, dr. and revet. within entrance, **72,** 36, 186. P. extension to 16′, n. p. 650 l. f., and s. p. 750 l. f., **73,** 37, 263; **74,** 43, 177; **75,** 246; **76,** ii, 469. To increase the height of 450 l. f. of the s. p., **76,** ii, 469. Orig. proj. stated to be a p. extension of 480 l. f. on each side of the chan. and dr. 27,898 c. y., **76,** ii, 469.
Proj. of 1866, with the modification of 1870 and 1874, proposed the parallel extension of crib ps. to obtain at least 12′ d. of chan.; est., $180,949, **76,** 469. Modified in 1870 and 1874 for extension of ps.; total est., $234,000, **80,** 2012. In 1886, after app. of $248,000, est. $92,700 would be required to complete proj., **86,** 1760.
In 1890, after further app. of $60,000, Maj. Ludlow est. $75,000 as requisite for completion of proj., **90,** 2617; **91,** 2679.
Act Mar. 2, 1907, contemplates (H. D. 511, 59th, 1st) securing 18′, p. extension, revet., and protection works, provided private and municipal work completed within reasonable time; land will be donated and U. S. shall be protected against claims; est., $147,488, **08,** 706; pledges not given, **12,** 1046.
Act June 25, 1910, modified proj. (H. D. 705, 61st, 2d) to secure 18′ bet. ps. and 16′ through R. to Lake Manistee without any limiting requirements; est., $25,000, **10,** 228.
Act July 25, 1912, contemplates (H. D. 599, 62d, 2d) constr. of s. break'r 1,300′ l., with shore connection 1,200′ l., removing 450′ s. p., dr. entrance basin and chan. bet. ps. to 20′ below l. w. dr. R. to 18′ below l. w. extending n. p. 200′ if required, mainten. of proj.; est., $456,000, and $6,000 an. mainten., contingent on donation U. S. of strip of land at shore line 200′ x 200′, 100′ on each side of center line of shore connection of break'r, to insure free access to p. and control of same, **12,** 1046.

SURVEYS.

By Capt. G. G. Meade, 1861, **76,** ii, 470.
By W. T. Casgrain, 1866, **66,** iv, 142; **67,** 115; **76,** ii, 470.
By Maj. Wheeler, 1868, **76,** ii, 472.
By Capt. Farquhar, 1869–70, **76,** ii, 472, 473.
Sur. made, 1893, by Lt. Col. Lydecker, **94,** 2225.
Pre. ex. and sur. au. act Mar. 3, 1905, for uniform d. of 18′. **R.,** Col. Adams, Nov. 1 and Dec. 7, 1905; est., $147,488, with $1,500 an. mainten. (H. D. 511, 59th, 1st), **06,** 644.
Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Maj. Keller, Aug. 25, 1909, and Jan. 7, 1910; est., $25,000 (H. D. 705, 61st, 2d), **10,** 831.
Pre. ex. and sur. for 20′ chan. Lake Michigan to Lake Manistee, enlargement of outer H., incl. constr of new breakw'r. **R.,** Lt. Col. Riché, 1910 and 1911; est., $456,000, and $6,000 an. mainten., land to be donated free to U. S. (H. D. 599, 62d, 2d), **12,** 1058.
Maps. (H. D. 511, 59th, 1st; H. D. 599, 62d, 2d.) **82,** 2288; **84,** 1976; **90,** 2618.

OO-51 PORTAGE LAKE (Manistee County), MICH. (Harbor of refuge.)

APPROPRIATIONS.

1879,	$10,000,	**79,** 166.
1880,	10,000,	**80,** 2034.
1881,	10,000,	**81,** 2204.
1882,	25,000,	**83,** 1813.
1884,	12,500,	**84,** 1975.
1886,	15,000,	**86,** 1759.
1888,	10,000,	**88,** 1902.
1890,	8,000,	**90,** 2615.
1894,	25,000,	**95,** 2812.
1896,	25,000,	**96,** 2712.
1899,	75,000,	**99,** 2943.
1900,	85,000,	**00,** 3923.
1902,	59,000,	**02,** 2175.
1907,	10,000,	**07,** 1980.
1910,	13,000,	**10,** 2209.
1912,	3,000,	**12,** 2601.
Total,	395,500	

COMMERCE.

Availability and importance as a H. of refuge, **79,** 1635, 1637.
Benefit of the imp. to C., **79,** 1637.
Letter from A. W. Farr relative to the imp., **79,** 1638.
Local C. insignificant, but H. of great benefit to prospective lake C., **94,** 2229.
Absolutely no local C., **02,** 473.
Local C. insignificant, **12,** 1049, 2599, 2601.

CONTRACTS.

1879. Carkin, Stickney & Cram, dr., 14¢ c. y., **80,** 2034.
1885. Truman & Cooper, dr., 12¾¢ c. y., **85,** 2070.
1887. Schwarz & Burner, p. extension, **87,** 2183.
1889. Truman & Cooper, dr., 10¢ c. y., **89,** 2170.
1891. Truman & Cooper, white pine plank, $17 M f. b. m.; Geer & Crawford, edgings, $2.50 cord; F. A. Hagen, st., $2.24 cord, **91,** 2677.
1897. N. J. Gaylord, p. repairs, $8,118.41, **97,** 2938.
1898. W. Brownrigg, p. repairs, $4,952.21, **98,** 2528.
1899. Greens Dredging Co., dr., **99,** 2943.
1900. Bennett & Schnorbach, p. extension (dr., piles, timber, ironwork, st.), $144,848.92; Greens Dredging Co., dr., **00,** 3924.
1903. The Fitz Simons & Connell Co., dr., 12½¢ c. y., **03,** 1974. T. J. Bennett & Co., repairs of s. p., prices given, **03,** 1975.
1908. Leathem & Smith Towing & Wrecking Co., st., prices given, **08,** 2064.

ENGINEERS.

Chief of Engineers. **R.,** **78,** 124; **79,** 166, 167; **80,** 219; **81,** 290; **82,** 285; **83,** 293; **84,** 294; **85,** 316; **86,** 310; **87,** 278; **88,** 234, 253; **89,** 274, 295; **90,** 247, 266; **91,** 316, 337; **92,** 323; **93,** 377; **94,** 350; **95,** 386; **96,** 341; **97,** 431; **98,** 420; **99,** 501; **00,** 564; **01,** 550; **02,** 472; **03,** 517; **04,** 565; **05,** 574; **06,** 638; **07,** 661; **08,** 708; **09,** 746; **10,** 824; **11,** 878; **12,** 1048.

Boards.
Review by R. and H. Board, Sept. 9, 1912, of special **R.** by Lt. Col. Riché, recom. abandonment of proj., **12,** 2601.

In charge:
Maj. S. M. Mansfield, 1878–79, **78,** 124. **R.,** **79,** 1634.
Maj. F. Harwood, 1879–82. **R.,** **80,** 2032; **81,** 2203.
Maj. D. P. Heap, 1882–83. **R.,** **82,** 2286.
Capt. D. W. Lockwood, 1883–87. **R.,** **83,** 1812; **84,** 1974; **85,** 2069; **86,** 1758; **87,** 2180.
Maj. C. E. L. B. Davis, 1887–88. **R.,** **88,** 1822.
Maj. S. M. Mansfield, 1888–89. **R.,** **88,** 1903.
Maj. Wm. Ludlow, 1889–93. **R.,** **89,** 2168; **90,** 2613; **93,** 2903.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R.,** **94,** 2228; **95,** 2811; **96,** 2709; **98,** 2526.
Capt. C. McD. Townsend, 1897. **R.,** **97,** 2936.
Capt. C. Harding, 1899–1900. **R.,** **99,** 2942; **00,** 3922.
Capt. Chas. Keller, 1901–03, **01,** 3119; **02,** 2174.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09, **03,** 1973; (Col.) **04,** 3025; **05,** 2203; **06,** 1824; **07,** 1979; **08,** 2063.
Maj. Chas. Keller, 1909–10. **R.,** **09,** 2049.
Maj. C. S. Riché, 1910–. **R.,** **10,** 2209; (Lt. Col.) **11,** 2405; **12,** 2595.

Assistants:
R. Strohmann. **R.,** **79,** 1636.
F. W. Lehnartz. **R.,** **01,** 3120; **02,** 2174.

OPERATIONS.

1879-80. N. j. extended to 236′ and s. j. to 190′ in l.; 29,992 c. y. sand dr., **80,** 2032, 2033.
1880-81. Both ps. extended to 12′ curve, **81,** 2204.
1881-82. N. p. extended to 815′ and s. p. to 575′ in l.; 62 cords st. filling placed in ps., **82,** 2286.
1882-83. N. p. extended 50′; 30,530 c. y. dr. from chan.; repairs to ps., **83,** 1812.
1884-85. N. revet. refilled; 10,120 c. y. dr., **85,** 2069.
1885-86. S. revet. completed to 805′ in l.; 555 piles driven, **86,** 1758.
1886-87. Filling revet. of s. p. completed; dr. in chan. with U.S. dr.; extension of n. p. in progress, **87,** 2180.
1887-88. N. p. extended 100′; 11,094 c. y. dr., **88,** 1903.
1888-89. 23,000 c. y. dr., **89,** 2169.
1889-90. 34,000 c. y. dr., **90,** 2614.
1890-91. Repairs to revet., **91,** 2676.
1892-93. Water gauge readings made, **93,** 2904.
1893-94. 24,870 c. y. dr., **94,** 2229.
1895-96. 18,039 c. y. dr. and repairs made to n. p., **96,** 2710, 2711.
1896-97. 34,542 c. y. dr., and reconstr. of n. pile p. and revet. completed, **97,** 2937.
1897-98. 18,019 c. y. dr., 612 l. f. old s. p. rebuilt, and 2′ added to h. of 1,342 l. f. of n. p., **98,** 2527.
1898-99. Repairs to ps. completed, **99,** 2942.
1899-00. 27,428 c. y. dr.; extension of n. p. in progress, **00,** 3922.
1900-01. 12,634 c. y. dr.; extension of n. p. in progress, **01,** 3119–20.
1901-02. Extensions of ps. completed, **02,** 2174.
1902-03. 24,404 c. y. dr., **03,** 1973.
1903-04. 183,521 c. y. dr.; repairs to ps., **04,** 3025–26.
1904-05. Repairs to s. p., **05,** 2203.
1906-07. 16,831 c. y. dr. by U.S. plant, **07,** 1979.
1907-08. 38,377 c. y. dr.; ps. repaired; **08,** 2063.
1909-10. 39,486 c. y. dr., **10,** 2209.
1910-11. 47,854 c. y. dr., **11,** 2405.
1911-12. 30,485 c. y. dr., **12,** 2595.

PHYSICAL CHARACTERISTICS.

General description, **79,** 1635, 1637; **90,** 2613.
Peculiar configuration of the coast; effects of, **79,** 1637.
In 1894 the zero of the water gauge at the H. lowered 0.09′ to make it conform to the new planes of reference estab. for Hs. of Lakes Michigan and Huron, **94,** 2229.
Shoaling, **00,** 3922.

Condition of works and d. of w., **01,** 550, 3120; **02,** 2174–75; **03,** 1973; **04,** 3026; **05,** 2203–04; **06,** 638, 1825; **07,** 661, 1979; **08,** 708, 2063; **09,** 747, 2049; **10,** 824, 2209; **11,** 878, 2405; **12,** 1049, 2595.

PRIVATE WORK.

Natural outlet being closed by a dam, which caused a rise in Portage Lake, a ditch was cut in 1871 across a narrow neck of land, which rapidly w. to 500′ by the scour of the rushing waters, **79,** 1637, 1639.

PROJECTS.

By Maj. Mansfield, 1879, chan. 300′ x 18′ to connect Lakes Michigan and Portage, the dr. chan. to be protected by parallel pile and crib ps. extending to 18′ curve in Lake Michigan; est., $189,-860, **79,** 1634, 1636, 1638; **87,** 2181.

Bet. 1879 and 1882, $55,000 app. In 1883 Capt. Lockwood est., for completion of orig. proj., $210,-000, **84,** 1975; **92,** 2322.

Act Mar. 3, 1899, placed work under continuous contract, cost not to exceed $160,000 added to the amount already app. up to 1899, **99,** 501.

Capt. Harding, 1899, est. $33,000 beyond limit of expense set by act 1899, to dr. 18′ chan. as required by existing proj., **00,** 3923.

In special **R.,** May 6, 1912, Lt. Col. Riché reviews history of proj. On account of unimportance of local C. and nearness of other suitable Hs. of refuge, recom. abandonment of future work on proj. as H. of refuge, but believes entrance should be maintained by occasional dr. and repair of ps., **12,** 2595–2600. R. and H. Board, with concurrence of Chief of Engineers, recom. abandonment of all work, **12,** 1049, 2601.

SURVEY.

By R. Strohman, 1878. **R., 79,** 1636.

Ex., 1894, by Lt. Col. Lydecker, **95,** 2812.

Maps:

Of sur. of Portage Lake, **79,** 1636. Sketch of Portage Lake and vicinity, **79,** 1638.

82, 2286; **84,** 1974.

OO-52 ARCADIA HARBOR, MICH.

APPROPRIATIONS.

1905,	$6,000,	**05,** 2206.
1907,	6,000,	**07,** 1980.
1909,	*3,000,	**09,** 2050.
1911,	10,000,	**11,** 2407.
1912,	15,000,	**12,** 2603.
Total,	40,000,	**12,** 2603.

COMMERCE.

Description of. Very small and local. **00,** 3943; **04,** 3040, 3046, 3047; **12,** 1051.

Rates to Chicago by boat 30% less than by rail, **10,** 826.

1911, 18,455 t.; passengers, 3,637, **12,** 1051.

CONTRACTS.

1905. Chicago & Great Lakes Dredge & Dock Co., dr., 17½¢ c. y., **05,** 2206.

1906. Great Lakes Dredge & Dock Co., dr., 17¢ c. y., **06,** 1826.

1907. Greiling Bros., dr., 21½¢ c. y., **07,** 1981.

1908. Greiling Bros., dr., 20½¢ c. y., **08,** 2065.

1909. John Smith, dr., 19¾¢ c. y., **09,** 2050.

1911. East Shore Dredging Co., third cut in chan. adjacent to 2 already made, **11,** 2407.

1912. Greiling Bros. Co., dr., 15¢ c. y., s. m., **12,** 2603.

ENGINEERS.

Chief of Engineers. R., 99, 505; **00,** 569; **04,** 570; **05,** 575; **06,** 639; **07,** 662; **08,** 709; **09,** 748; **10,** 825, 831; **11,** 879; **12,** 1050.

Boards. BERH. **R.** on sur. of H., concurring in recom. of DO. (see Projects), **04,** 3041.

In charge:

Capt. C. Harding, 1899–1900. **R., 00,** 3942.

Col. M. B. Adams, 1904–08. **R., 04,** 3037; **05,** 2205; **06,** 1825; **07,** 1980; **08,** 2064.

Maj. Charles Keller, 1909. **R., 09,** 2050.

Maj. C. S. Riché, 1910–12. **R., 10,** 2210; (Lt. Col.) **11,** 2406; **12,** 2602.

Assistants:

L. W. Goddard. **R., 00,** 3944.

C. W. H. Smith. **R., 04,** 3042.

OPERATIONS.

1905-06. 17,047 c. y. dr., **06,** 1826.

1906-07. 8,237 c. y. dr., **07,** 1980.

1907-08. 32,503 c. y. dr., **08,** 2064.

1908-09. Chan. redr. to 12′ x 50′, **09,** 2050.

1910-11. Cut dr. 16′ x 25′, removing 7,466 c. y., **11,** 2407.

1911-12. 5,685 c. y. dr. from chan. bet. ps., completing contract, **12,** 2602; *Meade* dr. 8,112 c. y. from entrance bar, giving chan. 16′ x 180′–200′; repairs by day labor and purchase of material made to both ps., **12,** 2602, 2603.

PHYSICAL CHARACTERISTICS.

Description of. Arcadia, a village 18 m. n. of Manistee H., having communication with Lake Michigan through Bar Lake, and through dr. chan. (see Private work), **00,** 3943.

Description of Bar Lake and Arcadia, **04,** 3042 3043.

Chan. fills up each year, **09,** 748.

Rapid shoaling, **10,** 2210.

Description of, **11,** 879, 2406; **12,** 1051.

Soundings, May, 1912, showed available d. of 14′ on entrance bar and 10.3′ bet. ps., **12,** 2603.

PRIVATE WORK.

Chan. connecting Arcadia with Lake Michigan dr. by private enterprise; cost, about $50,000, **00,** 3943.

Description of pierwork and dr. done by Henry Starke Land & Lumber Co., **04,** 3043–45.

Dr. for local interests completed chan. 14′ x 50′ from inner lake to Lake Michigan, **11,** 2407.

PROJECTS.

By Capt. Keller, imp. of H.; est., $90,390, and $5,200 an. mainten. Such expense not justified by importance of place; recom. that 12′ x 50′ chan. be maintained; est., $3,000 an. (H. D. 194, 58th, 2d), **04,** 570, 3039, 3040.

SURVEYS.

Ex. for 14′ chan., 150′ w., au. act Mar. 3, 1899; made, 1899, by Capt. Harding (**R.** unfav.), **00,** 3942.

Au. act June 13, 1902; made, 1902, by Capt. Keller (H. D. 194, 58th, 2d), **04,** 3037.

Ex. au. act Mar. 3, 1909; made, 1909, by Maj. Keller (**R.** unfav.) (H. D. 321, 61st, 2d; R. and H. D. 10, 61st, 2d) (see Boards), **10,** 831; **10,** 826.

Soundings. (See **R.** Engineers in Charge.)

Ex. au. act June 25, 1910; made, 1910, by Lt. Col. Riché (H. D. 701, 62d, 2d), **12,** 1058.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1050.

* Allotment.

OO-53 FRANKFORT (Aux Becs Scies) HARBOR, MICH.[1]

APPROPRIATIONS.[2]

1866,	$88,541.00,	**66,** iii, 10, 35, iv, 91.
1867,	10,000.00,	**67,** 26.
1868,	*10,000.00,	**68,** 36
1869,	*29,318.85,	**69,** 22.
1870,	8,115.00,	**70,** 40, 129.
1871,	10,000.00,	**71,** 38.
1872,	10,000.00,	**72,** 36.
1873,	10,000.00,	**73,** 37.
1874,	10,000.00,	**74,** 42.
1875,	10,000.00,	**75,** 47.
1876,	3,000.00,	**76,** 100.
1878,	8,800.00,	**78,** 120.
1879,	4,000.00,	**79,** 162.
1880,	5,000.00,	**80,** 2010.
1881,	10,000.00,	**81,** 2201.
1882,	15,000.00,	**82,** 2284.
1884,	5,000.00,	**84,** 1974.
1886	7,000.00,	**86,** 1758.
1888,	8,000.00,	**88,** 1902.
1890,	10,000.00,	**90,** 2612.
1892,	10,000.00,	**92,** 2320.
1894,	50,000.00,	**95,** 2814.
1896,	15,000.00,	**96,** 2714.
1899,	35,000.00,	**99,** 2945.
1902,	54,500.00,	**02,** 2177.
1905,	20,000.00,	**05,** 2208.
1907,	20,000.00,	**07,** 1982.
1910,	20,000.00,	**10,** 2212.
1911,	10,000.00,	**11,** 2408.
Total,	506,274.85	(incl. $37.09 sales; $1,885 trans. to Grand Haven H., less $5,721.50 returned to Treas., $502,475 44, **12,** 2605).

COMMERCE.

Benefit of imp., **66,** iv, 95; **68,** 135; **71,** 185.

Importance as H. of refuge, **68,** 135; **71,** 177, 185; **76,** 100; **77,** 903.

Practically entirely transacted by car-ferry lines of Ann Arbor RR.; important to maintain H., **02,** 474; **12,** 1052.

Definite information as to effect of imp. on freight rates not ascertainable, **06,** 474.

Average amount of, **09,** 750; **10,** 827.

1911, 756,505 t.; 9,504 passengers, **12,** 1053.

CONTRACTS.

1866. Macdonnel & Co.,[3] materials and labor, **66,** iv, 94.

1866–69. Whitwood & Hubbell, materials and labor, **66,** iv, 94, 95; **67,** 59, 119; **69,** 86.

1871. C. S. Stevens,[4] materials and labor, **71,** 132. T. S. White, dr., **71,** 132. W. Nichols, labor, **71,** 134.

1872. Bird & Michle, p. extension, **73,** 260.

1873. W. Nichols, p. extension, **73,** 260.

1874. W. L. Smith, p. extension, **76,** 244.

1875. T. L. Rosser & Co., p. extension, **75,** 244; **76,** ii, 464.

1877. R. M. Steel, p. extension, **77,** 902.

1878. H. S. Dale, p. extension, **79,** 1601.

1879. H. S. Dale, materials and labor, 80, 2010. Closed before completion, **80,** 2009.

1880. N. G. Dodge, dr., 15¢ c. y., **81,** 2201.

1882. Dewar & Wing, p. constr., **83,** 1808. Green Bay Dredge & Pile Driver Co., dr., 24¢ c. y., **83,** 1809.

1886. D. Dake, materials, **86,** 1758.

1887. L. E. Allen, repair and extension of p., **87,** 2179.

1889. Truman & Cooper, p. constr., $8,081.58, **89,** 2168.

1891. Gaylord & Wing, timber, plank, and hemlock, $18, $15, and $10 M f. b. m.; G. W. Crouter, bolts, spikes, and nails, 3¢ lb.; F. A. Hagen, st., $2.24 cord, **91,** 2675.

1892. F. S. Chandler, dr., 14¢ c. y., $7,000, **93,** 2907.

1895. D. A. & Wm. McLeod, p. extension, $21,188.66, **95,** 2815.

1896. W. A. Starke, dr., **97,** 2939.

1897. N. J. Gaylord, p. repairs, $7,417.89, **97,** 2941.

1898. R. B. Rice, p. repairs, $2,846.98, **98,** 2531.

1899. Green's Dredging Co., dr., **99,** 2946.

1900. R. Love, extension and repair of ps. (removing old work, dr., piles, timber, ironwork, st. filling), $24,831.65. Green's Dredging Co., dr., **00,** 3927.

1901. Samuel O. Dixon, dr., 18¢ c. y., **01,** 3125.

1902. Samuel O. Dixon, dr., 20¢ c. y., **03,** 1977.

1903. Lydon & Drews Co., dr., 16½¢ c. y., **03,** 1977. T. J. Bennett & Co., extension and repair of ps., prices listed, **03,** 1977.

1904. Samuel O. Dixon, dr., 17½¢ c. y., **04,** 3030.

1907. Century Fuel Co., coal (prices listed), **07,** 1983.

1908. S. P. Bennett Fuel & Ice Co., coal (prices listed), **08,** 2067. Leathem & Smith Towing and Wrecking Co., st. for refilling p. cribs, **08,** 2068. Burk, Smith and Nelson, extension and repair of s. p. (prices listed), **08,** 2068.

1909. Burk, Smith & Nelson, repair of s. p. (prices listed), **09,** 2052. S. P. Bennett Fuel & Ice Co., coal (prices listed), **09,** 2053.

1910. Century Fuel Co., coal (prices listed), **10,** 2213.

1911. Indian Refining Co., crude and fuel oil for dr. (prices listed), **11,** 2408. L. E. Schnorbach & Co., extending n. p., **11,** 2408.

1912. Indian Refining Co., fuel oil, 3.44¢ gal., **12,** 2606.

ENGINEERS.

Chief of Engineers. R., 66, 2, 5, ii, 41, iii, 10, 35; **67,** 20, 26; **68,** 35; **69,** 30; **70,** 39; **71,** 38; **72,** 36; **73,** 36; **74,** 42; **75,** 47; **76,** 100; **77,** 105; **78,** 120; **79,** 161; **80,** 214; **81,** 290; **82,** 285; **83,** 292; **84,** 294; **85,** 315; **86,** 310; **87,** 278; **88,** 252; **89,** 294; **90,** 265; **91,** 337; **92,** 322; **93,** 278; **94,** 351; **95,** 386; **96,** 342; **97,** 432; **98,** 421; **99,** 501; **00,** 565; **01,** 550; **02,** 473; **03,** 518; **04,** 566; **05,** 576; **06,** 640; **07,** 663; **08,** 710; **09,** 749; **10,** 826; **11,** 880; **12,** 1052.

Board. Convened, July 20, 1882, at Grand Rapids, Mich., by S. O. No. 65, C. of E., 1882, to **R.** upon modification of crib superstr. as proposed by Maj. Heap. **R., 83,** 1811. (Majs. Houston, Smith, and Benyaurd.)

In charge:

Capt. G. G. Meade, 1859, **66,** 33.

Col. T. J. Cram, 1864–65, **66,** 2, 5. **R., 66,** 13, 32.

Maj. J. B. Wheeler, 1866–69. **R., 66,** iv, 91, 94, 98; **67,** 117, 252, 258; **68,** 135.

Capt. F. U. Farquhar, 1869–72; **69,** 85, 101; **70,** 128; **71,** 132; **72,** 176.

Capt. S. M. Mansfield, 1872–79. **R., 72,** 185; **73,** 260; **74,** 174; **75,** 244; **76,** ii, 464; **77,** 902; **78,** 1201; **79,** 1601.

Maj. F. Harwood, 1880–82. **R., 80,** 2009; **81,** 2200.

Maj. D. P. Heap, 1882–83 **R., 82,** 2283; **83,** 1810.

Capt. D. W. Lockwood, 1883–87. **R., 83,** 1807; **84,** 1973; **85,** 2068; **86,** 1757; **87,** 2179.

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* Allotment.

[1] Sur.—**R.,** Oct. 14, 1864; est., $88,541. (H. D. 482, 55th, 2d.)

[2] Allotment of 1869 called $31,500, **69,** 30. Transferred from app. for this H. to Grand Haven, Mich., $1,885, **70,** 40, 129. Statements of app., **74,** 175; **76,** ii, 465; **79,** 1602.

[3] Failed to furnish bonds, **66,** iv, 94.

[4] Annulled, **72,** 176.

Maj. S. M. Mansfield, 1888–89. **R., 88,** 1901.
Maj. W. Ludlow, 1889–93. **R., 89,** 2167; **90,** 2612; **91,** 2674; **92,** 2318; **93,** 2905.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2230; **95,** 2813; **96,** 2712; **98,** 2529.
Capt. C. McD. Townsend, 1897. **R., 97,** 2929.
Capt. C. Harding, 1899–1901. **R., 99,** 2944; **00,** 3925.
Capt. Chas. Keller, 1901–03. **R., 01,** 3122; **02,** 2176.
Maj. J. G. Warren, **03,** 498.
Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1975; (Col.) **04,** 3028; **05,** 2207; **06,** 1826; **07,** 1981; **08,** 2066.
Maj. Chas. Keller, 1909–10. **R., 09,** 2051.
Maj. C. S. Riché, 1910–12. **R., 10,** 2211; (Lt. Col.) **11,** 2407; **12,** 2604.

Assistants:
Capt. A. Mackenzie. **R., 67,** 117; **68,** 136.
Lt. E. A. Woodruff, **70,** 39.
F. W. Lehnartz. **R., 00,** 3925; **01,** 3122.

ESTIMATES. (See Plans and Projects.)

Col. Cram, p. extension and dr., $88,541, **66,** 36.
Maj. J. B. Wheeler, sheath piling and p. extension, $68,756.60, **66,** iv, 95. P. extension and dr., $92,830.50, $34,388.50, **67,** 258, 259. Completion, $146,000, **67,** 117; **68,** 35.
Maj. F. U. Farquhar, increasing l. of ps. and d. of water, $60,000; completion, $56,000, **71,** 132; **72,** 36.
Capt. Mansfield, dr., $10,000, **72,** 185. To increase l. of ps. and dr., $40,536.58, **79,** 162, 1601.

OPERATIONS.

1867-68. Close piling completed; 315′ sheath piling; cribs refilled; superstr. built; 117,573 c. y. dr.; 514 l. f. s. p. built, **68,** 35, 135; **76,** ii, 466.
1868-69. 382 cords of st. and 100 cords brush put in ps.; 12,641 c. y. dr., **69,** 86; **74,** 174.
1869-70. 26,246 c. y. dr.; 320 l. f. n. p. built, **70,** 39, 128; **74,** 175.
1870-71. 210 l. f. of wings built; dr.; 64 l. f. n. p. built, **71,** 38, 132; **74,** 175.
1871-72. 64 l. f. superstr. built; 64 l. f. n. p. built; 64 l. f. s. p. built, **72,** 36, 176; **74,** 175.
1872-73. P. extension; 65 l. f. s. p. built, **73,** 36, 260.
1873-74. P. extension; 150 l. f. s. p. built, **74,** 42, 174.
1874-75. Dr.; 2,400 c. y. removed; 50 l. f. s. p. built, **75,** 47, 244.
1875-76. Superstr. built; 18,195 c. y. dr.; 100 l. f. n. p. built, **76,** 100, ii, 464.
1876-77. Repairs, **77,** 902.
1877-78. Old work refilled with st.; 50 l. f. s. p. built, **78,** 120, 1201.
1878-79. P. extension; 50 l. f. n. p. built; 50 l. f. s. p. built, **79,** 161, 1601.
1879-80. 13,350 c. y. dr., **80,** 2009.
1880-81. 13,500 c. y. dr., **81,** 2200.
1881-82. 100 l. f. cribwork sunk in extension of s. p.; cribs at outer end of s. p. leveled up and superstr. built; 77 cords of st. placed in superstr., **82,** 2283. Plan by Maj. Heap, 1883, for modified crib superstr., **83,** 1808, 1810, 1811.
1882-83. Work on modified superstr. completed; 10,028 c. y. dr.; 50 l. f. of cribwork added to s. p., **83,** 1808.
1883-84. Modified superstr. placed on end crib of s. p., **84,** 1973.
1884-85. 337 l. f. revet. on n. side of chan. and 187 l. f. on s. side rebuilt, **85,** 2068.
1886-87. 396 l. f. n. revet. completed; 230′ s. revet. repaired; s. p. extended 50′, **87,** 2179.
1889-90. S. p. extended 100′, **90,** 2612.
1890-91. 3,900 c. y. dr., **91,** 2674.
1891-92. 22,770 c. y. dr.; repairs to ps. and revet., **92,** 2318.
1892-93. 37,106 c. y. dr. and gauge readings made, **93,** 2906.
1893-94. General repairs in progress and 6,933 c. y. dr., **94,** 2231.
1894-95. 16,175 c. y. dr. and p.-extension work in progress, **95,** 2814.
1895-96. P. extension continued, **96,** 2714.
1896-97. P. extension completed and minor repairs made; 37,593 c. y. dr., **97,** 2939.
1897-98. Minor repairs made to old ps. and two unserviceable parts rebuilt, **98,** 2529.
1898-99. Completion of repairs to s. p.; filling of various parts of ps. with st.; 25,831 c. y. dr., **99,** 2944.
1899-00. 17,457 c. y. dr.; extension and repair of n. p. and repair of s. p. in progress, **00,** 3925.
1900-01. 3,540 c. y. dr.; repairs to ps. and extension of n. p. 200′, **01,** 3122.
1901-02. 8,316 c. y. dr., **02,** 2176.
1902-03. 25,023 c. y. dr.; extension of n. p. and repairs to s. p. in progress, **03,** 1975.
1903-04. 25,112 c. y. dr.; extension to n. p. and repairs to s. p. completed, **04,** 3028.
1904-05. 8,008 c. y. dr., **05,** 2207.
1905-06. 18,659 c. y. dr. by U. S. dr. *Gen. Gillespie;* repair of damage done by storm, 1905, to s. p.; repairs to dr., **06,** 1826–27.
1906-07. 20,831 c. y. dr. by U. S. dr. *Gen. Gillespie;* repairs to ps., **07,** 1981.
1907-08. 9,556 c. y. dr. by dr. *Gen. Gillespie;* repairs to ps., **08,** 2066.
1908-09. 54,716 c. y. dr. by dr. *Gen. Gillespie;* repairs to ps., **09,** 2052.
1909-10. Repairs to ps. completed; 39,795 c. y. dr. by U. S. dr. *Meade,* **10,** 2211–12.
1910-11. 17,942 c. y. dr. by U. S. dr. *Meade;* repairs to ps.; work commenced on extension of n. p., **11,** 2407–8.
1911-12. Extension of n. p. completed, 55,561 c. y. dr. by U. S. dr. *Meade* for mainten., **12,** 2604–5.

PHYSICAL CHARACTERISTICS.

An. shoaling, **00,** 3925.
Condition of works—damage to ps. by boats, **01,** 3123; **02,** 2176; **03,** 1976; **04,** 3029; **05,** 2207; **06,** 1827; **07,** 1982; **10,** 2212; **12,** 2605.
D. of water, **12,** 2605.
10 m. from Arcadia H. on s., 30 m. from South Manitou on n., **12,** 1052.

PLANS. (See Estimates and Projects.)

By Capt. Farquhar, to change the p. constr. from crib to pile work, **69,** 102. To extend the ps. 390′ and dr. to 14′, **70,** 129.

PRIVATE (CORPORATE) WORK.

2 pile ps., filled with cord-wood and st., extending into the lake 600′, built by a company for H. imp., cost, $16,000, **66,** 33.
In 1896 Toledo & Ann Arbor Ry. Co. received permission from the Sec. of War to add 400′ to the s. p. extension under the supervision of the DO., **96,** 2714; work done, 1897, **97,** 2939.
Damages to ps. by car ferry repaired by Ann Arbor RR. Co., **01,** 3124; **02,** 2176.
Frankfort Hotel Co. given permission, 1903, to occupy 800′ of n. p. at inner end on condition that they put in mooring posts and keep p. in repair, **04,** 3028. Use of p. discontinued, 1904, **05,** 2207.

PROJECTS. (See Estimates and Plans.)

By Col. Cram, 1866, dr. new outlet through strip of land separating Lake Aux Becs Scies from Lake Michigan, and building 2 parallel ps. 200′ apart. from 12′ in the inner lake to same d. in Lake Michigan; est., $88,541, **66,** 34, 36. Amended in 1875 and in 1879 to $254,196, **81,** 2201; **87,** 2179.
By Maj. J. B. Wheeler, sheath piling and refilling cribs with st., **66,** iv, 95. Increasing l. of ps. and dr., **67,** 117.
By Capt. Mansfield, to extend the s. p. farther into lake than the n. p., **73,** 261. For additional p. extension, **79,** 161, 1601.
By Maj. Harwood, 1881, completion of imp. by dr., and 550 l. f. of p. extension; est., $100,000, **81,** 2201.
Act 1896 au. chan. d. of 18′, **97,** 2939.

SURVEYS.

By Lt. O. M. Poe, 1859, **66,** 33.
By W. H. Hearding, **67,** 117, 126; **68,** 137.
Soundings taken, 1872, **76,** ii, 467; **77,** 902.
Maps. **82,** 2284; **83,** 1808; **84,** 1973.

OO-54(a) EMPIRE BAY AND HARBOR, MICH.

ENGINEERS.

Chief of Engineers. **R., 80,** 221; **81,** 301; **87,** 286; **10,** 832.

In charge:
Maj. F. Harwood, 1880. **R., 81,** 2258.
Capt. D. W. Lockwood, 1887. **R., 87,** 2209.
Maj. Chas. Keller, **10,** 801.

PHYSICAL CHARACTERISTICS.

In Leelenau Co., Mich.; the B.. is about 10 m. across, about 20 m. s. of S. Manitou Isld.; 2 small lakes adjacent to shore called South Bar and North Bar Lakes, **81,** 2259.
Description of H., **87,** 2210.

PLANS.

(1) By Maj. Harwood, 1881, for H. at North Bar Lake, chan. of entrance 200′ x 15′, made with 1,800 l. f. pile and brush p. and dr.; est., $60,000, **81,** 2260.
(2) Or for H., South Bar Lake, chan. of entrance 200′ x 10′, made with 1,400 l. f. pile and brush p. 20′ w., and dr.; est., $40,000, **81,** 2261.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Harwood, **81,** 2258.
Ex. for cutting chan. across bar, Lake Michigan to Bar Lake, au. act Aug. 5, 1886; made, 1887, by Capt. Lockwood (unfav.), **87,** 2211.
Ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Keller, 1909 and 1910 (unfav.) (H. D. 831, 61st, 2d) **10,** 832.

OO-54(b) LELAND HARBOR, MICH.

COMMERCE.

Present requirements local, **70,** 149.
Ample natural Hs. of refuge in the vicinity, **70,** 44, 149.

ENGINEERS.

Chief of Engineers. **R., 70,** 44; **10,** 832.
In charge:
Capt. F. U. Farquhar, 1870. **R., 70,** 148.
Maj. Chas. Keller, **10,** 801.

ESTIMATES. (See Plans.)

By Capt. Farquhar, break'r, $237,940.80, **70,** 149.

PHYSICAL CHARACTERISTICS.

General, of Leland H. and Carp R., **70,** 44, 149.

PRIVATE (CORPORATE) WORK.

Br. p. built at which vessels may lie during calm weather, **70,** 149.

PLANS. (See Estimates.)

By Capt. Farquhar, break'r 1,200′ x 34′, and 1,300′ from shore, **70,** 149.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Keller, Sept. 22, 1909, and Jan. 17, 1910 (unfav.) (H. D. 831, 61st, 2d), **10,** 832.

OO-54(c) CARP RIVER, MICH.

ENGINEERS.

Chief of Engineers. **R., 87,** 2208.

In charge. Capt. D. W. Lockwood. **R., 87,** 2208.

SURVEY.

Ex., with view to affording an entrance to Carp Lake for H. of refuge, au. act Aug. 5, 1886; made, 1887, by Capt. Lockwood (**R.** unfav.—"impractical"), **87,** 2208.

OO-55(a) TRAVERSE BAY (Grand Traverse Bay), MICH.

ENGINEERS.

Chief of Engineers. **R., 10,** 831.

In charge. Maj. Chas. Keller, **10,** 801.

SURVEY.

Pre. ex. au. act Mar. 3, 1909, of B. at Traverse City, with view to constr. of break'r. **R.** by Maj. Keller, Sept. 13, 1909 (H. D. 312, 61st, 2d) (unfav.), **10,** 831.

OO-55(b) GRAND TRAVERSE BAY, MICH. (Torch Lake near Eastport, Mich.)

ENGINEERS.

Chief of Engineers. **R., 87,** 286.
In charge. Capt. D. W. Lockwood, 1887. **R., 87,** 2210.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 2211.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Lockwood (**R.** unfav.—"local"—"too costly") **87,** 2210.

OO-58 CHARLEVOIX HARBOR AND ENTRANCE TO PINE LAKE, MICH.

APPROPRIATIONS.

1876, $10,000, **77,** 105.
1878, 12,000, **78,** 120, 1200.
1879, 9,000, **79,** 161, 1600.
1880, 10,000, **80,** 2009.
1881, 10,000, **81,** 2198.
1882, 10,000, **82,** 2282.
1884, 10,000, **84,** 1972.
1886, 10,000, **86,** 1756.
1888, 12,500, **88,** 1901.
1889, 9,000, **90,** 2611.
1892, 10,000, **92,** 2317.
1894, 8,000, **95,** 2817.
1896, 20,000, **96,** 2717.
1899, 15,000, **99,** 2948.
1902, 20,000, **02,** 2180.
1905, 25,000, **05,** 2212.
1907, 20,000, **07,** 1985.
1909, *6,000, **09,** 2054.

Total, 226,500 (incl. misc., $226,619.65, **12,** 2608).

COMMERCE.

H. a harbor of refuge, **69,** 29, 78; **73,** 283; **76,** ii, 522.
Importance, **69,** 79; **73,** 282, 283.
Principal traffic, lumber, iron ore, and pig iron, **12,** 1054.
1911, 212,232 t., **12,** 1054.
Much frequented summer resort, **12,** 1054.

CONTRACTS.

1877. Carkin & Stickney, materials and labor, **77,** 901, 902.
1878. Carkin & Stickney, p. extension, **79,** 1598. Hervey S. Dale, p. extension, **79,** 1597, 1600.
1880. N. G. Dodge, dr., 14¢ c. y., **81,** 2199.
1881. C. Sutherland, p. constr., **81,** 2198.
1882. L. E. Allen, p. constr., **83,** 1807.
1886. L. E. Allen, dr. and p. constr., **87,** 2178.
1889. G. W. Crouter, p. constr., $8,595.30, **89,** 2166.
1891. Gaylord & Wing, piles, 10¢ l. f.; and white pine timber, $18 M f. b. m. G. W. Crouter, bolts, 3¢ lb. Truman & Cooper, brush, $6 cord. F. A. Hagen, st., $2.24 cord, **91,** 2673.
1896. W. A. Starke, dr., **96,** 2716.
1897. J. A. Beauvais, reconstr. of p., $4,031.90, **97,** 2943.
1898. R. B. Rice, p. repair, $5,748.55, **98,** 2534.
1899. Green's Dredging Co., dr., **99,** 2948.
1900. Green & Anderson, p. repairs (removing old work, piles, ironwork), $6,606.25, **00,** 3931.
1901. Samuel O. Dixon, dr., 18¢ c. y., **01,** 3128.
1902. Samuel O. Dixon, dr., 20¢ c. y., **03,** 1980.
1903. The Lydon & Drews Co., dr., 16½¢ c. y.; Archibald J. Beauvais, repair of ps. and revet., prices listed, **03,** 1980.
1905. Nelson J. Gaylord, repair of p. and revet., at unit prices listed, **06,** 1830.
1907. Century Fuel Co., fuel, prices listed, **07,** 1985.
1908. Leathem & Smith Towing & Wrecking Co., furnishing st., at $9.23 and $10.23 cord; Burk, Smith & Nelson, repair of s. p., at unit prices, **08,** 2071. S. P. Bennett Fuel & Ice Co., fuel, prices listed, **08,** 2070.
1909. S. P. Bennett Fuel & Ice Co., fuel, prices listed, **09,** 2054.
1910. Century Fuel Co., coal, prices listed, **10,** 2215.
1911. Indian Refining Co., crude oil, 3.05¢ gal.; fuel oil, 2.75¢ gal., **11,** 2411.
1912. Indian Refining Co., fuel oil, 3.9¢ gal., **12,** 2608.

DOCUMENTS. (Not published in reports.)

Ex. D. 164, 43d, 2d, mentioned, **76,** ii, 522.

ENGINEERS.

Chief of Engineers. R., 69, 29; **73,** 40; **76,** 103; **77,** 105; **78,** 119; **79,** 161; **80,** 214; **81,** 289; **82,** 284; **83,** 292; **84,** 293; **85,** 315; **86,** 309; **87,** 277; **88,** 251; **89,** 294; **90,** 264; **91,** 336; **92,** 2315; **93,** 378; **94,** 352; **95,** 387; **96,** 343; **97,** 433, 435; **98,** 422; **99,** 503; **00,** 566; **01,** 552; **02,** 474; **03,** 519; **04,** 567, 570, 3048; **05,** 578; **06,** 641; **07,** 664; **08,** 712; **09,** 750; **10,** 828; **11,** 882; **12,** 1053.

Boards. BERH. **R., 04,** 3052.

In charge:
Maj. J. B. Wheeler, 1869. **R., 69,** 78.
Maj. S. M. Mansfield, 1873–80. **R., 73,** 281; **76,** ii, 522; **77,** 901; **78,** 1199; **79,** 1597; **80,** 214.
Maj. F. Harwood, 1880–82. **R., 80,** 2007; **81,** 2197.
Maj. D. P. Heap, 1882–83. **R., 83,** 2281.
Capt. D. W. Lockwood, 1883–87. **R., 83,** 1805; **84,** 1971; **85,** 2065; **86,** 1755; **87,** 2176.
Maj. S. M. Mansfield, 1888–89. **R., 88,** 1899.
Maj. W. Ludlow, 1889–93. **R., 89,** 2164; **90,** 2610; **91,** 2672; **92,** 2315; **93,** 2908.
Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94** 2233; **95,** 2816; **96,** 2715; **98,** 2532.
Capt. C. McD. Townsend, 1897. **R., 97,** 2942, 2953.
Capt. C. Harding, 1899–1900. **R., 99,** 2946; **00,** 3928.
Capt. Charles Keller, 1901–02. **R., 01,** 3126; **02,** 2178.
Lt. Col. M. B. Adams, 1903–08. **R., 03,** 1978; (Col.) **04,** 3031; **05,** 2210; **06,** 1829; **07,** 1983; **08,** 2069.
Maj. Charles Keller, 1909. **R., 09,** 2053.
Maj. C. S. Riché, 1910–12. **R., 10,** 2214; (Lt. Col.) **11,** 2410; **12,** 2608.

Assistants:
W. T. Casgrain. **R., 69,** 78.
C. M. Wells. **R., 73,** 284.
J. C. Nettleton, **73,** 285.
F. W. Lehnartz. **R., 00,** 3929.

ESTIMATES. (See Plans and Projects.)

By W. T. Casgrain, $198,044.14, **69,** 78,82.
By Capt. Mansfield, 1873, $192,780, **73,** 283. In 1875–76, $186,000; $91,303.50, **76,** ii, 523.

LEGISLATION.

16 sections of land granted by Michigan in aid of the imp., **73,** 282.

OPERATIONS.

1872-73. Crib p., n. side 460′ l., s. side 80′ l., built by people of Charlevoix; superstr. built by the State. Dr. 14,000 c. y., **73,** 282, 285.
1877-78. S. p. extended 190′; 159′ of brush work; old p. partly refillled with st.; dr. 23,436 c. y., **78,** 119, 1199, 1200.
1878-79. N. p. exended 150′, s. p. 100′; old p. reballasted, **79,** 161, 1597. History of operations, **79,** 1598. Cribwork compared with pilework, **73,** 287; **76,** ii, 522. Method of constr. proposed pilework, **73,** 284.
1879-80. 5,083 c. y. dr., 150 l. f. of n. p. extension nearly finished, **80,** 2007.
1880-81. 165 l. f. pile revet. repaired, superstr. over n. p nearly completed, 8,203 c. y. sand dr. from chan., **81,** 2197.
1881-82. 27,062 c. y. removed from chan., **82,** 2281. 1,401 l. f. plank-beam revet. and 440 l. f. close-pile revet. constr.; minor repairs to cribwork, **83,** 2282.
1882-83. 10,306 c. y. dr. from chan., **83,** 1806.
1883-84. Backing placed behind revet., **84,** 1972.

* Allotment.

1884-85. 161′ plank-beam revet. repaired, 75 l. f. plank-beam revet changed to close piling, chan. face of s. p. built up, 210 cords brush and 674 cords st. used in backing plank-beam revet., **85,** 2066.

1885-86. 330 l. f. of superstr. completed, **86,** 1756.

1886-87. 3,360 c. y. gravel dr. from lower chan., **87,** 2176.

1887-88. 354 l. f. of plank-beam revet. placed in n. side of chan.; 45,000 c. y. dr. from bet. the ps.; s. p. extended 50′, **88,** 1900.

1888-89. 3 cribs built and repairs made to end of n. p. by contract; 2,500 c. y. dr. by hired labor, **89,** 2164.

1889-90. 5,760 c. y. dr. by hired labor, **90,** 2610.

1890-91. 33,500 c. y. dr., and repairs made to upper chan. revet., **91,** 2672.

1891-92. Repairs to revet. in lower chan., and gap bet. n. p. and revet. at shore line filled with brush and st., **92,** 2316.

1892-93. 14,105 c. y. dr. and gauge readings made, **93,** 2908, 2909.

1893-94. Repairs made to ps. and revet., and 16,945 c. y. dr., 94, 2234.

1895-96. 35,348 c. y. dr., **96,** 2716.

1896-97. Rebuilding of n. p. in progress, **97,** 2943.

1897-98. Rebuilding of n. p. completed, the total amount of st. placed being 1,036 cords, and repairs to 723 l. f. of the s. revet. of lower chan. in progress, **98,** 2533.

1898-99. S. p. repairs completed, 99, 2946.

1899-00. 11,673 c. y. dr., about 168′ of revet. repaired, and about 400′ more revet. under repair, **00,** 3929.

1900-01. 402 l. f. of s. p. repaired, **01,** 3126.

1901-02. 11,228 c. y. removed from H., **02,** 2178.

1902-03. 30,370 c. y. removed by dr. 19′ chan. from Lake Michigan to Pine Lake, **03,** 1978.

1903-04. Repairs made to ps. in upper and lower chans.; 10,510 c. y. removed from lower chan.; damages caused by steam barge *Three Brothers* in collision with n. p. repaired by Lighthouse Dept., **04,** 3031.

1904-05. Repairs made to outer end of s. p. damaged by SS. *Three Brothers*, at cost of $119.65, which amount collected from owners through dist. atty.; empty pockets at end of s. p. filled with st., **05,** 2210.

1905-06. Dr. *Gen. Gillespie* removed 12,969 c. y. from the lower chan.; sunken piles and logs removed; breach in n. p. repaired with piling and st.; repairs on 600′ of n. p. begun, **06,** 1829.

1906-07. Dr. *Gillespie* removed 21,291 c. y.; repairs on 600 l. f. of n. p. continued; 321 l. f. of s. revet. and refilling of n. revet. completed; outer end pockets of both ps. refilled with st., **07,** 1983.

1907-08. Repairs to n. p. (lower chan.) and n. revet. (upper chan.) completed; 70 cords st. deposited in s. p. (lower chan.); inner end of s. p. lower chan.) rebuilt and repaired; 227 cords st. placed in s. p., **08,** 2069.

1909-10. Dr. *Meade* removed 32,004 c. y. from outer bar, etc., **10,** 2214.

1910-11. 15,440 c. y. dr. by U.S. dr. *Meade*, **11,** 2410.

1911-12. 13,297 c. y. dr., timber work removed from damaged revet., and s. p. walk repaired, **12,** 2608.

PHYSICAL CHARACTERISTICS.

Charlevoix H. and vicinity, **69,** 78; **73,** 281.
Natural advantages of H., **73,** 284.
Description of drainage area, **89,** 2165.
Soundings, **73,** 281, 282; **79,** 1599, 1600; **11,** 2410.
Max. draft, 15.5′, **12,** 1054.
H. 18 m. from Grand Traverse B. entrance, 47 m. from S. Manitou H., and 17 m. from Petoskey H., **12,** 1053.

PLANS. (See Estimates and Projects.)

By W. T. Casgrain, 1868, 2 parallel crib ps. 100′ apart to 14′ of water, each 672′ l.; also to connect e. end of the s. p. with base of sand hills by cribwork, 160′; dr. in chan. to 12′ of water, 2,466 l. f. of revet.; est., $198,044.14, **69,** 80, 81, 82.

By Capt. Mansfield, 1873, crib p. extension; n. p. 500 l. f., s. p. if necessary, chan. w. to 150′; est., $192,780, **73,** 282, 284.

By C. M. Webb, 1873, p. extension; n. p. 450 l. f., by pilework, s. p. 575′, 50′ crib pierhead for both ps.; completion of cribwork on n. side now partly built; pile revet. and dr., **73,** 284, 285.

PRIVATE (STATE AND CORPORATE) WORK. (See Legislation and Operations.)

$2,000 expend. in constr. of pile p., 1865, extending 900′ into the lake to 20′ of water, ample accommodation for shipping interests.

Attempt to open cut across sand beach; work abandoned as too expensive, **69,** 79, 80.

Cut made, crib ps. built, dr. to 11′ of water in R., **73,** 282.

Permission granted to Charlevoix Summer Home Assn. to occupy 45′ of w. end of s. revet. as landing place for passenger steamer; p. to be kept in repair by assn., **04,** 3032.

PROJECTS. (See Estimates and Plans.)

By Maj. Mansfield, 1868, dr. chan. 100′ x 12′, both sides to be protected by close piling; modified in 1876 by substitution of crib for pile ps.; est., $186,000, **69,** 80, 81, 82; **80,** 214; **87,** 2177.

By Maj. Mansfield, 1875–76, p. extension, by cribwork, on n. side, 925 l. f. to 20′ of water, s. p. 625 l. f. to 12′ of water, 2,550 l. f. of pile revet., and dr. in chan. to 12′; also removal of old n. p.; est., $186,000, **76,** ii, 523. Modification of above to meet "present" requirements; n. p. to 12′ of water, 600 l. f., s. p. 550 l. f., removal of old n. p., and dr.; est., $91,303.50, **76,** ii, 523.

In 1896 Capt. Townsend est. $160,000 to obtain 16′ in H., **97,** 2953.

Orig. proj. of 1868 extended act June 13, 1902, to include imp. of entrance to Pine Lake, **03,** 519.

SURVEYS.

By W. T. Casgrain, 1868. **R., 69,** 78.
Ex. by Maj. Mansfield, **73,** 40, 281.
Of upper and lower chans., 1883, **83,** 1806.
Sur. for 16′ au. act June 3, 1896; made, 1896, by Capt. Townsend (**R.** fav.; see Projects), **97,** 2953.
Pre. ex. au. act June 13, 1902, for 18′, Lake Michigan to Pine Lake; made by Capt. Keller (**R.** unfav.) (H. D. 222, 58th, 2d), **04,** 570, 3048.
Act July 25, 1912, au. ex. for increased d. bet. Lake Michigan and Pine Lake, **12,** 1054.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1054.
Maps. **82,** 2282; **83,** 1806.

OO-61 LITTLE TRAVERSE BAY, MICH. (Harbor of refuge, near Petoskey.)

ENGINEERS.

Chief of Engineers. **R., 85,** 324.

In charge. Capt. D. W. Lockwood. **R., 85,** 2095.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Lockwood (**R.** unfav.), **85,** 2095.

OO-62 PETOSKEY HARBOR, MICH.

APPROPRIATIONS.

1890,	$15,000,	**91,** 2671.
1892,	20,000,	**92,** 2315.
1894,	10,000,	**95,** 2820.
1896,	8,000,	**96,** 2720.
1899,	20,000,	**99,** 2950.
1902,	15,000,	**02,** 2182.
1905,	20,000,	**05,** 2214.
1907,	17,500,	**07,** 1987.
1910,	20,000,	**10,** 2216.
Total,	145,500	(incl. misc., $145,514.47, **12,** 2610).

COMMERCE.

"Present" and prospective C. of the locality, **90,** 2670.

CONTRACTS.

1895. Hughes Bros. & Bangs, break'r constr., $26,730.55, **95,** 2820.

1900. Adolph Green, repair of break'r, st., at $12 cord, **01,** 3130.

1903. Beauvais & Co., removing n. break'r and extension of n. break'r (prices given), **04,** 3037.

1905. Burk, Smith & Nelson, further extension of break'r, at prices given, **06,** 1833.

1907. Burk, Smith & Nelson, extension and repair of break'r, at prices given, **07,** 1987.

1911. T. L. Durocher, repairing s. break'r, at prices given, **11,** 2413.

ENGINEERS.

Chief of Engineers. **R., 89,** 306; **90,** 274; **91,** 336; **92,** 321; **93,** 379; **94,** 353; **95,** 388; **96,** 343; **97,** 434; **98,** 423; **99,** 504; **00,** 568; **01,** 553; **02,** 476; **03,** 521; **04,** 569; **05,** 580; **06,** 643; **07,** 666; **08,** 714; **09,** 752; **10,** 829, 860; **11,** 883; **12,** 1055, 1058.

In charge:

Lt. Col. S. M. Mansfield, 1888–90. **R., 90,** 2668.

Maj. W. Ludlow, 1890–93. **R., 90,** 2673; **91,** 2670; **92,** 2314; **93,** 2910.

Lt. Col. G. J. Lydecker, 1894–96, 1898. **R., 94,** 2235; **95,** 2818; **96,** 2718; **98,** 2535.

Capt. C. McD. Townsend, 1897. **R., 97,** 2944.

Capt. C. Harding, 1899–1901. **R., 99,** 2949; **00,** 3932.

Capt. Chas. Keller, 1901–03. **R., 01,** 3129; **02,** 2180.

Maj. J. G. Warren, **03,** 498.

Lt. Col. M. B. Adams, 1903–09. **R., 03,** 1981; (Col.) **04,** 3035; **05,** 2212; **06,** 1831; **07,** 1986; **08,** 2072.

Maj. Chas. Keller, 1909. **R., 09,** 2055.

Maj. C. S. Riché, 1910–12. **R., 10,** 2216; (Lt. Col.) **11,** 2412; **12,** 2610.

Assistant. Lt. J. E. Kuhn. **R., 90,** 2669.

OPERATIONS.

1894–95. W. break'r in course of constr., **95,** 2819.

1895–96. 400′ w. break'r constr. and 200′ of n. break'r completed, **96,** 2719.

1896–97. W. arm of break'r extended 200′, **97,** 2944.

1897–98. 70 cords of riprap st. placed on inshore section of the w. break'r to supply voids caused by heavy seas, **98,** 2536.

1898–00. Preparations made for repairing break'rs, **00,** 3932.

1900–01. Break'rs repaired under contract, **01,** 3129.

1903–04. Removal of n. break'r and extension of w. break'r commenced, **04,** 3035.

1904–07. Work on break'rs, **05,** 2213; **06,** 1831–32; **07,** 1986.

1907–08. Extension and repair of break'r, **08,** 2072.

1910–12. Repairs to break'r, **11,** 2412; **12,** 2610.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 2674.

Condition of works, **01,** 3129; **02,** 476; **04,** 3035; **05,** 2213; **06,** 1832; **09,** 752; **10,** 830; **11,** 884, 2412; **12,** 1056, 2610.

H. about 17 m. by water from Charlevoix H. to sw., and 4 m. to Harbor Springs on n. shore of Little Traverse B. In high gales dangerous to attempt a landing, **12,** 1055.

PRIVATE WORK.

Permit granted, 1905, to build dock, **06,** 1832.

Cost of repairs to break'r damaged by vessels, reimbursed by owners, **12,** 2610.

PROJECTS.

By Maj. Ludlow, 1890, constr. break'r extending 550′ offshore from point w. of landing to 26′ of water, thence extending e. about 1,200′, so as to overlap landing and inclose sheltered area open to the e. of about 12 acres; est., $170,000, **90,** 2675; **91,** 2671.

In 1892 proj. modified and limited to reconstr. existing landing p. of solid cribwork, with an arm extending e.; est., $70,000, **92,** 2314.

Act June 13, 1902, au. change in location of the 200′ of n. break'r already in place, **02,** 476.

Modified plans provide for removal of n. break'r and extension of w. break'r, **03,** 521, 1982.

Act June 25, 1910, app. $5,000 for restoring efficiency of st. portion of break'r, and $15,000 for addition of 100′ to break'r, **10,** 830.

SURVEY.

Surs. for H. of refuge au. act Aug. 11, 1888; made, 1889, by Maj. Ludlow, **90,** 2673.

Pre. ex. au. act Feb. 27, 1911. **R.** by Lt. Col. Riché, Sept. 21, 1911 (H. D. 450, 62d, 2d). Further imp. by U. S. not deemed advisable "at this time." Recom. that break'r be not extended, and that funds app. by act of 1910 be reserved for mainten. and repair, **12,** 1058.

Maps. **96,** 2722.

OO-62(b) CHEBOYGAN AND PETOSKEY, MICH. (Inland water route between.)

ENGINEERS.

Chief of Engineers. **R., 10,** 860.

In charge. Col. C. McD. Townsend, 1909–. **10,** 832.

SURVEY.

Pre. ex. au. act Mar. 3, 1909, inland water route Michigan, Cheboygan, on Lake Huron, to Petoskey on Lake Michigan. **R.** (unfav.) by Col. Townsend 1909 (H. D. 303, 61st, 2d), **10,** 860.

OO-63 CROSS VILLAGE HARBOR, MICH. (Harbor of Refuge.)

ENGINEERS.

Chief of Engineers. **R.,** **84,** 301; **85,** 332.

In charge:
Maj. D. P. Heap. **R.,** **84,** 1995.
Capt. D. W. Lockwood. **R.,** **84,** 1996.
Lt. Col. O. M. Poe. **R.,** **85,** 2185.

Assistants:
J. A. Mitchell. **R.,** **84,** 1997.
O. B. Wheeler. **R.,** **85,** 2185.

PHYSICAL CHARACTERISTICS.

Locality described; in n. Michigan, on w. shore, opposite Beaver Isld., **84,** 1995, 1997; **85,** 2185.

PLANS.

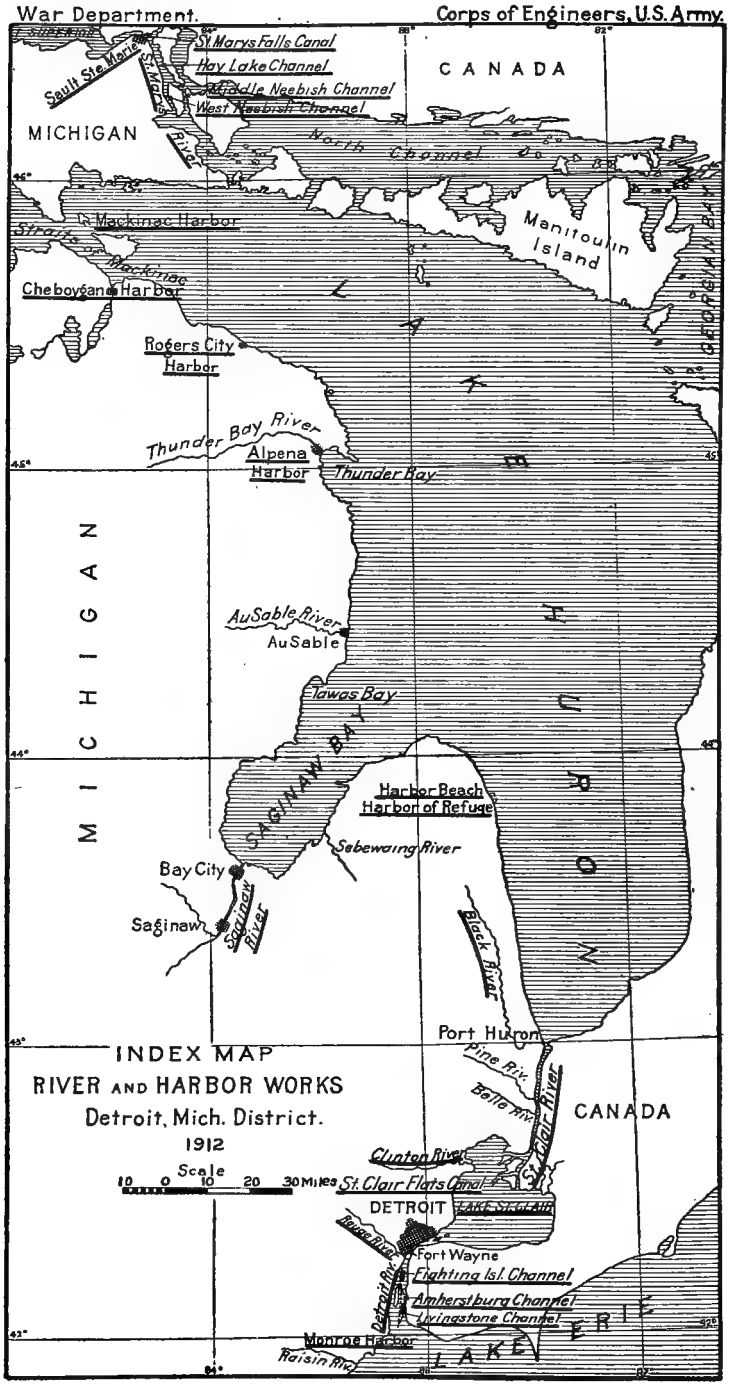
Sheltered area of 20 acres would cost $300,000. **84,** 1997, 1998.

SURVEYS.

Ex. au. acts Aug. 2, 1882, and July 5, 1884; made by Maj. Heap, Capt. Lockwood, and Col. Poe (**R.** unfav.), **84,** 1995, 1996; **85,** 2185.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

PP.—DETROIT, MICH., DISTRICT.


War Department.
Corps of Engineers, U.S. Army.
St. Marys Falls Canal
Hay Lake Channel
Middle Neebish Channel
West Neebish Channel
Sault Ste. Marie
St. Marys River
CANADA
MICHIGAN
North Channel
Mackinac Harbor
Straits of Mackinac
Manitoulin Island
Georgian Bay
Cheboygan Harbor
Rogers City Harbor
LAKE HURON
Thunder Bay River
Alpena Harbor
Thunder Bay
AuSable River
AuSable
Tawas Bay
SAGINAW BAY
Harbor Beach Harbor of Refuge
Sebewaing River
Bay City
Saginaw
Saginaw River
Black River
Port Huron
Pine Riv.
Belle Riv.
St. Clair River
CANADA
INDEX MAP
RIVER AND HARBOR WORKS
Detroit, Mich. District.
1912
Scale
10 0 10 20 30 Miles
Clinton River
St. Clair Flats Canal
DETROIT
LAKE St. CLAIR
Rouge River
Fort Wayne
Fighting Isl. Channel
Detroit Riv.
Amherstburg Channel
Livingstone Channel
LAKE ERIE
Monroe Harbor
Raisin Riv.

PP.—DETROIT, MICH., DISTRICT.[1]

In charge of U. S. Engineer Office,
Detroit, Mich.

NOTE.—See note on p. 1297.

PP 1 Lake Superior.
PP 2 White Fish B., Mich. (1)
PP 3 St. Marys R., Mich. (2)
PP 4 Waiska R., Mich. (3)
PP 5 St. Marys Falls Canal Mich. (3)
PP 6 Shunk Cr., Mich. (3)
PP 7 Frechette Cr., Mich. (3)
PP 8 Ermatinger Cr., Mich. (3)
PP 9 Hursley Cr., Mich. (3)
PP 10 Sailors Cr., Mich. (3)
PP 11 Charlotte R., Mich. (3)
PP 12 Hay Lake & Neebish Chans., Mich. (3)
PP 13 Hay Lake Chan., Mich. (3)
PP 14 Lake George Chan., Mich. (3)
PP 15 East Neebish Chan., Mich. (3)
PP 16 Middle Neebish Chan., Mich. (3)
PP 17 West Neebish Chan., Mich. (3)
PP 18 Little Munuscong R., Mich. (3)
PP 19 Munuscong R., Mich. (3)
PP 20 Gogomain R., Mich. (3)
PP 21 Mud Lake Chan., Mich. (3)
PP 22 Detour Passage, Mich. (3)
PP 23 Lake Huron. (1)
PP 24 Straits of Mackinac, Mich. (23)
PP 25 Les Cheneaux Is. Chans., Mich. (24)
PP 26 Pine R., Mich. (24)
PP 27 Carp R., Mich. (24)
PP 28 St. Ignace H., Mich. (24)
PP 29 Mackinac H., Mich. (24)
PP 30 Mackinaw H., Mich. (24)
PP 31 Cheboygan H., Mich. (24)
PP 32 [2] Cheboygan R., Mich. (32)
PP 33 [2] Mullet Lake, Mich. (32)
PP 34 [2] Indian R., Mich. (32)
PP 35 [2] Burt Lake, Mich. (32)
PP 36 [2] Crooked R. and Lake, Mich. (32)
PP 37 Sturgeon R., Mich. (32)
PP 38 Pigeon R., Mich. (32)
PP 39 Black R. and Lake, Mich. (32)
PP 40 Hammond Bay, Mich. (23)
PP 41 Ocqueoc R., Mich. (40)
PP 42 Rogers City H., Mich. (23)
PP 43 Calcite H., Mich. (23)
PP 44 Swan R., Mich. (23)
PP 45 Little Trout R., Mich. (23)
PP 46 Presque Isle H., Mich. (23)
PP 47 False Presque Isle H., Mich. (23)
PP 48 Rockport H., Mich. (23)
PP 49 Thunder Bay, Mich. (23)
PP 50 Alpena H. (Thunder Bay R.), Mich. (49)
PP 51 Devil R., Mich. (23)
PP 52 Black R., Mich. (23)
PP 53 Au Sable-Oscoda H. (Au Sable R.), Mich. (23)
PP 54 Saginaw B., Mich. (23)
PP 55 Tawas B., Mich. (54)
PP 56 Tawas City H. (Tawas R.), Mich. (55)
PP 57 Point Lookout, Mich. (54)
PP 58 Au Gres H. (Au Gres R.), Mich. (54)
PP 59 Rifle R., Mich. (54)
PP 60 Pine R., Mich. (54)
PP 61 Saganing R., Mich. (54)
PP 62 Pinconning R., Mich. (54)
PP 63 Kawkawlin R.. Mich. (54)
PP 64 Saginaw R., Mich. (54)
PP 65 Bay City H., Mich. (64)
PP 66 Sou-West Coning Cr., Mich. (64)
PP 67 Saginaw H., Mich. (64)
PP 68 Tittabawassee R., Mich. (64)
PP 69 Shiawassee R., Mich. (64)
PP 70 Swan Cr., Mich. (69)
PP 71 Bad R., Mich. (69)
PP 72 Flint R., Mich. (69)
PP 73 Cass R., Mich. (69)
PP 74 Sheboyganning Cr., Mich. (64)
PP 75 Quannicassee R., Mich. (54)
PP 76 Sebewaing (Sebewaing R.), Mich. (54)
PP 77 Caseville H. (Pigeon R.), Mich. (54)
PP 78 Port Crescent H. (Pinnebog R.), Mich. (54)
PP 79 Port Austin (Bird Cr.), Mich. (54)
PP 80 Point aux Barques H., Mich. (54)
PP 81 Huron H. (Willow R.), Mich. (23)
PP 82 Harbor Beach H. of Refuge, Mich. (23)
PP 83 Forestville H., Mich. (23)
PP 84 Forester H., Mich. (23)
PP 85 Port Sanilac H., Mich. (23)
PP 86 Lexington H., Mich. (23)
PP 87 Corsica Shoal, Mich. (23)
PP 88 St. Clair R., Mich. (23)
PP 89 Black R., (at mouth), Mich. (88)
PP 90 Black R. (at Port Huron), Mich. (88)
PP 91 Pine R. (St. Clair City H.), Mich. (88)
PP 92 Belle R., (Marine City H.), Mich. (88)

[1] North River, Mich. (Essex to North Bridge.) Chief of Engineers. R., 87, 294. In charge. Lt. Col. O. M. Poe, 1886. R., 87, 2271. Lt. Col. Poe, 1886, reports, in view of the fact that whereabouts of the above locality could not be ascertained, that the same is unworthy of imp., 87, 2271. Ex. au. act Aug. 5, 1886; made by Lt. Col. Poe. 87, 2271.

[2] Inland route between Cheyboygan and Petoskey.

PP 93 Algonac H., Mich. (88)
PP 94 North Chan., mouth of St. Clair R., Mich. (88)
PP 95 Chenal a Bout Rond and Middle, Chan. (93)
PP 96 Russell Island Chan., Mich. (88)
PP 97 South Chan., mouth of St. Clair R.), Mich. (88)
PP 98 St. Clair Flats Canal, Mich. (88)
PP 99 Lake St. Clair (88)
PP 100 Swan Cr., Mich. (99)
PP 101 Frog Cr., Mich. (99)
PP 102 Salt Cr., Mich. (99)
PP 103 Clinton R., Mich. (99)
PP 104 Milk R., Mich. (99)
PP 105 Detroit R., Mich. (99)
PP 106 Channel at Grosse Pointe, Mich. (105)
PP 107 Fox Cr., Mich. (105).
PP 108 Conners Cr., Mich. (105)
PP 109 Detroit H., Mich. (105)
PP 110 Rouge R., Mich. (105)
PP 111 Ecorse R., Mich. (105)
PP 112 Fighting Island Chan., Mich. (105)
PP 113 Channel W. of Grosse Isle, Mich. (105)
PP 114 Wyandotte H., Mich. (113)
PP 115 Trenton H., Mich. (113)
PP 116 Livingstone Chan., Mich. (105)
PP 117 Amherstburg Chan., Mich. (105)
PP 118 Lake Erie (105).
PP 119 Huron R., Mich. (118)
PP 120 Mouillee Cr., Mich. (118)
PP 121 Swan Cr., Mich. (118)
PP 122 Stony Cr., Mich. (118)
PP 123 Sandy Cr., Mich. (118)
PP 124 Monroe H. (Raisin R.), Mich. (118)
PP 125 La Plaisance B., Mich. (118)

PP-1(a) GREAT LAKES.[1] ("Ship Channel connecting Waters of the Great Lakes.")

APPROPRIATIONS.

1892,	$375,000,	**93,** 2962.
1893,	875,000,	**95,** 2865.
1895,	500,000,	**95,** 2865.
1896,	500,000,	**96,** 2754.
1897,	1,090,000,	**97,** 2959.
1909,	*25,000,	**09,** 2060.
Total,	3,365,000	

COMMERCE.

In 1897 the Lake Carriers' Assn. wrote to the Sec. of War suggesting what further imp. deemed necessary for benefit of C., **97,** 2960.

Very large and important, **91,** 2811, 2817; **99,** 505; **00,** 569.

Increase in, **03,** 533; **05,** 591; **06,** 665, 666; **07,** 686, 2059.

Reduction in rates, **06,** 666; **07,** 686; **08,** 717; **09,** 755; **10,** 834; **11,** 887; **12,** 1061.

Rules for navigation in St. Clair R., **07,** 2008.

In 1911, 53,500,000 t. through St. Marys R. section, St. Clair Flats Canal 61,500,000 t., and Detroit R. 67,000,000 t., **12,** 1061.

In 1900, rates averaged 1.18 mills per mile-ton; 1911, 0.67 mill. This enormous saving due to greater permissible draft, increasing carrying capacity permitted by U.S. works; 1900, greatest capacity was 8,000 t.; 1907, 13,000 t. per vessel, **12,** 1061.

Tabular statement for each year, 1855–1911, **12,** 2641, 2642.

CONTRACTS.

1892. Chan. excavation, c. y.: Bank measure—R. J. Cram, 44¢ ($39,600); C. E. Mitchell & Co., 25.9¢ ($98,420), **93,** 2967. John Hickler, $2.43 and 22¢ ($219,589.38 and $14,740), **93,** 2968. Scow measure—McCollum & Lee and R. J. Cram, 58¢ ($148,480), **93,** 2968. James Rooney, 16½¢ ($156,750); Breymann Bros., 14⅞¢ ($431,375); L. P. & J. A. Smith, 18¢ ($195,480), **93,** 2969.

1894. L. P. & J. A. Smith, excavating r., $2.24 c. y., b. m.; other material than r., 95¢ c. y., s. m. ($11,453.65), **95,** 2866.

1895. W. A. McGillis & Co., earth excavation, 65¢ c. y.; r. excavation, $3.75 c. y. ($7,075), **96,** 2755.

1897. M. Sullivan, dr. and submarine r. excavation, 52¢ and 98¢ c. y., b. m., **98,** 2553.

1898. M. Sullivan, removal of obstrs., $2.15 c. y., and $2.60 s. t. ($103,500). J. Rooney, furnishing and operating dr. plant, $9 per hour, **98,** 2553.

1892-98. List of bidders for various misc. supplies, **93,** 2970; **94,** 2267; **96,** 2755.

1900. E. J. Hingston, time work by dr., $10.25 per hour, **01,** 3161.

1901. Duluth Dredge & Dock Co., time-work by dr. plant, $12 per hour, **01,** 3161.

1902. G. H. Breyman & Bros., time-work by dr. plant, $17 per hour; Hickler Bros., time-work by dr. plant, $15 per hour; Lake Erie Dredging Co., time-work by dr. plant, $30 per hour, **03,** 2004.

1903. Hickler Bros., time-work by dr. plant, $15 per hour; Lake Erie Dredging Co., time-work by dr. plant, $30 per hour; M. Sullivan, time-work by dr. plant, St. Clair R., $19 per hour, and Lake St. Clair, $21 per hour; G. H. Breyman & Bros., time-work by dr. plant, St. Clair R., $17, and Lake St. Clair, $21 per hour, **03,** 2004. Wm. E. Rooney, time-work by dr. plant, St. Clair R., $11.75, and St. Clair Lake, $14 per hour; Lake Superior Contracting & Dredging Co., time-work by dr. plant, $24 per hour; Henry Hickler, hire of derrick boat, tug, etc.; derrick boat, $5.50 per hour; tug, $2.50 per hour; dynamite, 20¢ lb., **04,** 3093.

1904. Walter H. Oades, repairing U. S. S. *Hancock*, $3,053.62, **04,** 3093. H. W. Hubbell & Co., hire of derrick boat, etc., $6.15 per hour; dynamite, 18¢ lb., **04,** 3094.

1905. Lake Superior Contracting & Dredging Co., time-work by dr. plant, $25 per hour, **05,** 2243. Great Lakes Dredge & Dock Co., time-work by dr. plant, $30 per hour; Semande & Durocher, time-work by steam derrick boat, etc., $5 per hour; dynamite, 14¢ lb., **06,** 1853.

1906. Lake Erie Dredging Co., dr., prices given; M. Sullivan, dr., prices given, **06,** 1853. Great Lakes Dredge & Dock Co., time-work by dr. plant, $30 per hour; Semande & Durocher, time-work by steam derrick boat, etc., $6 per hour; dynamite, 14¢ lb., **07,** 2009.

1907. T. L. Durocher, time-work by steam derrick boat, etc., $6.75 per hour; dynamite, 17¢ lb.; T. L. Durocher, time-work by steam derrick boat, etc., $6.75 per hour; dynamite, 16¢ lb., **08,** 2075.

ENGINEERS.

Chief of Engineers. R., 91, 362; **93,** 389; **94,** 361; **95,** 397; **96,** 351; **97,** 435; **98,** 424; **99,** 505; **00,** 569; **01,** 563; **02,** 485; **03,** 532; **04,** 581; **05,** 590; **06,** 664; **07,** 685, 698; **08,** 715; **09,** 753; **10,** 832; **11,** 886; **12,** 1059.

[1] Act Mar. 3, 1907, au. report on ex. of harbors of Great Lakes and elsewhere, in which a whole or a part of the H. is imp. at local expense; object to determine if such imp. should be undertaken or maintained by U. S.; and to establish uniform rules in making H. imp. H. D. 1067, 61st 3d.

* Allotment.

In charge:
Col. O. M. Poe, 1891–95. **R., 91,** 2811; **93,** 2962; **94,** 2261; **95,** 2859.
Lt. Col. G. J. Lydecker, 1896–1901. **R., 96,** 2749; **97,** 2955; **98,** 2548; **99,** 2953; **00,** 3947; **01,** 3157.
Maj. W. H. Bixby, 1902–04. **R., 02,** 2197; (Lt. Col.) **03,** 2001.
Maj. W. L. Fisk, **04,** 581.
Lt. Col. C. E. L. B. Davis, 1904–08. **R., 04,** 3092; **05,** 2241; (Col.) **06,** 1851; **07,** 2007, 2059.
Capt. G. R. Spalding, **08,** 715.
Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2073; **09,** 2059; (Col.) **10,** 2219; **11,** 2415; **12,** 2615.

Assistants:
C. Y. Dixon. **R., 96,** 2755; **99,** 2957; **02,** 2201.
J. Ripley. **R., 99,** 2957; **02,** 2199; **03,** 2004; **04,** 3094; **05,** 2244.
B. Rohnert. **R., 00,** 3948; **01,** 3159.
E. S. Wheeler. **R., 03,** 2005; **04,** 3094; **05,** 2243.
1st Lt. L. H. Rand, **04,** 581; **05,** 590.
Capt. G. R. Spalding, **08,** 715; **09,** 753.

OPERATIONS.

1892-93. Work on all 8 sections in progress, about 230,000 c. y. being dr., **93,** 2965.
1893-94. About 1,800,000 c. y. dr., **94,** 2265.
1894-95. Sections 1, 4, and 6 completed, and work on other sections in progress, about 3,000,000 c. y. in all being dr., **95,** 2862.
1895-96. Nearly 3,000,000 c. y. dr., **96,** 2753.
1896-97. Sections 2, 3, 5, and 7 completed, and work on section 8 in progress, about 1,300,000 c. y. in all being dr., **97,** 2956.
1897-98. Increase of w. and d. of chans. through Round Isld. Shoals, St. Marys R., in progress; removal of bowlders, r., and other material from the chan. in the lower section of Detroit R. in progress; removal of dangerous shoal at foot of Mud Lake, St. Marys R., completed; part of Middle Ground Shoal, Port Huron, St. Clair R., removed; chan. through bar at mouth of Detroit R. completed; in all, 312,267 c. y. being dr., **98,** 2548.
1898-99. 240,307 c. y. dr. from Round Isld. Shoals; over 80,000 c. y. removed from Detroit R.; about 44,000 c. y. removed from St. Clair R., **99,** 2954.
1899-00. Over 50,000 c. y. removed from Round Isld. Shoals, and about 25,000 c. y. removed from Detroit R., **00,** 3949.
1900-01. 76,258 c. y. dr. from St. Clair R. and Lake, and 56,324 c. y. from St. Marys R., **01,** 3158–3159.
1901-02. 86,753 c. y. dr. from St. Clair R. and Lake, **02,** 2198.
1902-03. 143,566 c. y. dr. from St. Clair R. and Lake, and 154,317 c. y. from St. Marys R., **03,** 2002.
1903-04. 428,986 c. y. dr. from St. Clair R. and Lake and Lake Huron, and 113,542 c. y. from St. Marys R., **04,** 582.
1904-05. 115,230 c. y. dr. from St. Clair R. and Lake and Lake Huron; 80 c. y. bowlders removed from St. Marys R., **05,** 2242.
1905-06. 41,680 c. y. dr. in Lake St. Clair, and 15,774 c. y. in St. Marys R., **06,** 666, 1852.
1906-07. 209,911 c. y. removed from St. Marys, R., **07,** 2008.
1907-08. 1,580 c. y. removed from St. Marys R. **08,** 2074.
1908-12. Sur. work, **09,** 2060; **10,** 2220; **11,** 2416; **12,** 2616.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2817; **98,** 2551.
Monthly level varies 4″ to 2′ an., and daily variation may be 2′ at times, or even 6′ to 8′ in severe storms on Lakes Erie and Superior, **12,** 1061.
Slope of St. Marys R. affected by dr. of chans.; reduced elevation of lake levels, **08,** 716. Little shoaling in chan.; available d., 19′, **12,** 2616.
This work covers navigation through chain of lakes known as Erie, St. Clair, Huron, Michigan, and Superior, and their connecting waters. Orig. the chan. was obstr. by rapids in St. Marys R. and by a number of shoals. In 1855 Michigan made a canal at Sault Ste. Marie, with 2 tandem locks 11½′ x 70′ x 350′, each with a lift of 9′. Prior to Civil War chans. through Lake George in St. Marys R., and through the St. Clair Flats, at the outlet of St. Clair R., were d. to 12′ by U. S. The Weitzel Lock at the Sault provided 16′, making needful d. the connecting chans. accordingly (see St. Marys R. and Detroit R.), 1890, Poe Lock, giving 21′ made needful another d. of the chans., **12,** 1059.

PRIVATE WORK.

Permits given for constr. of docks, etc., **06,** 1852.

PROJECTS.

In 1892 Congress au. plan of Col. Poe, 1891, for ship chan. with navigable d. of 20′, to connect the waters of the Great Lakes bet. Buffalo, Chicago, and Duluth, at an est. of $3,340,000, as follows:
St. Marys R.—(1) Round Isld. Shoals, (2) Little Mud Lake, (3) reef abreast of Sailors Encampment Isld., (4) and shoal below the isld., 21′ x 300′; (5) 21′ x 2,400′ at the foot of Lake Huron; (6) 20′ from d. w. in St. Clair R. through St. Clair Flats Canal to Lake St. Clair, with a w. above the canal not greater than 650′, thence narrowing to the canal, thence for the full w. of the canal for its entire l., thence gradually w. to 800′ at d. w. in Lake St. Clair; (7) 20′ x 800′ through Grossepoint Flats, Lake St. Clair; (8) 21′ x 800′ through the bar at the mouth of the Detroit R., **93,** 2962, 2963. (See Surveys.)
Detroit R. provided for by separate app., 1899, **99,** 2955.
Lt. Col. Lydecker est., 1899, $250,000 to supply data for reliable conclusions as to what would be needed for the preservation of lake chans. and H. ds. and suggested that such investigations be made in connection with surs. of the northern and northwestern lakes, **99,** 2956.
Up to 1912, no modification of proj. save minor imp. of shoal areas more or less isolated, **12,** 1060; 1902, datum planes were changed for Lakes Michigan, Huron, St. Clair, and Erie (previously 1877 levels), making necessary addl. d. at various places, **12,** 1061.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1891, by Col. Poe, **91,** 2811.
System of triangulation along Detroit R., **96,** 2757, 2758.
Minor surs. See references to each an. **R.** of officer in charge.
Pre. ex. and sur. au. act Mar. 3, 1905; for 22′ and 25′, resp., and sufficient w., made by Col. Davis. **R.,** 1905 and 1906, presented plan for imp. which contemplates excavation of auxiliary chan. in Detroit R. 22′ d., designated as Plan B, e. route; est., $6,670,950 (H. D. 266, 59th, 2d), **07,** 698.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1060.
Maps. (H. D. 266, 59th, 2d.) **93,** 2962, 2964; **94,** 2266; **95,** 2866; **96,** 2758; **03,** 2002; **04,** 3092.

PP-1(b) LAKES SUPERIOR AND HURON. (Connecting waters.)

COMMERCE.

Comparison of, 1895 to 1899, **01,** 3206.

ENGINEERS.

Chief of Engineers. R., 01, 570; **02,** 494; **03,** 542; **04,** 591; **05,** 602; **07,** 698.

In charge:
Lt. Col. G. J. Lydecker, 1901–02. **R., 01,** 3200.
Maj. W. H. Bixby, **03,** 532; (Lt. Col.) **04,** 581.
Lt. Col. C. E. L. B. Davis, 1905–07. **R., 05,** 2289.

PHYSICAL CHARACTERISTICS.

Data concerning d., description, etc., **01,** 3202.

PROJECT.

This work is taken up under St. Marys R., Hay Lake Chan. For details, consult this title.

SURVEYS.

Pre. ex. and sur. of waters connecting Lakes Superior and Huron, incl. Hay Lake Chan., St. Marys R., au. act Mar. 3, 1899, for chan. 21′ d. **R.,** Col. Lydecker, June 4, 1900; est., **$9,000,000** (H. D. 128, 56th, 2d), **01,** 570; **02,** 494; **03,** 542; **04,** 591. Final **R.,** Col. Davis, Dec. 3, 1904; est., $10,160,000, **05,** 2291.

Au. act Mar. 3, 1899, of connecting waters bet. Lakes Superior and Huron, with plan and est. of cost of a new lock at St. Marys Falls Canal, Mich. **R.,** DO., Dec. 3, 1906; est., $6,200,000, **07,** 698.

PP-3 ST. MARYS RIVER AND ST. MARYS FALLS CANAL, MICH.

(See also "Ship Channel connecting waters of the Great Lakes," p. 1420.)

Part.	Title.	Period.	Appropriations.
a	St. Marys R. and St. Marys Falls Canal, Mich	1856–1912	$12,722,130.19
b	St. Marys R., Hay Lake, and Neebish Channels	1892–1912	8,629,807.00
c	St. Marys Falls Canal, Mich. (operating and care)	1882–1912	2,112,654.49
			23,464,591.68

Part (a), PP-3 St. Marys River and St. Marys Falls Canal, Mich.[1]

APPROPRIATIONS.[1]

1870,	$150,000.00,	**70,** 45.
1871,	350,000.00,	**71,** 42, 43.
1872,	300,000.00,	**72,** 40, 201.
1873,	200,000.00,	**73,** 40.
1874,	200,000.00,	**74,** 46, 198.
1875,	200,000.00	**75,** 50, 268.
1876,	130,000.00,	**76,** 104, ii, 527; **77,** 110.
1878,	175,000.00,	**78,** 125, 1219.
1879,	300,000.00,	**79,** 127, 1644.
1880,	250,000.00,	**80,** 2068.
1881,	150,000.00,	**81,** 2266
1886,	250,000.00,	**86,** 1789.
1888,	1,000,000.00,	**88,** 1928.
1890,	900,000.00,	**90,** 2688.
1891,	600,000.00,	**92,** 2403.
1893,	1,230,000.00,	**93,** 2997.
1894,	300,000.00,	**95,** 2894.
1895,	483,865.00,	**95,** 2894.
1896,	8,265.19, act June 11.	
1905,	420,000.00,	**05,** 2246.
1906,	100,000.00,	**06,** 1855.
1907,	1,450,000.00,	**07,** 2011.
1909,	650,000.00,	**09,** 2063.
1910,	625,000.00,	**10,** 2224.
1911,	500,000.00,	**11,** 2419.
1912,	1,800,000.00,	**12,** 2619.
Total,	12,722,130.19	

COMMERCE. (See pp. 1427, 1429.)

In 1851, about 12,600 t, **12,** 2646.

Rapidly increasing, **66,** iv, 67; very great, **66,** iv, 75; all to and from Lake Superior, **67,** 231; requires chan. for vessels drawing 14′, **67,** 252–255; requirements, **69,** 106, 107; **70,** 160, 163; **71,** 168, 170.

1880–86. Canal C., **81,** 2269; **82,** 2356, 2364; **83,** 1847; **84,** 2018, 2020, 2022; **85,** 2109; **86,** 1789; **87,** 2215, 2224, 2229.

Increased demands of C., **84,** 2012, 2015; **85,** 2099, 2105, 2106, 2108; **86,** 1784, 1786, 1789.

Necessity for dry dock, **84,** 2031.

Rules and regulations for use of canal, **85,** 2112.

Comparison bet. C. of St. Marys Falls Canal and Suez Canal, **87,** 2215.

1880–90. C. passing the canal, **88,** 260, 1930, 1931, 1932, 1933, 1941; **89,** 2213, 2214, 2218, 2227; **90,** 2690, 2691, 2710.

Comparison of charges by rail and water, **88,** 1933, 1934.

Charges on merchandise passing through the canal, **88,** 1935; **89,** 2220.

Effect of accident at St. Marys Falls Canal upon passage of vessels through the lock, **91,** 2743, 2746.

Rates on articles of C. passing through the canal for 1887, 1888, 1889, and 1890, **91,** 2753.

In 1897 over 18,000,000 t., value, $200,000,000, **98,** 2560.

Enormous, **99,** 2961; **00,** 3955.

C., 1902, 40 times greater than in 1870, and 6 times that of 1886, **02,** 487.

In 1906, about 82 times that of 1870, 32 times that of 1880, 5 times that of 1890, and twice that of 1900, **06,** 667.

Remarks relative to effect of imp. on C., 1887 to 1906, incl., **07,** 2059.

During 1911, 53,477,216 t., **12,** 2628.

Tabular statement for each year, 1855 to 1911, **12,** 2641–2642.

CONTRACTS.

1866. John Brown & Co., dr., 48¢, 90¢, and $2 c. y., **67,** 147.

1870. W. W. & E. T. Williams, removal of bowlders, **70,** 160; **71,** 162. Barker, Williams & Bangs, r. excavation, revetting wall, etc., **71,** 164.

1871. Barker & Williams, continuing imp., **71,** 162–167; **72,** 39, 199.

[1] Act Aug. 2, 1882, provided for applying $65,000 (balance of tolls offered by Michigan) to convert old lock into dry dock, **81,** 388.

1872. Barker & Williams, continuing imp., **72,** 198.

1873. Boyle & Roach, continuing work on canal, **73,** 287, 289.

1874. Barker & Williams, building p., **75,** 50, 266, 270; **76,** 103.

1875. A. Wallbaum,[1] face st., 64¢ c. f., **75,** 267, 269. H. Van Vleck, face st. for locks, **76,** ii, 524. Boyle & Roach, building new lock masonry, **75,** 267, 269. C. C. Barker & Son, pierwork, **76,** ii, 524.

1877. C. S. Barker, dr., **78,** 1219.

1879. E. A. Wetmore & Co., timber, 14½¢ c. y., **79,** 1645. Larkin & Patrick, timber, 14.4¢ c. f., **79,** 1645.

1880. C. S. Barker, furnishing dr., $7.95 per hour; Williams & Upham, furnishing dr., $12.50 per hour; C. S. Barker, canal excavation, 35¢ c. y.; W. S. Pope, furnishing brass and ironwork, 8¢ lb.; J. Hickler, furnishing dr., $7.48 per hour, **80,** 2070. Failure of Larkin & Patrick, **81,** 2264.

1881. C. S. Barker, dr. St. Marys R., 15½¢ c. y.; C. S. Barker, r. removal, $1.80 c. y., and revet. constr., 12¢ c. f., in the canal, **81,** 2266.

1883. J. Hickler, dr. on Middle Neebish, 72¢ c. y., **83,** 1838.

1884. J. Hickler, dr. on Middle Neebish, 58¢ c. y., **85,** 2098.

1885. Hickler & Green, dr. on Middle Neebish, 89¢ c. y., **85,** 2098.

1886. Hickler & Green, hire of dr. on canal enlargement; C. E. Mitchell, constr. of crib ps.; Durcharme, Fletcher & Co., iron, **87,** 2216, 2218; Hickler & Green, dr., $1.95 c. y., on Neebish Rapids, **87,** 2239, 2246.

1887. Carkin, Stickney & Cram, hire of dr. on canal enlargement, **87,** 2216, 2218. H. D. Edwards & Co., ship chandlery, $1,670.65, **88,** 1942.

1888. Hickler & Green, drilling and blasting, $4.47 per hole, **88,** 1929. W. R. Santley, white oak timber, $54 M f. b. m., **88,** 1942.

1889. L. E. Allen, p. constr. $49,042, **89,** 2215. Collins & Farwell, lock-pit excavation, $220,667; P. M. Church & Co., ship chandlery, $1,089; S. C. Forsaith Machine Co., "Cameron" steam pump and equipment, $1,137.11, **89,** 2216. H. M. Loud, lumber, $6,192.50, **89,** 2228, 2243. Fletcher, Jenks & Co., round iron, $1.93½ cwt.; P. M. Church, hardware, $1,032.56; Johnson & Goss, pine timber and lumber, $2,682, **90,** 2688, 2689, 2700, 2701.

1890. J. Hickler & Son, coal, $1,358.80; Soo City Machine Co., machine work, $2.20 per hour, **90,** 2689, 2690, 2718.

1891. Hughes Bros. & Bangs, furnishing all materials and building the masonry of a lock at St. Marys Falls Canal, $1,268,500, **91,** 2720. G. Kemp, coal, $1,292, **91,** 2720. J. H. Killmaster & Co., white pine, $22 M f., and hemlock timber, $13.50 M f.; Fletcher, Jenks & Co., drift bolts, 2¾ ¢, and spikes, 2¾¢ lb., **91,** 2721. W. S. Pope, furnishing 2 lock valves, $1,563.30; P. M. Church & Co., ship chandlery, $1,087.66; E. D. Weimer, pine timber, $7,310, **91,** 2729. Russell Wheel & Foundry Co., 4 valve frames, $4,367.30, **91,** 2730.

The following contracts were entered into for Hay Lake Chan.: J. Hickler, dr., $1.20 c. y. in bank; Dunbar & Sullivan, dr., 57¢ c. y.; Carkin, Stickney & Cram, dr., 14¾¢ c. y.; C. F. & H. T. Dunbar, dr., 14¢. c. y.; Carkin, Stickney & Cram, dr., 13 and 14¾¢ c. y.; Richmond & Backus Co., stationery, $1,043.32, **91,** 2763. King Iron Bridge & Manufacturing Co., ironwork, $20,477; J. Ryan, delivering clay, $2,632, **92,** 2403.

1892. G. Kemp, coal, $1,246; J. P. McGuire, 12 valve frames, $26,862.96, **92,** 2404.

The following contract was entered into under operation and care of canal: Chas. Hebard & Sons, lumber, $1,057.50, **92,** 2436.

1892. Dunbar & Sullivan, r. excavating, $1.47 and $1.53 c. y., b. m., **93,** 3023.

1893. Hughes Bros. & Bangs, constr. floors of 800′ lock, $208,192, **93,** 2997; mfg. and delivery of snub hooks, $1,598.40; turbine power plant, $37,691.04, **93,** 2998. R. J. Cram, dr., 12.9¢ c. y., s. m. **93,** 2999. W. S. Pope, gates for 800′ lock, $182,608.99 **94,** 2294. Southwark Foundry & Machine Co., pumping plant for 800′ lock, $24,935, **94,** 2295.

List of bidders for various misc. supplies, **93,** 2998.

1894. J. M. Lally, constr. clay dam, 800′ lock, $8,527.50. S. Dumond, excavating within cofferdam, 45¢ and $1.25 c. y. ($19,152); building cribs within cofferdam, framing 6½¢ c. f., filling 40¢ c. y. ($4,800). Michigan Brass & Iron Works, metal sill valves, $2,390. **94,** 2295–2296. J. V. Gearing, power house and office building for 800′ lock, $118,807. J. P. McGuire, operating machinery for 800′ lock, $59,400. **95,** 2895.

List of bidders for various misc. supplies, **94,** 2295.

1895. J. B. Donnelly, imp. R. at the falls; removing material from movable dam and constr. ps. for lock approaches, $165,197.91, **95,** 2896. F. S. Shurick, snubbing post, $4.50 per 100 pieces white oak. Dunbar & Sullivan, earth excavating 28¢ c. y., r. excavating $10 c. y. ($45,396). W. A. McGillis & Co., earth excavating, 14½¢ c. y. ($1,735.65). **96,** 2785.

List of bidders for various misc. supplies, **95,** 2896.

1896. Manhattan Cement Co., Portland cement $2.36 bbl. ($2,360). Russell Wheel & Foundry Co., well gratings and snubbing buttons, $2,313.52. **96,** 2786.

List of bidders for various misc. supplies, **96,** 2786.

1897. H. W. Hubbell & Co., dr. and submarine r. excavating, 94¢ c. y., b. m., **98,** 2560.

1898. Hingston & Woods, dr. e. approaches to Weitzel Lock. S. Dumond, dr. w. approaches to Weitzel Lock. J. F. Arnott, grading. **99,** 2960.

1902. The Soo Lumber Co., timber, $26.80 M f., **03,** 2008.

1903. Louis Belanger, clay, 39¢ c. y.; P. H. Sheppard, clay, 39¢ c. y., **03,** 2008.

1904. M. Bennett, clay for cofferdam, $1,386, **04,** 3097.

1905. Municipal Contracting & Engineering Co., concrete mixer and engine, $778.50, **05,** 2246.

1906. Allis Chalmers Co., r. crusher, $1,900; **06,** 1855. J. A. Lamontagne, limestone r., $3,360; Alpena Portland Cement Co., Portland cement, $2,697.30, **07,** 2012.

1907. Elk Cement & Lime Co., Portland cement, $1.51 bbl.; H. B. Waite Lumber Co., timber, $7,448.04; T. L. Durocher, steam derrick boat, with diving plant (4 contracts), prices given; O. G. Brubaker and A. McKechnie, excavating and building dike, $4,355.94; The Soo Lumber Co., timber, $5,974.30, **08,** 2079–82.

1908. Great Lakes Dredge & Dock Co., excavating, channeling, building cribs, mixing and placing concrete, prices given; Fiborn Limestone Co., crushed st., $300; Louis Belanger, clay, $1,470; The Soo Hardware Co., iron and steel, prices given; A. B. MacDonald and Geo. F. Fagan, excavating, constr. clay wall, etc., $3,300; A. McKechnie, clay, 52¢ c. y.; Great Lakes Dredge & Dock Co., time work by dr. plant, $5,900; Pittsburgh Forge & Iron Co., bolts, rods, etc., $1,000; Peninsula Bark & Lumber Co., timber, $11,000; Henry Watson, excavating and depositing material, $2,200, **08,** 2079–82. Burt Portland Cement Co., Portland cement, $9,000; A. McKechnie, filling and grading, $887.69; Tymon Lumber Co., timber, $4,149.63; Alex Moffatt, clay, $2,567.40; J. E. Ogden, drift bolts and twisted steel bars, $3,131.23; Hickler Bros., dr. for cofferdam, $6,337.64; Great Lakes Dredge & Dock Co., excavating and depositing material, $38,534.45; R. J. Clark, timber, $22,490.81; Rye & Fleming, clay, $2,511.33; N. G. De Haas, timber, $4,081.98, **09,** 2064, etc.

1909. Carmine Talarico and Henry Watson, excavating and depositing material, $3,136.27; Minneapolis Steel & Machinery Co., steel, $7,000; Lackawanna Steel Co., steel piling, $5,463.56; T. L. Durocher, time work with steam derrick and diving plant, $2,000; J. E. Ogden, driftbolts and steel bars, $1,200; F. E. Carpenter Co., iron fence, $1,178.92; Newbegin Lumber Co., timber, $2,500; Lawrence D. Weaning, furn. material and constr. superstr. of movable dam, $120,000, **09,** 2064, etc. Lehigh Portland Cement Co., Portland cement, $5,905.94; Alpha Portland Cement Co., Portland cement, $5,183.35, and $5,425; John Marsch, excavating lock pit, $350,000; T. B. Spear & Sons, Portland cement, $5,693.75; Great Lakes Dredge &

[1] Contract annulled, **76,** ii, 524.

Dock Co., dr., $4,683.93; T. L. Durocher, steam derrick boat, with diving plant, $2,109.88, **10,** 2225.

1910. G. Elias & Bro., pine timber, $5,500; White Star Lumber Co., fir timber, $11,200; Waterbury Co., electric-power cable and wire, $3,450; Standard Underground Cable Co., light and telephone cables, $1,477.09; E. D. Weimer, hemlock lumber, $32,000; Pittsburgh Screw & Bolt Co., bolts, rods, etc., $6,900; Jones & Laughlin Steel Co., twisted steel bars, $1,050; Northern Electric Co., transformers and oil switch, $1,337; W. B. Earle, oak timber, $815; Lehigh Portland Cement Co., Portland cement, $4,817.32; Minneapolis Steel & Machinery Co., rods, clevises, etc., $1,247.94, **10,** 2225. Lawrence D. Weaning, steel, $7,023.51; MacArthur Bros., excavating, channeling, building dike, cribs, etc., $680,000, **11,** 2421.

1911. Milwaukee Bridge Co., constr. sluice gates, $26,000, **11,** 2421. John Schroeder Lumber Co., fir timber, $7,000; C. M. McCoy, fir timber, $24,000; The Stearns Salt & Lumber Co., hemlock timber, $7,246.46; Penn Bridge Co., steel and iron for lock constr., $32,000; Great Lakes Dredge & Dock Co., furn. plant and materials and constr. concrete masonry of new lock, $1,055,000 (prices given), **12,** 2620, etc.

1912. American Steel & Wire Co., electric cables (prices given); Waterbury Co., telephone and series arc cables (prices given); Great Lakes Dredge & Dock Co., constr. e. approach to new lock (prices given); MacArthur Bros. Co., constr. w. canal, section 2 (prices given); Pittsburgh Screw & Bolt Co., manf. steel, etc., for canal ps. (prices given); Penn Bridge Co., furn. plant and materials and constr. lock gates, $115,000; Berthold & Jennings Lumber Co., oak timber, $5,000, **12,** 2620, etc.

DOCUMENTS. (Not published in reports.)

Rs. of Capt. Whipple in 1865, **66,** 4, iv, 63–66.

ENGINEERS.

Chief of Engineers. R., 66, 4, ii, 41, iii, 4, 7, 34, iv, 67; **67,** 27, 252; **68,** 36; **69,** 34; **70,** 44, 45, 162; **71,** 42, 43; **72,** 39, 40; **73,** 40; **74,** 45; **75,** 50; **76,** 103, 104; **77,** 109, 110; **78,** 124; **79,** 167; **80,** 222, 223; **81,** 301, 302; **82,** 295, 296; **83,** 299, 300; **84,** 301, 302. 303; **85,** 325, 326, 332, 2105; **86,** 318, 319; **87,** 286, 287; **88,** 259, 260, 261; **89,** 307, 308; **90,** 275, 276, 277; **91,** 345, 346, 347; **92,** 331, 332, 333; **93,** 390; **94,** 363; **95,** 399; **96,** 353; **97,** 437; **98,** 426; **99,** 506; **00,** 570; **01,** 564; **02,** 487; **03,** 534; **04,** 583; **05,** 592; **06,** 666; **07,** 687, 698; **08,** 717; **09,** 755; **10,** 834, 860; **11,** 888, 914; **12,** 1061, 1091.

Boards. Recom., 1858, abandonment of w. chan., Lake George, and adoption of middle chan., **66,** iv, 63.

In charge:

Capt. A. Canfield, 1853; **77,** 924.

Capt. A. N. Whipple, 1859, **66,** 4, iv, 63–66.

Col. T. J. Cram, 1866–70; **66,** ii, 41. **R., 66,** iv, 62–68; **67,** 147, 148, 230–233, 253–255; **68,** 139, 151, 152; **69,** 105, 106, 113; **70,** 162.

Maj. W. McFarland, 1870; **70,** 150.

Maj. O. M. Poe, 1870–73; **70,** 150.

Maj. G. Weitzel, 1873–83; **73,** 40. **R., 73,** 286; **74,** 196; **75,** 266; **76,** ii, 523; **77,** 921; **79,** 1641; (Lt. Col.) **80,** 2067, 2071; **81,** 2263, 2267; **82,** 2341, 2355, 2358.

Capt. A. Mackenzie, in temporary charge, 1878. **R., 78,** 1217.

Maj. F. U. Farquhar, 1883; **83,** 1835.

Capt. D. W. Lockwood, 1883; **83,** 1835.

Lt. Col. O. M. Poe, 1883–. **R., 83,** 1836; **84,** 2004, 2011, 2016, 2030,; **85,** 2098, 2104, 2108, 2124, 2186; **86,** 1777, 1783, 1789, 1809, 1823; **87,** 2214, 2220, 2227, 2238; (Col.) **88,** 1924, 1930, 1932, 1937, 1953, 1954; **89,** 2210, 2218, 2220, 2223, 2237, 2238; **90,** 2684, 2690, 2695, 2710, 2714; **91,** 2712, 2722, 2724, 2739, 2752, 2758; **92,** 2398, 2421, 2426, 2430, 2443; **93,** 2991; **94,** 2287; **95,** 2779.

Lt. Col. G. J. Lydecker, 1896–1901. **R., 96,** 2779, **97,** 2963; **98,** 2554; **99,** 2960; **00,** 3952; **01,** 3161.

Maj. W. H. Bixby, 1902–04. **R., 02,** 2201; **03,** 2006.

Lt. Col. C. E. L. B. Davis, 1904–08. **R., 04,** 3096; **05,** 2244; (Col.) **06,** 1853; **07,** 2009.

Capt. G. R. Spalding, **08,** 715.

Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2075; **09,** 2060; (Col.) **10,** 2220; **11,** 2416; **12,** 2616.

Assistants:

Capt. F. U. Farquhar, **66,** ii, 41.

Capt. G. J. Lydecker, **67,** 147; **68,** 140, 151.

Capt. H. C. Wharton, **69,** 34, 114, 115. **R., 70,** 158.

A. Noble. **R., 71,** 165; **75,** 266; **76,** ii, 523; **77,** 922; **78,** 1219; **79,** 1644; **80,** 2070, 2071; **81,** 2266; **82,** 2343.

H. A. Ulffers. **R., 74,** 198.

Capt. A. N. Lee, **74,** 45; **75,** 50; **76,** 103; **77,** 109.

E. S. Wheeler. **R., 84,** 2005, 2018; **85,** 2102, 2110; **92,** 2404; 93, etc., **93,** 2999; **94,** 2296; **95,** 2896; **96,** 2786; **97,** 2967.

Capt. H. F. Hodges. Memoir on constr. of lock gates, **95,** 3028.

F. H. Reed. **R., 94,** 2363–2366.

D. Molitor. **R., 95,** 3024.

J. Kennedy. **R.** on machinery, **97,** 2994.

F. M. Dunlap. **R.** on machinery, **97,** 2975.

B. Rohnert. **R., 98,** 2554.

J. L. Callard. **R., 98,** 2556.

J. Ripley. **R., 99,** 2962; **00,** 3953; **01,** 3171; **02,** 2204; **03,** 2008; **04,** 3098; **05,** 2246.

1st Lt. L. H. Rand, **04,** 581; **05,** 590.

Capt. G. R. Spalding, **08,** 715; **09,** 753.

ESTIMATES. (See Plans and Projects.)

By Capt. Whipple, 1859, dr. R., $50,000, **66,** 4. To complete middle chan., Lake George, $71,010; and East Neebish Chan., $14,290, **66,** iv, 63.

By Col. Cram, 1866, complete the R. imp., $445,000, **66,** iii, 34; aggregate for R. imp., $423,983, **66,** iv, 66, 73; revised, in 1867, to $437,313, **67,** 255. 1867, to complete, $323,983, **67,** 148, 230. 1868, to complete, exclusive of canal, $398,983, **68,** 36, 140, 151. 1869, for various imp. of R., $141,021, **69,** 34, 106.

By Maj. Poe, 1870, R. imp., $155,021.06; canal imp., $1,000,000 to $1,200,000, **70,** 160, 161, 162. 1872–73, abstract of monthly ests. for materials and labor, **73,** 288. 1872, new locks, $1,159,330, **74,** 197.

By H. A. Ulffers, 1874, imp. of Hay Lake Chan., $3,136,977, **74,** 199.

By Maj. Weitzel, 1876, complete proj., except locks, $265,000; for proposed imp. of upper end of canal, $210,000, **76,** ii, 525. 1877, for completion of existing projs., $570,000, **77,** 925. 1879, for completion of canal, $195,000, **79,** 1643.

LEGAL PROCEEDINGS.

Suit was brought against the U. S. in 1895 by the contractors for the constr. of the lock pits of the 800′ lock, **96,** 2782.

Negotiations for securing land for w. above locks entered into, **03,** 2007.

Land purchased from R. D. Perry, $148,000, **04,** 3096.

Land purchased from owners at total cost of $122,600, **05,** 2247.

Land purchased and deeded to U. S., **06,** 1854; **07,** 2010; **08,** 2075; **09,** 2060; **10,** 2223; **11,** 2419.

HISTORY.

See footnote to Operations.

LEGISLATION.

Michigan resolved to cede canal to the U. S., **69,** 106; **70,** 163. Addl. legislation necessary to secure right of way, or ownership of land by the U. S., **71,** 166. Commissioners appointed by State au. to condemn lands needed for enlargement of canal, **71,** 166, 167; **72,** 39, 195–198; **73,** 286; **74,** 45.

Acts of State of Michigan trans. control of canal to the U. S., **81,** 2267.

Acceptance of canal by U. S., au. by act June 14, 1880, under conditions stated therein.

State aid for constr. of canal, **82,** 2360; **86,** 1792.

Relating to operation of canal, **80,** 278.

Relating to use of old lock as dry dock, **82,** 388.

Relating to transfer of old canal, **80,** 278.

Act June 13, 1902, diverted $20,000 of unexpend. balances of app. for imp. at Sailors Encampment, $20,000 for expenses of a special commission, $85,000 to St. Clair Flats Canal, the balance remaining to be expend. in w. and imp. St. Marys Falls Canal; also gives au. to Lake Superior Power Co. to divert water from St. Marys R. into water-power canal now being constr. by them, **02,** 2201, 2202.

Sec. of War approves plan for water-power canal of Michigan Lake Superior Power Co., Dec. 12, 1902, as au. by act June 13, 1902, **03,** 641.

OBSTRUCTION.

Delays from accidents during 1899 and approx. money loss, S. Doc. No. 80, 56, 1.

OPERATIONS.[1]

1866-67. Dr. in middle chan., Lake George; 80 c. y. removed, **67,** 147, 148.

1867-68. Dr. 138,415 c. y. from middle chan., **68,** 36, 140.

1868-69. Dr. 76,342 c. y. from middle chan., **69,** 34, 105.

1869-70. 26,397 c. y. removed from middle chan., **70,** 44, 158. Work begun on imp. and enlargement of canal to give 14′, **70,** 160.

1870-71. Bowlders and earth dr.; ledge of limestone blasted and removed by diver; 30,383.17 c. y. r. and 4,307.19 c. y. gravel removed from canal, **71,** 42, 162, 165.

1871-72. 17,741.16 c. y. r. and 26,839.40 c. y. gravel removed from canal; 57,681.11 c. f. of revet. and the guard gates built, **72,** 40, 201.

1872-73. 40,404 c. y. r. and 20,572 c. y. gravel excavated from canal; 32,120 c. f. framing and 23,337 c. f. revet. built, **73,** 286, 287, 288.

1873-74. Work on old prism, of d. and w., p. revet. and lock pit for new lock nearly completed, **74,** 45, 46.

1874-75. Materials delivered and labor performed, **75,** 50, 266, 270.

1876-77. 54,637 c. f. of cut st. delivered; 113,373 c. f. of masonry laid; arm bet. s. p. at foot of new locks and the shore line filled to the level of the shore and banks of canal raised, **77,** 109, 110.

1877-78. Work on locks and s. p.; dr. a shoal below the canal, **78,** 124, 1219.

1878-79. Work on lock and s. p., **79,** 167, 1644.

1879-80. By hired labor and purchase in open market and also by contract, work was in progress on the locks and on the excavation of material over shallow areas in the canal, **80,** 2070. Under contracts the excavation of 5 shoals was in progress in St. Marys R., **80,** 2071.

1880-81. Progress on canal constr., **81,** 2267. Dr. and removal of bowlders from shoals in St. Marys R., **81,** 2267. Canal transferred to the U. S., **84,** 2030. Operation of canal by U. S., **81,** 2267.

1881-82. Progress on canal constr., **82,** 2343. Dr. and r. removal from E. Neebish, **82,** 2344. Tests of cement, **82,** 2345. Operation of canal by U. S., **82,** 2355.

1882-83. Extension of lock bulkheads and constr. of slope wall at locks; removal of 10,912 c. y. from chan. approaching lock and 14,361 c. y. from w. chan. of E. Neebish, **83,** 1839. Formation of a 17′ dr. chan. through Lake George, **83,** 1840. Operations of canal by U. S., **83,** 1846.

1883-84. Repairs at locks and imp. of grounds, **84,** 2014, 2017. 118,180 c. y. dr. from Middle Neebish, **84,** 301, 2006; **86,** 1805. Operations of canal by U. S., **84,** 2016.

1884-85. 135,664 c. y. dr. from Middle Neebish, **85,** 2098, 2102; **86,** 1805. Operations of canal by U. S., **85,** 2108, 2111.

1885-86. 90,280 c. y. removed from Middle Neebish, **86,** 1779, 1805. Operations of canal by U. S., **86,** 1783, 1791, 1809.

1886-87. Canal enlargement commenced; 15,700 c. y. removed by dr.; operations of drilling scow, **87,** 2116. Operation and care of canal, **87,** 2227. 10,863 c. y. removed from Neebish Rapids, **87,** 2239–2241.

1887-88. Progress on new lock, **88,** 1925. 1,224 l. f. of p. extension and cofferdam cribwork completed, and 2,115 c. y. clay puddling placed in cofferdam; 32,165 c. y. dr. from chan. in front of Ft. Brady Reservation, **88,** 1925. Dr. in canal above movable dam, **88,** 1926. Operation and care of canal, **88,** 1937, 1943. Progress on dry dock, **88,** 1953. Dr. at Middle Neebish, **88,** 1955.

1888-89. 49,669 c. y. puddling clay placed in cofferdam, **89,** 2211. Excavation of lock pit begun and 10,589 c. y. removed; r. removal above movable dam completed, **89,** 2212. Pile p. at Ft. Brady begun and 1,460 l. f. of piling driven, **89,** 2213. Operation and care of canal, **89,** 2223, 2229. 46,520 c. y. dr. from Hay Lake Chan., **89,** 2238. Progress in excavation of Middle Neebish Chan., **89,** 2239, 2240.

1889-90. 12,638 c y puddling clay placed in cofferdam, **90,** 2685. 95,261 c. y. earth and 9,956 c. y. r. excavated from lock pit; 4,961 c. y. st. removed from old lock walls and piled; 30,293 c. y. placed behind Ft. Brady p ; p. at Ft. Brady completed to 1,434′, **90,** 2686. Operation and care of canal, **90,** 2695. Progress on Middle Neebish Chan., **90,** 2716.

1890-91. Repairs to break in cofferdam, **91,** 2713. 120,880 c. y. earth and r. removed in excavation of lock pit, 468 c. y. of retaining wall built, and 35,139 c. y. placed behind Ft. Brady p., **91,** 2715. Masonry constr. in progress, **91,** 2716. Operation and care of canal, **91,** 2724. 20,958 c. y. dr. from chan. at Middle Neebish, **91,** 2761.

1891-92. 5,764 c. y. removed in excavation of lock pit; 8,478 c. y. of concrete and 9,547 c. y. of cut st. and backing st. laid, **92,** 2399. 12,000 c. y. removed in excavation of a chan. around a vessel sunk in the canal, **92,** 2424. Operation and care of canal, **92,** 2426. 921,732 c. y. dr. at Hay Lake Chan., **92,** 2445, 2446.

1892-93. 9,242 c. y. concrete, 8,065 c. y. cut st., and 26,271 c. y. backing st. laid; 11,172 c. y. earth filling placed, **93,** 2993. 82,504 c. y. r. excavated from canal prism, **93,** 2993. Models of lock of 1881 and of 800′ lock completed and sent to the Columbian Exposition at Chicago, **93,** 2994; cement, and other tests made, **93,** 3009.

1893-94. 1,280 c. y. concrete, 8,309 c. y. st., and 14,700 c. y. backing st. laid, **94,** 2289. 55,748 c. y. earth filling placed, 100,523 c. y. r. excavated; dam bet. the locks constr., and a 100′ p. built at old Ft. Brady, **94,** 2290. Constr. of clay dam bet. canal and R. commenced; 59,843 c. y. earth excavated from "Elbow"; turbine plant, lock gates, and floor of 800′ lock under constr.; 5,135 c. y. earth excavated for n. p. within cofferdam, **94,** 2291; 4,777 c. y. earth and 150 c. y. r. excavated for cribs within cofferdam, and 2,165 c. f. timber framed, **94,** 2292; cement, and other tests made, **94,** 2293.

1894-95. Masonry work in progress, 6,224 c. y. filling placed, 14,086 c. y. concrete laid, 4,379 c. y. r. removed, machinery of 800′ lock in course of erection, constr. of cribs within cofferdam and of clay dam in progress, erection of lock gates in progress, **95,** 2890. Power house and office building under constr.; 71,712 c. y. r., b. m., excavated from canal prism, **95,** 2891; cement, and other tests made, **95,** 2891.

1895-96. Masonry work and constr. of lock floors and culverts in progress; erection of machinery continued and some parts tested; 1,240 c. y. earth and 1,098 c. y. r. excavated for cribs within cofferdams; 1,294 c. y. material excavated; 817 c. y. clay placed in puddle wall; 1,187 c. y. embankment built for clay dam, and over 11,310 c. y., b. m., r., etc., excavated from canal prism, **96,** 2782; 75,117 c. y. shoals removed; 105,620 c. y. earth and 20,362 c. y. r. removed for side ps. of lock approaches, and large quantities of other materials placed for the constr. of the ps.; constr. of power house and office building continued, **96,** 2783; cement and other tests made, **96,** 2783.

1896-97. D. of canal prism almost completed, and 32,480 c. y. shoals removed, **97,** 2963; 42,225 c. y. r. and earth excavated from lock approaches, and large quantities of other materials placed in the constr. of the ps. for the approaches; power house and office building almost completed; 8,163 c. y. dr. from shoal below lock, and 3,956 sq. y. concrete walks constr., **97,** 2964; new lock opened to navigation Aug. 3, 1896; cement tests made, **97,** 2965.

1897-98. Over 39,263 c. y. excavated from w. approach to canal; sill of old movable dam removed and 4,082 c. y., b. m., of material removed in d. chan. in that vicinity; safety gates in canal

[1] Early history of imp., **66,** iv, 63. Historical and descriptive sketch, illustrated, **77,** 922–924; **79,** 1644, **86,** 1792. Historical notes, **12,** 2646. For details, see **Rs.** of Assistants.

to replace old movable dam completed, and power house and office building completed, **98,** 2554.

1898-99. 31,893 c. y. dr., completing w. approach to canal; e. and w. approaches to Weitzel Lock d. by excavation of 20,474 c. y.; about 20,000 c. y. handled in grading grounds; trees planted, and much misc. work done, **99,** 2960.

1899-00. 416′ crib p. extension constr. in ne. approach to Poe Lock; minor work of dr., bowlder removal, concrete walk constr., etc., **00,** 3952.

1900-01. Building 240 l. f. cribwork in extension of ne. p., Poe Lock, erecting 3 st. buildings on lock walls, imp. of canal grounds, and ex. and sur. to ascertain condition of chans., **01,** 3162.

1901-02. Two st. buildings erected, footpaths built, ex. and sur. of chan., and office building moved, **02,** 2203.

1902-03. Work on 2,500′ l. of first-needed portions of cofferdam commenced, plans prepared for movable dam, floors in power house raised 5″ with concrete, sidewalk built, and other misc. work, **03,** 2009.

1903-04. 2,000′ cofferdam constr., gauges read, sur. made, r. borings, etc., **04,** 3096.

1904-05. Work on cofferdam in progress, plans and sur. made and other misc. work, **05,** 2245.

1905-06. Specifications for w. canal prepared, bids to be opened July 24, 1906, and negotiations for purchasing land in progress, **06,** 1854.

1906-07. New plans and specifications prepared, purchase of land in progress, and st. crusher, cofferdam, etc., constr., **07,** 2010.

1907-08. Widening canal; 39,401 c. y. excavated, constr. of center p., abutments, and sill for dam finished, and plans for further work prepared. Lock and canal: Constr. of 1,600′ cofferdam, 20,000 c. y. excavated from lock pit for use in cofferdam, and misc. work in connection therewith, **08,** 2076.

1908-09. Widening canal: 287,163 c. y. excavated, and 2,253 c. y. concrete placed in canal walls. Lock and canal: Constr. of cofferdam around lock pit; excavation of 97,733 c. y., **09,** 2060.

1909-10. Widening canal: 198,044 c. y. excavated, 21,134 s. f. channeling, 8,466 c. f. timber framed and placed, 1,812 c. y. filling, 26,449 c. y. concrete in canal walls, mitering gates for w. canal constr., extension of tunnel for passing electric wires under w. canal and riprapping old dock. Lock and canal: Constr. of cofferdam around lock pit and of excavation of 181,191 c. y. earth and r. and 38,526 s. f. channeling on site of new lock, **10,** 2220.

1910-11. Widening canal: 42,795 c. y. excavated, 3,733 s. f. of channeling, 36,411 c. f. timber framed and placed, 9,124 c. y. filling, 165 c. y. concrete in canal walls; work of canal w. completed. Lock and canal: Work on excavating lock pit consisted in excavating 194,086 c. y., channeling 57,054 s. f. r., constr. w. portion canal and new head race for power plant, removing 11,135 c. y. material, 137,157 c. f. timber framed, 3,170 c. y. filling placed and other misc. work, **11,** 2416.

1911-12. Work on w. canal completed, and work on new lock and canal in progress, **12,** 2616.

PERMITS.

See Surveys, part b, p. 1428.

PHYSICAL CHARACTERISTICS.

66, iv, 64; **69,** 113, 115; **70,** 44, 158; **71,** 163.
Mean elevation of water, **71,** 169; **72,** 202.
Of Hay Lake Chan., St. Marys R., **74,** 199.
Of R. and rapids, **77,** 922.
Sketch showing water curve of 1877–78, **78,** 1218.
Stages of water and rainfall records, **82,** 2344; **83,** 1840; **84,** 2016.
Description of St. Marys R., **82,** 2358.
Description of bench marks, **84,** 2008; **87,** 2242.
Water-level observations, **87,** 2217, 2242.
Mean elevation of Lake Superior water surface above sea level for 1887–88, **88,** 1927. Mean elevation of Lake Superior water surface above mean tide at New York, **90,** 2692.
Lake levels, **93,** 2995, 2996; **94,** 2292; **95,** 2893; **96,** 2783; **97,** 2965; **98,** 2558; **99,** 2961; **00,** 3954.
Water levels (elevations), **01,** 3163, etc.; **02,** 2206; **03,** 2009; **04,** 3099; **05,** 2247; **06,** 1855; **07,** 2011· **08,** 2078; **09,** 2062; **10,** 2223; **11,** 2419.

Operations of private power companies inspected, and where necessary flow of water regulated, **07,** 2011; **08,** 2078; **09,** 2062; **10,** 2223; **11,** 2418; **12,** 2619.

PLANS. (See Estimates and Projects.)

By Col. Cram, 1866, imp. of R. by dr., revetting, and, perhaps, blasting, **66,** iv, 65, 67; **67,** 255; **69,** 106, 113–115. 1867. To d. and imp. canal, **67,** 255; **69,** 106, 107; **70,** 163.
By Maj. Poe, 1870, sheet piling 1,000 l. f. of dr. chan. in East Neebish; est., $20,000, **70,** 158.
By H. A. Uiffers, 1874, imp. of Hay Lake Chan., St. Marys R., by dr. and blasting; est., $3,136,977. **R.,** **74,** 198.

PRIVATE (CORPORATE) WORK.

Orig. canal, 12′ d., built by a private company at a cost of about $1,000,000, receiving 750,000 acres of land in payment that had been granted to Michigan by the U. S., **66,** iv, 66; **70,** 160; **77,** 922. Proposed transfer of the canal to the U. S., **78,** 1217; **79,** 1641.
Description of canal built by the State, **82,** 2360; **86,** 1792.
Misc. dr. by private parties (171,500 c. y. excavated), **03,** 2009.
See Legislation.

PROJECTS. (See Estimates and Plans.)

By BE., 1858, abandoning imp. of w. chan., Lake George, and adopting middle chan., **66,** iv, 63.
By Capt. Whipple, 1859, imp. of R. by dr.; est., $80,000, **66,** 4, iv, 63–65.
By Col. Cram, 1866, dr. middle chan., Lake George, 14′ x 300′, **66,** iv, 65, 67.
By Maj. Poe, 1870, removing bowlders, **70,** 160. For imp. and enlargement of canal to 14′ and new system of lockage; approx. est., $1,200,000, **70,** 160. 1871. Modifications of, **71,** 163, 164.
By Maj. Weitzel, 1876, imp. upper entrance to canal; est., $210,000, **76,** ii, 525. Historical and descriptive sketch of orig. proj. for canal and its enlargement illustrated, **77,** 922–924.
In 1852 a grant of 750,000 acres of public land was made to Michigan for the constr. of the canal. Grant trans. to a company who completed the canal and turned it over to the State in 1856, at a cost of $999,802.46. The canal as thus built was 12′ x 100′, provided with 2 locks 70′ x 350′, with lifts of 9′, **66,** iv, 66; **70,** 160; **77,** 922; **86,** 1792.
Previous to 1870 $210,692 app. by Congress, and applied to the imp. of the chan. of the R. through Lake George and the w. chan. of E. Neebish, **82,** 2361; **86,** 1793.
In 1869 Michigan provided for the future trans. of the canal to the U. S., **69,** 106; **70,** 163.
In 1870 Congress made the first app. for the enlargement of the canal to a w. of 100′–500′, with a d. of 16′, together with the constr. of a new lock 18′ x 80′ x 515′ lift; est., $2,460,000, **70,** 160; **71,** 163; **77,** 923; **79,** 1644; **82,** 2361; **86,** 1795.
In 1881 canal trans. to the U. S. by Michigan, **84,** 2030.
Canal enlargement completed in 1883; cost, $2,171,000; **82,** 2342; **86,** 1783, 1801, 1806.
In 1880 Col. Weitzel proposed further imp. of the chans. of St. Marys R., except through E. Neebish, to obtain chan. 16′ x 300′; est., $225,000, **80,** 2074.
In 1882 Col. Weitzel proposed chan. 17′ x 300′, passing through Sugar Isld. Rapids and Hay Lake, rejoining the American chan. via Middle Neebish; est., $2,127,292, **82,** 2367; **83,** 1836; **84,** 2004, 2016; **86,** 1802, 1805.
In 1885 proposed d. increased to 20′ and the est. cost to $2,659,115, **85,** 2100; **86,** 1778; **87,** 2238, 2245.
By Lt. Col. Poe, 1884, new lock 21′ x 70′ x 700′, built upon the site of the old locks, with a d. of the canal above and below the lock; est., $1,609,085, **84,** 2012. Increased in 1885 to $1,750,000, **85,** 2105. Revised in 1886 to $2,552,176, **86,** 1785.
By Lt. Col. Poe, 1884, dry dock 18′ x 330′, located near e. end of area trans. from Ft. Brady Military Reservation; est., $323,872, **84,** 2033; **85,** 2125.
Objections against use of old locks for dry dock, **84,** 2031; **85,** 2125.
History of past operations, **86,** 1792.

In 1886 Col. Poe revised the plan and est. of 1881 for the canal enlargement, wherein the proposed new lock was increased to 800′ bet. the gates, 100′ w. throughout, with 21′ of water on water sills; est., $4,738,865, **87,** 2215, 2217, 2220, 2223.

Act June 6, 1900, au. that $100,000 from the remainder of the app. for St. Marys R. at the falls should be used to imp. Lake George Chan., **00,** 3955.

Act June 13, 1902, au. w. and imp. St. Marys Falls Canal, **02,** 2202.

Act Mar. 2, 1907, au. proj. for constr. of new lock, with separate canal; est., $6,200,000 (H. D. 333, 59th, 2d), **07,** 688.

Act July 25, 1912 au. proj. for constr. of 4th lock; est., $3,275,000 (H. D. 64, 62d, 1st), **12,** 1062.

SURVEYS.

Under direction of Capt. Whipple, by J. H Forster, 1858, of middle chan., Lake George; map, **66,** i.

Under direction of Lt. Col. Graham, by O. N. Chaffee, 1863, **66,** iv, 64.

By Col. Raynolds, 1864, **66,** iv, 64.

Under direction of Col. Cram, by H. C. Wharton and Lts. Green and Haupt and a party under direction of Col. Raynolds, 1868, of parts of St. Marys R. **R., 69,** 113.

Under Maj. Poe, by A. Noble, 1871, of canal, **71,** 165.

Under direction of Maj. Weitzel, by H. A. Ulffers, 1874, of Hay Lake Chan. **R., 74,** 198–200.

By Maj. Weitzel, 1879, of approaches to canal for 16′ chan., **79,** 168, 1643.

Of navigable chans. of St. Marys R. au. act Mar. 3, 1879, **80,** 223; made by Col. Weitzel, **80,** 2071.

Bet. Middle Neebish and Sugar Isld., 1882, **83,** 1836; **84,** 2005.

R. of Lt. Col. Poe upon use of old locks at St. Marys Falls Canal as a dry dock, **85,** 2186.

Bench marks. (See Physical characteristics.)

Canal grounds resur., and an ice sur. of Bayfield Rock Shoal made in 1897 by Lt. Col. Lydecker, **97,** 2965.

Minor surveys, **99,** 2964; **00,** 3953.

Ex. and sur. au. by act Mar. 3, 1899, of waters connecting Lakes Superior and Huron. **R.,** by Col. Davis, Dec. 3, 1906; submits est. for a new lock, with canal; est., $6,200,000 (H. D. 333, 59th, 2d), **07,** 698.

R., by BERH. Dec. 29, 1906, concurring in Col. Davis's plan for new lock to cost $6,200,000. (R. and H. D. 44, 61st, 2d.)

Act Mar. 3, 1909, au. ex. and sur. with view to determining cost of constr. in the rapids filling basin or forebay, from which the ship locks shall be filled. **R.** by Col. Townsend, Dec. 7, 1909. As work already provided for amounting to $1,000,000 was in progress, further expend. thought unnecessary (H. D. 716, 61st, 2d), **10,** 860.

Pre. ex. and sur. au. act June 25, 1910, with view to constr. addl. lock. **R.** by Col. Townsend, Aug. 29 and Dec. 16, 1910; est., $3,275,000, with $45,000 an. mainten. (H. D. 64, 62d, 1st), **11,** 914.

Pre. ex. and sur. au. act June 25, 1910, with view to removal of shoals and reefs near Detour (**R.** to come), **12,** 1091.

Reference to ex. and surs. from 1855 to 1910, incl., **12,** 1063.

Maps:

(H. D. 64, 62d, 1st; H. D. 333, 59th, 2d.) **93,** 2994; **95,** 3048; **08,** 2078; **09,** 2062; **10,** 2224; **11,** 2418.

By J. H. Forster, showing dr. in middle chan., Lake George, **66,** i.

By Col. Cram, showing cross section of middle chan., Lake George, **66,** iv, 65.

By Maj. Weitzel, 5 plates, showing orig. and imp. canal, **77,** 924.

Of Northern and Northwestern Lakes, showing locality of St. Marys R. and Canal, **66,** i. Sketch of canal imp., 1878, **78,** 1218.

Of canal, **80,** 2068; **81,** 2267; **82,** 2342.

Of Middle Neebish, **84,** 2006.

Of Hay Lake Chan., **87,** 2241.

88, 1927, 1956; **90,** 2716; **91,** 2759; **92,** atlas, 112.

Harbor Lines:

At Sault Ste. Marie, **93,** 3037.

At Sailors Encampment Isld., **96,** 2897.

Part (b), PP-3 St. Marys River, Hay Lake and Neebish Channels, Mich.

APPROPRIATIONS.

Lake George Channel (86, 1793).

1856,	$100,000,	**66,** iii, 34, iv, 67.
1866,	50,000,	**66,** iii, 34, iv, 67.
1867,	50,000,	**67,** 27, 147.
1868,	[1] 10,000,	**86,** 1794, 1807. Act June 28, 1864.
1869,	[2] 10,692,	**69,** 22.
Total,	220,692	

Hay Lake Channel.

1882,	200,000,	**83,** 299.
1884,	125,000,	**84,** 2005.
1886,	150,000,	**86,** 1781.
1888,	500,000,	**88,** 1957.
1890,	400,000,	**90,** 2718.
1891,	300,000,	**92,** 2447.
1892,	115,000,	**92,** 2447.
1893,	225,000,	**93,** 3028.
1894,	150,000,	**95,** 3051.
1899,	100,000,	**99,** 2981.
1900,	250,000,	**00,** 3972.
1902,	144,115,	**02,** 2229.

Middle and West Neebish Channels.

1902,	500,000,	**02,** 2229.
1903,	800,000,	**03,** 2029.
1905,	1,200,000,	**05,** 2270.
1906,	1,000,000,	**06,** 1879.
1907,	1,000,000,	**07,** 2039.

Hay Lake and Neebish Channels.

1905,	$500,000,	**05,** 2270.
1908,	315,000,	**08,** 2109.
1909,	395,000,	**09,** 2094.
1910,	40,000,	**10,** 2256.
Total,	8,409,115	
Grand total,	8,629,807	

In addition to the above there was spent on river imp. about $10,000 of the $150,000 app. in 1870, $100,000 of the $300,000 app. in 1879, $40,000 of the $250,000 app. in 1880, and an unknown portion of the $150,000 app. in 1881; the balance being applied to lock and canal construction.

COMMERCE. (See pp. 1422, 1429.)

In 1896 the an. C. using the chan. value, $195,146,842.49, **97,** 3008.

C. 1894 to 1900, incl. (practically doubled), **01,** 567.

About 30,000,000 t. a year, **02,** 490.

In 1906 about 52,000,000 t., **07,** 692.

CONTRACTS.

1893. List of contracts for various misc. supplies, **93,** 3029. Hickler Bros., furnishing dr. plant $13.50 per hour, **93,** 3029.

1895. Dunbar & Sullivan, removing shoals, 65¢ s. y. ($21,255); R. J. Cram, cleaning up shoals, 16½¢

[1] Allotment. Part of $250,000 app. for Great Lakes Hs.
[2] Allotment made in 1869 from general app. of Apr. 10, 1869.

s. y. ($4,161.30); J. B. Sweatt, constr. quarters boat, $3,300, **95,** 3052. W. A. McGillis & Co., earth excavating, 10½¢ c. y. ($35,726.79), **96,** 2880.

1896. H. T. Dunbar, dr., 9.8¢ c. y., b. m. ($18,424); Hickler Bros., dr., 21.9¢ c. y., b. m. ($10,512); Hingston & Woods, dr., 34.5¢ c. y., b. m. ($7,003.50), **96,** 2880.

1897. H. W. Hubbell & Co., hire of dr. plant, $12.25 per hour of actual work, **97,** 3006. Hickler Bros., dr. and submarine r. excavating, $2.14 c. y., b. m., **98,** 2576.

1898. Thompson Towing & Wrecking Assn., tug, $37 per day, **99,** 2980.

1899. Hickler Bros., reinforcing dike; derrick scow with diver and crew, $4 per hour; attending tug, $1.80 per hour, **00,** 3970.

1901. Hickler Bros., reinforcing dike—derrick scow with diver and crew, $4.80 per hour; attending tug, $2 per hour, **01,** 3185.

1902. Henry Hickler, dr., 56¢ c. y. bank meas. (full rate), and 28¢ c. y., bank meas. (half rate); S. O. Dixon, dr., 11.4¢ c. y. bank meas. (full rate), and 5.7¢ c. y. bank meas. (half rate); Charles Simono, dr., 12¢ c. y., bank meas. (full rate), and 6¢ c. y. bank meas. (half rate), **02,** 2230.

1903. The Lake Erie Dredging Co., dr., $17.50 per hour; S. O. Dixon, dr., $18 per hour, **03,** 2032.

1904. H. W. Hubbell & Co., time work by dr. plant, $15 per hour; MacArthur Bros. Co., r. and earth excavation, $2,419,560; Chas. Simono, dr., $56,800; H. W. Hubbell & Co., dr., $67,404; S. O. Dixon, dr., $685,312.50; The Lake Erie Dredging Co., dr., $131,812.50; Chicago & Great Lakes Dredge & Dock Co., dr., $466,915.50, **04,** 3121.

1905. The Soo Lumber Co., fir timber, $5,-158.75; Frank Perry, hemlock timber, $4,805.15; J. A. Lamontagne, piles, $536.95, **05,** 2272.

1906. W. J. Freeborn, piles, $544.15; American Hoist & Derrick Co., one derrick outfit with engine and boiler, $1,588; Semande & Durocher, time work by steam derrick boat and diving plant, $5,785.04; The Soo Lumber Co., fir timber, $5,-156.28; Frank Perry, hemlock timber, $4,713.80; Great Lakes Dredge & Dock Co., time work by dr. plant, $46,818; Hickler Bros., dr., $102,000, **06,** 1880.

1907. The Soo Hardware Co., driftbolts, tie rods, washers, etc., $2,400; Peninsula Bark & Lumber Co., hemlock timber, $1,800; MacArthur Bros., excavations and constr. masonry wall ends, $5,810; The Lake Erie Dredging Co., dr. (time work), $65,000; Great Lakes Constr. Co., dr., $23,-962.50; H. W. Hubbell & Co., dr., $45,325, **07,** 2040.

1908. Great Lakes Dredge & Dock Co., dr., $580,000; Chas. Simono, dr., $80,000; Fiborn Limestone Co., crushed st., $800; N. G. De Haas, timber, $3,090.85; T. L. Durocher, time work by steam derrick boat with clamshell, $6.75 per hour, and dynamite, 16¢ lb.; Peninsula Bark & Lumber Co., piles, $1,698.30; T. L. Durocher, time work by steam derrick with diving plant, $2,000; Elk Cement & Lime Co., Portland cement, $981.50; T. L. Durocher, time work by steam derrick with diving plant, $2,192.48; Peninsula Bark & Lumber Co., hemlock timber, $12,738, **08,** 2111.

1909. F. X. Payment, constr. wooden tugboat, $7,668.50; Standard Contracting Co., earth excavation, $242,000; Lake Erie Dredging Co., dr., $83,000, **09,** 2095.

ENGINEERS.

Chief of Engineers. R., 93, 391; **94,** 364; **95,** 400; **96,** 354; **97,** 439; **98,** 427; **99,** 508; **00,** 573; **01,** 567, 570; **02,** 492; **03,** 537; **04,** 586; **05,** 596, 602; **06,** 670; **07,** 691; **08,** 722; **09,** 760; **10,** 839; **11,** 892; **12,** 1066.

In charge:

Col. O. M. Poe, 1883–95. **R., 93,** 3024; **94,** 2367; **95,** 3048.

Lt. Col. G. J. Lydecker, 1896–1901. **R., 96,** 2877; **97,** 3006; **98,** 2572; **99,** 2979; **00,** 3969; (Col.) **01,** 3185, 3201.

Maj. W. H. Bixby, 1902–04. **R., 02,** 2228; **03,** 2027.

Lt. Col. C. E. L. B. Davis, 1904–08. **R., 04,** 3118; **05,** 2269, 2291; (Col.) **06,** 1877; **07,** 2036.

Capt. G. R. Spalding, **08,** 715.

Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2105; **09,** 2092; (Col.) **10,** 2253; **11,** 2447; **12,** 2648.

Assistants:

D. Molitor. **R., 95,** 3052.

B. Rohnert. **R., 99,** 2979; **00,** 3970; **01,** 3185.

J. Ripley. **R., 02,** 2231; **03,** 2031; **04,** 3122; **05,** 2273.

1st Lt. L. H. Rand, **04,** 581.

Capt. G. R. Spalding, **08,** 715; **09,** 753.

HISTORY.

Of Imp., **95,** 3052.

LEGAL PROCEEDINGS.

Transfer of land to U. S., **01,** 3186.

OBSTRUCTIONS.

Sunken SS. closes navigation, **10,** 2255.

OPERATIONS.

1892-93. 1,537,303 c. y. dr., and a few dikes in course of constr., **93,** 3027.

1893-94. 393,124 c. y. dr., **94,** 2369, 2370.

1894-95. 433,582 c. y. dr., and chan. considered practically opened to traffic.

Historical sketch of the imp. prepared, **95,** 3052-3062.

1895-96. 90,676 c. y. dr., bank measure, **96,** 2878.

1896-97. 611,713 c. y. dr., bank measure, **97,** 3007.

1897-98. About 120,000 c. y. dr., **98,** 2573, 2574.

1898-99. 68,445 c. y. r. excavated; signal station and tug service estab. to help vessels in narrow chan. during dr., **99,** 2979.

1899-00. 10,744 c. y. r. excavated; dike reinforced by 2,300 c. y. r.; signal station and tug service discontinued. **00,** 3970.

1900-01. Dike reinforced by 2,414 c. y. bowlders, **01,** 3185.

1901-02. 918,983 c. y. dr., scow meas., **02,** 2228.

1902-03. 2,104,814 c. y. dr., **03,** 2028.

1903-04. 1,394,066 c. y. dr., **04,** 3118.

1904-05. 3,144,146 c. y. dr., **05,** 2269.

1905-06. 5,221,308 c. y. dr., and one steel SS. and 3 flat scows built, **06,** 1877.

1906-07. 2,395,199 c. y. dr., and constr. of cribs commenced at W. Neebish Chan., **07,** 2036.

1907-08. 1,113,447 c. y. dr.; constr. of dikes, deck scow, etc., **08,** 2105.

1908-09. 1,219,907 c. y. dr.; constr. and placing cribs, and wooden tugboat built, **09,** 2092.

1909-10. 1,219,341 c. y. dr., and wooden tug *West Neebish* constr., **10,** 2255.

1910-11. 77,896 c. y. dr., **11,** 2448.

1911-12. 1,480 c. y. dr., **12,** 2649.

PHYSICAL CHARACTERISTICS.

Description of, **01,** 3201.

Discharge of Middle Neebish and West Neebish Chans., **10,** 2255; **11,** 2449.

PROJECTS. (See History above.)

Proposed plans for 21′ chan. bet. Lake Superior and Lake Huron, **00,** 3971.

Act June 13, 1902, au. chan. 21′ x 300′, Hay Lake through the West Neebish to Mud Lake (H. D. 128, 56th, 2d), **02,** 2228.

SURVEYS.

Minor sur., **95,** 3049; **97,** 3008; **98,** 2574; **99,** 2980; **00,** 3971; **01,** 3186; **02,** 2231; **03,** 2032.

Plans and est. for 21′ chan. called for by act Mar. 3, 1899 (see Projects), **99,** 2980.

Sur. au. act Mar. 3, 1899, of waters connecting Lakes Superior and Huron, incl. Hay Lake Chan., with view to securing 21′ chan. **R.** by Col. Lydecker, June 4, 1900; est., $9,000,000 (H. D. 128, 56th, 2d), **01,** 570, 3200. Final **R.,** Col. Davis, Dec. 3, 1904; est., $10,160,000 (H. D. 215, 58th, 3d), **05,** 602, 2290.

Maps. (H. D. 215, 58th, 3d.) **93,** 3026; **96,** 2880; **02,** 2232; **05,** 2270; **06,** 1879; **07,** 2038; **08,** 2108; **09,** 2094; **10,** 2256; **12,** 2649.

WATER POWER.

Statement of permits, licenses, or other privileges granted by War Dept. in St. Marys R., for creation of water power or for occupancy of waters of said R. (H. D. 261, 59th, 2d.)

Part (c), PP-3 St. Marys Falls Canal, Mich. (Operating and care.)

ACCIDENTS, STRIKES, ETC.

See Physical Characteristics.

APPROPRIATIONS.[1]

1882,	$27,545.86
1883,	36,335.77
1884,	29,486.29
1885,	29,064.52
1886,	26,089.12
1887,	21,832.55
1888,	30,003.46
1889,	30,603.61
1890,	36,723.27
1891,	44,960.79
1892,	61,241.09
1893,	41,828.07
1894,	55,132.21
1895,	50,535.61
1896,	59,629.08
1897	79,207.15
1898,	56,674.16
1899,	89,000.88
1900,	80,309.27
1901,	75,559.34, **01,** 3173.
1902,	88,595.53, **02,** 2216.
1903,	82,946.09, **03,** 2011.
1904,	93,078.07, **04,** 3101.
1905,	85,422.92, **05,** 2248.
1906,	89,670.02, **06,** 1859.
1907,	89,827.26, **07,** 2015.
1908,	109,918.71, **08,** 2085.
1909,	106,514.26, **09,** 2070.
1910,	103,096.18, **10,** 2232.
1911,	149,626.01, **11,** 2425.
1912,	152,197.34, **12,** 2626.
Total,	2,112,654.49

COMMERCE. (See pp. 1422, 1427.)

Special **Rs.** on C. using the canal. Col. Poe, **93,** 2974; **94,** 2271; **95,** 2871. Lt. J. B. Cavanaugh, **96,** 2762. Lt. Col. G. J. Lydecker, **97,** 3004; **98,** 2564; **99,** 2965; **00,** 3956.

Discussion of statistics, **93,** 2976; **94,** 2273; **95,** 2875; **96,** 2764; **97,** 2999.

Panic of 1907 caused a diminution in traffic, **08,** 2085.

Growth of Lake Superior C., **12,** 2646.

Diagram of app., freight value and tonnage, **11,** 2440, 2442; **12,** 2628.

Tabular statement for each year, 1855 to 1911, **12,** 2641, 2642.

CONTRACTS.

Itemized list of expend., see each an. **R.**

1893-95. Lists of contracts for various misc. supplies, **93,** 2981; **94,** 2287; **95,** 2870.

1902. J. P. McGuire, 2 valve engines, $1,440, **02,** 2217.

1904. F. B. Spear & Sons, Portland cement, $1,809, **05,** 2249.

1907. F. B. Spear & Sons, Portland cement, $1,992.09, **07,** 2015. Elk Cement & Lime Co., Portland cement, $1,721 40; G. W. Gates & Co., fir timber, $3,163.46; T. L. Durocher, steam derrick boat, with diving plant, $500, **08,** 2086. T. L. Durocher, time work by steam derrick boat, with diving plant., $1,148.07, **09,** 2071.

1908. The Soo Hardware Co., iron and steel for new gates, $1,459.02, **08,** 2086. Fiborn Limestone Co., crushed st., $1,779.31; N. G. De Haas, oak timber, $167.47; Burt Portland Cement Co., Portland cement, $1,000, **09,** 2071. T. L. Durocher, time work by steam derrick boat, with diving plant, $308.47, **10,** 2232.

1910. W. B. Earle, oak timber, $432, **10,** 2232. G. W. Gates & Co., fir timber, $1,701.84; Minneapolis Steel & Machinery Co., iron and steel, $2,095.34, **10,** 2233. Michigan Bolt & Nut Works, bolts, rods, etc., $1,224.12; Great Lakes Dredge & Dock Co., repairs to s. canal wall, $34,296.94; L. D. Weaning, steel for canal gate, $2,820.91, **11,** 2426. Minneapolis Steel & Machinery Co., iron and steel, $2,029.92, **11,** 2425.

1911. Joseph Scales, crushed st., 82½¢ gross t. ($1,356.50); F. B. Spear & Sons, cement and sacks, $1,600; Cullen-Friestedt Co., repairs to s. canal wall $37,548.80, **12,** 2626.

ENGINEERS.

Chief of Engineers. **R.,** **93,** 390; **94,** 363; **95,** 398; **96,** 353; **97,** 438; **98,** 427; **99,** 507; **00,** 571; **01,** 565; **02,** 488; **03,** 535; **04,** 585; **05,** 594; **06,** 668; **07,** 690; **08,** 720; **09,** 758; **10,** 837; **11,** 891; **12,** 1065.

In charge:

Col. O. M. Poe, 1883–95. **R.,** **93,** 2970; **94,** 2267; **95,** 2867.

Lt. Col. G. J. Lydecker, 1896–02. **R.,** **96,** 2759; **97,** 2997; **98,** 2561; **99,** 2965; **00,** 3956; **01,** 3173.

Maj. W. H. Bixby, 1902–04. **R.,** **02,** 2215; **03,** 2010.

Maj. W. L. Fisk, **04,** 581.

Lt. Col. C. E. L. B. Davis, 1904–08. **R.,** **04,** 3100; **05,** 2248; (Col.) **06,** 1856; **07,** 2012.

Capt. G. R. Spalding, **08,** 715.

Lt. Col. C. McD. Townsend, 1908–12. **R.,** **08,** 2082; **09,** 2067; (Col.) **10,** 2228; **11,** 2422; **12,** 2623.

Assistants:

Lt. J. B. Cavanaugh. **R.,** **96,** 2762.

J. Ripley. **R.,** **99,** 2970; **00,** 3960; **01,** 3182; **02,** 2224; **03,** 2012; **04,** 3114; **05,** 2266.

1st Lt. L. H. Rand, **04,** 581; **05,** 590.

Capt. G. R. Spalding, **08,** 715; **09,** 753.

HISTORY.

See Physical Characteristics.

OPERATIONS.

1894-95. Lock floor and gates repaired, **95,** 2868.

1895-96. Repairs made to ps., **96,** 2759.

1896-97. Poe Lock opened for service and repairs made to ps. and machinery, **97,** 2997.

1897-98. Repairs made to machinery, **98,** 2561. Locks guarded by special details of deputy sheriffs and soldiers during war with Spain, **98,** 2561.

(For description of ordinary repair work performed, see references of officers' reports.)

1900-01. Repairs made to locks, **01,** 3173.

1901-02. Repairs to locks, etc., **02,** 2215.

1902-03. General repairs to locks and machinery, **03,** 2010.

1903-04. Extensive repairs to operating machinery, 10 new 12″ valve engines installed, and minor repairs to locks, **04,** 3100.

1904-09. Ordinary repairs to locks and machinery, **05,** 2248; **06,** 1856; **07,** 2013; **08,** 2083; **09,** 2068.

1909-10. Repairs to works; special repairs to operating gate, Poe Lock, **10,** 2229.

1910-11. Repair and mainten. to locks; upper service gate at Weitzel Lock replaced with solid timber gate of Oregon fir; timber revet. wall along slip, w. end of Ft. Brady Pier, repaired, **11,** 2423.

1911-12. Mainten. and repairs, s. canal gate completed and launched, and canal wall repaired, **12,** 2624.

PHYSICAL CHARACTERISTICS.

Height of water in locks and canal, **93,** 2971; **94,** 2268; **95,** 2867; **96,** 2759.

SS. *W. E. Lynn* caused considerable damage to Poe Lock by collision, **01,** 3173.

SS. *Robert Fulton* damaged gate on Poe Lock; canal service interfered with by strike of tugboat employees, **02,** 2215.

Historical notes on canal, **03,** 2024.

[1] Expend. under the permanent indefinite app. provided by act July 5, 1884, for operating and keeping in repair canals and other public works.

Tugboat men, on Sept. 4, 1902, settled their strike, **03,** 2013.
Longshoremen's strike ties up traffic, **06,** 1858.
(For accidents, delays, etc., see each an. **R.**).

PRIVATE (STATE) WORK.

In 1894 the Sec. of War au. Michigan State Fish Commission to occupy a portion of Isld. No. 3 and part of the adjacent waters of the canal for a fish hatchery under a revocable license, **95,** 2868.
Owners of SS. *Robert Fulton* made repairs to lock damages by that SS., **02,** 2226.
Permits to private parties for various purposes, **02,** 2015; **03,** 2014; **04,** 3116; **05,** 2267; **06,** 1858; **07,** 2015.

PP-23 LAKE HURON. (Levels.)

ENGINEERS.

Chief of Engineers. R., 06, 645.

In charge. Maj. L. H. Beach, **06,** 645.

PHYSICAL CHARACTERISTICS.

General statements as to usual variations in the level of the lake surface at all the Hs. on the w. shore of Lake Huron, **06,** 645. Mean surface, above mean tide at New York City (1860–1905) 581.39′. During "past" year varied from 580.53′ to 581.57′, monthly variation, 1′ to 1.7′. From head of St. Clair R. to foot of Detroit R. there is a progressive fall; monthly mean stages at Ft. Wayne varied during fiscal year bet. 573.29′ and 574.38′ above mean tide at New York City, difference in any one month varying bet. 1′ and 2.3′. **06,** 645.

PP-29 MACKINAC HARBOR, MICH.

APPROPRIATIONS.

1910,	$25,000,	**10,** 2257.
1912,	35,000,	**12,** 2650.
Total,	60,000	

COMMERCE.

Not important, **71,** 160.
Interests of, require protection, **80,** 2056.
Decadence of, **87,** 2272.
Description of, local and passenger traffic much larger in 1899 than 10 years earlier, **00,** 4009.
Large passenger traffic, **10,** 841; **12,** 1069.
1911, 13,000± t., **12,** 1070.

CONTRACTS.

1910. Great Lakes Dredge & Dock Co., furn. and placing 18,000 t. st., $1.29 t., **11,** 2450.
1911. T. L. Durocher, furn. and placing 18,000 t. st., $1.14½ t., **12,** 2651.

ENGINEERS.

Chief of Engineers. R., 79, 170; **80,** 221; **85,** 332; **87,** 294; **00,** 587; **10,** 840; **11,** 894; **12,** 1068.

In charge:
Capt. F. U. Farquhar, 1870. **R., 71,** 160.
Maj. F. Harwood, 1879–80. **R., 79,** 170; **80,** 2055.
Lt. Col. O. M. Poe, 1885–87. **R., 85,** 2180; **87,** 2271.
Lt. Col. G. J. Lydecker, 1899–1900. **R., 00,** 4008.
Col. C. McD. Townsend, 1910–. **R., 10,** 2257; **11,** 2450; **12,** 2650.

OPERATIONS.

1910-11. 13,715 c. y. st. placed in break'r, **11,** 2450.
1911-12. 17,349.9 t. st. placed in substr. of break'r at Mission Pt., completing same, **12,** 2650.

PHYSICAL CHARACTERISTICS.

Recession of beaches, **80,** 2055.
Description of, **71,** 160; **00,** 4009; **10,** 840.
H. on the s. shore of Mackinac Isld., **00,** 4009; located in Straits of Mackinac, at n. end of Lake Huron, 15½ m. from Cheboygan H., inclose 34 acres. Protected from n. and s. winds, it is exposed to heavy seas through Straits of Mackinac. At m. lake l. there is 18′ in H. to wharves, **12,** 1069.

PLANS.

By Capt. Farquhar, 1870, break'r 4,000′ x 35′ x 30′; est., $761,333.76, **71,** 160, 161. "Not the slightest necessity for a H. of refuge at this point. At present not local importance enough to justify any expend. in building a H. of any kind."—Capt. Farquhar's **R., 71,** 160.
By Maj. Harwood, 1880, converging ps. from Mission and Biddle Pts.; est., $125,000, **80,** 2056, 2057.
In 1884 Col. Poe est. cost of break'r to afford a H. of refuge at not less than $1,500,000; but C. requirements would not justify such expend., **85,** 2181.
Lt. Col. Poe, ex., 1886, repeats Maj. Harwood's est., $125,000, as cost of break'r located off Biddle Pt., **87,** 2272.
Lt. Col. Lydecker, 1900, est. $80,000 to constr. 2 break'rs, **00,** 4008.

PROJECTS.

Act June 25, 1910, au. 2 break'rs, 1 at Mission Pt. and 1 at Biddle Pt., 2,000′ in the aggregate, of st. or bowlders, where such will cost less than cribwork; est., $80,000 (H. D. 646, 56th, 1st; map), **10,** 840; act Feb. 27, 1911, au. continuing contracts, **12,** 1069.

SURVEYS.

Ex. by Capt. Farquhar, 1870. **R., 71,** 160.
Sur. in progress, by Maj. Harwood, **79,** 160.
Au. act Mar. 3, 1879, **80,** 221; made by Maj. Harwood, 1880, **80,** 2055.
Au. act July 5, 1884; made by Lt. Col. Poe, **85,** 2180.
Ex. of Biddle Pt. with view to break'r, au. act Aug. 5, 1886; made by Lt. Col. Poe, **87,** 2271.
Ex. and sur. for H. of refuge by means of 2 break'rs au. act Mar. 3, 1899; made, 1899–1900, by Lt. Col. Lydecker (**R.** fav.; see Projects), **00,** 4008.

Maps. (H. D. 646, 56th, 1st.)

PP-31 CHEBOYGAN HARBOR, MICH.

APPROPRIATIONS.

1871,	$10,000,	**71,** 43.
1872,	15,000,	**72,** 40.
1873,	15,000,	**73,** 40.
1874,	15,000,	**74,** 46.
1875,	15,000,	**75,** 51.
1876,	10,000,	**76,** 104.
1878,	8,000,	**78,** 127, 1238.
1879,	3,000,	**79,** 169, 1667.
1880,	6,000,	**80,** 2035.
1881,	6,000,	**81,** 2242.
1882,	10,000,	**82,** 2328.
1884,	5,000,	**84,** 2036.
1886,	15,000,	**86,** 1824.
1888,	15,000,	**88,** 1960.
1890,	12,000,	**96,** 2724.
1899,	8,000,	**99,** 2982.
1902,	8,000,	**02,** 2184.
1905,	7,500,	**05,** 2222.
1907,	15,000,	**07,** 1990.
Total,	198,500,	**12,** 2652.

COMMERCE.

Important, **73,** 290; **74,** 200; **76,** ii, 529, 531.
Description of, **00,** 4014.
Mostly lumber products; fav. but gradual effect on rates, **10,** 842; **12,** 1072.
Tonnage, 1910, 264,980 t., **11,** 2451; 1911, 335,000 t., **12,** 2652.

CONTRACTS.

1871. Carkin & Stickney, dr., 28¢ c. y., **71,** 173, 174.
1872. Carkin & Stickney, dr , 22½¢ c. y., **72,** 203.
1873. Carkin & Stickney, dr., 22¢ c. y., **73,** 290.
1874. Carkin & Stickney, dr., 19¢ c. y., **75,** 271.
1875. E. T. Williams & Co., dr., 17¢ c. y., **75,** 271, 272.
1878. Carkin, Stickney & Cram, dr., 11½¢ c. y., **79,** 1667.
1880. Carkin, Stickney & Cram, dr., 17¢ c. y., **81,** 2242.
1881. J. W. McGinn, p. constr., **81,** 2243.
1883. Carkin, Stickney & Cram, dr., **83,** 1851.
1887. Green Bay Dredging Co., dr., 11½¢ c. y., **87,** 2249. C. E. Mitchell, dr., 14.4¢ c. y., **88,** 1960.
1895. C. E. Mitchell, dr., 12.9¢ c. y., **95,** 2824.
1899. C. E. Mitchell, dr., 14.7¢ c. y., **00,** 3974.
1903. Edward Bros., dr., 24¢ c. y., s. m., **03,** 1984.
1907. Great Lakes Dredge & Dock Co., dr., 42¢ c. y., s. m., **08,** 2113.

ENGINEERS.

Chief of Engineers. R., 70, 31, 44; **71,** 43; **72,** 40; **73,** 40; **74,** 46; **75,** 51; **76,** 104; **77,** 112; **78,** 127; **79,** 169; **80,** 219; **81,** 297; **82,** 292; **83,** 301; **84,** 303; **85,** 326; **86,** 320; **87,** 288; **88,** 261; **89,** 309; **90,** 278; **91,** 348; **92,** 334; **93,** 380; **94,** 353; **95,** 389; **96,** 344; **97,** 440; **98,** 429; **99,** 510, 522; **00,** 574, 587; **01,** 554; **02,** 477; **03,** 522; **04,** 571; **05,** 581; **06,** 645, 664; **07,** 667; **08,** 724; **09,** 761; **10,** 841; **11,** 895; **12,** 1070.

In charge:
Capt. F. U. Farquhar, sur. in 1870. **R., 71,** 183.
Maj. O. M. Poe, 1871–73. **R., 71,** 172; **72,** 203.
Maj. G. Weitzel, 1873–77. **R., 73,** 290; **74,** 200; **75,** 271; **76,** ii, 529.
Maj. F. Harwood, 1877–83. **R., 77,** 944; **78,** 1236; **79,** 1666; **80,** 2034; **81,** 2241; **82,** 2327.
Lt. Col. O. M. Poe, 1883–92. **R., 83,** 1850; **84,** 2035; **85,** 2128; **86,** 1824; **87,** 2247; (Col.) **88,** 1958; **89,** 2243; **90,** 2719; **91,** 2764; **92,** 2448.
Maj. W. Ludlow, 1893. **R., 93,** 2917.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2239; **95,** 2823; **96,** 2723; **97,** 3009; **98,** 2576; **99,** 2982; **00,** 3973, 4012.
Maj. W. L. Fisk, 1901. **R., 01,** 3135.
Capt. L. H. Beach, 1902–05. **R., 02,** 2183; (Maj.) **03,** 1983; **04,** 3071; **05,** 2221.
Capt. Chas. Keller, 1906. **R., 06,** 1835.
Col. Chas. E. L. B. Davis, 1907. **R., 07,** 1989.
Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2112; **09,** 2096; (Col.) **10,** 2258; **11,** 2451; **12,** 2651.

Assistants.
R J. Cram, **71,** 183.
Capt. A. N. Lee. **R., 75,** 271; **76,** ii, 529.
B. H. Muehle. **R., 00,** 4014.

ESTIMATES. (See Plans and Projects.)

By Maj. Poe, 1871, to complete straight chan. 12′ x 120′ across the bar, without protection of its banks, $50,000, **72,** 203.
By Maj. Weitzel, 1873, to complete chan. and revet. about 2,500′ of its banks, $75,000, **73,** 290; **74,** 200.
By Maj. Harwood, 1879, to complete the imp., $25,000, **79,** 1666.

OPERATIONS.

1870–71. Dr. chan. 9′ d. in progress, **71,** 43.
1871–72. 32,000 c. y. removed; chan. 50′ x 9′, **72,** 40, 203.
1872–73. Dr. continued; chan. 12′ d. obtained, **73,** 40.
1873–74. Dr. continued, making chan. 13′ d.; 76,955 c. y. removed, **74,** 46.
1874–75. 30,156 c. y. removed, **75,** 51.
1875–76. 114,368 c. y. removed, **76,** 104; ii, 529.
1877–78. 58,510 c. y. removed; entrance chan. 150′–175′ w., 200′ w. abreast of SS. docks; clear d. of 13′ obtained, **78,** 127, 1236.
1878–79. Dr. continued; chan. 13′ x 200′, **79,** 169.
1879–80. 9,843 c. y. dr. from chans., **80,** 2035.
1880–81. 12,369 c. y. dr., **81,** 2241.
1881–82. 12,000 c. y. dr. from chan., **82,** 2327; constr. of pierhead crib, **82,** 2328.
1882–83. 28,000 c. y. removed, **83,** 1850.
1887–88. 29,979 c. y. dr., **88,** 1959.
1888–89. 28,472 c. y. dr., **89,** 2244.
1889–90. 31,204 c. y. dr., proj. completed, **90,** 2720.
1894–95. 36,086 c. y. dr., **95,** 2824.
1895–96. 74,515 c. y. dr., **96,** 2724.
1898–99. 106,115 c. y. dr., **00,** 3974.
1902–03. 27,304 c. y. dr., **03,** 522, 1983.
1906–07. Borings made bet. the br. and lock, and specifications prepared, **07,** 1989.
1907–08. 22,407 c. y. dr., **08,** 2113.
1908–09. Dr. completed, **09,** 2096; proj. completed with the exception of a stretch 900′ l. extending downstream from the State Road br., **12,** 2651.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 183, 184; **76,** ii, 530; **00,** 4013; **06,** 645.
Most unusual scour, 1898–99, increasing d. by 3′, **99,** 2982.
15′ chan. at 1912 had been secured, with w. of 200′; turning-basin 15′ d. also provided, **12,** 1070, 1071.
H. includes lower reach of Cheboygan R. and its outlet into Straits of Mackinac, Lake Huron. Proj. covers R. from d. w. in the straits to a lock and dam built under State au., a distance of 11,720′, of which 6,000′ are in the straits, **12,** 1070. Above lock R. is navigable through "Inland Route," 36 m., for boats of 4–5′ draft, **12,** 1072.
Datum plane changed, 1912, from 581.67 to 579, **12,** 1071.

PLANS. (See Estimates and Projects.)

By Capt. Farquhar, 1870, reducing w. of chan. to 100′, $334,157.43, **71,** 183–186.

PRIVATE WORK.

$2,000 contributed by citizens to imp. R. by dr. inside the inner end of imp. by U. S., **72,** 204; **76,** ii, 531.

PROJECTS. (See Estimates and Plans.)

By Capt. Farquhar, 1870, dr. 14′ x 200′, mouth of R. to Cheboygan village, and protection of chan. by pile ps. with crib pierheads; est., $395,000, **71,** 185, 186; **80,** 219; **87,** 2247.

By Maj. Poe, modification of Capt. Farquhar's plan for making chan. 9′ x 50′; to increase chan. to 100′ x 12′, **71,** 172; **72,** 203.

By Maj. Weitzel, revet. part of the cut to protect banks, dr. 13′ d., and to increase w. to 180′, **73,** 290; **75,** 271; **76,** ii, 529.

History of projs., **76,** ii, 530, 531.

By Maj. Harwood, to dispense with the revet. (as unnecessary) and to increase chan. to 200′ in w., **77,** 945. For addl. dr. about the axis of the chan. and a protecting p. on the w. border, **79,** 169, 1666.

Revised proj. by Maj. Harwood, 1882, providing uniform d. of 15′ throughout chan. and of basin opposite SS. landing, **82,** 2328; **87,** 2247.

In 1885 Col. Poe reduced est. to $218,000, **85,** 2128; **87,** 2248. In 1888 Col. Poe proposed continuation of 15′ chan. upstream to the State Road Br. Proj., therefore, is for chan. 15′ x 200′, 15′ curve in the Straits of Mackinac to the first br., and revet. of both sides of the chan. outside the shore line; est., $218,000, **88,** 1959.

Proj. completed in 1890; cost, $129,648, **90,** 2720; **92,** 2448.

In 1895 Lt. Col. Lydecker est. $80,000 to imp. H. by dr. 18′ x 200′, 18′ curve in the straits to the outer end of the w. p., and inside of that point bet. lines parallel to and 25′ from the ps.; plan of imp. adopted, **95,** 2823, 2824.

Lt. Col. Lydecker est., 1900, $15,500 for 18′ chan., **00,** 4014.

By Capt. Keller, 1905, plan for extending imp. up to lock and dam in Cheboygan R. by dr. chan. 8′ x 60′; est., $10,797.60 (H. D. 537, 59th, 1st), **06,** 664; au. act Mar. 2, 1907, **07,** 668.

SURVEYS.

Importance urged by Col. Cram, **69,** 113.

Under Capt. F. U. Farquhar, by R. J. Cram. **R., 70,** 44; **71,** 183–186.

Of chan., 1880, **80,** 2035.

Est. of amount required to d. existing chan., 1895, to 18′, au. act Aug. 17, 1894; sur. made, 1895, by Lt. Col. Lydecker for that purpose (see Projects), **95,** 2825.

Ex. made, 1897, by Lt. Col. Lydecker, **98,** 2577.

Ex. and sur. for 18′ chan., entrance to the first br., au. act Mar. 3, 1899; made by Lt. Col. Lydecker (**R.** fav.; see Projects), **00,** 4012.

Ex. of H., **05,** 2221.

Ex. au. act Mar. 3, 1905; made, 1905, by Maj. Beach (H. D. 537, 59th, 1st), **06,** 664.

Of H., **06,** 1836.

Maps. **82,** 2328; **95,** 2824; **03,** 1984.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1071.

PP-32(a) INLAND ROUTE BETWEEN CHEBOYGAN AND PETOSKEY, MICH.

SURVEY.

Ex. by Lt. Col. Townsend (**R.** unfav.), H. D. 303, 61st, 2d, **10,** 860.

PP-40 HAMMOND BAY, LAKE HURON, MICH.

COMMERCE.

Description of, **93,** 2949.

ENGINEERS.

Chief of Engineers. **R., 93,** 388.

In charge. Maj. W. Ludlow, 1892–93. **R., 93,** 2948.

Assistant. B. H. Muehle. **R., 93,** 2949.

PHYSICAL CHARACTERISTICS.

Description of; a part of Lake Huron into which flows the Ocqueoc, a narrow stream, **93,** 2949.

SURVEY.

Ex. of the B. at mouth of the Ocqueoc R. au. act July 13, 1892; made, 1892, by Maj. Ludlow (**R.** unfav.), **93,** 2948.

PP-42 ROGERS CITY HARBOR, MICH.

APPROPRIATIONS.

1910, $6,000, **10,** 2259.

CONTRACTS.

1911. James Davidson, dr., 75¢ c. y., **11,** 2452; annulled, **12,** 2653. Edward Bros., dr., $30 per hour working time, and $15 per hour lay time, **12,** 2653.

ENGINEERS.

Chief of Engineers. **R., 06,** 664; **10,** 843, 860; **11,** 897; **12,** 1072.

In charge:

Maj. L. H. Beach, **06,** 645.

Col. C. McD. Townsend, 1910–. **R., 10,** 2259; **11,** 2452; **12,** 2653.

OPERATIONS.

1911-12. Chan. 16′ x 130′ dr. by contractor, **12,** 2653.

PHYSICAL CHARACTERISTICS.

Town of 600 inhabitants, on Lake Huron, 37 m. e. of Cheboygan, Mich.

PRIVATE WORK.

Private parties have dr. around docks, **12,** 2653.

Michigan Limestone & Chemical Co. dr. a 21′ slip 90′ w.; also constr. break'r and dock for loading st. on vessels at Calcite, 1½ m. below Rogers City, **12,** 2653.

PROJECTS.

Act June 25, 1910, au. chan. 16′ x 200′ across bar in front of town, at mean stage Lake Huron; est., $6,000 (R. and H. Com. D. 28, 61st, 2d), **10,** 843.

SURVEYS.

Ex. au. act Mar. 3, 1905, with view to constr. H. of refuge. **R.** by Maj. Beach, July 24, 1905 (H. D. 162, 59th, 1st) (unfav.), **06,** 664.

Pre. ex. au. act Mar. 3, 1909. **R.** by Lt. Col. Townsend, June 18, 1909 (H. D. 352, 61st, 2d) (unfav.), **10,** 860.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1073.

PP-46 FALSE PRESQUE ISLE HARBOR, LAKE HURON, MICH. (Harbor of refuge.)

ENGINEERS.

Chief of Engineers. **R., 89,** 319.

In charge. Col. O. M. Poe, 1888. **R., 89,** 2276.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2276.

PP-50 ALPENA HARBOR (Thunder Bay River), MICH.

APPROPRIATIONS.

1876, $4,500, **77,** 111, 934.
1882, 15,000, **83,** 1853.
1890, 5,500, **91,** 2767; **93,** 2921.
1890, 10,000, **91,** 2770.
1892, 10,000, **92,** 2453.
1894, 4,000, **95,** 2827.
1896, 2,500, **96,** 2726.
1907, 4,000, **07,** 1990.
1910, 5,000, **10,** 2259.
1911, 10,000, **11,** 2453.

Total, 70,500

COMMERCE.

Rates decreased one-half, from imp., **10,** 844; **12,** 1075.
Traffic, 1911, 804,440 t., **12,** 1075.

CONTRACTS.

1877. Thomas M. Hubbell, dr., 17¢ c. y., **78,** 1236.
1882. C. S. Barker, dr., 20¢ c. y., **83,** 1853.
1889. Carkin, Stickney & Cram, dr., 40¢ c. y., **89,** 2246.
1891. Bay City Dredging Co., dr., 19¢ c. y., **91,** 2767.
1899. S. O. Dixon, dr., 13½¢ c. y. ($5,737.09), **00,** 3977.
1907. M. Sullivan, dr. plant (leased), $25 per working hour, **08,** 2115.

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 44; **71,** 42; **76,** 106; **77,** 110; **78,** 126; **80,** 219; **81,** 297; **82,** 292; **83,** 301; **84,** 303; **85,** 327; **86,** 321; **87,** 289; **88,** 262; **89,** 310, 319; **90,** 278; **91,** 348, 350; **92,** 335; **93,** 381; **94,** 354; **95,** 389; **96,** 345; **97,** 441; **98,** 430; **99,** 511; **00,** 575; **01,** 555; **02,** 477; **03,** 523; **04,** 572; **05,** 582; **06,** 647; **07,** 669; **08,** 726; **09,** 763; **10,** 843; **11,** 898; **12,** 1073.

In charge:
Capt. F. U. Farquhar, 1870–83. **R., 71,** 158; **77,** 933; (Maj.) **83,** 299.
Maj. G. Weitzel, 1874–77. **R., 76,** 548; **77,** 933.
Maj. F. Harwood, 1878–83. **R., 78,** 1235; **80,** 2036; **81,** 2244; **82,** 2329.
Lt. Col. O. M. Poe, 1883–87. **R., 83,** 1852; **84,** 2036; **85,** 2129; **86,** 1825; **87,** 2249; **88,** 1961; **89,** 2245, 2288, 2289; **90,** 2722; **91,** 2765, 2768; **92,** 2450, 2452.
Maj. W. Ludlow, 1893. **R., 93,** 2920; **93,** 2922.
Lt. Col. A. J. Lydecker, 1894–1900. **R., 94,** 2241; **95,** 2826; **96,** 2725; **97,** 3011; **98,** 2578; **99,** 2983; **00,** 3975.
Maj. W. L. Fisk, 1901. **R., 01,** 3137.
Capt. L. H. Beach, 1902–05. **R., 02,** 2185; **03,** 1985; **04,** 3073; **05,** 2223.
Capt. Charles Keller, 1906. **R., 06,** 1836.
Col. C. E. L. B. Davis, 1907. **R., 07,** 1990.
Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2114; **09,** 2097; (Col.) **10,** 2259; **11,** 2453; **12,** 2653.

Assistants:
H. A. Ulffers. **R., 76,** ii, 548.
R. Strohman. **R., 84,** 2037.

OPERATIONS.

1877–78. Dr. by contract, completed, **78,** 126, 1235.
1882–83. 16,900 c. y. dr., **83,** 1852.
1883–84. 21,294 c. y. dr.; proj. completed, **84,** 2040; **87,** 2249.
1888–89. 5,290 c. y. dr., **89,** 2246.
1889–90. 5,254 c. y. dr., **90,** 2722.
1890–91. 6,871 c. y. dr. from H., and 7,421 c. y. from R., **91,** 2766, 2769.
1891–92. 17,083 c. y. dr. from H., 33,370 c. y. from R., **92,** 2452.
1892–93. 10,770 c. y. dr., **93,** 2923.
1893–94. 9,306 c. y. dr., **94,** 2241.
1899–00. 42,497 c. y. dr., **00,** 3976.
1907–08. 14,961 c. y. removed in 194 hours and 5 minutes, **08,** 2114.

PHYSICAL CHARACTERISTICS.

71, 158, 159.
Description of, **89,** 2289.
Shoaling, slowly, **99,** 2984; **00,** 3976.
Datum plane 1′ to 2′ higher, 1912, than m. surface elevation during preceding 2 yrs., changed to 579 to provide proj. d., **12,** 1074.
Navigation farther than upper limit of imp. interrupted by a dam, **10,** 843, 844.
Shoaling; chan. narrowing, **11,** 898, 2453.

PLANS.

By Maj. Farquhar, crib ps. 20′ w., and pierhead cribs 32′ w., $53,496.30, **71,** 159.

PRIVATE (CORPORATE, PRIVATE) WORK.

Alpena Harbor Improvement Co. expended $40,000 in ps. and dr.; collecting toll from vessels drawing over 4′, **71,** 42, 158, 159.
Private parties expend., 1875, $3,000 in dr., **76,** ii, 548.

PROJECTS.

By Maj. Weitzel, dr. chan. 13′ x 200′, 1,100′ ou from p., $4,764, **76,** ii, 548; $4,500, **77,** 110, 934.
By Maj. Harwood, 1881, dr. chan. 14′ d.; est., $25,000, **81,** 2244; **84,** 2037.
By Maj. Harwood, 1881, excavation of entrance chan. 14′ d. from B. into R.; est., $25,000, **81,** 2244; **84,** 2037. Proj. completed in 1884, **87,** 2249.
In 1888 Col. Poe recom. redr. of partly deteriorated chan. to 16′; est., $34,511, **88,** 1961; **91,** 2765.
In 1889 Col. Poe proposed imp. of Thunder Bay R. by excavating 16′ chan., with w. from 50′ to 200′, from mouth to 1 m. above, requiring dr. of 109,356 c. y.; est., $36,087.48, **89,** 2290.

SURVEYS.

By Maj. Farquhar, 1870, **71,** 158, 159.
Under direction of Maj. Weitzel, by H. A. Ulffers, 1875, **76,** 106.
Sur. of Thunder Bay R., Alpena, Mich., for 16′ chan. from mouth to 1 m. above, au. act Aug. 11, 1888; made, 1889, by Col. Poe, **89,** 2288.
Minor surs., **97,** 3011; **99,** 2984.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 899; **12,** 1074.

Maps. **89,** 2290; **03,** 1985.

PP-53 AUSABLE HARBOR AND RIVER, MICH.

APPROPRIATIONS.

1867,	$50,000,	**67,** 27, 147.
1869,	*2,970,	**69,** 22.
1870,	15,000,	**70,** 45.
1871,	10,000,	**71,** 176.
1872,	10,000,	**72,** 207.
1876,	1,000,	**77,** 933.
1879,	7,000,	**79,** 169, 1657.
1880,	7,000,	**80,** 2039.
1881,	6,000,	**81,** 2247.
1882,	5,000,	**82,** 2331.
Total,	113,970	

COMMERCE.

Not unimportant, **66,** iii, 34; iv, 76, 90.
Increase, **69,** 109; **70,** 153.

CONTRACTS.

1867. Caskin & Kimball, materials and labor, **67,** 232, 233; **68,** 152.
1870. Caskin & Kimball, superstr., **70,** 159.
1871. W. H. Patten, superstr. Forfeited, **71,** 176; **72,** 204, 205.
1879. J. R. Worden, revets., **80,** 2037, 2039.
1880. C. Southerland, pile and slab. revet., **81,** 2245.
1881. Carkin, Stickney & Cram, dr., 26¢ c. y., **81,** 2247.
1889. Carkin, Stickney & Cram, dr., 34½¢ c. y., **89,** 2248.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 8, 34, 70; **67,** 27; **68,** 37; **69,** 22, 34; **70,** 44; **71,** 43; **72,** 40; **74,** 46; **75,** 51, 53; **76,** 104, 106; **77,** 110; **78,** 126; **79,** 169; **80,** 220; **81,** 298; **82,** 292; **83,** 302; **84,** 304; **85,** 327; **86,** 321; **87,** 289; **88,** 263; **89,** 311, 319; **90,** 279; **91,** 351; **92,** 336; **08,** 743.

In charge:
Maj. W. F. Raynolds, 1866. **R., 66,** iv, 76, 90.
Col. T. J. Cram, 1867–69. **R., 67,** 147, 149, 157, 230, 233; **68,** 141, 151, 152; **69,** 107.
Maj. W. McFarland, 1870, **70,** 150.
Maj. O. M. Poe, 1870–72. **R., 70,** 150, 159, 162; **71,** 175; **72,** 204.
Maj. G. Weitzel, 1873–77. **R., 73,** 291; **74,** 201; **75,** 272, 286; **76,** ii, 531, 550; **77,** 932.
Maj. F. Harwood, 1878–83. **R., 78,** 1229; **79,** 1657, S. D. 70, 45th, 3d; **80,** 2037; **81,** 2245; **82,** 2330.
Maj. F. U. Farquhar, 1883, **83,** 1835.
Lt. Col. O. M. Poe, 1883–92. **R., 83,** 1854; **84,** 2040; **85,** 2130, 2132; **86,** 1825; **87,** 2250; (Col.) **88,** 1962; **89,** 2247, 2279; **90,** 2723; **91,** 2771; **92,** 2453.
Col. C. E. L. B. Davis, **08,** 715.

Assistants:
Capt. G. J. Lydecker, **68,** 151.
H. G. Rothwell, **69,** 109; **72,** 205. **R., 75,** 272, 287.
Capt. A. N. Lee. **R., 74,** 202; **77,** 932.
H. A. Ulffers. **R., 76,** ii, 550.
B. H. Muehle. **R., 83,** 1857.

ESTIMATES. (See Plans and Projects.)

By Col. Cram, 1867, 10′ d. of water, $69,367, **67,** 27, 147. For completion, $20,000, and $6,000 an. for dr., **68,** 141.
By Maj. Poe, an. dr., $3,000, **70,** 153. Continuing work, $20,000, **72,** 206.
By Maj. Weitzel, 1876, break'r, off mouth of H., $900,000, **76,** ii, 550.
By Maj. Harwood, 1879, restoration and completion of H., $35,000, **79,** 1657. Revised to $25,000, **79,** 1658.

LEGISLATION.

Discussion of existing laws, showing addl. legislation necessary, **74,** 203. Legislation required to prevent encroachments on R. chan., and damage to ps., **74,** 202; **75,** 273; **76,** ii, 531; **77,** 933.

OBSTRUCTIONS.

Conditions imposed by Sec. War for bridging R., **79,** 1658.

OPERATIONS.

1868–69. 30 cribs, equal to 900 l. f. of p., placed; repairs, **69,** 34, 35.
1869–70. Ps. extended 274 l. f., **70,** 45.
1870–71. Constr. of superstr. and outer crib of n. p. repaired and replaced. Extension of s. p. 9 cribs 16′ x 30′, **71,** 175.
1871–73. Constr. of superstr. on s. p., by purchase in open market and hired labor, **72,** 40; **73,** 40.
1873–74. Repairs, and dr., **74,** 201, 205.
1874–75. Repairs, **75,** 272.
1879–80. Constr. of revet. along ne. bank of R., **80,** 2038.
1880–81. Revet. from the Oscoda Br. to U. S. piers completed, **81,** 2245. Constr. by hired labor of training wall across bar at entrance to mouth of H., **81,** 2246.
1881–82. Extension of s. p. by hired labor and dr. by contract of 3,000 c. y. of sand from bar at mouth of H., **82,** 2330.
1882–83. Slight repairs by hired labor, **83,** 1854.
1889–90. 12,864 c. y. dr., **90,** 2724; **91,** 2771.

PHYSICAL CHARACTERISTICS. (See Private work.)

Description, **66,** iii, 8, iv, 76; sand brought down by current, **67,** 149; R. long, rapid, and full of sand, deposit of sand at mouth, **69,** 107. The 10′ curve advanced 280′, **72,** 205; curve advanced 260′, **73,** 291.

PLANS. (See Estimates and Projects.)

By H. G. Rothwell, break'r, ¾ m. from ps., **73,** 291.

PRIVATE WORK.

Private ps. injured by freshet, **69,** 108. Character of work not substantial, **70,** 151. Damage to H. from indiscreet dr. by private parties, **72,** 205. Encroachments on R. chan., **73,** 291; **74,** 203. Necessary jurisdiction ceded to U. S. by owners of R. fronts, **79,** 169, 1657.

PROJECTS. (See Estimates and Plans.)

By Maj. Raynolds, 1866, extension of p. to 12′ curve and dr. for chan. to that d.; est., $114,754, **66,** iv, 77; **85,** 2132.
By Col. Cram, modifications of Maj. Raynolds' plan, d. of chan. 10′ adopted; est., $82,893; **67,** 147, 149, 151; **69,** 107; **85,** 2133.
By Maj. Poe, increase in w. of cribs to 18′, sheet-piling the n. side of R. for 1,000′, **70,** 152, 153–158; **72,** 206.
By Maj. Weitzel, extension of n. p., and dr. bar at mouth of R. as experiments, **73,** 291.
After expend. of app. aggregating $95,970, Maj. Harwood, 1879, proposed, at est. cost of $35,000 for completion of imp., formation of chan. 10′ x 100′, d. w. in the lake to the State St. Br. in Ausable (S. Ex. D. 79, 45th, 3d), **79,** 1657. Est., 1883, by Maj. Farquhar, $32,121, **83,** 1857.
In 1885 Lt. Col. Poe reported formation of bar at entrance to H. precluded its imp. at a cost commensurate with the advantages to be gained, **85,** 2130; **86,** 322. Expend. resulted in 4′ on the bar and 8′ in chan. from bar to Oscoda Br., **85,** 2137.
In 1891 Col. Poe reported against any further attempts to secure permanent imp., **91,** 2771.

SURVEYS.

By Maj. Raynolds, 1866, **66,** ii, 41, iii, 8. **R., 66,** iv, 76, 90.
By Col. Cram, resur., 1866, **67,** 147; **68,** 141.
By Maj. Poe, 1872, of a bar 1 m. from ends of p., **72,** 206.
By Maj. Weitzel, 1874, resur. of R., and estab. dock lines, **75,** 272, 286.

* Allotment.

By H. A. Ulffers, 1875, under direction of Maj. Weitzel, **76,** ii, 550.
By Maj. Harwood, 1882, **82,** 2330.
By Maj. Farquhar, 1883, **83,** 1854.
Ex. of Ausable R. for 12′ chan. and break'r, au. by act of Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2279.
Au. act Mar. 2, 1907; made, 1907, by Col. C. E. L. B. Davis (unfav.) (H. D. 71, 60th, 1st), **08,** 743.
-**R.,** by BERH., July 12, 1909, reviewing former **R.** of Col. Davis, 1907 (unfav.) (R. and H. C. 15, 61st, 2d.)

Maps.
Of sur. by H. G. Rothwell, under direction of Maj. Weitzel, 1874, S. D. 70, 45th, 3d.
82, 2330; **83,** 1856.

PP-58 AU GRES RIVER, MICH.

ENGINEERS.

Chief of Engineers. **R.,** **89,** 319.

In charge. Col. O. M. Poe, 1889. **R.,** **89,** 2277.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2277.

PP-60 PINE RIVER (Bay County), SAGINAW BAY, MICH.

ENGINEERS.

Chief of Engineers. **R.,** **70,** 32, 46; **71,** 45; **72,** 42; **73,** 41.

In charge. Maj. O. M. Poe, 1870–73. **R.,** **71,** 188; **73,** 300.

Assistant. H. A. Ulffers. **R.** **73,** 301.

PLANS.

By Maj. Poe, 1871, dr. chan. through bar at mouth of R. 7′; est., $7,500, **71,** 188.
By H. A. Ulffers, 1873, dr. chan. through bar at mouth 9′ d.; est., if bottom be rocky, $27,300; if free from r., $12,740, **73,** 301. "The H., if made, can be of no general importance, and is not required as a H. of refuge." Extract from **Rs.** of Maj. Poe, **71,** 189; **73,** 301.

SURVEYS.

By officers of the Lake Sur., 1857, **71,** 188.
By H. A. Ulffers, 1872, under direction of Maj. Poe. **R.,** **73,** 300, 301.

PP-63 KAWKAWLIN RIVER, MICH.

COMMERCE.

Description of, unimportant, **95,** 2846.

ENGINEERS.

Chief of Engineers. **R.,** **95,** 396.

In charge. Lt. Col. G. J. Lydecker, 1894–95. **R.,** **95,** 2846.

Assistant. B. H. Muehle. **R.,** **95,** 2847.

PHYSICAL CHARACTERISTICS.

Description of; a small stream flowing into Saginaw B. about 2 m. w. of the mouth of Saginaw R., **95,** 2847.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Lydecker (**R.** unfav.), **95,** 2846.

PP-64 SAGINAW RIVER, MICH.

APPROPRIATIONS.

1866,	$67,500,	**66,** iii, 7, 34, act June 23.
1867,	28,000,	**67,** 146.
1868,	*9,000,	**68,** 24.
1870,	1,500,	**71,** 177.
1874,	15,000,	**74,** 206.
1875,	30,000,	**75,** 274.
1876,	11,000,	**76,** 104.
1878,	25,000,	**78,** 126, 1233.
1879,	8,000,	**79,** 169, 1662.
1880,	15,000,	**80,** 2043.
1881,	10,000,	**81,** 2250.
1882,	125,000,	**82,** 2333.
1884,	50,000,	**84,** 2043.
1886,	33,750,	**86,** 1828.
1888,	65,000,	**88,** 1967.
1890,	$75,000,	**90,** 2728.
1892,	100,000,	**92,** 2458.
1894,	40,000,	**95,** 2829.
1896,	40,000,	**97,** 3013.
1899,	40,000,	**99,** 2986.
1902,	50,000,	**02,** 2186.
1905,	30,000,	**05,** 2224.
1907,	75,000,	**07,** 1992.
1909,	*25,000,	**09,** 2099.
1910,	50,000,	**10,** 2261.
1911,	300,000,	**11,** 2455.
1912,	100,000,	**12,** 2656.

Total, 1,418,750 (incl. $1.84 repayments, and less $1,000 carried to surplus fund, $1,417,751.84, **12,** 2656).

* Allotment.

COMMERCE.

Large and increasing, **68,** 142.
Amount paid for lighterage, **68,** 142.
Double the cost of the imp. already saved in lighterage, **69,** 110.
Importance of H., **76,** ii, 547.
Value of imp., **84,** 2043.
Rates both to Bay City and Saginaw materially lessened by existence of imp., **06,** 650.
Materially lessened, due to decrease in lumber trade, **07,** 672. 1901, 1,945,033 t.; 1906, 293,105 t., **07,** 672; 1911, 236,636 t., **12,** 2657. Saginaw R. is navigable for 22 m. from mouth, **10,** 846.

CONTRACTS.

1866. John Brown & Co., dr., 79¢ c. y., **66,** iv, 61, 62, 74; **67,** 232, 233; **68,** 152; **69,** 110.
1875. A. T. Wilcox, materials, labor, and dr., **75,** 274, 275; **76,** ii, 536.
1877. H. S. Dale, materials, labor, and dr., **77,** 944; **78,** 1233.
1878. Carkin, Stickney & Cram, materials, labor, and dr., **79,** 1664.
1878. Hemenway & Hayes, materials and labor, **79,** 1664.
1879. Castle Sutherland, materials and labor, **79,** 1664.
1879. E. H. French, dr., 11¢ c. y., **80,** 2043.
1880. T. M. Hubbell, dr., $16 per hour, **81,** 2250.
1881. G. Talbot, dr., 60¢ c. y., **81,** 2250.
1883. C. Sutherland, dr., 25¢ c. y., **83,** 1862. Carkin, Stickney & Cram, dr., 37½¢ c. y., **83,** 1862.
1884. Carkin, Stickney & Cram, dr., 27½¢ c. y., **85,** 2138. L. P. & J. A. Smith, dr., 23¢ c. y., **85,** 2138. Carkin, Stickney & Cram, dr., 38¢ c. y., **85,** 2138.
1886. Carkin, Stickney & Cram, dr., 34¢ and 44½¢ c. y. O. J. Quinn, pilework. Ducharme, Fletcher & Co., iron. Hickler, Green & Co., dr., 34¢ and 44½¢ c. y. J. W. Owen, timber. **87,** 2251, 2252.
1887. Hubbell & Skeldon, dr., 30¢ c. y., **87,** 2251–2254.
1888. Hubbell & Skeldon, dr., 28¢ c. y., Q. Gillmore, dr., 49¢ c. y., **89,** 2249. Carkin, Stickney, & Cram, revet. and beam-wall constr., and dr., 43¢ c. y., **89,** 2253.
1891. T. M. Hubbell, dr., 36¢ c. y. Hubbell & Stone, black ash and Norway pine piles, furnished and driven, 13¢ l. f. J. G. Owen, white pine timber and plank, $20 and $14 M f. b. m. Carkin, Stickney & Cram, bolts and nails, 4.1¢ and 3¢ lb. McCollum & Lee, dr., 34¢ c. y., **91,** 2775.
1892. T. M. Hubbell, dr., 26½¢ c. y., **93,** 2929, 2930. E. Hall, dr., 19 and 29¢ c. y., **93,** 2930.
1895. E. Hall, dr., 23¢ c. y. Hingston & Woods dr., 30¢ c. y., **95,** 2830.
1899. G. H. Breymann & Bros., dr. bar at R. mouth, 25¢ c. y. Bay City Dredging Co., dr., 19.9¢ c. y. **00,** 3980.
1903. G. H. Breymann & Bro., dr., 16, 20, and 21¢ c. y., s. m., **03,** 1987.
1905. James Davidson, dr., 25¢ c. y., s. m., **06,** 1838.
1908. Central Dredging Co., dr., 16½¢ c. y., s. m.; Toledo Dredge & Dock Co., dr., 28¢ c. y., p. m., **08,** 2117.
1909. G. H. Breymann & Bro., dr. 131,942 c. y., 18 and 25¢ c. y., **10,** 2262.
1911. G. H. Breymann & Bro., dr. 3,025,000 c. y., 12⅞ and 17¢ c. y., **11,** 2455.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 7, 34, iv, 61; **67,** 27; **68,** 24, 37; **69,** 35; **70,** 45; **71,** 44; **72,** 41; **74,** 46, 206; **75,** 51, 53; **76,** 104, 106; **77,** 112; **78,** 126; **79,** 169; **80,** 220; **81,** 298; **82,** 293; **83,** 302, 1863; **84,** 304; **85,** 327; **86,** 322; **87,** 289; **88,** 263; **89,** 311; **90,** 280; **91,** 351; **92,** 336; **93,** 382; **94,** 355; **95,** 390; **96,** 345; **97,** 442; **98,** 430, 439, 440; **99,** 511; **00,** 576; **01,** 555; **02,** 478; **03,** 524; **04,** 572; **05,** 582; **06,** 648; **07,** 670; **08,** 727; **09,** 765; **10,** 844, 861; **11,** 899; **12,** 1075.

Boards. Convened, Detroit, Mich., Oct. 19, 1882, by S. O. No. 82, to report upon proj. for imp. of Saginaw R. **R., 83,** 1863. (Majs, Robert, Farquhar, and Heap.)

In charge:
Capt. J. N. Macomb, 1856; **66,** iv, 59.
Col. T. J. Cram, 1866–70. **R., 66,** iv, 58, 62, 73, 75; **67,** 146, 148, 230, 233; **68,** 141, 151, 152; **69,** 110.
Maj. W. McFarland, 1870; **70,** 150.
Maj. O. M. Poe, 1870–73. **R., 70,** 150; **71,** 177; **72,** 207.
Maj. G. Weitzel, 1873–77. **R., 74,** 205; **75,** 273, 289; **76,** ii, 535, 547.
Maj. F. Harwood, 1877–82. **R., 77,** 941; **78,** 1231; **79,** 1659; **80,** 2040; **81,** 2248; **82,** 2331.
Maj. F. U. Farquhar, 1882–83; **83,** 1835.
Lt. Col. O. M. Poe, 1883–92. **R., 83,** 1858; **84,** 2041; **85,** 2138; **86,** 1826; **87,** 2250; (Col.) **88,** 1963; **89,** 2248; **90,** 2724; **91,** 2772; **92,** 2454.
Maj. W. Ludlow, 1893. **R., 93,** 2924.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2243; **95,** 2828; **96,** 2727; **97,** 3012; **98,** 2579, 2600, 2604; **99,** 2985; **00,** 3978.
Maj. W. L. Fisk, 1901. **R., 01,** 3139.
Capt. L. H. Beach, 1902–05. **R., 02,** 2186; (Maj.) **03,** 1986; **04,** 3074; **05,** 2224.
Capt. Chas. Keller, 1906. **R., 06,** 1837.
Col. C. E. L. B. Davis, 1907. **R., 07,** 1991.
Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2115; **09,** 2098; (Col.) **10,** 2260; **11,** 2454; **12,** 2655.

Assistants:
Capt. G. J. Lydecker, **68,** 151.
H. A. Ulffers. **R., 72,** 207.
H. Gillman. **R., 74,** 208.
Capt. A. N. Lee. **R., 75,** 273; **76,** ii, 536.
H. Kallman. **R., 84,** 2044.
B. H. Muehle. **R., 85,** 2140; **92,** 2458.
Lt. J. F. McIndoe. **R., 98,** 2603.

ESTIMATES. (See Plans and Projects.)

By Capt. Macomb, 1856, dr. 159,000 c. y., at mouth of R., **66,** iv, 59.
By Col. Cram, dr. a 12′ chan., 250′ w., $95,417; chan. 195′ w., $75,044, **66,** iv, 61. 1869. For an. dr., $1,500, **69,** 110.
By Maj. Weitzel, 1874, imp. in vicinity of E. Saginaw, by dr. and protection of chan. banks by pile revet., $56,000, **74,** 207. 1876. Addl. to complete the imp. in vicinity of E. Saginaw, $51,920, **76,** ii, 535. 1874. D. mouth of R. to 14′, $100,000, **75,** i, 290; to 13′, $62,500, **75,** i, 290; **76,** ii, 547.
By Maj. Harwood, 1869, complete existing proj., $17,000, **79,** 169, 1662.

HARBOR LINES.

At Saginaw, **05,** 2235.

LEGISLATION.

Necessary, to obtain jurisdiction over proposed imp., **74,** 207; **79,** 1661.

OPERATIONS.

At mouth of river:
1866–67. 3,426 c. y. removed; dr. delayed by accident, **67,** 146.
1867–68. 79,804 c. y. removed by dr., **68,** 141.
1868–69. 24,699 c. y. removed by dr., completing a cut 12′ x 195′ x 6,800′, **69,** 110.

At Carrollton and other bars in the vicinity of East Saginaw:
1874–75. 700′ of piling completed, **75,** 273.
1875–76. 2,255 l. f. of pile revet. built and 33,643 c. y. dr. from Carrollton Bar during the year, **76,** 104.
1876–77. Work resumed on pile revet. opposite Carrollton Bar, **77,** 112.
1877–78. Carrollton revet. connected with the mainland at both extremities; portion of the work incomplete, **78,** 126, 1231.
1878–79. Carrollton imp. completed; wing dam at Zilwaukee Bar built. Carrollton Bar being imp. by a training wall, **79,** 169, 1660.

The whole river:
1879–80. 46,629 c. y. sand dr. from chan., **80,** 2041.
1880–81. Repair of Carrollton Bar training wall commenced; sand barrier at tail of Carrollton Bar dr. through, and dr. commenced under Talbot contract, **81,** 2249.

1881-82. In the upper R.: Carrollton Bar revet. completed and chan. restored; plank-beam wall built up; revet. and Zilwaukee wing dam repaired. In lower R.: 11,019 c. y. dr., **82,** 2332, 2333.

1882-83. 14,160 c. y. dr. in vicinity of Bay City and at mouth of R., **83,** 1859.

1883-84. 247,185 c. y. dr. from R. mouth and vicinity of Bay City, **84,** 2042.

1884-85. 97,410 c. y. dr. in vicinity of Bay City and at mouth of R., **85,** 2138.

1885-86. 16,200 c. y. dr. from mouth of Saginaw R., **86,** 1826.

1886-87. 5,998 c. y. dr. and repairs made to Carrollton revet., **87,** 2252.

1887-88. 23,200 c. y. dr. from e. chan. and chan. across bar; repair and extension of beam wall and pile revet. continued above Bay City, **88,** 1964.

1888-89. 23,980 c. y. dr.; Carrollton revet. completed to 1,145'; plank-beam training wall completed, **89,** 2249.

1889-90. 61,956 c. y. dr., **90,** 2727.

1890-91. 16,345 c. y. dr.; repairs to Carrollton revet. and Crow Isld. wing dam, **91,** 2774.

1891-92. 137,992 c. y. dr.; repairs to Carrollton revet. and wing dam at Crow Isld. completed, **92,** 2455.

1892-93. 15,728 c. y. dr., **93,** 2925.

1893-94. 148,790 c. y. dr., **94,** 2244.

1894-95. 36,226 c. y. dr., **95,** 2828.

1895-96. Repairs made to dikes, and 121,787 c. y. dr., **96,** 2728.

1896-97. 7,097 c. y. dr., **97,** 3012.

1899-00. 101,650 c. y. dr. from bar; 86,811 c. y. dr. from R., **00,** 3978.

1900-01. 38,831 c. y. dr., **01,** 3140.

1902-03. 27,845 c. y. dr., **03,** 524, 1986.

1903-04. 106,107 c. y. dr., and wreck removed, **04,** 3074.

1904-05. Wreck of schr. *Garrett Smith* removed, **05,** 2224.

1905-06. 51,753 c. y. dr., **06,** 1838.

1906-07. 31,669 c. y. dr., **07,** 1991.

1907-08. 40,549 c. y. dr., **08,** 2116.

1908-09. 110,786 c. y. dr. in section A; chan. 12' x 200' dr. from Interurban Br. to Michigan Central RR. br., **09,** 2098.

1909-10. Dr. continued. One contract completed producing chan. 12' x 200' from Interurban Br. to Michigan Central RR. br., also a chan. 12' x 150' 400' above Center St. Br. Under new contract 131,942 c. y. dr., **10,** 2260.

1910-11. 69,181 c. y. dr., **11,** 2455.

1911-12. 765,523 c. y. dr., **12,** 2655.

PHYSICAL CHARACTERISTICS.

Formation of bar at mouth of R., **66,** iv, 60.

Peculiar formation of conglomerate clay, forming bed of chan., **66,** iv, 60; **67,** 146.

Height of spring freshets, **74,** 208.

Action of winds on R. current, **74,** 208.

Reduction in general d., **00,** 3978.

PLANS. (See Estimates and Projects.)

By Capt. Macomb, 1856, dr. chan. through bar off mouth of the R.; est. dr., 159,000 c. y., **66,** iv, 59.

By Maj. Weitzel, 1861, d. chan. at mouth to 14'; est. dr., 100,000 c. y. D. chan. to 13'; est., 50,000 c. y. **75,** 290; **76,** ii, 547.

PRIVATE (CORPORATE) WORK.

$80,000 raised by local taxation and expend. in dr. in vicinity of E. Saginaw, **74,** 208.

PROJECTS. (See Estimates and Plans.)

By Col. Cram, 1866, dr. entire new chan. through the bar off mouth 12' x 195' (or 250') x 3,274; est., $95,417, **66,** iv, 59–61; **67,** 146; **68,** 141. L. of chan. as completed, 6,800', **69,** 110.

By Maj. Weitzel, 1874, removing Carrollton and other bars in vicinity of E. Saginaw by dr. and protection of banks by pile revet.; est., $56,000, **74,** 205–209; **75,** 274. Experience proves that more extensive works will be required at Carrollton, Zilwaukee, and New York Bars; est., $51,920, **76,** ii, 535.

By Maj. Harwood, 1877, bulkhead from the upper end of revet., across to Hoyt's mill site, thereby cutting off the current behind the revet. and confining it to the main chan., **77,** 941.

In 1881 Maj. Harwood proposed, at and below Bay City, securing 14' in that portion of chan. in front of Bay City, and restoring and d. the chan. of entrance from Saginaw B. to 14', **81,** 2250.

By BE., 1882, removal of snags, logs, and store booms projecting into the chan.; excavation of chan. 12' x 200' bet. the junction of Tittabawassee and Shiawassee Rs. and Portsmouth Br. at Bay City; excavation of chan. 14' x 200' through shoals in vicinity of Bay City, and across bar at mouth of R.; est., $446,000, **83,** 1866, 1867; **84,** 2041.

Amount app. 1882 to 1886, incl., $208,750. Amount est. to complete proj., $337,250. **86,** 1828.

By Gen. Poe, 1892, expend. app. of 1892, $100,000, in dr. bar at mouth, Essexville Bar, West Chan., and above Bay City, **93,** 2925.

In 1897 Lt. Col. Lydecker est. $482,625 to imp. R. as contemplated by act June 3, 1896 (see Surveys), **98,** 2602.

Lt. Col. Lydecker, 1899, believed that the best plan for imp. R. would be by U. S. plant, which would cost $125,000 for constr. and mainten. and operation for 1 year, $50,000 an. for the next 5 years, after which period the H. imp. could be maintained for about $20,000 an., **99,** 2986.

Act June 13, 1902, au. imp. of Flint, Shiawassee, and Bad Rs., in connection with the Saginaw R.; est., not to exceed $12,500, **02,** 479.

Act of 1905 diverted sums app. for Flint, Shiawassee, and Bad Rs. to imp. of Saginaw R., **05,** 583, 2224.

Act June 25, 1910, au. chan. 18' x 200', Saginaw B. to mouth of R., and 16' from that point to junction with the Tittabawassee R.; est., $686,000, with $20,000 an. mainten. (H. D. 740, 61st, 2d), **10,** 845.

SURVEYS.

By Capt. Macomb, T. E., 1856, **66,** iv, 59.

Soundings and borings through the ice by Col. Cram, 1867, **67,** 146.

Resur. under direction of Maj. Poe, by H. A. Ulffers, 1871. **R., 72,** 207.

Sur. in vicinity of E. Saginaw, under the direction of Maj. Weitzel, by H. Gillman, 1874. **R., 74,** 206–209.

Sur. of mouth by Maj. Weitzel, 1875. **R., 75,** 289.

Under direction of Maj. Harwood, of Carrollton Bar, 1877. **R., 78,** 1234.

Resur. of upper R., 1881, **82,** 2332.

Sur. of a shoal in the vicinity of n. part of Bay City made, 1893, by Maj. Ludlow, **93,** 2928. Surs. made at various bars, 1894, by Lt. Col. Ludlow, **94,** 2244. Resur. of R. made, 1895, by the same officer, **95,** 2829. Ex. of chan. bet. Saginaw and d. w. in the B. made, 1898, by Lt. Col. Lydecker, **98,** 2579.

Sur. of R. from its head to a point in Saginaw B. with view to chan. 14' x 200' and 16', au. act June 3, 1896; made, 1897, by Lt. Col. Lydecker (see Projects), **98,** 2600, 2604.

Minor surs., **99,** 2985; **00,** 3978; **06,** 1837; **08,** 2115.

For estab. H. lines, **05,** 224.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to securing 20', Saginaw B. to Tittabawassee R. **R.** by Col. Townsend, 1909 and 1910; est., $686,000 (H. D. 740, 61st, 2d), **10,** 861.

Cong. docs., etc., relating to exs., surs., plans etc., **12,** 1076.

Maps. (H. D. 740, 61st, 2d.) Of the R., **79,** 1662; **84,** 2042; **85,** 2150; **03,** 1986.

PP-68 TITTABAWASSEE RIVER, MICH.

COMMERCE.

Description of. For more than 30 years the R. has been in the possession of a logging company, and in 1894 there was no immediate or prospective demand for its imp., **95,** 2849.

ENGINEERS.

Chief of Engineers. **R., 95,** 396.

In charge. Lt. Col. G. J. Lydecker, 1894–95. **R., 95,** 2848.

Assistant. B. H. Muehle. **R., 95,** 2849.

PHYSICAL CHARACTERISTICS.

Description of. The R. a connection of the Shiawassee, the two together forming the Saginaw R., **95,** 2849.

SURVEY.

Ex. from Saginaw to head of navigation au. act Aug. 17, 1894; made, 1894, by Lt. Col. Lydecker (**R.** unfav.), **95,** 2848.

PP-69(a) SHIAWASSEE, BAD, AND FLINT RIVERS, MICH.

COMMERCE.

Description of; that of Flint R. unimportant, **95,** 2854.

ENGINEERS.

Chief of Engineers. **R., 95,** 396; **98,** 439.

In charge. Lt. Col. G. J. Lydecker, 1895–98. **R., 95,** 2852; **98,** 2600.

Assistants:

Lt. J. F. McIndoe. **R., 98,** 2603.
B. H. Muehle. **R., 95,** 2854.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 2854, 2856.

The Shiawassee unites with the Tittabawassee near the city of Saginaw, Mich., forming the Saginaw R. The Flint and Bad Rs. are tributaries of the Shiawassee, and respectively enter it about 6 and 10 m. above its mouth, **95,** 2852.

PROJECTS.

In 1897 Lt. Col. Lydecker est. it would cost $21,000 to imp. the Shiawassee and Bad Rs., but that a temporary imp. could be made for $5,000; and $15,000 to imp. the Flint R. as far as practicable, **98,** 2602, 2603.

SURVEYS.

Ex. of the Shiawassee R. from Saginaw R. to Bad R., of Bad R. to the village of St. Charles, and of Flint R. to head of navigation, au. act Aug. 17, 1894; made, 1894, by Lt. Col. Lydecker (**R.** unfav. to Flint R.), **95,** 2852.

PP-75 QUANICASSEE RIVER, MICH.

ENGINEERS.

Chief of Engineers. **R., 89,** 319.

In charge. Col. O. M. Poe, 1888. **R., 89,** 2284.

PHYSICAL CHARACTERISTICS.

"Impossible to d. chan."; Sebewaing not within 15 m. of R., **89,** 2284.

SURVEYS.

Ex. "of Quanicassee R. to d. chan. from mouth to village of Sebewaing to 12'," au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2284.

PP-76 SEBEWAING HARBOR (River), SAGINAW BAY, MICH.

APPROPRIATIONS.

1875,	$8,000,	**75,** 51.
1881,	7,000,	**81,** 2251.
1896,	5,000,	**97,** 3014.
1899,	32,000,	**99,** 2988.
1905,	5,000,	**05,** 2225.
1907,	2,000,	**07,** 1993.
Total,	59,000	

COMMERCE.

The approach of any but the smallest coasting vessels will always be impracticable, **73,** 307.

Description of, **93,** 2952.

In 1900, 885,080 t., **01,** 3143; in 1904, 14,770 t., **05,** 2226.

C. of this R. has diminished from year to year and in 1908 amounted to 1,325 t., **10,** 2262.

CONTRACTS.

1875. J. P. Clark, dr., **76,** ii, 537.
1880. T. M. Hubbell, dr., 25¢ c. y., **81,** 2252.
1899. Campbell Bros., dr., 16¢ c. y., **00,** 3982.
1906. C. B. Curtiss, dr. and bldg. pile revet. (prices given), **06,** 1839.
1908. T. B. Creswell, lease of dr. plant, $10 per working hour, **08,** 2117.

ENGINEERS.

Chief of Engineers. **R., 73,** 42; **75,** 51, 53; **76,** 104; **79,** 170; **80,** 220, 221; **81,** 299; **82,** 294; **84,** 308; **91,** 362, 2804; **93,** 388; **95,** 397; **96,** 346, 351; **97,** 443; **98,** 431; **99,** 513; **00,** 577; **01,** 557; **02,** 479; **03,** 525; **04,** 574; **05,** 584; **06,** 650; **07,** 672; **08,** 729; **09,** 767; **10,** 847; **11,** 902; **12,** 1077.

In charge:
Maj. G. Weitzel, 1873–76. **R., 73,** 306; **75,** 275, 290; **76,** ii, 537.
Maj. F. Harwood, 1879–84. **R., 80,** 2043, 2044; **81,** 2251; **82,** 2334; **84,** 2079.
Col. O. M. Poe, 1891. **R., 91,** 2804.
Maj. W. Ludlow, 1893. **R., 93,** 2950.
Lt. Col. G. J. Lydecker, 1896–1900. **R., 96,** 2743; **97,** 3014; **98,** 2581; **99,** 2987; **00,** 3981.
Maj. W. L. Fisk, 1901. **R., 01,** 3142.
Capt. L. H. Beach, 1902–05. **R., 02,** 2187; **03,** 1987; **04,** 3075; **05,** 2225.
Capt. Chas. Keller, 1906. **R., 06,** 1839.
Col. C. E. L. B. Davis, 1907. **R., 07,** 1993.
Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2117; **09,** 2100; **10,** 2262; **11,** 2456; **12,** 2657.

Assistants:
H. A. Ulffers. **R., 73,** 307.
Capt. A. N. Lee, **75,** 290; **76,** ii, 537.
B. H. Muehle. **R., 93,** 2951.

OPERATIONS.

1875. Dr. chan. 6′ x 100′ x 2,000′, **76,** 104, ii, 537.
1880-81. 13,279 c. y. dr., **81,** 2251.
1881-82. 11,332 c. y. dr., **82,** 2334.
1899-00. 10,770 c. y. dr., **00,** 3982.
1900-01. 46,828 c. y. dr., **01,** 557.
1901-02. 53,257 c. y. dr., **02,** 2188.
1902-03. 79,256 c. y. dr., **03,** 1988.
1903-04. 16,789 c. y. dr., **04,** 574, 3076.
1905-06. 16,735 c. y. dr. and cast over on n. bank of R., **06,** 1839.
1907-08. Dr. plant worked 37¾ hours, and completed cut 24′ wide through the bar, **08,** 2117.
1908-09. 7,886 c. y. dr.; chan. 75′ w., 7′ to 8′ d., and 1,400′ l., made through bar at mouth, **09,** 2100.

PHYSICAL CHARACTERISTICS.

Description, **73,** 307; **75,** 275, 291; **91,** 2805; **93,** 2952.
Material removed: Clay mixed with sand and gravel, **76,** ii, 537.
A small stream not over 60′ w., **93,** 2952.
Filling in chans., **03,** 1938.
Shoaling, **05,** 2225; **07,** 1993.
Outer chan. in good condition for about 1½ m., beginning from outer end. Available d. over entire imp. not over 7′. Banks cast up on both sides of cut further inshore have caved in, reducing w. of dr. chan., **07,** 1993.
Max. draft, June 30, 1910, m. l. w. over shoalest part of R., was 6.5′, **10,** 847.

PRIVATE WORK.

$16,000 expend. by private enterprise in opening the R., **73,** 307; **75,** 291.

PROJECTS.

By Capt. Lee, 1874, concurred in by Maj. Weitzel, dr. cut. 100′ w., 6′ d. from mouth of R. to 6′ curve in B.; expend. the app. of 1875, $8,000, and sowing of wild rice on the banks; straightening and d. the R. as far as funds available would permit, **75,** 291, 292.
By Maj. Harwood, 1880, excavation of a chan. 50′ w. and 7′ d. to Saginaw B.; est., $7,000, **80,** 2045. Work completed in 1881, **82,** 2334.
In 1895, Lt. Col. Lydecker est. that it would cost $37,000 to imp. the R., **96,** 2744, by dr. at the entrance a chan. 100′ w. and 8′ d. for a l. of 15,000′; the plan of imp. adopted, **97,** 3014.
R. is not regarded as worthy of continued imp., expend. being deemed out of proportion to C. involved; expend. for mainten. not to exceed $2,000 per an., **08,** 2117.

SURVEYS.

Under direction of Maj. Weitzel, by H. A. Ulffers, 1873. **R., 73,** 306, 307.
Under direction of Maj. Weitzel, by Capt. A. N. Lee, 1874, **75,** 290.
Under direction of Maj. Harwood, 1879, a resur. in progress, **79,** 170.
Au. act Mar. 3, 1879; made, 1880, by Maj. Harwood, **80,** 2044. Resur., to obtain a 12′ chan. (**R.** unfav.), **84,** 2079.
Ex. au. act Sept. 19, 1890; made, 1890, by Col. Poe (**R.** unfav.), **91,** 2804.
Ex. au. act July 13, 1892; made by Maj. Ludlow 1893 (**R.** fav.), **93,** 2951.
Sur. au. act Aug. 17, 1894; made by Lt. Col. Lydecker, 1895 (see Projects), **96,** 2743.
In Apr., 1908, an ex. of R. was made and chan. was found to be blocked by bar at mouth of R., with 2.5′ of water over it, **08,** 2117.
Ref. to ex. or sur. reports, maps, plans, H. D., etc., **12,** 1078.
Maps. **03,** 1988.

PP-77(a) CASEVILLE, MICH. (Harbor at.)

ENGINEERS.

Chief of Engineers. **R., 81,** 301; **84,** 308; **06,** 664.

In charge:
Maj. F. U. Farquhar. **R., 84,** 2077.
Maj. L. H. Beach, **06,** 645.

Assistant. C. P. Gilbert. **R., 84,** 2077.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Maj. Farquhar (**R.** unfav.), **84,** 2077.
Ex. au. act Mar. 3, 1905; made, 1905, by Maj. Beach (**R.** unfav.) (H. D. 192, 59th, 1st), **06,** 664.

PP-77 (b) PIGEON RIVER, MICH.[1]

COMMERCE.

Local, **87,** 2208.

ENGINEERS.

Chief of Engineers. **R., 87,** 286; **10,** 831.

In charge:
Capt. D. W. Lockwood. **R., 87,** 2207.
Maj. Chas. Keller, **10,** 801.

PHYSICAL CHARACTERISTICS.

Description, **87,** 2207.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1887, by Capt. Lockwood (**R.** unfav.), **87,** 2207.
Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Keller, Sept. 21, 1909 (H. D. 413, 61st, 2d) (unfav.), **10,** 831.

[1] Sur.—**R.,** Jan. 30, 1837; est., $83,860.52. (H. D. 482, 55th, 2d.)

PP-78 (a) PINNEBOG RIVER, MICH.

ENGINEERS.

Chief of Engineers. **R., 87,** 294.

In charge. Lt. Col. O. M. Poe, 1886. **R., 87,** 2274.

PHYSICAL CHARACTERISTICS.

Description of, **87,** 2274.

SURVEY.

Ex. au. act Aug. 5, 1886; made, 1887, by Lt. Col. Poe (**R.** unfav.; cost too great), **87,** 2274.

PP-78 (b) PORT CRESCENT, MICH.

COMMERCE.

Unimportant, **73,** 304.

ENGINEERS.

Chief of Engineers. **R., 72,** 42; **73,** 41.

In charge. Maj. O. M. Poe, 1872–73. **R., 73,** 304.

Assistants:

H. A. Ulffers. **R., 73,** 304.
W. C. Sauer, **73,** 304.

PHYSICAL CHARACTERISTICS.

Described, **73,** 304, 305.

SURVEY.

Under the direction of Maj. Poe (**R.** unfav.), by H. A. Ulffers and W. C. Sauer, 1872, **73,** 304.

PP-79 PORT AUSTIN, MICH.

ENGINEERS.

Chief of Engineers. **R., 72,** 42; **73,** 41; **89,** 319.

In charge. Maj. O. M. Poe, 1872–88. **R., 73,** 302; (Col.) **89,** 2280.

Assistant. H. A. Ulffers. **R., 73,** 302.

PLAN.

By H. A. Ulffers, 1873, concurred in by Maj. Poe, break'r on the 24′ curve, with a cross section of 32′; est., $864,000, or on the 18′ curve, with cross section of 24′; est., $588,000, **73,** 302, 303. "The break'r proposed is in my opinion the only way of securing adequate protection in all weathers. A glance at the est. will show this to be a costly plan, * * * not justified in view of the proposed H. of refuge on the Lake Huron side of Point Aux Barques." Extract from **R.** of Maj. Poe. **73,** 302.

SURVEY.

Under the direction of Maj. Poe, by H. A. Ulffers, 1872. **R., 73,** 302.

Ex. au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2280.

PP-80 POINTE AUX BARQUES, MICH.

ENGINEERS.

Chief of Engineers. **R., 04,** 581, 3088.

Boards. BERH. **R., 04,** 3090.

In charge. Maj. L. H. Beach, 1904. **R., 04,** 3089.

PHYSICAL CHARACTERISTICS.

Bottom is rocky and irregular, with dangerous rocky coast, **04,** 3089.

SURVEY.

Pre. ex. au. act June 13, 1902, with view to imp. as a H. of refuge. **R.** by Maj. Beach, Jan. 15, 1903 (H. D. 74, 58th, 2d) (unfav.), **04,** 581, 3088.

PP-82 HARBOR BEACH, LAKE HURON, MICH. (Harbor of refuge.)

APPROPRIATIONS.[1]

1871,	$100,000,	
1872,	100,000,	
1873,	75,000,	**77,** 929; **79,** 1646.
1874,	75,000,	
1875,	100,000,	
1876,	75,000,	
1878,	100,000,	**78,** 125.
1879,	75,000,	**79,** 168.
1880,	75,000,	**80,** 2075.
1881,	50,000,	**81,** 2272.
1882,	75,000,	**82,** 2370.
1884,	75,000,	**84,** 2048.
1886,	75,000,	**86,** 1833.
1888,	70,000,	**88,** 1970.
1890,	30,000,	**90,** 2732.
1892,	150,000,	**92,** 2467.
1894,	20,000,	**95,** 2832.
1896,	16,000,	**96,** 2731.
1899,	50,000,	**99,** 2989.
1900,	150,000,	**00,** 3984.
1902,	7,500,	**02,** 2189.
1904,	50,000,	**04,** 3079.
1905,	200,000,	**05,** 2227.
1907,	150,000,	**07,** 1997.
1909,	*10,000,	**09,** 2102.
1910,	100,000,	**10,** 2263.

Total, 2,053,500 (less $30,000 carried to surplus fund and incl. misc., $2,026,367.21, **12,** 2658).

COMMERCE.

Requirements of, discussed, H. D. 60, 41st, 3d, p. 95, **72,** 219.

No doubt as to importance of the work (Maj. Poe), **72,** 213; **74,** 211.

Importance does not justify the expense (BE.), **73,** 295.

Its importance estab. by experience (Maj. Weitzel), **75,** 277; **76,** ii, 540.

H. used by 637 boats in one season, **78,** 125, 1222.

List of vessels using the H., 1875 to 1879, **79,** 1645, 1649.

Statement of vessels seeking refuge at H., 1877 to 1886, incl., **87,** 2261.

Importance of the H. to the general lake C., **89,** 2256; **92,** 2468.

Continually increasing each year, **93,** 2931; **94,** 2249; **95,** 2832; **98,** 2583.

Grand total of vessels that found shelter, 1877–99, incl., 27,465; total tonnage, 9,664,107 t. Vessels sheltered, 1877, had an average tonnage of 289 t.; in 1899, 544 t., **00,** 3983.

Number of vessels entering H. of refuge during 1901, 1,427, tonnage, 958,302 t., **02,** 481.

Benefits of H. to C., **06,** 1843.

1912, 660 vessels sheltered; tonnage, 571,864 t., **12,** 1079.

Vessels drawing 19′–20′ can lie safely in H., **12,** 1079.

CONTRACTS.

1874–78. Dale & Davidson, **74,** 209. H. S. Dale. Hemenway & Hays, **77,** 926; **78,** 1219. C. S. Barker, removing wreck, **77,** 926; and bowlders, **78,** 1219.

1879. Farris & Garfield, for timber, O. J. Jennings, for st., **79,** 1647.

1880. J. W. McGinn, timber. H. T. Stock, furnishing dr., $7.60 per hour. Ducharme, Fletcher & Co., iron, 4¼¢ lb. **80,** 2076.

1881. C. F. Dunbar, furnishing dr., tug, and scows, $7.50 per hour, **81,** 2272.

1882. T. M. Hubbell, use of tug, **82,** 2370. J. Van Buskirk, timber, **83,** 1871. J. Stover, iron, 3¢ lb. J. Hickler, hire of dr., tug, and 2 scows, **83,** 1872.

1883. Blanchard & McAlpine, use of tug, **83,** 1872.

1884. Brooks, Joslyn & Co., timber and plank. G. Talbot, furnishing a dr., a tug, and 2 dump scows. C. Currie, furnishing tug. W. H. McCurdy & Co., iron, **85,** 2151.

1885. I. P. Donaldson, paints and oils, **85,** 2157.

1886. Brooks & Joslyn, timber, **86,** 1830. H. D. Edwards, supplies, **86,** 1833. J. Jenks & Co., supplies, **86,** 1834. D. Bell, steam launch constr., $5,250, **86,** 1837. H. Howard & Co., furnishing timber and iron, **87,** 2258.

1887. Brooks, Joslyn & Co., timber; Ducharme, Fletcher & Co., iron; McNellis & Johnson, st., **87,** 2258.

1889. H. M. Loud, timber and planks, $8,220.69; Fletcher, Jenks & Co., bolts and spikes, $1,028.56; E. G. Johnson, st., $470 per cord, **89,** 2257. Detroit Boat Works, lengthening and repairing steam launch, $2,835, **90,** 2732.

1890. H. D. Edwards & Co., ship chandlery, $189.65; J. Jenks & Co., coal, $375; C. E. Mitchell, hire of 1 dr., 1 tug, and 2 dump scows, $7.90 per hour; H. M. Loud, timber (white pine), $19.50 per M f. b. m., **90,** 2733.

1891. H. D. Edwards & Co., ship chandlery, $133; J. Jenks & Co., coal, $425, **91,** 2779.

1892. J. Jenks & Co., coal, $425, **92,** 2467.

1893. Dunbar & Sullivan, dr., 43¢ c. y., **93,** 2935. H. Howard, white pine, $22 per M f. ($1,863.64). H. N. Loud, hemlock timber, $12 per M f. ($3,040.40). Parkhurst & Wilkinson, ironwork, 2.4¢ lb. ($1,022.92). **93,** 2936. F. S. Shurick, timber, $28 per M f. ($1,367.71), **94,** 2247. Michigan Bolt & Nut Works, bolts, $2.07½ per 100 lbs. ($497.27) **94,** 2247, 2248.

1903. Hugo & Tims, rebuilding superstr. of main p., $115.51 l. f., **04,** 3077, 3080.

1905. James Davidson, dr. test pits in H., **05,** 2228. Murray Co., reconstr. part of superstr. of main p. (contract surrendered Apr. 19, 1906), **06,** 1840.

1906. Hugo & Tims, rebuilding in concrete second section of superstr. of main p., $108.62 l. f., **06,** 1843.

1907. Hugo & Tims, rebuilding in concrete remaining portion of main p., $119.98 l. f., **07,** 1996.

1911. Burk, Smith & Nelson, rebuilding in concrete superstr. of n. p. and of pierhead of s. p. (prices given), **11,** 2457.

ENGINEERS.

Chief of Engineers. R., 70, 46; H. D. 60, 41st, 3d, p. 8, **71,** 44; **72,** 41; **73,** 41; **74,** 47; **75,** 51; **76,** 105; **77,** 110; **78,** 125; **79,** 167; **80,** 222; **81,** 302; **82,** 296; **83,** 303; **84,** 305; **85,** 328; **86,** 322; **87,** 290, 291; **88,** 264; **89,** 312; **90,** 281; **91,** 353; **92,** 337; **93,** 384; **94,** 356; **95,** 391; **96,** 346; **97,** 444; **98,** 432; **99,** 513; **00,** 578; **01,** 557; **02,** 480; **03,** 526; **04,** 575; **05,** 584; **06,** 652, 664; **07,** 674; **08,** 730; **09,** 768; **10,** 847; **11,** 902; **12,** 1078.

Boards. Convened Oct. 19, 1871, **72,** 209; examined proposed sites, reported against them, recom. further ex. made near Pt. aux Barques, and adjourned, **72,** 210. Reconvened July 17, 1872; recom. ex. be continued to the s. not to exceed 40 m. from Pt. aux Barques, and adjourned, **72,** 212. Again reconvened Oct. 9, 1872; discussed the merits of various sites, adopted that at Sand Beach as the least expensive, and submits proj. for break'r there to cost $1,452,550, **73,** 294; but does not recom. so large an expend., **73,** 294. (Cols. Macomb and Woodruff, Lt. Col. Foster, and Majs. Comstock, Poe, and Farquhar; the latter relieved before final action, **73,** 295.)

In charge:

Maj. O. M. Poe, 1870–73; **70,** 46. **R., 72,** 209, 217; H. D. 60, 41st, 3d, p. 93.

Maj. G. Weitzel, 1873–82. **R., 73,** 292, 295; **74,** 209; **75,** 276; **76,** ii, 538; **77,** 925; **78,** 1219; **79,** 1645; **80,** 2074; **81,** 2270; **82,** 2369.

* Allotment. [1] Least amount required an., $200,000, **73,** 296; **75,** 277; **76,** ii, 540.

Lt. Col. O. M. Poe, 1883–92. **R., 83,** 1870; **84,** 2046; **85,** 2151; **86,** 1829, 1836; **87,** 2256, 2261; (Col.), **88,** 1968, 1972; **89,** 2254; **90,** 2729; **91,** 2776; **92,** 2464.
Maj. W. Ludlow, 1893. **R., 93,** 2931.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2247; **95,** 2831; **96,** 2730; **97,** 3015; **98,** 2583; **99,** 2988; **00,** 3983.
Maj. W. L. Fisk, 1901. **R., 01,** 3144.
Capt. L. H. Beach, 1902–05. **R., 02,** 2189; (Maj.), **03,** 1989; **04,** 3077; **05,** 2226.
Capt. Chas. Keller, 1906. **R., 06,** 1840.
Col. C. E. L. B. Davis, 1907. **R., 07,** 1994.
Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2118; **09,** 2101; (Col.), **10,** 2263; **11,** 2457; **12,** 2658.

Assistants:
W. H. Hearding, H. D. 60, 41st, 3d, pp. 93, 95.
Capt. J. A. Smith. **R., 72,** 218.
H. A. Uliffers, **72,** 217.
R. J. Cram, **72,** 217; **75,** 276.
Capt. A. N. Lee. **R., 74,** 209; **75,** 276; **76,** ii, 538; **77,** 931.
C. P. Gilbert, **75,** 276; **77,** 926; **78,** 1220. **R., 78,** 1220; **79,** 1647; **80,** 2076; **81,** 2273; **82,** 2370; **83,** 1872; **84,** 2048.

ESTIMATES. (See Plans and Projects.)

By Maj. Poe, break'r at Sand Beach, $328,000, H. Ex. D. 60, 41st, 3d, p. 95; $500,000, **71,** 44; **72,** 213.
By Capt. Smith, break'r at Port Hope, $477,744, **71,** 44; **72,** 221.
By BE., Sand Beach break'r, $1,452,550, **73,** 294; **78,** 1120.
Est. and actual cost compared, **77,** 927. Probable cost based on experience, $885,000, **77,** 929; **78,** 1220; **79** ,1646.

LEGISLATION. (See Appropriations.)

Act for government of H. submitted by Maj. Weitzel, **77,** 927; **78,** 1220.
Reasons for its necessity, **77,** 929; **79,** 1645.

OPERATIONS. (See Surveys.)

1872–73. Proposals advertised for Apr. 19, 1873. First contract awarded to Dale & Davidson May 20, 1873. **73,** 296, 297, 298.
1873–74. Preparations; 4 cribs sunk, **74,** 209.
1874–75. 1,485 l. f. of break'r (24 cribs) settled to June 30, 1875, **75,** 276.
1875–76. 3,070 l. f. of break'r to June 30, 1876, **76,** 105. Cribs 38′ x 65′, 25′ x 50′, and 18′ x 45′ sunk without superstr., **76,** ii, 538; by Maj. Houston's method, **75,** 276. P. light estab. Oct. 25, 1875, **76,** ii, 538.
1876–77. 9 cribs sunk in 1877, **77,** 931; and 2,310′ of sea arm in place, **77,** 110. Removal of wreck of *City of Buffalo*, **77,** 930.
1877–78. Superstr. built over 13 cribs and 5 cribs built and sunk; bowlders removed, **78,** 125. Repairs, **78,** 1219, 1220.
1878–79. Superstr. of 5 cribs completed, the bottoms for several more were finished, and a small quantity of dr. done, **79,** 167.
1879–80. 585 l. f. cribwork placed in extension of lake arm of break'r; 650 l. f. superstr. built and filled, **80,** 2074, 2075.
1880–81. 585 l. f. superstr. built; 580 l. f. cribwork sunk in extension of lake arm of break'r, **81,** 2271.
1881–82. 520 l. f. cribwork added to lake arm of break'r, **82,** 2369.
1882–83. 520 l. f. cribwork added to s. arm of break'r, **83,** 1870.
1883–84. 2,755 l. f. cribwork placed in break'r; 49,039 c. y. dr., **84,** 2046.
1884–85. 1,075 l. f. superstr. built, 27,740 c. y. dr., and 260 l. f. face wall built, **85,** 2152.
1885–86. Extensive repair and reconstr. work done on ps. damaged by storm, **86,** 1827. Constr. of steam launch commenced under contract, **86,** 1829, 1836.
1886–87. Extensive repairs to cribs in progress, **87,** 2256. Completion of steam launch; cost, $5,901, **87,** 2261.
1887–88. Chan. dr. continued, and low superstr. built over unprotected portion of s. p., **88,** 1969.
1888–89. Extensive repairs made to main p., **89,** 2255.
1889–90. Repairs to main and s. ps.; reconstr. of steam launch *Sand Beach*, **90,** 2730.
1890–91. 6,164 c. y. dr.; repairs to ps., **91,** 2777.
1891–92. 25,383 c. y. dr.; repairs to main, w., and s. ps., **92,** 2465.
1892–93. Crib fenders repaired, **93,** 2932; dr. in progress, and 330′ of sea wall repaired, **93,** 2933.
1893–94. General repairs to ps., and 70,160 c. y. dr., **94,** 2248.
1894–95. General repairs to ps., and 85,832 c. y. dr., **95,** 2831.
1895–98. General repairs, **96,** 2730; **97,** 3016; **98,** 2583.
1898–99. Temporary repairs to storm damaged superstr. of the main break'r, **99,** 2989.
1902–03. Advertisement made inviting bids for partly rebuilding superstr., **03,** 1989.
1903–04. 110,585 c. y. removed, **04,** 3079.
1904–05. Repairs made to portion of main p. not under contract; work on old superstr. in progress, **05,** 2226–27.
1905–06. Old superstr. torn out and retimbered; concrete work in progress, **06,** 1840.
1906–07. Total of 1,706 l. f. superstr. built and accepted under first contract with Hugo & Tims; work under second contract begun s. along main p.; old timber superstr. torn out and retimbered to station 3180; concrete blocks built in place; new deck plank put over s. 720′ of s. p., **07,** 1994.
1907–08. Rebuilding superstr. in concrete of part of main p. completed, making total of 3,542′ since beginning; 12 monoliths built and 305′ of completed structure provided under 3d contract with Hugo & Tims, and 250′ new decking placed for s. p. by day labor, **08.** 2118–19.
1908–09. Work under 1907 contract with Hugo & Tims completed Sept. 15, 1908; total of work done under this contract, 1,153 l. f. of concrete superstr. completed, making total l. of 4,695′, completing work on main p.; repairs to s. p., **09,** 2101.
1909–10. Some repairs made to wooden superstr. of s. p., **10,** 2263.
1910–11. Replacing wooden superstr. of n. and s. ps. with concrete begun; 450 l. f. of n. p. leveled off to grade, and work on p. three-fourths completed, **11,** 2457.
1911–12. Removing old wooden superstr. and replacing with concrete monoliths completed, **12,** 2658.

PHYSICAL CHARACTERISTICS.

Of proposed sites, Port Hope, Sand Beach, and Blue Ledge, H. D. 60, 41st, 3d, p. 93, **72,** 218.
Unfav. holding ground along 50 m. of coast, **73,** 293.
Soundings show gradual filling of H., **05,** 2226.
Timber in n. p. in advanced stage of decay, **08,** 2119.
On w. shore Lake Huron, 60 m. n. of its outlet into St. Clair R. H. built the only safe refuge on that coast from foot of lake to Tawas B., 115 m. above, **12,** 1078.

PLANS. (See Estimates, Projects, and Surveys.)

Three, by Maj. Poe, break'r at Sand Beach, H. D. 60, 41st, 3d, p. 94. Pt. aux Barques the central point, **72,** 221.
By Mr. Stafford, H. at Port Hope, **72,** 220; H. D. 60, 41st, 3d, p. 93.
By Capt. Smith, crib break'rs, 4,800′ l., to cost $477,744, **72,** 220; Maj. Poe approves, **72,** 221; but asks for a BE., **71,** 44; **72,** 222.

PROJECTS. (See Estimates and Plans.)

By BE., 1871, H. of refuge formed by a break'r, composed of sea and shore arms (3) of an aggregate l. of 7,000′, and consisting of timber cribwork, with st. filling, inclosing an area (650 acres) to be d. by dr. where necessary; est. by BE., $1,452,550, **73,** 294; **77,** 927; **85,** 2156.
In 1877, under experience of work already done, Maj. Weitzel considered proj. might be accomplished for $855,000, **77,** 927; **86,** 1832; **87,** 2258.
Break'r completed, 1885, **12,** 1079.

In 1887, after the app. of $1,050,000, it was est. that $130,000 would be required to complete the proj., inclusive of repairs, **87,** 2257, 2258.

In 1889 Col. Poe est. amount required for repairs to existing works, and dr., at $230,000, **89,** 2256. Increased $30,000 in 1890, **90,** 2731.

By Maj. Ludlow, 1893, expend. app. of 1892; $20,000 for repairs to timber work, and $60,000 for dr. to 21′ mainly in the vicinity of the 2 entrances, and for general repairs, **93,** 2933.

By Lt. Col. Lydecker, 1898, for reconstr. of main break'r, new superstr. to be of st.; est., $250,000, **99,** 2989.

Plan by Maj. Beach for imp. break'r, w. entrance chan. to 800′, building an interior p., and dr., **03,** 1989.

Maj. Beach recom. changing name of imp. from Sand Beach to Harbor Beach, **03,** 1990; change au. act Mar. 3, 1905, to Harbor Beach, **05,** 2226.

Pier Decay. (See Physical Characteristics.)

Act Mar. 2, 1907, app. $150,000 for continuing work of rebuilding superstr. of main p., of n. and s. ps., in concrete, riprap protection of main p., closing n. entrance, and dr. and d. H. to 24′ and entrance to 23′; est., $970,000, and $10,000 an. mainten. (H. D. 900, 59th, 1st), **08,** 731.

SURVEYS.

Au. act July 11, 1870, **70,** 46. Maj. Poe **R.** that special sur. is unnecessary and recom. Sand Beach B. as the site, with est. for 2,800′ of p. to cost $328,000. Discussion of sites, H. D. 60, 41st, 3d, p. 93.

Surs. made at Port Hope, Sand Beach, and Blue Ledge, but no site selected, **71,** 44; **72,** 209. Maj. Poe recom. Port Hope, **71,** 44.

Sur. made, Pt. aux Barques, **72,** 211.

Sur. for location of site au., **72,** 217. **R.,** Capt. Smith, with plans and est., **72,** 218. (See Estimates and Plans.)

Minor surs., **95,** 2832; **96,** 2730; **97,** 3016.

Ex. and plan, with est. of cost, au. act Mar. 3, 1905, to ascertain what further imp. be necessary so as to make H. suitable for demands of C.; **Rs.,** Capt. Keller, 1905 and 1906; est., $970,000, with $20,000 an. mainten. (H. D. 900, 59th, 1st), **06,** 664.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1079.

Maps (H. D. 900, 59th, 1st):

Location of work, **77,** 930.

Of the H., showing condition of the work June 3, 1879, **79,** 1646.

82, 2372; **84,** 2048; **85,** 2156; **86,** 1830; **03,** 1990; **06,** 1842.

Plan of main p., **06,** 1842.

PP-83 FORESTVILLE HARBOR, LAKE HURON, MICH.

ENGINEERS.

Chief of Engineers. R., 87, 294; **89,** 319; **10,** 860.

In charge:

Lt. Col. O. M. Poe, 1886, **R., 87,** 2273; **89,** 2282.

Col. C. McD. Townsend, **10,** 832.

PHYSICAL CHARACTERISTICS.

Details, on shore of Lake Huron, 47 m. n. of the foot of the lake (head of St. Clair R.) and about 14 m. s. of H. of refuge at Sand Beach, **87,** 2273.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Poe (unfav.), "costly," **87,** 2273.

Ex. au. act 11, 1888; made, 1888, by Col. Poe (unfav.), **89,** 2282.

Ex. au. act Mar. 3, 1909. **R.,** Col. Townsend, 1909 (unfav.) (H. D. 354, 61st, 2d), **10,** 860.

PP-84 FORESTER HARBOR, MICH.

ENGINEERS.

Chief of Engineers. R., 10, 860.

In charge. Col. C. McD. Townsend, **10,** 832.

PHYSICAL CHARACTERISTICS.

Details, village of Forester on s. shore of Lake Huron, 35 m. n. of Port Huron. (H. D. 350, 61st, 2d.)

SURVEY.

Pre. ex. au. act Mar. 3, 1909, with view to d. Forester H. **R.,** Col. Townsend, June 18, 1909 (unfav.) (H. D. 350, 61st, 2d), **10,** 860.

PP-85 PORT SANILAC, MICH. (Harbor of refuge.)

ENGINEERS.

Chief of Engineers. R., 89, 319; **10,** 860.

In charge:

Col. O. M. Poe, 1888. **R., 89,** 2284.

Col. C. McD. Townsend, **10,** 832.

PHYSICAL CHARACTERISTICS.

Description of, bet. head of St. Clair R. and H. of refuge at Sand Beach, **89,** 2285.

SURVEYS.

Ex. of H. of refuge au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2284.

Ex. au. act Mar. 3, 1909, with view to imp. by dr. **R.,** Col. Townsend, June 18, 1908 (unfav.) (H. D. 353, 61st, 2d), **10,** 860.

PP-86 LEXINGTON HARBOR, MICH.

ENGINEERS.

Chief of Engineers. **R., 89,** 319; **10,** 860.

In charge:
Col. O. M. Poe, 1888. **R., 89,** 2281.
Col. C. McD. Townsend, **10,** 832.

PHYSICAL CHARACTERISTICS.

Details, on open coast of Lake Huron, 18 m. above head of St. Clair R., about 43 m. below H. of refuge at Sand Beach, **87,** 2281.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2281.
Pre. ex. au. act Mar. 3, 1909. **R.,** Col. Townsend, June 18, 1909 (unfav.) (H. D. 348, 61st, 2d); **10,** 860.

PP-87 CORSICA SHOAL (foot of Lake Huron), MICH.

ENGINEERS.

Chief of Engineers. **R., 91,** 363.

In charge. Col. O. M. Poe, 1890. **R., 91,** 2820, 2821.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2821.

PLANS.

By Col. Poe, 1891, chan. 21′ d. through Corsica Shoal near entrance to St. Clair R.; est., $410,666, **91,** 2822.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1891, by Col. Poe, **91,** 2820.

PP-88 ST. CLAIR RIVER, MICH.

ENGINEERS.

Chief of Engineers. **R., 85,** 332; **87,** 294; **08,** 743.

In charge:
Lt. Col. O. M. Poe. **R., 85,** 2197, 2203; **87,** 2270.
Col. C. E. L. B. Davis, **08,** 715.

Assistants:
B. H. Muehle. **R., 85,** 2205.
O. B. Wheeler. **R., 85,** 2199.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 2199, 2204.
Erosion of right bank, **85,** 2198, 2200.
In 1884 Col. Poe did not consider that the bank erosion was harmful to the R. chans., **85,** 2198, 2202.

PLANS.

By Col. Poe, 1886, for removing shoal opposite St. Clair City to d. of 17′; est., $40,000, **87,** 2270.

SURVEYS.

Of right bank from Lake Huron to St. Clair au. act July 5, 1884; made by Col. Poe (**R.** unfav.), **85,** 2197, 2203.
Of bar opposite St. Clair City au. act Aug. 5, 1886; made by Col. Poe (see Plans), **87,** 2270.
Pre. ex. and sur., bet. Russell Isld. and Grand Pt., au. act Mar. 2, 1907. **R.,** Col. Davis, Apr. 22 and Nov. 26, 1907, submitting plan for imp.; est., $100,000 (H. D. 453, 60th, 1st), **08,** 743.
Maps. (H. D. 453, 60th, 1st.)

PP-89 BLACK RIVER, PORT HURON AT MOUTH, AND VICINITY OF BLACK RIVER MOUTH IN ST. CLAIR RIVER, MICH.

Part.	Title.	Period.	Appropriation.
a	St. Clair R. (at mouth of Black R., Mich.)	1871–1879	$56,500
b	Black R., Mich. (at mouth)	1886–1912	44,000
c	Black R. (at Port Huron)	1888–1912	68,500
	Total		169,000

Part (a), PP-89 St. Clair River at the mouth of Black River, Mich.

APPROPRIATIONS.

1872,	$15,000,	**73,** 41.
1873,	15,000,	**73,** 41.
1874,	15,000,	**74,** 47.
1875,	10,000,	**75,** 279.
1878,	1,500,	**78,** 126, 1228.
Total,	56,500,	**78,** 126, 1228.

COMMERCE.

The whole C. of the lakes passes here and would be benefited by this imp., **75,** 279; **76,** ii, 541.

CONTRACTS.

1873. T. M. Hubbell, dr., 27¢ c. y., **73,** 300.
1878–79. P. Smith, dr., 18¢ c. y., **79,** 1656.

ENGINEERS.

Chief of Engineers. **R., 71,** 44; **73,** 41; **74,** 47; **75,** 52; **76,** 105; **77,** 111; **78,** 126; **79,** 169.

In charge:
Maj. O. M. Poe, 1871–73. **R., 71,** 177.
Maj. G. Weitzel, 1873–78. **R., 73,** 299; **74,** 212; **75,** 278; 76, ii, 540; **77,** 934.
Maj. F. Harwood, 1878–79. **R., 78,** 1227; **79,** 1656.

Assistants:
R. J. Cram, **71,** 177.
H. A. Ulffers. **R., 71,** 177.

OPERATIONS.

1872–73. Dr. commenced Sept. 23 and closed for the season Nov. 25, 1872; resumed Apr. 13, 1873; to June 30, 1873, nearly 50,000 c. y. removed, **73,** 300.
1873–74. 53,074 c. y. removed, **74,** 212.
1874–75. 35,000 c. y. removed, **75,** 279.
1875–76. 67,000 c. y. removed, **76,** 105.
1878–79. Dr. of Port Huron middle ground completed to 15′, **79,** 169, 1657.

PHYSICAL CHARACTERISTICS.

A bar of sand and gravel at the junction of the R.; docks in St. Clair R. above the junction, causing the bar to form more rapidly, **71,** 178, 179.

PLANS.

By Maj. Poe, 1871, building a dam across Black R. and dr., $66,924; for removing the middle ground to d. of 15′, $67,320; for removing the middle ground to d. of 18′, $157,520; for changing direction of outlet and obtaining 15′ of water, $134,244; for changing direction of outlet and obtaining 18′ of water, $244,-444, **71,** 44, 179.

PROJECTS.

By Maj. Poe, 1871, removing bar and middle ground by dr. to d. of 15′; est., $67,320, **73,** 300; **74,** 47, 212; **75,** 52, 278.
By Maj. Weitzel, 1876, to expend $15,000 in dr. to remove a bar formed by a freshet in Black R. last spring, **76,** ii, 541.
To complete work, 1877, dr. 4,000 c. y.; est., $1,500, **77,** 934.

SURVEY.

Au. act Mar. 3, 1871, **71,** 44; assigned to Maj. Poe; made by H. A. Ulffers and R. J. Cram. **R., 71,** 177–180.
Map. Showing condition of the work Sept. 30, 1876, **77,** 935.

Part (b), PP–89 Black River, Mich. (at the mouth).

APPROPRIATIONS.

1888,	$10,000,	**89,** 2260.
1890,	10,000,	**90,** 2736.
1892,	10,000,	**92,** 2472.
1894,	4,000,	**95,** 2837.
1896,	4,000,	**97,** 3022.
1899,	4,000,	**99,** 2993.
1902,	*1,000,	**02,** 2192.
1907,	*1,000,	**07,** 1999.
Total,	[1] 44,000,	**12,** 2661.

COMMERCE.

Benefit of imp. to general lake C., **89,** 2260.
Rates probably reduced, **06,** 654; **10,** 849.
Slight local traffic only; no traffic otherwise, **12,** 2661.

CONTRACTS.

1889. W. Richardson, dr., 20¢ c. y., **89,** 2260.
1891. Bay City Dredging Co., dr., 16¢ c. y., **91,** 2782.
1892. L. E. Allen, dr. 41,692 c. y., at 18½¢ c. y., **93,** 2942.
1897. E. Hall, dr., 10¢ c. y., s. m., **97,** 3022.
1907. Muir-O'Sullivan Dredge & Dock Co., dr., 15½¢ c. y., s. m., **07,** 1999.

ENGINEERS.

Chief of Engineers. **R., 87,** 294; **88,** 264; **89,** 313; **90,** 283; **91,** 355; **92,** 339; **93,** 386; **94,** 358; **95,** 393; **96,** 348; **97,** 446; **98,** 433; **99,** 515; **00,** 579; **01,** 558; **02,** 481; **03,** 527; **04,** 576; **05,** 585; **06,** 654; **07,** 675; **08,** 732; **09,** 769; **10,** 849; **11,** 904; **12,** 1080.

In charge:
Lt. Col. O. M. Poe, 1886–92. **R., 87,** 2279; (Col.) **89,** 2259; **90,** 2735; **91,** 2782; **92,** 2471.
Maj. W. Ludlow, 1893. **R., 93,** 2940.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2253; **95,** 2836; **96,** 2735; **97,** 3021; **98,** 2585; **99,** 2992; **00,** 3986.
Maj. W. L. Fisk, 1901. **R., 01,** 3147.
Capt. L. H. Beach, 1902–05. **R., 02,** 2191; (Maj.) **03,** 1993; **04,** 3081; **05,** 2229.
Capt. Chas. Keller, 1906. **R., 06,** 1845.
Col. Chas. E. L. B. Davis, 1907. **R., 07,** 1998.
Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2121; **09,** 2104; (Col.) **10,** 2266; **11,** 2460; **12,** 2661.

OPERATIONS.

1888–89. 20,800 c. y. dr., **89,** 2260.
1889–90. 26,000 c. y. dr., **90,** 2736.
1890–91. 17,504 c. y. dr., **91,** 2783.
1891–92. 40,011 c. y. dr., **92,** 2471.
1892–93. 41,692 c. y. dr., and proj. completed, **93,** 2941.
1896–97. 729 c. y. dr., **97,** 3021.
1897–98. 45,729 c. y. dr., **98,** 2585.
1906–07. 14,405 c. y. dr. from St. Clair R. adjoining, **07,** 1998.
1907–08. 9,101 c. y. dr., **08,** 2122.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 2735.
Tendency to shoaling, **99,** 2992. (See Private work.)

PRIVATE WORK.

Contract dr. by private parties; about 250,000 c. y. removed, 1909; sand and gravel tending to retard shoaling, **09,** 2104; **10,** 2266; should be prohibited, **11,** 2460; **12,** 2661.
Canadian Govt. doing extensive work at Pt. Edward, opposite, **10,** 2266.
Small amount of sand and gravel removed by private parties from mouth, thus imp. chan. in front of docks, **12,** 2661.

PROJECTS.

By Lt. Col. Poe, 1887, removal of shoal at mouth to uniform d. of 17′; est. cost, $69,300, **87,** 2280.
Col. Townsend, in view of possibility of endangering entire C. of Lakes Huron and Michigan by enlarging cross section through dr. on bar, St. Clair R., recom. that dr. be suspended, **10,** 2266; **12,** 2661.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1886, by Lt. Col. Poe, **87,** 2279.
Minor surs., **99,** 2992; **00,** 3986.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1080.
Maps. **03,** 1993.

* Allotment. [1] Not including $56,500 app., St. Clair R., mouth of Black R.

Part (c), PP-89 Black River (at Port Huron), Mich.[1]

APPROPRIATIONS.

1890, $25,000, **91,** 2781.
1892, 10,000, **92,** 2470.
1894, 4,000, **95,** 2835.
1896, 4,000, **96,** 2734.
1899, 4,000, **99,** 2994.
1907, 6,000, **07,** 2002.
1909, *4,000, **09,** 2108.
1910, 5,000, **10,** 2269.
1911, 5,000, **11,** 2463.
1912, 1,500, **12,** 2664.

Total, 68,500, **12,** 2664.

COMMERCE.

1899, 110,860 t.; 1900, 1,607,356 t., **01,** 559; about 140,000 t., value $400,000, **07,** 681; 115,182 t., value, $500,000, **12,** 1085.

Rates reduced. Probably no effect on rates, **07,** 681; **10,** 854.

CONTRACTS.

1891. C. E. Mitchell, dr., 11⅞¢ c. y., **91,** 2781.
1893. L. P. & J. A. Smith, dr., 18¢ c. y., **93,** 2940.
1897. E. Hall, dr., 8¢ c. y., s. m., **97,** 3023.
1900. E. Hall, dr., 14¢ c. y., **00,** 3989. Edmund Hall, dr., **01,** 3149.
1907. Muir-O'Sullivan Dredge & Dock Co., dr., $13 per hour, **08,** 2126.
1909. The Central Dredging Co., dr., 12.5¢ c. y., s. m., **09,** 2108.
1910. Muir-O'Sullivan Dredge & Dock Co., dr., 20¢ c. y., s. m., **10,** 2269.
1911. Muir-O'Sullivan Dredge & Dock Co., dr. 40,000 c. y. at 15½¢ c. y., s. m., **11,** 2463.

ENGINEERS.

Chief of Engineers. R., 89, 320; **91,** 354; **92,** 339; **93,** 385; **94,** 358; **95,** 392; **96,** 347; **97,** 446; **98,** 433; **99,** 515; **00,** 580; **01,** 559; **02,** 483; **03,** 529; **04,** 578; **05,** 587; **06,** 658; **07,** 680; **08,** 736; **09,** 774; **10,** 853; **11,** 907; **12,** 1084.

In charge:

Col. O. M. Poe, 1888–92. **R., 89,** 2291; **91,** 2780; **92,** 2469.
Maj. W. Ludlow, 1893. **R., 93,** 385.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2251; **95,** 2834; **96,** 2733; **97,** 3028; **98,** 2586; **99,** 2993; **00,** 3987.
Maj. W. L. Fisk, 1901. **R., 01,** 3148.
Capt. L. H. Beach, 1902–05. **R., 02,** 2193; (Maj.) **03,** 1996; **04,** 3084; **05,** 2232.
Capt. Chas. Keller, 1906. **R., 06,** 1848.
Col. Chas. E. L. B. Davis, 1907. **R., 07,** 2002.
Lt. Col. C. McD. Townsend, 1908–12. **08,** 2126; **09,** 2108; (Col.) **10,** 2269; **11,** 2463; **12,** 2664.

OPERATIONS.

1890-91. 18,225 c. y. dr., **91,** 2781.
1891-92. 73,048 c. y. dr., **92,** 2470.
1892-93. 93,716 c. y. dr., **93,** 2938.
1893-94. 46,630 c. y. dr., **94,** 2251.
1896-97. 16,844 c. y. dr., **97,** 3022.
1897-98. 53,205 c. y. dr., **98,** 2587.
1900-01. 23,214 c. y. dr., **01,** 3149.
1903-04. 1,750 c. y. dr., **04,** 3084.
1907-08. 22,449 c. y. dr., **08,** 2126.
1908-09. 18,000 c. y. dr., **09,** 2108.
1909-10. 7,500 c. y. dr., **10,** 2269.
1910-11. 5,761 c. y. dr., **11,** 2463.
1911-12. 47,454 c. y. dr., restoring proj. d. and w. from mouth to Washington Ave., **12,** 2664.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2291; **06,** 659.
Chans. dr. in upper part of imp. probably not permanent, **99,** 2994.
Description of, chan. not permanent, shoaling, **01,** 3148; **06,** 659; **10,** 853.
14′–16′ generally, 1905–06, **06,** 659.

PRIVATE WORK.

Michigan Sulphite Fiber Co. enlarged chan. to enable vessels to reach their wharf, **04,** 3084.
Chan. bet. Grand Trunk RR. br. and Washington Ave., dr. an. by Michigan Fiber Co., **07,** 681.

PROJECTS.

By Col. Poe, 1889, imp. of Black R. by excavation of chan. 15′ d. and of w. from 160′ to 87′ from mouth through city of Port Huron to Grand Trunk RR. br., 8,200′; est., $55,110, **89,** 2292, 2293. D. increased, 1891, to 16′, increasing est. to $75,000, **91,** 2781; **92,** 2469.
Canal to be cut by city of Port Huron from Lake Huron to Black R. should retard deterioration, **02,** 483.

SURVEYS.

Au. act Aug. 11, 1888; made, 1889, by Col. Poe, **89,** 2292.
Minor surs., **99,** 2993; **00,** 3988; **10,** 2269.
Pre. ex. au. act July 25, 1912 (**R.** to come), **12,** 1085.
Change in datum plane under proj. changed from 579.6 to 577.6 to correspond with m. s. elevation of Lake Huron, **12,** 1085.
Maps. **03,** 1996.

PP-91 PINE RIVER, AT ST. CLAIR CITY, MICH.

APPROPRIATIONS.

1875, [2] $5,000, **75,** 280.
1896, 5,000, **97,** 3024.
1899, 5,560, **99,** 2995.

Total, 15,560

COMMERCE.

Requirements of C. discussed, **73,** 306.
Description of, increasing, **93,** 2955.
1906, 13,495 t., entirely brick and coal, **07,** 682

CONTRACTS.

1876. For dr., awarded and work under it satisfactorily executed; app. exhausted and work stopped June 10, 1876, **76,** ii, 541.
1896. Carkin, Stickney & Cram, dr. 46,326 c. y. at 8⅝¢ c. y., s. m., **97,** 3024.
1899. J. Rooney, dr., 9½¢ c. y., s. m., **00,** 3990.

ENGINEERS.

Chief of Engineers. R., 73, 41, 42; **75,** 52; **76,** 105; **85,** 332; **89,** 319; **93,** 388; **95,** 397; **96,** 348, 351; **97,** 447; **98,** 434; **99,** 516; **00,** 581; **01,** 560; **02,** 484; **03,** 530; **04,** 579; **05,** 588; **06,** 660; **07,** 681.

In charge:

Maj. G. Weitzel, 1873–76. **R.** on sur., **73,** 306. Orders reconnoissance, **75,** 280. **R., 76,** ii, 541, 542.
Lt. Col. O. M. Poe, 1885–89. **R., 85,** 2183; **89,** 2282.
Maj. W. Ludlow, 1893. **R., 93,** 2954.
Lt. Col. G. J. Lydecker, 1895–1900. **R., 96,** 2744; **97,** 3024; **98,** 2588; **99,** 2995; **00,** 3989.
Maj. W. L. Fisk, 1901. **R., 01,** 3150.
Capt. L. H. Beach, 1902–05. **R., 02,** 2194; (Maj.), **03,** 1997; **04,** 3085; **05,** 2233.
Capt. Chas. Keller, 1906. **R., 06,** 1848.
Col. C. E. L. B. Davis, 1907. **R., 07,** 2003.

* Allotment.
[1] Harbor lines, Port Huron, **98,** 2607.
[2] Imp. of junction of Pine and St. Clair Rs.

Assistants:
H. A. Ulffers. **R., 73,** 306.
Capt. A. N. Lee. **R.,** 76, ii, 541.
O. B. Wheeler. **R., 85,** 2184.
B. H. Muehle. **R., 93,** 2955.

ESTIMATES. (See Plans and Projects.)

No original est. made; $5,000 app., and work completed for that amount, **76,** ii, 542.

OPERATIONS.

1875–76. Dr. under contract awarded. Work commenced Dec. 1, 1875; suspended Dec. 20, 1875; resumed Apr. 20, 1876; completed June 10, 1876. Chan. through bar 12′, and 9′ d. of chan. in R. secured, ample to meet all requirements of navigation, **76,** ii, 541, 542.
1896–97. 46,326 c. y., s. m., dr., **97,** 3024.
1899–00. 36,652 c. y. dr., **00,** 3990.

PHYSICAL CHARACTERISTICS.

Described, **73,** 306; **75,** 280; **76,** ii, 541; **93,** 2955.
Small stream, 150′ w., flowing into St. Clair R., **93,** 2955.

PLANS.

In 1884 Lt. Col. Poe did not think that the C. of the R. justified imp. of stream, **85,** 2183.

In 1888 Col. Poe considered existing chan. facilities sufficient for existing C. requirements, and did not recom. further imps., **89,** 2283.

PROJECT.

By Maj. Weitzel, 1875, removal of a bar by dr. at mouth of Pine R., and clearing chan. up R. as far as app. would permit, **76,** 105, ii, 541, 542.
Lt. Col. Lydecker est., 1895, $10,560 to imp. stream, **95,** 2745; by dr. upstream from mouth 2,500′ a chan. 14′ x 100′, thence for 3,300′ a chan. 12′ x 75′; plan of imp. au., **97,** 3024.

SURVEYS.

Au. act Mar. 3, 1873; assigned to Maj. Weitzel, **73,** 41, 42; made under his direction by H. A. Ulffers, 1873. **R., 73,** 306.
Reconnoissance by order of Maj. Weitzel, 1875, **75,** 280.
Ex. au. act July 5, 1884; made by Lt. Col. O. M. Poe. **R.** (unfav.), **85,** 2183.
Ex. au. act Aug. 11, 1888; made, 1888, by Col. Poe (**R.** unfav.), **89,** 2282.
Ex. au. act July 13, 1892; made by Maj. Ludlow, 1893 (**R.** fav.), **93,** 2954.
Sur au. act Aug. 17, 1894; made by Lt. Col. Lydecker, 1895 (see Projects), **96,** 2745.
Minor surveys, **99,** 2995.
Map. **03,** 1997.

PP-92 BELLE RIVER, MARINE CITY (including ice harbor of refuge), MICH.

APPROPRIATIONS.

1881,	$7,000,	**81,** 2253.
1882,	5,000,	**83,** 1875.
1884,	2,000,	**85,** 2159.
1895,	5,000,	**97,** 3026.
1899,	10,000,	**99,** 2997.
Total,	29,000	

COMMERCE.

Danger to shipping from movement of ice in R., **80,** 2060.
Necessity for protection against ice, **80,** 2060, 2062.
Description of; increasing, **93,** 2957.
1901, about 18,000 t., **02,** 484; 1907, 13,000 t., **07,** 683.
Rates reduced on coal and lumber products, not less than 15¢ t. on coal, **06,** 661; **07,** 683.

CONTRACTS.

1881. Carkin, Stickney & Cram, dr., 13¢ c. y., **81,** 2253.
1882. T. M. Hubbell, dr., 16¢ c. y., **83,** 1876.
1885. T. M. Hubbell, dr., 20¢ c. y., **85,** 2159.
1899. J. Rooney, dr., 9½¢ c. y., s. m., **00,** 3992.

ENGINEERS.

Chief of Engineers. **R., 80,** 221; **81,** 299; **82,** 294; **83,** 303; **84,** 306; **85,** 329; **86,** 324; **87,** 291; **93,** 388; **95,** 397; **96,** 351; **97,** 448; **98,** 435; **99,** 517; **00,** 582; **01,** 560; **02,** 484; **03,** 531; **04,** 579; **05,** 588; **06,** 661; **07,** 682.

In charge:
Maj. F. Harwood, 1880–82. **R., 80,** 2059; **81,** 2252; **82,** 2335.
Maj. F. N. Farquhar, 1882–83. **R., 83,** 299.
Lt. Col. O. M. Poe, 1883–88. **R., 83,** 1875; **84,** 2070; **85,** 2157; **86,** 1837; **87,** 2262; **88,** 1972.
Maj. W. Ludlow, 1893. **R., 93,** 2956.
Lt. Col. G. J. Lydecker, 1895–1900. **R., 96,** 2745; **97,** 3025; **98,** 2589; **99,** 2996; **00,** 3991.
Maj. W. L. Fisk, 1901. **R., 01,** 3152.
Capt. L. H. Beach, 1902–05. **R., 02,** 2195; (Maj.) **03,** 1998; **04,** 3086; **05,** 2233.
Capt. Chas. Keller, 1906. **R., 06,** 1849.
Col. Chas. E. L. B. Davis, 1907. **R., 07,** 2003.

Assistant. B. H. Muehle. **R., 93,** 2957.

OPERATIONS.

1881–82. 40,873 c. y. dr. bet. mouth of R. and first br., **82,** 2335.
1882–83. 28,235 c. y. dr. bet. 1st and 2d brs., **83,** 1875.
1884–85. 8,100 c. y. dr., completing proj., **85,** 2158; **87,** 2262; **88,** 1972.
1896–98. 39,035 c. y., s. m., dr., **98,** 2590.
1899–00. 52,074 c. y. dr., **00,** 3991.

PHYSICAL CHARACTERISTICS.

Description of; small stream, 125′ to 150′ w., entering St. Clair R., **93,** 2957; **07,** 682.
Principal use of imp. is as a H. of refuge, **02,** 484.
Dr. chan. deterioration, **06,** 661.

PROJECTS.

By Maj. F. Harwood, 1880, chan. 13′ x 50′, mouth of R. to Marine City drawbr., thence to 2d br., 12′ d.; est., $14,465, **80,** 2060; **83,** 1875. Proj. completed, 1885; cost, $14,000, **85,** 2158; **87,** 2262.
Lt. Col. Lydecker est., 1895, $21,500 to imp. stream, **96,** 2746; by redr. R. from mouth to 2d br. above, chan. to be 15′ x 75′ to 1st br., thence 14′, **97,** 3026.

SURVEYS.

Au. act Mar. 3, 1879; made by Maj. Harwood, 1880, **80,** 2059.
Ex., mouth to Broadway St. Br., au. act July 13, 1892; made by Maj. Ludlow, 1893 (**R.** fav.), **93,** 2956.
Sur. au. act Aug. 17, 1894; made by Lt. Col. Lydecker. 1895 (see Projects), **96,** 2746.
Minor surs., **99,** 2996.
Maps. 1882, **82,** 2336; **03,** 1998.

PP-93 ST. CLAIR RIVER AT ALGONAC.

COMMERCE.
Local, **89,** 2287.

ENGINEERS.
Chief of Engineers. R., 89, 2285.

In charge. Col. O. M. Poe, 1888–89. **R., 89,** 2285.

PHYSICAL CHARACTERISTICS.
Description of, **89,** 2286.

SURVEY.
Ex. au. act Aug. 11, 1888; made, 1889, by Col. Poe (**R.** unfav.), **89,** 2285.

PP 98 ST. CLAIR FLATS AND SHIP CANAL, MICH. [1]

Part.	Title.	Period.	Appropriation.
a	St. Clair Flats and Ship Canal, Mich.	1852–1912	$1,159,810.00
b	St. Clair Flats and Ship Canal—operating and care	1882–1912	214,425.44
	Total		1,374,235.44

Part (a), PP–98 St. Clair Flats and Ship Canal, Mich.

APPROPRIATIONS.[2]

1852,	$20,000,	act Aug. 30.
1856,	45,000,	**66,** iii, 34, iv, 44, 47.
1866,	80,000,	**66,** iii, 24, iv, 43; **67,** 145.
1867,	150,000,	**67,** 28, 145.
1868,	*86,000,	**68,** 24, 38, 144; **69,** 35.
1869,	*142,560,	**69,** 23.
1870,	16,500,	**70,** 46; **71,** 187.
1871,	1,500,	**72,** 42, 217.
1872,	4,000,	**72,** 42, 217.
1873,	100,000,	**73,** 41.
1878,	5,000,	**78,** 126, 1227.
1879,	3,000,	**79,** 168, 1656.
1880,	2,500,	**80,** 2049.
1886,	18,750,	**86,** 325.
1888,	75,000,	**88,** 1976.
1890,	80,000,	**90,** 2739.
1902,	330,000,	**02,** 2234.

Total, 1,159,810 (less app. of 1852 and 1856, $65,000, as they did not enter into imp. of St. Clair Flats Canal, $1,094,810, and plus $86,491.28 diverted from app. "Imp. St. Mary's R. at the Falls," making total expend. $1,181,301.28, **07,** 2041).

COMMERCE.
66, iii, 34; **79,** 1655.
Requirements of, **67,** 252–255.
Importance of the imp., **84,** 2071.
Total an. t. passing through canal, **90,** 2739.
In 1896 canal considered much too small to furnish proper facilities for the enormous and rapidly increasing C. passing through it, **96,** 2882.
(See Detroit River, Mich.)
About 44,000,000 t. through freight from Lake Erie to Lakes Superior or Michigan, **02,** 492.

CONTRACTS.
1866. W. W. & E. T. Williams, dr., **66,** iv, 74.
1867. J. Brown, dr., materials, and labor, **67,** 214, 232; **68,** 152; **71,** 45. M. Hill, iron, **67,** 232; **68,** 152.
1870. M. Hill, planting willows, etc., **71,** 187.
1873. J. Brown, dr., 21¢ c. y., **73,** 299; **74,** 211; **75,** 280.
1877. J. A. Smith, fascines, **78,** 1227. W. Lacroix, turf and marsh hay, **78,** 1227.
1882. A. J. Dupuis, constr. ice H., **83,** 1878.
1884. Chandler Bros., repairs to revet., **85,** 2162.
1885. E. H. French, dr., 11½¢ c. y., **86,** 1839.
1886. A. J. Dupuis, reconstr. canal revet., **87,** 2263.
1888. A. J. Dupuis, revet. constr., $7.94 l. f., **89,** 2263. Dunbar & Sullivan, hire of 1 dr., 1 tug, and 2 dump scows, $10 per hour; 1 dr. and 3 dump scows, $8 per hour. Hickler & Green, hire of 1 dr., 1 tug, and 2 dump scows, $12 per hour. W. Richardson, hire of 1 dr., 1 tug, and 2 dump scows, $8.80 per hour. Hubbell & Skeldon, hire of same plant as above, $10 per hour. Hickler & Green, hire of same plant as above, $10.75 per hour. **89,** 2264.
1890. Steiner & Griffin, revet. constr., $7.88 l. f.; L. E. Allen, dr., 23¢ c. y., **91,** 2786.
1904. The M. Rabbitt & Sons Co., constr. new chan.; prices given; total, $361,699.88, **04,** 3127.
1906. Walter H. Oades, rebuilding U. S. SS *Hancock*, $4,438, **06,** 1883.

DOCUMENTS. (Not printed in reports.)
On proj. and operations under app. of 1852. **R.** of Col. Graham and Capt. Whipple, **66,** iv, 44.

ENGINEERS.
Chief of Engineers. R., 66, 4, ii, 41, iii, 7, 34, v, 51, 52, 53; **67,** 28, 158, 162, 176–183, 214, 252; **68,** 24, 37, 38; **69,** 23, 35; **70,** 46; **71,** 45; **72,** 41, 42, 222; **73,** 41; **74,** 47; **75,** 52; **76,** 105; **77,** 111; **78,** 125; **79,** 168; **80,** 221; **81,** 300; **82,** 295; **83,** 304; **84,** 306; **85,** 329; **86,** 324, 325; **87,** 291, 292; **88,** 266; **89,** 314, 315; **90,** 283, 285; **91,** 356, 358; **92,** 340, 341; **93,** 392; **94,** 365; **95,** 401; **96,** 355; **97,** 445; **98,** 435; **99,** 518; **00,** 582, 587; **01,** 568, 571; **02,** 491; **03,** 539; **04,** 588; **05,** 598; **06,** 672; **07,** 693.

In charge:
Col. J. D. Graham, 1855; **66,** iv, 44.
Capt. A. W. Whipple, 1858–59; **66,** 4, iv, 44.
Col. T. J. Cram, 1864–71. **R., 66,** iv, 43–58; **67,** 145, 148, 159–214, 253, 254; **68,** 142–144, 151, 152; **69,** 110; **70,** 164–168; **71,** 187, 188.
Maj. O. M. Poe, 1871–73. **R., 72,** 215, 223.

* Allotment.
[1] Harbor lines, Lake St. Clair, from lower end of Grossepoint to Milk R. **95,** 3069.
[2] $20,000 app. for dr. South Pass by the Canadian au., **66,** iv, 54.

Maj. G. Weitzel, 1873–77. **R., 73,** 299; **74,** 211; **75,** 280, 281; **76,** ii, 542.
Maj. F. Harwood, 1877–82. **R., 77,** 939; **78,** 1225; **79,** 1653; **80,** 2047; **81,** 2255; **82,** 2339.
Maj. F. U. Farquhar, 1883. **R., 83,** 1878.
Lt. Col. O. M. Poe, 1883–95. **R., 83,** 1876; **84,** 2071, 2072; **85,** 2159, 2160; **86,** 1837, 1838; **87,** 2262, 2264; (Col.) **88,** 1976; **89,** 2260, 2263; **90,** 2737, 2739; **91,** 2784, 2787; **92,** 2473, 2475; **93,** 3029; **94,** 2371; **95,** 3063.
Lt. Col. G. J. Lydecker, 1896–1901. **R., 96,** 2881; **97,** 3018; **98,** 2591; **99,** 2998; **00,** 3993; (Col.) **01,** 3188, 3204.
Maj. W. H. Bixby, 1901–03. **R., 02,** 2233; **03,** 2034.
Maj. W. L. Fisk, **04,** 581.
Lt. Col. C. E. L. B. Davis, 1904–07. **R., 04,** 3126; **05,** 2276; (Col.) **06,** 1881; **07,** 2041.

Assistants:
Capt. F. U. Farquhar, **66,** ii, 41.
Capt. G. J. Lydecker, **68,** 151.
W. H. Mott, **70,** 168.
Capt. A. N. Lee. **R., 74,** 211; **75,** 280.
D. Molitor. **R., 96,** 2882.
E. S. Wheeler. **R., 03,** 2034; **05,** 2277.
Lt. L. H. Rand, **04,** 581; **05,** 590.

ESTIMATES. (See Projects.)

By Capt. Whipple, 1859, dr. chan., $80,000, **66,** 4.
By Col. Cram, 1866. entire and permanent completion, $300,000, **66,** iii, 34. For imp. existing chan., 1st plan, $374,130; 2d plan, $54,960, **66,** iv, 51, 73. For straight ship canal 13′ x 200′ x 8,200′, with dikes, $351,133, **66,** iv, 49. If 300′ w., $428,754, **66,** iv, 57, 58; **67,** 28, 145, 159, 254, 255.
By Col. Cram, 1868, creosoting timber for canal dikes, $25,000; protection to foot of outer slope of dikes, $20,000, **68,** 38, 144.
By Maj. Poe, 1872, d. 200′ chan. to 16′; repairs and custodian, $85,000, **72,** 216. Repairs, $40,000 addl., **72,** 42.
By Maj. Harwood, 1877, repairs, $5,000, **77,** 940; **79,** 1656.
By Maj. Harwood, 1879, completion of existing proj., $5,000, **79,** 1656.

HISTORY.

Of imp., **66,** iv, 44, 45, 54; **96,** 2882.

LEGISLATION.

Congressional, necessary for estab. and enforcing needful regulations for this work, **70,** 168.

OBSTRUCTIONS.

Delays from accidents during 1899, and approx. money losses, Doc. No. 80, 56, 1.
U. S. S. *Hancock* sunk by S. *Binghamton*, necessitating its rebuilding at a cost of $12,000, **06,** 1883.

OPERATIONS.[1]

1855–58. Dr. 150,000 c. y. from South Pass, **66,** iv, 44, 54.
1867–68. Ship canal, 13′ x 300′ x 8,200′, begun Aug., 1867, and work carried on to the end of fiscal year, **68,** 37, 142–144.
1868–69. Work on canal continued, **69,** 35, 110–112.
1869–70. Canal nearly completed, **70,** 164–168.
1870–71. Completion of canal, **71,** 45, 187.
1871–72. Repairs, **72,** 41, 215, 216.
1872–73. Repairs and protection to embankments; d. chan. 16′ x 200′, **73,** 41, 299.
1873–74. D. canal; 194,657 c. y. excavated, **74,** 47; 5,035 c. y. of sods and 16,504 c. y. of dr. material used in stopping leaks, **74,** 212.
1874–75. Chan. completed; repairs, and 2,500 willow cuttings set on embankments, **75,** 52, 280.
1875–76. 2,800 willow cuttings planted, **76,** 105, ii, 542.
1876–77. Damage to p. repaired, **77,** 939.
1877–78. Repairs to canal banks, **78,** 125, 1225.
1878–79. Heads of canal banks secured by pile protection, and other repairs made, **79,** 168, 1654.
1879–80. 3,626 c. y. dr. from shoal in canal, **80,** 2047.
1880–81. Operations and mainten., **81,** 2255.
1881–82. Minor repairs of revet., **82,** 2339.
1882–83. Minor repairs to revet. and constr. of ice breaker, **83,** 1876.
1883–84. Minor repairs of revet., **84,** 2072.
1884–85. Minor repairs of revet. and 4,282 c. y. dr. from chan., **85,** 2161.
1885–86. Minor repairs to revet. and 60,298 c. y. dr. from chan., **86,** 1839.
1886–87. Repair of revet. in progress, **87,** 2263. Care and operation of canal, **87,** 2264.
1887–88. Operations limited to care of canal, **88,** 1976.
1888–89. 56,117 c. y. dr.; 4,082 l. f. sheet piling built, **89,** 2261, 2265.
1889–90. 4,385 l. f. sheet piling built, **90,** 2738.
1890–91. 490 l. f. of sheet piling completed; 43,496 c. y. dr.; operation and care of canal, **91,** 2786, 2787.
1891–92. 142,965 c. y. dr.; 3,160 l. f. of sheet piling and 90′ of superstr. completed; operation and care of canal, **92,** 2474, 2475.
1892–93. 10,477 c. y. dr., **93,** 3030.
1895–96. Proj. considered completed. Historical sketch given, **96,** 2882–2887.
1904–05. Work on new chan. in progress; 1,328,789 c. y. excavated to a w. of 150′, d. of 18′, and l. of 4,317′, and 2,558′ p. revet. built, **05,** 2276, 2277.
1905–06. Work on new chan. in progress; 932,448 c. y. excavated, and 4,588 l. f. revet. built, **06,** 1882.
1906–07. Work on new chan. in progress 783,564 c. y. excavated, and 74 l. f. revet. built New chan. opened to navigation Sept. 5, 1906; work entirely completed Oct. 17, 1906, **07,** 2041.

PHYSICAL CHARACTERISTICS.

66, iv, 44, 45, 54; **68,** 143; **70,** 165, 166; **90,** 2737.

PRIVATE AND FOREIGN WORK.

3 range lights estab. and maintained by navigators, **66,** iv, 44, 45, 54.
$20,000 app. for dr. the South Pass by the Canadian authorities., **66,** iv, 54.

PROJECTS. (See Estimates.)

Early proj., **66,** iv, 53.
By Col. Cram, 1866, straight ship canal, 13′ x 200′ x 8,200, **66,** iv, 47; afterwards changed to 300′ w., **66,** iv, 57; **67,** 28, 145, 159; **68,** 142.
By Maj. Poe, 1872, dr. chan. 16′ x 200′ through canal to d. w. above and below, **72,** 216.
Proj. of 1866 and 1872 proposed chan. 16′ x 200′ x 7,221′ protected on each side by revet. Est., $428,754, **66,** iv, 57; **67,** 28; **72,** 216. Canal completed, 1875, **75,** 52, 280. Statement of cost of work, **83,** 1878.
By Maj. Farquhar, 1883, rebuilding revet., est., $132,908, **83,** 1877, 1879, 1880; **84,** 306.
By Col. Poe, 1885, rebuilding revet., est., $153,300, **85,** 2160; **86,** 1838. Increased to $200,000 in 1887, **87,** 2263. Increased to $256,000 in 1888, **88,** 1976. Increased in 1889, for completion of sheet piling, renewal of decayed portions of H. superstr., and dr. chan. to 18′ x 300′, to $276,250, **89,** 2262; **91,** 2785.
Lt. Col. Lydecker, 1899, recom. attention Congress be invited to great need for a doubling of the chan. capacity, **99,** 2998.
Act June 13, 1902, au. constr. of 2d chan. 20′ x 300′ alongside existing chan.; est., $330,000; also diversion from St. Marys Falls app. of $80,000, or as much as might be needed, **02,** 491, 492.
Special **R.** by Col. Davis on 2d chan., giving history of proj. and résumé of work, **07,** 2041.

SURVEYS.

By Capt. Whipple, 1858, showing dr., 1857–58 (see Maps), **66.**
By Lt. Col. Kearney, 1856, **66,** iv, 44.
By Capt. Meade, 1856, **66,** iv, 50; **67,** 145; **68,** 144.
By Maj. Raynolds, 1864, **66,** iv, 49.
Current observations by Lts. Mercur and Green, 1866, **66,** iv, 58.

[1] History of, to 1879, **66,** iv, 44, 45, 54. By the Canadian Govt., **66,** iv, 45, 47.

In 1897 complete ex. of local conditions and a resur. of the waterway made by Lt. Col. Lydecker, **97,** 3018.

Plans and est. of the cost of doubling the w. of the chan. called for by act June 6, 1900, **00,** 3993.

Ex. and sur. of canal, with view to doubling its capacity, au. act June 6, 1900. **R.,** by Lt. Col. Lydecker, July 28, and Dec. 6, 1900; est., $330,000 (H. D. 234, 56th, 2d), **01,** 571, 3203.

Maps:

Of n. and nw. lakes, showing location of imp., **66,** i.

Of natural chan., South Pass, showing lighthouses and dr. of, 1857–58, **66,** i.

Showing progress of work, **05,** 2276; **06,** 1882, **07,** 2046.

Part (b), PP-98 St. Clair Flats Canal, Mich. (Operating and care of.)

APPROPRIATIONS.[1]

1882,	$8,778.59	
1883,	5,118.47	
1884,	3,090.65	
1885,	4,274.16	
1886,	10,171.54	
1887,	1,819.53	
1888,	1,510.00	
1889,	20,070.00	
1890,	2,403.16	
1891,	1,845.20	
1892,	1,866.67	
1893,	2,697.93	
1894,	3,586.18	
1895,	1,999.32	
1896,	2,288.49	
1897,	2,375.89	
1898,	2,056.53	
1899,	2,049.75	
1900,	3,916.30	
1901,	2,860.23,	**01,** 3189.
1902,	2,314.97,	**02,** 2235.
1903,	3,912.11,	**03,** 2035.
1904,	16,875.66,	**04,** 3129.
1905,	28,823.79,	**05,** 2279.
1906,	7,528.22,	**06,** 1884.
1907,	15,673.61,	**07,** 2047.
1908,	9,094.81,	**08,** 2127.
1909,	11,340.21,	**09,** 2109.
1910,	5,301.16,	**10,** 2271.
1911,	9,010.63,	**11,** 2464.
1912,	19,771.68,	**12,** 2665.
Total,	214,425.44	

COMMERCE.

Increasing, **08,** 738.

1911, 61,498,884 t., **12,** 1086.

CONTRACTS.

1903. C. W. Kotcher, hemlock lumber, $17 M f. b. m., **03,** 2036. A. J. Dupuis Co., repairs to e. p. revet., $5,890; Chas. Boston & Sons, repairs to e. dike, $7,405; A. J. Dupuis Co., hire of pile-driver plant, $1,560; Candler Dock & Bridge Bldg. Co., hire of pile-driver plant, $1,560, **04,** 3129, 3130.

1904. A. J. Dupuis Co., hire of pile-driver plant, $900, **04,** 3129, 3130. Chas. Boston & Sons, hire of pile-driver plant, at $4.75 per working hour ($885.87); C. S. Rose and F. X. Pouliot, constr. custodian's dwelling and boathouse, $3,757, **05,** 2279.

1907. O. E. Dunbar, hire of scow, $12.50 per working day; The M. Rabbitt & Sons Co., furn. and delivering st., $5,415.97 ($2.45 c. y.); and tie rods, $2,726.43, **07,** 2048–49.

1910. J. D. Kennedy, furn. and placing 9,000 t. r., $11,430, **11,** 2465.

ENGINEERS.

Chief of Engineers. R., 93, 393; **94,** 366; **95,** 401; **96,** 356; **97,** 445; **98,** 436; **99,** 518; **00,** 583; **01,** 568; **02,** 492; **03,** 540; **04,** 589; **05,** 599; **06,** 673; **07,** 694; **08,** 738; **09,** 775; **10,** 854; **11,** 909; **12,** 1085.

In charge:

Col. O. M. Poe, 1883–95. **93,** 3031; **94,** 2373; **95,** 3064.

Lt. Col. G. J. Lydecker, 1896–1901. **R., 96,** 2889; **97,** 3019; **98,** 2592; **99,** 2999; **00,** 3994; (Col.) **01,** 3189.

Maj. W. H. Bixby, 1901–03. **R., 02,** 2234; **03,** 2034.

Maj. W. L. Fisk, **04,** 581.

Lt. Col. C. E. L. B. Davis, 1904–08. **R., 04,** 3126; **05,** 2278; (Col.) **06,** 1884; **07,** 2047.

Capt. G. R. Spalding, **08,** 715.

Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2127; **09,** 2109; (Col.) **10,** 2270; **11,** 2464; **12,** 2665.

Assistants:

E. S. Wheeler. **R., 03,** 2036; **04,** 3130; **05,** 2279.

Lt. L. H. Rand, **04,** 581; **05,** 590.

Capt. G. R. Spalding, **08,** 715.

OPERATIONS. (General repairs made each year.)

1892–93. Repairs made to e. dike, **93,** 3031.

1893–94. Repairs made to e. and w. dikes, **94,** 2373.

1901–02. General repairs, mainten., etc., each year (see each, an. report).

1903–04. Repairs to e. dike, and rebuilding revet. p., **04,** 3130.

1905–06. Repairs to e. dike, 100 elm trees planted, and well for water gauge made, **06,** 1884.

1906–07. Repairs made to e. dike and e. and w. ps., **07,** 2047.

1910–11. 7,442 t. st. placed around ps., **11,** 2464.

1911–12. 8,456 t. st. placed around ps., **12,** 2665.

PROJECTS.

By Lt. Col. Lydecker, 1898, extensive repairs to the 15,000′ of old canal dikes; increased permanent force for care and supervision of the canal; a more efficient enforcement of the regulations governing the traffic; est., $45,300, and after first year an an. cost of $8,000, **98,** 2592; **99,** 2999. Not in operation in 1900, **00,** 3994.

SURVEYS.

Map. **07,** 2046.

[1] Expend. under the permanent-indefinite app. provided by act July 1, 1884, for operating and keeping in repair canals and other public works, 1899.

PP-100 SWAN CREEK, LAKE ST. CLAIR, MICH.

ENGINEERS.

Chief of Engineers. **R., 80,** 221; **81,** 301.

In charge. Maj. F. Harwood. **R., 81,** 2255.

PLANS.

By Maj. Harwood, 1881, excavating 9′ chan. from Fair Haven Br. to 9′ curve in Lake St. Clair; est., $10,000; or for a chan. of same d. to the Elbow, and thence a canal 50′ w. with 9′ d. to 10′ curve in the lake; est., $17,000, **81,** 2257.

SURVEY.

Ex. au. act June 14, 1880; made, 1881, by Maj. Harwood, **81,** 2255.

PP-103 CLINTON RIVER, MICH.

APPROPRIATIONS.

1852,	$5,000,	**66,** 7.
1870,	5,000,	**70,** 46.
1871,	1,500,	**71,** 182.
1881,	8,000,	**81,** 2254.
1882,	6,000,	**82,** 2338.
1886,	6,000,	**86,** 1842.
1888,	10,000,	**88,** 1974.
1890,	10,000,	**90,** 2744.
1892,	8,564,	**92,** 2478.
1894,	5,000,	**95,** 2838.
1896,	10,000,	**96,** 2737.
1905,	3,000,	**05,** 2235.
1907,	2,500,	**07,** 2005.
1910,	5,000,	**10,** 2271.
1911,	2,000,	**11,** 2465.
1912,	2,000,	**12,** 2666.
Total,	89,564,	**12,** 2666.

COMMERCE.

Local and unimportant, **72,** 214; **76,** ii, 549.
Small, **95,** 2838.
Effect of imp. on rates unknown, **10,** 856; **12,** 1087.
1911, 12,449 t., **12,** 1087.

CONTRACTS.

1870. J. Brown, dr., 22¢ c. y., **70,** 161; **71,** 181, 182.
1881. Dupuis, Johnston & Co., dr., $5.40 per hour, **81,** 2254.
1882. T. M. Hubbell, dr., 20¢ c. y., **83,** 1882. Carkin, Stickney & Cram, material and labor, **83,** 1882.
1888. Hubbell & Skeldon, furnishing dr., and tug, $6.45 per hour, **88,** 1974.
1889. Hubbell & Skeldon, revet. constr. and dr., $9,756.16, **90,** 2744.
1891. G. Lockerbie, dr., 23½¢ c. y., **91,** 2789.
1893. M. Steiner, revet. constr., total, $6,559.21, **93,** 2945.
1897. E. Hall, dr., 15¢ c. y., s. m., **97,** 3028.
1903. Detroit Dredging Co. (Ltd.), dr., about 23,535 c. y., **04,** 3088.
1907. Toledo Dredge & Dock Co., lease of dr. plant, $20 per hour, **07,** 2005.
1908. George Lockerbie, hire of dr. plant, $10 per hour, **09,** 2110.
1912. Great Lakes Dredge & Dock Co., dr., 34,000 c. y. at 20¢ c. y., b. m., **12,** 2666.

ENGINEERS.

Chief of Engineers. **R., 66,** 7; **70,** 46; **71,** 44; **72,** 41; **76,** 106; **79,** 170; **80,** 221; **81,** 300; **82,** 294; **83,** 304; **84,** 307; **85,** 330, 332; **86,** 325; **87,** 293; **88,** 265; **89,** 316; **90,** 286; **91,** 358; **92,** 341; **93,** 386; **94,** 359; **95,** 393, 397; **96,** 349; **97,** 449; **98,** 436; **99,** 519; **00,** 583; **01,** 561; **02,** 485; **03,** 531; **04,** 580; **05,** 589; **06,** 662; **07,** 683; **08,** 738; **09,** 776; **10,** 855; **11,** 909; **12,** 1086.

In charge:
Maj. O. M. Poe, 1870. **70,** 159, 161, 162; **71,** 44, 180; **72,** 41.
Maj. G. Weitzel, 1870–76. **R., 72,** 214; **76,** ii, 549.
Maj. F. Harwood, 1880–83. **R., 80,** 2062; **81,** 2253; **82,** 2337.
Lt. Col. O. M. Poe, 1883–92. **R., 83,** 1880; **84,** 2074; **85,** 2165, 2190, 2192; **86,** 1842; **87,** 2265; **88,** 1973; (Col.) **89,** 2270; **90,** 2742; **91,** 2788; **92,** 2477.
Maj. W. Ludlow, 1893. **R., 93,** 2942.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2254; **95,** 2837, 2857; **96,** 2736; **97,** 3027; **98,** 2595; **99,** 3001; **00,** 3996.
Maj. W. L. Fisk, 1901. **R., 01,** 3153.
Capt. L. H. Beach, 1902–05. **R., 02,** 2196; (Maj.) **03,** 1998; **04,** 3087; **05,** 2234.
Capt. Chas. Keller, 1906. **R., 06,** 1850.
Col. Chas. E. L. B. Davis, 1907. **R., 07,** 2004.
Lt. Col. C. McD. Townsend, 1908–12. **R., 08,** 2128; **09,** 2109; (Col.) **10,** 2271; **11,** 2465; **12,** 2666.

Assistants:
H. A. Ulffers. **R., 72,** 214; **76,** ii, 549.
B. H. Muehle. **R., 80,** 2063; **85,** 2193.

ESTIMATES. (See Plans and Projects.)

By Maj. Poe, dr. chan. from mouth of R., $5,000, **70,** 161, 162; **71,** 180.

OPERATIONS.

1870. 20,454 c. y. dr., making chan. 9′ x 98′ x 2,700′, **70,** 161; **71,** 181, 182.
1881–82. 2,700 l. f. of chan. 8′ x 60′ dr., 38 piles driven, and 600′ mattress placed in bank protection, **82,** 2337.
1882–83. 800 l. f. brush mattress sunk, 23 pile clusters driven; pile crib constr. at terminus of line of piles; 3,275 brush bundles and 23 cords st. placed in pile crib; 6,123 c. y. sand dr., **83,** 1880, 1881.
1886–87. App. held until au. to purchase necessary right of way be granted, **87,** 2266.
1887–88. Dr. of chan. under contract begun, **88,** 1973.
1889–90. 8,169 c. y. dr., **90,** 2743.
1890–91. 40,637 c. y. dr., completing removal of shoals at Green Fence, Tets and Fortons Bends, and Reimolds Bar, **91,** 2788.
1891–92. 23,374 c. y. dr., **92,** 2477.
1892–94. 2 sections of training dike on the n. side of entrance to R. built, **93,** 2943; **94,** 2254.
1896–97. 8,655 c. y., s. m., dr., **97,** 3027.
1897–98. 25,708 c. y., s. m., dr., **98,** 2595.
1903–04. 23,535 c. y. dr., **04,** 3087.
1906–07. Dr. shoals in progress, **07,** 2004.
1907–08. Chan. dr. 8′ x 80′–100′, mouth to Tucker's coal dock, **08,** 2128.
1908–09. Chan. dr. 8′ d. bet. Market and Macomb St. Brs., Mt. Clemens, **09,** 2109.
1911–12. 31,744 c. y. dr.; contract completed, **12,** 2666.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 214; **76,** ii, 549.
Shoaling of dr. chans., **99,** 3001; from freshets, **04,** 3087.
R. navigable considerable distance above Mt. Clemens; available d. does not exceed 8′, **12,** 1087.
Datum plane, 1912, had been 1′ to 2′ higher than m. s. elevation of Clinton R. for prior 2 years; changed to 573.6 to provide chan. d. of proj., **12,** 1086.

PLANS. (See Estimates and Projects.)

By Maj. Poe, for curved chan., with banks protected by wild rice, **72,** 214.

PROJECTS. (See Estimates and Plans.)

By Maj. Poe, 1870, dr. chan. of entrance 8′ x 100′ x 2,700′; est., $5,000, **71,** 180; **81,** 300.

By Maj. Harwood, 1880, below Mt. Clemens, excavation of chan. 8′ x 100′, and constr. of pile revet.; est., $25,000, **80,** 2063.

By Lt. Col. Poe, 1885, entrance, dr. 10′ x 100′ x 3,400′, and constr. of 3,280 l. f. of pile revet., and repairs to pile crib; est., $32,926; **85,** 2193, 2195; **86,** 325; **91,** 2788; revised, 1888 and 1889, **12,** 1086.

By Lt. Col. Lydecker, 1899, applying available funds to redr. entrance chan., and to reinforcing and extending old dike adjoining entrance, **99,** 3001.

SURVEYS.

Under direction of Maj. Poe, by H. A. Ulffers, Oct., 1871. **R., 72,** 214.

Au. act Mar. 3, 1875; assigned to Maj. Weitzel, **76,** 106; made by H. A. Ulffers. **R., 76,** ii, 549.

Resur. in progress, by Maj. Harwood, **79,** 170.

Resur., 1880, au. act Mar. 3, 1879; made by Maj. Harwood, **80,** 2062.

Sur., 1885, au. act July 5, 1884; made by Lt. Col. Poe, **85,** 332.

Minor surs., **95,** 2838; **99,** 3001; **00,** 3996; **10,** 2271.

Ex. of R. made Apr., 1911, showed d. of 7′ over 3 shoals bet. mouth and Mt. Clemens, **11,** 2465.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1087.

Maps:

Of n. and nw. lakes, showing location of imp., **66,** i; **82,** 2338.

03, 1998.

PP-105 DETROIT RIVER, MICH.

Part.	Title.	Period.	Appropriations.
a	Detroit R., Mich.	1874–1912	$11,894,500
b	Detroit R., Mich. (Channel of Grosse Pt.)	1888–1892	5,000
	Total		11,899,500

Part (a), PP-105 Detroit River, Mich.

ACCIDENTS, ETC. (See Miscellaneous, below.)

APPROPRIATIONS.

1874,	$25,000,	**74,** 47.
1878,	100,000,	**78,** 125, 1223.
1879,	50,000,	**79,** 168, 1650.
1880,	50,000,	**80,** 2081.
1881,	50,000,	**81,** 2276.
1882,	60,000,	**82,** 2374.
1884,	200,000,	**84,** 2075.
1886,	37,500,	**86,** 1844.
1888,	130,500,	**88,** 1980.
1892,	30,000,	**92,** 2482.
1894,	30,000,	**95,** 3067.
1896,	30,000,	**96,** 2895.
1899,	100,000,	**99,** 3003.
1900,	200,000,	**00,** 4003.
1901,	325,000,	**01,** 3193.
1902	500,000 136,500	**02,** 2237.
1903,	450,000,	**03,** 2039.
1905,	500,000,	**05,** 2281.
1906,	700,000,	**06,** 1889.
1907	150,000 [1] 2,000,000	**07,** 2054.
1908	150,000 [1] 575,000	**08,** 2135.
1909,	[1] 3,000,000,	**09,** 2116.
1910	560,000 [1] 600,000 [1] 630,000	**10,** 2277.
1911	375,000 [1] 150,000	**11,** 2472.
Total,	11,894,500	

COMMERCE.

Large and increasing, **75,** 283.

The C. of the entire chain of lakes benefited by this work, **75,** 284.

Benefits of the imp. to C., **88,** 1979.

1898, 30,000,000± t., **98,** 2597; 1911, 66,951± t., **12,** 2671.

Detailed description of, **99,** 3004; **03,** 2040.

Mainly through freight from Lake Erie to Lakes Superior and Michigan, **02,** 493.

Description of Wyandotte and Trenton, their industries and C., **01,** 3210; **04,** 3142.

Diagram showing relation of app. to tonnage and value, 1884–1904, **05,** 2284; **12,** 2474.

Great growth due to imp., **07,** 2059.

Source of information for traffic data and valuation, **12,** 2674.

CONTRACTS.

1876. Case & Jennings, blasting and dr., $7.50 c. y., **77,** 935, 936.

1878. C. F. Dunbar, removing solid r., $7 c. y.; removing bowlders, $5 c. y., **79,** 1651.

1880. C. F. Dunbar, r. removal, $7 and $1 c. y., **81,** 2277.

1881. C. F. Dunbar, r. removal, $7 and $1 c. y., **82,** 2374.

1882. C. F. Dunbar, r. removal, $7.50 and $1 c. y., **83,** 1883.

1884. Carkin, Stickney & Cram, r. removal, $5.40 and $1 c. y., **85,** 2168.

1886. Dunbar & Sullivan, r. removal, $6 and $1 c. y., **87,** 2269.

1888. Dunbar & Sullivan, r. removal, **89,** 2272.

1892. C. E. Mitchell & Co., hire of dr., tug, and 2 dump scows, $14.74 per hour, **93,** 3036.

1894. Carkin, Stickney & Cram, removing bowlders and other material, actual volume and s. m., 87¢ c. y., **95,** 3068.

1897. M. Sullivan, removing bowlders, bed r., etc., $4.15 per s. t., **97,** 3030.

1900. J. B. Donnelly, r. excavation, Limekiln Crossing, $2.27 c. y. ($172,520). Buffalo Dredging Co., dr., Ballards Reef chan., $2.65 c. y. ($74,200).

[1] Livingstone Chan.

M. Sullivan, dr., time-work, Limekiln Crossing, $14.50 per hour. E. J. Hingston, dr., time-work, Ballards Reef, $10.25 per hour. **00,** 4004.

1901. M. Sullivan, dr. Amherstburg Reach, $2.90 per c. y., **01,** 3193. Duluth Dredge & Dock Co., dr., time-work, $12 per hour, **02,** 2238.

1902. G. H. Breymann & Bros., dr., time-work, $17 per hour, **02,** 2238. M. Sullivan, dr., $2.90 and $1.45 c. y., **02,** 2238. Donnelly Contracting Co., dr., $4.21 and $2.10½ c. y., **03,** 2039. Charles Boston & Sons, constr. scow, $3,692; M. Sullivan, hire of tug, $600 per month, **03,** 2040.

1904. G. H. Breymann & Bro., dr., $3.25 and $1.62½ c. y.; J. H. & D. Sullivan, hire of tug, $574 per month; G. H. Breymann & Bro., dr. (chan. to Wyandotte), $20 per hour; M. Sullivan, dr., $2.40 and $1.20 c. y., **04,** 3133. Muir-O'Sullivan Dredge & Dock Co., dr., time-work, $20 per hour, **05,** 2282.

1905. G. H. Breymann & Bro., dr., 27¢ c. y., s. m., **05,** 2282. J. H. & D. Sullivan, hire of tug, $22 per day, **06,** 1890.

1906. G. G. & F. H. Hackett, hire of tug, $25 per day, **06,** 1889. Dunbar & Sullivan Dredging Co., dr., 19¾ ¢ and 9⅞ ¢ c. y., **07,** 2054. G. G. & F. H. Hackett, hire of tug, $25 per day, **07,** 2055.

1907. Dunbar & Sullivan Dredging Co., dr., $3.80 and $1.90 c. y.; G. G. and F. H. Hackett, hire of tug, $25 per day; L. S. Sullivan, hire of tug, $25 per day, **07,** 2055. G. H. Breymann & Bro., hire of dr. plant, $25 per hour; M. Sullivan, hire of 2 dr. plants, $20 and $25 per hour; Great Lakes Dredge & Dock Co., dr., $1.98 c. y.; Grant Smith & Co. and Locher, r. and earth excavation, unit prices given, **08,** 2136. P. B. McNaughton and O. E. Dunbar, earth and r. excavation; earth, 50¢ and r. $2.80 c. y.; G. H. Breymann & Bro., dr., 25½¢ c. y., s. m., **08,** 2137.

1908. Hackett & Crumrine, hire of tug, $25 per hour, **08,** 2136.

1909. L. S. Sullivan, hire of tug, $24 per day, **09,** 2116.

1910. Hackett & Mullen, hire of tug, $23 per day, **10,** 2278. Great Lakes Dredge & Dock Co., furnishing and operating dr. plant, $22.50 per hour; est., $50,000. G. H. Breymann & Bro., furnishing and operating dr. plant, $24 per hour; est., $47,118; M. Sullivan, furnishing and operating dr. plant, $25 per hour; est., $85,000, **11,** 2472. Grant Smith & Co. and Locher pumping to maintain unwatered area of sec. 1 and 2, Livingstone Chan., $130 p. d., **11,** 2473.

1911. M. Sullivan, dr. Ballards Reef ($292,000), $2.61 c. y., bank measurement; Hackett & Mullen, hire of tug, $24 per day, **11,** 2472.

1912. The Buffalo Dredging Co., furnishing and operating steam drill boat, $3.50 per drill hour; est., $12,884.67; Dunbar & Sullivan Dredging Co., furnishing and operating steam drill boat, $2.75 per drill hour; est., $9,321.58; M. Sullivan, furnishing and operating dr. plant, $20 per hour; est., $20,000; Hackett & Mullen, hire of tug, $24 per day; est., $5,000; M. Sullivan, furnishing and operating steam drill boat, $9 per hour; est., $8,455.50, **12,** 2673.

ENGINEERS.

Chief of Engineers:

Orders that the imp. shall be made wholly in American waters, **76,** ii, 546.

R., 74, 47, 48; **75,** 52, 285, 286; **76,** 106, ii, 543; **77,** 111; **78,** 125; **79,** 168; **80,** 222; **81,** 303; **82,** 297; **83,** 305; 1885; **84,** 307; **85,** 331; **86,** 326; **87,** 293; **88,** 267; **89,** 317; **90,** 287; **91,** 361; **92,** 343; **93,** 393; **94,** 336, 367; **95,** 402; **96,** 356; **97,** 449; **98,** 437; **99,** 520; **00,** 584, 587; **01,** 569, 571, 3208; **02,** 492, 494; **03,** 540, 542; **04,** 589, 591, 3140; **05,** 600, 602, 2292; **06,** 674; **07,** 695, 698; **08,** 740; **09,** 777; **10,** 856, 861; **11,** 911; **12,** 1087.

In charge:

Majs. Comstock and Weitzel au. to make est. of cost, **74,** 48; joint **R., 74,** 213, 214. **R.,** Maj. Comstock, **75,** 283.

Maj. G. Weitzel, 1874–83. **R., 75,** 281; **79,** 1650; **80,** 2080; **81,** 2275; **82,** 2373. Correspondence, **76,** ii, 542–547; **77,** 935.

Capt. A. Mackenzie, in temporary charge, 1878. **R., 78,** 1223.

Maj. F. U. Farquhar, 1883. **R., 83,** 1885.

Lt. Col. O. M. Poe, 1883–95. **R., 83,** 1882; **84,** 2074; **85,** 2165; **86,** 1842; **87,** 2266; **88,** 1978; **89,** 2272; **90,** 2745; **91,** 2793; **92,** 2481; **93,** 3034; **94,** 2376; **95,** 3066.

Lt. Col. G. J. Lydecker, 1896–. **R., 96,** 2893; **97,** 3029; **98,** 2597; **99,** 3003; **00,** 3997, 4015.

Col. G. J. Lydecker, 1901. **R., 01,** 3190, 3209.

Maj. Wm. H. Bixby, 1902–03. **R., 02,** 2235; **03,** 2036; **04,** 3141, 3146.

Lt. Col. C. E. L. B. Davis, 1904–07. **R., 04,** 3130; **05,** 2280, 2293; (Col.) **06,** 1885; **07,** 2049, 2059.

Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2129; **09,** 2110; (Col.) **10,** 2272; **11,** 2466; **12,** 2661.

Assistants:

Capt. A. N. Lee, **75,** 282. **R., 76,** ii, 545; **77,** 935.

H. A. Leavitt, **77,** 936. **R., 80,** 2080.

Capt. A. Mackenzie. **R., 79,** 1651.

Capt. B. D. Greene. **R., 80,** 2081.

H. Kallman. **R., 81,** 2277; **82,** 2374; **83,** 1883; **84,** 2076; **85,** 2168.

B. H. Muehle. **R., 99,** 3004; **01,** 3211.

C. Y. Dixon. **R., 00,** 4002; **01,** 3194, 3210; **02,** 2239; **03,** 2042; **04,** 3135; **05,** 2284.

E. S. Wheeler. **R., 03,** 2040; **04,** 3133; **05,** 2282.

ESTIMATES. (See Plans and Projects.)

By Majs. Comstock and Weitzel, 1874, blasting and dr. chan. at Limekiln, if partly in Canadian waters, $1,899,990; if wholly in American waters, 6% addl.; at mouth of R., $105,558, and 10% for contingencies, **74,** 214.

By Maj. Comstock, proposed imp. at Malden and mouth of Detroit R., $100,000, **75,** 283, 284.

By Maj. Weitzel, 1875, imp. at Limekiln Crossing for 18′ chan., wholly in American waters, $500,000; if partly in Canadian waters, $262,000; for d. shoal at mouth of R., $300,000; for a 20′ chan. addl., $900,000 to $1,000,000, **76,** ii, 544. Details, **76,** ii, 545. For completion of the work, chan. 20′ x 300′, $200,000, **77,** 936. Revised, 1879, to $250,000, to complete the work, **79,** 168.

HISTORY

Of imp., **91,** 2794.

LEGISLATION.

Resol. H. of R., directing est. to be made, Dec., 1873, **74,** 48. Proposed uniting of U. S. and Canadian Govts. in this work, **75,** 52, 286.

MISCELLANEOUS.

Nitroglycerin and dynamite exploded on Fox Isld. Dec. 1879, **91,** 2797.

Accidents to vessels, **02,** 2243; **07,** 2052; **08,** 2133; **09,** 2114; **10,** 2276.

18 t. dynamite accidentally exploded, June, 1906, **06,** 1887.

OPERATIONS.

1876–77. 2,632 c. y. r. removed by blasting and dr., **77,** 935, 936.

1879–80. 90,000 s. f. drilled and blasted, 3,262 c. y. dr., **79,** 168, 1652; 12,121 c. y. r. broken, 8,401 c. y. r. removed by dr., **80,** 2082.

1880–81. 5,065 c. y. solid r. blasted, 10,775 c. y. r. dr., **81,** 2277.

1881–82. 10,270 c. y. solid r. and 199 c. y. loose r. removed, **82,** 2374.

1882–83. 7,190 c. y. solid r. removed, **83,** 1884.

1883–84. 656 c. y. solid r. removed, **84,** 2076.

1884–85. 8,369 c. y. solid and 32 c. y. loose r. removed, **85,** 2166.

1885–86. 15,140 c. y. solid and 49 c. y. loose r. removed, **86,** 1843.

1886–87. 14,544 c. y. solid and 144 c. y. loose r. removed from the straight chan.; total amount of work done on the imp., **87,** 2267.

1887–88. 81,078 c. y. solid r. and 1,052 c. y. loose r. removed, **88,** 1979.

1888–89. 8,508 c. y. solid r. removed, **89,** 2272.

1889–90. 16,583 c. y. solid and 1,766 c. y. loose r. removed, **90,** 2745.

1890–91. 1,213 c. y. solid and 1,554 c. y. loose r. removed from chan., **91,** 2793.

1894-95. 2,230 c. y., s. m., large bowlders removed, **95,** 3067.
1895-96. 13,866 c. y., s. m., bowlders and other material removed, and a line of levels run from bench mark Trenton to Amherstburg, **96,** 2894.
1896-97. 5,174 c. y. dr. and 254 bowlders removed, **97,** 3029.
1897-98. About 10,000 t. bedrock and bowlders removed, **98,** 2597.
1899-00. R. excavating in progress at Limekiln Crossing; 780 bowlders removed from chan. below Limekiln Crossing, **00,** 4001.
1900-01. 98,704 c. y. r., bowlders, sand, clay, etc., dr.; 2,040 c. y. bowlders removed by hired labor, **01,** 3190, 3191.
1901-02. 168,520 c. y. r., bowlders, and other heavy material removed; 530 c. y. bowlders removed by hired labor, **02,** 2236.
1902-03. 136,286 c. y. r., bowlders, and other heavy material removed; 370 c. y. bowlders removed by hired labor, **03,** 2038.
1903-04. 20,461 c. y. bedr. and 7,500 c. y. overlying material removed; 65,568 c. y. dr. from chan. to Wyandotte; 775 c. y. bowlders removed by hired labor, **04,** 3131.
1904-05. 209,734 c. y., mostly r., removed; 259,900 c. y. dr.; 660 c. y. bowlders removed, **05,** 2280.
1905-06. 315,561 c. y. bedr., bowlders, sand, etc., removed; 859,112 c. y. sand, silt, small bowlders, etc., dr.; 485 c. y. bowlders removed by hired labor, **06,** 1885.
1906-07. 86,956 c. y., mostly bedr., removed; 588,810 c. y. sand, earth, small bowlders, etc., dr.; 125 c. y. bowlders removed by hired labor, **07,** 2049.
1907-08. 99,806 c. y., mostly r., removed; 220,551 c. y. bowlders, clay, sand, etc., dr., and 570 c. y. bowlders removed by hired labor from Amherstburg Chan., **08,** 2129. 19,074 c. y., mostly bedr., removed, and 2,471,943 c. y. sand, clay, bowlders, etc., dr. from Livingstone Chan., **08,** 2131.
1908-09. Cofferdams partly completed; 36,923 c. y., mostly r., removed; 2,545 c. y. sand, clay, bowlders, etc., dr., and 1,845 c. y. bowlders removed by hired labor from Amherstburg Chan., **09,** 2110. 625,826 c. y., mostly r., removed, and 2,643,420 c. y. sand, clay, bowlders, etc., dr. from Livingstone Chan., **09,** 2112.
1909-10. Ridge of loose r. along chan. removed, 444,892 c. y. sand, clay, bowlders, etc., dr., and 690 c. y. bowlders removed from Amherstburg Chan., **10,** 2272. 838,234 c. y., mostly bedr., removed, and 891,220 c. y. sand, clay, bowlders, etc., dr. from Livingstone Chan., **10,** 2273.
1910-11. Removal of clay, hardpan, bowlders, bedr., etc., in progress at Ballards Reef, Amherstburg Chan.; about 80% of work completed, **11,** 2466–2467. Work in progress on w. and d. Livingstone Chan.; about 90% completed, **11,** 2468–2470.
1911-12. Work under 9 contracts in progress at Ballards Reef in Amherstburg Chan., and under 2 contracts in Livingstone Chan.; work 85% completed in Amherstburg and 98% in Livingstone Chan.; details of work given, **12,** 1089.

PHYSICAL CHARACTERISTICS.

Bed of R. composed of r. Swift current, **74,** 213, 214.
Water-level curves at Limekiln Crossing, Detroit R., **88,** 1979.
Description of, **00,** 4016.
Water-gauge readings, **00,** 4003; **01,** 3197; **02,** 2237, 2243; **03,** 2038, 2046; **04,** 3131, 3138; **05,** 2281, 2287; **06,** 1888; **07,** 2052; **08,** 2133; **09,** 2115; **10,** 2276; **11,** 2471; **12,** 2671.
Description of chan. w. of Grosse Isle, **01,** 3209.
Description of back chan. to Wyandotte, **04,** 3141.
Lowering of water surface, **05,** 2294.
Condition of Livingstone and Ballards Reef Chans., **11,** 912; **12,** 1090.
R. flows from Lake St. Clair into Lake Erie; about 31 m. from Windmill Pt. Lighthouse at Lake St. Clair to Detroit R. Lighthouse at Lake Erie, **12,** 1087.

PLANS. (See Estimates and Projects.)

By Majs. Comstock and Weitzel, blasting and dr. chan. 20′ x 300′ at various places in the R., Lakes Huron to Erie, **74,** 213, 214.
By Maj. Comstock, removing bowlders near Malden, dr., buoying; and a lightship at the mouth of Detroit R., **75,** 283–285.
By Lt. Col. Poe, 1885, increasing w. of chan. to 400′; addl. cost, $167,986, **85,** 2166, 2167.

PRIVATE (FOREIGN) WORK.

Canada removed 120 c. y. of r.; cost, $60 c. y., **77,** 936.
TUNNEL. Begun and abandoned 1873. See H. D. 369, 51, 1st, **74,** 598, 631.
BRIDGE. Report of B. E. on, **74,** 587. Act au. constr. across w. chan. to connect Belle Isle with mainland, **86,** 431. R. R. br. at Grosse Isld. and Stony Isld. unau., **74,** 598.

PROJECTS. (See Estimates and Plans.)

By Maj. Weitzel, 1876, imp., Limekiln Crossing, expend., by contract, the available balance in blasting and dr. r. wholly in U. S. waters, **76,** 105, ii, 546. In 1878, for a chan. 20′ x 300′, by drilling, blasting, and dr., **78,** 1223; **79,** 1652. Est., $1,166,500, **80,** 222, 2080.
Modified, in 1883, by Maj. Farquhar to a straight chan. of same dimensions, at an addl. cost of $40,000, **83,** 1885; **87,** 2268. Reduction, cost of the work, **86,** 326; **87,** 2268.
In 1886 Col. Poe proposed increasing the w. of straight chan. to 400′; est., $168,000, **86,** 1843; **87,** 2268; **92,** 2481.
In 1895 Col. Poe est. $180,000 to dr. chan. head of Limekiln Crossing to head of Ballards Reef, **95,** 3067.
Act Mar. 3, 1899, au. continuing contract, not to cost more than $661,500 exclusive of the amount already app., **99,** 3003.
Descriptions of plans by Lt. Col. Lydecker, 1900, for 21′ chan., **00,** 4017. Adoption of any proj. dependent upon settlement of the question of lake-level regulation, **00,** 4018.
Col. Lydecker, 1900, did not fav. imp. west of Grosse Isle, **01,** 3209.
By Maj. Lydecker, 1900 (au., 1902), known as "Plan A," for completing chan. 21′ x 600′; est., $1,750,000 (H. D. 712, 56th, 1st), **02,** 2236. Est. increased to $3,750,000, **05,** 600, 2296.
Modified 1904 to allow slight shifting of proposed chan. at Bar Pt. Shoals, mouth of Detroit R., without increasing cost, **12,** 1088.
Act 1902 app. $10,000 (from $500,000 for "Plan A"), for imp. of chan. to Wyandotte, n. and w. of Grosse Isle, **02,** 2236.
By Maj. Bixby, 1902, w. and straightening entrances to back chan. to Wyandotte; est., $57,500 (H. D. 160, 58th 2d,) **04,** 3147.
Act Mar. 2, 1907, au. 2d chan. (Livingstone), to provide up and down routes known as "Plan B," at mouth, 22′ x 300′–800′ x 12 m.; est., $6,670,950 (H. D. 266, 59th, 2d;), **07,** 698, 2049.
Lt. Col. Townsend recom., 1909, that section of chan., about 5 m. l., Detroit to Lake Erie, lying bet. Fighting Isld. and city of Wyandotte, be imp. by straightening; est., $420,000, **09,** 2113.
Act June 25, 1910, modified proj. of Mar. 2, 1907, and app. $630,000 for w. that portion of Livingstone Chan. inside cofferdam from 300′–450′ (H. D. 676, 61st, 2d), and au. 22′ n. of junction with Livingstone Chan. and app. $560,000, **10,** 857, 861, 2275.

SURVEYS.

By Canada, and by Maj. Weitzel, 1875, **75,** 281–285.
Under direction of Maj. Weitzel, by H. A. Ulffers, 1875, **79,** 1652.
At Grosse Pt., **90,** 2750.
Ex. of American Chan. au. act Sept. 19, 1890; made, 1890, by Col. Poe, **91,** 2809.
Ex. chan. from Ballards Reef to head of Limekiln Crossing; made 1892–94, by Col. Poe, **93,** 3035; **94,** 2377, and an ice sur. of the same locality made, 1896, by Lt. Col. Lydecker, **96,** 2894.
In 1896, a sur. made of the shoal abreast of Detroit, and in 1897 an ice sur. from Limekiln Crossing to

Bois Blanc Isld, and for 1,680′ over the e. half of Ballards Reef, **97,** 3029.

Act Mar. 3, 1899, called for plans and est. of 21′ chan., Detroit to Lake Erie, **99,** 3003; **R.** by Lt. Col. Lydecker, 1900 (see Projects), **00,** 4015.

Minor surs., etc., **00,** 4002; **01,** 3191, 3197; **02,** 2237, 2242; **03,** 2038, 2045; **04,** 3131, 3138; **05,** 2281, 2287; **06,** 1887; **07,** 2051; **08,** 2132; **09,** 2114; **10,** 2275.

Ex. of chan. on w. side of Grosse Isle, for sufficient d., au. act June 6, 1900; made, 1900, by Col. Lydecker (**R.** unfav.) (H. D. 82, 56th, 2d), **01,** 3208.

Of back chan. from main ship chan. to Wyandotte, au. act June 13, 1902; made, 1902, by Maj. Bixby (H. D. 160, 58th, 2d), **04,** 3140.

From Detroit to Lake Erie, au. act Mar. 3, 1899; final **R.** by Lt. Col. Davis (H. D. 40, 58th, 3d), **05,** 2292.

Au. act Mar. 3, 1905, for 22′ and 25′ chan.; made, 1905–06 (see ship chan. connecting waters of Great Lakes bet. Chicago, Duluth, and Buffalo) (H. D. 266, 59th, 2d), **07,** 698.

Ex. of Livingstone Chan., au. act Mar. 3, 1909; made by special BE. (H. D. 676, 61st, 2d), **10,** 861.

Pre. ex. and sur. au. act June 25, 1910, of Wyandotte Chan., for straightening same; **Rs.** by Col. Townsend, 1910 and 1911; est., $310,000 (H. D. 17, 62d, 1st), **11,** 914.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1089.

HARBOR LINES:

At Detroit, **93,** 3039.
Detroit to Ecorse, **96,** 2900.
Modification, near Ecorse, **96,** 2901.
Ecorse to below Trenton, **96,** 2904.
Around Grosse Isle, **96,** 2908.
Modification at mouth of Rouge River, **05,** 2296.

Maps: (4 H. D. 266, 59th, 2d; H. D. 17, 62d, 1st):
Showing condition of the work June 30, 1877, **77,** 939; **80,** 2082; **81,** 2278; **82,** 2374; **83,** 1882; **84,** 2074; **85,** 2168.
Limekiln Crossing, **86,** 1843; **87,** 2267; **90,** 2746; **91,** 2794; **94,** 2376; **02,** 2242; **03,** 2038; **04,** 3092; **05,** 2282; **06,** 1888; **07,** 2052; **08,** 2134; **09,** 2114; **10,** 2272; **11,** 2466.

Part (b), PP–105 Detroit River, Mich. (Channel at Grosse Pointe.)

APPROPRIATION.

1888, $5,000, **89,** 2270.

COMMERCE.

Gross an. t. passing through Grosse Pointe Chan., **89,** 2268.

CONTRACT.

1889. Dunbar & Sullivan, hire of 1 tug and 2 dump scows, $10 per hour, **90,** 2741.

ENGINEERS.

Chief of Engineers. **R.,** **88,** 267; **89,** 315; **90,** 285, 289; **91,** 359; **92,** 342.

In charge. Lt. Col. O. M. Poe, 1883–92. **R.,** **88,** 1978; (Col.) **89,** 2267; **90,** 2740; **91,** 2790; **92,** 2478.

OPERATIONS.

1889–90. 2,500 c. y. material dr., **90,** 2741.

PLANS.

By Col. Poe, 1890, excavating a chan. through the flats off Grosse Pointe, 800′ x 20′, requiring removal of 3,140,000 c. y., at $690,800; or for a chan. 800′ x 19′, the removal of 2,515,000 c. y., at a cost of $553,300, **90,** 2742.

PROJECTS.

By Lt. Col. Poe, 1888, imp. of Grosse Pointe Chan., at head of Detroit R., by dr. 19½′ x 800′, involving removal of about 2,515,000 c. y.; est., $553,300, **88,** 1978.

In 1891 Col. Poe proposed excavating a chan. 800′ x 5½ m. x 20′, at a cost of $956,825, **91,** 2790; **92,** 2479.

SURVEY.

Au. act Aug. 11, 1888; made, 1890, by Col. Poe, **90,** 2750.

PP-110 ROUGE RIVER, MICH.

APPROPRIATIONS.

1888,	$10,000,	**88,** 268.
1890,	10,000,	**90,** 2749.
	[1] 5,000	
1892,	11,690,	**92,** 2480; **93,** 2947.
1894,	5,000,	**95,** 2839.
1896,	5,000,	**96,** 2738.
1902,	*5,000,	**02,** 2092.
1905,	*8,000,	**05,** 2230.
1907,	*7,000,	**07,** 2000.
1909,	*10,000,	**09,** 2106.
1910,	20,000,	**10,** 2267.
1911,	5,000,	**11,** 2461.
Total,	101,690	

COMMERCE.

Description of, **98,** 2605.

In 1897 its extent and nature seemed to justify chan. of only 13′ d. from Wabash RR. br. to Maples Road, **98,** 2605.

Largest vessels should be able to enter R., **03,** 1993.

As a result of imp. area available for mfg. plants in vicinity of Detroit greatly extended, and these plants enabled to receive raw material which they use without transfer or reshipment, **06,** 657.

Rates reduced 30 to 50%, **10,** 851.

1911, 951,309 t., **12,** 1082.

CONTRACTS.

1888. J. Rooney, dr., 11½¢ c. y., **89,** 2274.

1890. J. B. & G. H. Breymann, dr., 10¼¢ c. y., **91,** 2792.

1899. Carkin, Stickney & Cram, dr., 13¢ c. y. (2,538 c. y.); G. Lockerbie, dr., 13½¢ c. y. (15,818 c. y.), **00,** 4006.

1900. W. A. McGillis & Co., dr., 11¢ c. y., s. m., **00,** 4007.

1903. G. H. Breymann & Bros., dr., 11¢ c. y., s. m., **03,** 1994.

1906. Muir-O'Sullivan Dredge & Dock Co., dr., 13⅞¢ c. y., s. m., **06,** 1847.

1907. Toledo Improvement Co., dr., 16¢ c. y., s. m.; G. H. Breymann & Bro., dr., $16 per working hour, **08,** 2124.

1909. G. H. Breymann & Bro., dr., 15.5¢ c. y., s. m., **09,** 2106.

* Allotment. [1] Site for turning-basin. Trans. to general work. **99,** 3013.

ENGINEERS.

Chief of Engineers. **R., 87,** 294; **88,** 268; **89,** 318; **90,** 288; **91,** 360, 363; **92,** 343; **93,** 387; **94,** 360, 361; **95,** 394; **96,** 349; **97,** 450; **98,** 437, 440; **99,** 521; **00,** 586; **01,** 562; **02,** 481; **03,** 528; **04,** 576; **05,** 586; **06,** 655; **07,** 676; **08,** 733; **09,** 770; **10,** 850; **11,** 905; **12,** 1081.

In charge:
Lt. Col. O. M. Poe, 1886–92. **R., 87,** 2275, 2277; (Col.) **89,** 2274; **90,** 2747; **91,** 2791, 2822; **92,** 2480.
Maj. W. Ludlow, 1893. **R., 93,** 2946.
Lt. Col. G. J. Lydecker, 1894–1900. **R., 94,** 2255; **95,** 2839; **96,** 2738; **97,** 3031; **98,** 2598, 2605; **99,** 3013, 3014; **00,** 4006.
Maj. W. L. Fisk, 1901. **R., 01,** 3155.
Capt. L. H. Beach, 1902–05. **R., 02,** 2192; (Maj.) **03,** 1993; **04,** 3082; **05,** 2230.
Capt. Chas. Keller, 1906. **R., 06,** 1846.
Col. C. E. L. B. Davis, 1907. **R., 07,** 2000.
Lt. Col. C. McD. Townsend, 1908–. **R., 08,** 2123 **09,** 2105; (Col.) **10,** 2266; **11,** 2461; **12,** 2661.

OBSTRUCTIONS.

In 1893 Sec. War au. Wabash Ry. to alter position of its br. under supervision of officer in charge of district, **93,** 2946.

OPERATIONS.

1887–88. 28,792 c. y. dr. **89,** 2274.
1888–89. 52,371 c. y. dr., **89,** 2275.
1890–91. 90,189 c. y. dr., **91,** 2791.
1892–93. 98,809 c. y. dr., **93,** 2946.
1898–99. 18,356 c. y. dr., **00,** 4006.
1900–01. 95,351 c. y. dr., **01,** 3155.
1902–03. 20,417 c. y. dr., **03,** 1993.
1903–04. Dr. completed, 21,062 c. y. removed, **04,** 3082.
1905–06. 25,430 c. y. dr., **06,** 655, 1846.
1906–07. 12,235 c. y. dr., **07,** 2000.
1907–08. 46,046 c. y. dr., **08,** 2123.
1908–09. 60,000 c. y. dr., **09,** 2105.
1909–10. 4,818 c. y. dr., **10,** 2266.

PHYSICAL CHARACTERISTICS.

Caving banks due to action of water, **11,** 2461.

PRIVATE WORK.

Detroit Iron & Steel Co. dr. a chan. 21′ d. mouth of R. to their wharf, **04,** 3082.
Act June 25, 1910, au. private interests shall constr. suitable docks or revets. to protect caving banks, **10,** 851.

PROJECTS.

By Lt. Col. Poe, 1886, dr. chan. from 240′ to 100′ w. and 16′ d., from R.'s mouth to br. of St. Louis & Wabash RR.; est., $31,690, **87,** 2278.
By Col. Poe, 1890, for turning-basin about 2 m. above junction of Rouge with Detroit, 250′ x 500′; est., $15,611.10, **91,** 2823; **93,** 2947.
In 1897 Lt. Col. Lydecker est. $33,000 to dr. 16′ chan. from Wabash Br. crossing to Maples Road, and $5,000 for 13′ chan., **98,** 2605. The latter work provided for by Congress, **99,** 3013.
Proj. for turning-basin abandoned au. act 1899, which diverted app., $5,000, for this purpose, to app. for general imp. of R., **99,** 3014.
(See Private work, 1910.)
Proj. modified by ad. Mar. 2, 1907, to increase d. to 21′ from mouth to first bride **07,** 677.

SURVEYS.

Au. act Aug. 5, 1886; made by Lt. Col. Poe, **87,** 2275.
Sur. from Wabash Br. crossing to Maples Road, au. act June 3, 1896, with view to chan. 16′; made by Lt. Col. Lydecker, 1897 (see Projects), **98,** 2005.
Pre. ex. au. act Mar. 3, 1905. **R.** by Maj. Beach, Apr. 19, and Capt. Keller, Nov. 2, 1905; est., $3,575, with $3,000 an. mainten., for 21′ chan. for about 1,400′ from mouth (H. D. 289, 59th, 1st), **06,** 664
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1081.
Maps. (H. D. 289, 59th 1st.) **87,** 2278; **03,** 1994.

PP-118(a) LAKES HURON AND ERIE. (Channel to connect.)

ENGINEERS.

Chief of Engineers. **R., 74,** 48.

Boards. Considered excavating necessary, 1874, at 4 different points, viz: 1st, St. Clair Flats Ship Canal; 2d, Lake St. Clair; 3d, Detroit R. at the Lime Kilns; 4th, mouth of Detroit R. **R., 74,** 213. (Majs. Comstock and Weitzel.)

PLANS.

By BE., 1874, dr. at St. Clair Flats Ship Canal, Lake St. Clair, and mouth of Detroit R.; also blasting r. at Limekiln Crossing, Detroit R.; est., if partly in Canadian waters, $2,790,907; if wholly in American waters, $3,930,901, **74,** 214.

SURVEY.

Resol. of H. of R., Dec. 18, 1873, called for an approx. est. of expense of d. and w. the navigable chans. of the Rs. and waters connecting these lakes, for practical navigation for vessels drawing 20′, **74,** 48 213.

PP-119 HURON RIVER, MICH.

COMMERCE.

Description of, **97,** 3035. Present and prospective C. unimportant, **97,** 3036.

ENGINEERS.

Chief of Engineers. **R., 97,** 451.

In charge. Lt. Col. G. J. Lydecker, 1896–97. **R. 97,** 3034.

PHYSICAL CHARACTERISTICS.

Description of. Small stream discharging into Lake Erie at its nw. corner, **97,** 3035.

SURVEYS.

Ex., mouth to the point of crossing of the Michigan Central RR., au. act June 3, 1896; made, 1897, by Lt. Col. Lydecker (**R.** unfav.), **97,** 3034.

PP-124 MONROE HARBOR (Raisin River), MICH.[1]

APPROPRIATIONS.

1835,	$30,000.00,	**66,** iii, 7.
1836,	15,000.00,	**66,** iii, 7.
1837,	30,000.00,	**66,** iii, 7.
1838,	15,000.00,	**66,** iii, 7.
1844,	20,000.00,	**66,** iii, 7.
1852,	14,000.00,	**66,** iii, 7.
1866,	31,015.27,	**66,** iii, 7.
1872,	10,000.00,	**72,** 224.
1873,	15,000.00,	**73,** 308.
1874,	10,000.00,	**74,** 215.
1875,	10,000.00,	**75,** 293.
1876,	5,000.00,	**76,** ii, 552.
1878,	2,500.00,	**78,** 127, 1241.
1879,	2,000.00,	**79,** 170, 1677.
1880,	2,000.00,	**80,** 2092.
1881,	$1,000.00,	**81,** 2280.
1882,	1,000.00,	**82,** 2379.
1886,	2,000.00,	**86,** 1849.
1888,	5,000.00,	**88,** 1983.
1890,	5,000.00,	**90,** 2755.
1892,	10,000.00,	**92,** 2486.
1894,	5,000.00,	**95,** 3072.
1896,	5,000.00,	**96,** 2916.
1899,	5,000.00,	**99,** 3019.
1902,	*1,500.00,	**03,** 1995.
1905,	*5,000.00,	**05,** 2231.
1907,	*4,000.00,	**07,** 2001.
1910,	1,000.00,	**10,** 2268.
Total,	262,015.27	

COMMERCE.

Present and prospective increase, **90,** 2754.

Description of, **96,** 2915; **97,** 3039, 3096; **98,** 2613, 2692.

C. small owing to the situation of the H. bet. Detroit and Toledo, both of which places have better situations for shipments by rail and water, **93,** 3049; **94,** 2385; **95,** 3073; **96,** 2915.

Small and entirely local, 1897 and 1900, **98,** 2692; **00,** 4020.

Not large; mainly excursion boats, **02,** 482.

Too small to affect rates, **10,** 852.

1911, 10,000 t., **12,** 2663.

CONTRACTS.

1866. W. H. Mott, labor, **66,** iv, 74; **67,** 145, 232, 233; **68,** 152.

J. M. Sterling, materials, **66,** iv, 74; **67,** 145, 232, 233; **68,** 152.

1868. W. C. Colbun, screw bolts, **68,** 152.

1870. J. M. Sterling, materials and labor, **70,** 170. Thomas Dunbar & Co., dr., 24¢ c. y., **70,** 169, 170; **71,** 189.

1872. W. Richardson, dr., 28¢ c. y., **73,** 311. W. Richardson, materials and labor, **73,** 311.

1873. J. M. Sterling, materials and labor, **73,** 310, 311; **74,** 216. Cartwright, McCurdy & Co., iron, **73,** 310, 311; **74,** 216.

1874. J. M. Sterling, materials and labor, **75,** 293.

1875. E. H. French, dr., 24¢ c. y., **75,** 293; **76,** ii, 552.

1880. W. Richardson, dr., 11¢ c. y., **80,** 2092.

1888. Sterling & Cooper, p. and revet. repairs, $2,913.15, **89,** 2297.

1889. W. St. John & Son, dr., 28¢ c. y., **89,** 2296.

1890. W. C. Sterling, repair of break'r, $4,650, **91,** 2827.

1895. C. E. Mitchell & Co., white pine timber, $21.85 per 1,000 f. b. m. Upson & Co., hardware, $111.81, **95,** 3073.

1897. M. J. Griffen, dr., 11½¢ c. y., s. m., **98,** 2612.

1899. E. J. Hingston, dr., 12¼ and 13½¢ c. y. ($4,160), **00,** 4021.

1903. G. H. Breymann & Bros., dr., 25¢ c. y., s. m., **03,** 1995.

1908. John Ginzel Co., repairs to ps., $1,780, **08,** 2125.

DOCUMENTS. (Not printed in reports.)

All details of orig. proj. by Capt. H. Smith, submitted 1834 or 1835, and operations under app. from 1835 to 1852, for **R.** of Col. J. D. Graham, in 1857. (See S. D., 35th, 1st.)

ENGINEERS.

Chief of Engineers. **R.,** **66,** 2, 5, iii, 7, iv, 40; **67,** 28; **68,** 38; **69,** 36; **70,** 46; **71,** 45; **72,** 42; **73,** 42; **74,** 48; **75,** 54; **76,** 106; **77,** 112; **78,** 127; **79,** 170; **80,** 223; **81,** 303; **82,** 298; **83,** 306; **84,** 308; **85,** 332; **86,** 326; **87,** 294; **88,** 268; **89,** 320, 328; **90,** 289; **91,** 363; **92,** 344; **93,** 395; **94,** 368; **95,** 403; **96,** 357; **97,** 452, 463; **98,** 440, 452; **99,** 523; **00,** 588; **01,** 571; **02,** 482; **03,** 528; **04,** 577; **05,** 586; **06,** 657; **07,** 678; **08,** 735; **09,** 772; **10,** 851; **11,** 906; **12,** 1082.

In charge:

Capt. H. Smith, 1834. (See act approv. Feb. 24, 1835.)

Col. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st; **66,** 5.

Col. T. J. Cram, 1866–69. **R.,** **66,** 29–32, iv, 40; **67,** 145; **68,** 144.

Maj. W. McFarland, 1869–71. **R.,** **70,** 169.

Capt. G. L. Gillespie, 1871–73. **R.,** **71,** 189; **72,** 224, 237.

Maj. F. Harwood, 1873–74. **R.,** **73,** 307; **74,** 215.

Lt. Col. C. E. Blunt, 1874–76. **R.,** **75,** 292; **76,** ii, 551.

Maj. N. Michler, 1876–78. **R.,** **77,** 947; **78,** 1239; **79,** 1669.

Maj. J. M. Wilson, 1878–83. **R.,** **79,** 1675; **80,** 2083; **81,** 2279; **82,** 2377.

Maj. L. C. Overman, 1883–92. **R.,** **83,** 1887; **84,** 2081; **85,** 2209; **86,** 1847; **87,** 2281; **88,** 1981; **89,** 2295; **90,** 2753; **91,** 2825.

Lt. Col. J. A. Smith, 1892–1900. **R.,** **92,** 2486; **93,** 3047; **94,** 2383; **95,** 3071; **96,** 2913; (Col.) **97,** 3037, 3094; **98,** 2612, 2689; **99,** 3017; **00,** 4019.

Maj. Dan C. Kingman, 1901–02. **R.,** **01,** 3215; **02,** 2247.

Maj. L. H. Beach, 1903–05. **R.,** **03,** 1995; **04,** 3083; **05,** 2231.

Capt. Chas. Keller, 1906. **R.,** **06,** 1847.

Col. C. E. L. B. Davis, 1907. **R.,** **07,** 2001.

Lt. Col. C. McD. Townsend, 1908–12. **R.,** **08,** 2124; **09,** 2106; (Col.) **10,** 2268; **11,** 2462; **12,** 2663.

Assistants:

Capt. G. J. Lydecker, **68,** 151.

Mr. Enright, **72,** 237.

W. T. Blunt. **R.,** **97,** 3039.

ESTIMATES. (See Plans and Projects.)

Orig. by Capt. H. Smith, 1834, unknown.

By Col. Graham, 1857, p. extension, repairs, and dr., $31,015.27, **66,** 5.

By Col. Cram, 1866, repairs to ps., $10,423.66, **66,** iv, 40. An. repair, $1,700, **68,** 145.

By Capt. Gillespie, 1872, repairs and dr., $15,600, **72,** 239.

By Maj. Harwood, 1873, entire and permanent completion, $50,000, an. dr., $4,000, **73,** 309. In 1874, $40,000 addl., for entire and permanent completion, **74,** 215.

By Lt. Col. Blunt, 1876, completion of repairs, $11,000, **76,** ii, 551.

By Maj. Michler, 1877, completion, $10,000, **77,** 948.

By Maj. Wilson, 1879, completion of existing proj., $10,037, **79,** 170, 1677.

LEGISLATION.

Act making 1st app. approv. plan of Capt. Smith and prohibits any expend. for imp. R. chan.; act Feb. 24, 1835.

* Allotment.

[1] Surs.—**Rs.:** 1826, est., $6,296.61; Jan. 15, 1827, est., $3,977.81; Nov. 9, 1829, est., $24,259; Nov. 20, 1834, est., $55,885; Feb. 7, 1866, est., $10,423.66. (H. D. 482, 55th, 2d.)

OPERATIONS.[1]

1866-67. Repairing ps., **67,** 28.
1867-68. The old ps. repaired and 550 l. f. of sheathed pile p. constr., **68,** 145.
1869-70. 30,000 c. y. dr. and 150 l. f. of deflector p. built, **70,** 169.
1870-71. 8,000 c. y. dr., **71,** 189.
1872-73. 31,029 c. y. dr., obtaining chan. 11′ d. from Lake Erie to Monroe City; repairs to ps. in progress, **73,** 307.
1873-74. Ps. repaired and 1,160 l. f. of canal revet. built, **74,** 215.
1874-75. 4,379 l. f. of revet. rebuilt, **75,** 293.
1875-76. 18,516 c. y. dr. by contract and repairs to ps. by day labor, **76,** ii, 551.
1876-77. Ps. repaired by day labor, **77,** 947.
1877-78. Repairs to revets. and cribs by hired labor, **78,** 127, 1240.
1878-79. Both ps. thoroughly repaired and 612 l. f. of canal revet. renewed, **79,** 170, 1675.
1879-80. 12,370 c. y. material and 53 logs, snags, and piles removed from chan., **80,** 2090.
1880-81. Extensive repairs to ps., **81,** 2280.
1881-82. 600 l. f. revet. renewed and 600 addl. f. strengthened; also repairs to s. p., **82,** 2378.
1882-83. 1,733 l. f. old revet. of U. S. canal and n. and s. ps. repaired, **83,** 1888.
1883-84. Extensive repairs to n. and s. ps.; 798 l. f. U. S. revet. repaired, **84,** 2082.
1886-87. Extensive repairs to ps. and revet., **87,** 2282.
1887-88. Repairs to ps., **88,** 1982.
1888-89. Repairs to ps. and revet.; 7,500 c. y. dr., **89,** 2296.
1889-90. Repairs to ps. and revet., **90,** 2754.
1890-91. Repairs to ps. and revet., **91,** 2826.
1892-93. Repairs to n. p. in progress, **93,** 3048.
1893-94. Repairs of preceding year completed, **94,** 2384.
1894-95. Repairs to n. and s. ps. in progress, **95,** 3072.
1895-96. Repairs of previous year completed, **96,** 2914.
1897-98. 9,845 c. y., s. m., dr., **98,** 2612.
1898-99. 14′ chan., 200′ w. for 1,600′, dr. from outer end of ps. eastward over the bar, **99,** 3018.
1899-00. About 20,000 c. y. dr., **00,** 4020.
1900-01. About 11,500 c. y. dr., **01,** 3216.
1902-03. 4,663 c. y. dr., **03,** 529, 1995.
1903-04. Repairs to ps., **04,** 3083.
1905-06. Piles driven and repairs made to ps., **06,** 1847.
1906-07. Slight repairs made to decking of ps., **07,** 2001.
1907-08. Repairs to cribwork of n. p. and decking of both ps., **08,** 2124.
1908-09. Repairs to ps. completed, **09,** 2106.
1910-11. Decking of s. p. repaired, **11,** 2462.

PHYSICAL CHARACTERISTICS.

Description, **66,** 29; **68,** 145; **72,** 237; **77,** 947; **78,** 1239; **89,** 2295, 2338; **97,** 3038, 3040; **98,** 2690.

Mouth of Raisin R., situated at w. end of Lake Erie, about midway bet. mouth of Detroit R. and entrance to Maumee B. **97,** 3095.

In a narrow sense the H. is the part of Raisin R., Mich., that is opposite the wharves on the s. bank of R. for about 1,500′, and in a broader sense extends from head of wharves to and into the lake for 2½ m., **98,** 2690, 2691.

Sand shoaling, **00,** 4020.

Description of; only second-class H., **01,** 3215-17.

PLANS. (See Estimates and Projects.)

By Capt. Gillespie, 1871, 11′ chan. from ps. to Monroe wharves. Dr. 42,000 c. y., **72,** 239.

By Maj. Overman, 1888, chan. 16′ x 100′ from 16′ curve in lake to Monroe Dock, with r. excavation and p. and revet. repair; est., $123,200, **89,** 2339.

PRIVATE (CITY CORPORATE) WORK.

Canals and ps. constr. in connection with Michigan Southern and Northern Indiana RR. Co., **66,** 29.

Inner or Monroe City Canal, built by town of Monroe, **72,** 238.

PROJECTS. (See Estimates and Plans.)

Earliest imp. proposed 1826 by Capt. T. W. Maurice, and provided for constr. of a break'r in La Plaisance B. Under an aggregate of $19,014.87 this work completed in 1835, **80,** 2085.

In 1834 Capt. H. Smith proposed straightening Raisin R. at its mouth by making a direct connection with Lake Erie through a sand peninsula by canal 100′ x 4,000′, and protection of entrance by parallel ps. extending to 10′ curve in the lake. (See act Feb. 24, 1835.) **80,** 2085.

From 1835–82, incl., $213,515.27 app., when it was est. that $20,000 would be required to complete proj., **82,** 2379; **86,** 327. Increased to $27,000, **89,** 2297.

By Col. Cram, 1866, repairing ps. and imp., **66,** 32, 33; **67,** 145.

By Maj. McFarland, 1869, dr., and building deflector p., **69,** 115.

By Capt. Gillespie, 1872, d. chan. by dr. from outer bar to Monroe City, repairs to ps., and piling, **72,** 224.

By Maj. Harwood, 1873, thorough renewal of canal revet., **73,** 308; **74,** 215.

Lt. Col. Blunt, 1875, rebuilding revet. by hired labor, and dr., **75,** 293. In 1876, renewal of canal revet., and repairs to ps., hired labor, **76,** ii, 551.

By Maj. Michler, 1877, dr., and repairs to ps. and revet., hired labor, **77,** 948.

By Maj. Wilson, 1879, dr., and repairs to revet., **79,** 170, 1677.

Summary of, **77,** 947.

By Lt. Col. Smith, 1896–97, dr. chan. 13′ through bar for about 1,800′ and w. of 150′, using app. of 1896, $5,000, **97,** 3039.

In 1897 Lt. Col. Smith est. $626,750 to secure 14′ in H., **98,** 2692.

SURVEYS.

1834. By Capt. H. Smith. (See act Feb. 24, 1835.)
1866. By Col. Cram, **66,** 29.
1868. By Col. Cram, **68,** 145.
1871. Under direction of Capt. Gillespie, by Mr. Enright. **R., 72,** 237–239.

Ex. of Monroe H. for 16′ chan. au. act Aug. 11, 1888; made, 1888, by Maj. Overman, **89,** 2338.

Ex. of chan. made, 1892, by Lt. Col. Smith, **93,** 3048.

Ex. of R. mouth to U. S. canal to wharves au. act June 3, 1896; made by Lt. Col. Smith, 1896 (**R.** unfav.), **97,** 3094.

Sur. of bar with view to 14′ made, 1896, by Lt. Col. Smith, **97,** 3038, and sur. of H. with view to 14′ au. act June 3, 1896, made, 1897, by Lt. Col. Smith (**Rs.** unfav.) (see Projects), **98,** 2689.

Minor surs., **00,** 4020; **01,** 3216; **03,** 1995; **06,** 1847; **07,** 2001; **08,** 2124; **10,** 2268.

Reference to ex. and sur. **Rs., 12,** 1083.

Maps:
Showing location of works, **66,** i.
Sketch of canal and ps., **66,** i; **91,** 2827; **98,** 2692. **03,** 1995.

PP-125 LA PLAISANCE BAY, MICH.

APPROPRIATIONS.

1826,	$200.00,	act May 20.
1827,	3,977.81,	act Mar. 2.
1829,	2,318.00,	act Mar. 3.
1832,	8,000.00,	act July 3.
1834,	4,895.00,	act June 28.
1836,	323.15,	act July 2.
Total,	19,713.96	(total by H. D. 120, 44th, 1st, $19,603.07.)

PHYSICAL CHARACTERISTICS.

Condition in 1866, dilapidated; of comparatively little use since the RR. terminus was abandoned, **66,** 30.

A little more than a mile to sw. of mouth of R. Raisin, **66,** 30.

SURVEYS.

Maps. Showing location of, **66.**

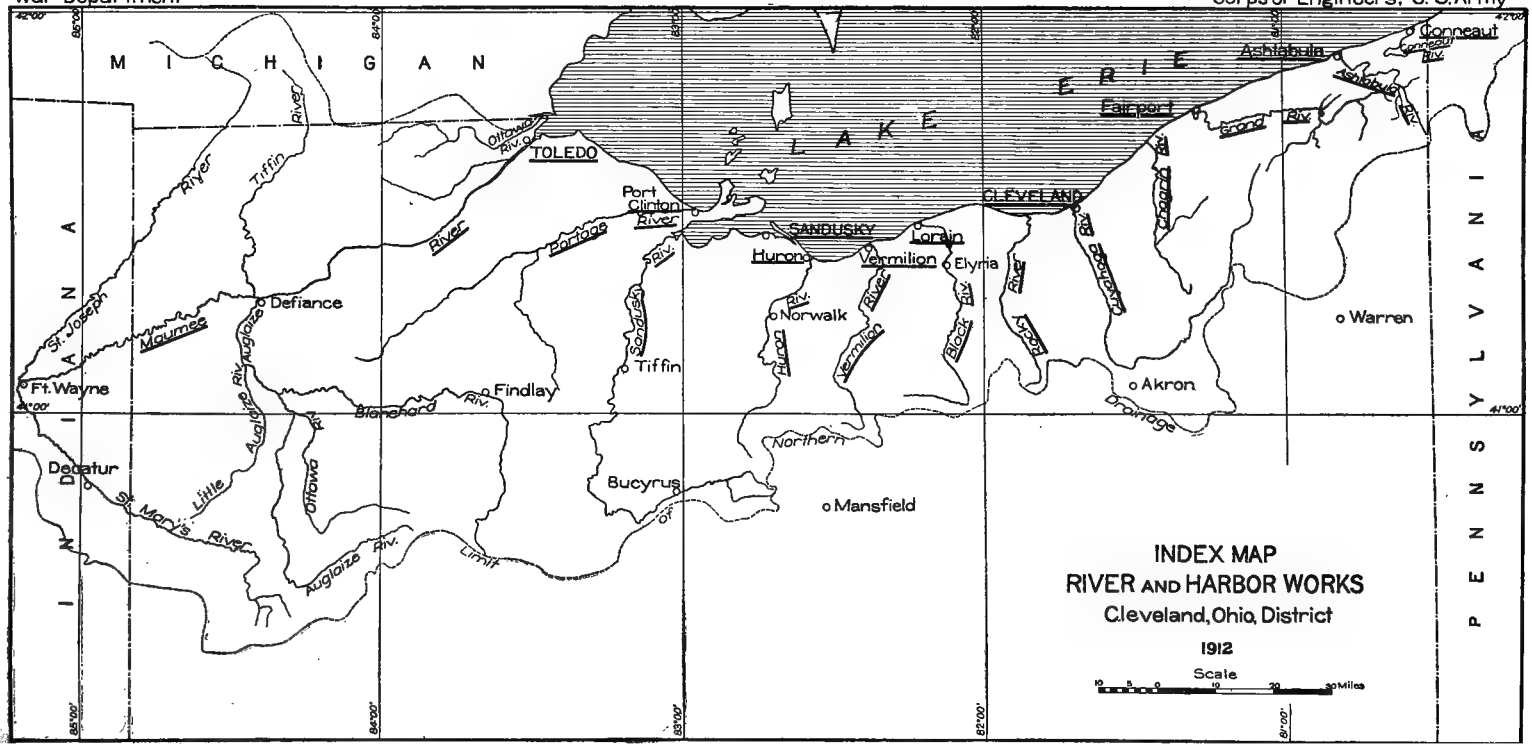
[1] Summary of, from commencement to 1877, **77,** 947.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

QQ.—CLEVELAND, OHIO, DISTRICT.

War Department

Corps of Engineers, U. S. Army



QQ.—CLEVELAND, OHIO, DISTRICT.[1]

In charge of U. S. Engineer Office,
Cleveland, Ohio.

QQ 1 Lake Erie.
QQ 2 Ottawa R., Ohio and Mich. (1)
QQ 3 Toledo H., Ohio (1)
QQ 4 Maumee R., Ohio (3)
QQ 5 Wabash and Erie Canal, Ind. and Ohio (4)
QQ 6 Swan Cr., Ohio (4)
QQ 7 Tiffin R., Ohio and Mich. (4)
QQ 8 St. Joseph R., Ohio and Mich. (4)
QQ 9 St. Marys R., Ohio (going downstream) (4)
QQ 10 Auglaize R., Ohio (4)
QQ 11 Little Auglaize, Ohio (10)
QQ 12 Ottawa R., Ohio (10)
QQ 13 Blanchard R., Ohio (10)
QQ 14 Portage R., Ohio (1)
QQ 15 Port Clinton, Ohio (1)
QQ 16 Sandusky R., Ohio (1)
QQ 17 Sandusky H., Ohio (1)
QQ 18 Huron H., Ohio (1)
QQ 19 Huron R., Ohio (18)
QQ 20 Vermilion H. Ohio (1)
QQ 21 Vermilion R., Ohio (20)
QQ 22 Lorain H., Ohio (1)
QQ 23 Black R., Ohio (22)
QQ 24 Rocky R., Ohio (1)
QQ 25 Cleveland H., Ohio (1)
QQ 26 Cuyahoga R., Ohio (25)
QQ 27 Chagrin R., Ohio (1)
QQ 28 Fairport H., Ohio (1)
QQ 29 Grand R., Ohio (28)
QQ 30 Big Creek (Cunningham Cr.), Ohio (1)
QQ 31 Ashtabula H., Ohio (1)
QQ 32 Ashtabula R., Ohio (31)
QQ 33 Conneaut H., Ohio (1)
QQ 34 Conneaut R., Ohio (33)

QQ-3 TOLEDO HARBOR (Maumee Bay), OHIO.

APPROPRIATIONS.

1866,	[2] $20,000,	**66,** iii, 6, 33, iv, 37, 38.
1867,	[2 3] 20,000,	**67,** 144.
1869,	*[2] 29,700,	**69,** 23.
1870,	[2] 50,000,	**70,** 47.
1871,	[2] 50,000,	**71,** 190.
1872,	[2] 15,000,	**72,** 225.
1873,	[2] 100,000,	**73,** 42.
1874,	[2] 75,000,	**74,** 216.
1875	[2] 75,000,	**75,** 295.
1876,	[2] 60,000,	**76,** ii, 553.
1878,	[2] 50,000,	**78,** 128, 1250.
1879,	[2] 20,000,	**79,** 170, 1680.
1880,	[2] 30,000,	**80,** 2099.
1881,	[2] 40,000,	**81,** 2284.
1882,	[2] 50,000,	**82,** 2382.
1884,	[2] 20,000,	**84,** 2086.
1884,	[4 5] 25,000,	**84,** 2086.
1886,	[4] 112,500,	**86,** 1853.
1888,	[4] 150,000,	**88,** 1986.
1888,	[2] 5,000,	**88,** 1986.
1890,	[4] 200,000,	**90,** 2758.
1890,	[2] 5,000,	**90,** 2759.
1892,	[4] 200,000,	**92,** 2490.
1894,	70,000,	**95,** 3074.
1896,	150,000,	**96,** 2920.
1899,	150,000,	**99,** 3022.
1900,	132,500,	**00,** 4024.
1901,	8,000,	**01,** 3221.
1902	15,000 / 223,000	**02,** 2251.
1903,	190,000,	**03,** 2051.
1904,	70,000,	**04,** 3151.
1905,	181,000,	**05,** 2301.
1909,	*45,000,	**09,** 2122.
1910,	145,000,	**10,** 2284.
1911,	75,000,	**11,** 2478.
1912,	75,000,	**12,** 2678.
Total,	2,931,700	(incl. $2,110 misc. rects. and $7,000 allotted for Maumee R. in 1872 (see QQ-4), $2,940,810. **12,** 2678).

COMMERCE.

Description of, **66,** iii, 33; **67,** 252–254; **69,** 119; **79,** 1679.

Growth of, and demand for increased facilities, **80,** 2097, 2098; **81,** 2287; **87,** 2290.

In 1892–94 Detroit & Cleveland Steam Navigation Co. compelled to stay away from Toledo because of the narrow chan., **94,** 2389.

Place, 1895–96, considered an important shipping point upon the lake; reason to believe increased chan. w. would increase receipts and shipments by water, **96,** 2920.

In 1896–97, 2,000,000 t. an., **97,** 3043.

Materially increasing, **01,** 573.

1900, 3,000,000 t., **01,** 573; 1904, 3,115,019 t., **05,** 603; 1908, 3,946,819 t., **09,** 781; 1909, 5,284,715 t.. **10,** 862; 1911, 6,407,878 t., **12,** 1093, 2679.

Marked reduction in rates since proj. was inaugurated, **07,** 700.

Diagram showing an. freight movement and app., **12,** 2679.

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* Allotment.
[1] Havre Bay and Vance R., Mich.—Sur., Mar. 23, 1837; est., $34,788.51. (H. D. 492, 55th, 2d.)
[2] Old chan.
[3] Maumee B. and R.
[4] Straight chan.
[5] Balance of $9,632.61 to be applied to clearing old chan., **86,** 447, 1852; **87,** 295.

CONTRACTS.

1866. T. Dunbar, dr., 40¢ c. y., **66,** iv, 39, 74; **67,** 144, 232, 233.
1869. P. Smith, dr., 35¢ c. y., **69,** 117; **70,** 171, 172; **71,** 190.
1871. A. Spaulding, dr., 21¢ c. y., **71,** 190; **72,** 224; C. Fitzsimons, dr., 30¢ c. y., **71,** 190; **72,** 225.
1872. W. Richardson, dr., 29¢ c. y., **73,** 312, 313.
1873. W. Richardson, 4 dr., tugs, etc., **73,** 313; **74,** 116.
1874. W. Richardson, 4 dr., tugs, etc., **75,** 295; **76,** ii, 553.
1875. W. Richardson, 6 dr., tugs, etc., **75,** 295; **76,** ii, 553.
1877. W. Richardson, dr., 12½¢ c. y., **77,** 953–955; O. J. Jennings, dr., 14¢ c. y., **77,** 953–955.
1878. E. H. French, dr., 9¾¢ c. y., **79,** 1680.
1879. E. H. French, dr., 9¾¢ c. y., **79,** 1680; E. H. French, dr., 9¾¢ c. y., **80,** 2099.
1880. E. H. French, dr., 14¢ c. y., **81,** 2285; E. H. French, dr., 19¢ c. y., **81,** 2285.
1881. Symmes & Scandlon, dr., 15¢ c. y., **81,** 2285.
1882. S. A. Murphy, removal of scow-and cargo, **82,** 2383; E. H. French, dr., 21¢ c. y., **83,** 1892.
1884. E. H. French, dr., 15¾¢ c. y., **85,** 2215; W. E. Rooney, dr., 14¾¢ c. y., **85,** 2215.
1885. G. Talbot, dr., 10¢ c. y., **86,** 1853.
1886. Carkin, Stickney & Cram, dr., 16½¢ c. y., **87,** 2287.
1887. G. Kellogg, dr., 12¢ c. y., **87,** 2286; French & Rooney, dr., 15¢ c. y., **87,** 2286.
1889. J. Rooney, dr., 20¢ c. y., **89,** 2300.
1890. J. Rooney, dr., 18½¢ c. y., **90,** 2756.
1891. J. Rooney, dr., 19¢ c. y.; L. P. & J. A. Smith, dr., 22¢ c. y., **91,** 2830; J. Kelly, constr. of 1,800 l. f. of pile protection, $20,911, **91,** 2834.
1892. G. H. Breymann & Bros., dr., 12, 14, and 16¢ c. y., s. m. ($100,000), **93,** 3057.
1895. J. Rooney, dr., 11 and 13¢ c. y., s. m. ($38,000 to $40,000), **95,** 3080.
1896. G. H. Breymann & Bros., dr., 9¢ c. y. ($80,000), **97,** 3048.
1899. Lydon & Drews Co., dr., 8 and 9$\frac{111}{1000}$¢ c. y. ($446,636.50); dike constr. (mattresses, st., filling), $32,816, **99,** 3024.
1908. The Standard Contracting Co., dr. inner section, 78,596 c. y., 22¢ c. y.; Duluth Marine Contracting Co., dr. middle section, 80,727 c. y., 21¢ c. y.; Breymann Bros., dr. outer section, 69,508 c. y., 20¢ c. y.; Standard Contracting Co., dr. 12,270 addl. from inner section, 20¢ c. y., **09,** 2122–23.
1911. Zenith Dredging Co., dr. about 1,113,000 c. y., 13½¢ c. y., s. m., **12,** 2679.

DEFENSE.

Military importance of H., **67,** 144; **68,** 146.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 4, 6, 33, iv, 38; **67,** 28, 252; **68,** 38; **69,** 23, 36, 118, 124; **70,** 47; **71,** 45; **72,** 42; **73,** 42, 313, 314; **74,** 48; **75,** 54; **76,** 106; **77,** 113; **78,** 127; **79,** 170; **80,** 223, 229; **81,** 304, 314, 315; **82,** 299, 309; **83,** 306; **84,** 309; **85,** 333; **86,** 327; **87,** 295; **88,** 269; **89,** 320; **90,** 290; **91,** 364; **92,** 345; **93,** 395; **94,** 369; **95,** 403; **96,** 358; **97,** 452; **98,** 441; **99,** 524; **00,** 589; **01,** 572; **02,** 494; **03,** 542; **04,** 592; **05,** 602; **06,** 676; **07,** 699; **08,** 743. 761; **09,** 780; **10,** 861, 879; **11;** 914, 933; **12,** 1091, 1111.

Boards:

Convened 1869; approv. plan for ship canal only as regards d., 13′; recom. continuation of imp. of main or w. chan. with U. S. dr. operated by hired labor; est., $124,212 or $152,800, **69,** 124–128. (Cols. Macomb and Simpson, Lt. Col. Woodruff and Majs. Wheeler and McFarland.)

Convened Dec., 1872; recom. imp. of existing chan. by dr. to 15′, est. $450,000, **73,** 314–324. (Majs. Poe, Houston, Merrill, and Wilson, and Capt. Gillespie.)

BE. convened, New York, Apr. 12, 1887, to consider location of proposed straight chan. for imp. Toledo H. **R., 87,** 2295. (Cols. Casey, Abbot, and Craighill, Lt. Cols. Houston and McFarland, and Maj. King.)

In charge:

Lt. Col. T. J. Cram, 1864–69. **R., 66,** ii, 41, iv. 37–39, 73–75; **67,** 144, 230–233, 253; **68,** 146, 151, 152; **69,** 112, 119.
Maj. W. McFarland, 1869–71. **R., 69,** 116, 128; **70,** 171.
Capt. G. L. Gillespie, 1871–73. **R., 73,** 311.
Maj. F. Harwood, 1873–74. **R., 74,** 216.
Lt. Col. C. E. Blunt, 1874–76. **R., 74,** 215; **75,** 294; **76,** ii, 552.
Maj. N. Michler, 1876–79. **77,** 112. **R., 77,** 948; **78,** 1241; **79,** 1670.
Maj. J. M. Wilson, 1878–83. **R., 79,** 1675; **80,** 2092; **81,** 2281, 2286; **82,** 2379, 2383.
Maj. L. C. Overman, 1883–92. **R., 83,** 1889; **84,** 2083; **85,** 2211; **86,** 1849; **87,** 2283, 2291; **88,** 1983; **89,** 2298; **90,** 2755; **91,** 2828.
Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2487; **93,** 3050; **94,** 2385; **95,** 3074; **96,** 2917; (Col.) **97,** 3040; **98,** 2614; **99,** 3020; **00,** 4022.
Maj. D. C. Kingman, 1901–05. **R., 01,** 3218; **02,** 2249; **03,** 2049; **04,** 3150; (Lt. Col.) **05,** 2299.
Maj. C. McD. Townsend, 1906–07. **R., 06,** 1893; **07,** 2061.
Lt. Col. John Millis, 1908–. **R., 08,** 2141; **09,** 2121; (Col.) **10,** 861, 2283; **11,** 914, 2477; **12,** 1091, 2677.

Assistants:

Capt. G. J. Lydecker, **68,** 151; **69,** 112, 122.
W. T. Blunt. **R., 90,** 2759; **94,** 2390; **95,** 3078; **96,** 2921; **97,** 3043; **98,** 2619; **99,** 3026; **00,** 4026; **01,** 3222; **02,** 2252; **03,** 2052; **04,** 3152; **05,** 2303.
Lt. W. V. Judson. **R., 92,** 2491.

ESTIMATES. (See Plans and Projects.)

By Col. Cram, 1866, entire and permanent completion of chan. 12′ x 200′, $20,000, in addition to $20,000 app., 1866, **66,** iii, 63, iv, 73.

By Col. Cram, 1867, chan. 200′ to 300′ w. and 15′ d., $470,000, **67,** 28; $469,664, **67,** 144, 230, 254; **68,** 146, 151. In 1869, ship canal 13′ d., $885,526, **69,** 118, 123.

By BE., 1869, imp. of w. chan. to 13′ in d. by U. S. dr. and hired labor, $124,212; by contract, $152,800; **69,** 116, 118, 127.

By Maj. McFarland, 1869, to complete proj. of board, $150,000, **69,** 129. In 1870, addl. for completion of proj., $70,000, and for beacon, $5,000, **70,** 171.

By Capt. Gillespie, 1871, completion of work, $20,000, **71,** 190.

By BE., 1872, 3 plans submitted, $1,853,500, $3,074,500, and $450,000; the latter recom., **73,** 314–319.

By Lt. Col. Blunt, 1875, completion of proj., $200,000, **75,** 294; $140,000, **76,** ii, 552.

By Maj. Wilson, 1879, complete existing proj., $30,000; to obtain 16′ chan., $100,000, **79,** 1680.

LEGAL PROCEEDINGS.

Rules and regulations for navigation in Maumee B., **00,** 4028.

OPERATIONS.

1866-67. 16,236 c. y. dr., **67,** 28, 144.
1867-68. 46,833 c. y. dr., **68,** 38, 146.
1868-69. 19,100 c. y. dr., **69,** 36.
1869-70. 55,000 c. y. dr., **70,** 47.
1870-71. 54,573 c. y. dr., **71,** 45.
1871-72. 332,791 c. y. dr. from sw. chan., making it 14′ x 120′, **72,** 42.
1872-73. 43,000 c. y. dr. from sw. chan., **73,** 311.
1873-74. Dr. on chan. from Toledo to the lake 15′ x 100′, **74,** 48, 216.
1874-75. 364,428 c. y. dr., **75,** 54, 294.
1875-76. 243,215 c. y. dr., **76,** 106, ii, 552.
1876-77. 44,541 c. y. dr., **77,** 953.
1877-79. Dr. by contract, **78,** 127. 1247; **79,** 170, 1670, 1678.
1879-80. 126,649 c. y. dr. from chan., **80,** 2097.
1880-81. 167,453 c. y. dr. from chan., **81,** 2283.
1881-82. 94,385 c. y. dr. from chan.; wreck of scow *Wellhouse* removed, **82,** 2381.
1882-83. 229,070 c. y. dr. from chan., **83,** 1890.
1883-84. 78,345 c. y. dr. from chan., **84,** 2084.
1884-85. 155,085 c. y. dr. from chan., **85,** 2211.
1885-86. 127,260 c. y. dr. from straight chan., **86,** 1851.

1886-87. 45,397 c. y. dr. from old chan., **87,** 2284.

1887-88. Straight chan.: 428,913 c. y. dr., **88,** 1985.

1888-89. Straight chan.: 748,940 c. y. dr., **89,** 2300.

1889-90. Old chan.: 28,000 c. y. dr., **90,** 2756. Straight chan.: 659,970 c. y. dr., **90,** 2757.

1890-91. Old chan.: 3,494 c. y. dr., **91,** 2829. Straight chan.: 182,077 c. y. dr., **91,** 2830.

1891-92. Old chan.: 20,356 c. y. dr., **92,** 2488. Straight chan.: 548,599 c. y. dr., **92,** 2488.

1892-93. 70,921 c. y., s. m., dr., **93,** 3052.

1893-94. 308,458 c. y., s. m., dr., **94,** 2386, 2387.

1894-95. 601,812 c. y. dr., **95,** 3075, 3076.

1895-96. 432,901 c. y. dr., and 429 c. y. r. excavated, **96,** 2918, 2919.

1896-97. 244,000 c. y. dr., **97,** 3043.

1897-98. 643,058 c. y. dr., and wharf and storehouse erected, **98,** 2615, 2616.

1898-99. Nearly 60,000 c. y. dr., **99,** 3022.

1899-00. Plant enlarged and repaired; some obstr. removed; over 140,000 c. y. dr. from H., and 144,999 c. y. dr. from Maumee B., **00,** 4023.

1900-01. Floating plant repaired, 184,996 c. y. dr. by U. S.; 961,552 c. y. dr. by contractor, **01,** 3219.

1901-02. 147,449 c. y. excavated by U. S.; 1,151,300 c. y. dr. by contractor, **02,** 2249.

1902-03. 182,270 c. y. excavated by U. S. dr. plant; 983,893 c. y. excavated by contractor, **03,** 2050.

1903-04. 115,527 c. y. removed by U. S.; 771,679 c. y. dr. by contractor. Contract work about 54% completed, **04,** 3150.

1904-05. 43,740 c. y. removed by U. S. dr. *Maumee;* 1,292,849 c. y. dr. under contract, **05,** 2299, 2300.

1905-06. 548,211 c. y. dr. under contract, completing same Oct., 1905; 62,743 c. y. dr. by U. S. dr. *Maumee;* 14,322 c. y. by dr. *Burton.* Work on dike constr. under contract carried on, **06,** 1894.

1906-07. Constr. of dike connecting range lights in B. completed; 54,019 c. y. dr. by U. S. dr. *Maumee;* 243,897 c. y. dr. by U. S. dr. *Burton.* Repairs to dr., **07,** 2062.

1907-08. U. S. dr. *Burton* removed 402,528 c. y. (mainten. work), repairs to plant; 2 dump scows completed, **08,** 2141.

1908-09. 90,866 c. y. dr. from inner section; 80,727 c. y. dr. from middle section; 69,508 c. y. dr. from outer section. U. S. dr. *Burton,* in mainten. work, removed 162,729 c. y. from Maumee R. and from outer division of B. chan. Repairs to dr. *Maumee* and other floating plant, **09,** 2122.

1909-10. U. S. dr. *Burton,* removed 32,580 c. y. from Maumee R., and 85,839 c. y. from outer division of straight chan. through Maumee B. Rebuilding of U. S. dr. *Maumee* completed Aug. 19, **10,** 2283–84.

1910-11. Mainten. dr. done by U. S. dr. *Burton,* removing 133,263 c. y. from chan. through Maumee B. and 11,371 c. y. from chan. through R., **11,** 2477.

1911-12. 591,194 c. y. removed from outer end of chan., completing it for 13,900′ and partly for 6,900′. Mainten. carried on by U. S. dr. *Burton,* removing 32,184 c. y. from chan. through Maumee B., and 53,347 c. y. from chan. through R. Wrecked dr. *Maumee* raised from Cleveland H. and cost charged in part to this app., **12,** 2678.

PHYSICAL CHARACTERISTICS.

Description of, **69,** 122, 125–127; **73,** 315–318; **98,** 2617.

Description of straight chan., Maumee B., **00,** 4026.

Comparative soundings, **99,** 3022; **00,** 4031.

Improbability of arriving at any general principles which would govern deposit and scour in chan., **99,** 3022–3026.

Stirring up of bottom of chans. by moving steamers helpful in maintaining depths, **99,** 3022–3026.

Ice-covered R. and B., 1899–1900, taken advantage of to make H. line sur., **99,** 3027.

Bar at the R. mouth an obstr., 1900, owing to changes in the chan. due to extension of wharf front to H. lines, **00,** 4023, 4030.

Actual scour occurring, while at other places, particularly toward inner end of chan., considerable fill; heaviest fill over 3′, about 2 m. outward from mouth of R.; fill caused by silt brought down the R. during spring freshets; **01,** 3219.

Severe storm wrecked and sunk dr. of contractor, placed on the work July, 1901, **02,** 2249.

Tendency to fill, in dr. chan., **02,** 495; **03,** 2050.

Violent freshet, ice dams form, damage to brs., wharves, and vessels in H., **04,** 3150, 3153.

Water levels, **05,** 2305.

Triangulation of Maumee B. and R., **05,** 2306.

Continuous shoaling in dr. chan., **07,** 2062.

June 30, 1908, max. draft over shoalest portion of chan. 20′, **08,** 744.

Extreme fluctuation due to wind, 7.9′ above to 7.1′ below m. lake level, **09,** 781.

Deterioration of dike at range lights, **10,** 2284.

Result of work, to create and maintain chan. through Maumee B. and R. 23′ x 400′ for outer 2½ m., 21′ x 400′, thence 12½ m. up to Fassett St. Br., and 20′ x 100′ for 1 m. above this br. Maumee R. navigable for launches to Perrysburg, 15 m. above mouth, **12,** 1093.

PLANS. (See Estimates and Projects.)

By Col. Cram, 1869, ship canal with ps. and revet.; est., $885,526, **69,** 119. 123.

By Maj. McFarland, 1870, beacon; est., $5,000, **70,** 171.

By BE., 1872, straight cut through North Cape Pt.; est., $1,853,500; and extension of R. through B. and North Cape to Lake Erie with revetted banks; est., $3,074,500; not recom., **73,** 314–318.

By Maj. Wilson, 1881, extension of Maumee R. on straight line through the B. and North Cape Pt. to Lake Erie, confining R. bed in a new chan. of about same dimensions as its natural bed, by dr. in B. and lake, and constr. of 2 parallel lines of revet. on either side of chan. Est., $2,363,923. **82,** 2385, 2386; **86,** 1850; **87,** 2291, 2296.

By Maj. Overman, 1887, chan. beginning at mouth of Maumee R. and extending straight through North Cape Pt. on a course n. 26° 36′ 13″ e. to 17′ d. of water in Lake Erie, Ottawa R. to be diverted by a cut through North Cape Peninsula; the revet. of the cut to be determined by experience, **87,** 2294, 2296. Plan considered by BE., **87,** 2295.

PRIVATE WORK.

Dr., 1899, by Hocking Valley RR., **99,** 3020.

PROJECTS. (See Estimates and Plans.)

By Col. Cram, 1866, dr. existing chan. in Maumee B. for 1 m. to 12′ x 200′; est., $40,000, **66,** iii, 6, 33, iv, 38.

By Maj. Wilson, 1879, 16′ chan.; est., $100,000, **79,** 1679.

BE. in 1869 recom. adoption of present location of chan. Est., $152,800. **69,** 118, 125, 127; **80,** 2093.

In 1872 BE. submitted 3 plans, of which the Sec. of War approv. that which provided for w. of "existing" chan. to 250′ at top with d. of 15′; est., $450,000, **73,** 313–324; **77,** 953; **80,** 2094.

In 1880 the proposed d. was increased to 16′, **80,** 2097; **87,** 2285.

In 1886 there had been obtained a chan. 200′ w. at bottom and from 15′ to 17′ d. bet. Toledo and d. w. in the lake, under an aggregate of app., 1866 to 1884, incl., of $704,700, **86,** 327, 1850; **87,** 2283.

In 1887 BE. recom. straight cut from mouth of Maumee R. to Lake Erie by extending crib reach at the present natural chan. outward into the lake and inward across the B. to the "present" natural chan. of the R., thereby utilizing about 2 m. of previously imp. chan., chan. to have 17′ with bottom w. of 200′; est., $1,875,000, **87,** 2286, 2297. Approv. by Sec. of War, **87,** 2299.

In 1890 est. $45,000 would be required to complete proj. of 1872, for imp. of old chan., **90,** 2757.

By Lt. Col. Smith, 1892, dr. in straight chan. at est. of $100,000, and purchase of dr. plant at est. cost of $48,000, **93,** 3051; in 1893 for w. chan. to 300′ in lake division or part outside the turn-out, **93,** 3052, 3053.

By Lt. Col. Smith, 1894, dr. chan. through shoal at "Crossing" to 19′ bet. the curves of 18′ d., and with w. of 400′, est., $18,000, **94,** 2387.

By Lt. Col. Smith, 1895, dr. chan. 18′ x 400′ over shoal in vicinity of br. at Cherry St., **95,** 3076.

By Col. Smith, 1897, 21′ chan, 400′ w., throughout chan. in Maumee R. and B.; est. $1,095,000, **98,** 2693; **99,** 3020. Proj. modified, 1899, providing for w. of 200′ at upper end, reducing est. to $1,005,000. Est. cost in addition to considerable amount for mainten., **99,** 3021.

By Col. Smith, 1899, application of $100,000 of app. of 1899 to enlargement, operation, and mainten., of plant, **99,** 3021.

Act June 13, 1902, au. purchase of dr. for this district, and provides for payment of portion of its cost from the app. applicable to continuous contract at Toledo, **02,** 2250. Sec. of War au. constr. of a seagoing suction dr. for work in Hs. of Toledo, Sandusky, Cleveland, Fairport, Ashtabula, and Conneaut on Lake Erie, **03,** 979.

Act June 25, 1910, app. $145,000 for continuing imp. by making chan. 23′ d., m. l. l., and 400′ w. from d. w. in Lake Erie to Fassett St. Br., Toledo; est., $400,000, and $25,000 an. mainten. (H. D. 865, 60th, 1st), **10,** 862.

SURVEYS.

By Lt. Col. Cram, 1863–64, for military defense, **67,** 144.

Under direction of Col. Cram, by Capt. Lydecker, 1868, **69,** 112, 122.

By Maj. McFarland, 1869, **69,** 117.

Au. act June 14, 1880; made, 1880, by Maj. Wilson, for d. of 16′, **81,** 2286.

Au. act Mar. 3, 1881; made, 1881, by Maj. Wilson, for straight chan. to Lake Erie, **82,** 2383.

Resur. made by Maj. Overman, 1886, **87,** 2285, 2291.

Triangulation of Maumee B.; made, 1890, by Maj. Overman, **90,** 2759.

Ex. of straight chan. made by Lt. Col. Smith, 1893, **93,** 3050.

Geodetic surs. made, 1894, by Lt. Col. Smith, **95,** 3079.

Sur. made, 1894, of that part of R. above br. at Cherry St. as far as br. of Lake Shore & Michigan Southern Ry. Co., by Lt. Col. Smith, **95,** 3076.

H. lines verified on ice of H. (See Physical characteristics.)

Minor, **01,** 3219; **02,** 495, 2254.

Triangulation of Maumee B. and R., **05,** 2306.

Pre. ex. and sur. au. act Mar. 2, 1907, of Maumee R., Ohio, from d. w. in Lake Erie to the Fassett St. Br., Toledo, with view to obtaining greater d. and increased w. of approx. 100′. **R.** by Lt. Col. Townsend, Aug. 10, 1907, and Feb. 18, 1908, recom. chan. 23′ d., m. l. l., and 400′ w. from d. w. in Lake Erie to the Fassett St. Br., Toledo, with suitable easement of bends at range lights; est., $400,000, and $25,000 an. mainten. (H. D. 868, 60th, 1st), **08,** 761.

Pre. ex. au. act Mar. 3, 1909, of Maumee R., **10,** 879. At hearing held by BERH. in reference to said ex. the fact was developed that act June 25, 1910 (see Projects), was intended to correct certain ambiguity and to supersede act Mar. 3, 1909, in all respects, and consequently it was not deemed necessary or advisable to report further under act Mar. 3, 1909 (see H. D. 769, 62d, 2d).

Pre. ex. au. act June 25, 1910, of Maumee R., from Toledo, Ohio, to Ft. Wayne, Ind. **R.** by Col. Millis, Oct. 31, 1911 (H. D. 769, 62d, 2d) (unfav.), **12,** 1111.

Maps. (H. D. 769, 62d, 2d.)

89, 2304; **90,** 2766; **91,** 2831; **92,** Atlas, 114; **94,** 2390; **95,** 3080; **98,** 2646; **01,** 3226; **09,** 2122; **10,** 2284; **11,** 2477.

QQ–4 MAUMEE RIVER (above Toledo), OHIO.[1]

APPROPRIATIONS.

1872, $7,000, **72,** 225.

COMMERCE.

Important, **72,** 235, 236.

Toledo, situated on the R., has a large C.; in 1896 the registered t. over 2,250,000 t., **98,** 2701.

CONTRACT.

1872. H. T. Stock & Co., dr., 25¢ c. y., **73,** 324, 325.

ENGINEERS.

Chief of Engineers. R., 71, 48; **72,** 43, 45; **73,** 42; **81,** 314; **98,** 453.

In charge:

Capt. G. L. Gillespie, 1871. **R., 72,** 225, 235.
Maj. F. Harwood, 1873. **R., 73,** 324.
Maj. J. M. Wilson, 1881. **R., 81,** 2341.
Col. J. A. Smith, 1898. **R., 98,** 2693.

Assistant. W. T. Blunt. **R., 98,** 2701.

ESTIMATES. (See Plans and Projects.)

By Maj. Gillespie, 8′ chan., Toledo to Maumee City, $7,000, **72,** 237.

By Maj. Harwood, 1873, to complete chan., Perrysburg to Maumee City, $15,000, **73,** 324, 325.

OPERATIONS.

1872-73. 23,159 c. y. dr., making chan. for vessels drawing 7′, Toledo to Perrysburg, **73,** 324, 325.

PHYSICAL CHARACTERISTICS.

Description of, **72,** 236, 237; **81,** 2341; **98,** 2694.

PLANS. (See Estimates and Projects.)

By Maj. Wilson, 1880, chan. 100′ x 8′ l. w. Perrysburg to Toledo, by dr., r. removal, and dike constr.; est., $124,748, **81,** 2342.

PRIVATE (STATE) WORK.

Canal embankment built by Ohio, 1840–41, an injury to the chan., **72,** 236.

PROJECTS. (See Estimates and Plans.)

By Maj. Gillespie, chan. 8′ x 60′, Maumee City to Perrysburg, and d. existing chan. over Delaware Flats, **72,** 225.

By Maj. Harwood, chan. for vessels drawing no more than 7′, Toledo to Maumee City, **73,** 42.

In 1897 Col. Smith est. $1,095,000 to obtain 21′ x 400′ m. l. throughout the chan. in the B. and R.; this cost could also be reduced probably by $90,000, **98,** 2693.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1871, **71,** 48; made by Capt. G. L. Gillespie. **R., 72,** 235.

Au. act June 14, 1880; made by Maj. Wilson, 1880, **81,** 2341.

Sur. of the straight chan. in Maumee B. and R. au. act June 4, 1897; made by Col. Smith, 1897 (see Projects), **98,** 2693.

Maps. **98,** 2704.

[1] Sur.—**R.,** Feb. 12, 1836; est. $21,682.88. (H. D. 482, 55th, 2d.)

QQ–5(a) WABASH AND ERIE CANAL, IND. AND OHIO.

APPROPRIATION.[1]
1834, $28,337.55.

QQ–5(b) LAKE ERIE TO OHIO RIVER. (Canal through the State of Ohio.)

APPROPRIATIONS.

1894,	$20,000.00, **96,** 368, 2973.
1897 (claims),	119.47, act July 19.
Total,	20,119.47

COMMERCE.
C. consideration, **96,** 3035, 3065.

ENGINEERS.
Chief of Engineers. **R., 96,** 368, 2973.

Boards:
Convened by S. O. No. 43, 1894, at Detroit, Mich., on Sept. 11, 1894, to make certain surs., etc. (See Surveys.) **R., 96,** 2976–3090. (Detailed index,[2] **96,** 2975.) (Lt. Col. A. Stickney, Majs. W. T. Stanton, and W. L. Marshall.)

Assistant. Capt. H. M. Chittenden. **R., 96,** 2996.

PHYSICAL CHARACTERISTICS.
Detailed description of the 3 routes considered available for continuous canals (see Surveys), e. route, Cleveland to Marietta; central route, Sandusky B. to Portsmouth; w. route, Toledo to Cincinnati, **96,** 2974, 3028; water supply, 3007.

PROJECTS.
In 1896 the BE. est. $12,311,472 to constr. e. route, $18,118,165 the central route, and $24,011,274 the w. route, **96,** 2974, 3034.

SURVEYS.
Sur. Feb. 3, 1825. (No est.) (H. D. 482, 55th, 2d.)
Sur. of the Miami and Erie Canal, the Ohio Canal, and various branches as might be deemed available for the constr. of a continuous canal, 70′ at water line and 7′ d., with new locks not less than 21′ x 150′, able to pass boats of at least 280 t. burden, to connect Lake Erie with the Ohio R. through Ohio, au. act Aug. 17, 1894; **R.** by BE., 1896 (see (Projects), **96,** 2973). (**R.** unfav. to canal of dimensions named by Congress; and, apart from an adequate imp. of the Ohio, constr. of a canal not deemed advisable by the Board.)

QQ–5(c) LAKE ERIE TO THE WABASH AND OHIO RIVERS. (Ship canal.)

ENGINEERS.
Chief of Engineers. **R., 80,** 229; **81,** 315

In charge. Maj. J. M. Wilson. **R., 81,** 2348.

Assistants:
B. Holley. **R., 81,** 2363.
C. D. Ward. **R., 81,** 2400.
W. S. Williams. **R., 81,** 2393.

PLANS.
By Maj. Wilson, 1880, enlarging prism of existing canal Toledo to La Fayette, 216 m., to w. of 70′; locks 7′ x 18′ x 110′ over miter sill. Est., $24,236,135. **81,** 2352, 2354, 2362, 2393.

Enlarging existing canal, Junction City to Cincinnati, to 70′, locks 18′ x 110′, and 7′ over miter sill. Est., $23,440,275, **81,** 2356, 2358, 2363, 2400.

PRIVATE (CORPORATE) WORK.
Description of Wabash and Erie Canal, **81,** 2349, 2413.
Of the Miami and Erie Canal, **81,** 2354, 2414.

SURVEY.
Au. act June 14, 1880, **80,** 229; made by Maj. Wilson, 1880, **81,** 2348.
Maps. Of proposed routes, **81,** 2362.

QQ–9 ST. MARYS RIVER, OHIO.

ENGINEERS.
Chief of Engineers. **R., 81,** 314.

In charge. Maj. J. M. Wilson. **R., 81,** 2343.

PHYSICAL CHARACTERISTICS.
R. described, **81,** 2345.

PLANS.
In 1880 imp. of R. not feasible, **81,** 2345.

SURVEYS.
Ex. au. act June 14, 1880; made by Maj. Wilson (see Physical characteristics), **81,** 2343.

[1] H. R. D. 482, 55th, 2d. See also Act June 30, 1834 (4 Statutes, 716) for land selection.
[2] Including, with other data, sources of information, historical sketch, comparison of the routes, advisability of constructing.

QQ–14 PORTAGE RIVER, OHIO.

COMMERCE.

Entirely local, and, if imp. were undertaken, it would be totally incommensurate with cost of work, **04,** 3222.

ENGINEERS.

Chief of Engineers. R., 04, 609.

Boards. BERH. concurs in opinion of DO. as to inadvisability of imp., **04,** 3222.

In charge. Maj. D. C. Kingman, 1904. **R., 04,** 3218.

PHYSICAL CHARACTERISTICS.

At mouth of Portage R. lies Port Clinton H. Entrance chan. is 12′ d. and inner H. 10′, **04,** 3221.

SURVEY.

Pre. ex. au. act June 12, 1902, of R. from mouth to Oak H. Br. **R.** by Maj. Kingman, June 13, 1903 (H. D. 189, 58th, 2d) (unfav.), **04,** 3219.

QQ–15 PORT CLINTON HARBOR, OHIO.

APPROPRIATIONS.

1872,	$8,000,	**72,** 234.
1872,	*2,000,	**73,** 344.
1875,	5,000,	**75,** 295.
1876,	5,000,	**76,** ii, 553.
1878,	10,000,	**78,** 128, 1253.
1879,	10,000,	**79,** 171, 1682.
1880,	5,000,	**80,** 2102.
1881,	5,000,	**81,** 2291.
1882,	6,000,	**82,** 2389.
1886,	2,000,	**86,** 1855.
1888,	5,000,	**88,** 1988.
1890,	3,000,	**90,** 2768.
1892,	10,000,	**92,** 2494.
1894,	6,000,	**95,** 3082.
1896,	6,000,	**96,** 2927.
1899,	6,000,	**99,** 3035.
1902,	5,000,	**02,** 2256.
1905,	2,000,	**05,** 2315.
1907,	3,000,	**07,** 2066.
1909,	*2,500,	**09,** 2124.
1910,	1,000,	**10,** 2285.
1912,	500,	**12,** 2682.
Total,	108,000 ($106,000,	**02,** 2682.)

COMMERCE.

Requirements, **68,** 153; **71,** 210.

Local traffic small, but place a port for extensive fisheries on the lake, **93,** 3059; **94,** 2395; **95,** 3082.

Practically no C., 1900; traffic local only, **00,** 4040.

Proj. has had little effect on rates, as C. of port is small, **06,** 678.

CONTRACTS.

1872. H. T. Stock & Co., dr., 35¢ c. y., **73,** 344.

1879. J. Stang, p. constr., **80,** 2103. Cleveland, Brown & Co., iron, **80,** 2104.

1880. S. A. Sague, iron. Salmon & Mares, p. constr., **81,** 2291.

1881. F. Wilson, iron. J. Stang, p. constr., **81,** 2292.

1882. J. Stang, p. constr., **82,** 2388.

1887. J. Stang, repairs to ps. and revets., **87,** 2301.

1889. J. Stang, dr., 25 and 26¢ c. y., **89,** 2306; p. and revet. repair, **89,** 2307.

1890. Carkin, Stickney & Cram, dr., 25¢ c. y., **91,** 2835.

1893. Sadler & Allen, dr. 12,400 c. y., 16¢ c. y., s. m., **93,** 3060.

1897. J. Stang, reinforcing js. with st., total bid, $6,940, **97,** 3051.

1900. C. H. Strong & Co., st. reinforcement and repair of js., **01,** 3229.

1902. Detroit Dredging Co., dr., **03,** 2056.

1905. Buckeye Contracting Co., st. reinforcement and repair of js., **06,** 1897.

1907. Buckeye Contracting Co., st. reinforcement and repair of js., **08,** 2144.

ENGINEERS.

Chief of Engineers. R., 67, 18; **68,** 40; **70,** 31, 50; **71,** 48; **72,** 45; **73,** 45; **74,** 48; **75,** 54; **76,** 106; **77,** 113; **78,** 128; **79,** 171; **80,** 224; **81,** 305; **82,** 299; **83,** 307; **84,** 310; **85,** 334; **86,** 329; **87,** 297; **88,** 270; **89,** 322; **90,** 291; **91,** 365; **92,** 346; **93,** 396; **94,** 370; **95,** 404; **96,** 359; **97,** 454; **98,** 443; **99,** 525; **00,** 590; **01,** 573; **02,** 496; **03,** 543; **04,** 593, 609, 3218; **05,** 604; **06,** 678; **07,** 700; **08,** 745; **09,** 782; **10,** 863, 879; **11,** 916; **12,** 1094.

Boards. BERH. reviews report of Maj. Kingman's, July 31, 1903, on pre. ex. of Portage R., Ohio, from mouth to Oak H. Br., **04,** 322.

In charge:

Col. T. J. Cram, 1868. **R., 68,** 150, 153.

Maj. W. McFarland, 1869–71; **69,** 116. **R., 71,** 210.

Capt. G. L. Gillespie, 1871–73. **R., 72,** 234.

Maj. F. Harwood, 1873–74; **73,** 42. **R., 73,** 344; **74,** 217.

Lt. Col. C. E. Blunt, 1874–76; **74,** 215. **R., 75,** 295; **76,** ii, 553.

Maj. N. Michler, 1876–78; **77,** 112. **R., 77,** 955; **78,** 1250; **79,** 1671.

Maj. J. M. Wilson, 1878–83. **R., 79,** 1681; **80,** 2099; **81,** 2289; **82,** 2387.

Maj. L. C. Overman, 1883–92. **R., 83,** 1892; **84,** 2086; **85,** 2215; **86,** 1854; **87,** 2299; **88,** 1986; **89,** 2305; **90,** 2767; **91,** 2835.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2494; **93,** 3058; **94,** 2394; **95,** 3081; **96,** 2925; (Col.) **97,** 3049; **98,** 2647; **99,** 3034; **00,** 4038.

Col. S. M. Mansfield, **01,** 571.

Maj. D. C. Kingman, 1901–06. **R., 01,** 3227; **02,** 2256; **03,** 2055; **04,** 3157; (Lt. Col.) **05,** 2315.

Maj. C. McD. Townsend, 1906–08. **R., 06,** 1896; (Lt. Col.) **07,** 2065.

Lt. Col. John Millis, 1908–. **R., 08,** 2143; **09,** 2124; (Col.) **10,** 2285; **11,** 2481; **12,** 2681.

Assistants:

H. G. Rothwell, **68,** 150, 155.

D. Enwright. **R., 75,** 296.

W. T. Blunt. **R., 04,** 3159.

ESTIMATES. (See Plans and Projects.)

By Col. Cram, 1868, entire imp., $89,045.78, **68,** 155.

By Maj. McFarland, 1871, $120,000, **71,** 210.

By Lt. Col. Blunt, 1875, $122,000, **75,** 296.

By Maj. Wilson, 1879, completion of existing proj., $55,000, **79,** 171, 1682.

LEGAL PROCEEDINGS.

In 1893 transfer of necessary portion of the sand beach adjoining the inner end of w. revet. at H. commenced, **93,** 3059; and completed in 1894; cost being $1,200, as provided act 1892, **94,** 2395.

* Allotment.

OPERATIONS.

1873. 20,302 c. y. dr., giving chan. 8′ x 20′, mouth of R. to lake, **73,** 344.

1874. Catch-sand fence built on n. spit, **74,** 217.

1875. Fence extended 840′ by hired labor, **75** 295.

1877. Constr. of e. revet. by hired labor begun, **77,** 956.

1877-78. Constr. of revet., **78,** 128, 1251.

1878-79. Extension of e. and w. ps. and dr. by hired labor, **79,** 171, 1671, 1681.

1879-80. Pilework completed upon 300 l. f. of w. p. and 320′ of e. revet., **80,** 2102.

1880-81. W. p. extended 450′ and e. p. 904′, **81,** 2289, 2290.

1881-82. W. p. extended 260 l. f. and 210′ added to e. p., **82,** 2388.

1882-83. 195 piles driven, forming 4,934 l. f. of p. foundation, **83,** 1893.

1883-84. W. p. extended 150′ and old portions of w. p. and e. revet. repaired, **84,** 2087.

1886-87. Repairs to p. work commenced, **87,** 2300.

1887-88. Repairs to ps. completed under contract, **88,** 1987.

1888-89. 9,025 c. y. dr. from H. entrance, **89,** 2306.

1891-92. 11,705 c. y. dr., **92,** 2494.

1893-94. 35,491 c. y. dr., s. m., and some large bowlders removed, **94,** 2394.

1897-98. About 39,000 t. st. placed in repair and strengthening of ps., **98,** 2648.

1900-01. 1,150 t. st. placed in j., **01,** 3228.

1901-02. 3,250 t. st., placed in revet., **02,** 2256.

1902-03. 33,764 c. y. dr., **03,** 2055.

1906-07. 1,204 t. st. placed in js.; plant repaired, **07,** 2065.

1907-08. 1,397 t. heavy riprap st. and 204 t. small riprap st. placed in js., **08,** 2143. Two 500-yd. dump scows completed, **08,** 2144.

1908-09. Scows overhauled, **09,** 2124.

1910-11. Repairs made to ps. damaged by sea and ice, **11,** 2481.

PHYSICAL CHARACTERISTICS.

Description of, **68,** 153, 154; **71,** 210.

Slight increase of d. of dr. chans. shown by soundings of 1900. Vessels drawing 10′ could easily enter, **00,** 4040.

Condition of works and d. of w., **01,** 3228; **02,** 2256; **03,** 544, 2055; **04,** 594, 3158; **05,** 2315; **10,** 2285; **11,** 917.

PLANS. (See Estimates and Projects.)

By Col. Cram, 1868, dr. new outlet, 10′ x 200′, for Portage R., and protecting with 5,300′ of pile revet. and 1,100′ of pile ps.; est., $80,045.78, **68,** 154, 155.

PROJECTS. (See Estimates and Plans.)

By Maj. McFarland, 1871, d., by dr., entrance to Portage R. to 8′, and protection of chan. by 2 parallel ps.; est., $120,000, **71,** 210; **80,** 2100.

By Capt. Gillespie, 1872, d., by dr., entrance to Portage R., and 1,000′ of timber revet. on n. side of entrance, to cost $8,000, **72,** 234.

By Maj. Harwood, 1873, building catch-sand fence for temporary benefit, **73,** 344; **74,** 217.

By Lt. Col. Blunt, 1875, extending catch-sand fence, by hired labor, as part of Maj. McFarland's proj., **75,** 295, 296.

By Maj. Michler, 1877, constr. e. revet., **77,** 956.

By Maj. Wilson, 1879, extending pile p. and revet., **79,** 1681.

Efforts of 1872–73 to maintain chan. by dr. having failed, in 1875 Lt. Col. Blunt proposed pile revet. from n. shore, and parallel and 200′ distant an e. pile p. extending to 10′ curve in lake, **75,** 295, 296; **80,** 2100; **81,** 2290.

From 1872 to 1886, incl., $58,000 app., when it was est. that $41,000 would be required to complete proj., **86,** 330; **92,** 2494.

By Lt. Col. Smith, 1892, w. chan. of 10′ d. by dr., **93,** 3059.

By Lt. Col. Smith, 1894, strengthening ps. by adding to riprap st. on each side with a view to securing piling below water, making ps. tight to confine the currents in and out, and to form a foundation upon which a st. superstr. or sea wall might be built at some future day, **96,** 2927.

Efforts made by citizens to have app. of 1899 applied to dr. 12½′ chan. instead of to repairs, **00,** 4039.

SURVEYS.

Under Col. Cram, by H. G. Rothwell, 1867. **R., 68,** 150, 153–155.

By Maj. McFarland, 1870, **70,** 50. **R., 71,** 210.

By Lt. Col. Blunt, 1875, **75,** 295.

Of H., 1882, **82,** 2388.

Ex. of H., 1884, **84,** 2088.

Ex. of chan., 1889, **90,** 2768.

Sur. of land purchased made in connection with ex. of H., 1892, by Lt. Col. Smith, **93,** 3059.

Pre. ex. au. act June 13, 1902, of Portage R., Ohio, from mouth to Oak Harbor Br. **R.** by Maj. Kingman, June 13, 1903 (H. D. 189, 58th, 2d) (unfav.), **04,** 609, 3219. **R.,** reviewed by BERH., **04,** 3221.

Pre. ex. and sur. au. by act Mar. 3, 1909, of Port Clinton H. **R.** by Lt. Col. Millis, 1909, and Jan. 20 and Feb. 4, 1910 (H. D. 815, 61st, 2d), locality not considered worthy of imp. by U. S. further than contemplated by existing proj., **10,** 879.

Maps. (H. D. 815, 61st, 2d.) **81,** 2290; **91,** 2836; **94,** 2394; **09,** 2124; **10,** 2284; **11,** 2477.

QQ–15(b) STARVE ISLAND REEF, NEAR BASS ISLAND, LAKE ERIE, OHIO.

ENGINEERS.

Chief of Engineers. **R., 98,** 452.

In charge. Col. J. A. Smith, 1896–98. **R., 98,** 2705.

Assistant. W. T. Blunt. **R., 98,** 2707.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 2706.

PROJECTS.

In 1897 Col. Smith est. $258,300 to remove r. to 21′, and $761,250 to 25′, **98,** 2707.

SURVEY.

Sur. au. act June 3, 1896; made, 1897, by Col. Smith, **98,** 2705.

QQ–16 SANDUSKY RIVER, OHIO.

APPROPRIATIONS.

1867,	$20,000, **67,** 143.
1872,	10,000, **72,** 43.
1880,	10,000, **80,** 2114.
1881,	7,500, **81,** 2298.
1882,	4,000, **82,** 2392.
1890,	1,500, **90,** 2772.
1892,	5,000, **92,** 2498.
Total,	58,000

COMMERCE.

Not considered large or important, **93,** 3066; **94,** 2399.

In 1894–95 the passage of a boat with freight or passengers was so infrequent that the cost of maintaining a chan. 9′ or 10′ would exceed the total receipts of the C., **95,** 3092.

CONTRACTS.

1867. With Thomas Dunbar & Co., dr., 27¢ c. y., **67,** 144, 216.

1872. With O. J. Jennings, dr., 25¢ c. y., **73,** 326.

1880. W. Richardson, dr., 19¢ c. y., **81,** 2299.

1881. W. Richardson, dr., 17¢ c. y., **81,** 2299.

1882. L. P. & J. A. Smith, dr., 12¢ c. y., **83,** 1898.

1890. A. Couche & Co., dr., 25¢ c. y., **90,** 2771.

1891. Carkin, Stickney & Cram, dr., 25¢ c. y., **91,** 2843.

1893. Sadler & Allen, dr., 16¢ c. y., s. m., **93,** 3067.

ENGINEERS.

Chief of Engineers. **R., 66,** ii, 41, iii, 6, 33; **67,** 28; **68,** 39; **69,** 36; **70,** 47; **71,** 46; **72,** 43; **73,** 43; **80,** 225; **81,** 307. 314; **82,** 301; **83,** 309; **84,** 312; **85,** 337; **86,** 331; **87,** 298; **88,** 271; **89,** 323; **90,** 292; **91,** 366; **92,** 347; **93,** 398; **94,** 372; **95,** 406; **04,** 609.

Boards. BERH. concur in Maj. Kingman's **R.,** in connection with ex. for chan. 9½′, that R. not worthy of further imp., **04,** 3233.

In charge:

Col. T. J. Cram, 1866–69. **R., 66,** iv, 35; **67,** 143, 214, 230–233; **68,** 147, 151, 152.

Maj. W. McFarland, 1869–71; **69,** 36. **R., 69,** 130; **70,** 173.

Capt. G. L. Gillespie, 1871–73; **71,** 189. **R., 72,** 226.

Maj. F. Harwood, 1873; **73,** 42. **R., 73,** 325.

Maj. J. M. Wilson, 1880–83. **R., 80,** 2112, 2114; **81,** 2296, 2299; **82,** 2391.

Maj. L. C. Overman, 1883–92. **R., 83,** 1897; **84,** 2091; **85,** 2218; **86,** 1857; **87,** 2305; **88,** 1996; **89,** 2312; **90,** 2771; **91,** 2840; **92,** 2497.

Lt. Col. J. A. Smith, 1882–95. **R., 92,** 2497; **93,** 3065; **94,** 2398; **95,** 3091.

Maj. Dan C. Kingman, 1904. **R., 04,** 3229.

Assistants:

Capt. F. U. Farquhar, **66,** ii, 41, iv, 35, 36.

Capt. G. J. Lydecker, **68,** 151.

W. T. Blunt. **R., 94,** 2379.

OPERATIONS.

1867-68. 41,697 c. y. dr., **68,** 147.

1868-69. 27,353 c. y. dr., **69,** 36.

1872-73. App. of 1872 expend. in dr. 9′ chan. from R. mouth to the head of navigation, **73,** 43.

1880-81. 44,976 c. y. dr. from the various bars, **81,** 2297.

1881-82. 38,000 c. y. dr. from chan. through outer bar, **82,** 2392.

1882-83. 25,000 c. y. dr. from chan. in the B., **83,** 1897.

1889-90. 1,600 c. y. dr. from the R., **90,** 2771.

1890-92. Dr. in progress, **91,** 2841; **92,** 2497.

1893-94. 25,569 c. y., s. m., dr., **94,** 2398.

PHYSICAL CHARACTERISTICS.

Described, **66,** iv, 36; **81,** 2300; **90,** 2771.

PRIVATE (COUNTY) WORK.

Sandusky County subscribed $5,000 and individuals $12,000, a total of $17,000; expend. in dr., **66,** iv, 36.

PROJECTS.

By Col. Cram, 1866, chan. from 160′–200′, with d. of 12′, from the mouth of the R. to Fremont; will require the excavation, by dr., of 185,075 c. y.; est., $67,955.53, **66,** iv, 36, 37; **67,** 28.

By Capt. Gillespie, 1872, 9′ chan., **72,** 226; **73,** 43.

From 1867 to 1872, incl., $30,000 app. and expend. in formation of a dr. chan. through the bars below Fremont, **80,** 2112.

By Maj. Wilson, imp. of the R. by excavation of a chan. 9′ x 100′ through the various bars bet. the city of Fremont and the 9′ curve in Sandusky B.; est., $44,000, **81,** 2297, 2298; **87,** 2306.

SURVEYS.

Au. act June 23, 1866, **67,** 143; assigned to Col. Cram, **66,** ii, 41; made by Capt. Farquhar, under direction of Col. Cram. **R., 66,** iv, 35–37; cost, $468.90, **67,** 143.

Of R. near Fremont, au. act of June 14, 1880; made 1880, by Maj. Wilson, **81,** 2299.

Ex. of the entire R. below Fremont, and surs. where dr. was needed over a long bar in the upper end of Sandusky B. at the mouth of the R. made, 1892–93, by Lt. Col. Smith, **93,** 3066.

Pre. ex. au. act June 13, 1902, of R. from its mouth to Fremont. **R.** by Maj. Kingman, Apr. 27, 1903 (H. D. 242, 58th, 2d) (unfav.), **04,** 609, 3229.

Pre. ex. au. act June 25, 1910, from mouth to Fremont, view to securing 11′, **12,** 1111.

Maps. **94,** 2398.

QQ–17 SANDUSKY CITY HARBOR, OHIO.[1]

APPROPRIATIONS.

1826,	$400 (sur.), act May 20.
1844,	15,000, **66,** iii, 33.
1852,	15,000, **66,** iii, 33.
1864,	10,000, **66,** iii, 33.
1866,	38,580, **66,** iii, 33.
1870,	10,000, **70,** 48; **71,** 192.
1872,	13,000, **72,** 43, 227.
1873,	25,000, **73,** 43.
1874,	25,000, **74,** 217.
1875,	25,000, **75,** 54.
1876,	25,000, **76,** 107.
1878,	20,000, **78,** 128, 1255.
1879,	1,000, **79,** 171, 1685.
1880,	12,500, **80,** 2111.
1881,	10,000, **81,** 2295.
1882,	10,000, **82,** 2391.
1884,	[2] 20,000, **84,** 2090.
1886,	5,000, **86,** 1857.
1888,	40,000, **88,** 1990.
1890,	45,000, **90,** 2770.
1892,	41,712, **92,** 2496.
1894,	30,000, **95,** 3086.
1896,	40,000, **96,** 2930.
1899,	80,000, **99,** 3038.
1902,	125,000, **02,** 2258.
1904,	*10,000, **04,** 3160.
1905,	125,000, **05,** 2318.
1906,	175,000, **06,** 1898.
1907,	300,000, **07,** 2068.
1910,	5,000, **10,** 2287.
Total,	1,297,192

[1] Sur.—**R.,** May 23, 1827; Oct. 27, 1864, est. $38,580. (H. D. 482, 55th, 2d.).

[2] See act Aug. 5, 1886; **86,** 447.

COMMERCE.

General C. of the lakes benefited by a H. of refuge **66,** iii, 33.

Requirements, **73,** 331; **87,** 2340.

Description of, **96,** 2930; **97,** 3054; **98,** 2652.

City thriving and well located for shipment by water of the products of the coal fields of the State; 1896, C. increasing at rate of 160,000 t. per year, **96,** 2930.

Steadily increasing with imp. of chan., **99,** 3038; **01,** 3232; **10,** 866.

Marked reduction in rates, **06,** 680.

1911, 2,279,318 t., **12,** 2,685.

CONTRACTS.

1866. Thomas Dunbar & Co., dr., 75¢ c. y., **66,** iv, 35, 74; **67,** 143.

1869. P. Smith, dr., 33½¢ c. y., **69,** 131; **70,** 174.

1871. O. J. Jennings, dr., 26½¢ c. y., **71,** 192; **72,** 226.

1872. W. Richardson, dr., 34¢ c. y., **73,** 326–328.

1873. W. Richardson, hire of 2 dr. and tugs, **73,** 328; **74,** 217.

1874. J. Sims, hire of 2 dr. and tugs, **75,** 297.

1875. Smith & Sims, hire of 4 dr., tugs, etc., **75,** 297; **76,** ii, 554.

1877. M. I. Wilcox, dr., 11¾¢ c. y., **77,** 958, 959.

O. J. Jennings, dr., 11¢ c. y., **77,** 958, 959.

1878. J. C. & J. H. Davis, dr., 12¢ c. y., **79,** 1685.

1879. J. C. & J. H. Davis, dr., 12¢ c. y., **79,** 1685; **80,** 2111.

1880. W. Richardson, dr., 20¢ c. y., **81,** 2295.

1881. W. Richardson, dr., 16¢ c. y., **81,** 2295.

1882. W. Richardson, dr., 12¢ c. y., **83,** 1896.

1884. Stang & Gilmore, dr., 17½¢ c. y., **85,** 2218.

1886. Carkin, Stickney & Cram, dr., 15¢ c. y., **87,** 2303.

1888. C. H. Starke, dr., 17¢ c. y., **89,** 2311.

1890. L. P. & J. A. Smith, dr., 18¢ c. y., **91,** 2839.

1891. Carkin, Stickney & Cram, dr., 25¢ c. y., **91,** 2840.

1893. Carkin, Stickney & Cram, dr., 13½¢ c. y., s. m., **93,** 3065.

1896. Carkin, Stickney & Cram, dr., 14, 17, and 97.5¢ c. y. J. Stang, constr. of st. and brush j., st., $1.09 t.; mattresses, 40¢ s. y.; piles, $11 per piece, **97,** 3063.

1899. E. J. Pryor, dr., 9, 10, and 12¢ c. y., and $12 per hour for bowlder removal ($27,000), **99,** 3039.

P. Keohane, constr. of j. and bar protection (mattress work, st., piles), $45,000, **99,** 3039.

1902. J. J. Stang, dr., **03,** 2058.

1905. The Great Lakes Dredge & Dock Co., dr., (prices given), **06,** 1897.

1906. Groch & Townsend, dr., r. removal $2.05 c. y., overlying material 20¢ c. y., **07,** 2067.

1907. The Great Lakes Dredge & Dock Co., dr., **08,** 2147.

1911. The Breakwater Co., extending st. j., 26,000 t. st. at 95¢ t. in place, **12,** 2684.

ENGINEERS.

Chief of Engineers. **R.,** **66,** 4, ii, 41, iii, 6, 33, iv, 34; **67,** 29; **68,** 39; **69,** 36; **70,** 47, 48; **71,** 46; **72,** 43; **73,** 43; **74,** 49; **75,** 54; **76,** 107; **77,** 113; **78,** 128; **79,** 171; **80,** 224; **81,** 306; **82,** 300; **83,** 308; **84,** 311; **85,** 335; **86,** 330; **87,** 297, 303; **88,** 271; **89,** 322; **90,** 291; **91,** 366; **92,** 346; **93,** 397; **94,** 371; **95,** 405; **96,** 360; **97,** 454; **98,** 443, 454; **99,** 526; **00,** 591, 604; **01,** 574, 585; **02,** 496; **03,** 545; **04,** 594, 609; **05,** 605; **06,** 679; **07,** 701; **08** 746; **09,** 783; **10,** 864; **11,** 917, 933; **12,** 1095, 1111;

In charge:

Lt. Col. T. J. Cram, 1864–69; **66,** 12; **69,** 116. **R.** **66,** 13, 24, 25, iv, 33, 35, 73–75; **67,** 143, 230, 233; **68** 148, 151, 152.

Maj. W. McFarland, 1869–71. **R.,** **69,** 130; **70,** 173.

Capt. G. L. Gillespie, 1871–73. **R.,** **71,** 191; **72,** 226.

Maj. F. Harwood, 1873–74. **R.,** **73,** 326; **74,** 217.

Lt. Col. C. E. Blunt, 1874–76. **R.,** **75,** 296; **76,** ii, 554.

Maj. N. Michler, 1876–78. **R.,** **77,** 957; **78,** 1253; **,79,** 1672.

Maj. J. M. Wilson, 1878–83. **R.,** **79,** 1682; **80,** 2105; **81,** 2293; **82,** 2389.

Maj. L. C. Overman, 1883–92. **R.,** **83,** 1894; **84,** 2088; **85,** 2216; **86,** 1855; **87,** 2302, 2335; **88,** 1988; **89,** 2308; **90,** 2768; **91,** 2837.

Lt. Col. J. A. Smith, 1892–1900. **R.,** **92,** 2495; **93,** 3061; **94,** 2396; **95,** 3083; **96,** 2928; (Col.) **97,** 3052; **98,** 2650, 2708; **99,** 3036; **00,** 4042.

Col. S. M. Mansfield, **01,** 571.

Maj. Dan C. Kingman, 1901–06. **R.,** **01,** 3230; **02,** 2257; **03,** 2057; **04,** 3159; (Lt. Col.) **05,** 2316.

Maj. C. McD. Townsend, 1906–08. **R.,** **06,** 1897; (Lt. Col.) **07,** 2067.

Lt. Col. John Millis, 1908–. **R.,** **08,** 2145; **09,** 2125; (Col.) **10,** 2286; **11,** 2483; **12,** 2683.

Assistants:

Capt. F. U. Farquhar, **66,** ii, 41, iv, 33.

Capt. G. J. Lydecker, **68,** 151.

W. T. Blunt. **R.,** **95,** 3089; **97,** 3054; **98,** 2716; **99,** 3041; **00,** 4047; **01,** 3234; **02,** 2259; **03,** 2059; **04,** 3161; **05,** 2319.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Cram, 1864, entire imp., $38,580; dr. chan. on outer bar 12′ x 400′, $6,580, **66,** 5, 24, iv, 34, 73.

By Maj. McFarland, 1869, chan. over inner bar 12′ x 250′, $10,000, **69,** 37, 130, 131.

By Capt. Gillespie, 1873, imp. and protection of old chan., $578,050; dr. without protection of banks, $50,000; new chan. through Horseshoe Shoals, $412,500, **73,** 330, 331.

By Maj. Harwood, 1873, w. inner chan., $30 000; constr. chan. through outer bar, $100,000, **73,** 327.

By Lt. Col. Blunt, 1876, complete chan. on outer bar 15′ x 150′, $25,000; imp. inner chan., $80,000, **75,** 297; dikes to protect chan., $300,000; extend the 15′ chan. to the city wharves, $105,000, **76,** ii, 554.

By Maj. Wilson, 1879, completion of existing proj., $20,000, **79,** 1684.

LEGAL PROCEEDINGS.

Rules and regulations for the government of navigation in the chans. estab. by Sec. of War, 1889, **99,** 3038; **00,** 4049.

OPERATIONS.[1]

1867-68. 17,632 c. y. removed by dr., **68,** 39, 148.

1868-69. 17,685 c. y. removed by dr., **69,** 130.

1870-71. 33,692 c. y. removed from inner chan., cut 60′ x 2,500′, **71,** 192.

1871-72. 30,784 c. y. removed from inner chan., **72,** 226.

1872-73. 34,000 c. y. removed, **73,** 326, 327.

1873-74. Chan. 15′ x 75′ completed over the shoal in the B., **74,** 217.

1874-75. 84,808 c. y. removed from outer bar, **75,** 54.

1875-76. 89,561 c. y. removed from outer bar, **76,** ii, 554.

1877-78. Dr. by contract, **78,** 128, 1253.

1878-79. Dr. by contract, **79,** 171, 1672, 1683.

1879-80. 80,861 c. y. dr. from chan. and outer bar, **80,** 2109.

1880-81. 48,656 c. y. dr. from chan. on the "Clock" and "Middle" ranges, **81,** 2294.

1881-82. 49,934 c. y. dr. within the B. and from chan. through outer bar, **82,** 2390.

1882-83. 60,000 c. y. dr. from chan. parallel to city docks and the "Clock" Range, **83,** 1895.

1883-84. 10,000 c. y. dr. from outer bar, **84,** 2089.

1884-85. 51,941 c. y. dr. from chan. through the bar, **85,** 2217.

1886-87. Dr. in progress, **87,** 2303.

1887-88. Dr. under contract continued, **88,** 1989.

1888-89. 75,050 c. y. dr., **89,** 2308, 2309.

1889-90. 134,000 c. y. dr., **90,** 2769.

1890-91. 67,952 c. y. dr., **91,** 2838.

1891-92. 154,510 c. y. dr., **92,** 2496.

1893-94. 200,093 c. y., s. m., dr., **94,** 2397.

[1] Suspended since 1852.

1894-95. 156,719 c. y. dr., **95,** 3084, 3085.
1895-96. 55,841 c. y. dr. and 300 bowlders removed, **96,** 2929.
1896-97. 97,952 c. y. dr. and constr. of j. in progress, **97,** 3053.
1897-98. 25,133 c. y. dr., bowlders removed, and 1,775 l. f. j. constr., **98,** 2650.
1898-99. Over 5,000 c. y. dr., **99,** 3037.
1899-00. About 35,000 c. y. dr. by U. S. plant belonging to Toledo H.; 145,000 c. y. dr. by contractor (photographs showing large bowlders); j. constr. in progress, **00,** 4043–4045.
1900-01. 74,579 c. y. dr. by contract, 27,355 c. y. dr. by U. S. plant, and 1,018' j. built, **01,** 3231.
1901-02. 6,035 c. y. dr. by U. S. plant, and soundings taken over entire chan., **02,** 2259.
1902-03. 60,297 c. y. dr. by contract, **03,** 2061.
1903-04. 351,436 c. y. dr., **04,** 3162.
1904-05. 50,929 c. y. dr. by U. S. plant, and 58,518 c. y. dr. by contract, **05,** 2320.
1905-06. 1,031,346 c. y. dr. by contract, and 202,271 c. y. by U. S. plant, **06,** 1898.
1906-07. 629,644 c. y. dr. by contract, 5,478 c. y. r. excavated, 4,014 c. y. dr. by U. S. plant, and 400 l. f. j. built by U. S., **07,** 2067.
1907-08. 277,176 c. y. dr., 14,081 c. y. earth and r. removed by contract, and U. S. dr. cast over st. on j. for 1,305', **08,** 2146.
1908-09. 93,387 c. y. earth and r. removed by contract, and 16,907 c. y. dr. by U. S. plant, **09,** 2125.
1909-10. 959 c. y. earth and r. removed by contract, and 119,899 c. y. dr. by U. S. plant, **10,** 865, 2286.
1910-11. 71,988 c. y. dr. by U. S. plant, and 750' e. j. shaped by U. S. dr. *Maumee* and hired labor, **11,** 2483.
1911-12. 2,949.1 t. st. placed in j. by contract, and 75,267 c. y. dr. by U. S. plant, **12,** 2683.

PHYSICAL CHARACTERISTICS.

Description of, **66,** iii, 6, iv, 34, 36; **68,** 39; **69,** 130; **72,** 226, 227; **73,** 328–331; **88,** 1991; **93,** 3063; **94,** 2397; **95,** 3087, 3088; **96,** 2930; **97,** 3053; **98,** 2651, 2708–2715.
Soundings in straight chan., **97,** 3055–3061.
Comparative soundings, **99,** 3041; **00,** 4049.
Chan. over outer bar in better condition, 1899, than ever before known. Shoaling and narrowing at one place caused by efforts of SS. to get free after running aground. **99,** 3037.
Injuries to chan. from unskillful navigation, **00,** 4043.
Effect of j. constr. on currents, etc., all that could be expected, **00,** 4045.
Condition of chan. and permanent works, **03,** 2059; **04,** 3162; **05,** 2320.
Triangulations, **05,** 2320.

PLANS. (See Estimates and Projects.)

By Lt. Col. Cram, 1864, 2 parallel ps. to protect the chan., **66,** iv, 34; **67,** 143.
By Maj. Gillespie, (1) 1872, recom. imp. of w. chan., **72,** 226; (2) 1873, dr. old chan. 14' x 200' x 8,000' of protection piering; (3) new and more direct chan. through Horseshoe Shoals, and 4,500' of protection piering; (4) continuation of imp. to existing chan. and dr. an. instead of building protection ps., **73,** 330, 331.
Maj. Harwood, 1873, considers permanent completion can not be effectual without confining chan. bet. canal dikes, **73,** 327; **74,** 217.
By Maj. Wilson, 1882, increasing chan. d. to 16'; est., $61,000, **82,** 2390; **87,** 2337.
By Maj. Overman, 1887, increasing chan. d. to 17'; est., $111,000, **87,** 2337.
By Maj. Overman, 1887, straight chan. by dr. from the n. end of Cedar Pt. to the e. end of the existing chan. in front of the city, chan. to be 200' x 17'; est., $96,712, **87,** 2337, 2339.

PRIVATE WORK.

Citizens of Sandusky dr. nearly 35,000 c. y., 1899, employing U. S. plant, **99,** 3037.

PROJECTS. (See Estimates and Plans.)

Orig. cribwork for protection of Peninsula Pt., **75,** 296, 297.
By Col. Cram, 1864, 800' of p. and dr. to 12' d. the outer bar, **66,** 24.
By Maj. McFarland, 1870, dr. inner bar, **70,** 173.
By Maj. Gillespie, 1873, d. w. chan. to 14', **73,** 42, 327, 331.
By Lt. Col. Blunt, 1876, d. to 15', **79,** 1683.
From 1844 to 1879, incl., $222,580 app. and expend. on the protection of Peninsula Pt., and in dr. on the outer and inner bars, **80,** 2105, 2109; **87,** 2305.
History of operations and projs. prior to 1880, **80,** 2105.
By Lt. Col. Michler, 1887, extend. as to limits of chan. 15' x 200' through the outer bar and in the B. up to within 50' of the dock line and then parallel to the docks, with 15' x 100', **80,** 2110; **87,** 2302, 2336.
From 1880 to 1886, incl., $67,500 was app. and applied upon the proj. of 1880. In 1887 $61,000 est. as required for completion of the entire proj. **87,** 2305.
By Maj. Overman, 1888, excavation of a straight chan. 17' x 200' l. w., from the n. end of Cedar Pt. to the e. end of the existing chan. in front of the city, involving removal of 538,000 c. y. of material; est., $96,712. This, with $10,000 est. as required for the completion of the existing chan., makes a total for the proj. of $106,712, or, including the app. of 1888, of $66,712 for completion. **88,** 1991, 1993.
By Lt. Col. Smith, 1894, dr. chan. with d. of 18' on the outer bar; est., $5,000, and dr. chan. of 17' along the dock front; est., $25,000, **95,** 3084.
In 1894 Lt. Col. Smith est. $225,000 to complete the imp. of the H., **95,** 3089; comprising the dr. of a chan. 18' x 400' or more from Deep Hole to the lake, and a chan. 17' x 200' along water front; chan. over the outer bar to be partly obtained and wholly maintained by confining the currents by a j. and dike of st. upon a foundation of mattresses, **96,** 2928–2929; the j. from Cedar Pt. to be 2,500' l., and the dike to be on the opposite side of the chan., **97,** 3053.
By Lt. Col. Smith, 1896, expend. balance of 1896 app. in constr. part of the j. from Cedar Pt., in dr., and in paying a small amount toward the constr. or purchase of a small SS., **96,** 2930.
In 1898 Col. Smith est. $425,796 to secure and maintain a permanent navigable chan. of sufficient d. next to Cedar Pt., **98,** 2716.
By Col. Smith, 1898, enlarging proj. by extension of the parallel js. to about 5,000' from shore, and protection of the bar crest by a low dam of brush and st., these parts supple. by a few small works of brush and st. to direct the currents and maintain the chans (map, **98,** 2716) **98,** 2708–2717; **99,** 3037; est., incl. $185,000 to complete the proj. of 1896, $425,796, **00,** 4043.
Act June 13, 1902, au. securing and maintaining chan. 21' x 400' at entrance and 300' in H. chan.; est., $781,000, **01,** 3276; **02,** 496.
Act Mar. 3, 1905, modified proj. to exclude excavation of r. in dock chan., diminishing cost by $320,000, **05,** 606.

SURVEYS.

By Maj. McFarland, 1869, **69,** 131.
By Maj. Gillespie, 1873, **73,** 328–331.
Of H. made, 1879, **80,** 2109.
Sur. au. act of Aug. 5, 1886, from n. end of Cedar Pt. to e. end of existing chan.; made by Maj. Overman, **87,** 2336.
Sur., with a view to a straight chan. from the n. end of Cedar Pt. to e. end of the existing chan., au. act Aug. 5, 1886; made, 1887, by Maj. Overman (see Projects), **88,** 1991.
Hydrographic sur. made 1892–93, by Lt. Col. Smith, **93,** 3062, 3063; and another made, 1895, **95,** 3085.
Sur. and est. required by act 1894; in 1895 Lt. Col. Smith submitted **R., 95,** 3089.
Sur. of the bar at the mouth of Sandusky H. au. act June 3, 1896; made, 1898, by Col. J. A. Smith, **98,** 2708.
Minor ex., **99,** 3037.
Ex. and sur. for 21' chan., m. l. l., 400' w. at entrance and 300' in H., au. act June 6, 1900. **R.** by Col. Smith, Aug. 22 and Nov. 17, 1900; est., $781,000, and $10,000 an. mainten. (H. D. 120, 56th, 2d), **00,** 4045; **01,** 585, 3270, 3275.
Ex. for further imp. au. act June 25, 1910. **R.** by Col. Millis, Aug. 22, 1910 (H. D. 78, 62d, 1st) (unfav.), **11,** 933.

Maps:

Of northern and northwestern lakes, showing location of H., **66,** i.
88, 1994; **91,** 2839; **95,** 3090; **96,** 2930; **98,** 2716 (photographs, see Operations, 1900); **09,** 2126.

QQ–18 HURON HARBOR, OHIO.[1]

APPROPRIATIONS.

1826,	$5,000.00,	**66,** iii, 33.
1828,	4,413.35,	**66,** iii, 33.
1829,	5,935.00,	**66,** iii, 33.
1830,	1,880.36,	**66,** iii, 33.
1831,	3,480.00,	**66,** iii, 33.
1832,	1,500.00,	**66,** iii, 33.
1834,	6,700.00,	**66,** iii, 33.
1836,	4,300.00,	**66,** iii, 33.
1837,	2,565.00,	**66,** iii, 33.
1838,	5,000.00,	**66,** iii, 33.
1844,	5,000.00,	**66,** iii, 33.
1852,	10,000.00,	**66,** iii, 33.
1866,	39,000.00,	**66,** iii, 33.
1874,	1,500.00,	**74,** 49.
1875,	1,000.00,	**75,** 55.
1878,	1,000.00,	**78,** 129, 1256.
1880,	3,000.00,	**80,** 2122.
1881,	3,000.00,	**81,** 2303.
1882,	2,500.00,	**82,** 2394.
1884,	7,500.00,	**84,** 2093.
1886,	3,000.00,	**86,** 1859.
1888,	6,000.00,	**88,** 1998.
1890,	16,000.00,	**90,** 2773.
1892,	15,000.00,	**92,** 2499.
1894,	10,000.00,	**95,** 3094.
1896,	8,000.00,	**96,** 2934.
1899,	25,000.00,	**99,** 3052.
1902,	40,000.00,	**02,** 2261.
1904,	*40,000.00,	**04,** 3163; **12,** 1097.
1905,	68,500.00,	**05,** 2325.
1906,	150,000.00,	**06,** 1900.
1907,	63,000.00,	**07,** 2071.
1910,	3,000.00,	**10,** 2289.
Total,	561,773.71	(incl. misc., $561,800.38, **10,** 2289).

COMMERCE.

Not extensive, but increasing, **96,** 2934; **97,** 3067.
Almost entirely iron ore and coal, **00,** 4053.
Large and increasing, **01,** 3237.
Marked reduction in rates noted, **06,** 681; **12,** 1098.
Decrease, 1910, over previous years, **10,** 867.
In 1911, 1,257,724 t., an increase of 66,000± t. over 1910, **12,** 1098.

CONTRACTS.

1866. W. H. Mott, labor, **66,** iv, 74. F. D. Ketchum, st., spike, and timber, **66,** iv, 74. J. Loveday, iron, **66,** iv, 74.
1867. Brooks & Adams, timber, **67,** 142, 232, 233. Brooks & Adams, materials and labor, **68,** 152.
1869. W. Nicolls, materials, labor, and dr., **70,** 174, 176; **71,** 192.
1880. J. Stang, pile protection constr., **81,** 2304.
1882. J. Stang, removal and reconstr. of old superstr., **83,** 1900.
1884. L. P. & J. A. Smith, p. repairs and dr., **85,** 2221.
1886. Stang & Gillmore, dr., 25¢ c. y., **87,** 2307. L. P. & J. A. Smith, repair to ps., **87,** 2309.
1889. Stang & Kerr, p. repair, $4,685.20, **89,** 2315. W. St. John & Son, dr., 28¢ c. y., **89,** 2313.
1890. J. Stang, for repairs to ps., $5,270, **91,** 2845. Carkin, Stickney & Cram, dr., 25¢ c. y., **91,** 2847.
1893. Q. Gilmore, extension of ps., $9,410.01±; Sadler & Allen, dr., 25¢ c. y., s. m., **93,** 3069.
1895. J. Stang, p. extension, $6,390.86±, **95,** 3095.
1900. I. R. Churchyard, removing and rebuilding w. p. (annulled Apr. 25, 1901, at contractor's request), **01,** 3239.
1906. The Hunkin Bros. Cons. Co., constr. concrete superstr. and building rubble mound j. on e. side of entrance, 1,800′, **06,** 1901.

DOCUMENTS. (Not printed in reports.)

Details relating to this imp. previous to 1867, S. D. 42, 35th, 1st, containing **R.** of Col. J. D. Graham, in 1857, **66,** 5.

ENGINEERS.

Chief of Engineers. R., 66, 5, ii, 41, iii, 5, 6, 33, iv, 31; **67,** 29; **68,** 39; **69,** 37; **70,** 48; **71,** 46; **72,** 43; **73,** 43; **74,** 49; **75,** 54; **76,** 107; **77,** 113; **78,** 129; **79,** 171; **80,** 225; **81,** 307; **82,** 302; **83,** 310; **84,** 313; **85,** 337; **86,** 332; **87,** 298; **88,** 272; **89,** 324; **90,** 293; **91,** 367; **92,** 347; **93,** 398; **94,** 372; **95,** 407; **96,** 361; **97,** 455; **98,** 445; **99,** 527; **00,** 593; **01,** 576; **02,** 498; **03,** 546; **04,** 596, 609; **05,** 607; **06,** 680; **07,** 703; **08,** 748; **09,** 785; **10,** 866; **11,** 920; **12,** 1097.

Boards. BERH. reviews Maj. Kingman's **R.,** recom. plan; est., $315,500, with $2,500 an. mainten., **04,** 3214.

In charge:
Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st.
Col. T. J. Cram, 1866–69. **R., 66,** iv, 30, 73; **67,** 142, 148, 230–233.
Maj. W. McFarland, 1869–71. **R., 69,** 131; **70,** 174.
Capt. G. L. Gillespie, 1871–73. **R., 71,** 192; **72,** 228.
Maj. F. Harwood, 1873–74; **73,** 331; **74,** 218.
Lt. Col. C. E. Blunt, 1874–76. **R., 75,** 297; **76,** ii, 555.
Maj. N. Michler, 1876–78. **R., 77,** 959; **78,** 1255; **79,** 1673.
Maj. J. M. Wilson, 1878–83. **R., 79,** 1686; **80,** 2117; **81,** 2302; **82,** 2393.
Maj. L. C. Overman, 1883–92. **R., 83,** 1898; **84,** 2092; **85,** 2219; **86,** 1858; **87,** 2307; **88,** 1997; **89,** 2313; **90,** 2772; **91,** 2843.
Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2498; **93,** 3067; **94,** 2400; **95,** 3092; **96,** 2931; (Col.) **97,** 3064; **98,** 2653; **99,** 3051; **00,** 4051.
Col. S. M. Mansfield, **00,** 571.
Maj. Dan C. Kingman, 1901–06. **R., 01,** 3236; **02,** 2260; **03,** 2061; **04,** 3163, 3209; (Lt. Col.) **05,** 2323.
Maj. C. McD. Townsend, 1906–08. **R., 06,** 1899; (Lt. Col.) **07,** 2070.
Lt. Col. John Millis, 1908–. **R., 08,** 2148; **09,** 2127; **10,** 2288; **11,** 2485; (Col.) **12,** 2687.

Assistants:
Capt. F. U. Farquhar, **66,** ii, 41, iv, 30, 31.
Capt. G. J. Lydecker, **68,** 151.
Capt. M. B. Adams, **75,** 292.
W. T. Blunt. **R., 02,** 2262; **03,** 2063; **04,** 3165; **05,** 2326.

ESTIMATES. (See Projects.)

By Maj. Graham, imp. of H., $39,000; repairs of ps., $26,782.
By Col. Cram, for an. preservation, $2,000, **68,** 149, 151.
By Maj. McFarland, $1,500, **69,** 131.
By Maj. McFarland, repairs, $2,500; an. repairs, $1,500, **69,** 131.
By Capt. Gillespie, an. repairs, $1,000, **71,** 193.
By Maj. Harwood, entire and permanent completion of repairs, $2,000, **73,** 331; $1,000, **74,** 218.
By Maj. Michler, repairs to p., $1,000, **77,** 959.
By Maj. Wilson, rebuilding superstr. to both ps. and break'r, $25,000, **79,** 171, 1686.

LEGAL PROCEEDINGS.

Suit against U. S. by owner of land adjacent to p., **11,** 2486.

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* Allotment.
[1] Sur.—**R.,** July 27, 1826; est. $15,349.12. (H. D. 482, 55th, 2d.)

OPERATIONS.[1]

1866–67. Both ps. repaired and cribs replaced; amount expend., $10,960.24, **67,** 142, 148; **68,** 40.

1870. Ps. repaired and sand and r. removed from chan. by dr., **70,** 48; **71,** 192.

1873–74. Repairs to ps. by day labor, **73,** 331; **74,** 49.

1875–76. Repairs and dr., **75,** 298; **76,** ii, 555.

1878–79. Repairs to ps., **79,** 171, 1673, 1686. Partial history of operations from 1826 to 1877, **77,** 959.

1879–80. Repairs to ps., **80,** 2121.

1880–81. 219 l. f. pile protection completed; repairs to ps., **81,** 2302, 2303.

1881–82. 300 l. f. e. p. superstr. completed; p. repairs, **82,** 2393.

1882–83. 250 l. f. old work removed and rebuilt; 182 l. f. superstr. removed and rebuilt; repairs to ps. by hired labor, **83,** 1899.

1884–85. 501 c. y. dr., 185 l. f. of w. p. rebuilt, and 576 l. f. repaired; 48 l. f. pile protection built and 72 l. f. repaired; repairs to ps., **85,** 2220.

1886–87. 4,147 c. y. dr. from bar; repair of ps. in progress, **87,** 2307.

1888–89. P. repair under contract begun; 1,366 c. y. dr., **89,** 2313.

1889–90. P. repair continued, **90,** 2772.

1890–91. 8,092 c. y. dr.; repairs to ps. and extension of w. p., **91,** 2844.

1891–92. W. p. extended 120′; minor repairs to superstr. of old ps., **92,** 2499.

1892–93. Building of cribs for extension of e. and w. ps. in progress, **93,** 3068.

1893–94. Work of last year completed, comprising extension of the e. p. by 80′ and of w. p. by 40′; repairs made to superstr. of w. p., **94,** 2401, 2402.

1894–95. 4,000 c. y. dr., and extension of e. p. by 72′ in progress, **95,** 3093, 3094.

1895–96. P. extention of last year completed, **96,** 2932.

1896–97. 188′ of old w. p. entirely removed, the site dr., and 180′ of new p. 16′ w. constr., **97,** 3065.

1897–98. 9,347 c. y. dr., **98,** 2654.

1902–05. Work of renewal on w. j., **02,** 2260; **03,** 2062; **04,** 3163; **05,** 2323.

1905–06. 131,206 c. y. dr.; work of renewal on w. j. completed, 2 cribs placed in extension of w. j. and foundations for pierheads constructed, **06,** 1899.

1906–07. Progress of work on concrete superstr. and js., **07,** 2070.

1907–08. 26,783 c. y. dr.; work under contract for concrete superstr. and building of js. completed, **08,** 2148.

1908–09. 65,986 c. y. dr.; overhauling scows and tug, **09,** 2127.

1909–10. 14,142 c. y. dr., **10,** 2288.

1910–11. 14,220 c. y. dr.; minor repairs to ps., **11,** 2486.

1911–12. Minor repairs to ps., **12,** 2687.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3068; **96,** 2933; **97,** 3067.

H. so situated that the chan. d. vary but little from year to year; 19′ 1900, **99,** 3051, 3053; **00,** 4053.

Description of chan. since new proj. was started, **07,** 704.

Deterioration of ps., **10,** 2288.

H. is lower mile of Huron R., 48± m. w. from Cleveland, Ohio, 8′ chan. to Milan, 8 m. above mouth, but practically no navigation thereon, **12,** 1097, 1098.

PRIVATE WORK.

The Wheeling & Lake Erie Ry. Co. given revocable license by the Sec. of War, 1896, for removal of a part of an old p. to enable them to constr. a dock 250′ x 1,200′ near the shore and parallel to the e. side of the shore, **96,** 2933. Dr. by the company, **99,** 3051.

Wheeling & Lake Erie RR., dr. chan., **02,** 2261.

PROJECTS.

History of the orig. projs., **77,** 959.

By Col. Cram, repairs to the ps.; est., $26,782, **66,** iv, 31; **67,** 142; **68,** 149.

By Maj. McFarland, repairs to ps. and dr., **69,** 131; **70,** 174.

By Maj. Harwood, repairs and dr., **73,** 331; **74,** 218.

By Maj. Michler, repairs to ps., **77,** 959.

By Maj. Wilson, rebuilding superstr. to both ps. and break'r at inner end of the w. p., **79,** 1686.

The proj. adopted, 1826, and modified 1871, proposed extension of 2 parallel ps. 140′ apart, to afford chan. for entrance not less than 14′, **80,** 2127; **85,** 332. 1826 to 1880, $101,273.71 had been app., **80,** 2121.

In 1879 Maj. Wilson proposed rebuilding the superstr. to both ps. and reconstr. of a short break'r at the shore end of the w. p.; est., $25,000, **79,** 1686; **80,** 2121. Increased in 1885 by $6,500, **85,** 2220; **87,** 2308.

By Maj. Overman, 1890, 17′ chan. d. by extension of ps. to 17′ curve in the lake; est., with necessary dr., $40,000, **90,** 2773; **92,** 2498.

In 1892–93 Lt. Col. Smith est. that after revising the proj. it would cost $125,000 to extend the ps. to 16′, **93,** 3068.

By Col. Smith, 1899, application of available funds to renewal of parts of old ps., **99,** 3051. After completion of this work, est. that $206,400 would be required for further work of this character, **00,** 4053.

Col. Smith recom., 1900, as in preceding years, and because of the increasing demand for d. chans., that no further extensions of the ps. be made under the plans and limitations of the proj. of 1890, **00,** 4052.

Act Mar. 3, 1905, au. extension of w. j. 240′ with pierhead 50′ square; also another pierhead, same dimensions, 300′ e. of 1st one; connecting it with shore by new j. of st.; chan. to be dr. to 21′, and renewal of old e. j.; est., $315,500 (H. D. 122, 58th, 2d), (see Surveys, 1902), **05,** 607.

SURVEYS.

Of H., 1879, **80,** 2121; 1882, **82,** 2393.

A hydrographic sur. made to cover the chan. and approaches at Huron, 1892–93, by Lt. Col. Smith, **93,** 3068.

Sur. chan. made in 1895, by Lt. Col. Smith, **95,** 3094.

Minor sur., **00,** 4053.

Pre. ex. and sur. au. act June 13, 1902, for 20′ d. **R.,** Maj. Kingman, Feb. 12 and Aug. 1, 1903; est., $315,500, and $2,500 an. mainten. (H. D. 122, 58th, 2d), **04,** 609, 3209.

Maps:
66, i; **91,** 2845; **94,** 2402; **99,** 3052; **09,** 2128.

Photographs, cribs, **02,** 2262.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1098.

QQ–20 VERMILION HARBOR, OHIO.[2]

APPROPRIATIONS.

1836,	$10,000.00,	**66,** iii, 33.
1837,	20,000.00,	**66,** iii, 33.
1838,	23,626.57,	**66,** iii, 33.
1864,	*5,758.97,	**68,** 40, 149, 151.
1866,	15,315.74,	**66,** iii, 33.
1872,	5,000.00,	**72,** 228.
1873,	12,000.00,	**73,** 122.
1874,	3,000.00,	**74,** 49.
1875,	10,000.00,	**75,** 164.
1876,	5,000.00,	**76,** 139.
1878,	4,000.00,	**78,** 129, 1258.
1880,	2,000.00,	**80,** 2126.
1881,	2,000.00,	**81,** 2306.
1882,	3,000.00,	**82,** 2396.
1886,	3,000.00,	**86,** 1861.
1888,	1,000.00,	**88,** 1999.
1890,	2,000.00,	**90,** 2775.

*Allotment.

[1] No record of details prior to 1867. Suspended since 1852, **66,** 5.

[2] Sur.—**R.,** 1836, est. $74,342.34; Apr. 5, 1865, est. $16,461.94. (H. D. 482, 55th, 2d.)

1892,	2,000.00,	**92,** 2501.
1894,	2,000.00,	**95,** 3096.
1896,	2,000.00,	**96,** 2936.
1900,	*[1] 1,500.00,	**01,** 3241.
1902,	*400.00,	**03,** 2065.
1905,	15,000.00,	**05,** 2328.
1907,	15,000.00,	**07,** 2073.
1909,	*2,000.00,	**09,** 2128.
1910,	1,000.00,	**10,** 2290.
Total,	167,601.28	(less $1,323.73 returned to Treas., $166,277.55, **12,** 2689).

COMMERCE.

Is rapidly growing, **74,** 218; no apparent increase since the ps. completed, **77,** 961.

Not a C. port, but used to a small extent by fishing boats, and vessels often lie up at the H. for the winter or for repairs, **96,** 2936; **97,** 3070.

At 1898 C. for several years back averaged about 4,000 t. an., **98,** 2656.

Place a resort for fishing boats, **99,** 3053.

Insufficient to warrant d. chan., **04,** 3239.

Letters from interested C. parties, **04,** 3239.

In 1904, 4,900 t., **05,** 609; in 1911, 1,608 t., **12,** 1099.

Imp. has little effect on rates, as t. of port is small, **08,** 750.

CONTRACTS.

1866. W. Nicoll, repairs to ps., **66,** iv, 74; **67,** 29, 143. J. Loveday, iron, **66,** iv, 74; **67,** 29, 143. Standart & Richardson, timber and lumber, **66,** iv, 74; **67,** 29, 143. F. D. Ketchum, st. and spikes, **67,** 232, 233.

1872. O. J. Jennings, drilling and blasting r., $2.75 and $3 c. y.; dr. loose r. and sand, $1 c. y., **73,** 334.

1873. O. J. Jennings, materials and labor, **73,** 334; **74,** 218, 219. Cartwright, McCurdy & Co., bolts and spikes, **73,** 334; **74,** 218, 219.

1875. Case & Jennings, drilling and blasting rs., $2.90 c. y.; dr. loose r., 60¢, and sand, 60¢ c. y., **75,** 299; **76,** ii, 556.

1880. J. Sims, dr., 30¢ c. y., **81,** 2306.

1886. L. P. & J. A. Smith, repair to ps., **87,** 2312.

1905. The Buckeye Cont. Co., st. reinforcement and repair of js., **06,** 1902.

1907. The Buckeye Cont. Co., st. reinforcement and repair of js., **08,** 2151.

DOCUMENTS. (Not printed in reports.)

All details relating to this imp. prior to 1865, **66,** 5.

ENGINEERS.

Chief of Engineers. **R., 66,** 2, 5, ii, 41, iii, 5, 33, iv, 27; **67,** 29; **68,** 40; **69,** 37; **70,** 43; **71,** 46; **72,** 43; **73,** 43, 122; **74,** 49; **75,** 55, 151, 164; **76,** 107, 139; **77,** 114; **78,** 129; **79,** 172; **80,** 225; **81,** 308; **82,** 302; **83,** 310; **84,** 313; **85,** 338; **86,** 332; **87,** 299; **88,** 272; **89,** 324; **90,** 293; **91,** 368; **92,** 348; **93,** 399; **94,** 373; **95,** 407; **96,** 362; **97,** 456; **98,** 445; **99,** 528; **01,** 577; **02,** 499; **03,** 547; **04,** 597, 609; **05,** 608; **06,** 682; **07,** 705; **08,** 749; **09,** 786; **10,** 867; **11,** 921; **12,** 1098, 1111.

Boards. BERH. (See Surveys.)

In charge:

Capt. Stansbury, 1853–54; **66,** 26, 27.

Col. T. J. Cram, 1864–69. **R., 66,** 24–29, iv, 26–30, 73–75; **67,** 143, 148, 216, 230–233; **68,** 149, 151, 152.

Maj. W. McFarland, 1869–71; **69,** 132; **70,** 176.

Capt. G. L. Gillespie, 1871–73. **R., 71,** 193; **72,** 228.

Maj. F. Harwood, 1873–74; **73,** 42. **R., 73,** 332; **74,** 218.

Lt. Col. C. E. Blunt, 1874–77; **74,** 215. **R., 74,** 219; **75,** 298; **76,** ii, 555.

Maj. N. Michler, 1877–80. **R., 77,** 960; **78,** 1256; **79,** 1673.

Maj. J. M. Wilson, 1880–83. **R., 80,** 2124; **81,** 2304; **82,** 2394.

Maj. L. C. Overman, 1883–92. **R., 83,** 1901; **84,** 2093; **85,** 2222; **86,** 1859; **87,** 2310; **88,** 1998; **89,** 2316; **90,** 2774; **91,** 2847.

Lt. Col. J. A. Smith, 1892–99. **R., 92,** 2500; **93,** 3071; **94,** 2403; **95,** 3096; **96,** 2934; (Col.) **97,** 3068; **98,** 2656; **99,** 3053.

Maj. D. C. Kingman, 1901–05. **R., 01,** 3239; **02,** 2263; **03,** 2064; **04,** 3167, 3236, 3241; (Lt. Col.) **05,** 2327.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1901; **07,** 2072.

Lt. Col. John Millis, 1908–. **R., 08,** 2150; **09,** 2128; (Col.) **10,** 2289; **11,** 2488; **12,** 2689.

Assistants:

Capt. G. J. Lydecker, **68,** 151.

Capt. M. B. Adams, **75,** 53; **76,** ii, 555.

W. T. Blunt. **R., 04,** 3167.

ESTIMATES. (See Projects.)

By Col. Cram, 1865, repairs to ps., $15,315.94 (erroneously stated as $16,461.94, **66,** 27–29), **66,** 5, iii, 5, iv, 27, 73. 1866, for repairs of w. p., $6,511, **67,** 143, 148, 230. 1867, $8,000 to $9,000, **67,** 217.

By Capt. Gillespie, 1872, extension of ps. 400′, $25,000, **72,** 228.

By Maj. Harwood, 1873, completion of repairs, $5,000, **73,** 332.

By Lt. Col. Blunt, 1874, to w. chan. to 100′ and d. to 14′, $10,000, **74,** 219. 1875, to complete chan. and repairs to ps., $5,000, **75,** 298. 1876, $9,000 addl., **76,** ii, 556.

By Maj. Wilson, 1879, completion of existing proj., $5,000, and $1,000 an. for mainten., **79,** 1688, 1689.

OPERATIONS.[2]

1853–54. Some repairs made, **66,** 26, 27.

1867–68. Repairs to old ps. above and under water, raising them to 5′ above water, filling with st., and planking over all, **68,** 40.

1872–73. 2,216.45 c. y. of solid and loose r. removed by drilling, blasting, and dr., **73,** 332.

1873–74. E. p. extended 132′, w. p. 66′, blasting and dr. chan. completed, **74,** 218.

1874–75. Repairs to ps. by day labor, **75,** 298.

1875–76. 4,000 c. y., mostly r., blasted and removed from chan. by contract, **75,** ii, 555.

1876–77. Ps. repaired and a cut at shore end of w. p. closed, **77,** 961.

1877–78. Repairs to ps., **78,** 129, 1256.

1878–79. Blasting r. and dr. r., gravel, etc.; chan. 70′ x 12′ obtained, **79,** 172, 1673, 1688.

1879–80. Minor repairs to ps., **80,** 2125.

1880–81. 5,656 c. y. shale r. dr. from chan., **81,** 2305.

1881–82. 125′ breach in e. p. repaired; 66 l. f. e. p. superstr. rebuilt, **82,** 2395.

1882–83. Crib built and sunk in repair of w. p., **83,** 1901.

1883–84. 106 l. f. of w. p. removed and rebuilt; 330 l. f. superstr. repaired, **84,** 2093.

1886–87. Repairs to ps., **87,** 2310.

1889–90. Repairs to ps. by hired labor, **90,** 2774.

1892–93. 317 l. f. of the superstr. of e. p. rebuilt and 365 plank on the w. p. removed and replaced with new, **93,** 3071.

1896–97. W. p. repaired by removing 3 cribs and superstr. and replacing these by an entire new section of p. after dr. the site, **97,** 3069.

1898–99. Minor repairs to end of w. p., **99,** 3053.

1900–01. Break around shore end e. j. repaired, **01,** 3240.

1905–06. 217 l. f. inner end w. p. built up with a vertical face, and succeeding 755 l. f. reinforced and built up with sloping face. Work entirely completed, **06,** 1901.

1907–08. Reinforcing and repair of js.; work completed, **08,** 2150.

1910–11. Minor repairs to ps., **11,** 2488.

* Allotment. [1] $1,323.73 returned to Treas. [2] Suspended since 1838, **66,** 5.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 2935.

Chan. d. bet. ps. vary less than at most other places on the lake, **95,** 3096.

Damage to e. j. by storm, **01,** 3240; **02,** 2064.

Deterioration of ps., **02,** 2263.

Result of expend. provides chan. 11½′ d. to inner end of ps. Chan. 8′ extends to Lake Shore RR. br., ½ m. above, **06,** 683.

Slight deterioration of ps., **10,** 2289.

PRIVATE WORK.

Portion of superstr., 504 l. f. of the e. p., rebuilt by the citizens; much dr. done by them in times past, **66,** 27.

PROJECTS. (See Estimates.)

Orig., for ps. and dr. at mouth of Vermilion R.; details unknown (see Map, **66,** i); partial history of, **66,** 26–29; **77,** 960.

By Col. Cram, 1865, repairs to e. and w. ps. by contract, **66,** 26–29, iv, 26; **67,** 143. For repairs and protection to w. p., **67,** 216; **68,** 40.

By Capt. Gillespie, 1872, d. chan. by blasting and dr., and repairs to ps., **72,** 228.

By Maj. Harwood, 1873, extension of e. and w. ps., **73,** 332.

By Lt. Col. Blunt, 1874, w. and d. chan. to 14′ x 100′; blasting and dr. by contract, **74,** 219; **75,** 298; **76,** ii, 555.

By Maj. Michler, completing existing proj. by hired labor, **77,** 960.

Earliest proj. 1836, proposed extension of 2 parallel ps. from each side of R.'s mouth to 10′ curve in lake. In 1838 proj. amended to provide for dr. bet. ps. Proj. subsequently amended to provide for increase of d. to 12′, involving r. removal from chan. bet. ps. **66,** 27; **72,** 228; **73,** 332; **74,** 219; **77,** 960; **80,** 2122.

In 1880 proj. expanded to provide for an increase of chan. d. to 14′ from d. w. in lake to city wharves, **80,** 2126; **86,** 1860.

Total amount app., 1836 to 1886, incl., $123,701.28; est. cost of completion of existing proj., $11,000, **86,** 1860, 1861; **87,** 2311.

In 1892 Lt. Col. Smith did not consider C. of H. sufficiently extensive to justify any further expend. other than such as would be required for the preservation of existing works, **92,** 2500.

Est. cost, 1899, to put the ps. and chan. in good condition, $50,000, an expense that could not be justified by importance of the place, **99,** 3053.

Act Mar. 3, 1905, au. proj. for repair of existing js. in a durable and permanent manner; timber superstr. to be removed down to level of water, side walls of cribs to be reinforced by riprapping of heavy st. having a slope of 1 on 1½; slopes to be carried up above the surface of water so as to give j. height of 5′; cost, $42,350 (H. D. 252, 58th, 2d), **05,** 609.

SURVEYS.

By Maj. Raynolds, 1865, **66,** 25.

Ex. of chan. made, 1892–93, by Lt. Col. Smith, **93,** 3071; and of chan. and ps., 1898, by same officer, **98,** 2656.

Pre. ex. au. act June 13, 1902. **R.** by Maj. Kingman, Sept. 17, 1902, and Aug. 26, 1903 (H. D. 252, 58th, 2d); est., $42,350 for repairs to ps., $2,400 for dr. chan., **04,** 609, 3236, 3241.

BERH. recom. repairs to ps. and no dr., **04,** 3239.

Pre. ex. au. act June 25, 1910, with view to securing addl. w. of H. entrance. **R.** by Col. Millis, Aug. 20, 1910 (H. D. 283, 62d, 2d) (unfav.), **12,** 1111.

Maps:

Of northern and northwestern lakes, showing location of imp., **66,** i.

By Col. Cram, showing condition of ps. in Mar., 1865, **66,** i.

81, 2304; **91,** 2848; **09,** 2129.

QQ–22 LORAIN (Black River) HARBOR, OHIO.[1]

APPROPRIATIONS.

1828,	$7,500.00,	**66,** iii, 33.
1830,	8,559.77,	**66,** iii, 33.
1831,	9,275.00,	**66,** iii, 33.
1832,	8,000.00,	**66,** iii, 33.
1833,	2,400.00,	**66,** iii, 33.
1834,	5,000.00,	**66,** iii, 33.
1835,	4,400.00,	**66,** iii, 33.
1836,	6,660.00,	**66,** iii, 33.
1837,	6,410.00,	**66,** iii, 33.
1838,	5,000.00,	**66,** iii, 33.
1852,	5,000.00,	**66,** iii, 33.
1864,	20,000.00,	**66,** iii, 33.
1866,	10,000.00,	**66,** iii, 33.
1872,	20,000.00,	**72,** 229.
1873,	20,000.00,	**73,** 122.
1874,	20,000.00,	**74,** 50.
1875,	10,000.00,	**75,** 55.
1876,	6,000.00,	**76,** 142.
1878,	1,000.00,	**78,** 129, 1259.
1880,	1,000.00,	**80,** 2132.
1881,	7,000.00,	**81,** 2307.
1882,	7,000.00,	**82,** 2397.
1884,	10,000.00,	**84,** 2096.
1886,	10,000.00,	**86,** 1862.
1888,	10,000.00,	**88,** 2000.
1890,	12,000.00,	**90,** 2776.
1892,	20,000.00,	**92,** 2502.
1894,	10,000.00,	**95,** 3098.
1896,	30,000.00,	**96,** 2938.
1899,	50,000.00,	**99,** 3055.
1900,	125,000.00;	**00,** 4057.
1902	6,000.00	**02,** 2266.
	300,000.00	
1903,	9,000.00,	**03,** 2068.
1904,	100,000.00,	**04,** 3170.
1905,	105,000.00,	**05,** 2331.
1906,	46,000.00,	**06,** 1905.
1907,	30,000.00,	**07,** 2077.
1910,	150,000.00,	**10,** 2291.
1911,	5,000.00,	**11,** 2490.
Total,	[2] 1,218,204.77	($1,218,284.37 C. E. R., incl. $79.60 misc. rects., **12,** 2691).

COMMERCE.

The general C. of the lake benefited by this imp., **66,** 24. Requirements of, discussed, **72,** 239; **75,** 301.

Increasing, **96,** 2938; **97,** 3073; rapidly, **98,** 2660, 2719, 2721; **01,** 3242.

Description of, **01,** 578; **03,** 549; **04,** 599.

1,101,531 t., 1901, and 8 vessels built in H., **02,** 2265; 2,400,000 t., 1904, **05,** 610; 4,300,000 t., 1907, **07,** 707; over 5,200,000 t., 1909, **10,** 869; 6,460,000 t., 1911, **12,** 1100.

Marked decrease from 1901 (letter of explanation from Chamber of Commerce of Lorain), **02,** 2265.

H. rapidly growing in importance, **03,** 2067.

Marked reduction in rates, but credit should also be given to other lake imps., **06,** 684.

Detailed analysis of C., **11,** 2492; **12,** 2993.

Diagram showing relation bet. app. and amount and value of freight, **12,** 2692.

[1] Sur.—**R.,** Nov. 26, 1827, est. $14,465.20; 1828, est. $25,334.22. (H. D. 482, 55th, 2d.)
[2] Does not include $79.60 received from other sources.

CONTRACTS.

1866. W. L. Lampman, furn. timber; failed to fulfill, **66,** iv, 26.

1868. M. Z. Lampman, materials and labor, **68,** 152.

1869. William Nicolls, materials and labor, **70,** 178.

1872. D. E. Bailey, materials and labor, **73,** 337.

1873. D. E. Bailey, dr., 35¢ c. y., and materials and labor, **73,** 337.

1874. Cartwright, McCurdy & Co., iron, **73,** 334–337; **74,** 220. John Stang, materials and labor, **75,** 299, 300. Cartwright, McCurdy & Co., iron, **75,** 299, 300.

1875. Smith & Sims, dr., 28¢ c. y., **75,** 299, 300; **76,** ii, 557.

1881. J. Stang, constr. of pile revet., **81,** 2308; modified in 1883 to cover repairs, **83,** 1902. James Rooney, jr., dr., 24¢ c. y., **81,** 2308.

1884. J. Stang, p. repairs, **85,** 2224. Stang & Gillmore, dr., 21¢ c. y., **85,** 2224.

1886. Stang & Gillmore, dr., 25½ ¢ c. y., and repairs to ps., **87,** 2313, 2315.

1888. B. S. Horton, p. extension and repair, $9,162.90, **89,** 2319.

1889. O. Townsend, dr., 35¢ c. y., **90,** 2776.

1890. J. Stang, p. extension and repair, $2,-184.75.

1891. J. Stang, p. extension and repair, $7,-029.80, **91,** 2851.

1893. J. Stang, repair and extension of ps., approx. total of bid, $16,000, **93,** 3074.

1895. J. Stang, p. extension, approx. total of bid, $6,390.86, **95,** 3099.

1899. E. J. Hingston, dr., 14¢ c. y. ($25,000), **00,** 4058.

1900. Patrick Keohane, constr. of js. and w. break'r, **01,** 3243.

1901. Patrick Keohane, supple., moving e. j. 100′ e., **02,** 500.

1904. Patrick Keohane, completion of e. break'r, $142,782.50, **05,** 2331.

1905. The Buckeye Contracting Co., reconstr. and repairing parts of w. p., **06,** 1905.

1907. Patrick Keohane, supple., substituting 5′ of selected quarry-run st. for paving st. called for in orig. plans for w. break'r, **07,** 2075.

1910. The Breakwater Co., extending outer break'rs toward shore, **11,** 2491.

DOCUMENTS. (Not printed in Rs.)

R. of Col. Cram, dated Mar. 31, 1865, **66,** 23.

ENGINEERS.

Chief of Engineers. R., 66, 5, ii, 41, iii, 5, 33; **67,** 29; **68,** 40; **69,** 37; **70,** 48; **71,** 46; **72,** 43, 44; **73,** 43, 122; **74,** 49; **75,** 55, 151; **76,** 107, 108, 142; **77,** 114; **78,** 129; **79,** 172; **80,** 226; **81,** 309; **82,** 303; **83,** 311; **84,** 314; **85,** 339; **86,** 333; **87,** 299; **88,** 273; **89,** 325; **90,** 294; **91,** 369; **92,** 349; **93,** 400; **94,** 374; **95,** 408; **96,** 362; **97,** 457; **98,** 446, 454; **99,** 529; **00,** 594; **01,** 577; **02,** 499; **03,** 547; **04,** 593; **05,** 609; **06,** 683; **07,** 706; **08,** 750; **09,** 787; **10,** 868; **11,** 922; **12,** 1099.

In charge:

Col. T. J. Cram, 1864–68. **66,** 13. **R., 66,** 13, 23–25, iv, 26, 73–75; **67,** 142, 148, 230–233; **68,** 150–152.

Maj. W. McFarland, 1869–70. **R., 69,** 132; **70,** 176–178.

Maj. G. L. Gillespie, 1871–72. **71,** 189. **R., 71,** 193; **72,** 229, 239.

Maj. F. Harwood, 1873–74. **R., 73,** 334; **74,** 220.

Lt. Col. C. E. Blunt, 1875–76. **R., 75,** 299; **76,** 556.

Maj. N. Michler, 1876–79. **R., 77,** 962; **78,** 1258; **79,** 1674.

Maj. J. M. Wilson, 1878–82. **R., 79,** 1689; **80,** 2127; **81,** 2306; **82,** 2396.

Maj. L. C. Overman, 1882–92. **R., 83,** 1902; **84,** 2094; **85,** 2223; **86,** 1861; **87,** 2312; **88,** 1999; **89,** 2317; **90,** 2775; **91,** 2849.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2501; **93,** 3072; **94,** 2405; **95,** 3097; **96,** 2937; (Col.) **97,** 3072; **98,** 2658, 2717; **99,** 3055; **00,** 4054.

Maj. Dan C. Kingman, 1901–05. **R., 01,** 3241; **02,** 2264; **03,** 2066; **04,** 3168 (**R.** on flood and on sediment and discharge observations, **04,** 3803); (Lt. Col.) **05,** 2329.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1903; (Lt. Col.) **07,** 2074.

Lt. Col. John Millis, 1908–. **R., 08,** 2152; **09,** 2129; (Col.) **10,** 2291; **11,** 2490; **12,** 2691.

Assistants:

Capt. G. J. Lydecker, **68,** 151.

Capt. M. B. Adams, **75,** 53; **76,** 106.

G. T. Nelles. **R., 01,** 3243; **02,** 2267; **03,** 2069; **04,** 3171 (**R.** on flood and on sediment and discharge observations, **04,** 3807); **05,** 2332.

ESTIMATES. (See Plans and Projects.)

(Orig. not known.)

By Col. Cram, for repairs to e. and w. ps., $19,-883.09, **66,** 23. For an. repairs, $1,500, **68,** 150, 151.

By Maj. McFarland, an. repairs, $1,000, **69,** 132; **70,** 176.

By Maj. Gillespie, an. repairs, $1,000, **71,** 193. Extension of ps. and dr., $61,000, **72,** 239.

By Maj. Harwood, completion, $30,000, and an. repairs and dr., $4,000, **73,** 335. Addl. for completion, $10,000, **74,** 220.

By Lt. Col. Blunt, break'r for new H. of refuge, $1,000,000. Not recom., **75,** 300.

OPERATIONS.[1]

1865–66. Repairs of ps. and extension of inner end of e. p., **66,** iv, 26.

1869–70. Slight repairs to ps., by contract, **70,** 176.

1870–71. Slight repairs, **71,** 46.

1872–73. Extension of e. p. 165′, and w. p. 150′, and dr. 23,000 c. y., by contract, **73,** 334.

1873–74. P. extension by contract, 7 cribs sunk, and superstr. over 12 cribs completed; also dr. the outer bar, by hired labor, **74,** 220.

1874–75. 7 cribs sunk, completing the e. p., **75,** 55.

1875–76. Completion of w. p. extension, and dr. 21,996 c. y.; repairs, by day labor, to w. p., **76,** ii, 557.

1876–77. Repairs and extension of inner end of e. p., **77,** 962.

1878–79. Repairs to e. and w. ps., **79,** 172, 1674, 1690.

1879–80. Repairs to ps. by hired labor, **80,** 2131.

1880–81. Minor repairs to ps., **81,** 2306.

1881–82. 10,637 c. y. dr., 400 l. f. pile revet. built at inner end e. p., and minor repairs made to ps., **82,** 2396.

1882–83. Minor repairs to ps., 428 l. f. w. p. superstr. removed, **83,** 1903.

1883–84. 693 l. f. of superstr. of w. p. removed, 308 l. f. pile revet. at inner end e. p. rebuilt, 138 l. f. w. p. superstr. repaired; minor repairs to both ps., **84,** 2095.

1884–85. 3,331 c. y. dr. from chan., 656 l. f. of e. p. superstr. removed, 262 l. f. pile revet. placed on chan. side of w. p., and 225 l. f. of pile revet. placed on both sides of e. p., **85,** 2224.

1886–87. 3,994 c. y. dr. from bar at entrance, and repairs made to ps., **87,** 2313.

1887–88. P. repair continued under contract, **88,** 2000.

1888–89. Extension of w. p. and repairs to e. and w. ps. continued under contract, **89,** 2317.

1889–90. 2,000 c. y. dr., **90,** 2776.

1890–91. 6,400 c. y. dr. from chan. bet. ps.; e. p. extension and dr. in progress, **91,** 2849.

1891–92. E. p. extension completed; minor repairs to superstr. of old ps., **92,** 2501.

1892–93. 2,974 c. y. dr., **93,** 3073.

1893–94. E. and w. ps. repaired, and dr. done through bar, **94,** 2406–2407.

1894–95. Both ps. repaired, extension of w. p. in progress, and 9,405 c. y. dr., **95,** 3098.

[1] History of operations to 1879, **78,** 1258; **79,** 1689.

1895-96. P. extension of previous year completed, **96,** 2937.

1896-97. 39,684 c. y. dr., and reconstr. of w. p. in progress, **97,** 3072.

1897-98. W. p. extended, **98,** 2658, and 4,184 c. y. dr., **98,** 2659.

1898-99. 66,780 c. y. dr., **00,** 4055.

1900-01. 41,974 c. y. dr., **01,** 3241.

1901-02. 5 cribs, aggregate l. of 992′, built and sunk for new e. j.; 4 cribs under constr.; 36 concrete blocks molded for superstr., **02,** 2264.

1902-03. 1,135′ of crib substr. for js. sunk in place; 729 l. f. of concrete superstr. built on e. j., timber cribs for pierheads of break'r partly constr. and 9,212 t. st. deposited in break'r. Rate of progress not satisfactory, **03,** 548, 2066.

1903-04. 1,192 l. f. of concrete superstr. completed; 17,903 t. of foundation st. and 21,989 t. of shale core st. placed; 49,000 c. y., s. m., of shale dumped by private parties on the line of the proposed e. break'r; brush mattress and stone placed for shore protection e. of e. pier. **04,** 599, 3168.

1904-05. Over 50,000 t. st. placed w. break'r; mainten. dr. by dr. *Maumee;* 951 c. y. concrete and 3,825 t. st. placed in pierhead and ps.; 11,123 c. y. shale core filling and 17,634 t. st. placed in e. break'r, **05,** 2332, 2333.

1905-06. Work on w. break'r and pierheads continued; st. placed in e. break'r, cost $47,282.65; reconstr. w. p., **06,** 1904.

1906-07. St. to value of $24,504 placed in w. break'r; concrete costing $3,900 used in e. and w. p. reconstr. and pierheads; st. costing $30,173 placed in e. break'r; concrete st. and iron placed in reconstr. w. p. at cost of $18,329.77; mainten. dr. continued by dr. *Maumee;* proj. 75% completed, **07,** 707, 2075, 2076.

1907-08. Contract of Oct. 27, 1900, for constr. of w. break'r, ps., and pierheads 95% completed; contract of Aug. 3, 1904, for constr. of e. break'r 85% completed; contract of July 3, 1905, for reconstr. w. p. completed Jan. 31, 1908; mainten. work continued by dr. *Maumee,* proj. 90% done, **08,** 751, 2152.

1908-09. Contract of Oct. 27, 1900, for. w. break'r, 2 pierheads, and removing and rebuilding parts of e. and w. ps. completed Aug. 4, 1908; contract of Aug. 3, 1904, for e. break'r completed Aug. 4, 1908; 41,760 c. y. material removed from Black R. bet. certain limits by dr. *Maumee* at cost of $4,901.91; proj. 95% done, **09,** 788, 2129, 2130.

1909-10. Dr. *Burton* removed 19,379 c. y. of material from entrance chan. at cost of $3,049.22, **10,** 2291.

1910-11. Dr. *Burton* removed 5,234 c. y. from entrance chan. at cost of $978.09; work of extending break'rs shoreward begun and about 19% completed; H. lines estab., **11,** 2490.

1911-12. Dr. *Burton* removed 29,432 c. y. from area sheltered by break'r (imp. work); extension of break'r in progress and contract thereon 58% completed; whole project 88% done, **12,** 1100, 2691.

PHYSICAL CHARACTERISTICS.

Drift of sand from e. beach into H., with the usual drift of sand in the littoral current around the end of the w. p., **72,** 239; **73,** 335; **75,** 300.

Description of, **96,** 2938; **98,** 2718, 2721.

Chan. 20′ d. existed bet. js. and outward to d. w. of lake, **01,** 577.

Rapid recession of shore line occurring near shore end of e. break'r, augmented by freshet conditions Jan., 1904, raising R. 8′ to 10′; mattresses, dr. material, and riprap st. placed; freshet conditions shoaled chan. bet. js., **04,** 3168.

Report on rainfall and run-off, and movement of silt, **04,** 3171, 3803, 3807.

Water surface fluctuations similar to those at Cleveland, **08,** 751.

All ds. referred to m. l. l. 1860–75, **11,** 923.

PLANS. (See also Estimates and Projects.)

Break'r for H. of refuge, submitted by Lt. Col. Blunt, but not recom., **75,** 300.

PRIVATE WORK.

City of Lorain app. $200,000 for w. and straightening R. from shore line to U. S. Steel Corporation works, **03,** 2067; 160,000 c. y. dr., dumped bet. j. and beach to re-form latter, **04,** 3168.

See R. of operations, **04,** 3168.

Chan. 21′ extends 3 m. up R. to steel plant, maintained by city, **09,** 788.

Inner H., consisting of about 3 m. of Black R., with turning-basin, under imp. by dr. at expense of city, **12,** 2691.

PROJECTS. (See Estimates and Plans.)

History of work, 1828 to 1880, **80,** 2131.

Orig., by Capt. Maurice, 1828, for parallel ps. of cribwork, brushwood, and loose st., running nearly at right angles to coast line, into lake. See map, **66,** and partial history of, **66,** 23; **77,** 962; **79,** 1680.

By Col. Cram, in 1865, repairs to ps. and extension of inner end of e. p., **66,** iv, 26; **67,** 142.

By Maj. Gillespie, repairs and extension of ps. and dr. to obtain 14′, **72,** 229, 239.

By Lt. Col. Blunt, to obtain 15′, **74,** 220. Completed in 1876, **76,** ii, 557. For repairs to e. p., and shore protection at the inner end, **76,** ii, 557.

Projs. bet. 1828 and 1880 proposed, by p. extension and dr., formation of chan. entrance of navigable w. and not less than 14′ d. In 1880 expend. of $175,138.92 resulted in chan. not less than 15′ d., **80,** 226, 2132.

In 1880 Maj. Wilson proposed extension of ps. to 16′ curve in lake, with renewal of 2,000 l. f. of old superstr.; est., $42,000, **80,** 2131; increased 1882 to $45,000, **82,** 2397; increased 1884 to $64,000, on account of unexpected repairs, **84,** 2096.

In 1892 understood by officer in charge that Congress by app. of 1892 approved proj. for extending ps. to 17′, **93,** 3072.

By Lt. Col. Smith, 1896, expend. app. of 1894 in extending w. p., and dr. and repairs, using $7,500 for former and $2,500 for latter, **96,** 2938.

By Lt. Col. Smith, in 1896, dr. chan. bet. ps. and into lake to 19′, and w. of 150′, at an actual cost of about $6,000, **97,** 3072.

By Lt. Col. Smith, 1896, expend. app. of 1896 in removing and rebuilding 396 l. f. of w. p., **97,** 3072.

In 1897 Col. Smith est. $590,500 or $695,500 to imp. H., **98,** 2721.

By Col. Smith, 1897, extension of e. break'r 1,500′ and w. break'r 1,800′; for 2 pierheads; extending and rebuilding ps.; and dr. anchorage and chan.; est., $695,000, **98,** 2721; **99,** 3055; **00,** 4054–4062. Drawings, **00,** 4054: Act June 6, 1900, provided that cost of any part of work should not exceed by more than one-tenth the orig. est., **00,** 4056.

Est. of entire proj., 1900, $705,350, **00,** 4057.

Type of work found, 1889, most suitable for break'rs, **00,** 4055.

Proj. of 1894 au. Mar. 3, 1899, provides 2 break'rs 500′ apart and prolongation of axial line in jettied chan., rebuilding js., and dr. protected areas to d. of 20′. Proposals invited on this work but lowest bid in excess of amount allowed by law. Act June 6, 1900, au. expend. not to exceed 10% increase over orig. est., which would cover all the proposed works except e. break'r; est. for latter, $190,000, **01,** 577.

Plans modified to allow 300′ instead of 200′ chan. bet. js., **02,** 499.

$135,000 remains after completion of proj. au. June 6, 1900; to be applied to constr. of e. break'r, **04,** 599.

Sheathing of j., costing $50,000, recom. in mainten. **04,** 3169.

Outer thickness of 5′ selected quarry st. substituted for paving w. break'r in accordance with finding of BE. which studied Cleveland Break'r, **07,** 2075.

Act of Mar. 2, 1907, au. $15,000 for dr. e. side of Black R. from inner end of e. U. S. p. to East Erie Ave. Br., **07,** 706.

In the 5 years prior to 1908, nearly $24,000 spent for mainten., **08,** 751.

Act Mar. 3, 1909, au. extension of the w. arm of break'r toward shore, **09,** 788.

Act June 25, 1910, au. extension of both e. and w. arms of break'rs toward the shore, and dr. in the H.; est., $248,129; with $5,000 for an. mainten. (H. D. 644, 61st, 2d), **10,** 868.

SURVEYS.

By Maj. Raynolds, 1865, **66,** 25.

By Lt. Col. Blunt, 1874, for break'r for H. of refuge. **R., 75,** 300.

In 1892–93. a hydrographic sur. and sur. of chan. and its approaches made by Lt. Col. Smith, **93,** 3073, and another sur. of chan. made, 1895, by the same officer, **95,** 3098.

Sur. of H., with view to providing better access for boats and for their safety, au. act June 3, 1896; made by Col. Smith, 1897 (see Projects), **98,** 2717.

Ex. bet. js. showed d. of 20′ had been maintained, **01,** 577.

Comprehensive sur. for basis of comparison, **02,** 2269.

Pre. ex. and sur. of Lorain H., incl. portion of Black R. from inner end of the U. S. ps. to East Erie Ave. Br., au. by R. and H. act Mar. 2, 1907; est., $23,000 (H. D. 560, 60th, 1st), **08,** 761.

Pre. ex. and sur. of Lorain H. with view to enlarging and imp. outer H. area, also dock wall at e. side of R. extending e. of U. S. p.; **Rs.** 1909 and 1910; est., $248,129 (H. D. 644, 61st, 2d), **10,** 879.

Maps. (H. D. 644, 61st, 2d):

Of n. and nw. lakes, showing location of H., and of H., showing its condition Sept., 1865; **66,** 6.

81, 2308; **91,** 2850; **94,** 2407; **12,** 2692.

Cross section of proposed e. break'r, **04,** 3172.

Lorain H., Ohio, **09,** 2130.

Lorain H. and Black R., showing extension of break'r, **10,** 2291; **12,** 2692.

Photographs. **98,** 2660, 2722.

Drawings. (See Projects, 1897.)

Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 3244; **11,** 922, 923; **12,** 1100.

QQ–24 ROCKY RIVER HARBOR, OHIO.

APPROPRIATIONS.[1]

1872,	$10,000,	**72,** 45.
1874,	10,000,	**74,** 50; **75,** 301.
1875,	15,000,	**75,** 165.
1880,	4,000,	**80,** 2134.
Total,	39,000	

COMMERCE.

Unimportant, **72,** 235; **74,** 221; **75,** 301; **76,** ii, 557.

Requirements of C. discussed, **73,** 345; **74,** 221; **76,** ii, 557.

Not great; H. mostly used by yachtsmen and pleasure craft, **04,** 3225.

CONTRACTS.

1872. Hemenway & Garfield, materials and labor, **73,** 345; contract extended, **73,** 345.

1874. J. Caldwell, materials and labor, **75,** 302. Cartwright, McCurdy & Co., iron, **75,** 302.

1875. J. Caldwell, dr., materials, and labor, **75,** 302; **76,** ii, 558. Wm. H. McCurdy, iron, **75,** 302; **76,** ii, 558.

ENGINEERS.

Chief of Engineers. R., 70, 32, 50; **71,** 48; **72,** 45; **73,** 45; **74,** 50; **75,** 55, 165; **76,** 108; **80,** 226; **81,** 309; **82,** 304; **83,** 312; **84,** 315; **85,** 339; **86,** 334; **87,** 300; **88,** 273; **04,** 609; **08,** 760.

Boards. BERH. reviews Maj. Kingman's sur. **R.** of 1902, and states locality not worthy of further imp. **R., 04,** 3226.

In charge:

Maj. W. McFarland, 1870; **70,** 50. **R., 71,** 211–213.

Maj. G. L. Gillespie, 1872. **R., 72,** 235.

Maj. F. Harwood, 1873–74; **73,** 42. **R., 73,** 345; **74,** 221.

Lt. Col. C. E. Blunt, 1874–76; **74,** 215. **R., 75,** 301; **76,** ii, 557.

Maj. J. M. Wilson, 1879–83. **R., 80,** 2132; **81,** 2309; **82,** 2398.

Maj. L. C. Overman, 1883–88. **R., 83,** 1905; **84,** 2097; **85,** 2227; **86,** 1862; **87,** 2315; **88,** 2001.

Maj. D. C. Kingman, 1904. **R., 04,** 3223.

Lt. Col. C. McD. Townsend, **08,** 743.

Assistants:

I. Camp, **71,** 211.

D. Enwright, **71,** 211.

Capt. M. B. Adams, in immediate charge of operations, **75,** 292.

ESTIMATES. (See Plans and Projects.)

By Maj. Harwood, 1873, entire and permanent completion, $250,000, **73,** 345; 1874, $240,000, **74,** 221.

OPERATIONS.

1871–72. At close of the working season, cribs were ready to sink for p. on the e. side of chan., **73,** 345.

1872–73. 360′ of p. completed, **74,** 221.

1873–74. 288′ added to the p., **75,** 301.

1874–75. 180′ of p. built, making it "now" 828′ l.; 31,820 c. y. removed from chan. by dr., **76,** ii, 557.

1880–81. 120 l. f. of cribwork built, 135 l. f. top-course superstr. removed, and 175 l. f. replanked, **81,** 2310.

1883–84. Repairs to ps. with hired labor, **84,** 2097.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 211; **72,** 235.

PLANS. (See Estimates and Projects.)

Maj. Overman, 1888, reported "existing" imp. sufficient, **88,** 2001.

PRIVATE WORK.

Small amount of dr., **71,** 212.

PROJECTS. (See Estimates and Plans.)

By Maj. McFarland, 1871, 500′ p. extension, dr., and blasting if required, $93,347.30, or $212,226.60, **71,** 212.

By Maj. Gillespie, 1872, expend app. by building p. on e. side of chan., and pilework, **72,** 235.

By Lt. Col. Blunt, 1875, further p. extension, d. chan. by dr., **75,** 301.

Proj. of 1871 proposed formation of chan. of entrance from Lake Erie 100′ w. and from 6′ to 12′ d. by constr. of an e. p. and dr., **71,** 212; **80,** 2133; **81,** 2310.

SURVEYS.

Sur. and ex. au. act July 11, 1870, **70,** 32; assigned to Maj. W. McFarland, **70,** 50. **R., 71,** 211.

Pre. ex. au. act June 13, 1902. **R.** by Maj. Kingman, Sept. 6, 1902 (H. D. 37, 58th, 2d) (unfav.), **04,** 609, 3222.

Pre. ex. au. act Mar. 2, 1907. **R.** by Lt. Col. Townsend, June 14, 1907 (H. D. 559, 60th, 1st) (unfav.), **08,** 761.

Maps. **81,** 2310.

[1] Statement of app., **75,** 301. Recom. concerning further app., **72,** 235; **73,** 345; **74,** 221; **76,** ii, 345.

QQ–25 CLEVELAND HARBOR, OHIO.[1]

APPROPRIATIONS.

1825,	$5,000.00,	act Mar. 3 (sur.).
1827,	10,000.00,	**66,** iii, 33.
1829,	12,179.00,	**66,** iii, 33.
1830,	1,786.56,	**66,** iii, 33.
1831,	3,670.00,	**66,** iii, 33.
1832,	6,600.00,	**66,** iii, 33.
1834,	13,315.00,	**66,** iii, 33.
1836,	15,006.59,	**66,** iii, 33.
1837,	10,000.00,	**66,** iii, 33.
1838,	51,856.00,	**66,** iii, 33.
1844,	25,000.00,	**66,** iii, 33.
1852,	30,000.00,	**66,** iii, 33.
1853,	145.69,	**66,** iii, 33.
1864,	20,000.00,	**66,** iii, 33.
1866,	59,806.00,	**66,** iii, 33.
1868,	*17,000.00,	**68,** 24.
1869–70,	*[2]13,380.00,	**69,** 22.
1870,	20,000.00,	**71,** 46.
1871,	*[3]636.77,	**72,** 230.
1873,	1,000.00,	**73,** 122.
1874,	30,500.00,	**75,** 151.
1875,	50,000.00,	**75,** 168.
1876,	58,000.00,	**76,** 139.
1878,	100,000.00,	**78,** 130, 1263.
1879,	100,000.00,	**79,** 172, 1695.
1880,	125,000.00,	**80,** 2144.
1881,	200,000.00,	**81,** 2314.
1882,	175,000.00,	**82,** 2401.
1884,	100,000.00,	**84,** 2103.
1886,	93,750.00,	**86,** 1868.
1888,	100,000.00,	**88,** 2004.
1890,	75,000.00,	**90,** 2780.
1892,	100,000.00,	**92,** 2505.
1894,	50,000.00,	**95,** 3101.
1896,	80,000.00,	**96,** 2947.
1897,	350,000.00,	**97,** 3080.
1898,	294,000.00,	**98,** 2671.
1899,	175,000.00,	**99,** 3061.
1900,	175,000.00,	**00,** 4068.
1902	625,000.00	**02,** 2271.
	107,000.00	
1903,	227,500.00,	**03,** 2074.
1904	25,200.00	**04,** 3178.
	460,000.00	
1905,	830,800.00,	**05,** 2340.
1906,	350,000.00,	**06,** 1911.
1907	223,000.00	**07,** 2084.
	200,000.00	
1908,	475,000.00,	**08,** 2159.
1909,	337,500.00,	**09,** 2134.
1910,	616,000.00,	**10,** 2294.
1911,	200,000.00,	**11,** 2495.
1912,	200,000.00,	**12,** 2696.

Total, 7,624,631.61 (incl. sales, etc., $7,624,-666.77; **12,** 2696).

COMMERCE.

Important, **67,** 252, 253, 254.

Report of Board of Industry upon development of lake C. and necessity for increased H. facilities, **88,** 2008.

Description of, **96,** 2950; **98,** 2728–2731.

Large shipments of coal, **96,** 2947; more than 7,000,000 t. of freight carried, 1896, **96,** 2950.

Large and increasing, **98,** 2670, **00,** 4067.

7 new vessel lines estab., **05,** 2341.

Marked reduction in rates, **06,** 686; **10,** 871.

Diagram showing relation of tonnage, value, and app., **11,** 2496–2498.

Tonnage, 1911, 10,949,760 t., **12,** 1103.

CONTRACTS.

1866. J. E. & D. E. Bailey, st. and labor, **66,** iii, 74; **67,** 142, 232. Patrick Smith, piles, **66,** iii, 74; **67,** 142, 232. J. D. Palmer & Wright, timber and lumber, **66,** iii, 74; **67,** 142, 232. James Loveday, iron, **66,** iii, 74; **67,** 142, 232.

1871. A. Spaulding, dr., 25¢ c. y., **71,** 194; **72,** 229.

1874. Hemmingway & Garfield, materials and labor, **75,** 303. Cartwright, McCurdy & Co., iron, **75,** 303.

1875. C. H. Strong, materials and labor, **76,** ii, 559. W. H. McCurdy, iron, **76,** ii, 559.

1877. W. H. McCurdy, iron, **77,** 964. Ferris & Garfield, materials and labor, **77,** 964; **79,** 1697.

1878. W. H. McCurdy, iron, **79,** 1697. F. H. Colton, timber and labor, **79,** 1697.

1879. C. H. Strong, timber and labor, **79,** 1697. O. Sherwood and J. Geissendorfer, break'r constr., **80,** 2145. G. Worthington & Co., iron, **80,** 2145.

1880. P. Smith, dr., 30¢ c. y., **80,** 2146. J. Barrett, iron, **81,** 2314. J. C. Williams, break'r constr., **81,** 2315.

1881. J. Stang, pile protective works, **81,** 2315. C. G. Hubbell, iron, **81,** 2316. Sherwood, Strieberger & Geissendorfer, material and workmanship, **81,** 2317.

1882. W. H. McCurdy, iron, **83,** 1909. L. P. & J. A. Smith, materials and labor, **83,** 1910. W. P. Stanton, driftbolts and boat spikes, $2\frac{6}{10}$¢ and $2\frac{8}{100}$¢ lb., resp., **83,** 1910.

1884. J. Stang, repair of lake arm of break'r, **85,** 2232.

1885. L. P. & J. A. Smith, filling st., $5.50 cord, **86,** 1868.

1886. L. P. & J. A. Smith, foundation st. for break'r, **87,** 2318, 2322.

1887. L. P. & J. A. Smith, break'r constr., **87,** 2318, 2322. B. S. Horton constr. of break'r parapet, **87,** 2319, 2322.

1888. W. M. Pattison, driftbolts and spikes, spikes, 2½¢ lb., **89,** 2323. Kelley Island Lime and Transport Co., foundation st., $4.89 cord. J B. Donnelly, st. and timber, $65,268, **89,** 2324. A. Lacour, iron, $3,926, **89,** 2324.

1890. Kelley Island Lime & Transport Co., st., $10,680, **91,** 2857. L. P. & J. A. Smith, break'r extension, $47,954, **91,** 2857. W. M. Pattison, iron, $3,147, **91,** 2857. Carkin, Stickney & Cram, dr., 25¢ c. y., **91,** 2859.

1892. L. P. & J. A. Smith, constr. of breakr., approx. total, $59,825.37, **93,** 3080.

1893. Sadler & Allen, dr., 14¢ c. y., **93,** 3080.

1896. J. B. Donnelly, constr. of e. p., approx. total, $27,484.77, **96,** 2948.

1897. Hunkin Bros., repair of break'r, approx. total, $413,843.78, **97,** 3081.

1898. J. B. Donnelly, furnishing st. in place for foundation of e. break'r, 92¢ t., **98,** 2671.

1899. W. A. McGillis & Co., dr., 11.95¢ c. y. (70,000), **99,** 3063.

1902. The L. P. & J. A. Smith Co., dr.; Hughes Bros. & Bangs, imp. and enlargement of H. (e. division); Hughes Bros. & Bangs, imp. and enlargement of H. (w. division); the L. P. & J. A. Smith Co., imp. of main entrance to H., **03,** 2075.

1905. The Hunkin Bros. Constr. Co., repairing shore end of w. break'r; The L. P. & J. A. Smith Co., dr., **06,** 1910, 1911.

1907. The Great Lakes Dredge & Dock Co., dr., **08,** 2160.

1909. The Breakwater Co. (successors to Hughes Bros. & Bangs), further extension of break'r, **09,** 2135; The Great Lakes Dredge & Dock Co., dr., **10,** 2294.

1910. The Great Lakes Dredge & Dock Co., dr., 17¢ c. y., 163,812 c. y., **10,** 2496; Great Lakes Constr. Co., break'r repairs, 31,366 t. st., 30,646 t. in place at $1.30 and 720 t. in place at $3, **11,** 2496; **12,** 2697. The Breakwater Co., break'r constr. and removal, 237,000 t., at $1.30 t. in place; removing 1,725 l. f. break'r, at $10 l. f., **11,** 2496; **12,** 2697.

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* Allotment.

[1] Sur.—**Rs.,** 1825, est. $27,653.91; 1833, est. $13,315; Nov. 15, 1837, est. $120,350.20, $47,609.20; Oct. 14, 1865, est. $59,806. (H. D. 482, 55th, 2d.)

[2] Said to be $12,000, **69,** 137.

[3] Difference between $1,000 and the amount which reverted to the Treas.

DOCUMENTS. (Not printed in reports.)

All details of projs. and operations prior to 1864. **Rs.** of Col. T. J. Cram, dated Nov. 2, 1864, **66,** 24; and Feb. 1, 1867, **66,** iv, 142.

ENGINEERS.

Chief of Engineers. **R., 66,** 5, ii, 37, 41, iii, 5, 33, iv, 20; **67,** 29, 30, 252; **68,** 24, 41; **69,** 22, 37; **70,** 48; **71,** 46; **72,** 44; **73,** 44, 46, 122; **74,** 50, 53; **75,** 55, 57, 151, 168; **76,** 108, 139, ii, 559; **77,** 114, 115; **78,** 129, 130; **79,** 172; **80,** 226; **81,** 309; **82,** 304; **83,** 312; **84,** 315; **85,** 340, 2232, 2233; **86,** 344; **87,** 300; **88,** 274, 2005; **89,** 325; **90,** 294; **91,** 370; **92,** 349; **93,** 400; **94,** 375; **95,** 409; **96,** 363; **97,** 458; **98,** 447, 455; **99,** 530, 536; **00,** 595, 604; **01,** 578, 585, 3277; **02,** 500; **03,** 549; **04,** 600; **05,** 611; **06,** 685; **07,** 707, 717; **08,** 752; **09,** 789; **10,** 869; **11,** 923; **12,** 1101.

Boards:

1875. To consider subject of break'r; various plans discussed. Recom. a closed break'r with area of 200 acres. Adjourned to await ex. of lake bed, **75,** 308. Reassembled and selected the w. side of the city front for its location, and recom. its constr. as follows: W. side, 1,000′ pile p. from shore line to 15′ of water, thence 1,400′ of cribwork extending to 27′ water. N. side, 4,700′ of cribwork nearly parallel with the shore. E. side, extension of the w. H. p. 600′, leaving an entrance 300′ in w. to new H. Est., $1,373,000. **R., 75,** 308. (Col. Woodruff, Lt. Col. Blunt, Majs. Comstock and Wilson.)

Constituted by S. O. No. 98, 1884, Corps of Engineers (Lt. Cols. McFarland and Wilson and Maj. Overman), **85,** 2234.

Appointed to revise plans under which e. break'r is being constr., revision made necessary by settlement of sand core break'r (DO.'s plan. approv.), **07,** 2080.

In charge:

Col. T. J. Cram, 1864–68. **R., 66,** 13, 22, 24, 45, iv, 19–25, 69–75; **67,** 41, 48, 230–233.

Maj. W. McFarland, 1868–70. **R., 68,** 155; **69,** 133; **70,** 178.

Capt. G. L. Gillespie, 1870–72. **71,** 45. **R., 71,** 193; **72,** 229.

Maj. F. Harwood, 1872–74. **73,** 42. **R., 73,** 337; **74,** 222. On sur. for H. of refuge, **74,** 232–238.

Lt. Col. C. E. Blunt, 1874–77. **77,** 215. **R., 75,** 302, 304; **76,** ii, 558; **77,** 963, 964.

Maj. W. McFarland, 1878. **R., 78,** 1261, 1263.

Maj. J. M. Wilson, 1878–83. **R., 79,** 1691; **80,** 2135; **81,** 2310; **82,** 2398.

Maj. L. C. Overman, 1883–92. **R., 83,** 1905; **84,** 2097; **85,** 2227; **86,** 1863; **87,** 2317; **88,** 2001, 2006; **89,** 2319; **90,** 2777; **91,** 2853.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2503; **93,** 3075; **94,** 2409; **95,** 3100; **96,** 2939; (Col.) **97,** 3075; **98,** 2661, 2724; **99,** 3057, 3075; **00,** 4063.

Maj. D. C. Kingman, 1901–05. **R., 01,** 3244; **02,** 2269; **03,** 2071; **04,** 3174; (Lt. Col.) **05,** 2335.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1906; (Lt. Col.) **07,** 2079.

Lt. Col. John Millis, 1908–. **R., 08,** 2155; **09,** 2132; (Col.) **10,** 2292; **11,** 2493; **12,** 2694.

Assistants:

Maj. F. U. Farquhar. Est. by, **66,** iv, 19, 71.

Capt. M. B. Adams, **75,** 53. In immediate charge of H., **75,** 292, 304.

G. E. Fell, **74,** 233.

F. S. Burrows. **R., 98,** 2675.

W. T. Blunt. **R., 98,** 2732.

G. T. Nelles. **R., 01,** 3249; **02,** 2272; **03,** 2076; **04,** 3180; **05,** 2341.

ESTIMATES. (See Plans and Projects.)

By Col. Cram, proposed extension, $59,806, **66,** 23. iv, 73; addl. to complete existing proj., $3,691; addl. for chan. for vessels drawing 14′ water, $130,000, **67,** 252.

By Maj. Harwood, break'r for H. of refuge, $500 l. f.; aggregate, $4,000,000, **74,** 237.

By Lt. Col. Blunt, break'r in 4-fathom water, $521,000; in 5-fathom water, $1,155,000, **75,** 305, 306.

By BE., break'r, $1,373,000; softness of the lake bed might increase the cost 25%, **75,** 310.

By Chief of Engineers, modified to $1,800,000, **75,** 303. To complete existing proj., $1,500,000, **79,** 173, 1695.

LEGAL PROCEEDINGS.

Part of proj. delayed because of difficulty in obtaining necessary land, **97,** 3078; **98,** 2666; **00,** 4067.

Claim in hands of Dept. of Justice for collection, against owners of barge *John Fritz;* damages ($2,315.67) done in collision with w. p., **01,** 3247.

Petition submitted to War Dept. by property owners for estab. of H. lines along the H. front from East 9th St. to Gordon Park; referred by the Chief of Engineers to mayor of Cleveland; a R. and H. commission appointed by mayor, **11,** 2495.

Lease of water front of U. S. Marine Hospital by Cleveland Yacht Club should be terminated; prevents constr. of storehouse provided for by act Mar. 2, 1907, **12,** 2695.

OBSTRUCTIONS.

Filling of H., 1900, preventable, **99,** 3078.

OPERATIONS.

1865. Repairs to w. p., **66,** 22.

1867–68. 450 l. f. of w. p. built, **68,** 41.

1868–69. 50′ added to w. and 400′ to e. p., **69,** 133.

1869–70. 175′ added to e. p., making ps. of equal length; w. p. repaired, **70,** 178.

1870–71. Repairs to e. pierhead, dr. 9,500 c. y., **71,** 47.

1871–72. 65,664 c. y. sand and gravel removed; e. and w. ps. repaired by day labor, **72,** 229.

1874. Repairs to ps., **74,** 222.

1875–76. Repairs to ps. by contract, **75,** 303. Repairs to e. p. in progress, **77,** 964. 333′ of pile p. for break'r completed, **76,** ii, 558.

1876–77. 1,150′ of pile p. nearly completed, **77,** 964.

1877–78. Substr. of break'r extended 300′ by 6 cribs, each 50′ l.; repairs to e. p., **78,** 129, 130, 1261, 1263.

1878–79. 600 l. f. of cribwork sunk, 500 l. f. of superstr. built, and st. foundation prepared for 1,000 l. f. of cribwork for break'r; repairing ps. and dr. at mouth of R., **79,** 172, 1693.

1879–80. 800 l. f. cribwork sunk, 1,054 l. f. superstr. built, 208 c. y. st. placed in pile portion of break'r, 550 l. f. foundation completed upon new break'r, **80,** 2142; 737 l. f. w. p. superstr. rebuilt, 80 l. f. e. p. repaired, 12,802 c. y. dr. at mouth of Cuyahoga R., **80,** 2143.

1880–81. Method of break'r constr.: 700 l. f. cribwork sunk and 700 l. f. of superstr. built, **81,** 2312.

1881–82. 620 l. f. pile protection built, repairs to 541 l. f. of e. p. and 500 l. f. of w. p., 700 l. f. superstr. filled with st., 350 l. f. riprapped with heavy st., 1,800 l. f. foundation completed, 1,100 l. f. cribwork, **82,** 2399, 2400. Abstract of materials used in constr. of 1,004 l. f. of break'r, **82,** 2403.

1882–83. Repairs to U. S. boathouse, 4,000 c. y. dr. bet. ps., minor repairs to new break'r, 950 l. f. foundation built, 1,600 l. f. cribwork sunk, 1,350 l. f. superstr. completed, **83,** 1906, 1907, 1908.

1883–84. 21,122 c. y. dr. from bet. ps., repairs to break'r injured by collision, repairs to settled part of break'r, 505 l. f. foundation built, 950 l. f. cribwork placed, 1,900 l. f. of break'r riprapped, 1,912 l. f. superstr. built, **84,** 2098, 2099, 2100, 2101. Proj. of 1875 completed, **85,** 2228.

1884–85. 163 l. f. decking of e. p. renewed, 80′ of decking of w. p. renewed. Repairs to e. p. cribs, repairs to U. S. Engineers' boathouse, repairs to break'r, junction of crib top, and lower course of superstr. closed by boiler-iron plating, **85,** 2228, 2229.

1885–86. 988 cords st. placed in lake arm superstr., **86,** 1864. 150 cross-ties spliced and replaced, 2,120 t. st. placed in break'r, **86,** 1865.

1886–87. Progress on formation of foundation of break'r, repairs to ps. and break'r, **87,** 2318.

1887–88. Foundation of 1,200 l. f. of break'r completed by deposit of 4,620 cords of st.; 600 l. f. of break'r parapet and superstr. completed; 3,530

l. f. of parapet wall built; repairs to ps. and superstr. by hired labor, **88,** 2002, 2003.

1888-89. Superstr. placed on 7 cribs by hired labor; 7 cribs placed and filled under contract; repairs to ps. and break'r by hired labor, **89,** 2320, 2321.

1889-90. 550 l. f. of break'r completed under contract; repairs to ps. by hired labor; 3,256 c. y. dr., **90,** 2778.

1890-91. 13,300 c. y. dr. from chan. bet. ps. and from break'r basin; extension of e. break'r begun, **91,** 2854.

1891-92. 4,786 c. y. dr.; repairs to break'r, **92,** 2503.

1892-93. 4,252 c. y. dr., **93,** 3076; dr. in progress, and extension of e. break'r in progress, **93,** 3077.

1893-94. In connection with previous year, 142,998 c. y., s. m., dr., and 450 l. f. e. break'r extended, **94,** 2410.

1894-95. W. break'r repaired, **95,** 3105; removal of 200 l. f. of w. break'r in progress, **95,** 3104; and H. line on e. side of R. changed, **95,** 3105.

1895-96. Opening of w. break'r, commenced in previous year, completed, **96,** 2940; and 11,033 c. y. dr., **96,** 2941.

1896-97. Old e. p. removed and replaced with new p., **97,** 3075; 64,323 c. y. dr., and repairs made to break'r, **97,** 3077.

1897-98. Repair of w. break'r in progress, **98,** 2662; storehouse erected on w. p., small SS. purchased, and extension of e. break'r in progress, **98,** 2664, 2665.

1898-99. Concrete superstr. of w. break'r under constr.; foundation of riprap st. for e. break'r extension completed; 15,648 c. y. dr.; constr. of part of w. p. in progress; damaged works repaired (photographs), **99,** 3057.

1899-00. Concrete superstr. of w. break'r in progress of constr. (photographs; sketch map); completion of e. break'r and reconstr. of w. p. in progress; repairs made to old w. break'r; 520,792 c. y. dr. (photographs), **00,** 4064.

1900-01. Work in progress on the renewal of superstr. of w. break'r, extension of e. break'r, repair and renewal of js., and dr.; damages to w. p. by barge *John Fritz* repaired, cost, $2,315.67, **01,** 3245, 3247, 3249.

1901-02. Work in progress on renewal of superstr. of w. break'r and extension of e. break'r; damage done by SS. *Superior* in collision with e. p. repaired (cost, $90, refunded by owners), **02,** 2269, 2272, 2275.

1902-03. Renewing superstr. of w. break'r, repairs to e. break'r and dr. continued, **03,** 2072.

1903-04. Renewing superstr. of w. break'r completed; repairs on e. break'r continued; work on new entrance to H. in progress and about 17% completed; break'r extension continued and about 13% completed, **04,** 3174, 3176, 3180.

1904-05. W. break'r repairs completed, total cost $438,725.13; sheathing e. break'r continued; e. j. at mouth of Cuyahoga R. repaired; work on main entrance and break'r extension continued; dr. *Burton* completed and delivered, **05,** 2335, 2341.

1905-06. Repair and reconstr. of 662′ shore end of w. break'r with concrete begun; imp. of main entrance and break'r constr. continued; 256,580 c. y. dr. from w. basin; dr. *Burton* removed 68,080 c. y. from e. basin, **06,** 1906, 1909, 1910.

1906-07. Repairs to shore end of w. break'r completed; main entrance work and break'r extension continued; 980,820 c. y. dr. and 26,474 c. y. removed by dr. *Maumee,* **07,** 2079, 2081.

1907-08. Main entrance imp. continued; e. break'r constr. continued; 55,295 c. y. dr. from w. basin; 33,185 c. y. dr. from e. basin, completing contract, a total of 1,270,585 c. y. having been removed, **08,** 2155, 2157.

1908-09. Main entrance imp., consisting of 2 pierheads, w. break'r, e. break'r, w. protection and e. protection, completed; extension of main break'r continued, w. division completed, 1908; 746,333 c. y. removed from w. basin, completing contract, a total of 801,628 c. y. having been removed; wharf constr. at foot of Erie St. begun, **09,** 2132–2134.

1909-10. Further extension of e. break'r continued; 232,803 c. y. dr. from shoals in e. and w. basins and entrance chan.; constr. of wharf at foot of Erie St. completed (cost, $84,628.15); dr. *Maumee* removed 2,290 c. y. from shoal at foot of E. 9th St., **10,** 2292, 2293.

1910-11. 222,120.9 t. riprap placed in extension of break'r; 163,812 c. y. dr. from e. and w. basin and entrance chan.; 1,686.7 t. st. used in repairs to timber section e. break'r; 14,448 c. y. dr. from shoal in e. basin; 63,385 t. riprap, etc., used in closing gap bet. timber and rubble mount section e. break'r, **11,** 2493.

1911-12. 124,788.3 t. large st. and quarry run st. placed in extending main break'r eastward; 93,911.1 t. riprap st. and quarry waste used in closing gap bet. timber section of e. break'r and rubble mount section; 20,946 c. y. dr., **12,** 2694.

PHYSICAL CHARACTERISTICS.

D. of water on outer bar diminished 5′ during violent storms, **71,** 194.

Character of lake bottom, **75,** 304.

Description of, **74,** 233; **75,** 309; **93,** 3077; **94,** 2410; **95,** 3102; **97,** 3078; **98,** 2665, 2669, 2670, 2726.

In 1897 the officer in charge did not deem it advisable for physical reasons to abandon constr. of shore arm of break'r, as at that time planned, **98,** 2725.

Storms damaging works (photographs), **00,** 4065.

Surs. made 1901–02 indicate an. deposit of silt amounts to 40,000 c. y., **02,** 502.

Silt deposit, floods and discharge, **04,** 3176, 3186.

Silt shoals in H. too light to be removed efficiently by dr. *Burton,* **05,** 2336, 2343.

Storm on Lake Erie, Oct. 26, 1906, caused considerable settling in the 2,000′ of completed e. break'r where much sand had been used as core filling, **07,** 2080.

A 25′ chan. at R. mouth provided; large outer H. available for docks, and an anchorage nearly constr., **11,** 925.

U. S. dr. *Maumee* wrecked near main entrance; raised and towed to local shipyard, and hull repaired, **12,** 2696.

PLANS. (See Estimates and Projects.)

Sketches of, suggested for a H. of refuge by Board of Trade of Cleveland, **74,** 234.

By P. C. Watmough and Maj. Harwood, **74,** 235.

By Lt. Col. Blunt and Maj. Harwood, **75,** 306.

Discussion of pile ps., **66,** iv, 19, 20, 69–72; **68,** 156; **69,** 133–136; **73,** 338.

Bids received for break'r constr. considered excessive; readvertised with substitution of lake sand as core of break'r; privilege also allowed to quarry st. on West Sister Isld. in Lake Erie belonging to U. S., **03,** 2072.

By Maj. Kingman, imp. of land owned by U. S. in Cleveland H. and used by marine hospital; plan presented for dock constr., etc.; est., $500,000, **03,** 2073.

Specifications for break'r called for a sand core; upon constr. 20% of sand escaped through the st.; plans modified, **04,** 3176.

By Lt. Col. Townsend, approv. by a BE., for completing e. break'r by using quarry-run st. containing not more than 25% st. weighing less than 1 ton in substitution for sand filling of orig. spec., **07,** 2080.

PRIVATE (CITY AND CORPORATE) WORK.

Dr. by the city on bar, **66,** 22.

E. p. in possession of private parties, **66,** 22, 23, ii, 37.

The Cleveland & Pittsburgh RR. Co. permitted to use a portion of the e. p., agreeing to keep it in repair, **77,** 965.

Dr. by city, **90,** 2778; **94,** 2410.

Dr. and other work, by city, **01,** 3246; **02,** 2270; **03,** 2083; **04,** 3187; **05,** 2348.

Considerable amount of filling in rear of U. S. wharf done by city, with au. of U. S.; area so reclaimed will be valuable to the U. S., **12,** 2695.

Cuyahoga R. has navigable d. of 20′ for 5½ m. above H., and is maintained by local authorities, **12,** 1103.

PROJECTS. (See Estimates and Plans.)

Orig. ps. at mouth of Cuyahoga R. and dr.; details not known (see map), **66,** 23.

By Col. Cram, repairs of ps., **66,** 13, 22. Extension of w. p. 500′ and e. p. 575′, 18′ w. and 5′ above water, **66,** 23. Pile-pier constr. adopted for p. extension instead of cribs, **66,** iii, 5, 20.

By Maj. Gillespie, repairs of ps. by day labor, and dr. to 18′ by contract, **71,** 193, 194; completed, **72,** 229.

By Maj. Harwood, repairs to ps. by day labor, **73,** 337; **74,** 222.

By Lt. Col. Blunt, repairs to e. p., **77,** 965.

By BE., as finally adopted, **75,** 303.

By Lt. Col. Blunt, shore arm of break'r by contract as far as available funds would allow, **75,** 303.

By BE., 1875, break'r on w. side of mouth of Cuyahoga R.; est., $1,800,000, **80,** 2141, 2143; **85,** 2228. Modification by Chief of Engineers, **75,** 303; **80,** 2141. Completed in 1883; cost, $800,000, **85,** 2228. Modified in 1884 by BE., by addl. break'r with parapet; est., $500,000, **85,** 2235; **87,** 2317, 2319. Amount required, in 1888, for completion of above proj., incl. app. of 1888, $219,250.

In 1888 Maj. Overman proposed to extend lake arm of e. break'r from about 1,100′ to 3,500′ in l., then incline toward the shore on a line parallel with the "present" proj. break'r, and constr. 2,000 l. f. of break'r, making total of 5,500 l. f. for e. break'r, and increasing anchorage space beyond the 16′ curve from 75 to 200 acres. Est., proposed extension, $300,000. Total in 1888, for completion of orig. and revised proj., $519,250, **88,** 2004, 2006.

By Lt. Col. Smith, 1892, dr. chan. and approach to anchorage, and extension of break'r, at cost of about $25,000, **93,** 3076.

In 1892–93 Lt. Col. Smith est., after revising the existing proj., that it would cost $568,000 to imp. the H., **93,** 3078.

By Lt. Col. Smith, 1894, removal of 200′ of superstr. of w. break'r, that currents might pass through w. anchorage to remove and prevent settlements of sewage; est., $5,000, **95,** 3104.

By Lt. Col. Smith, 1895–96, rebuilding the e. p. as far as could be done with available funds, substr. to be built of cribwork filled with st., the superstr. of concrete masonry, **95,** 3105.

By Lt. Col. Smith, 1896, renewing 322 l. f. of the e. p. and 1,478 l. f. of the w. p.; w. chan. to 260′ for dr.; constr. of 5,440 l. f. w. break'r, and sheathing faces of cribs of e. break'r; est., $860,000, **96,** 2946, 2952.

By Col. Smith, 1898–99, d. the H. to 21′ bet. ps. n. of the RR. br., and from H. line to a line 50′ from break'r and to 25′ over shoal at entrance on the e.; est., $181,000. Est., 25′ d. instead of 21′, $368,000 (not adopted), **99,** 3077; 25′ adopted act June 13, 1902; est., $478,400, **99,** 3061, 3076–78; **12,** 1101.

Break'rs of st. commended, **00,** 4065.

(See Legal proceedings.)

History of, **01,** 578.

By Col. Smith, 1900, au. act June 13, 1902, new entrance to H. and extension of break'r, e. to city limits (for full proj. see **01,** 3278); modified in above act by a proviso requiring that work be discontinued on the shoreward return of the e. break'r, and also by requiring that extension should be in the prolongation of center line of main break'r; $500,000 app. and addl. expend. au. not exceeding $2,300,000; act also app. $125,000 for imp. of H. and mainten., and au. expend. of $40,000 for dr.; total est., $4,481,456. **01,** 3277–3299; **02,** 501, 2269.

$2,800,000 au. act June 13, 1902, increased by $900,000 by act Mar. 3, 1907; also au. by same act, $98,000 for constr. of U. S. dock at foot of Erie St. (H. D. 270, 59th, 2d), **07,** 708.

Au. act June 25, 1910, for timber portion of e. break'r, with new e. break'r extension, and removal of inclined break'r, **10,** 870.

SECRETARY OF WAR.

Approves recom. of Chief of Engineers for proj. for H. of refuge, **75,** 308.

Au. act Aug. 14, 1876, to make agreement with RR. company for use and occupancy of the e. p., **76,** ii, 139.

SURVEYS.

By Col. Raynolds, 1865, **66,** 25.

For H. of refuge, 1873, by Maj. Harwood. **R., 74,** 232.

For break'r, 1874, by Lt. Col. Blunt. **R., 75,** 304.

Of chan. bet. ps., 1881, **81,** 2311.

Ex., 1885, of condition of superstr. of break'r, **86,** 1864.

Hydrographic sur. made, 1892, by Lt. Col. Smith, **93,** 3076; one of the chan. break'rs to the Lake Shore & Michigan Ry. br., made by the same officer, 1895, **95,** 3105.

Entire bottom of the w. side of the H, shore line to the break'r, ex., 1895–96, by Lt. Col. Smith, **96,** 2942.

Sur., break'r at H., with view to determining advisability of changing the plan so as to abandon the proposed e. shore arm, and in lieu thereof extending break'r e. in a general direction parallel with the shore. Au. act June 3, 1896, made by Col. Smith, 1897, **98,** 2724.

Minor surs., **99,** 3059.

Resolution of Congress, 1899, called for **R.** on necessity and probable cost of partly restoring H. d. **R.** by Col. Smith (see Projects), **99,** 3075.

Au. act June 6, 1900; made by Col. Smith (H. D. 118, 56th 2d), **01,** 585, 3278, 3285.

Made by Maj. Kingman, **02,** 502; **03,** 2083; **04,** 3175, 3176.

Au. act Mar. 3, 1905, for obtaining wharf room for storage of U. S. property; made, 1905, by Maj. Kingman; est., $98,000 (H. D. 270, 59th, 2d), **07,** 717.

Sur. and est. au. act Feb. 27, 1911, for imp. Cuyahoga R. from mouth to a more s. connection with the Ohio Canal; sur. made, **R.** 1912, by Col. Millis, **12,** 1111, 2696.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1101.

Maps (H. D. 270, 59th, 2d):

N. and nw. lakes, showing location of imp., **66,** 24.

H., showing condition of, in 1865, **66,** 24.

Sketches of proposed H. of refuge, **74,** 235; **75,** 306.

81, 2310; **82,** 2400; **88,** 2006, 2010; **91,** 2856; **94,** 2412; **95,** 3106; **96,** 2952; **97,** 3080; **98,** 2676 (photographs, **99,** 3059; **00,** 4068); **03,** 2080; **04,** 3186; **09,** 2134; **10,** 2294; **11,** 2494.

QQ–26 CLEVELAND, OHIO. (Old Cuyahoga river bed.)

ENGINEERS.

Chief of Engineers. R., 84, 318; **85,** 344, 2249.

In charge:

Maj. J. M. Wilson, 1884. **R., 84,** 2110.

Maj. L. C. Overman, 1885. **R., 85,** 2249.

PHYSICAL CHARACTERISTICS.

Old R. bed described, **84,** 2110; **85,** 2250.

SURVEYS.

Ex. au. act Aug. 2, 1882, and July 5, 1884; made by Majs. Wilson (**R.** unfav. to immediate imp.) and Overman (**R.** fav.), **84,** 2110; (Chf. E. **R.** unfav.), **85,** 2249.

QQ–27 CHAGRIN RIVER, OHIO.

COMMERCE.

None of importance, **81,** 2340; **87,** 2334.

ENGINEERS.

Chief of Engineers. **R., 80,** 228; **81,** 314; **89,** 328.

In charge:
Maj. J. M. Wilson. **R., 81,** 2339.
Maj. L. C. Overman. **R., 87,** 2333; **89,** 2337.

PHYSICAL CHARACTERISTICS.

Description of; flows into Lake Erie about 10 m. w. of Fairport, Ohio, **89,** 2337.

PLANS.

By Maj. Wilson, 1881, diverting stream into main chan. by cutting off w. branch at its head; 2 ps., 1,400′ and 1,300′ l., resp., to extend into lake on either side of main chan., and for dr. bet. ps. Est., $200,420, **81,** 2339, 2340.

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Wilson, **80,** 228.
Ex. of mouth au. Aug. 5, 1886; made by Maj. Overman (**R.** unfav.), **87,** 2333.
Ex. (near Willoughby) au. act Aug. 11, 1888; made, 1889, by Maj. Overman (**R.** unfav.), **89,** 2336.

QQ–28 FAIRPORT HARBOR (Grand River Harbor), OHIO.[1]

APPROPRIATIONS.

1825,	$1,000.00, **66,** iii, 32.
1826,	5,620.00, **66,** iii, 32.
1828,	9,135.11, **66,** iii, 32.
1830,	5,563.18, **66,** iii, 32.
1831,	5,680.00, **66,** iii, 32.
1832,	2,600.00, **66,** iii, 32.
1834,	10,000.00, **66,** iii, 32.
1836,	6,000.00, **66,** iii, 32.
1838,	10,000.00, **66,** iii, 32.
1844,	10,000.00, **66,** iii, 32.
1852,	10,000.00, **66,** iii, 32.
1864,	24,453.24, **66,** iii, 32; **67,** 141.
1866,	24,072.00, **66,** iii, 32.
1867,	60,000.00, **67,** 141.
1874,	20,000.00, **74,** 51.
1875,	15,000.00, **75,** 164.
1876,	5,000.00, **76,** 142.
1878,	5,000.00, **78,** 130, 1264.
1880,	3,000.00, **80,** 2154.
1881,	10,000.00, **81,** 2321.
1882,	10,000.00, **82,** 2408.
1884,	10,000.00, **84,** 2109.
1886,	18,750.00, **86,** 1870.
1888,	10,000.00, **88,** 2012.
1890,	30,000.00, **90,** 2783.
1892,	35,000.00, **92,** 2507.
1894,	20,000.00, **95,** 3112.
1894,	5,434.18, act of Aug. 8.
1896,	30,000.00, **96,** 2955.
1899,	100,000.00, **99,** 3066.
1900,	*3,000.00, **01,** 3258.
1902	*1,800.00, **02,** 2280.
	200,000.00, **02,** 2281.
1905,	135,000.00, **05,** 2351.
1907,	100,000.00, **07,** 2087.
1909,	*5,000.00, **09,** 2137.
1910,	100,000.00, **10,** 2297.
1911,	105,000.00, **11,** 2500.
1912,	45,000.00, **12,** 2701.

Total, 1,206,107.71 (incl. $208.44 from sales, etc., $1,206,316.15, **12,** **2701**).

COMMERCE.

H. of refuge much-needed, **66,** 22.
Local C. not important, **67,** 219.
Description of, **95,** 3111.
1895–96 the H. 3d on the lake for shipments of coal and iron ore, and 5th in the total of all freight, **96,** 2955.
1896–97, 2,000,000± t., **97,** 3084.
Increasing, **06,** 689.
Marked reduction in rates, **10,** 874; **12,** 1106.
1911, 1,456,000± t., a decrease of 915,000± t. from 1910, **12,** 1106.

CONTRACTS. (m.=material; l.=labor.)

1866. J. Loveday, iron, **66,** iv, 74. *
1867. J. Loveday, iron, **67,** 232, 233. J. E. & D. E. Bailey, m. and l., **67,** 232, 233. Brooks & Adams, m., **67,** 232, 233.
1872. Hemenway & Garfield, m., l., and dr., **72,** 230, 232; **73,** 339.
1874. Hemenway & Garfield, m. and l., **75,** 311, 312. Cartwright & McCurdy, iron, **75,** 311, 312; **76,** ii, 562.
1875. Wilcox & Merry, m. and l., **75,** 311, 312; **76,** ii, 562. W. H. McCurdy, iron, **75,** 311, 312; **76,** ii, 562.
1879. C. Schulz, m. and l., **79,** 1698. S. A. Sprague, iron, **79,** 1699.
1881. D. M. Averill, p. repairs, **81,** 2321.
1882. E. H. French, dr., 27¢ c. y., **82,** 2409. J. Bennett, iron, **83,** 1915. C. T. Dennis, p. extension, **83,** 1914.
1885. W. E. Rooney, dr., 23⅞¢ c. y., **85,** 2236. C. D. Merry, p. extension and repairs, **85,** 2236.
1886. W. J. Starkweather, dr., 28¢ c. y., **87,** 2324. L. P. Smith, repair to ps., **87,** 2324.
1887. Kerr, Stang & Gillmore, p. extension, **87,** 2324.
1888. B. S. Horton, p. extension and repair, $6,144, **89,** 2328.
1889. Q. Gillmore, dr., 25¢ c. y., **89,** 2328.
1890. J. R. Irwin, dr., 23¢ c. y., **90,** 2781. American Transportation Co., dr., 17½¢ c. y., **91,** 2862. Q. Gillmore, p. extension and repair, $14,724, **91,** 2862.
1891. J. R. Irwin, dr., 17½¢ c. y., **92,** 2507.
1893. J. B. Donnelly, p. extension, $19,033.32±, **93,** 3084. Sadler & Allen, dr., 20¢ c. y., s. m., **93,** 3084.
1895. J. B. Donnelly, removal of and replacing portion of p., $10,921±, **95,** 3112.
1899. E. J. Hingston, dr. (circular letter), 18¢ c. y., **99,** 3065. J. B. Donnelly, part of w. break'r (dr., 30¢ c. y.; timber, st., ironwork, and mattress work), $24,428, **99,** 3067.
1902. Buffalo Dredging Co., dr. through bars at entrance, 32¢ c. y., **02,** 2279. The Donnelly Contracting Co., reconstr. and repairing parts of e. and w. ps.; quantities and cost (est.) given, **03,** 2088, 2090.
1903. Rogers & O'Brien, excavating 15,000 c. y., 31¢ c. y., **03,** 2091.
1904. (See Operation, 1904–05.)
1905. The Federal Contracting Co., constr. shore end of w. break'r, **06,** 1913.
1907. Sea Coast Construction Co., extension of w. break'r lakeward, constr. st.-filled timber crib pierhead, w. side of entrance, and connecting this

* Allotment. [1] Sur.—**R.,** 1825, est. $26,997.81; Nov. 9, 1864, est. $56,726. (H. D. 482, 55th, 2d.)

with timber crib break'r by rubble mound, **08,** 2163.

1910. Great Lakes Construction Co., break'r and pierheads; st., $1.329 t., **11,** 2499.

DOCUMENTS. (Not printed in reports.)

R., Maj. Graham, 1857, S. D. 42, 35th, 1st.

R., Lt. Col. Cram, 1864, and all reports of early operations.

ENGINEERS.

Chief of Engineers. R., 66, 5, ii, 41, iii, 4, iv, 15, 19; **67,** 30, 220; **68,** 41; **69,** 37; **70,** 48; **71,** 47; **72,** 44, 230; **73,** 44, 339; **74,** 51; **75,** 56; **76,** 108; **77,** 115; **78,** 130; **79,** 173; **80,** 227; **81,** 311; **82,** 305; **83,** 313; **84,** 317; **85,** 341; **86,** 336; **87,** 302; **88,** 275; **89,** 326; **90,** 295; **91,** 371; **92,** 350; **93,** 401; **94,** 376; **95,** 410; **96,** 365; **97,** 459; **98,** 449; **99,** 532; **00,** 598; **01,** 580; **02,** 502; **03,** 551, 979; **04,** 602, 1209; **05,** 613; **06,** 688; **07,** 711; **08,** 755; **09,** 792; **10,** 873; **11,** 927; **12,** 1105.

Boards. Date unknown; approv. plan suggested by Col. H. Bache, 1853, for extension of e. p. to l. of w. p., **66,** iv, 15. Convened, Feb. 26, 1872, at Buffalo. Recom. (Lt. Col. Woodruff not concurring) extension of w. p. 600′ and e. p. 300′; est., $53,000, **72,** 243, 244. (Lt. Col. Woodruff, Majs. McFarland and Wilson, and Capts. Farquhar and Gillespie.)

In charge:

Maj. J. D. Graham, T. E., 1857. **R.,** S. D. 42, 35th, 1st.

Lt. Col. T. J. Cram, 1864–67. **R.,** (Col.) **66,** 21, iv, 16; **67,** 141, 217, 220.

Maj. W. McFarland, 1868–70, **68,** 158; **69,** 137; **70,** 178.

Capt. G. L. Gillespie, 1871–72; **71,** 189. **R., 71,** 195; **72,** 230, 240.

Lt. Col. I. C. Woodruff. **R., 72,** 241, 243.

Maj. F. Harwood, 1873–74. **R., 73,** 338; **74,** 222.

Lt. Col. C. E. Blunt, 1874–77; **74,** 215. **R., 75,** 310, 312; **76,** ii, 561; **77,** 965.

Maj. W. McFarland, 1878. **R., 78,** 1263.

Maj. J. M. Wilson, 1878–83. **R., 79,** 1698; **80,** 2147; **81,** 2320; **82,** 2407.

Maj. L. C. Overman, 1883–92. **R., 83,** 1914; **84,** 2108; **85,** 2235; **86,** 1868; **87,** 2324; **88,** 2011; **89,** 2326; **90,** 2781; **91,** 2859.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2506; **93,** 3081; **94,** 2414; **95,** 3107; **96,** 2953; (Col.) **97,** 3082; **98,** 2676; **99,** 3064; **00,** 4070.

Maj. Dan C. Kingman, 1901–05. **R., 01,** 3255; **02,** 2279; **03,** 2084; **04,** 3188; (Lt. Col.) **05,** 2349.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1912; (Lt. Col.) **07,** 2086.

Lt. Col. John Millis, 1908–. **R., 08,** 2160; **09,** 2136; (Col.) **10,** 2295; **11,** 2499; **12,** 2700.

Assistants:

Capt. F. U. Farquhar, **67,** 217.

Capt. M. B. Adams, in immediate charge, **75,** 292.

F. S. Burrowes. **R., 94,** 2416.

G. T. Nelles. **R., 01,** 3259; **02,** 2281; **03,** 2089; **04,** 3190; **05,** 2352.

ESTIMATES. (See Plans and Projec s.)

By Maj. Graham, 1857, extension of p. 716′, $32,819.39; tearing away old work and repairs, $6,179.55; dr., etc., $2,500; total, $41,498.94; S. D. 42, 35th, 1st.

By Lt. Col. Cram, 1864, extension of e. p. 510′, $24,072, **66,** 22, 24, iv, 73.

By Col. Cram, 1867, extension of e. p. 320′, $21,631, **67,** 141.

By Capt. Gillespie, 1872, extension of w. p. 360′, $21,716; extension of w.p. 490′ and e. p. 130′, $37,000, **72,** 241.

By BE., 1872, extension of w. p. 600′ and e. p. 300′, $53,000, **72,** 243.

By Maj. Harwood, 1873, entire completion, $30,000, **73,** 44.

By Lt. Col. Blunt, 1875, 3 plans for converting the old bed of the R. into a H. of refuge: (1) $6,778,000; (2) $4,413,000; (3) $2,295,000, and for ice H., $350,000, **75,** 313.

By Maj. Wilson, 1879, completion of existing proj., $5,000, **79,** 1699.

LAW MATTER, LEASES, ETC.

In 1899 the e. p. licensed by the Sec. of War to a corporation for 1 year; an. rental, $2,000, which was paid for the 1st year, but after that the corporation still retained and made use of the p., refusing, however, to pay rental. In 1891 matter referred to the Dept. of Justice; 1894, nothing had been done in the matter, **94,** 2415, 2418; **95,** 3111.

In 1894 the American Transportation Co. made claim for an amount which had been forfeited under the terms of a contract for dr., 1890–91. **95,** 3109.

In 1895 information given to the U. S. district attorney that a dock company was engaged in placing permanent obstr. in Grand R. beyond the dock line, **95,** 3111.

Reference to unsettled question relating to ownership of portion of old e. p., **12,** 2700.

SS. *Spokane* struck e. j., doing considerable damage, **01,** 3257.

OPERATIONS.

1865. Ps. repaired, **66,** 12, 21.

1866–67. Extension and repairs of ps., **67,** 141.

1867–68. Repairs to old ps.; extension of e. p.; 4 cribs placed, **68,** 41.

1868–69. 6 cribs placed and superstr. built, completing the e. p. extension, **69,** 137.

1871–72. Ps. repaired by day labor, **72,** 230.

1872–73. Extension of e. p. 240′; 120′ superstr. built on it; extension of w. p. 450′, and 96′ of superstr. built; repairs made and removal of wreck, **73,** 44, 338.

1873–74. Extension of ps. by contract, **75,** 310.

1874–75. Completion of both ps. as proj.; w. p. repaired, **75,** 56.

1875–76. Extension of w. p. 136′ by contract, **76,** ii, 562.

1876–77. Piling at inner ends of ps. and catchsand fence built; ps. repaired, **77,** 965, 966.

1879–80. 575 l. f. e. p. superstr. rebuilt, 6,975 c. y. dr. from bar, and repairs to ps., **80,** 2153.

1881–82. 376 l. f. e. p. superstr. rebuilt and extensive repairs made; 10,000 c. y. dr. through bar, **82,** 2407.

1882–83. 4 cribs completed, **83,** 1914.

1883–84. W. p. extended 160′ and settled part rebuilt; minor repairs to e. p., **84,** 2109.

1884–85. 10,082 c. y. dr., **85,** 2236.

1885–86. E. p. extended 80′, w. p. superstr. repaired, **86,** 1869.

1886–87. 4,930 c. y. dr. through bar and bet. the ps.; repairs made to ps.; extension of e. p. in progress, **87,** 2324.

1887–88. E. p. extended 200′ under contract, **88,** 2012.

1888–89. 8,240 c. y. dr. bet. the ps.; w. p. extension begun, **89,** 2326.

1889–90. W. p. extension completed; 3,000 c. y. dr., **90,** 2781.

1890–91. 42,001 c. y. dr.; 3 cribs sunk in extension of w. p., **91,** 2860.

1891–92. 51,353 c. y. dr., **92,** 2506.

1892–93. 10,562 c. y. dr. and extension of e. and w. ps. in progress, **93,** 3082.

1893–94. 2,263 c. y. dr., **94,** 2414; and in connection with previous year the extension of the e. p. 120 l. f. and the w. p. 160 l. f. completed, **94,** 2415.

1894–95. Part of the w. p. removed and rebuilt, **95,** 3108; 7,041 c. y. dr., **95,** 3109; and H. lines estab., **95,** 3111.

1895–96. 7,968 c. y. dr., **96,** 2955.

1896–97. 56,995 c. y. dr., **97,** 3083.

1897–98. Dr. in progress, **98,** 2678.

1898–99. Soundings made through ice for break'r foundations; 9,966 c. y. dr., **99,** 3065.

1899–00. Part of w. break'r in progress; about 40,000 c. y. dr., **00,** 4072.

1900–01. Inner 828′ w. break'r completed; method of constr., dimensions of parts, and object of arrangement described; 43,500 c. y. dr. from outer bar, **01,** 3256, 3259–60.

1901-02. Damage to outer end of e. j. repaired; 617′ of w. p. and 520′ e. p. strengthened; 21,500 c. y. dr., **02,** 2279.

1902-03. Reconstr. and repair of js. commenced, **03,** 2091. 15,831 c. y. dr. from bar at entrance to jettied chan., **03,** 2092.

1903-04. 1,540 l. f. sheathing placed in w. p. and 309 l. f. in e. p.; cost during year, and total cost given, **04,** 3191. Concrete work during year given; U. S. dr. *Maumee* removed 30,500 c. y., at 12½¢ c. y., forming chan. 21′ x 300′, **04,** 3192.

1904-05. Repairs to e. and w. ps. completed; extent, character, quantities, and cost given, **05,** 2352–2355. 10 112 c. y. dr. by B. & O. RR. and Detroit Dredging Co.'s dr., at 18¢ to 25¢ c. y., and 21,016.5 c. y. dr. by dr. *Burton* at 8.4¢ c. y., producing chan. 21′ x 250′, **05,** 2354.

1905-06. Extension of w. break'r to shore 30% completed; outer 600 l. f. of substr. ready for st. covering and footing course placed in lake side; inner 225′ completed; work done and cost given, **06,** 1912. Dr. *Burton* removed 55,722 c. y. from chan. to d. of 20–23′ across bar, **06,** 1912–1913.

1906-07. Extension of w. break'r to shore 74% completed; outer 600′ and inner 900′ completed, leaving 200′ built above w. surface; 34,248 c. y. dr. by dr. *Burton* through bar, **07,** 2086.

1907-08. The joining of inner end of timber crib, w. break'r, with shore by rubble mound structure 1,500′ l., completed; work done and cost given; work done and cost of extension seaward during year stated, **08,** 2161. 19,168 c. y. dr. by dr. *Burton* from outer bar, **08,** 2162.

1908-09. Pierhead crib, w. break'r, constr., sunk in place and filled with st., and break'r built up to within 4′ of m. l. l. for 850′; 10,616 c. y. dr. from outer bar by dr. *Burton* at field cost of $1,-998.61, **09,** 2136. Dr. *Burton* repaired, **09,** 2137.

1909-10. Concrete superstr. placed on pierhead crib; substr. 1,000′ completed and work on superstr. advanced; 10,823 c. y. dr. from chan., **10,** 2296.

1910-11. Outer 1,000′ w. break'r and w. pierhead completed; st. placed in e. break'r and pierhead crib commenced; tables of quantities and cost of work completed and commenced given; 8,927 c. y. dr. by dr. *Burton,* **11,** 2499.

1911-12. Pierhead crib, e. break'r, completed and placed and work on superstr. begun; break'r built up to −4′ throughout its l.; work about 45% completed; detailed statement of work given, **12,** 2700. Dr. *Burton* dr. 7,121 c. y. from entrance chan. and dr. site for pierhead, **12,** 1106, 2700. 21′ obtained across bar; proj. 71% completed, **12,** 1106.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3082; **94,** 2415; **95,** 3108; **96,** 2955, 2956; **98,** 2677; **05,** 614, 2349, 2354, 2355; **12,** 1106.

The H. exceptionally subject to the formation of sand bars, **95,** 3108; **99,** 3066.

The H. simply a part of Grand R., Ohio, near its mouth, where it flows into Lake Erie, **96,** 2956.

Shore line w. of js. advanced about 1,700′ since imp., **01,** 3256.

Difficulty of entering H. during storms, **01,** 3257.

Sand movement at entrance more marked than at any other H. in district; observations in progress, **02,** 2279–2280.

Effect of storm of Nov., 1901; current not sufficient to hold up sand, **02,** 2280.

Observations for nearly 50 years show no change e. of js., **02,** 2280.

Discussion of causes of bar formation, **03,** 2084–2087, 2092.

Flood and ice gorges in Jan., 1904, caused scouring under js. and unequal settlement, and left d. of w. on bar not greater than 8′ or 9′, **04,** 3188.

H. suffers from movement of sand, **06,** 688.

Draft of largest vessels using H., 20′, **06,** 689.

All depths referred to m. l. l. 1860–1875—572.77 above m. t. at New York, **12,** 1106.

PLANS. (See Estimates and Projects.)

By Col. Cram, 1866, to abandon a portion of w. p. and rebuild it parallel to e. p., and for dr. through outer bar, **66,** 21.

By Capt. Gillespie, 1872, removal of flare in w. p., and extension of 360′; est., $21,716. Extension of w. p. parallel to e. p., and extension of e. p.; total extension, 460′; est., $27,000. Total extension of ps., 770′; inclining w. p. extension toward e. p.; est., $46,000. Removal of superstr. of flare of w. p., and extension of both ps. to the general line of the ice bar; total extension, 620′; est., $37,000. **72,** 240, 241.

By Lt. Col. Blunt, 1875, converting the old bed of the R. into a H. of refuge by dr. a basin with an area of 492 acres, constr. of ps., etc.; est., $6,778,000. For a basin of smaller dimension, ps., etc.; est., $4,-413,000; or for still smaller basin, ps., etc.; est., $2,295,000. For an ice H. by dr., revet., etc.; est., $350,000. **75,** 313.

PRIVATE (CORPORATE) WORK.

Dr. by Painesville & Youngstown RR. Co., **80,** 2153.

PROJECTS. [See Estimates and Plans.)

By Lt. Col. Cram, 1864, repairs of old ps., **66,** 13.

By Col. Cram, 1867, extension of e. p. 510′, **67,** 221.

By BE., 1872, removal of superstr. from flare of w. p. and extension of both ps. an aggregate of 900′; est., $53,000, **72,** 230, 243, 244.

By Maj. Harwood, 1874, protection of the inner ends of the ps., **74,** 222.

By Lt. Col. Blunt, 1875, extension of w. p. 150′, **75,** 311.

By Maj. Wilson, 1879, removal of superstr., **79,** 173, 1698.

By Capt. Maurice, 1825, removal of bar at mouth of R. with parallel ps. 200′ apart, extending out to 10′; the w. p. to be longer than the e. and to flare to the w.; est., $26,997.81, **80,** 2147. For extension and changes in orig. proj., see history of work, **80,** 2147.

In 1879 the w. p. had reached 1,060±′ and the e. p. 1,250′, **81,** 2320.

By Maj. Wilson, 1880, extension of the w. p. 500′ and e. p. 600′, renewal of superstr., and dr. in chan. to maintain d. 15′ at H. entrance; est, $80,300, **80,** 2153. Increased in 1882 to $93,000, **82,** 2407; **87,** 2325.

In 1890 Maj. Overman proposed increased d. of 18′ by extension of both ps. lakeward 600′, with dr. bet. ps., beyond their ends, and in Grand R.; est., $114,100, **90,** 2782.

In 1892–93 Lt. Col. Smith revised cost of completing 2 parallel ps. in accordance with the existing proj., making the total $212,000, **93,** 3081.

By Lt. Col. Smith, in 1895, removing nearly 138 l. f. of the w. p. and replacing the removed portion with new; cost, $10,921, **95,** 3108.

By Lt. Col. Smith, 1896, for 2 break'rs converging toward the lake, with 500±′ bet. outer ends to form an entrance, and the dr. of an area bet. to 20′; est., $510,000; the e. break'r to be 1,350 l. f. and the w. break'r 2,050′, **96,** 2956.

By Lt. Col. Smith, in 1896, expend. only such part, not exceeding $10,000, of the app. of 1896, for mainten. of the chan. as might be required, balance to be held for further app. before beginning the constr. of the break'rs as proposed above, **97,** 3084.

In 1900 Col. Smith est. that because of the advance in the price of materials and necessary changes in constr. methods it would cost $480,000 to complete proj., **00,** 4071; and for that year also $184,825 would be required for mainten. and repair, **00,** 4073.

By Maj. Kingman, mainten. and repairs; est., $184,825, **01,** 3256, 3257.

By Maj. Kingman, modification of proj. for extension of w. break'r (rubble mound type) to connect with shore; est., $273,000, **03,** 2087, 2092. Modi. au. by act. Mar. 3, 1905; rubble mound structure adopted, top and sides to be covered with heavy blocks of st., **05,** 614, 2349. Est., $120,000, **12,** 1105.

SURVEYS.

By W. J. Casgrain, 1865, under direction of Col. Raynolds, **66,** 25; **69,** 138.

By Col. Cram. **R., 67,** 217.

By Capt. Gillespie. **R., 72,** 240.

By Lt. Col. Blunt. **R., 75,** 312.

By Maj. Wilson. **R., 79,** 173, 1698.

Ex. H., 1881, **81,** 2320.

Sur. H., 1882, **82,** 2407.

Hydrographic sur. made, 1892, covering the chan. and the bar outside to 18′ in the lake, by Lt. Col. Smith, **93,** 3081.

In 1893 an ex. and sur. of the e. p., occupied by a private corporation, made by Lt. Col. Smith, **94,** 2415.

Ex. of the ps. made, 1894, **95,** 3108, and sur. of the bar made in 1894–95 by Lt. Col. Smith, **95,** 3109.

Resur. of the port with an est. of the cost of imp. that might be recom. au. by resolution of Congress Mar. 24, 1896; and a **R.** was submitted, 1896, by Lt. Col. Smith, **96,** 2956.

Ex. of bar made, 1896–97, by Lt. Col. Smith, **97,** 3083.

Sur. and map of the chan. and bar made, 1897, by Col. Smith, **98,** 2677.

Maps:

Of n. and nw. lakes, showing location of H., **66,** i.

Of the H., by Col. Cram, in 1865, **66,** i; **81,** 2320; **91,** 2861; **94,** 2418; **95,** 3112; **09,** 2136; **10,** 2296; (photographs) **04,** 3192.

QQ–29 GRAND RIVER, OHIO.

ENGINEERS.

Chief of Engineers. **R., 91,** 373; **92,** 352.

In charge. Maj. L. C. Overman, 1890. **R., 92,** 2511, 2513.

PHYSICAL CHARACTERISTICS.

Description of; flows into Fairport H., **92,** 2511.

PLANS.

By Maj. Overman, 1891, chan. 160′ x 18′ x 7,310′; est., $39,000, **92,** 2514.

SURVEY.

Sur. made, 1891, by Maj. Overman, **92,** 2513.

QQ–30(a) BIG (Cunningham) CREEK, OHIO.[1]

APPROPRIATIONS.[2]

1826,	$2,000.00
1828,	1,517.76
1829,	2,956.00
1832,	[3] 1,500.00
1833,	[3] 500.00
1836,	1,257.00
1836,	32.36
1837,	5,000.00
1838,	5,000.00
Total,	19,763.12

QQ–30(b) COWLES CREEK, OHIO.

ENGINEERS.

Chief of Engineers. **R., 89,** 328.

In charge. Maj. L. C. Overman, 1888. **R., 89,** 2335.

PHYSICAL CHARACTERISTICS.

Description of; flows into Lake Erie 16 m. e. of Fairport H. and 9 m. w. of Ashtabula H., **89,** 2335.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1889, by Maj. Overman (**R.** unfav.), **89,** 2335.

QQ–31 ASHTABULA HARBOR, OHIO.[4]

APPROPRIATIONS.

1826,	$12,000.00, **66,** iii, 32.
1828,	2,403.50, **66,** iii, 32.
1829,	6,940.25, **66,** iii, 32.
1831,	7,015.00, **66,** iii, 32.
1832,	3,800.00, **66,** iii, 32.
1833,	3,400.00, **66,** iii, 32.
1834,	5,000.00, **66,** iii, 32.
1835,	7,591.00, **66,** iii, 32.
1837,	8,000.00, **66,** iii, 32.
1838,	8,000.00, **66,** iii, 32.
1844,	5,000.00, **66,** iii, 32.
1852,	10,000.00, **66,** iii, 32.
1853,	42.64, **66,** iii, 32.
1859,	809.65, act Feb. 9.
1866,	24,708.82, **66,** iii, 32.
1867,	54,000.00, **67,** 140.
1871,	15,000.00, **71,** 195.
1872,	15,000.00, **72,** 232.
1873,	16,000.00, **73,** 44.
1874,	35,000.00, **74,** 51.
1875,	25,000.00, **75,** 56.
1876,	5,000.00, **76,** ii, 562; **77,** 115.
1878,	12,000.00, **78,** 130, 1265.
1879,	9,000.00, **79,** 1702.
1880,	20,000.00, **80,** 2164.
1881,	20,000.00, **81,** 2325.
1882,	20,000.00, **82,** 2411.
1884,	22,500.00, **84,** 2117.
1886,	30,000.00, **86,** 1872.

[1] Sur.—R. July 17, 1826, est. $2,000. (Treas. D. 373, 1882. H. R. D. 482, 55th, 2d.)
[2] Removing obstrs. at mouth of creek.
[3] Pierhead.
[4] Sur.—**R.,** July 14, 1826, est. $12,000. (H. D. 482, 55th, 2d.)

1888,	25,000.00,	**88,** 2014.
1890,	40,000.00,	**90,** 2786.
1892,	70,000.00,	**92,** 2510.
1894,	75,000.00,	**95,** 3116.
1896,	50,000.00,	**96,** 2964.
1899,	50,000.00,	**99,** 3068.
1900,	110,000.00,	**00,** 4079.
1900,	*3,000.00,	**02,** 2286.
1901	*[1] 2,858.45,	**02,** 2286.
	2,000.00,	**01,** 3262.
1902	200,000.00	**02,** 2286.
	200,000.00	
1903,	118,000.00,	**03,** 2095.
1905,	20,000.00,	**05,** 2358.
1907,	20,000.00,	**07,** 2091.
1910,	115,000.00,	**10,** 2298.
1911,	376,430.00,	**11,** 2503.
1912,	200,000.00,	**12,** 2704.
Total,	[2] 2,080,499.31 ($2,094,256.36—**12,** 2704).	

COMMERCE.

Rapidly increasing, **79,** 1702.

Increase in t., 1884 to 1890, **91,** 2864.

Development of H. as shipping point for ore and coal thought remarkable, amount of such freight handled, 1892, being about 4,500,000 t., **93,** 3087; in 1893–94, port considered greatest shipping point on the lake for coal and ore, **94,** 2422; **97,** 3087; **98,** 2681; **99,** 3069.

Would be greatly benefited by completion of break'rs, **00,** 4078.

Marked reduction in rates, **10,** 876.

Chart showing relation of an. app. to tonnage and value of latter, **11,** 2503.

Traffic, 1911, 13,000,000+t., a decrease of 3,000,000+t. from 1910. Impracticable to determine how much of lowered freight rates due to this particular imp., **12,** 1108.

CONTRACTS.

1866. K. McKenzie, and J. Loveday, materials and labor, **67,** 232, 233.

1868. R. R. Dodge, dr. sand, $0.30; r., $1.20, **69,** 140; **70,** 179.

1871. Lee & Dunbar, blasting and dr. r., $2.25, **71,** 195; **72,** 232; $2.75 and $0.50, **73,** 341.

1872. Lee & Dunbar, dr. sand, $0.35, **73,** 341.

1873. F. A. Seymour, drilling, blasting, and removing r. and sand, $2.35, $0.50, and $0.35, **74,** 223; **73,** 341.

1874. Hemenway & Garfield, materials and labor. Cartwright, McCurdy & Co., iron, **75,** 314.

1875. Case & Jennings, drilling, blasting, and dr. r. and sand, $1.80 and $0.50, **75,** 315; **76,** ii, 562.

1877. Charles H. Strong, materials and labor. W. H. McCurdy, iron, **77,** 967.

1878. Kenneth McKenzie, timber and labor. Pratt & Co., iron, **79,** 1704. K. McKenzie, crib constr., **80,** 2166.

1879. Cleveland, Brown & Co., iron. Hemenway & Hayes, crib constr., **80,** 2166; contract annulled as to principals and continued by bondsmen, **81,** 2324.

1880. J. Barnett, iron; G. W. and A. T. McKenzie, materials and work; J. Caldwell, materials and work; F. Wilson, iron; D. B. McCoy, dr., 20¢ c. y., **81,** 2324, 2327.

1883. G. B. Rasher, dr., 30¢ c. y., **84,** 2115.

1884. McKenzie & Barrett, dr. and p. constr., **85,** 2244.

1886. L. P. & J. A. Smith, dr. and p. constr., **85,** 2244.

1887. Carkin, Stickney & Cram, r. removal and dr., **87,** 2331.

1888. Carkin, Stickney & Cram, r. excavation, $1.90 c. y., **89,** 2332. B. S. Horton, p. extension and repair, $8,920, **89,** 2333.

1890. Q. Gillmore, p. extension and repair, $9,733.12, **91,** 2867.

1892. Carkin, Stickney & Cram, removal and rebuilding p., and p. extension; total, $61,056.20, **93,** 3088.

1893. Sadler & Allen, dr., 20¢ c. y., s. m., **93,** 3088.

1895. Carkin, Stickney & Cram, r. excavation, 97¢ c. y.; furn. dr. plant, $10 per hour, $28,857, **95,** 3116.

1897. L. P. & J. A. Smith, break'r constr., $43,139.63, **97,** 3088.

1899. E. J. Hingston, dr., 20¢ c. y. (circular letter), **99,** 3069.

1900. Donnelly Contracting Co., constr. break'rs of st. and pierheads of timber, st., and concrete, $407,410, **00,** 4083; **01,** 3263.

1903. W. A. McGillis & Co., dr., 30¢ c. y., **03,** 2097.

1904. Detroit Dredging Co., dr., 30¢ c. y., **04,** 3199.

1905. U. S. Fidelity & Guaranty Co., constr. e. and w. break'rs (to complete contract of Donnelly Contracting Co.); Federal Contracting Co., constr. shoreward end of w. break'r, $142,480, **06,** 1917.

1909. Edward Gillen Dock, Dredge & Construction Co., extending and repairing break'r, st. $1.45 per t., **10,** 2298, 2299.

1911. Edw. Gillen Dock, Dredge & Construction Co., break'r constr., unit prices given, **12,** 2704.

ENGINEERS.

Chief of Engineers. **R., 66,** iii, 32, iv, 13; **67,** 30; **68,** 42; **69,** 38; **70,** 49; **71,** 47; **72,** 44; **73,** 44; **74,** 51; **75,** 56; **76,** 108; **77,** 115; **78,** 130; **79,** 173; **80,** 227; **81,** 311; **82,** 306; **83,** 314; **84,** 318; **85,** 342; **86,** 337; **87,** 302; **88,** 276; **89,** 327; **90,** 296; **91,** 372; **92,** 351; **93,** 402; **94,** 376; **95,** 411, 413; **96,** 366; **97,** 460; **98,** 450; **99,** 533; **00,** 600; **01,** 581; **02,** 503; **03,** 553; **04,** 604; **05,** 615; **06,** 689; **07,** 712; **08,** 757; **09,** 794; **10,** 875, 879; **11,** 929; **12,** 1106.

Boards:

Convened, Cleveland, Ohio, Oct. 25, 1899, S. O. No. 55, Oct. 6, 1899, to consider and report on use of st. in break'rs for Hs. of Black R., Ashtabula, Conneaut, and Fairport, Ohio, **00,** 4084. **R., 00,** 4086.

(Col. J. A. Smith, Maj. C. B. Sears, Maj. T. W. Symons.)

In charge:

Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st.

Col. T. J. Cram, 1866–67. **66,** ii, 41. **R., 66,** iv, 10; **67,** 230, 233.

Maj. W. McFarland, 1868–70. **R., 68,** 159; **69,** 139; **70,** 179.

Maj. G. L. Gillespie, 1871–72. **71,** 189. **R., 71,** 195; **72,** 232.

Maj. F. Harwood, 1873–74. **73,** 42. **R., 73,** 340; **74,** 223.

Lt. Col. C. E. Blunt, 1874–77. **74,** 215. **R., 75,** 314; **76,** ii, 562; **77,** 963.

Maj. W. McFarland, 1878. **R., 78,** 1264.

Maj. J. M. Wilson, 1878–82. **R., 79,** 1700; (Lt. Col.) **80,** 2155; **81,** 2322; **82,** 2409.

Maj. M. B. Adams, 1882–83. **R., 83,** 1917.

Capt. E. Maguire, 1883–85. **R., 84,** 2113.

Maj. L. C. Overman, 1885–92. **R., 85,** 2240; **86,** 18/1; **87,** 2327; **88,** 2013; **89,** 2329; **90,** 2783; **91,** 2863.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2508; **93,** 3085; **94,** 2420; **95,** 3113, 3122; **96,** 2959; (Col.) **97,** 3086; **98,** 2679; **99,** 3068; **00,** 4075, 4084.

Maj. Dan C. Kingman, 1901–05. **R., 01,** 3260; **02,** 2283; **03,** 2093; **04,** 3193; (Lt. Col.) **05,** 2355.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1914; (Lt. Col.) **07,** 2088.

Lt. Col. John Millis, 1908–. **R., 08,** 2163; **09,** 2138; (Col.) **10,** 2298; **11,** 2502; **12,** 2703.

Assistants:

Capt. F. U. Farquhar, **66,** ii, 41, iv, 10, 11.

W. T. Blunt. **R., 95,** 3126.

H. E. Smith. **R., 01,** 3263; **02,** 2286; **03,** 2096; **04,** 3197; **05,** 2359.

ESTIMATES. (See Plans and Projects.)

By Maj. Graham, for 22 cribs, repairs and dr., to complete the work, $38,015.56. S. D. 42, 35th, 1st.

By Col. Cram, for completion of work, $54,000 addl., **66,** iii, 4, 32, iv, 12.

* Allotment.

[1] $3,000 less $141.55 redeposited Apr. 19, 1902.

[2] Does not include $10,200 claim, 1901, and $3,557.05 received 1905 "from other sources."

For entire and permanent imp., completion, $78,464, **66,** iv, 73.

By Capt. Farquhar, repairs of ps. and dr., $20,753.91; p. extension, $57,710.28, **66,** iv, 11, 12.

By Maj. McFarland, completion of the work, $2,073.98, in addition to Col. Cram's est.; for w. chan. 30′ or 40′, $15,000, **68,** 159, 160; **69,** 140; **70,** 180.

By Maj. Gillespie, an. repairs, $800, **71,** 195; **72,** 232.

By Maj. Harwood, extension of w. p. 500′ and dr., $65,000; repairs to ps., $6,000; prolonging chan., $9,000, **73,** 340. Completion of work, $45,000, **74,** 223.

By Lt. Col. Blunt, completion of work, $20,000, **75,** 314.

By Maj. Wilson, completion of existing proj., $50,000, **79,** 173, 1702.

LEGAL PROCEEDINGS.

SS. *M. A. Hanna* struck and damaged outer end of e. j.; suit entered against owners of SS. to recover cost of repairs, $1,843.67, **04,** 605, 3195. Owners of SS. offered $3,375.75; accepted to cover damages to p., etc., **05,** 2357.

OBSTRUCTIONS.

Ex. by BE. officers, of dumping in the R. by Pennsylvania Co., **99,** 3069.

OPERATIONS.

1852–55. Repairs and extension of ps., S. D. 42, 35th, 1st.

1866–67. Contracts for ps. let, **67,** 140.

1867–68. Repairs and extension of ps.; 8 cribs, total of 240′, placed, **68,** 159, 160.

1868–69. Completion of p., 12 cribs, and superstr. built; dr., **69,** 139, 140.

1869–70. Blasting and dr. completed; chan. 60′ w., **70,** 179.

1871–72. Removal of 4,505 c. y. solid r., and 3,436 c. y. loose st. and sand. Chan., 13′ x 30′. **72,** 232.

1872–73. Removal of 9,306 c. y. r. and 4,212 c. y. sand, **73,** 44.

1873–74. Blasting and dr.; chan. from H. to lake, 14′ x 60′, **74,** 223.

1874–75. Extension of w. p. by 9 cribs, 270′; 10,455 c. y. sand removed from bar; 400′ of sandcatch fence built, **75,** 314.

1875–76. Extension of w. p. 190′; chan. 14′ x 100′, **76,** ii, 562.

1876–77. Repairs to ps. and dr., by open purchase and day labor, **77,** 967.

1877–78. Repairs to ps. by hired labor. Extension of w. p. by contract, **78,** 130, 1264.

1878–79. Repairs to ps., extension of e. p. 80′, and dr., **79,** 173, 1701.

1879–80. 120 l. f. of substr. and 202 l. f. of superstr. built; extensive repairs to w. and minor repairs to e. ps.; 7,989 c. y. dr. from shoal at entrance to H., **80,** 2162, resulting in formation of chan. d. bet. ps. of from 14½′–16′, with chan. of entrance from 15′ to 17′ d., **80,** 227.

1880–81. E. and W. ps. each extended 200 l. f.; 4,433 c. y. dr. from bar at entrance to ps., resulting in chan. 15′–17′ d., **81,** 2323, 2324.

1881–82. W. p. extended 403′ and e. p. 121′; 5,447 c. y. removed from chan. and repairs made to ps., **82,** 2411.

1882–83. 7 crib substr. built and ready to place in position, **83,** 1918.

1883–84. Extension of w. p. shoreward 285 l. f.; 2,968 c. y. dr. from chan.; repair of e. p. by hired labor, **84,** 2114.

1884–85. Extension of w. p. shoreward 282¼ l. f.; repairs to e. p. and to shore protection at inner end of w. p., 17,173 c. y. dr. from chan. and bank in rear of old p.; chan. 15½′ d. obtained from d. w. outside, **85,** 2240.

1885–86. 400 l. f. of shore end of w. p. removed and 380 l. f. of same partly revetted; slight repairs by hired labor to shore protection, **86,** 337, 1871.

1886–87. 8,483 c. y. of sand dr. from bar. and chan.; repair of old ps.; r. removal from chan. commenced, **87,** 2328.

1887–88. 12,731 c. y. dr., **88,** 2013.

1888–89. 2,414 c. y. dr.; extension of e. ps. and repairs to both ps. begun, **89,** 2330.

1889–90. 2,800 c. y. dr.; extension of e. p. completed, **90,** 2784.

1890–91. 2,957 c. y. ledge r. and 4,101 c. y. loose r., sand, and gravel removed from chan., **91,** 2864.

1891–92. 24,000 c. y. dr., **92,** 2509.

1892–93. Extension of e. p. in progress, and 1,189 c. y. dr., **93,** 3086.

1893–94. In connection with previous year 242′ of old e. p. torn out and reconstr., and e. and w. each extended 240′, **94,** 2420. Renewal of superstr. of w. p. in progress, **94,** 2421.

1894–95. Renewal of superstr. of w. p. completed, **95,** 3114.

1895–96. 24,179 c. y. r. and 22,375 c. y. of other material removed, **96,** 2960.

1896–97. About 24,000 c. y. r. and other material removed, **97,** 3086; and constr. of w. break'r commenced, **97,** 3086.

1897–98. Portion of w. break'r constr., **98,** 2680, and 4,860 c. y. dr., gauge readings made, repairs made to small storehouse (drawings), **98,** 2681.

1898–99. Break'r lines laid out on ice; soundings made through ice; 18,152 c. y. dr., **99,** 3068.

1899–00. Over 1,000 c. y. dr., **00,** 4077.

1900–01. 12,000 c. y. dr. from bar, chan. redr., and framework on pierheads completed, **01,** 3261.

1901–02. Work in progress on break'r and pierheads, outer end of w. j. repaired, and chan. at entrance to H. dr., **02,** 2283.

1902–03. Constr. of break'r continued, and chan. at entrance to H. dr., **03,** 2093.

1903–04. Constr. of break'rs continued, repairs made to outer end of e. j., and chan. at entrance to H. dr., **04,** 3193, 3195.

1904–05. Constr. of break'rs continued, chan. at entrance to H. dr., **05,** 2355. Contractor quits work, claiming that changed conditions owing to work done by RR. company with permission of U. S. had deprived him of storage ground and interfered with his work, **04,** 3193, 3195. Contractor financially involved and receiver appointed, **05,** 2355. 1,900 t. small st. lost from break'r charged to contractor, **05,** 2356.

1905–06. Constr. of break'rs continued, constr. of shoreward extension of w. break'r begun, and chan. at entrance to H. dr., **06,** 1914.

1906–07. Constr. of e. and w. break'rs continued, constr. of shore end of w. break'r continued, and chan. at entrance to H. dr., **07,** 2089.

1907–08. Constr. of break'rs continued, about 90% completed; shoreward end of w. break'r completed, **08,** 2164.

1908–09. Break'rs completed, **09,** 2138.

1909–10. 430′ timber sec. w. break'r protected with riprap, and st. break'r extended 280′ shoreward, **10,** 2298.

1910–11. Dr. *Burton* removed 5,953 c. y., **11,** 2502.

1911–12. Portions of each sec. of new work on the break'rs entirely built, and removal of old work commenced, **12,** 2703. Detailed statement of work, **12,** 2704.

PHYSICAL CHARACTERISTICS.

Described, **67,** 140; **70,** 180; **93,** 3123; **97,** 3087; **98,** 2681; **08,** 757; **12,** 1108.

Advance of outer bar proportionate to p. extension, **82,** 2410.

Advantage taken, 1899, of heavy ice formation to lay out break'r lines and to make soundings along its situation, **99,** 3068.

Formation of bars checked slightly by small section of break'r in existence in 1899, **99,** 3069.

Bar formation, **00,** 4077.

Bar beyond js. constantly re-forming by shifting sand, and chan. shoaled by sand blown over w. j., **01,** 3261.

Gauge readings, **03,** 2098.

Imp. resulted d. of bar increased to 21′, and 20′ chan. extends up R. 1¾ m. above mouth, **12,** 1107.

PLANS. (See Estimates and Projects.)

By Col. Cram, repairs to ps., ignoring the "flare," and carrying them parallel with each other to 12′ curve, and dr. 7,329 c. y. of sand, and 7,158 c. y. of shale work, **66,** iv, 13; **67,** 140; **69,** 140.

By Maj. McFarland, blasting and dr. chan. from 60′ to full w. bet. ps., about 100′, **70,** 180.

By Maj. Gillespie, blasting and dr. chan. to 14′, $15,000, **72,** 232.

By Maj. Harwood, extension of w. p. 500′ to 14′ of water, repairing ps., and l. chan. by blasting and dr., **73,** 340; **74,** 223; **75,** 314.

By Lt. Col. Blunt, repairs to ps. and dr., $5,000, **77,** 967.

By Maj. Wilson, extension of w. p. 400 l. f. and e. p. 600 l. f., **79,** 1701.

PRIVATE (CORPORATE) WORK.

Part of old e. p., 116′ l., removed, 1893–94, by Lake Shore & Michigan Southern RR. Co., **94,** 2420; and 380′, 1896–97, by au. of Sec. of War, **97,** 3086.

Lake Shore & Michigan Southern Ry. Co., under au. of Congress, removed inner end of old e. U. S. p., **02,** 2284, 2289. P. replaced with new bulkhead 45′ farther e. by Ry. company, **03,** 2094.

Pittsburgh, Youngstown & Ashtabula RR. Co., au. Sec. of War (**03,** 2093, 2098), removed first 1,000′ (**04,** 3195) and later the remainder of w. j. (**05,** 2356), and replaced it with bulkhead 60′ farther w., and dr. area bet. to 21′, reclaiming 16 acres of land, and made various other imp., **06,** 1915; **07,** 2090; **08,** 2164.

Lake Shore & Michigan Southern RR. Co., under au. of Sec. of War (**06,** 1916), took possession of e. p., extended it n. 720′, thence e. 900′, thence s. to their property, reclaiming about 15 acres; also extended e. break'r and made various other imp., **07,** 2090; **08,** 2163.

20′ chan. for 1¾ m. up R. maintained by local au., **12,** 1107.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Wilson, 1880, further extension of ps. to 16′ curve, with removal of 1,100 l. f. of old w. p., revetting R. bank, and removal by dr. of 20,000 c. y. of material; est., $88,000, **80,** 2163. In 1882 Lt. Col. Wilson est. $62,000 would be required, in addition to $60,000 app. since 1880, to complete work, **82,** 2411; impossible to maintain d. at entrance to p. of 16′ without continual dr., **82,** 2411.

In 1883 Maj. Adams increased foregoing est. to $91,800, **83,** 1918.

In 1884 Maj. Maguire increased previous est. to $102,750, **84,** 2117; **85,** 342.

In 1890 Maj. Overman proposed securing 20′ d. by extension of ps. to 22′ curve in lake, involving constr. of 1,360 l. f. of p., with repairs to existing works; est., $265,650, **90,** 2785.

In 1891 Maj. Overman proposed removal of 242 l. f. of lake end of e. p. and relocation of the same 45′ to e. of its "present" position, with addl. r. excavation as required by such change of p.; est., $23,492, making total cost of revised and approv. proj. $329,142, **91,** 2864.

Lt. Col. Smith, 1892–93, revised est., making it $225,000, **93,** 3086.

By Lt. Col. Smith, 1896, 2 break'rs converging toward lake, 400′ apart at outer ends, to be protected by pierheads, w. break'r to be 1,800′ l. and e. break'r 1,200′ l., excl. of pierheads; est., $530,000, **95,** 3125; **96,** 2963.

By Col. Smith, 1899, chan. mainten. by dr. with allotment of $5,000, **99,** 3068.

Change made in proj. of 1896 to provide for break'rs of st., with timber crib pierheads (drawings), **00,** 4076.

Existing works badly in need of repair, 1900; est., incl. restoration, mainten., etc., for one year, $205,520, **00,** 4078.

Description of break'rs of st. recom. by Board of 1899 (drawings), with est. of cost of the various types, **00,** 4086.

Maj. Kingman recom., 1901, that U. S. acquire land w. of and adjoining j. in order that an attempt might be made to arrest or control movement of sand, **01,** 3261; plan obviated by purchase and imp. of land by Pennsylvania RR. Co., **02,** 2283.

Act June 13, 1902, app. $200,000 for repairs to js. and purchase of dr. ($20,000), **02,** 2284. Proposed reconstr. of w. j. obviated by action of RR. company (see Private work), **03,** 2093. Plan by Maj. Kingman, for expend. of unexpend. balance (about $159,000) of above app. in extending w. break'r by rubble-mound constr. 1,500′ shoreward, **03,** 2093; au., 1903, **05,** 2356.

Slight change in design of break'r on recom. of Maj. Kingman, **04,** 3194.

Maj. Townsend, 1906, did not consider extension of break'r by U. S. advisable at that time (H. D. 86, 59th, 2d), **07,** 717.

By Col. Millis, 1910, extending w. break'r at both ends, building new e. break'r and removing part of old; est., $1,385,529, and $5,000 an. mainten. (H. D. 654, 61st, 2d), **10,** 875, 879.

SURVEYS.

Under direction of Lt. Col. Raynolds, by W. T. Casgrain, 1865, **66,** iv, 10; **67,** 140.

By Maj. Wilson, 1879, **79,** 1701.

Sur. to determine what imp. should be made with view to constr. H. of refuge, and to enlarging capacity of port for purposes of C., au. act Aug. 17, 1894; made by Lt. Col. Smith, 1895, **95,** 3122.

Minor surs., **93,** 3085; **98,** 2681; **00,** 4077; **01,** 3264; **03,** 2097; **04,** 3198; **05,** 2360; **07,** 2089.

Au. act Mar. 3, 1905; made, 1907, by Maj. Townsend (H. D. 86, 59th, 2d), **07,** 717.

Au. act Mar. 3, 1909; made, 1909–10, by Col. Millis (H. D. 654, 61st, 2d), **10,** 879, 2298.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1108.

Maps (H. D. 654, 61st, 2d):
81, 2324; **84,** 2116; **91,** 2866; **94,** 2422; **95,** 3126; **96,** 2964; **09,** 2138; **10,** 2298.

Of Hs. of n. and nw. lakes, showing location of this H, **66,** 24.

Of H., **11,** 2502.

QQ–33 CONNEAUT HARBOR, OHIO.[1]

APPROPRIATIONS.

1829,	$7,500.00,	**66,** iii, 32.
1830,	6,135.65,	**66,** iii, 32.
1831,	6,370.00,	**66,** iii, 32.
1832,	7,800.00,	**66,** iii, 32.
1836,	2,500.00,	**66,** iii, 32.
1837,	5,000.00,	**66,** iii, 32.
1838,	8,000.00,	**66,** iii, 32.
1844,	5,000.00,	**66,** iii, 32.
1852,	10,000.00,	**66,** iii, 32.
1866,	[2] 20,513.74,	**66,** iii, 4, iv, 7; **67,** 139.
1867,	10,000.00,	**67,** 139.
1869,	*[3] 8,910.00,	**69,** 22; **70,** 49.
1870,	6,000.00,	**70,** 49, 181; **71,** 47.
1873,	400.00,	**73,** 342.
1874,	1,500.00,	**74,** 51; **75,** 315.
1875,	1,000.00,	**75,** 56, 315.
1880,	6,000.00,	**80,** 2172.
1892,	40,000.00,	**93,** 3092.
1894,	40,000.00,	**95,** 3120.
1896,	40,000.00,	**96,** 2969.
1899,	100,000.00,	**99,** 3073.
1900,	*3,000.00,	**01,** 3267; **12,** 2708.
1901,	*2,068.20,	**12,** 2708.

* Allotment.
[1] Conneaut and Elk Creeks to Erie Harbor, Pa., Canal. Sur.—**R.,** May 12, 1832. (H. D. 482, 55th, 2d.)
[2] Error of $7,000 in app. of 1866 as printed in list of app., **79,** 1702.
[3] Called, $9,000, **69,** 38, 141, 142; **70,** 181.

1902,	$200,000.00,	**02,** 2291.
1903,	10,000.00,	**03,** 2101.
1904,	240,000.00,	**04,** 3202.
1905,	60,000.00,	**05,** 2363.
1907,	20,000.00,	**07,** 2095.
1910,	144,900.00,	**10,** 2300.
1911,	160,000.00,	**11,** 2506.
1912,	100,000.00,	**12,** 2708.

Total, 1,272,597.59 (incl. sales, etc., and less amounts redeposited, $1,277,450.22, **12,** 2708).

COMMERCE.

Description of, **95,** 3120; **96,** 2968; **97,** 3091.

Shipments of coal and ore, large, **94,** 2425; **95,** 3120.

Tonnage in 3 years rose from nothing to 500,000 t., **96,** 2968; the average an. increase exceeding 100,000 t., **98,** 2686.

Phenomenal growth, **99,** 3072; **01,** 3266.

Marked reduction of rates due probably to imp. of this H., **06,** 692; **10,** 878; **12,** 1110.

Chart showing relation of tonnage, value, and app., **11,** 2506.

Statistics show considerable increase in freight traffic over previous years, **12,** 2709.

Tonnage, 1911, 8,879,000 t., embracing 1,626 cargoes, **12,** 2709.

CONTRACTS.

1866. Kenneth & McKenzie, materials and labor, **66,** iv, 8, 74; **67,** 232. J. Loveday, iron, **66,** iv, 8, 74; **67,** 232.

1871. H. W. Smith, materials and labor, **71,** 196; **72,** 233.

1881. J. W. Dennis, pile constr., **81,** 2329.

1893. L. P. & J. A. Smith, p. constr., $35,906.40, **93,** 3093.

1895. C. M. Carrier, hemlock timber, $10 M f.; E. D. Weimer, white pine timber, $21.37 M f.; Wm. Pattison, ironwork, $2,447.86; Kelley Island Lime & Transport Co., st., $5.55 cord, **95,** 3121.

1897. E. F. Loud, hemlock timber, $10.98 M f.; C. H. Carleton, white pine timber, $19.40 M f., **97,** 3092. T. C. Gill & Co., ironwork, $1,871.65; Breckinridge & Uber, riprap st., 95¢ t. ($2,375); Kelley Island Lime & Transport Co., filling st., $1.18 t. ($7,788), **97,** 3093.

1899. J. B. Donnelly, break'r constr. (dr., timber, st., ironwork), $23,404.20, **99,** 3073. E. J. Hingston, dr., 18¢ c. y. (circular letter), **99,** 3072.

1902. The Donnelly Contracting Co., constr. e. and w. break'rs, and the extension and reconstr. of e. and w. ps., **03,** 2099, 2101.

1903. G. H. Breyman & Bros., dr., 27¢ c. y., **03,** 2103.

1905. Empire State Surety Co., continuance of contract for break'r constr. and reconstr., of ps., **06,** 1920.

1906. Great Lakes Construction Co., constr. 256 l. f. of shoreward end of e. break'r, **06,** 1920.

1910. Breyman Bros., dr. outer H., 19.9¢ c. y., **11,** 2505; **12,** 2708. The Edward Gillen Dock, Dredge & Construction Co., constr. break'r, 58,975.1 t. st., at $1.55 t., **11,** 2506; **12,** 2708.

1911. Great Lakes Dredge & Dock Co., removing 439 l. f. break'r, at $15 l. f.; constr. break'rs, 150,000 t. st., at $1.38 t., **12,** 2708.

ENGINEERS.

Chief of Engineers. **R., 66,** 4, iii, 32, iv, 7; **67,** 30; **68,** 42; **69,** 22, 38; **70,** 49; **71,** 47; **72,** 44; **73,** 44; **74,** 51; **75,** 56; **76,** 108; **77,** 115; **78,** 130; **79,** 173; **80,** 228; **81,** 312; **82,** 307; **83,** 315; **84,** 319; **85,** 343; **86,** 338; **87,** 303; **88,** 276; **89,** 328; **91,** 373; **92,** 352; **93,** 403; **94,** 377; **95,** 412; **96,** 367; **97,** 461; **98,** 451; **99,** 534; **00,** 601; **01,** 582; **02,** 505; **03,** 555; **04,** 605; **05,** 616; **06,** 691; **07,** 714; **08,** 759; **09,** 795; **10,** 877, 879; **11,** 931; **12,** 1108.

In charge:

Capt. Howard Stansbury, 1856, S. D. 42, 35th, 1st.

Lt. Col. J. D. Graham, 1857. S. D. 42, 35th, 1st.

Col. T. J. Cram, 1866–68. **R., 66,** iv, 6–10, 69, 72–75; **67,** 139, 148, 230–233.

Maj. W. McFarland, 1868–71. **R., 68,** 160; **69,** 141; **70,** 180.

Capt. G. L. Gillespie, 1871–73; **71,** 89. **R., 71,** 196; **72,** 233.

Maj. F. Harwood, 1873–74; **73,** 42. **R., 73,** 342; **74,** 224.

Lt. Col. C. E. Blunt, 1874–78; **74,** 215. **R., 75,** 292, 315; **76,** ii, 563; **77,** 963, 968.

Maj. W. McFarland, 1878. **R., 78,** 1265.

Maj. J. M. Wilson, 1878–82. **R., 79,** 1705; **80,** 2166; **81,** 2328; **82,** 2412.

Capt. M. B. Adams, 1883–84. **R., 83,** 1920.

Capt. E. Maguire, 1884–85. **R., 84,** 2118.

Maj. L. C. Overman, 1885–92. **R., 85,** 2245; **86,** 1873; **87,** 2332; **88,** 2015; **89,** 2340.

Lt. Col. J. A. Smith, 1892–1900. **R., 92,** 2515; **93,** 3089; **94,** 2423; **95,** 3117; **96,** 2965; (Col.) **97,** 3090; **98,** 2683; **99,** 3071; **00,** 4091.

Maj. D. C. Kingman, 1901–05. **R., 01,** 3264; **02,** 2290; **03,** 2099; **04,** 3200; (Lt. Col.) **05,** 2361.

Maj. C. McD. Townsend, 1906–07. **R., 06,** 1917; (Lt. Col.) **07,** 2092.

Lt. Col. John Millis, 1908–. **08,** 2167; **09,** 2140; (Col.) **10,** 2299; **11,** 2505; **12,** 2707.

Assistants:

Maj. F. U. Farquhar submitted est., **66,** iv, 7.

Capt. M. B. Adams, **75,** 53, 292.

H. E. Smith. **R., 01,** 3268; **02,** 2291; **03,** 2102; **04,** 3203; **05,** 2365.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Graham, extension of ps. 600′ to 12′ of water, repairs, and dr., $31,559.60, S. D. 42, 35th, 1st.

By Maj. Farquhar, under direction of Col. Cram, repairs and extension of w. p. and dr. 12′ x 115′, $31,112, **66,** iv, 7, 73.

By Col. Cram, addl. to complete the work, $10,638, **67,** 140, 148.

By Maj. McFarland, repairs of injury caused by freshet, $9,000, **68,** 161; to complete the work, $6,000, **69,** 142.

By Maj. Harwood, permanent completion, $3,500, **73,** 342; $1,000, **74,** 224.

By Maj. Wilson, completion of existing proj., $26,092, **79,** 173, 1706.

LEGAL PROCEEDINGS.

Claim against owners of SS. *Mecosta* for damages to w. break'r, $1,345.84, **04,** 3201.

U. S. atty. collected $1,000 in satisfaction of damages to w. break'r by SS. *Mecosta*, and $600 in payment for damages to e. j. by SS. *W. D. Rees*, **05,** 2362.

OPERATIONS.

1856. 890′ of p. rebuilt on old foundations; 120′ of p. repaired, S. D. 42, 35th, 1st.

1867–68. Repairs to ps. continued and material collected for extension of w. p., **68,** 160.

1868–69. E. p. repaired and extension to w. p. completed, **69,** 141.

1869–70. Repairs and extension to p., **70,** 180.

1870–71. Repairs of w. pierhead completed, **71,** 196.

1871–72. Extension of e. p. 90′, **72,** 44.

1873–74. W. pierhead riprapped, **74,** 224.

1874–77. Slight repairs of ps., **75,** 315; **76,** ii, 563; **77,** 968.

1881–82. 473 l. f. pile protection finished, **82,** 2413.

1893–94. Extension of old w. p. completed, **94,** 2423.

1894–95. A device to throw large waves from the end of the p. erected and p. constr. in progress, **95,** 3118.

1895–96. Misc. dr. done, repairs made to outer end of new w. p., and in connection with preceding year 600 l. f. of e. break'r constr., **96,** 2965.

1896–97. Break'r constr. commenced, **97,** 3090.

1897–98. 282 l. f. w. break'r completed in connection with previous year, 15,776 c. y. dr., and repairs made to e. p., **98,** 2685, 2686.

1898–99. Lines of break'rs laid out on heavy ice formation; 9,000 c. y. dr., **99,** 3071.

1899–00. 16,500 c. y. dr.; preparations made for break'r constr., **00,** 4092.

1900–01. 4 cribs sunk in constr. of w. break'r, 16,000 c. y. dr. from bar, restoring chan. to full d. in fall of 1900; bar re-formed again in spring and was redr., 10,057 c. y. having been removed, **01,** 3266.

1901–02. Superstr. over cribs built, completing contract for 774′ of w. break'r; 10,420 c. y. dr. from chan. outside of ps. and 680 c. y. removed from reported shoaling, **02,** 2291, 2292.

1902–03. Plant and materials assembled for prosecution of work on e. and w. break'rs, 10,500 c. y. dr., and damages to w. p. made by SS. *Mecosta*, temporarily repaired. **03,** 2099, 2102, 2103.

1903–04. 8 cribs, 1,377′ l., built and sunk in renewal of shoreward end of js.; temporary spur j. constr. for protection of trenches for reception of cribs; one crib, 163′ l., placed at outer end of w. j.; 745 l. f. concrete superstr. completed; work done on preparing foundations for e. and w. break'rs; damage done by SS. *Mecosta* repaired at cost of $1,345.84; 9,956 c. y. dr., **04,** 3200, 3203.

1904–05. W. break'r extension completed; timber crib pierheads for e. and w. break'rs in place; substr. for 750′ e. break'r sunk and 264 l. f. concrete superstr. built (contractor became involved financially, and work ceased in Nov.); dr. *Burton* removed 14,000 c. y. from chan., **05,** 2361, 2365.

1905–06. 71% of work of break'r constr. and reconstr. completed by failing contractor, and work continued by their surety, the Empire State Surety Co.; foundation prepared for new cribs, shoreward end e. break'r; dr. *Burton* removed 14,089 c. y., **06,** 1917, 1919.

1906–07. Constr. of break'rs and the extension and reconstr. of parts of e. and w. ps. completed (tabulated statement of work for year and contract); 256 l. f. shoreward end of e. break'r completed; dr. *Burton* removed 14,291 c. y., **07,** 2093, 2094.

1907–08. Minor repairs made to concrete superstr. by hired labor; dr. *Burton* removed 16,242 c. y., **08,** 2167.

1908–09. Dr. *Burton* removed 20,584 c. y., **09,** 2140.

1909–10. Dr. *Burton* removed 18,698 c. y. and dr. *Maumee* 21,030 c. y., **10,** 2299.

1910–11. 275,173.2 c. y. dr. under contract; 8,943 c. y. dr. by U. S. dr. *Burton*, **11,** 2505. 13,393.1 t. quarry-run st. placed in rubble-mound protection and 30,117.9 t. st. in rubble-mound break'r, **11,** 2505. Protecting e. break'r, extending it shoreward, about 70% completed under contract, **11,** 932.

1911–12. 8,220.4 t. st. placed in rubble-mound protection, and 7,243.7 t. in rubble-mound break'r, completing e. break'r and extending it shoreward; lakeward extension of e. break'r and of the new w. break'r in progress; removal of part of old w. break'r begun, 26% completed; 22,140 c. y. dr. by U. S. dr. *Burton*, **12,** 2707.

PHYSICAL CHARACTERISTICS.

Description of, **66,** iv, 6; **67,** 139; **93,** 3090; **96,** 2970, 2971.

Beach at inner end of w. p. washed away in a remarkable way by sea, **99,** 3072.

Action of break'rs at the H. on sand movement, **00,** 4092; bar formation, **00,** 4092.

Shoaling of chan., **04,** 3200; **06,** 1919; **07,** 2094.

Outer break'r deteriorated; will be partly abandoned, **11,** 2506.

As a result of U. S. imp. an entrance chan. of 21′ and an outer H. have been provided, **12,** 1109, 1110.

H. 74 m. from Cleveland, Ohio, **12,** 1108.

PLANS. (See Estimates and Projects.)

By Lt. Col. Graham, repairs, dr., and extension of ps. to 12′ of water, S. D. 42, 35th, 1st.

By Col. Cram, pile p. proposed, description of, **66,** iv, 69.

Maj. Overman reported, 1888, that unless the facilities of H. were increased further imp. would be unnecessary, **88,** 2015.

In 1889 Maj. Overman est. repair and removal of ps. and revet. and dr. to 16′d. through H. entrance would cost $115,000, **89,** 2341.

In 1891 Maj. Overman, recom. constr. of new ps. and dr. bet. them to 17′, each p. to be about 2,000 l. and to extend to 17′ curve in lake; est., $418,140, **92,** 2519.

Orig. plans for e. break'r were for rubble-mound constr., but contractor submitted est. for timber crib with concrete superstr., which method of constr. approv., **04,** 3201.

PRIVATE WORK.

Description of work done by the Pittsburg, Shenango & Lake Erie RR. Co. for imp. of H., **93,** 3091; **94,** 2425; **95,** 3120; **97,** 3090; **99,** 3072.

W. break'r, injured by SS. *George Stephenson*, repaired by Pittsburg Steamship Co., **04,** 3206.

PROJECTS. (See Estimates and Plans.)

Orig., **75,** 315; **76,** ii, 563; **77,** 968.

By Capt. Maurice, 1829, closing existing chan. through sand bar at mouth of R. by means of parallel ps. of cribwork; est., $20,001.65, **80,** 2166. Proj. completed in 1835, **80,** 2167.

By Col. Cram, 1866, repair of existing p. work, prolongation of w. p. 350′, and dr. chan. 115′ x 12′; est., $31,112, **66,** iv, 7; **67,** 139; **80,** 2169. Proj. completed in 1872, **80,** 2170.

By Maj. Wilson, e. p., 480 l. f. of p. and 381 l. f. of superstr.; w. p., 791 l. f. of superstr., **79,** 1706.

History of early projs., **79,** 1705.

By Maj. Wilson, 1880, restoration of p. and constr. of pilework; est., $35,090, **80,** 2171; **86,** 1873; **87,** 2332.

By Lt. Col. Smith, 1892–93, w. and d. existing old chan. to 17′ by extension of e. and w. ps. each 480′; est., $500,000, **93,** 3090.

By Lt. Col. Smith, 1892–93, expend. available funds in extending w. p. into lake as far as possible from old w. p., with the usual type of crib and superstr. filled with st. and resting upon foundation riprap st., **93,** 3090.

By Lt. Col. Smith, 1896, constr. 480′ of p. on the w. side, for extending e. p. 450′ and w. p. 150′, for 2 break'rs—one on the w. side 1,250′ l., one on the e. 1,050′ l.—and removal of r. and other material at an est. cost of $530,000, to obtain 25.5′ in an entrance of 350′ w. and d. of 20′ or more in the protected area, **96,** 2971; est., $610,000, excl. of mainten., **12,** 1109.

By Col. Smith, 1897, expend. $35,000 of app. of 1896 on constr. of the break'rs, and reserving $5,000 for mainten. and contingencies, **97,** 3091.

$8,000 reserved from app. of 1899 for mainten. of ps. and chan. d., **99,** 3072.

Method of constr. break'r to avoid extensive repairs, **00,** 4092.

Act June 13, 1902, au. expend. of $450,000 on proj. of 1896; $10,000 of which for purchase of hydraulic dr., **03,** 555; modified by act June 25, 1910, au. expend. of $144,900 in mainten. and continuing imp. in accordance with plans; est., $1,338,681, with $10,000 an. for mainten. (H. D. 653, 61st, 2d), **10,** 877.

Existing proj., 1912, that of 1896, modified by act 1910, **12,** 1109.

SURVEYS.

By Capt. Stansbury, in 1856, S. D. 42, 35th, 1st.

By Maj. Wilson, in 1878–79, **79,** 1705.

Ex. made in 1879, **80,** 2170.

Ex. for d. and w. chan. au. act Aug. 11, 1888; made, 1889, by Maj. Overman, **89,** 2340.

Sur. of Conneaut H.; made, 1891, by Lt. Col. Smith, **92,** 2517.

Complete hydrographic sur. of the H. and the lake inside the 25′ contour made in 1894 by Lt. Col. Smith, **96,** 2966.

Ex. of the chan. made, 1898, by Col. Smith, **98,** 2685.

Minor surs., **99,** 3071; **00,** 4093.

Of chan., **02,** 2292; **03,** 2102; **06,** 1919.

Borings and soundings along line of new ps., **02,** 2292.

Au. act Mar. 3, 1909, for enlarging and imp. the outer H. area, made, 1909, by Lt. Col. Millis; est., $1,338,681 (H. D. 653, 61st, 2d), **10,** 879.

Maps (H. D. 653, 61st, 2d):

Of n. and nw. lakes, showing location of this H., **66;** **81,** 2330; **93,** 3090; **95,** 3120; **96,** 2972; **09,** 2140; **10,** 2300.

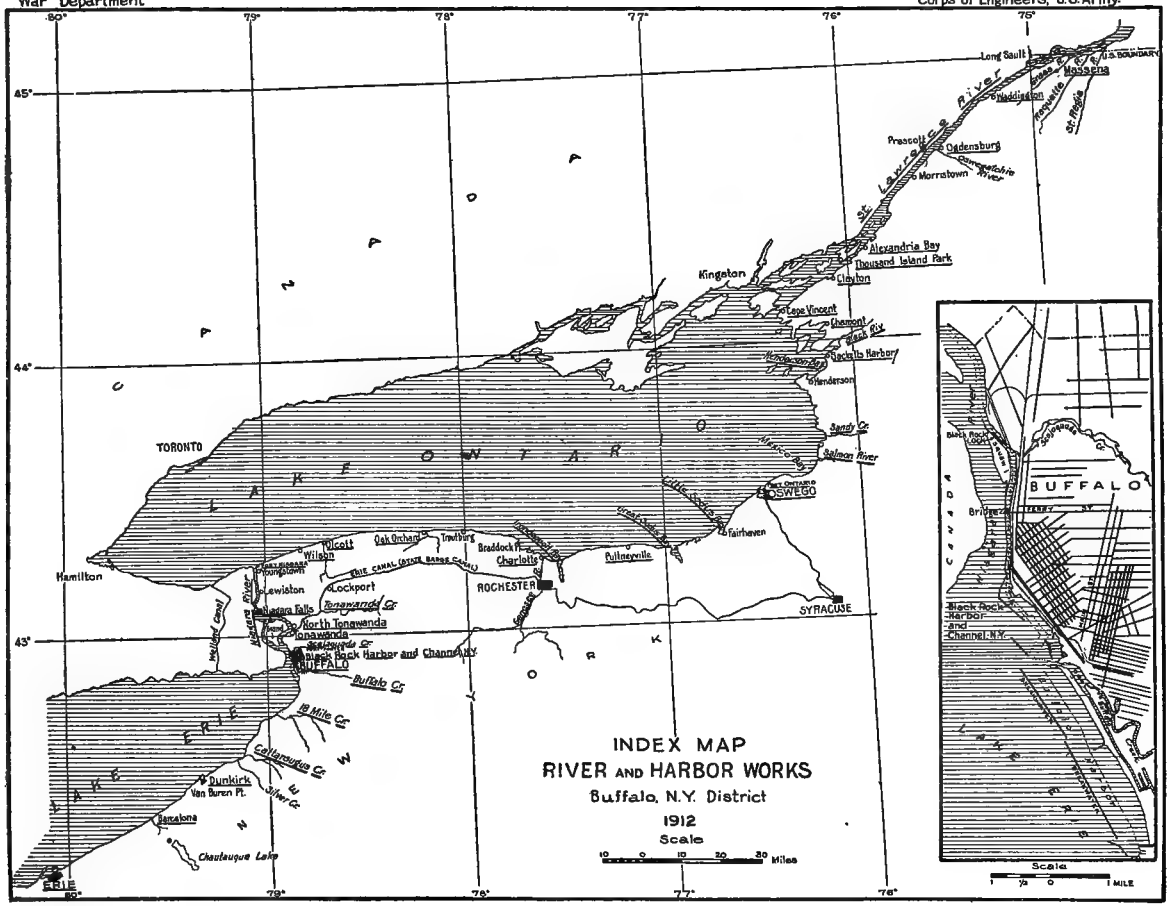
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1110.

RIVER AND HARBOR WORKS—GREAT LAKES SYSTEM.

RR.—BUFFALO, N. Y., DISTRICT.

War Department

Corps of Engineers, U.S. Army.



RR.—BUFFALO, N. Y., DISTRICT.

In charge of U. S. Engineer Office,
Buffalo, N. Y.

RR 1 Lake Erie.
RR 2 Elk Cr., Pa. (1)
RR 3 Walnut Cr., Pa. (1)
RR 4 Presque Isle B., Pa. (1)
RR 5 Erie H., Pa. (4)
RR 6 Portland H., N. Y. (1)
RR 7 Chautauqua Cr., N. Y. (1)
RR 8 Canadaway Cr., N. Y. (1)
RR 9 Dunkirk H., N. Y. (1)
RR 10 Silver Cr., N. Y. (1)
RR 11 Cattaraugus Cr., N. Y. (1)
RR 12 Eighteenmile Cr., N. Y. (1)
RR 13 Buffalo, H., N. Y. (1)
RR 14 Buffalo R., N. Y. (13)
RR 15 Niagara R., N. Y. (1)
RR 16 Cazenovia Cr., N. Y. (14)
RR 17 Black Rock H., N. Y. (1)
RR 18 Scajaquada Cr., N. Y. (16)
RR 19 Erie Canal (Buffalo to Tonawanda Cr., N. Y.) (15)
RR 20 Rattlesnake Cr., N. Y. (15)
RR 21 Tonawanda Cr., N. Y. (15)
RR 22 Ellicott Cr., N. Y. (21)
RR 23 La Salle Cr., N. Y. (15)
RR 24 Niagara R., N. Y. (below Niagara Falls) (15) (25)
RR 25 Lake Ontario (15) (63)
RR 26 Wilson H., N. Y. (25)
RR 27 Twelvemile Cr., N. Y. (26)
RR 28 Olcott H., N. Y. (25)
RR 29 Eighteenmile Cr., N. Y. (28)
RR 30 Johnsons Cr., N. Y. (28)
RR 31 Oak Orchard H., N. Y. (25)
RR 32 Oak Orchard Cr., N. Y. (31)
RR 33 Sandy Cr., N. Y. (25)
RR 34 Braddock Pond, N. Y. (25)
RR 35 Cranberry Pond, N. Y. (25)
RR 36 Long Pond, N. Y. (25)
RR 37 Buck Pond, N. Y. (25)
RR 38 Round Pt., N. Y. (25)
RR 39 Charlotte H., N. Y. (25)
RR 40 Genesee R., N. Y. (39)
RR 41 Irondequoit B., N. Y. (25)
RR 42 Pultneyville H., N. Y. (25)
RR 43 Salmon Cr., N. Y. (42)
RR 44 Great Sodus B., N. Y. (25)
RR 45 Port B., N. Y. (25)
RR 46 Little Sodus B., N. Y. (25)
RR 47 Fairhaven H., N. Y. (46)
RR 48 Oswego H., N. Y. (25)
RR 49 Oswego R., N. Y. (48)
RR 50 Little Salmon R., N. Y. (Mexico Bay) (25)
RR 51 Salmon R. (Port Ontario H.), N. Y. (25)
RR 52 South Pond, N. Y. (25)
RR 53 North Pond, N. Y. (25)
RR 54 South Big Sandy Pond, N. Y. (25)
RR 55 North Big Sandy Pond, N. Y. (25)
RR 56 Stony Cr., N. Y. (25)
RR 57 Henderson B., N. Y. (25)
RR 58 Sacketts H., N. Y. (25)
RR 59 Black R. B., N. Y. (25)
RR 60 Black R., N. Y. (59)
RR 61 Guffin B., N. Y. (25)
RR 62 Chaumont B., N. Y. (25)
RR 63 St. Lawrence R., N. Y. (25)
RR 64 Cape Vincent H., N. Y. (63)
RR 65 Clayton H., N. Y. (63)
RR 66 Thousand Isld. Park, N. Y. (63)
RR 67 Alexandria B., N. Y. (63)
RR 68 Goose B., N. Y. (63)
RR 69 Chippewa B., N. Y. (63)
RR 70 Morristown H., N. Y. (63)
RR 71 Oswegatchie R., N. Y. (63)
RR 72 Ogdensburg, N. Y. (63)
RR 73 Waddington H., N. Y. (63)
RR 74 Massena Power Canal, N. Y. (63)
RR 75 Grasse R., N. Y. (63)
RR 76 Raquette R., N. Y. (63)
RR 77 St. Regis R., N. Y. (63)
RR 78 [1] Salmon R., N. Y. (63)

RR–2 ELK CREEK, PA. AND OHIO.

Sur.—**R.**, Apr. 17, 1834; est., $34,380. (H. D. 482, 55th, 2d.)

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[1] The list of waterways of the U. S. of importance or probable importance after RR–78 begins at the southernmost portion of the Pacific Coast of the U. S.

RR–5 ERIE HARBOR, PA.

Part.	Title.	Period.	Appropriation.
a	Erie H. (Presque Isle)	1819–1912	$1,478,156.56
b	Erie H. (Presque Isle Peninsula)	1888–1896	60,000.00
	Total		1,538,156.56

Part (a), RR–5 Erie (Presque Isle) Harbor, Pa.[1]

APPROPRIATIONS.[2]

1823,	$150.00 (sur.), act Mar. 3.	
1824,	20,000.00,	**66,** iii, 31.
1826,	7,000.00,	**66,** iii, 31.
1827,	2,000.00,	**66,** iii, 31.
1828,	6,223.18,	**66,** iii, 31.
1829,	7,390.25,	**66,** iii, 31.
1831,	1,700.00,	**66,** iii, 31.
1832,	4,500.00,	**66,** iii, 31.
1833,	6,000.00,	**66,** iii, 31.
1834,	23,045.00,	**66,** iii, 31.
1835,	5,000.00,	**66,** iii, 31.
1836,	15,122.80,	**66,** iii, 31.
1837,	15,000.00,	**66,** iii, 31.
1838,	30,000.00,	**66,** iii, 31.
1844,	40,000.00,	**66,** iii, 31.
1852,	30,000.00,	**66,** iii, 31.
1864,	* 15,000.00,	**66,** iii, 31; **67,** 138, 145.
1866,	36,961.00,	**66,** iii, 4, 31, iv, 1.
1867,	25,000.00,	**67,** 31.
1868,	* 40,000.00,	**68,** 24, 42, 164.
1869,	* [3] 22,275.00,	**69,** 22.
1870,	20,000.00,	**70,** 50; **71,** 48, 198.
1871,	29,000.00,	**71,** 48, 198.
1871,	* [4] 10,000.00,	**71,** 48, 198.
1872,	15,000.00,	**72,** 44, 234.
1874,	20,000.00,	**74,** 52, 225.
1875,	80,000.00,	**75,** 57.
1876,	40,000.00,	**76,** 109, 142, ii, 566; **77,** 968.
1878,	25,000.00,	**78,** 131, 1267.
1879,	25,000.00,	**79,** 174, 1710.
1880,	25,000.00,	**80,** 2186.
1881,	20,000.00,	**81,** 2334.
1882,	20,000.00,	**82,** 2417.
1884,	50,000.00,	**84,** 2122.
1886,	37,500.00,	**86,** 1880.
1888,	23,000.00,	**88,** 2033.
1890,	40,000.00,	**90,** 2797.
1892,	40,000.00,	**92,** 2525.
1894,	10,000.00,	**95,** 3140.
1896,	1,289.33,	act May 11.
1899,	125,000.00,	**99,** 3093.
1902,	125,000.00,	**02,** 2297.
1905,	125,000.00,	**05,** 2369–2371.
1907,	120,000.00,	**07,** 2099.
1910,	70,000.00,	**10,** 2305.
1911,	30,000.00,	**11,** 2511.
Total,	1,478,156.56 (incl. receipts from sales and $60,000 app. for Erie H., Presque Isle Peninsula, $1,542,882.28, **12,** 2713).	

COMMERCE.

Requires chan. to admit vessels drawing 14′, **67,** 252.

Great increase of, **69,** 144.

Increasing, 1900; due probably to better chan. and H., **00,** 4107; **01,** 3300; **02,** 2296; **04,** 3249.

Arrivals, departures and tonnage for 10 years, **03,** 558; **05,** 620.

U. S. work having fav. effect in controlling rates on bulk commodities, **06,** 695; **12,** 1113.

1902, 3,874,000± t.; 1905, 2,135,000± t.; 1908, 3,691,000± t.; 1911, 3,464,836 t., **12,** 1113.

CONTRACTS.

1866. J. Loveday, iron, **66,** iv, 74; **67,** 232, 233.

1867. Brooks & Adams, timber, **67,** 232, 233. Vincent & King,[5] materials and labor, **67,** 232, 233; **68,** 168–177, 188. Lee & Dunbar, dr., **67,** 232, 233; **72,** 233.

1868. Lee & Dunbar, dr., **68,** 163, 168. William Nichols, repairing ps., **68,** 163, 168.

1871. Lee & Dunbar, dr., 23¢ c. y., **71,** 198; **73,** 343. H. W. Smith, p. work, completed, **71,** 198; **72,** 233.

1872. Lee & Dunbar, dr., 29½¢ c. y., **73,** 343; **74,** 224.

1877. O. J. Jennings, dr., tug, and scows, $5.44 per hour, **77,** 970.

1878. W. H. McCurdy, iron, **78,** 1266. Ferris & Garfield, materials and labor, **78,** 1266.

1879. O. J. Jennings, dr., 15¢ c. y., **79,** 1710. Hemenway & Hayes, p. constr., **81,** 2187; amended, **81,** 2331. Cleveland, Brown & Co., p. constr., **80,** 2188. O. J. Jennings, dr., 15¢ c. y., **80,** 2189.

1880. G. W. & A. F. McKenzie, pile j. constr., **80,** 2188. H. H. Hine, p. constr., **81,** 2334; annulled, **81,** 2331. H. B. Strong, p. constr., **81,** 2335. J. Barnett, iron, **81,** 2334. G. W. & A. F. McKenzie, p. constr., **81,** 2335.

1881. G. Talbot, dr., 23¢ c. y., **81,** 2336.

1882. J. L. Linn, removing and replacing old superstr., **82,** 2418; dr., 22½¢ c. y., **82,** 2418.

1886. J. Rooney, dr., 26¢ c. y., **87,** 2346.

1887. D. McNaughton, iron, **87,** 2346. G. Elias & Bro., timber, **87,** 2346.

1888. J. L. Linn, dr., 28¢ c. y., **89,** 2347. O. Gillmore, dr., 28¢ c. y., **89,** 2347.

1890. Hingston & Wood, dr., 18½¢ c. y., **90,** 2792. Benham & Doville, transporting material, **90,** 2793.

1891. J. B. Donnelly, p. extension, $61 l. f., **91,** 2876.

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* Allotment.

[1] Surs.—**Rs.,** Oct. 4, 1823, est. $39,617.47; Oct. 1, 1835, est. $97,000; Sept. 30, 1839, est. $326,150; 1855, est. $269,105.37; Nov. 12, 1864, est. $15,000. Ex.—**R.** (indefinite), Nov., 1833.

[2] Statement of app. from 1823, with method of expend., **83,** 1926.

[3] Called $22,500, **69,** 38, 144.

[4] Called $6,080, **72,** 44, 234. Allotted from app. for ex. and sur. of northern and northwestern lakes, etc., **72,** 4, 234.

[5] Controversy between Col. Cram and contractors; history of the case, and plan for settlement submitted by Col. Cram, **68,** 168–177. Report of a BE. in relation to, **68,** 180–183.

1892. J. B. Donnelly, p. extension, $25,620, **93,** 3100.

1896. Hingston & Woods, dr. 29,399 c. y., at 19¢ c. y., s. m.; riprap st., 781 c. y., at $2.45 t., measured on boat, **97,** 3102.

1898. Carkin, Stickney & Cram, dr., 17¢ c. y., $1,110.95, **98,** 2746.

1899. Breymann Bros., dr., 8¼¢ c. y., $33,000, **99,** 3094. J. B. Donnelly, concrete superstr. of n. p., and extension of p., timber crib j. constr. (removing old works, furn. st. concrete, ironwork, dr., timber), $78,458.70, **00,** 4107.

1902. Buffalo Dredging Co., dr. (18½¢ c. y.) and constr. concrete superstr., s. p., timber crib j., and placing riprap st. in n. p. (unit prices listed), **03,** 2122–23.

1905. Lake Erie Dredging Co., dr. chan., 23¢ c. y., s. m., and dr. basin, 25¢ c. y., p. m.; William H. Shelton, extending n. p. and concrete superstr. on n. p., unit prices listed, **05,** 2372.

1907. Great Lakes Dredge & Dock Co., extending s. p. and st. superstr. on s. break'r, unit prices listed, **07,** 2100.

1909. Buffalo Dredging Co., dr. chan., **10,** 2303. The Central Dredging Co., dr. basin, 18¢ c. y., s. m., **10,** 2305.

DOCUMENTS. (Not printed in reports.)

Report of BE. of 1874 to consider plan for shore protection for Peninsula Pt., **75,** 316.

ENGINEERS.

Chief of Engineers. R., 66, 4, ii, 41, iii, 4, 31, iv, 2; **67,** 31, 252; **68,** 42, 177, 178; **69,** 22, 38; **70,** 49; **71,** 45, 47; **72,** 42; **73,** 45; **74,** 51; **75,** 56; **76,** 109, 142; **77,** 116; **78,** 130; **79,** 173; **80,** 228; **81,** 313; **82,** 308, 2420; **83,** 316; **84,** 319; **85,** 344; **86,** 339; **87,** 304; **88,** 277; **89,** 328; **90,** 297; **91,** 373; **92,** 352; **93,** 404; **94,** 378; **95,** 413; **96,** 369; **97,** 463, 473; **98,** 455; **99,** 536; **00,** 604; **01,** 585; **02,** 507; **03,** 557; **04,** 609; **05,** 619; **06,** 694; **07,** 717; **08,** 761; **09,** 797; **10,** 879; **11,** 933; **12,** 1111.

Boards:

Convened, Detroit, Mar. 18, 1868, to consider causes of careening of cribs and remedy for. Adjourned, and reconvened at Erie, Mar. 23. Ex. the work and adjourned. Reconvened, Detroit, and recom. the use of cribs 24′ instead of 18′ w., grillage instead of tight bottoms, and riprap. **R., 68,** 179–183. (Col. Macomb, Lt. Cols. Newton, Raynolds, and Blunt; Maj. Wheeler, and Capt. Harwood.)

Convened, Erie, Oct. 18, 1870. Recom. brush and st. constr. in places, protection of beach by planting slips of poplar, beech, etc., and legislation to prevent the removal of standing or fallen timber, etc. **R., 71,** 206–208. (Lt. Cols. Woodruff and Foster, and Maj. McFarland.)

Convened, S. O. No. 49, C. of E., 1882, **82,** 2422. The Board did not consider the danger of a break through the peninsula of Presque Isle imminent, **82,** 2422.

In charge:

Capt. T. W. Maurice, 1824, **67,** 138; **79,** 1707.

Col. Wm. Turnbull, 1855–56. **R.,** S. D. 42, 35th, 1st.

Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st.

Lt. Col. T. J. Cram, 1864–68. **R., 66,** 13, 20, iv, 1–5, 73–75; **67,** 138, 148, 230–233, 254; **68,** 168–177, 183–185.

Maj. W. McFarland, 1868–71. **R., 68,** 162–168; **69,** 142; **70,** 181; **71,** 200.

Capt. G. L. Gillespie, 1871; **71,** 189. **R., 71,** 198, 200; **72,** 223.

Maj. F. Harwood, 1873–74. **R., 73,** 342; **74,** 225.

Lt. Col. C. E. Blunt, 1874–78; **74,** 215. **R., 75,** 316; **76,** ii, 563; **77,** 963, 968.

Maj. W. McFarland, 1878. **R., 78,** 1266.

Maj. J. M. Wilson, 1878–83. **R., 79,** 1707; **80,** 2172; **81,** 2331; **82,** 2414, 2422.

Capt. M. B. Adams, 1883–84. **R., 83,** 1923.

Capt. E. Maguire, 1884–86. **R., 84,** 2120; **85,** 2253; **86,** 1879.

Capt C. F. Palfrey, 1886. **87,** 2343.

Capt. F. A. Mahan, 1886–90. **R., 87,** 2343; **88,** 2017; **89,** 2343.

Maj. A. Stickney, 1890–92. **R., 90,** 2789; **91,** 2869.

Maj. E. H. Ruffner, 1892–95. **R., 92,** 2522; **93,** 3096; **94,** 2427; **95,** 3135.

Maj. T. W. Symons, 1896–1902. **R., 96,** 3097; **97,** 3097, 3237; **98,** 2737; **99,** 3091; **00,** 4099; **01,** 3295; **02,** 2295.

Maj. Theo. A. Bingham, 1903. **R., 03,** 2115.

1st Lt. P. S. Bond, 1904. **R., 04,** 3243.

Col. H. M. Adams, 1905–07. **R., 05,** 2369; **06,** 1923; **07,** 2097.

Lt. Col. W. L. Fisk, 1908–10. **R., 08,** 2169; (Col.) **09,** 2143; **10,** 2303.

Lt. Col. J. G. Warren, 1911–. **R., 11,** 2509; (Col.) **12,** 2711.

Assistants:

Capt. F. U. Farquhar, **66,** ii, 41, iv, 2.

I. Camp, **68,** 169, 172, 180. **R., 71,** 202, 205.

Capt. M. B. Adams. **R., 79,** 1710.

ESTIMATES. (See Projects.)

By BE., date not known, entire and permanent completion of e. entrance, $56,760; w. entrance, $212,345.37; total, $269,105.37, S. D. 1, 34th, 1st.

By Maj. Graham, 1857, immediate repairs of ps., $8,638. Est. of BE. revised to $83,091.86 for e. entrance and $334,408.09 for w. entrance; total, $417,499.95, S. D. 42, 35th, 1st.

By Col. Cram, 1865, for dr. to 13′, $15,126.90, and extension of n. p. 500′ to 13′ of water, $21,835; total, $36,961.90, **66,** 4, 20, 21, 24, iv, 1, 73.

By Col. Cram, 1866, permanent completion, $25,000, **66,** iii, 4, 31.

By Col. Cram, 1867, repairs and dr. to 14′, $69,000, **67,** 31.

By Maj. McFarland, 1868, repairing p., $16,000; dr. outer bar, $5,000; dr. inner bar, $35,000, **68,** 164.

By Maj. McFarland, 1869 completion of work, $45,900, **69,** 143; **70,** 182.

By Maj. Harwood, 1873, entire and permanent completion of chan., beach protection, and repairs of ps., $75,000, **73,** 343. In 1874, $80,000, **74,** 225.

By Lt. Col. Blunt, 1875, extension of s. p., $50,000, **75,** 317.

By Lt. Col. Blunt, 1876, protection of shore, etc., $56,000, **76,** 106, ii, 566.

By Maj. Wilson, 1879, completion of existing proj., $90,000, **79,** 1710.

LEGISLATION.

Detailed history of efforts made by various persons to obtain the right to occupy the peninsula by State legislation. Letter sent by the Sec. of War to the governor of Pennsylvania in 1897 asking that the rights of the U. S. to ownership of the peninsula be confirmed. **98,** 2743.

Maj. Symons reports effort again being made to secure title or possession of Presque Isle Peninsula. Bill introduced in Legislature of Pennsylvania au. city of Erie to "improve, use, or sell" defeated; correspondence covering case, **01,** 3299, 3300.

Act of Legislature of Pennsylvania, 1903, gave commissioners of waterworks of Erie all rights of State in about 175 acres of land on peninsula of Presque Isle. Plans for extension of intake to and across Presque Isle were submitted to Sec. of War for approv., and permission asked to use the 175 acres of land for settlement basins. Sec. of War approv. plans and offered lease for 2 years of portion of Presque Isle. Conditions of permission and lease declined; no further action taken, **03,** 2117–2120.

Act approv. Apr. 27, 1904, grants to the commissioners of waterworks of city of Erie the right to use and occupy as much of the land of the U. S. on Presque Isle Peninsula, not exceeding 175 acres, as may be necessary for proj. imp. of water supply for city of Erie, including intake pipe, reservoirs, settling basins, filter beds, etc.; usual rights reserved to the U. S., **04,** 3248.

OPERATIONS.

History of early operations, **79,** 1707; **80,** 2172; **82,** 2423.

1855–56. Closing breach in peninsula and protection of beach by brush work, S. D. 42, 35th, 1st.

1866–67. Repairs of ps. and protection of shore completed, **66,** 20.

1867–68. Repairs, p. extension, and dr., **67,** 31, 139; **68,** 164.
1868–69. 380′ of damaged p. repaired, **69,** 142.
1869–70. Removal of 60,000 c. y. from inner bar, chan. 14′ x 200′; 110′ of ps. rebuilt, **70,** 49, 181.
1870–71. Removal of 25,317 c. y. from inner and outer bars; repairs to break'r completed, **71,** 47, 48, 198.
1871–72. Extension of n. p. 120′; removal of 63,877 c. y. from bars; n. and s. ps. repaired; 51,300 assorted trees and roots planted on the neck of the peninsula, and shores protected by brush and st., **72,** 44, 233, 234.
1872–73. Dr., **73,** 45, 342.
1873–74. Dr., **74,** 51, 224.
1874–75. About 18,000 c. y. dr.; n. p. repaired; 1,472′ of n. spit protected by piles, brush, and st., and 1,480′ of beach protected by piles and plank bulkhead, backed by rubble, **75,** 57, 316.
1875–76. Dr. 52,800 c. y. from inner chan., 3,056′ of pile-plank riprapped fence built, repairs to ps., and 500′ of superstr. rebuilt over break'r, **76,** 109, ii, 565.
1876–77. Extension of catch-sand fence 1,461′, 415′ of n. p. rebuilt, and 28,594 c. y. of sand dr., **77,** 116, 968.
1877–78. Dr., rebuilding part of n. p., and extending catch-sand fence, **78,** 130, 1266.
1878–79. Dr. and rebuilding 400 l. f. of superstr. of n. p.; ps. repaired, **79,** 173, 1708.
1879–80. 102,763 c. y. sand dr. from chan.; 10 snags removed, **80,** 2182.
1880–81. 160 l. f. cribwork placed in n. p. and 150 l. f. on s. p.; 455 l. f. superstr. rebuilt on s. p.; 11,808 l. f. piling driven in spur js.; 2,000 l. f. brush and st. protection renewed, **82,** 2332.
1881–82. N. p. extended 242 l. f. and riprapped with 1,200 t. large st.; strengthened by driving oak piles along 380 l. f. of chan. face; s. p. extended 423 l. f.; 25,000 c. y. material dr., **82,** 2415.
1882–83. 385 l. f. n. p. superstr. rebuilt and 90′ redecked; 18,000 c. y. sand dr.; 193 piles driven for catch-sand j.; pile protection at neck of peninsula completed, **83,** 1924.
1883–84. Extension of j. at e. end of peninsula, **84,** 2121.
1884–85. Minor repairs to n. p. and s. break'r, **85,** 2253.
1886–87. Dr. bet. and in front of ps., **87,** 304, 2344.
1887–88. General repairs to ps. and break'r, **88,** 2021.
1888–89. 10,700 c. y. dr.; steam launch and boathouse built; minor repairs to ps. and break'r, **89,** 2347, 2349.
1889–90. 2 breaches in break'r repaired; minor repairs to break'r and ps.; 20,000 c. y. dr., **90,** 2792, 2793.
1890–91. Repairs to s. break'r and n. p.; 125,471 c. y. dr. from inner and outer chans., **91,** 2870.
1891–92. 2,800 c. y. dr. in outer chan.; n. p. extended 452′; repairs to break'r and ps., **92,** 2522.
1892–93. Repairs to p. and break'r, **93,** 3096, and extending of n. p. in progress, **93,** 3097.
1893–94. Repairs to p. and break'r, **94,** 2428; extending of n. p. for 301.4′ completed, and boathouse removed to another location, **94,** 2429.
1894–95. Repairs to ps. and break'r, **95,** 3136, 6,235 c. y., s. m., dr., and steam launch repaired, **95,** 3137.
1895–96. Repairs to ps. and break'r, **96,** 3099.
1896–97. Repairs in progress at beginning of year completed, **97,** 3099, 29,399 c. y. dr. and 781 c. y. riprap st. placed along n. p., **97,** 3099; 2 wrecks removed, H. lines estab., and 2,400 locust trees planted **97,** 3100.
1897–98. Repairs to ps. and break'r, **98,** 2739; 6,535 c. y. dr., **98,** 2739; 2,000 locust trees planted on the peninsula, **98,** 2742.
1898–99. Presque Isle Peninsula watched and trees on it tended; preparations made for work on existing proj., **99,** 3093.
1899–00. Extending of n. p. completed; 203,174 c. y. dr.; timber crib j. built at Presque Isle Peninsula, and the peninsula watched, etc. (photographs), **00,** 4102–4.
1900–01. 236,499 c. y., s. m., dr. in H., over area 21′ x 750′ x 1,600′, except where r. occurred; work completed, **01,** 3297. Repairs made to 750′ of n. p. and to s. break'r at cost of $776.89, **01,** 3297–98. Automatic water gauge installed on n. p.; watchman on peninsula throughout year, **01,** 3298.
1901–02. Minor repairs, protection of property, and surveillance of Presque Isle Peninsula, **02,** 2296.
1902–03. 20,735 c. y. dr. from chan. and 286,871 c. y. from H.; s. p. superstr. and crib walls above grade removed for 421.7′ from e. end, 210′, or 7 crib lengths, from e. end leveled and repaired for reception of concrete blocks, 31 side-wall blocks and 2 cross-wall blocks placed, flagstone removed and deposited in deck of s. break'r for 571′ from n. end. Timber crib j. commenced and practically completed; minor repairs made to structures; surveillance of peninsula and automatic water gauge observations continued, **03,** 2116–17.
1903–04. Reconstr. of superstr., s. p., completed, and underlying cribs repaired, **04,** 3244. Timber crib j. completed, **04,** 3246. 272.5 c. y. placed in n. p.; minor repairs made to H. structures and U. S. property; 1,200 l. f. deck, n. p.; repaired, **04,** 3247. Surveillance of peninsula, and automatic gauge observations continued, **04,** 3248.
1904–05. Minor repairs to j. No. 2, **05,** 2369. Work under dr. contract started, **05,** 2370.
1905–06. 8,069 c. y., s. m., dr. from chan. and 176,386 c. y., p. m., from basin; 500 l. f. cribs filled and sunk on extension of s. p.; timber superstr. on 750′ of n. p. partly torn out, and making of concrete blocks for new superstr. in progress, **06,** 1924.
1906–07. Dr. completed; total excavated from basin 189,050 c. y., p. m., and from chan. 8,069 c. y., s. m., **07,** 2097. Extending s. p. 500′ completed; replacing 750′ of timber superstr., n. p., continued, **07,** 2098.
1907–08. 750′ of n. p. repaired with concrete superstr.; st. superstr. on 1,200 l. f. of Smith Break'r completed, **08,** 2169. All of the 500′ crib, s. p., sunk and filled; making concrete blocks for superstr. in progress; repairs to deck of timber portion (1,262′) of n. p. made by hired labor, **08,** 2170.
1908–09. Extension of s. p. 500′ lakeward completed; minor repairs on n. p. and s. break'r made by hired labor, **09,** 2143. Fires on peninsula extinguished; peninsula watched to prevent fires and settlement of squatters, **09,** 2144.
1909–10. 51,926 c. y., s. m., dr. from chan. at cost of $10,802.04, **10,** 2303. 7,111 c. y., s. m., dr. from basin; watch of peninsula continued, **10,** 2304.
1910–11. 133,067 c. y., s. m., removed from H. basin, **11,** 2509. Dr. inner chan. and e. and w. ends of H. basin completed at cost of $40,554.20, **11,** 2509–10. S. break'r repaired, and minor repairs made to machinery of launch *Gwendolen*, **11,** 2510.
1911–12. Surveillance of Presque Isle and care of property continued; minor repairs made to boathouse, and specifications prepared and approv. for replacing 755′ of timber superstr. on n. p. with concrete, **11,** 1113, 2711. Proj. 95% completed, **12,** 1113. Condition of work and proposed operations, **12,** 2712.

PHYSICAL CHARACTERISTICS.

Description, **71,** 200, 208; **75,** 316; **76,** ii, 564; **77,** 969; **88,** 2022; **96,** 3099, 3100, 3102; **97,** 3238–45; **12,** 1111, 1112.
Discussion of, **79,** 1713.
Table of gauge readings from 1875 to 1879, **79,** 1714.
Retrograde movement of shore line, **82,** 2420, 2423.
Water gauge raised 1.56′, **97,** 3100.
Current observations made, **97,** 3100; **98,** 2740.
Shoaling along the Presque Isle Peninsula, **00,** 4105.
Description of, condition of and effect of structures on shore erosion, **01,** 3297–98.
Max. draft carried, 1902, 18½′; variation of water surface, 2′, **02,** 507.
Shoaling of dr. area under influence of gales, **03,** 2116.
Beach erosion on n. side of peninsula corrected to some extent by js. built out from the shore, **03,** 2121.
Chan. 20′ x 300′, **04,** 3249.
Jetty No. 2. damaged by storm, 1904, **05,** 2369.

Weakest portion of peninsula at w. end; danger exists during storms, **05,** 2370.

Some trees planted on peninsula washed out by heavy sea, **06,** 1924.

Storm in 1907 made some changes in shore line of peninsula, **07,** 2098.

Beach erosion along the body of the peninsula has not been materially corrected by js. built out from the shore, **08,** 2170.

250 acres of woods on peninsula burned over, 1908, destroying underbrush and small trees, **09,** 2143. Shoaling of entrance chan. in 1908 by sand hummocks formed by churning of propellers of vessels running aground on chan. banks, **09,** 2144.

On s. shore Lake Erie, in Presque Isle B.; l. from e. to w., 4½ m.; w. from n. to s., 1–1½ m.; H. basin 2 m. l., ½–1½ m. w., 18′–24′ d.; 80 m. from Buffalo, N. Y., and 99 m. from Cleveland, Ohio, **12,** 1111.

PROJECTS. (See Estimates.)

By BE., date not known, repair and extension of ps. at e. entrance to 12′ of water; ps. to form a w. entrance at or near the breach in Peninsula Pt., and checking abrasion and restoring the orig. water line of the isld.; est., $269,105.37, S. D. 42, 35th, 1st.

By Col. Cram, 1865, dr., repairs, and extension of ps. by pile work to 13′; modified by Chief of Engineers, ordering cribs instead of pile ps.; est., $36,961.90, **66,** 20, 21, iii, 4, iv, 1, 2.

By Col. Cram, 1867, 14′ d. chan.; est., $54,666, **67,** 31, 139, 254; **68,** 43.

By BE., 1868, increasing w. of cribs from 18′ to 24′; grillage and riprap, **67,** 179–183. Plans and specifications for this proj. by Col. Cram, **68,** 163, 183–185.

By Maj. McFarland, 1868, dr. inner chan. 14′ x 300′, **68,** 164.

By Maj. McFarland, 1869, rebuilding s. break'r, **69,** 143; **70,** 181.

By BE., 1870, protection and preservation of peninsula by planting slips of silver poplar or beech, brush and st. protection in places; est., $10,000, **71,** 48, 208.

By BE., 1874, protection of n. spit by constr. of pile work and rubble st., **75,** 316.

By Lt. Col. Blunt, 1875, extension of beach protection of pile and plank bulkhead or fence backed with rubble, **75,** 57, 316.

By Lt. Col. Blunt, 1876, extension of s. p , beach protection, thorough repairs of ps., and dr., **76,** ii, 564–566; **77,** 969.

By Maj. Wilson, 1879, extension of n. p. 800′, s. p. 1,600′; est., $120,000, **79,** 1708.

By Capt. Adams, 1879, shore protection by log and pile js., **79,** 1713.

In 1886 Capt. Maguire est. that $84,120 would be required to extend the p. to the 16′ curve and maintain a chan. 16′ d. bet. the H. and d. w. in the lake, **86,** 339.

In 1890 the proj. was modified by Maj. Stickney, extension of the n. p. to the 18′ curve; est., $96,000, making the revised est. for completion, incl. the app. of 1890, $47,657, **90,** 2796, 2797.

By Maj. Symons, 1897 (new and extended proj.), for repair and mainten. of existing structures; the extension of the n. p. 500′ and the s. p. 1,000′; for dr. 20′ chan. at entrance, and at e. end of B. a part needed for access to docks; for 4 protection js. along the outer side of Presque Isle Peninsula; and for mainten. of structures on and care of Presque Isle Peninsula; est., $377,000, **97,** 3238 **99,** 3094.

Proj. modified by Chief of Engineers and by act June 25, 1910, to give 20′ at all stages in the entrance chan. and e. and w. ends of basin; est., $75,625, making total est. of proj. in force $452,625 (R. and H. Com. D. 26, 61st, 2d), **10,** 880.

Existing proj. with modifications described, **12,** 1112.

SURVEYS.

By Maj. John Anderson, 1819, **79,** 1707.
By Capt. T. W. Maurice, 1823, **79,** 1707.
By Capt. Williams, 1830, **79,** 1707.
By Col. T. J. Cram, 1864, **79,** 1707.
By J. De La Camp, under direction of Col. Raynolds, 1865, **66,** 25; **71,** 200, 202.
By I. Camp, 1870, under direction of Maj. McFarland. **R., 71,** 202–205.
By Lt. Col. Blunt, **75,** 317.
Beach line sur., **80,** 2184.
Ex. of H., 1881, **81,** 2332.
Ex. of outer beach of peninsula, 1881, **81,** 2333.
Sur. of peninsula, **85,** 2253.
Sur. of Presque Isle Peninsula, made, 1888, by Capt. Mahan, **88,** 2021; **89,** 2346.
Sur. of e. end of the peninsula and H. entrance by Maj. Ruffner, 1893, **94,** 2429.
Ex. of the chans. made, 1894–95, by Maj. Ruffner, **94,** 2429; **95,** 3136.
Sur. of the inner and outer chans. made, 1895, by Maj. Symons, **96,** 3099.
Ex. into the feasibility and advisability of imp. the H. by dikes to prevent closing by sand of the entrances au. by joint resol. of Cong.; **R.** submitted by Maj. Symons, 1896 (unfav.), **96,** 3101.
Sur. au. act June 3, 1896; made, 1897, by Maj. Symons (see Projects), **97,** 3237.
Ex. of the chans. made, 1898, by Maj. Symons, **98,** 2739.
Sur. of outer bar made, 1903, by Maj. Bingham, **03,** 2116.
Ex., for 22′ d., and protecting Presque Isle Peninsula, au. act Mar. 2, 1907; made by Col. Adams (**R.** unfav.) (H. D. 83, 60th, 1st. Reconsidered by BERH. in R. and H. Com. D. 26, 61st, 2d), **08,** 770.
Ex., for extension of ps., au. act Mar. 3, 1909; made, 1909, by Col. Fisk (**R.** unfav.) (H. D. 394, 61st, 2d), **10,** 890.
Cong. docs, etc., relating to exs., surs., plans, etc., **12,** 1113.

Maps:
Of N. and Nw. Lakes, showing location of H., **66,** i.
Of entrance to Erie H., sur. of Lt. Col. Raynolds, **66,** i.
List of maps, H., and peninsula, **71,** 206.
81, 2238; **84,** 2122; **98,** 2742.
Photographs. (See Operations, 1900.)
See special report on "Pictorial Engineering," History of Breakwater Construction in the Buffalo, N. Y., District, **04,** 3818.
Erie H., Pa., and diagram of freight received and shipped, value of, and app., **11,** 2510.

Part (b), RR–5 Erie Harbor, Presque Isle Peninsula, Pa.

APPROPRIATIONS.

1888, $60,000, **88,** 278.

CONTRACTS.

1888, J. Friday, shore protection, $75,830, **89,** 2356.

ENGINEERS.

Chief of Engineers. R., 88, 278; **89,** 329; **90,** 298; **91,** 374; **92,** 353; **93,** 405; **94,** 379; **95,** 413; **96,** 370.

Boards. Convened New York City, Jan., 1890, to ex. and report upon Capt. Mahan's proj. for shore protection. **R., 90,** 2800. (Cols. Abbot and Comstock and Lt. Col. Gillespie.)

In charge.
Capt. F. A. Mahan, 1888–90. **R., 89,** 2353.
Maj. A. Stickney, 1890–92. **R., 90,** 2799; **91,** 2877.
Maj. E. H. Ruffner, 1892–95. **R., 92,** 2526; **93,** 3101; **94,** 2433; **95,** 3142.
Maj. T. W. Symons, 1896. **R., 96,** 3104.

LEGISLATION.

Permission was given to the water commissioners of Erie, Pa., by Congress, to extend an intake pipe of the city water-supply system across the B., H., and peninsula, and thence out into Lake Erie, **93,** 3602, 3603.

OPERATIONS.

1888–89. 805 l. f. of shore protection built, **89,** 2354.

1889–90. 3,695 l. f. of shore protection built, **90,** 2800.

1892–93. Experiments in tree planting made, **93,** 3102.

1895–96. About 2,000 trees planted, and experiments made with grasses, **96,** 3105, 3106.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 2801; **93,** 3102; **96,** 3104.

PLANS.

By Capt. Mahan, 1889, 6,000 l. f. of crib protection; est., $360,000, **90,** 2800.

PROJECTS.

By Capt. Maguire, 1885, protection of the peninl sula with pile and sheet pile work 6,000′ l., parallewith and about 100′ from the shore; est., $173,000, **89,** 2353, 2355.

In 1890 proj. was abandoned; recom. by the BE. that $20,000 be held in reserve to repair any possible breach through the peninsula, the further constr. of shore protection being considered inadvisable, **90,** 2803, 2804. (Cols. Abbot and Comstock and Lt. Col. Gillespie.)

SURVEYS.

Ex. with a view to planting trees on the peninsula for the purpose of increasing the growth thereon and strengthening of the neck made, 1893, by Maj. Ruffner, **93,** 3102.

Maps. **89,** 2354.

RR–5(c) TWENTYMILE CREEK, PA.

Sur.—**R.,** Feb. 19, 1830; est., $4,063.03. (H. D. 482, 55th, 2d.)

RR–6 PORTLAND HARBOR, N. Y.[1]

APPROPRIATIONS.

1836,	$10,000, act July 4.
1837,	10,000, act Mar. 3.
1838,	35,466, act July 7.
1844,	1,150, act June 15.
Total,	56,616

RR–7(b) VANBUREN HARBOR, N. Y.

Sur.—**R.,** Oct., 1836; est., $362,777.50. (H. D. 482, 55th, 2d.)

RR–9 DUNKIRK HARBOR, N. Y.

APPROPRIATIONS.

1827,	$3,000.00, **66,** iii, 31.
1828,	6,000.00, **66,** iii, 31.
1829,	9,812.75, **66,** iii, 31.
1830,	1,342.75, **66,** iii, 31.
1831,	[2] 6,400.00, **66,** iii, 31.
1831,	702.50, act Mar. 2.
1832,	10,200.00, **66,** iii, 31.
1834,	4,000.00, **66,** iii, 31.
1835,	10,988.43, **66,** iii, 31.
1836,	11,000.00, **66,** iii, 31.
1837,	15,000.00, **66,** iii, 31.
1838,	10,000.00, **66,** iii, 31.
1844,	5,000.00, **66,** iii, 31.
1852,	30,000.00, **66,** iii, 31.
1867,	100,000.00, **67,** 138, 221; **68,** 198.
1869,	*2,000.00, **70,** 30, 51, 187.
1870,	25,000.00, **70,** 51, 187; **71,** 49.
1871,	25,000.00, **71,** 49.
1872,	25,000.00, **72,** 45.
1873,	40,000.00, **73,** 45.
1874,	35,000.00, **74,** 52.
1875,	35,000.00, **75,** 57, 317.
1876,	18,000.00, **76,** 109, ii, 568; **77,** 116.
1879,	*2,500.00, **79,** 1716.
1880,	10,000.00, **80,** 2192.
1884,	10,000.00, **84,** 2125.
1886,	20,000.00, **86,** 1876.
1888,	15,000.00, **88,** 2027.
1890,	20,000.00, **90,** 2807.
1892,	20,000.00, **92,** 2529.
1894,	20,000.00, **95,** 3145.
1896,	10,000.00, **96,** 3107.
1897,	398,258.00, **97,** 3105.
1902,	25,000.00, **02,** 2299.
1909,	*5,000.00, **09,** 2147.
1910,	99,275.00, **10,** 2308.
Total,	1,089,112.38 (incl. sales, $1,089,534.88, **12,** 2715).

* Allotment. [1] H. D. 482, 55th, 2d. [2] Erroneously called $6,000, act Mar. 2, 1831, **66,** iii, 31.

COMMERCE.

Requirements of, discussed, **75,** 318; **76,** ii, 557; **77,** ii, 971. Requirements of, will not justify further extension of break'r, **77,** ii, 971.

Statistics, S. D. 42, 35th, 1st, **66,** iii, 31, iv, 157; **67,** 231; **68,** 197; **69,** 149; **70,** 189; **72,** 247; **73,** 348; **74,** 225; **75,** 318; **76,** ii, 567; **78,** 1268; **79,** 1717.

Description of, **93,** 3121, 3130; **95,** 3174.

Local, and not large, 1899, but arrangements made for its increase, **00,** 4149.

Small; not increasing, **05,** 2373; **08,** 2173.

Rates hve not been affected by proj., **06,** 696; **10,** 882.

1903, 65,000 t.; 1908, 3,000 t.; 1911, 6,000 t., **12,** 1115.

CONTRACTS.

1867. Alex. McDonnell, labor and materials, **67,** 232, 233; **68,** 197. R. N. Gere, iron, **68,** 197.

1868. Hart & Jennings, labor and materials, **69,** 150; **70,** 189. Pratt & Co., iron, **69,** 150; **70,** 189.

1869. Bailey & Denny, materials, **69,** 150; **70,** 189.

1871. O. J. Jennings, materials and labor, **71,** 213; **72,** 247.

1872. O. J. Jennings, materials and labor, **73,** 350; **74,** 226.

1873. O. J. Jennings, materials, labor, and dr., **73,** 350; **74,** 226.

1874. Cartwright, McCurdy & Co., iron, **73,** 350; **74,** 226. O. J. Jennings, materials and labor, drilling, blasting, and dr., **75,** 319. Cartwright, McCurdy & Co., iron, **75,** 319.

1875. Spaulding & Bennett, materials and labor, **75,** 319. William H. McCurdy & Co., iron, **75,** 319.

1876. Case & Jennings, drilling, blasting, and dr., **76,** ii, 568.

1877. O. J. Jennings, materials and labor, **77,** ii, 971. William H. McCurdy, iron, **77,** ii, 971.

1878. O. J. Jennings, removal of wreck and dr., **79,** 1716.

1881. G. W. White, material and labor, **81,** 2419. F. B. Gay, iron, **81,** 2419.

1884. Hingston & Woods, dr. and break'r repair, **85,** 2248.

1887. G. Elias & Bro., timber, **87,** 2349. D. McNaughton, iron, **87,** 2349.

1889. Hingston & Woods, dr., 27¢ c. y. for mud and $1 for loose r., **89,** 2358.

1891. G. C. Grimard, constr. and repair of break'r and ps., $14,970, **91,** 2880.

1892. D. E. Horton, repairs to break'r and p., bid, at $12,859.18±; H. K. Gustin, extension of break'r, $15,114.56± (annulled, **94,** 2435), **93,** 3106.

1893. J. B. Donnelly, break'r extension, bid, $14,749.65±, **94,** 2435.

1894. Hingston & Woods, dr., $9.67 per hour; J. B. Donnelly, break'r extension, $13,752.28±, **95,** 3145.

1897. E. J. Hingston, chan. and H. excavation, repairs to w. p., constr. of break'r, and extension of, $321,386.85±, **97,** 3106. Supple. contracts for extra work, **98,** 2749, 2753.

1906. Wm. H. Shelton, repair of w. p., st. $2.60 c. y., concrete $11.70 c. y., **06,** 1927.

1909. Great Lakes Constuction Co., repair of w. p. (removing old work, timber, ironwork, concrete), $4,574, **10,** 2308.

DEFENSE.

This H. necessary for U. S. Navy in time of war, S. D. 42, 35th, 1st.

ENGINEERS.

Chief of Engineers. **R.,** **66,** 7, ii, 41, iii, 15, 31; **67,** 31; **68,** 43, 198, 201; **69,** 39, 162; **70,** 50, 190; **71,** 48, 214; **72,** 45; **73,** 45; **74,** 57; **76,** 109; **77,** 116; **78,** 131; **79,** 174; **80,** 229; **81,** 315; **82,** 309; **83,** 316; **84,** 320; **85,** 343; **86,** 338; **87,** 304; **88,** 278; **89,** 330; **90,** 298; **91,** 374; **92,** 353; **93,** 405, 409; **94,** 379; **95,** 414, 418; **96,** 370, 376; **97,** 464; **98,** 456; **99,** 537, 543; **00,** 605, 611; **01,** 586; **02,** 508; **03,** 558; **04,** 611; **05,** 620; **06,** 695; **07,** 719; **08,** 762, 770; **09,** 798; **10,** 881, 890; **11,** 935; **12,** 1114.

Boards. (See also Projects.)

1869. To consider modified plan of break'r proposed by Col. Harwood; recom.: 1st, riprap on H. side of the portion built; 2d, increase in w. of extension from 20′ to 24′; 3d, grillage bottom. **R.,** **70,** 191.

1870. To prepare plan and est. for H. imp.; recom.: 1st, reconstr. of "dummy" crib for a day beacon; 2d, constr. of break'r inside of former break'r on plan proposed by Capt. Harwood (see **70,** 193–197), with slight modifications; 3d, blasting and dr. chan. 13′ x 170′, entrance to anchorage, **71,** 214–217.

(Lt. Col. Woodruff, Maj. McFarland, and Capt. Harwood.)

In charge:

Capt. W. G. Williams, 1839; **66,** iv, 155.

Capt. Wm. Turnbull, 1855–56. **R.,** S. D. 1, pt. 2, 34th, 1st.; extracts from, in S. D. 42, 35th, 1st.

Lt. Col. Graham, 1857. **R.,** S. D. 42, 35th, 1st.

Capt. J. A. Tardy, 1866. **R.,** **66,** iv, 155.

Col. T. J. Cram, 1867–68; **67,** 137, 148, 221.

Maj. F. Harwood, 1868–74. **R.,** **68,** 195; **69,** 147–153, 154, 155–162; **70,** 186, 189, 190, 191–198; **71,** 213; **72,** 246; **73,** 347; **74,** 225.

Lt. Col. C. E. Blunt, 1874–78; **74,** 215. **R.,** **75,** 317; **76,** ii, 566; **77,** ii, 970.

Maj. W. McFarland, 1878–83. **R.,** **78,** 1267; **79,** 1715; **80,** 2191; **81,** 2417; **82,** 2429.

Capt. M. B. Adams, 1883–84. **R.,** **83,** 1927.

Capt. E. Maguire, 1884–85. **R.,** **84,** 2124.

Maj. L. C. Overman, 1885–86. **R.,** **85,** 2246; **86,** 1874.

Capt. F. A. Mahan, 1886–90. **R.,** **87,** 2348; **88,** 2024; **89,** 2356.

Maj. A. Stickney, 1890–92. **R.,** **90,** 2804; **91,** 2878.

Maj. E. H. Ruffner, 1892–95. **R.,** **92,** 2527; **93,** 3103, 3119; **94,** 2434; **95,** 3143, 3173.

Maj. T. W. Symons, 1896–. **R.,** **96,** 3106, 3127; **97,** 3103; **98,** 2748; **99,** 3096; **00,** 4108, 4148, 4150; **01,** 3302; **02,** 2298.

Maj. Theo. A. Bingham, 1903. **R.,** **03,** 2124.

1st Lt. P. S. Bond, 1904. **R.,** **04,** 3251.

Col. H. M. Adams, 1905–07. **R.,** **05,** 2373; **06,** 1927; **07,** 2101.

Lt. Col. W. L. Fisk, 1908–10. **R.,** **08,** 2173; (Col.) **09,** 2146; **10,** 2307.

Lt. Col. J. G. Warren, 1911–. **R.,** **11,** 2512; (Col.) **12,** 2714.

Assistants:

J. S. Lawrence, **66,** iv, 164.

Capt. F. Harwood, **67,** 137, 221; **68,** 199.

Mr. Mifflins, **68,** 202.

1st Lt. P. S. Bond, **04,** 609.

1st Lt. W. L. Guthrie, **09,** 797.

ESTIMATES. (See Plans and Projects.)

By BE., 1854, completing the work, $192,600.81; revised by Lt. Col. Graham to $401,818.66, S. D. 42, 35th, 1st.

By Capt. Tardy, cribwork, $267,130.20, **66,** iii, 15, 31; cribwork, with masonry superstr., $433,977.46, **66,** iv, 157.

By Col. Cram, to complete work, $148,584, **67,** 138.

By Capt. Harwood, permanent completion, $404,500, **68,** 197; opening e. chan. and for an auxiliary break'r, $155,684.78, **68,** 204; for entire and permanent completion, $407,894.10, **69,** 149; $505,213.06, **70,** 188; buttress cribs, 8′ x 30′, $326.93; 10′ x 30′, $367.89, **69,** 159.

By BE., $331,000, **71,** 216.

By Capt. Harwood, to complete proj. of the BE., $306,000, **72,** 247; $275,000, **73,** 348; $100,000, **74,** 226.

By Lt. Col. Blunt, necessities of C. require, $18,000, **76,** ii, 567; to complete existing proj., $31,000, **77,** ii, 971.

By Maj. McFarland, to complete existing proj., $262,000, **79,** 174, 1717. Modification proposed and recom. to meet requirements, $31,000, **79,** 1716.

OPERATIONS.[1]

1855-56. 8 cribs, 19′ x 30′, placed in position; 5 of them injured by ice; injury repaired, S. D. 42, 35th, 1st.

1867-68. Repairs of p. connecting beacon light with mainland, **68,** 43.

1868-69. 7 cribs, 210 l. f., of the w. p. carried away, repaired; reinforcement in consequence. Constr. of the new break'r begun, **69,** 39, 148.

1869-70. W. p. finished; removal of old outer break'r; 390′ of new break'r constr., **70,** 50, 193.

1870-71. W. p. repaired and reinforced; removal of outer break'r completed; reconstr. of day beacon and building about 200′ of break'r under contract, **71,** 213.

1871-72. "Dummy" and 210′ of break'r built; repairs to w. p.; dr. in chan. and approaches begun, **72,** 45, 246.

1872-73. 360′ break'r completed; bar removed by dr., making chan. 13′ d., **73,** 45, 347.

1873-74. 2,375 c. y. r. removed; 8,500 c. y. sand dr.; break'r extended w. to its edge; 60′ of substr. added to e. end, **74,** 52, 225.

1874-75. 4 cribs, 120′, sunk; 60′ superstr. built, and 120′ of superstr. without oak slope or decking, **75;** 57.

1875-76. 120′ superstr. completed; 7 cribs, 210′, break'r finished; total length, 828′; 4,465 c. y. mostly r., removed from chan., **76,** 109, ii, 567.

1876-77. Chan. completed 13′ x 170′; w. p. repaired, **77,** 116, ii, 970.

1877-78. Break'r extended 251′, **78,** 131, 1268.

1878-79. Repairs to w. p.; removal of wreck and dr., **79,** 1715, 1716.

1881-82. 150 l. f. of cribwork placed and superstr. commenced, **82,** 2430.

1884-85. 13,318 c. y. dr. for chan., 100 l. f. of face timbers removed, **85,** 2246.

1885-86. 23,317 c. y. excavated, **86,** 1875.

1886-87. Repairs to w. break'r, **87,** 2348. History of work, **87,** 2348.

1887-88. 9 cribs sunk in repair of w. p.; break'r H. wall rebuilt, and decking repaired, **88,** 2026.

1888-89. Repairs to w. p. by hired labor, **89,** 2358.

1889-90. Extensive repairs to w. p. by hired labor; 14,370 c. y. of mud and 120 c. y. loose st. removed under contract, **90,** 2805.

1891-92. Constr. of w. p. superstr.; 2,900 c. y. dr., **92,** 2528.

1892-93. P. and break'r superstr. repaired, **93,** 3103, 3104.

1893-94. 250′ of extension to break'r completed, minor repairs made to w. p., and 22,727 c. y. dr., **94,** 2435.

1894-95. Minor repairs were made to w. p. and break'r extended 400′, **95,** 3143.

1896-97. 111,612 c. y., p. m., dr. and break'r constr. in progress, **97,** 3105.

1897-98. 442,629 c. y., p. m., excavated and removed, **98,** 2751; 582′ of break'r constr., **98,** 2751, 2752; repairs to w. p. in progress, **98,** 2752; and minor repairs made to structures, **98,** 2755.

1898-99. 91,415 c. y. dr.; work on concrete superstr. of w. p. completed and protected with riprap st.: break'r extension completed; minor repairs made. Proj. completed, **99,** 3097–3100. Photographs, **00,** 4108.

1899-00. Repair of w. p. **00,** 4110.

1900-01. Office work, **01,** 3303.

1902-03. Two breaches in w. p. closed by sinking cribs 7′ x 9′ x 29′, and 8′ x 8′ x 56′, and rebuilding timber superstr.; 365 l. f. deck, stringers and plank w. end of main break'r rebuilt, **03,** 2124.

1905-06. Minor repairs made to timber portion of w. p., **06,** 1927.

1906-07. Repairs to concrete apron, w. p., completed; repairs made by hired labor to timber portions of p. and break'r, **07,** 2101.

1907-08. Break'r: Timber back wall and deck on 860 l. f. rebuilt; 660 c. y. st. placed in this section; 71 l. f. of timber lake slope replaced with concrete; 481 l. f. deck plank replaced. W. p.: 167 l. f. timber p. at shore end rebuilt; broken back wall timbers and deck plank of superstr. replaced, **08,** 2173.

1908-09. Break'r: 285 c. y. st. placed; 97 l. f. of decayed slope timbers removed whole length of slope, and 171 l. f. removed 6′ down from top; al replaced with concrete, and plank deck repaired. W. p.: Lower half of old timber slope removed for 30 l. f., and 25 st. blocks placed along breached crib front under water; 150 c. y. st. placed in superstr., and new concrete slope laid; 20 l. f. concrete apron removed and 36 l. f. new concrete apron laid; slope repaired with concrete, **09,** 2146.

1909-10. 30 l. f. wrecked cribwork of w. p. removed; new crib built in contractor's yard and towed to the site; foundation made ready for sinking new crib, **10,** 2307.

1910-11. Foundation for crib (w. p.) completed; crib sunk; concrete superstr. placed; contract completed, **11,** 2512. Condition of works, **11,** 2513.

PHYSICAL CHARACTERISTICS.

Description of, **66,** iii, 15, iv, 155; **68,** 199, 205; **69,** 156, 162; **70,** 194–196; **88,** 2027; **93,** 3121, 3122; **95,** 3175; **96,** 3128; **98,** 2755; **00,** 4148–4150.

Storms damaging w. p., **99,** 3097.

Max. draft carried, 1901, over shoalest part, 16′, **01,** 587.

New repair cribs fully settled upon their foundations, **04,** 3252.

Max. draft carried, 1904, 16′; variation of water surface, 2′, **04,** 611; max. draft carried, 1910, 16′; variation of water surface, 2′, **10,** 882.

P. and break'r damaged by storms, **07,** 2101.

H. is break'r protected; indentation of s. shore Lake Erie, 36 m. w. from Buffalo, 44 m. from Erie, Pa., **12,** 1114.

PLANS. (See Estimates and Projects.)

By Col. Cram, various plans for n. p., basin, etc., **68,** 198–205.

By Maj. Harwood, for buttress cribs to reinforce p., **70,** 193–197.

Lt. Col. Blunt considers the building of the break'r to the full l. unnecessary, **75,** 318; **76,** ii, 567; **77,** 971.

PRIVATE WORK.

A sur. of the H. made by citizens of Dunkirk in 1895–96, **96,** 3128.

PROJECTS. (See Estimates and Plans.)

Orig., for a w. p. and break'r of cribwork in from 8′ to 12′ of water, **66,** iv, 155.

By BE., 1854, 3 distinct break'rs, e., middle, and w., on a line from Lighthouse Pt. to Battery Pt., in 18′ of water, **66,** iv, 155; **67,** 221; est., $192,600.81; increased by Lt. Col. Graham, 1857, to $401,818.66, S. D. 42, 35th, 1st.

By Capt. Tardy, 1866, refers to former projs. and recom. returning to the orig.; urges superstr. of masonry; est., for wood superstr., $267,130.20; for masonry, $433,977.46, **66,** iv, 156, 157.

By Col. Cram, 1867, recom. Capt. Tardy's plan, except in preferring wood to masonry superstr.; est., $148,584, **67,** 137, 138, 221.

By Capt. Harwood, 1868, removing old outer break'r to 14′ of water, **68,** 43, 196; repair and reinforcement of p. by buttress cribs on lake side, **69,** 155, 162; buttress cribs on land side instead of lake side, **70,** 189, 190; riprap on land side instead of buttress cribs, **70,** 190.

By BE., 1869, increasing the w. of the cribs from 20′ to 24′ and constr. them with grillage bottoms, **70,** 191.

By BE., 1870, reconstr. "dummy" crib as a day beacon; constr. 2,860′ of break'r and an e. p.; also blasting and dr. in the chan. to 13′; est., $331,000; revised est., $275,000, **71,** 216; **76,** ii, 567. Modified in 1873 to extension of break'r 180′ w., **73,** 45, 347; **80,** 229; **81,** 315; **87,** 2348.

By Maj. McFarland, 1879, proposed modifications, by extending the break'r 510′ instead of 1,109′; est. to complete, $31,000, **79,** 174, 1716.

By Capt. Adams, 1883, 860 l. f. of break'r extension. Est., $60,200. **83,** 1928.

In 1890 Maj. Stickney est. that to complete the imp. as projected, without repair to existing structures, would require, including the app. of 1890, $147,916, **90,** 2807; **91,** 2878.

[1] Early history of, **66,** iv, 155.

By Maj. Ruffner, 1896, completing the break'r by the addition of 360′ to its e. end and adding to the chan. arm 560′, and in addition thereto dr. entrance chan. to H. basin, containing in all about 65 acres, to a d. at m. l. l. suitable for vessels drawing 16′; est., $408,258, **96,** 3107.

In 1899 Maj. Symons est. $74,827.50 for a 1,300′ arm to existing break'r, **00,** 4152.

By Maj. Bingham, completing concrete superstr. on w. p., rebuilding superstr. on break'r with concrete, and mainten. of structures and chans.; est., $57,000, **03,** 2125.

Proj. modified by act June 25, 1910, provides for removal of rocky reef to 18′ at m. l. l.; est., $99,275, provided local au. builds concrete dock or terminal facilities satisfactory to Sec. of War., **10,** 882; **12,** 1114.

Break'r compared (detail drawings) with break'rs of lakes and other famous break'rs of the world, **04,** 3818.

SURVEYS.

Soundings by Lts. Brown and Morell, 1835, **68,** 203.

Under direction of Capt. Tardy, by J. S. Lawrence, 1866, **66,** ii, 41, iii, 15. **R.,** **66,** iv, 155.

By Maj. Harwood, 1872, **72,** 246.

Ex. for 16′ d. au. act July 13, 1892; made, 1892, by Maj. Ruffner (**R.** of DE. unfav.), **93,** 3119.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Ruffner (**R.** of DE. unfav.), **95,** 3173.

Sur. au. act Mar. 4, 1895; made, 1895, by Maj. Ruffner (see Projects), **96,** 3127.

Hydrographic sur. to determine location of the 19′ curve, made, 1898, by Maj. Symons, **98,** 2755.

Ex. and sur. for e. break'r au. act Mar. 3, 1899; ex. made (sur. not required) by Maj. Symons (**R.** fav.; see Projects), **00,** 4148.

Pre. ex. and **R.,** Col. Adams; locality not considered worthy of imp. (H. D. 81, 60th, 1st), **08,** 770.

Pre. ex. and sur. au. act Mar. 3, 1909; made, 1909, by Col. Fisk (H. D. 720, 61st, 2d), **10,** 890.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1115.

Maps. (H. D. 720, 61st, 2d.) **79,** 1716; **81,** 2418; **84,** 2124; **97,** 3106; **98,** 2754; **03,** 2124.

Photographs. (See Operations, 1899, and Projects, last paragraph.)

RR–10 SILVER CREEK, N. Y.

Sur.—**R.,** Jan. 15, 1830; est., $332,099.30. (H. D. 482, 55th, 2d.)

RR–11 CATTARAUGUS CREEK, N. Y.

APPROPRIATIONS.[2]

1836,	$15,000, July 4.	
1837,	10,000, Mar. 3.	
1838,	32,410, July 7.	
Total,	57,410	

RR–13 BUFFALO AND BLACK ROCK HARBORS, N. Y.

Part.	Title.	Period.	Appropriations.
a	Buffalo H.	1826–1912	$6,220,695.96
b	Black Rock H.	1829–1834	52,098.00
c	Black Rock H., N. Y. (Buffalo entrance)	1899–1900	241,701.25
d	Black Rock H., N. Y. (Lake Erie entrance)	1901–1910	814,643.00
e	Black Rock H. and Chan., N. Y.	1904–1912	4,100,000.00
	Total		11,429,138.21

Part (a), RR–13 Buffalo Harbor, N. Y.

APPROPRIATIONS.

1826,	$15,000.00, **66,** iii, 30.	
1828,	34,206.00, **66,** iii, 30.	
1830,	15,488.00, **66,** iii, 30.	
1831,	12,900.00, **66,** iii, 30.	
1832,	10,300.00, **66,** iii, 30.	
1833,	31,700.00, **66,** iii, 30.	
1834,	$20,000.00, **66,** iii, 30	
1838,	68,500.00, **66,** iii, 30	
1844,	40,000.00, **66,** iii, 30.	
1852,	14,000.00, **66,** iii, 30.	
1853,	349.05, **66,** iii, 30.	
1855,	452.32 (relief of J. R. Bowes, act Mar. 2, 1855).	

[1] Sur.—**R.,** 1835, est. $55,712.17. (H. D. 482, 55th, 2d.)
[2] For imp. H. at mouth of. (Treas. D. 373, 1882.)

1864,	$15,000.00, June 28.
1864,	[1] 37,500.00, act July 2.
1866,	131,000.00, **66,** iii, 30.
1867,	100,000.00, **68,** 198.
1869,	* [2] 89,100.00, **69,** 22.
1870,	80,000.00, **70,** 51, 184; **71,** 49.
1871,	100,000.00, **71,** 49.
1872,	75,000.00, **72,** 45.
1873,	75,000.00, **73,** 46.
1874,	95,000.00, **74,** 53, 228; **75,** 320.
1875,	100,000.00, **75,** 57, 322; **76,** ii, 568.
1876,	85,000.00, **76,** 109, ii, 567; **77,** 117.
1878,	80,000.00, **78,** 131, 1270.
1879,	100,000.00, **79,** 175, 1719.
1880,	90,000.00, **80,** 2194.
1881,	90,000.00, **81,** 2423.
1882,	125,000.00, **82,** 2436.
1884,	100,000.00, **84,** 2130.
1886,	112,500.00, **86,** 1883.
1888,	225,000.00, **88,** 2054.
1890,	300,000.00, **90,** 2836.
1892,	300,000.00, **92,** 2531.
1894,	70,000.00, **95,** 3149.
1897,	481,250.00, **97,** 3111.
1898,	489,746.00, **98,** 2784.
1899,	560,498.00, **99,** 3110.
1901,	400,000.00, **01,** 3319.
1902	30,000.00 } **02,** 2310.
	200,000.00 }
1905	150,000.00 } **05,** 2378.
	143,506.00 }
1907,	533,436.00, **07,** 2105.
1909,	[3] 3,264.44, **09,** 2150.
1910,	99,605.00, **10,** 2312.
1911,	[4] 1,395.15, **11,** 2515; **12,** 2719.
1912,	290,000.00, **12,** 2719.
Total,	6,220,695.96, **12,** 2719.

COMMERCE.

C. of Buffalo, **89,** 2383.

Amount of grain (flour included) delivered in New York City by various routes during 1890, **91,** 2888.

Buffalo considered one of the greatest ports of the U. S., **95,** 3154. Congestion of the H. at times very great, **96,** 3113; **97,** 3110; **98,** 2781.

Erie Canal important factor in C. of the port, **98,** 2780.

Enormous, **99,** 538.

Details, Black Rock H., etc., **01,** 3347–3348.

Proj. has material effect in controlling rates on bulk commodities, **09,** 801.

1911, 13,000,000+ t., **12,** 2721.

Diagram showing relation of app. to tonnage, etc., **11,** 2517.

CONTRACTS.[5]

1869. Baileys & Denny, materials and labor, **69,** 147, 150; **70,** 184; **71,** 217; **74,** 228; **75,** 321.

1870–71. D. E. Bailey, materials and labor, **71,** 217; **74,** 228; **75,** 321.

1874. Spaulding & Bennet, materials, labor, and dr., **74,** 228; **75,** 321.

1875. J. F. Blair, materials and labor; W. H. McCurdy, iron, **75,** 321.

1876. George T. Talbot, dr., 26¢ c. y., **76,** ii, 569.

1877. W. H. McCurdy, iron; Ambrose Clark, materials and labor, **78,** 1269.

1878. Pratt & Co., iron; F. B. Colton, materials, labor, and dr., **79,** 1725.

1880. Messrs. Pratt & Co., iron for crib constr.; D. E. Bailey, crib constr., **80,** 2193, 2204. Gibson & Granger failed to enter into contract, **80,** 2193.

1881. Frank Wilson, ironwork; D. E. Bailey and E. J. Kingston, crib constr., **81,** 2421, 2425.

1882. A. J. Packard, ironwork, **83,** 1932, 1934.

1884. C. E. Williams, crib constr., **84,** 2127. D. E. Bailey, repairs to break'r, **84,** 2128. I. Farnsworth, iron; D. E. Bailey, repairs to ps., **85,** 2264.

1885. D. E. Bailey, break'r repairs, **85,** 1882.

1888. Williams & McConnell, broken st., $1.84 c. y.; H. Fleming, Portland cement, $2.09 bbl.; F. O. Norton, natural cement, $1.20 bbl., **88,** 2034.

1889. Union Akron Cement Co., Portland cement, $2.45 bbl.; Fox & Holloway, sand, 80¢ c. y.; D. McNaughton, iron moorings, $1,852; J. M. McCarthy, recovering concrete blocks washed off the break'r, $2 block; J. Longprey & Co., furn. and driving piles, $8 pile, **89,** 2386.

1890. W. E. Carroll, pebbles, $1.40 c. y., **90,** 2837. J. H. Ross, Portland cement, $2.45 bbl.; Ira Farnsworth, broken st., $2 c. y.; Fox & Holloway, sand, 70¢ c. y., **90,** 2837.

1891. J. Donnelly, break'r extension, $66,271.16, **91,** 2884. Emil Thiele, Portland cement, $2.58 bbl., **91,** 2885. D. McNaughton, iron moorings, $65 mooring, **91,** 2886. J. B. Donnelly, rubble st., $1.16 c. y., **91,** 2886. P. G. Straub, broken st., $1.47 c. y., **91,** 2886. Fox & Holloway, sand, 90¢ c. y., **91,** 2886. J. MacGregor, pebbles, $1.75 c. y., **91,** 2886.

1892. J. J. Churchyard, break'r constr., $107,067.94, **93,** 3110.

1893. Daniel Bros., break'r constr., $92,879.83, **93,** 3110.

1894. Wm. S. Bartlemes and W. C. Hiam, test borings, 74¢ l. f. ($5,000), **95,** 3149.

1895. C. A. Dennis, break'r repairs; actual cost, $2,340.97, **96,** 3113.

1896. C. A. Dennis, break'r repairs, actual cost, $2,933.26, **97,** 3108.

1897. Hughes Bros. & Bangs, break'r constr. and sand-catch p. extension, $1,765,450.63, **97,** 3113. Supple. contracts made for increased quantities of material brought from Canada, **98,** 2780. Extra work on crib, **99,** 3111.

1899. Buffalo Dredging Co., constr. of concrete superstr. on break'r (removal of old work; timber, st., concrete, dr., ironwork), $70,169.25, **99,** 3111.

1900. Buffalo Dredging Co., new concrete superstr. on s. p., prices given, **01,** 3320.

1901. Chas. A. Dennis, repairing deck of break'r, Stony Pt. sec., prices given; Buffalo Dredging Co., new concrete superstr. on break'r, prices given, **01,** 3320.

1903. Hughes Bros. & Bangs, repairs to restore superstr. of sunken break'r, to receive actual force account, plus 15%, and rental for plant employed; rubblest. 80¢ t. addl., capping st. $1.25 c. y., **03,** 2128, 2140.

1904. James B. Donnelly, riprapping n. end of old crib break'r, **05,** 2375.

1905. The Grattan Contracting Co., concrete superstr. on s. p., **05,** 2379. Buffalo Dredging Co., dr., 29¢ c. y., s. m., **05,** 2379. C. M. Handy, st. superstr., sea slope, and riprap, South H. sec. of break'r, $93,160, **06,** 1932.

1906. Canal Quarry Co., constr. of st. break'r, s. chan. arm, $130,000, **06,** 1932.

1907. Great Lakes Construction Co., st. concrete superstr. on break'r, $259,148.80; Buffalo Dredging Co., dr. s. end of H., 14¢ c. y., s. m.; Lake Erie Dredging Co., removing shoals outside n. entrance to H., $1.74 c. y., s. m., **07,** 2106.

1909. The Breakwater Co., completing constr. of st. break'r, s. chan. arm, $51,298.75, **09,** 2151.

1910. The Breakwater Co., supple., addl. st., **11,** 2515.

1911. Empire Engineering Corporation, dr. in n. entrance chan., removing r. shoals outside n. entrance, removing Watson elevator site, prices given, **12,** 2719.

ENGINEERS.

Chief of Engineers. R., 66, 2, 4, 49, 50, ii, 38, 39, iii, 15, 30; **67,** 31, 32; **68,** 43, 44, 219; **69,** 39; **70,** 51; **71,** 49; **72,** 45; **73,** 46; **74,** 52, 53; **75,** 57; **76,**

* Allotment.
[1] Erroneously called $52,500, **66,** iii, 30.
[2] Erroneously called $90,000, **69,** 39, 147.
[3] Transf. from app. for Buffalo entrance to Erie Basin and Black Rock H.
[4] Au. to be used from other allotments for H.
[5] Au. to make contracts and instructions in regard to, **68,** 219.

109, ii, 573; **77,** 116; **78,** 131; **79,** 174; **80,** 229; **81,** 315; **82,** 309; **83,** 317; **84,** 321; **85,** 345; **86,** 340; **87,** 305; **88,** 279; **89,** 330; **90,** 299; **91,** 375; **92,** 354; **93,** 406; **94,** 380; **95,** 414; **96,** 371; **97,** 466; **98,** 458; **99,** 538; **00,** 606; **01,** 587; **02,** 509; **03,** 559; **04,** 612, 618; **05,** 621; **06,** 696, 703; **07,** 720; **08,** 764; **09,** 800; **10,** 883, 890; **11,** 936; **12,** 1115.

Boards:

1845. For consideration of plans for imp. of H., **68,** 228.
(Gen. Swift, Col. Kearney, and Maj. Turnbull.)

1868. To consider plans submitted by Col. Cram. Recom. repair of lighthouse p. and its extension 300′, repair of n. p., removal of portion of s. end of Erie break'r; dr. H. entrance to allow draft of 15′. Constr. of break'r of cribwork should conform to principles already laid down by Board of 1854 for similar localities as to dimensions of cross sec. and l. **68,** 220, 224. Col. Cram dissents; see letter and memoir. **68,** 225–231. Reconvened to consider letter and memoir of Col. Cram; reconsider whole subject, submit plans and est. for sec. of break'r; est., 100′, $19,828.40. Met at Detroit Mar. 27, 1868, and after general discussion and balloting submitted **R. 68,** 232–235. Col. Cram again dissents; see letter and memoir. **68,** 236. (Cols. Cram and Macomb, Lt. Cols. Raynolds, Newton, and Blunt, Maj. Wheeler, and Capt. Harwood.)

Apr., 1873. To consider proj. of Maj. Harwood to prevent displacement of cribs in break'r. Concur in his proj., except in regard to dimensions of st. foundations; report that the st. foundations need only be raised about 4′ above bottom of lake, and should be extended 25′ exterior to the work and 15′ on the interior. **R., 73,** 353, 354. (Col. Macomb and Majs. Houston, Wilson, and Harwood.)

Nov., 1873. To consider question of accretions of sand, and constr. of break'r. Report that a sur. necessary to furnish requisite data. **74,** 229–232.

Mar., 1874. Approve plan of Maj. Harwood for arresting progress of sand along the beach, viz, by p. of pile and cribwork, and building submerged end of break'r to full height; report borings necessary to furnish data for final report; submit preliminary **R., 74,** 229–232. (Col. Woodruff, Majs. Comstock, Wilson, and Harwood.)

Aug., 1874. Board locates position of catch-sand ps. Objects to proposed private ps. or transfer of U. S. property near lighthouse to private parties. Recom. preparing artificial foundation for portion of break'r by dr. trench 50′ x 2,500′, filling it with gravel and st. Break'r should be prolonged s. on its "present" line to 7,600′. At s. end of break'r a fair-weather exit should be left bet. the break'r and catch-sand p. W. of the cribs should, in all cases, be equal to their height. **76,** ii, 569. (Col. Woodruff, Lt. Col. Blunt, and Majs. Comstock, Wilson, and Harwood.)

Sept., 1874. Board consider question of changing location of catch-sand p.; recom. change in location of shore end of p.: Starting from a point on the beach about opposite the s. end of Blackwell Canal, extending to 16′ water in a line at right angles to the shore, oblique branch of break'r to be changed to correspond to this new position. **R., 76,** ii, 573. (Col. Woodruff, Lt. Col. Blunt, and Maj. Wilson.)

Convened, New York, 1886–87, to consider reconstr. of superstr. of break'r. **R., 87,** 2362, 2363. (Cols. Casey and Abbot, Lt. Cols. Comstock and Houston.)

Convened, Buffalo, N. Y., Dec. 21, 1888, by S. O. No. 69, to report upon constr. of a plant for building superstr. of Buffalo Break'r. First **R., 89,** 2388. (Lt. Col. King, Maj. Overman, and Capt. McC. Derby.)

Convened, Buffalo, N. Y., Mar. 6, 1889, to ex. and report upon plant for new break'r superstr. Second **R., 89,** 2391. (Lt. Col. King, Maj. Overman, and Capt. Mahan.)

Convened, Buffalo, May 27, 1895, S. O. No. 13, 1895, to consider and report upon plan and est. by Maj. Ruffner for extending p. and break'r at Buffalo, N. Y. **R., 95,** 3153. (Gen. H. L. Abbot, Maj. H. M. Adams, Capt. D. C. Kingman.)

BERH. reviews report of Maj. Symons on ex. and sur. of Erie Basin; not desirable to imp. this place until chan. shall have become a navigable waterway of the U. S. **R., 04,** 3309.

In charge:

Capt. Williams, 1839, **67,** 227; **68,** 221, 222.
Capt. I. C. Woodruff, 1856, **67,** 227.
Col. William Turnbull. (See S. D. 1, 34th, 1st.)
Col. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st.
Capt. John A. Tardy. **R., 66,** 49, 50, ii, 38, 39, v, 161–164; **67,** 32, 135–137, 227–229; **68,** 222.
Col. T. J. Cram, assigned to charge, 1867. **R., 67,** 135–137, 148, 224–233; **68,** 150, 205–219, 225–231, 236–244.
Capt. Franklin Harwood, 1868. **R., 68,** 193–195, 197, 198; **69,** 145–150, 163–170; **70,** 183; **71,** 217; **72,** 244; **73,** 350; **74,** 226.
Lt. Col. Charles E. Blunt, 1874, **74,** 215. **R., 75,** 319; **76,** ii, 568; **77,** 972.
Maj. W. McFarland, 1878–83. **R., 78,** 1269; **79,** 1717; **80,** 2192; **81,** 2420; **82,** 2431.
Lt. Col. H. M. Robert, 1883. **R., 83,** 1931.
Capt. E. Maguire, 1883–86. **R., 84,** 2126; **85,** 2255; **86,** 1881.
Capt. C. F. Palfrey, 1886, **87,** 2351.
Capt. F. A. Mahan, 1886–90. **R., 87,** 2351; **88,** 2028; **89,** 2361.
Maj. A. Stickney, 1890–92. **R., 90,** 2808; **91,** 2882.
Maj. E. H. Ruffner, 1892–95. **R., 92,** 2529; **93,** 3107; **94,** 2438; **95,** 3146.
Maj. T. W. Symons, 1896–1902. **R., 96,** 3110; **97,** 3107; **98,** 2756; **99,** 3101; **00,** 4113; **01,** 3305; **02,** 2300; **04,** 3305, 3309.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2126.
Lt. P. S. Bond, 1904. **R., 04,** 3253.
Col. H. M. Adams, 1905–07. **R., 05,** 2374; **06,** 1928; **07,** 2103.
Lt. Col. W. L. Fisk, 1908–10. **R., 08,** 2174; (Col.) **09,** 2148; **10,** 2309.
Lt. Col. J. G. Warren, 1911–. **R., 11,** 2514; (Col.) **12,** 2716.

Assistants:

J. S. Lawrence, **66,** iv, 164.
Capt. Franklin Harwood, **67,** 31, 137, 229; **68,** 150, 206.
W. Griswold, **68,** 150.
G. E. Fell, **74,** 233; **75,** 320.
G. U. Mayo. **R., 79,** 1719.

ESTIMATES. (See Plans and Projects.)

By Col. Turnbull, 1856, repairs of towpath of s. p. and rebuilding sea wall, $20,209.85, S. D. 42, 35th, 1st.

By Col. Graham, 1857, repairs, dr., etc., $27,679.35, S. D. 42, 35th, 1st.

By Capt. Tardy, 1865, repairing lighthouse p., repairs and completion of sea wall, $131,000, **66,** 4, 49, 50. 1866, extension of lighthouse p. and a new break'r with st. superstr., $1,697,194.78, **66,** iv, 163; **67,** 228.

By Col. Cram, 1867–68, repair and protection of H. ps., extension of s. H. p., removal of portion of break'r, constr. of break'r 4,000′ l., and navigable ship chan. bet. lake and Buffalo Creek, $6,484,415.12, **68,** 205, 207, 243.

By BE., 1868, section of break'r 100′ l., $19,828.40, **68,** 235.

By Capt. Harwood, 1869, completion of H. work and break'r, constr. of s. chan. and Buffalo sea wall, $926,803.17, **69,** 149.

By BE., 1874, catch-sand p. and repairs to break'r, $83,000, **74,** 232.

By Lt. Col. Blunt, 1875, proj. of BE. for extension of break'r, $1,987,700, **75,** 321.

By Maj. McFarland, 1879, complete existing proj., $1,635,000, **79,** 1719.

LEGAL PROCEEDINGS.

In 1893–94 the officer in charge knew of nothing having been done to regain possession of the n. p. from Delaware, Lackawanna & Western RR., which had taken unau. possession of it, **94,** 2439;

95, 3147. Detailed description of the case, and of efforts made to obtain withdrawal of the company from occupancy of the p., **98,** 2774.

Failure of city of Buffalo to transfer site of Watson elevator to the U. S., **11,** 2515. Trans. of site completed by city of Buffalo, **12,** 2716.

LEGISLATION.

In 1897–98 New York Legislature au. city of Buffalo to use for highway purposes the sea-wall strip on portions of which the U. S. had built a sea wall in 1830–36, **98,** 2781.

Laws of New York affecting Erie Basin, **04,** 3315.

OPERATIONS. (See also Private work.)

1857. S. D. 42, 35th, 1st.

1864–65. Repairs in progress on H. and sea wall, **66,** 4. Details of, **66,** 49, 50, 51.

1865–66. On lighthouse p. several cribs placed in position; 16,710 l. f. of piling driven, and 594 cords of st. for riprap; 1,303′ of sea wall built, 357′ of it coped, **66,** 38, 39.

1866–67. Work on sea wall continued, **66,** iv, 164; **67,** 136.

1867–68. Repairs of pierhead and towpath; extension of p. and building about 900′ of break'r under contract, **68,** 44.

1868–69. Interior works of repair nearly completed; s. p. extended nearly 318′; 150′ of break'r built to l. w. level, **69,** 39, 145, 146.

1869–70. Repairs of interior H. works and dr. chan. to inner H. completed; total l. of break'r, 950′. Superstr. over 400′ of same, **70,** 51, 183.

1870–71. Break'r extended 783′; total l., 1,183′, **71,** 49, 217.

1871–72. Repairs to n. pierhead and other completed work; 425′ added to break'r, partly covered with superstr., **72,** 45, 244.

1872–73. Extension of break'r. Rectification of injury to 6 cribs. **73,** 350.

1873–74. Break'r repaired and extended 100′; dr. done under special app., and work of repair continued to amount of over $23,000 after app. exhausted, **74,** 52, 226–228.

1874–75. 180′ of s. end of break'r rebuilt, 1,500′ of its lake face protected by oak and iron sheathing, 650′ of pile p. built, 3,956 c. y. dr., and foundation trench for cribs in break'r commenced, **75,** 57, 320.

1875–76. Break'r extended 250′, with superstr. over 200′ of same; pile p. extended 220′, and about 10,000 c. y. dr. from shoal outside of s. p., **76,** 109, ii, 568.

1876–77. Break'r extended 150′; total l., 2,924′; chan. ps. repaired and pile p. refilled, **77,** 116, 972.

1877–78. S. end of break'r extended 150′, **78,** 131, 1270.

1878–79. Break'r extended, making total l. 3,076′, **79,** 1718.

1879–80. Break'r extended by contract 350 l. f.; total "present" l., 3,426 l. f., **80,** 2193.

1880–81. Break'r extended 694 l. f., making total l. 4,120 l. f., **81,** 315, 2420.

1881–82. Break'r extended 317 l. f., making total "present" l. of 4,437 l. f., **82,** 2431.

1882–83. Break'r extended 454 l. f., making total "present" l. of 4,891′ f. Repairs break'r and lighthouse p., **83,** 1932, 1933.

1883–84. Break'r extension in progress, with repairs to break'r, **84,** 2127, 2129. Removal of wreck, **84,** 2130.

1884–85. Break'r extended 805.9′, making total "present" l. of 5,696.9 l. f., **85,** 2262. Repairs to break'r and s. p., **85,** 2265.

1885–86. Break'r extended 659.9′, making total extension of 6,349.8′, **86,** 1881. Repairs to break'r **86,** 1882. Cost of break'r extension, **86,** 1883.

1886–87. Repairs to structures, **87,** 2354.

1887–88. Repairs to s. p. by hired labor; 750 l. f. of break'r parapet rebuilt with concrete and masonry superstr.; repairs to break'r and boathouse, **88,** 2034, 2046.

1888–89. S. p. repaired by hired labor; break'r reconstr. continued, and manf. of concrete blocks begun by hired labor; minor repairs to the break'r, **89,** 2363, 2372.

1889–90. Work continued on reconstr. of break'r superstr., **90,** 2832.

1890–91. 950 concrete blocks manf., entire break'r superstr. removed, and 800 concrete blocks placed in position in reconstr. of same, **91,** 2883.

1891–92. 362 concrete blocks washed from break'r recovered and replaced; reconstr. of break'r continued, **92,** 2530.

1892–93. Break'r constr. in progress, **93,** 3108.

1893–94. S. p. repaired, 800′ of extension of break'r in progress of constr. at beginning of year completed, **94,** 2439.

1894–95. Minor repairs made to the break'r, **95,** 3148, and H. lines estab., **95,** 3149.

1895–96. Older portions of break'r repaired, **96,** 3112, 3113; 5,385 c. y. r., etc., dumped along front of break'r, **96,** 3113.

1896–97. Older portions of superstr. of break'r repaired, **97,** 3108; 100,865 c. y. clean r. dr. and waste r. placed along front of break'r, **97,** 3108, 3109. Supervision maintained over dumping of dr. of other than U. S. work, and care of property, and other misc. work performed, **97,** 3109. 13,861 t. st. placed in break'r, and extension of sand-catch p. in progress, **97,** 3110.

1897–98. 100,000 c. y. r. and other filling material dumped along front of break'r, **98,** 2758. Supervision maintained over dumping by other than U. S. contractors, **98,** 2758. In connection with previous year, sand-catch p. extended 278′, **98,** 2759. 145,304 c. y. st. and 92,279 c. y. gravel placed in break'r, and timber-crib break'r jutting out from Stony Pt. under constr., **98,** 2763.

1898–99. S. p. and break'r repaired; preparations made for constr. of concrete superstr. on old break'r; printing of charts of Buffalo H. and Niagara R; constr. of rubble-mound break'r in progress, about 80,000 t. st. being placed; entire Stony Pt. sec. of timber-crib break'r completed (see also Private work), **99,** 3102–3108.

1899–00. Over 100,000 t. st. placed in break'r extension to Stony Pt.; work in progress on South H. sec.; constr. of concrete superstr. on old break'r in progress. (Photographs.) **00,** 4114.

1900–01. 65,615 t. revet. and capping st. placed in extension of break'r to Stony Pt.; contractors' plant and break'r damaged by storms of Sept. and Nov.; Stony Pt. timber-crib break'r damaged by storm, Nov.; 901 l. f. of break'r redecked; timber-crib break'r, s. H. sec., damaged by storm, 1900; repairs made by contractors on unaccepted secs. and by U. S. on accepted secs. with hired plant; gale of Nov. 21, 1900, further damaged timber superstr. of work; plans made to build superstr. of concrete; concrete superstr. on old break'r finished Oct. 28, 1900; work commenced on concrete superstr. of s. p. (photographs), **01,** 3306–3317.

1901–02. 75,556 t. revet. and capping st. placed in extension of break'r to Stony Pt.; 1,400 l. f. concrete superstr. placed in s. p.; about 1,800′ timber superstr., s. H. section of break'r., replaced with concrete; wreck of SS. *Gov. Cushman* removed, at cost of $3,300.89, **02,** 2300–2308.

1902–03. Break'r extension to Stony Pt. practically completed Dec., 1902; storm of Dec. 10–15, 1902, caused soft clay bottom to give way, and the structure settled about 10′; building up of this settled work and strengthening of st. break'r., and timber crib concrete break'r continued; work of drilling, blasting and removal of small r. shoal on n. side of entrance chan. to Buffalo R. and City Ship Canal completed, 1,994 c. y. r. removed at cost of $4,482.33, **03,** 2126–33. Proj. of 1895, modified act June 3, 1896, practically completed, except mainten. of existing structures, **03,** 560.

1903–04. Building up of settled break'r extension completed, about 43,000 t. capping and rubble st. used; total cost of st. break'r, $965,002.99; lake face of s. H. section timber crib concrete break'r reinforced by riprap of large st.; Stony Pt. timber crib break'r completed, 1901, at cost of $277,425.12; statement of st. obtained for break'r constr. from Windmill Pt. Quarry, Ontario, Canada, and U. S., **04,** 3253–59.

1904–05. Minor repairs made to old timber crib break'r at cost of $229.40, n. side of substr. of it repaired under contract by placing 4,982.7 t. st. at cost of $11,460.21, **05,** 2374.

1905–06. Timber superstr. of s. p. removed and replaced with concrete; work completed at a cost of

$11,320.25, **06,** 1928, 1929. 50,002 c. y. dr. from Buffalo R. entrance chan. to 23′ m. l. l. with w. of 200′–300′ for 2,200′ outward from outer end of n. p., completing work at cost of $14,500.58; extension of Stony Pt. Break'r raised to 12′ below m. l. l. with st. excavated from Lake Erie entrance to Black Rock H., and contract entered into for constr. above this level; 13,386 t. riprap placed in superstr. and sea slope of s. H. section; minor repairs made to Stony Pt. and old break'r sections, **06,** 1928, 1929.

1906-07. Work commenced on extension of Stony Pt. section of break'r and in progress at the close of year, about half the rubble placed; about 14,000 t. riprap, 458 t. rubble, and 1,382 t. capping placed in s. H. section of break'r; work started on repairing 1,910′ timber superstr. of old break'r damaged by storm Jan. 20, 1907; dr. at s. end of H. and excavating rocky shoals outside n. entrance to H., **07,** 2103.

1907-08. Work on Stony Pt. section of break'r continued, and that on s. H. section completed at cost of $101,805.43; reconstr. of break'r damaged by storm of 1907 continued; 100,273 c. y. material removed from s. end of H. and work completed; excavating shoals outside n. entrance to H. continued, **08,** 2174–76.

1908-09. Work continued on s. entrance arm of break'r; repairing old break'r, and removal of shoals outside main entrance to H., **09,** 2148, 2149.

1909-10. Work continued on s. entrance arm; 1,910′ of old section of break'r, damaged by storm of 1907, completed at cost of $283,438.19; shoals outside of n. entrance excavated and blasted r. removed, and work completed except for isolated points of r. developed by sur., **10,** 2309, 2310.

1910-11. Work on 1,000′ extension of Stony Pt. section of break'r suspended Dec. 7, 1910, resumed Apr. 24, 1911, and completed June 29, 1911, **11,** 2514. Work on excavation of shoals outside n. entrance, **11,** 2515. Inspection and care of public property, and condition of works, **11,** 2516.

1911-12. Removal of Watson elevator site 43% completed; 170 c. y. loose r. removed outside n. entrance; 1,640 c. y. loose material and 4,928 c. y. ledge r. excavated from n. entrance chan.; repairs made to break'r; inspection and care of public property and condition of work, **12,** 2716, 2717.

PHYSICAL CHARACTERISTICS.

Description of, **66,** iv, 162; **67,** 135, 225, 226; **69,** 165–168; **70,** 194; **72,** 245; **73,** 351; **76,** ii, 568, 569, 571; **94,** 2240; **95,** 3150, 3153, 3158; **11,** 938.

Foundation so unstable as to cause doubling of the est. cost and to require dr. 19′ below bed of lake to obtain good foundation for cribs, **74,** 236; **79,** 1718.

Level of lake during sw. gale of Oct. 14, 1886, **87,** 2352.

Wind observations, **87,** 2351.

In 1893–94 the shore arm of the break'r showed evidence by sinking that it was located on the edge of a preglacial R., **94,** 2440.

Storms damaging and delaying works, **00,** 4123.

Severe gales Sept. 11 and Nov. 21, 1900, velocity 80 m., caused a variation in m. l. l. of 9.4′, **01,** 3308, 3309.

Storm Dec. 10–15, 1902, caused settlement of 910 l. f. st. break'r, **03,** 2127.

Description of Erie Basin, **04,** 3309.

Good H. gained by 1912. Entrance 23′ x 200′–300′, and 150′ bet. ps., **12,** 1317.

PLANS. (See also Estimate and Projects.)

Early history of plans, **67,** 224–229; **68,** 222.

By Capt. Williams, 1839, extension of p. 2,040′ to 23′ of water, and a detached break'r 3,690′ l., **66,** iii, 15, iv, 161, 162.

By Capt. Tardy, 1866, urging adoption of Capt. Williams's plan, **66,** iv, 161, 162.

Discussion of above plans by Col. Cram, viz: Extending the s. p. from 300′ to 600′, removing 200′ or 400′ of s. end of Erie break'r, and a new break'r 4,000′ l., and modifications proposed, **67,** 31, 135–137, 224–229. For a cut or canal 200′ w., with p. or ps. extending into lake to 15′, lake to Buffalo Creek, **67,** 229; **68,** 205, 206, 214–216.

By Maj. T. W. Symons for work yard and shop for loading and unloading of timber and material, and for storage of floating plant, by the reclamation of ground "now" under water, **03,** 2136–38.

By Maj. Theo. A. Bingham on revised plans and est., **03,** 2136–38.

PRIVATE (STATE, CORPORATE) WORK.

State of New York, 1819, loaned $12,000 to a committee of citizens on security, to build certain ps.; cost $14,000. The s. p., ½ m. l., ended in 13′ water; begun in 1820, finished, 1821, under superintendence of S. Wilkinson, **67,** 225.

Erie break'r, built by New York at great expense, **67,** 226. Dr. by city of Buffalo, **67,** 225.

Claims of RR. company to U. S. p., **80,** 2195.

Agreement made with U. S., **80,** 2201.

Question reopened 1884, **85,** 2255.

Improper use of break'r by parties mooring rafts thereto, **81,** 2421, 2422.

Description of, **95,** 3153.

Large part of lake frontage owned by the Lehigh Valley and Buffalo Creek RRs., who constr. wharves and warehouses thereon, **95,** 3150.

In 1895 the Sec. of War au. private persons to dump clean r. dr. along lake face of break'r, **96,** 3113.

Dr. in Buffalo R. and Erie Canal by city and State au. and private persons, **97,** 3109; **98,** 2758; **99,** 3105.

S. p. repaired by owners of a vessel which had injured it, **98,** 2757.

PROJECTS. (See Estimates; Plans; Private work.)

Prior to 1866 app. expend. in building and repairing 2 ps. at mouth of Buffalo Creek, dr. and constr. masonry sea wall to protect the beach s. of H. entrance.

By Capt. Williams, 1839, **66,** iii, 15, iv, 161; **67,** 227; **68,** 221, 222.

By Capt. Woodruff, 1856, **67,** 227.

By Col. Turnbull, S. D. 1, 34th, 1st.

By Maj. Graham, 1857, S. D. 42, 35th, 1st.

By Capt. Tardy, 1865, **66,** 49, 50, ii, 38, 39, iii, 30, iv, 161.

By Col. Cram, 1866, repairs and protection of the n. and s. ps., and extension of the s. p. 300′, **67,** 32, 68, 137, 193, 194.

By BE., 1868, repairing end of the lighthouse p. and extending it about 300′, removing a portion of the s. end of the Erie Canal basin break'r, dr. at H. entrance 15,′ and constr. break'r s. from H. entrance 4,000′ l. (est. section of 100′, $19,828.40, **68,** 235), of cribs 50′ x 34′ base and 29′–37′ in height, **68,** 222, 232.

By BE., 1873, st. foundations for cribs in the break'r to prevent displacement, **73,** 353.

By BE., 1873, increasing l. of break'r to 7,600′, with cribs 32′ x 34′ x 50′, and an artificial foundation for about 2,500′ of the distance, dr. to hard bottom, 50′ w., filled with gravel and st. Pile p. 1,000′ l. continued by cribwork 3,100′, commencing at point on shore opposite head of Blackwell Canal, and extending toward s. end of break'r, leaving chan. bet. it and break'r 150′ w.; est., $2,000,000, **76,** ii, 570; **77,** 972; **79,** 1718.

Detailed history of, **88,** 2028.

Scheme of imp., as modified at various times, provides for 2 ps. at entrance to Buffalo Creek, for a masonry sea wall running s. from s. p.; for break'r about one-half m. from and parallel with the shoal, and for shore arm to the break'r from its s. end, **87,** 305, 2351, 2366.

In 1866 a masonry and concrete superstr. adopted for break'r, **87,** 2353, 2365.

Est. for completion of proj., $1,117,500, **87,** 2357; **91,** 2882.

By BE., 1895, for abandonment of shore arm, and for extension of break'r from its s. end at that time to Stoney Pt., leaving necessary openings for convenience of C.; est. $2,200,000, **95,** 3157. Addition made by Congress, 1896, providing for extension of catch-basin p. to the estab. pierhead line under continuous contract, **96,** 3111.

By Maj. Symons, 1896, modification of plan and location for break'r, to provide for constr. of a sec-

tion of break'r 9,700′ l., beginning at s. end of old break'r, leaving fair-weather entrance bet., thence extending s. in straight line, 5,000′ of n. part to be of rubble-mound type, and remaining portion to be timber-crib type, mounted upon artificial foundation extending down to solid r. Another section of timber-crib break'r, 2,800′ l., to extend out from shore at Stoney Pt. nw., leaving entrance 600′ w. bet. the 2 structures, also au. **98,** 2760.

By Maj. Symons, 1899, repair of s. p., **00,** 4114.

Acts June 6, 1900, and June 13, 1902, made special provisions for d. entrance to Buffalo H., and the city ship canal, **04,** 612.

By Col. H. M. Adams, contlnuin3 imp. by constr. of an extension to Stony Pt. sec. of break'r, to be of st. similar to the st. break'r already built, 1,000′ l. Proposed to raise this to h. of 12′ below m. l. l. with st. excavated from Lake Erie entrance to Black Rock H. and Erie Basin. After being raised to above h., balance of structure to be built under contract; est., $204,884.50 (approv., 1904–05) **05,** 2376.

By Col. Adams, for reconstr. with concrete of 1,910′ of old break'r damaged by storm 1907; $350,000 app. for this work act Mar. 2, 1907; same act app. $25,000 for dr. entrance to canals at S. Buffalo, and $56,100 for excavating r. shoals at entrance to Buffalo H. to 23′, **07,** 2103.

By Col. Fisk, expend. of $37,400 for removal of addl. r. shoals outside n. entrance, **10,** 2310, au. act June 25, 1910, **10,** 883, 884; same act au. proj. for removal of Watson elevator site; est., $62,205, **10,** 883, 884.

Act Feb. 27, 1911, au. that $15,000, or as much thereof as necessary, could be taken from previous app. to be applied to completion of Stony Pt. break'r, **12,** 1116.

By Col. Warren, proposed operations, and remarks, **11,** 2517.

Act July 25, 1912, au. proj. to secure 23′ in outer H. and 23′ and 25′, resp., over areas D and C at n. entrance (H. D. 550, 62d, 2d) (see Surveys, 1910), **12,** 1118.

SURVEYS.

By William Peacock, 1818, **67,** 224.

By Capt. Williams, 1839, **67,** 227.

Under direction of Col. Cram, 1867, by Capt. Harwood, assisted by W. Griswold, **68,** 150, 206; **69,** 164.

By direction of BE. under Maj. Harwood, **74,** 52, 53.

Pre. ex. and sur. of Scajacuada Creek, **85,** 2283, 2284.

Sur. for lake sur. charts, made in 1893–95, by Maj. Ruffner, **94,** 2442; **95,** 3149.

In 1894–95 investigations made by Capt. Kingman to ascertain probable cost of st. suitable for use in extension of Buffalo Break'r, **95,** 3157.

Plan and est. for extending break'r from s. end of H. to Stony Pt. asked by act Aug. 17, 1894; necessary surs. made, and **R.** submitted, 1895, by Maj. Ruffner, **95,** 3149.

Soundings made, 1896, through ice to ascertain character of lake bottom on line of proposed break'r, by Maj. Symons, **96,** 3113.

Misc. soundings, exs., and surs. made, 1897–98, by Maj. Symons, **97,** 3109; **98,** 2759.

In 1897–98 soundings taken by means of a specially constr. sounding scow, by Maj. Symons, **98,** 2758.

Pre. ex. and sur. au. act June 6, 1900, Lake Erie entrance Black Rock H. and Erie Basin. **Rs.,** Maj. Symons; est., chan. to Erie Basin, $188,743; branch chan. and basin to Black Rock H., $625,900. Latter expense to care only for future C., **01,** 3342.

Pre. ex. and sur. of Erie Basin, au. act June 13, 1902; **Rs.** by Maj. Symons, 1902 and 1903; est. $475,426.82 and $257,684.46 (H. D. 35, 58th, 2d), **04,** 618, 3304–3316.

Au. act Mar. 3, 1905, to ascertain. modifications, if any, required; made, 1905, by Col. Adams; plan presented; est., $1,296,875.85 (H. D. 240, 59th, 1st), **06,** 703.

Au. act Mar. 3, 1909, with view to w. chan. at entrance to inner H., together with **R.** and est. of cost of removal of Watson elevator site, etc., excl. of cost of acquiring title to same. **Rs.** June 26 and 29, 1909, submitted. (H. D. 298, 61st, 2d.) Locality not considered worthy of imp. in manner indicated in either case, but BE. reported fav., Jan. 10, 1910, a plan of imp.; est., $62,203 (R. and H. Com. D. 2 61st, 2d), **10,** 890.

Au. act Mar. 3, 1909, pre. ex. Buffalo H., with view to w. and imp. entrance to Erie Basin (**R.** unfav.) (H. D. 327, 61st, 2d), **10,** 890.

Ex. shoals outside of s. entrance, **11,** 2515.

Ex. and sur. au. act June 25, 1910, with view to increasing d. in outer H. and entrance thereto; **Rs.** by Lt. Col. J. G. Warren, 1910 and 1911; plan presented for imp. at cost of $624,750 for 1st constr. and $1,000 an. mainten. (H. D. 550, 62d, 2d), **12,** 1125.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1119.

Maps. (H. D. 240, 59th, 1st; H. D. 298, 61st, 2d; H. D. 327, 61st, 2d; H. D. 550, 62d, 2d.) Of N. and NW. Lakes, showing location of H., **66;** of H. and vicinity, **66.**

Map of H., June 30, 1879, **79,** 1720.

80, 2204; **81,** 2424; **84,** 2130; **87,** 2356; **88,** 2054; **89,** 2370; **95,** 3160; **98,** 2784; **03,** 2140; **11,** 2514.

(Photographs; see Operations, 1900.)

Part (b), RR–13 Black Rock Harbor, N. Y. (Pier extension.)

APPROPRIATIONS.[1]

Mar.	2, 1829,	$30,000
Apr.	23, 1830,	3,198
Mar.	2, 1831,	1,800
July	3, 1832,	$5,100
June	28, 1834,	12,000
	Total,	52,098

Part (c), RR–13 Black Rock Harbor, N. Y. (Buffalo entrance to.)[2] (North Breakwater.)

APPROPRIATIONS.

1899,	$50,000.00,	**99,** 3114.
1900,	191,701.25,	**00,** 4137.
Total,	241,701.25	

COMMERCE.

Important, **97,** 3246, 3247.

Same as Buffalo H. practically, **06,** 700.

CONTRACTS.

1899. J. B. Donnelly, break'r constr. (excavating, st., timber cribs, concrete, ironwork), $210,175, **00,** 4138.

ENGINEERS.

Chief of Engineers. R., 97, 473; **99,** 540; **00,** 608, 611; **01,** 589; **02,** 511; **03,** 562; **04,** 615; **05,** 625; **06,** 700; **07,** 723; **08,** 767; **09,** 803.

[1] H. D. 482, 55th, 2d; Treas. D. 373, 1882.

[2] Sur.—**R.,** Oct. 1, 1836, est. $321,430.20. (H. D. 482, 55th, 2d.)

In charge:
Maj. T. W. Symons, 1897–1902. **R., 97,** 3245; **99,** 3114; **00,** 4135; **01,** 3324; **02,** 2313.
Maj. T. A. Bingham, 1903. **R., 03,** 2143.
1st Lt. P. S. Bond, 1904. **R., 04,** 3267.
Col. H. M. Adams, 1905–07. **R., 05,** 2382; **06,** 1936; **07,** 2110.
Lt. Col. W. L. Fisk, 1908–. **R., 08,** 2182; (Col.) **09,** 2154.

OPERATIONS. (See Private work.)

1899–00. Substr. of break'r in process of constr., **00,** 4136.
1900–01. Laying of concrete; proj. completed June 4, 1901; total cost, $236,278.10, **01,** 3333.
1901–02. Fenders placed on break'r; cost, $1,653.75, **02,** 2313.

PHYSICAL CHARACTERISTICS.

Description of; entrance to the basin and H. is an opening 2,300′ w. bet. 2 break'r structures near the shore along the lake front of Buffalo, N. Y., built by New York, **97,** 3246; **01,** 3324.
17′ d., 1902, **02,** 511; 20′, 1903, **03,** 562.

PRIVATE WORK.

History of Erie Basin, Black Rock H., and of Federal and other proj., work done, etc., giving list of au. cited, **01,** 3324.

PROJECTS.

By Maj. Symons, 1897, break'r about 2,200′ l., covering and protecting entrance to Erie Basin and Black Rock H., and the lake front of Buffalo H., bet. the New York State structures; est., $248,000, **97,** 3246; **99,** 3114.
Col. Adams recom., 1907, available funds be reapp. for Buffalo H., the work be maintained as part of that proj., **07,** 2110.
Act Mar. 3, 1909, reapp. the funds in hand for the work to the H. at Buffalo, N. Y., and the break'r will hereafter be maintained, and reports made, under the latter head and app., **09,** 804.

SURVEYS.

Sur. of the Buffalo entrance to the Erie Basin and Black Rock H., N. Y., au. act June 3, 1896; made by Maj. Symons, 1897 (see Projects), **97,** 3245.
Ex. of the Lake Erie entrance au. act June 6, 1900, **00,** 611.
Cong. docs., etc., relating to exs., surs., plans, etc., **01,** 589, 3324; **02,** 511, 2313; **03,** 563, 2143; **04,** 616; **05,** 625; **06,** 725; **08,** 768; **09,** 804.
Maps. **03,** 2143.

Part (d), RR–13 Black Rock Harbor, N. Y. (Lake Erie entrance to.)

APPROPRIATIONS.

1902,	$200,000,	**02,** 511.
1903,	200,000,	**03,** 2142.
1904,	125,000,	**04,** 3267.
1905,	52,000,	**05,** 2382.
1906,	237,643,	**06,** 1935.
Total,	814,643	

COMMERCE.

Imp. works would help utilize large portion of water front of Buffalo, and provide H. of refuge, **01,** 3348.
Imp. as a separate work has not affected rates, **10,** 886.
See Buffalo H.

CONTRACTS.

1902. Buffalo Dredging Co., dr. and r. removal; chan. excavation, 66¢ c. y., p. m.; basin excavation, $1.84 c. y., p. m.; placing r. with derrick, $1.25 t., **03,** 2143.

ENGINEERS.

Chief of Engineers. R., 01, 592; **02,** 511; **03,** 562; **04,** 615; **05,** 624; **06,** 699; **07,** 722; **08,** 766; **09,** 802; **10,** 885.

In charge:
Maj. T. W. Symons, 1901–02. **R.** (sur.), **01,** 3345.
Maj. T. A. Bingham, 1903. **R., 03,** 2142.
1st Lt. P. S. Bond, 1904. **R., 04,** 3264.
Col. H. M. Adams, 1905–07. **R., 05,** 2381; **06,** 1934; **07,** 2108.
Lt. Col. W. L. Fisk, 1908–. **R., 08,** 2180; (Col.) **09,** 2153; **10,** 2314.

OPERATIONS.

1902–03. Removal of overlying material begun on June 20, **03,** 2142.
1903–04. Over 200,000 c. y. overlying sand removed; 18,785 c. y. r. drilled, blasted, and removed, **04,** 3264.
1904–05. 5,897 c. y. earth and 32,222 c. y. r. removed; progress unsatisfactory, **05,** 2381.
1905–06. 50,490 c. y. r. and 20,020 c. y. earth removed, **06,** 1935.
1906–07. 176,647 c. y. removed, **07,** 2108.
1907–08. 55,896 c. y. sand and r. removed, **08,** 2180.
1908–09. Work of excavation of basin and chan., which is the whole proj., was completed Dec. 29, 1908; total amount of material removed from chan., 245,494 c. y. earth and 61,000 c. y. r., and from basin 34,276 c. y. earth and 286,835 c. y. r., at total cost of $814,643, **09,** 2153.

PHYSICAL CHARACTERISTICS.

Details of, **01,** 3345.
10′ over. shoalest part, 1903, **03,** 562; 21′, 1910, **10,** 886.

PRIVATE WORK.

N. Y. State and local au. have imp. vicinities, **01,** 3344.

PROJECTS.

By Maj. Symons, approv. July 20, 1900, contemplating the formation by dr. and r. removal of a chan. 23′ x 400′ x 3,300′, m. l. l., from Buffalo main entrance chan. to Erie Basin, and a branch chan. 23′ x 500′ x 1,920′ to Black Rock H.; est. $814,643 (H. D. 125, 56th, 2d), **02,** 511.

SURVEYS.

Au. E. R. and H. act June 6, 1900, made by Maj. Symons; **Rs.,** July 6 and Nov. 8, 1900 (H. D. 125, 56th, 2d), **01,** 592, 3345.
Cong. docs., etc., relating to exs., surs., plans, etc., **03,** 562; **04,** 614; **05,** 624; **06,** 699; **07,** 722; **08,** 766; **09,** 803; **10,** 885.
Maps. **03,** 2142.

Part (e), RR–13 Black Rock Harbor and Channel, N. Y.

APPROPRIATIONS.

1905,	$100,000,	**05,** 2385.
1906,	233,000,	**06,** 1938.
1907	367,000	**07,** 2111.
	1,000,000	
1909,	1,000,000,	**09,** 2158.
1910,	1,000,000,	**10,** 2319.
1911,	400,000,	**11,** 2523.
Total, [1]	4,100,000	($4,152,420.25—incl. $52,098 old p. work, and $322.25 for sales, etc., **12,** 2726).

COMMERCE. (See Buffalo H., Tonawanda H., Niagara R.)

Importance of locality to U. S. industry generally and the local industry such that Federal imp. urgently recom. by Maj. Symons, **04,** 3275.

Proj., being auxiliary to imp. at Buffalo, has not, as a separate work, affected rates, **12,** 1121.

Black Rock H., Buffalo, Tonawanda, Erie Canal, Niagara R.[2]

CONTRACTS.

1906. Empire Engineering Corporation, excavating chan. 23′ x 200′–240′ x 6,400′; prices listed, **06,** 1938.

1907. Buffalo Dredging Co., excavating 3,400 l. f. of chan.; amount of contract, $820,640, **08,** 2185.

1908. MacArthur Bros. Co., constr. cofferdam and lock walls; amount of contract, detail prices listed, $823,304.45, **08,** 2185.

1910. Arthur L. Vodel, excavation, prices given; D'Olier Engineering Co., constr. and erecting steel lock gates, valves, and operating machinery, unit prices given, **11,** 2524.

1911. Great Lakes Dredge & Dock Co., excavation in n. sec., prices given; Buffalo Dredging Co., excavation in Bird Isld. sec., prices given, **11,** 2524.

1912. Buffalo Dredging Co., constr. wing walls for Black Rock ship lock, prices given; Great Lakes Dredge & Dock Co., removing sheet pile cofferdam and purchase of steel piles, prices given; Great Lakes Dredge & Dock Co., constr. steel bascule br., **12,** 2727, 2728.

ENGINEERS.

Chief of Engineers. **R., 04,** 617; **05,** 625; **06,** 700, 703; **07,** 724; **08,** 768; **09,** 804; **10,** 886; **11,** 939; **12,** 1119.

In charge:

Lt. Col. H. M. Adams, 1905–07. **R., 05,** 2383; (Col.) **06,** 1937; **07,** 2111.

Lt. Col. W. L. Fisk, 1908–10. **R., 08,** 2182; (Col.) **09,** 2155; **10,** 2315.

Lt. Col. J. G. Warren, 1911–. **R., 11,** 2519; **12,** 2722.

Assistant. J. C. Quinten, **04,** 3303.

LEGAL PROCEEDINGS.

A list of lands, structures, and right of way required; application therefor to land office, State of N. Y., **05,** 2384. Grant made 1905, Atty. Genl. U. S. recognizing validity, **06,** 1937. 169 different occupants; permits and leases for occupation, water-power rights, etc. (considered restriction on title), requested from State of N. Y., **06,** 1938.

OPERATIONS.

1904–05. Acquiring adjoining land, structures and rights of way, **05,** 2384.

1905–06. Lands, structures and rights of way were granted to the U. S. by State of New York; contractor engaged in the constr. of working plant, **06,** 1937.

1906–07. Little progress in r. removal, owing to constant breaking of steel drills; filling of 300′ gaps in Bird Isld. begun, **07,** 2110.

1907–08. 138,990 c. y. overlying material and 15,551 c. y. r. removed under contract with Empire Engineering Co.; 34,469 c. y. overlying material, 31,002 c. y. r., and 2,950 l. f. canal wall removed under contract with Buffalo Dredging Co.; steel piling for 947 l. f. e. wall of cofferdam had been driven under contract with MacArthur Bros. Co.; filling in of gap in Bird Isld. P. section completed at cost of $3,581.25; proj. 8% done, **08,** 768, 2183.

1908–09. 77,057 c. y. overlying material and 50,023 c. y. bed r. removed under contract with Empire Engr. Co.; 27,868 c. y. overlying material and 119,501 c. y. bed r. removed under contract with Buffalo Engr. Co.; cofferdam completed, using 6,546,116 t. steel sheet piling and 170,705 lbs. steel walling and braces, and dr. within cofferdam carried on, under contract with MacArthur Bros. Co. (detailed), **09,** 2157.

1909–10. 18,422 c. y. overlying material and 96,265 c. y. bed r. removed under contract with Empire Engr. Co.; 8,978 c. y. overlying material, 66,319 c. y. bed r. and canal wall removed, under contract with Buffalo Dredging Co., and chan. completed except trunk-sewer section, to be finished when sewer obstr. chan. is removed by city of Buffalo; constr. of concrete walls for ship locks continued, under contract with MacArthur Bros. Co.; table of material placed, proj. 38% done, **10,** 887, 2315–18.

1910–11. 733,096 c. y. dr., 2,974 c. y. blasted r. excavated, constr. of concrete walls, machinery, etc., for ship lock in progress, and repairs made to Bird Isld. P., proj. 55% done, **11,** 2519.

1911–12. 1,310,338 c. y. dr., constr. of steel lock gates, valves, machinery and removing cofferdam for ship lock in progress, and constr. of timber crib concrete wing wall in progress, **12,** 2722.

PHYSICAL CHARACTERISTICS.

Details, **04,** 3273, 3285.

Effect on Lake levels, **04,** 3275.

Max. draft overshoaled sec., 1905, m. l. l., 8′, **05,** 626.

PRIVATE WORK.

City of Buffalo, removal of old and constr. of new sewer below grade of new chan., saving $100,000 of proj. est., **10,** 2316.

PROJECTS.

R. and H. act Mar. 3, 1905, au. $700,000 for work on basis of ex. and sur. (q. v.) by Majs. Symons and Bingham and BE., namely, chan. 23′ x 200′ m. lake l. joining at foot of Maryland St., Buffalo, the 23′ chan. under existing contract—the chan. to extend w. and n., through Black Rock H. and the Erie Canal combined, to existing lock, where ship lock is to be built—the chan. to extend from the foot of ship lock through Niagara R. to d. water above Tonawanda, 400 x 23 m. R. l. A specific delaying of expend. until there be assurance projected large canal of N. Y. State shall be built; also steps to be taken to see if portion of cost of imp. may not be borne by abutting properties, **05,** 626, 2383.

Chief of Engineers au. building lock, 70′ x 650′ instead of 60′ x 600′, **07,** 2111.

Act Mar. 2, 1907, au. continuing contracts in sum of $2,700,000 for prosecuting proj. of Nov. 4, 1905, **09,** 804.

SURVEYS.

Pre. ex. and sur. au. under act June 13, 1902, made, 1902, with view to obtaining d. draft chan. around rapids and shoals at head of Niagara R, made by Majs. Symons and Bingham; est $4,500,000 (not fav. by BE., increased expense) (H. D. 428, 58th, 2d), **04,** 617, 3271–3304.

[1] Subject to provision that no part of app. be expend. until assurance be given that barge canal would be constr. by State of New York.

[2] Com. R. and H., H. D. 36, 61st, 2d.

R., au. by act Mar. 3, 1905, as to whether any portion of the expense of imp. should be borne by abutting owners of property (H. D. 913, 59th, 1st), **06,** 703.

Pursuant to resol. of H. R. Com. R. and H., the BERH. reported Dec. 2, 1904, that new matter since report of Dec. 22, 1903, gave reason for providing d. draft chan. around rapids and shoals of Niagara R. Board recom. this be done on condition—(1) Part of Erie Canal, etc., bet. Tonawanda, and Buffalo, as might be needful, be trans. free of cost to U. S.; and (2) that part of Erie Canal bet. Tonawanda and Buffalo be abandoned by N. Y. to aid in full development of max. frontage in Tonawanda Reach. (Com. R. and H., H. D. 36, 61st, 2d.)

Cong. docs., etc., relating to exs., surs., plans, etc., **04,** 328, 617, 3301; **05,** 626; **12,** 1121.

Maps. (H. D. 913, 59th, 1st.), **11,** 2520.

RR–15 NIAGARA RIVER, N. Y.

Part.	Title.	Period.	Appropriations.
a	Niagara R., Tonawanda H	1880–1912	$692,200.00
b	Niagara R., Tonawanda to Port Day	1892–1912	97,562.50
c	Niagara R., Tonawanda to Gill Creek	1907–1908	
d	Niagara R., Port Day	1880–1881	
e	Niagara R. (Youngstown to Lake Ontario)	1884–1885	
	Total		789,762.50

Part (a), RR–15 Tonawanda Harbor and Niagara River, N. Y.

APPROPRIATIONS.

1881, $5,000, **81,** 2426.
1882, 1,500, **82,** 2437.
1888, 100,000, **89,** 2394.
1890, 75,000, **90,** 2840.
1892, 75,000, **92,** 2533.
1894, 50,000, **95,** 3164.
1896, 50,000, **96,** 3117.
1899, 75,000, **99,** 3118.
1902, 257,700, **02,** 2315.
1907, 3,000, **07,** 2113.

Total, 692,200 (incl. misc., $692,531.42, **12,** 2729).

COMMERCE.

Importance as a lumber port, **81,** 2425.
Magnitude of lumber interests, **88,** 1066.
Description of, **96,** 2119.
In 1896 an extensive trade had been developed, **96,** 3119.
Increasing, **97,** 3120; **98,** 2790; **99,** 3117; **00,** 4141.
C. large and increasing, **01,** 590, 3337.
Imp. had material effect on rates, **07,** 726.
1911, 1,104,392 t., **12,** 1122.

CONTRACTS.

1881. E. J. Hingston, dr. mud, clay, and gravel, 18, 20, and 22¢ c. y., **81,** 2426.

1888. Hingston & Woods, r. excavation, $11.50 c. y., and dr., 17¢ c. y., **89,** 2394.

1890. Hingston & Woods, r. removal, $4 c. y., **90,** 2841.

1891. Hingston & Woods, r. removal, $3.74 c. y., and dr., 74¢ c. y., **91,** 2890.

1892. Hingston & Woods, r. excavation, $3.70 c. y., p. m.; removal of sand, gravel, clay, etc., 70¢ c. y., p. m.; hire of dr., $155.20 per day of 8 hours ($75,566.25), **93,** 3113.

1894. Union Dry Dock Co., constr. of sounding scow, $633; Hingston & Woods, hire of dr. plant, $136 per day of 8 hours ($34,494), **94,** 2446. $122.40 per day of 8 hours ($49,000), **95,** 3164.

1896. Hingston & Woods, furnishing and operating dr. plant, $168 per day of 8 hours, **97,** 3120.

1899. Hingston & Woods, drill boats per day, $80; dr. per day, $76, **99,** 3118.

1902. Lake Erie Dredging Co., hire of dr. plant—dr. $112, drill boats $112, tugs $24, per day of 8 hours, **01,** 2146.

1907. William Anderson, removal of wreck of SS. *Embury,* $2,655, **07,** 2113.

ENCROACHMENTS.

Protest by Tonawanda Lumbermen's Ass'n against deposit by city of Buffalo of dr. material below city waterworks crib, claiming that above material conduced to the shoaling of the upstream chan., **83,** 1935, 1936.

ENGINEERS.

Chief of Engineers. R., 80, 233; **81,** 316, 320; **82,** 310; **83,** 318; **84,** 221; **85,** 346; **86,** 341; **87,** 306–308; **88,** 279, 282; **89,** 331; **90,** 299; **91,** 376; **92,** 355; **93,** 407; **94,** 381; **95,** 415; **96,** 373; **97,** 469; **98,** 460; **99,** 541, 543; **00,** 609, 611; **01,** 590; **02,** 512; **03,** 563; **04,** 616; **05,** 626; **06,** 702; **07,** 725; **08,** 769; **09,** 805; **10,** 888; **11,** 941; **12,** 1122.

In charge:

Maj. W. McFarland, 1879–83. **R., 81,** 2425; **82,** 2436.
Maj. H. M. Robert, 1883. **R., 83,** 1935.
Capt. E. Maguire, 1883–86. **R., 84,** 2131; **85,** 2268; **86,** 1884.
Capt. C. F. Palfrey, 1886. **87,** 2343.
Capt. F. A. Mahan, 1886–90. **R., 87,** 2366; **88,** 2056, 2064; **89,** 2393.
Maj. A. Stickney, 1890–92. **R., 90,** 2839; **91,** 2888.
Maj. E. R. Ruffner, 1892–95. **R., 92,** 2533; **93,** 3111; **94,** 2444; **95,** 3162.
Maj. T. W. Symons, 1896–1902. **R., 96,** 3116; **97,** 3116; **98,** 2788; **99,** 3115; **00,** 4138, 4152, 4155; **01,** 3335; **02,** 2314.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2144.
Lt. P. S. Bond, 1904. **R., 04,** 3268.
Col. H. M. Adams, 1905–07. **R., 05,** 2385; **06,** 39; **07,** 2112.
19Lt. Col. W. L. Fisk, 1908–10. **R., 08,** 2186; **09,** 60; **10,** 2320.
21Lt. Col. J. G. Warren, 1911–. **R., 11,** 2525; (Col.) **12,** 2729.

Assistants:
F. T. Hampton. **R., 81,** 2427.
M. Kingsley. **R., 82,** 2437; **83,** 1937, 1939.

OPERATIONS.

1881–82. 24,740 c. y. dr. from bars at head and middle of Tonawanda Isld. and mouth of creek, **82,** 2436.
1888–89. 6,925 c. y. dr., **89,** 2394.
1889–90. 7,950 c. y. dr., **90,** 2840.
1890–91. 6,000 c. y. r. excavated, **91,** 2888.
1891–92. 9,086 c. y. r. and 4,324 c. y. material removed near Strawberry Isld.; 1,650 c. y. r. removed by hired labor from Horseshoe Reef Shoal, **92,** 2533.
1892–93. 57,168 c. y. sand, etc., dr., and 5,193 c. y. r. removed, **93,** 3112.
1893–94. 3,150 c. y., s. m., sand, etc., dr., and 15,275 c. y., s. m., r. removed, **93,** 2445.
1894–95. In connection with previous year, 17,045 c. y., s. m., dr., and an obstr. removed from chan., **95,** 3163–3164; 2,246 c. y. dr. from H., **95,** 3164.
1895–96. Over 35,000 c. y., s. m., dr., **96,** 3118, and about 25,000 c. y. dr. from H., **96,** 3119.
1896–97. 32,841 c. y. dr., **97,** 3118, and 29,015 c. y. dr. from Tonawanda H., **97,** 3119.
1897–98. Misc. dr. done, **98,** 2789.
1898–00. 96,380 c. y. excavated from Strawberry Isld. Chan., and 44,895 c. y. dr. from Tonawanda H., **00,** 4140.
1900–01. 8,940 c. y. dr., **01,** 3337.
1902–03. 124,410 c. y. dr., **03,** 2144.
1903–04. 325,019 c. y. dr., **04,** 3268.
1904–05. 151,181 c. y. dr., **05,** 2386.
1906–07. Wreck of SS. *Embury* removed, **07,** 2112.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 2427; **88,** 2066; **97,** 3119; **98,** 2789; **00,** 4153.

Tonawanda Cr. enters Niagara R. about 11 m. below its head at Lake Erie and forms boundary bet. Tonawanda and North Tonawanda, **00,** 4153–4155.

H. obstr. by sediment deposits, 1900, **00,** 4155.

PROJECTS.

By Maj. McFarland, 1881, imp. of Tonawanda Cr. by excavating bars at head of Tonawanda Isld., mouth of cr. opposite Smith & Fassett's dock, and cutting off point at mouth of Tonawanda Cr.; est., $15,000, **81,** 2429.

By Capt. Mahan, 1887, imp. of Niagara R. bet. Tonawanda and Black Rock H., giving 16′ chan. 400′ w., by dr. and r. removal at Horseshoe Reef, at head of Strawberry Isld., and in R. front at Tonawanda; est., $593,538.

In 1891 est. for an 18′ chan. 400′ w. revised on account of excess of r. removal required over that orig. est., to $1,152,987, **91,** 2890.

Act 1896 extended proj. to include R. to n. line of village of North Tonawanda, **96,** 3117.

In 1899 Maj. Symons est. $27,000 to imp. H. and cr., **00,** 4156.

Proj. extended, 1902, to include dr. Tonawanda H. and Cr., **02,** 2314.

SURVEYS.

Au. act. Mar. 3, 1879; made, 1880, by Maj. McFarland, **81,** 2426.

Ex. bet. Black Rock and Tonawanda au. act Aug. 5, 1886, **87,** 308.

Sur. of Tonawanda H. and Niagara R., with view to 16′ chan., au. act Aug. 5, 1886; made, 1887, by Capt. Mahan, **88,** 2066.

Misc. surs. made, **93,** 3112; **94,** 2444.

Surs. made, 1896–97, by Maj. Symons for map of H. of Tonawanda, **97,** 3119.

Ex. and sur. of H. and of cr. au. act Mar. 3, 1899; made by Maj. Symons, 1899 (**R.** fav.; see Projects), **00,** 4152.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1123.

Maps. **81,** 2426.

Part (b), RR-15 Niagara River, N. Y., From Tonawanda to Port Day.

APPROPRIATIONS.

1892,	$20,000.00,	**93,** 3115.
1894,	10,000.00,	**95,** 3167.
1896,	15,000.00,	**96,** 3124.
1899,	15,000.00,	**99,** 3122.
1910,	10,000.00,	**10,** 2322.
1912,	27,562.50,	**12,** 2731.
Total,	97,562.50	

COMMERCE.

Description of, **97,** 3124; **98,** 2794.

During the season of 1892 the practicability of constant navigation of the R. by vessels drawing more than 6′ demonstrated, and app. 1892 held by au. of Sec. of War until further action in the matter could be taken looking to a greater d. (see Projects), **95,** 2166.

C. in 1896 considered small, and chiefly confined to excursion traffic, **96,** 3124. No change 1900, **00,** 4146.

None except excursion boats, **01,** 591.

Wood pulp the only freight, carried down to paper mills at Niagara Falls. For 1911, 56,176 t., **12,** 2732.

CONTRACTS.

1894. Hingston & Woods, hire of dr. plant, $112.64 per day of 8 hours ($30,000), **95,** 3167.
1896. Hingston & Woods, furnishing and operating dr. plant, $168 per day of 8 hours, **97,** 3125.
1899. Hingston & Woods, drill boats, $80 per day; drs., $76 per day, **99,** 3122.
1911. The Buffalo Dredging Co., excavation at Cayuga Isld. Shoal, 76¢ c. y., **11,** 2527.

ENGINEERS.

Chief of Engineers. **R., 92,** 357; **93,** 407; **94,** 381; **95,** 416; **96,** 374; **97,** 470; **98,** 461; **99,** 542; **00,** 610; **01,** 591; **02,** 513; **08,** 770; **10,** 888; **11,** 942; **12,** 1122, 1127.

In charge:
Maj. A. Stickney, 1891. **R., 92,** 2539, 2541.
Maj. E. H. Ruffner, 1892–95. **R., 93,** 3113; **94,** 2447; **95,** 3166.
Maj. T. W. Symons, 1896–1902. **R., 96,** 3122; **97,** 3123; **98,** 2792; **99,** 3121; **00,** 4144; **01,** 3340; **02,** 2316.
Col. W. L. Fisk, 1910–. **R., 10,** 2322.
Lt. Col. J. G. Warren, 1911–. **R., 11,** 2527; (Col.) **12,** 2731.

Assistant. E. Siegesmund. **R., 92,** 2545.

OPERATIONS.

1894–95. 32,044 c. y., s. m., dr., **95,** 3167.
1895–96. 44,306 c. y. dr., **96,** 3123.
1896–97. Pierhead lines laid out, and excavation of r. in progress, **97,** 3124.
1897–98. 24,185 c. y. r. blasted and removed in connection with previous year, **98,** 2794.
1899–00. 18,800 c. y. blasted and removed from Cayuga Isld., **00,** 4146.
1911–12. 10,680 c. y., s. m., blasted r. excavated, completing contract, **12,** 2731.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 2542; **96,** 3124; **97,** 3123.

PROJECTS.

By Maj. Stickney, 1891, chan. 8′ d. m. l. l., 300′ w. Tonawanda to Connors Isld., 200′ w. thence to Grass Isld., and from 200′ to 400′ w. thence to Port Day; also constr. of r. embankment, Connors Isld. to Port Day to inclose lower end of chan.; est., $257,829, **92,** 2544. Act 1892 limited d. to 6′, **92,** 2544; **93,** 3113.

By Congress, 1894, imp. of R., on recom. of Maj. Ruffner, Tonawanda to Port Day, with view to 12′ d. to Schlossers Dock, by cutting through shoal at head of Connors Isld. App. 1892 reapp., and an addl. app. of $10,000 made, **95,** 3166.

In 1896 Maj. Symons est. cost of this proj. would be $180,000, **96,** 3123, and in 1897, $95,000, **97,** 3123.

By Lt. Col. Fisk, expend. of $10,000 to complete proj. as specified act June 25, 1910, by w. cut across Cayuga Isld. Shoal to 200′ (H. D. 75, 60th, 1st), **10,** 2322.

Act July 25, 1912, au. proj. for a 14′ chan.; est., $55,125, and $1,000 an. mainten. (H. D. 549, 62d, 2d). U. S. app. $27,562.50, and act provides that like sum shall be contributed by local interests, **12,** 2731.

SURVEYS.

Au. act Sept. 19, 1890; made, 1891, by Maj. Stickney, **92,** 2541.

Hydrographic sur. made, 1896, by Maj. Symons, **97,** 3123.

Ex., Tonawanda to Gill Cr., N. Y., au. act Mar. 2, 1907. **R.,** by Col. H. M. Adams, and plan presented; est., $10,000 (H. D. 75, 60th, 1st), **08,** 770.

Pre. ex. au. act June 25, 1910, view to securing 18′ from Black Rock H. to foot of Sugar St., Niagara Falls, N. Y. **R.** by Lt. Col. Warren, Oct. 17, 1910, and Jan. 23, 1911 (H. D. 286, 62d, 2d) (unfav.), **12,** 1125.

Pre. ex. and sur. au. act Feb. 27, 1911, view to securing 14′ in chan. bet. Navy and Grand Islds. leading to foot of Sugar St., Niagara Falls, N. Y. **R.** by Lt. Col. Warren, May 20 and Dec. 2, 1911; est., $55,125, and $1,000 an. mainten. (H. D. 549, 62d, 2d), **12,** 1127, 1128.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1124.

Maps. (H. D. 549, 62d, 2d.)

Part (c), RR-15 Niagara River, N. Y. (From Tonawanda to Gill Creek.)

ENGINEERS.

Chief of Engineers. **R., 08,** 770.

In charge. Col. H. M. Adams, **08,** 761.

SURVEY.

Pre. ex. with plan and est. of cost au. act Mar. 2, 1907, of Niagara R. from Tonawanda to Gill Cr.. **R.** by Col. Adams, May 17 and June 15, 1907; est., $10,000 (H. D. 75, 60th, 1st), **08,** 770.

Part (d), RR-15 Port Day, Niagara River, N. Y.

COMMERCE.

Benefit of the imp., **81,** 2456.

ENGINEERS.

Chief of Engineers. **R., 80,** 233; **81,** 320.

In charge. Maj. W. McFarland. **R., 81,** 2454.

Assistant. F. T. Hampton. **R., 81,** 2455.

PLANS.

By Maj. McFarland, inside chan. at Port Day, by r. removal, 6′ x 75′ x 600′; est., $17,000, **81,** 2454.

SURVEY.

Au. act June 14, 1880; made, 1881, by Maj. McFarland (see Plans), **81,** 2454.

Part (e), RR-15 Niagara River. (Youngstown to Lake Ontario.)

ENGINEERS.

Chief of Engineers. **R., 85,** 352.

In charge. Capt. E. Maguire. **R., 85,** 2283.

SURVEY.

Ex. au act July 5, 1884; made by Capt. Maguire (**R.** unfav.), **85,** 2283.

Part (f), RR-15 Niagara Falls, N. Y. (Canal around.)[1]

COMMERCE.

Important, **68,** 47, 272.

DEFENSE.

Facilities for defending Eighteenmile Creek route, **68,** 47. Difficulties of defending proposed extension from Tonawanda to Buffalo, **68,** 47.

ENGINEERS.

Chief of Engineers. **R., 67,** 18; **68,** 47; **89,** 337.

In charge:
Lt. Col. C. E. Blunt, 1867–68, **67,** 18. **R., 68,** 271.
Capt. C. F. Palfrey, 1888–89. **R., 89,** 2434.

Assistants:
J. E. Lawrence, **68,** 271.
S. F. Gooding, **68,** 271.

PLANS.

By Lt. Col. C. E. Blunt, canal around Falls of Niagara: (1) Lewiston line; 1., 7.05 m., 21 lifts; est.

[1] From Lake Erie to Lake Ontario. Sur.—**R.,** Mar. 17, 1836, est. $2,568,899.36 and $5,041,725.50. (H. D. 482, 55th, 2d.)

cost, $12,095,438, **68,** 273. (2) Lewiston line; l., 9.39 m., 21 lifts; est. cost, $11,128,438, **68,** 274. (3) Lewiston line; l., 7.8 m.; 21 lifts; est. cost, $11,031,916, **68,** 275. By Fourmile Creek line; l., 14.43 m.; 21 lifts; est. cost, $12,673,520, **68,** 275. By Wilson or Twelvemile Creek; l., 18.35 m.; 21 lifts; est. cost $13,993,638, **68,** 276. By Olcott or Eighteenmile Creek; l., 25.28 m.; 21 lifts; est. cost, $12,893,170, **68,** 277. From Tonawanda to Buffalo H.; l., 15 m.; est. cost., $23,893,170, **68,** 278. No particular route recom., **68,** 271, 272.

By Capt. Palfrey, 1889, for waterway around Niagara Falls of capacity and facilities sufficient to float merchant ships and ships of war of modern build drawing 20′ of water, waterway to commence in navigable part of Niagara R., at or near Tonawanda, and to end in the navigable waters of said R. below the falls. Est. cost of route No. 4, known as Wilson or Twelvemile Creek line, with 18 lifts, would be, if single locks, $24,201,550; if double locks, $29,347,900. Est. cost of route No. 5, known as Olcott or Eighteenmile Creek route, with 18 lifts, would be $23,617,900, **89,** 338, 2436.

SURVEYS.

By Capt. W. G. Williams, 1835, **68,** 47.

By J. E. Lawrence and S. F. Gooding, C. E., 1867, under direction of Lt. Col. C. E. Blunt, **68,** 271.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey, **89,** 2434.

RR–18 SCAJAQUADA CREEK. (At Buffalo, N. Y.)

ENGINEERS.

Chief of Engineers. **R., 85,** 352.

In charge. Capt. E. Maguire. **R., 85,** 2283.

OBSTRUCTIONS.

Brs. obstr. navigation, **85,** 2285.

PLANS.

By Capt. Maguire, 1884, dr. chan. 1 m. x 100′ x 10½′; est., $26,000, **85,** 2286.

SURVEY.

Au. act July 5, 1884; made by Capt. Maguire, **85,** 2283.

RR–19(a) ERIE CANAL, N. Y.

COMMERCE.

C. aspects, detailed description, and discussion of, **97,** 3263.

ENGINEERS.

Chief of Engineers. **R., 97,** 473.

In charge. Maj. T. W. Symons, 1897. **R., 97,** 3250.

PHYSICAL CHARACTERISTICS.

Description of the canal, **97,** 3251.

PRIVATE WORK.

Imp. under way and those contemplated by the State of New York, which owns the canal, **97,** 3254.

PROJECTS.

Detailed est. for enlargement of locks of the canal by U. S. to allow of the passage of torpedo boats; total, $3,840,000 or $5,941,000, **97,** 3260.

SURVEY.

In 1896 the Committee on Railways and Canals of the H. of R. requested the Sec. of War to have made an ex. to ascertain the practicability and probable cost of a proposed proj. contained in a House bill of the 54th Cong., 1st sess., for w. the locks of the Erie Canal to permit the passage of torpedo boats for the protection of lake cities. **R.** by Maj. Symons, 1896. (See Projects.) **97,** 3250.

RR–19(b) NORTH TONAWANDA, N. Y.

ENGINEERS.

Chief of Engineers. **R., 12,** 1126.

In charge. Col. J. G. Warren, **12,** 1111.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, of a d. w. connection with suitable terminals that may be estab. at North Tonawanda, at head of New York State Barge Canal (**R.** to come), **12,** 1126.

RR–19(c) GREAT LAKES TO NEW YORK CITY. ("Transportation Routes to Seaboard.")

APPROPRIATION.

1874 (allot. for sur.), $60,000, **75,** ii, 535.

COMMERCE.

National character of the work, its object, and benefits to C., **75,** ii, 535, 538.

Cost of transportation on Erie Canal reduced by enlargement of locks, **75,** ii, 555.

ENGINEERS.

Chief of Engineers. **R., 75,** 37; **97,** 472, 3128.

In charge:

Maj. J. M. Wilson. **R., 75,** ii, 534.

Maj. T. W. Symons. **R., 97,** 3131.

Assistants:
O. Blanc. **R., 75,** ii, 549.
M. King, **75,** ii, 537, 555.
J. S. Lawrence. **R., 75,** ii, 561.
C. A. Fuller. **R., 75,** ii, 586.

ESTIMATES. (See Plans.)

By Maj. Wilson, 1875, imp. of E ie Canal, $8,173,-596, **75,** ii, 539, 552; without d., $6,676,231, **75,** ii, 539; summary, **75,** ii, 548, 561. For imp. of Oneida Lake Ship Canal, $25,213,857, **75,** ii, 542; summary, **75,** ii, 585. Imp. of Lake Champlain Ship Canal to Troy, $11,152,916, **75,** ii, 546. Canal from Hudson R. above Troy to d. w. at Albany, $2,962,976, **75,** ii 546, 605.

By W. Shanley, proposed Caughnawaga Canal, $5,500,000, and imp. of Richelieu R., $35,000, **75,** ii, 543, 588.

PLANS. (See Estimates.)

By O. Blanc, 1875, enlargement of one tier of locks on Erie Canal, except at Lockport and Lockville, to 7′ x 26′ x 225′ lift. Recom. by Maj. Wilson, including changes in brs., aqueducts, etc., incident thereto, and d. of canal so that there would be nowhere, except upon mechanical structures, a less d. than 8′. **75,** ii, 537, 538, 549, 550, 551.

By Maj. Wilson, 1875, enlargement of the Oneida Canal by constr. of ship canal from Oswego to Oneida Lake, the "cross-cut line" being recom., **75,** ii, 540, 541, 561, 567–586. Enlargement of Champlain Canal, including ship canal from Caughnawaga, on the St. Lawrence, to St. Johns, on the Richelieu R.; the Richelieu R. and Lake Champlain to Whitehall, N. Y.; a ship canal from Whitehall to Ft. Edward, on the Hudson R.; and slackwater navigation from Ft. Edward to Troy, **75,** ii, 586.

MEMORANDA:
History of the Erie Canal, **75,** ii, 536, 549, 550, 551.
Description of canal, **75,** ii, 536, 549, 550, 551.
Enlargement of locks, **75,** ii, 537, 549.
Steam power on canal, **75,** ii, 552.
Removal of bench walls, **75,** ii, 549, 550.
Connection with Niagara R. route, **75,** ii, 551.
Water supply, **75,** ii, 537, 538, 547, 552, 553, 554.
History and description of the Oneida Lake Ship Canal, **75,** ii, 539, 561, 562.
Present route (207.9 m.), **75,** ii, 539, 540.
Welland Canal, **75,** ii, 540, 542.
Water supply, **75,** ii, 541, 547, 562, 563, 564, 565.
History and description of the Champlain Canal, **75,** ii, 542, 543.
Route, **75,** ii, 542, 543, 544, 586.
St. Lawrence R. and Canal, **75,** ii, 542.
Water supply, **75,** ii, 545, 547, 588, 591, 592.
Canal from the Hudson above Troy to d. w. at Albany, **75,** ii, 546.
Water supply, **75,** ii, 546, 547.
Proposed canal from the Hudson above Troy to d. w. at Albany, **75,** ii, 546.

SURVEYS.

By Mr. Goodsell, 1866, of Hudson R., Troy to Ft. Edward, **75,** ii, 592, 593.

By Messrs. Blanc, Lawrence, and Fuller, 1874–75. Ex. of water communication from the lakes to New York City, including the Erie Canal from Buffalo to Albany, and the Champlain Canal from Lake Champlain to d. w. in the Hudson R. (with such connections as may be effected between Lake Champlain and the St. Lawrence, with the cooperation of the British provinces). **75,** ii, 535, 547, 549, 586.

Ex. au. act June 3, 1896, for ship canal from the Great Lakes to the navigable waters of the Hudson R., made by Maj. Symons, **97,** 3131–3237.

Maps:
Of routes, S. D. 307, part iii, 43d, 1st. Profile of Erie Canal, **75,** ii, 554. Profile of Oneida Canal from Oswego to Albany, **75,** ii, 566. Diagram of locks and dams of Hudson R. division, **75,** ii, 594.

RR–19(d) GREAT LAKES,[1] SHIP CANAL FROM, TO THE HUDSON RIVER. (Survey.)

APPROPRIATIONS.[1]

1895,	$10,000, act Mar. 2.
1897,	150,000, act June 4.
1898,	225,000, act July 1.
1899,	90,000, act Mar. 3.
1900,	20,000, act Feb. 9.
Total,	495,000

COMMERCE.

Tonnage to be benefited by ship canal, **97,** 3164.
Ocean, lake, and canal vessels that would probably use the proposed canal, **97,** 3172.
Misc. freight business, **97,** 3179.
C. and military considerations, **97,** 3194.
Comparison of cost of transportation by proposed ship canal and existing Erie Canal, **97,** 3207; by imp. Erie Canal, **97,** 3210.
Cost of transportation by barge canal, Erie Canal route, **97,** 3212.
Conditions, methods, and expenses attending the receipt, storage, transfer, and shipment of grain in the H. of New York, **97,** 3219.
(See Summary, **97,** 3235.)

ENGINEERS.

Chief of Engineers. R., 97, 472, 3128.

In charge. Maj. T. W. Symons, 1896. **R., 97,** 3130.

PHYSICAL CHARACTERISTICS.

3 probable routes for a ship canal entirely within the U. S. from Great Lakes to the Hudson, and 1 route not wholly within the U. S., **97,** 3129.
Detailed description of possible routes: Oswego route, **97,** 3135; Oswego-Hudson route, **97,** 3142; Erie Canal route, **97,** 3147; St. Lawrence-Champlain route, **97,** 3149.
(See Summary, **97,** 3235.)

PROJECTS.

In 1897 Maj. Symons est. $200,000,000 to build canal of the character contemplated by act of 1896, **97,** 3129; of opinion that enlargement of Erie Canal of the State of N.Y. was worthy of being undertaken by the U. S., as the benefits to be derived therefrom would be properly commensurate with the cost, which was est. to be approx. one-fourth that of a ship canal; and that the C. advantages would be practically equal to those of a ship canal as proposed, **97,** 3130. (See Summary, **97,** 3235.)

SURVEYS.

Act June 3, 1896, directed the Sec. of War to cause to be made accurate ex. and ests. of constr. of ship canal by the most practicable route wholly within the U. S. from Great Lakes to Hudson R., of sufficient capacity to transport the tonnage of the lakes to the sea. Ex. made by Maj. Symons in 1896–97 (see Projects, **97,** 3128.)

[1] See also H. D. 149, 56th, 2d, for report on surs. and exs. of deep waterways "between the Great Lakes and the Atlantic tidewaters, as recommended by the report of the Deep Waterways Commission, transmitted by the President to Congress Jan. 18, 1897 . . . the surs. to be made by a board of 3 engineers" (1 from Corps of Engineers). Board consisted of Gen. C. W. Raymond, Corps of Engineers, president; Mr. Alfred Noble, and Mr. G. Y. Wisner. (Considerable of the data on locks collected by the Board, for its voluminous report, used as a basis for the construction of the locks of the Panama Canal.)

RR–26 WILSON HARBOR, N. Y.

APPROPRIATIONS.

1875,	$10,000,	**75,** 58.
1876,	10,000,	**76,** 110.
1880,	10,000,	**80,** 2205.
1881,	10,000,	**81,** 2431.
1882,	10,000,	**82,** 2442.
1886,	10,000,	**86,** 1885.
1888,	5,000,	**88,** 2058.
1896,	5,000,	**96,** 3125.
1899,	2,500,	**99,** 3130.
1902,	*2,250,	**03,** 2148.
Total,	74,750	

COMMERCE.

Importance as H. of refuge, **73,** 392.
Benefits of imp., **68,** 289; **73,** 391.
Description of, **97,** 3127.
About the only business of the place is excursion traffic, **97,** 3127.
1900, 653 t., **01,** 592.
Very insignificant, **02,** 2320.

CONTRACTS.

1875. F. A. Seymour, material and labor, **75,** 323, 326; **76,** ii, 574. H. J. Mowry, dr., 17¢ c. y., **75,** 323, 326; **76,** ii, 574.
1877. H. J. Mowry, dr., **78,** 1271.
1881. W. D. Taylor, iron; W. J. Harris, materials and labor; W. E. Hingston, materials and labor; W. D. Taylor, iron, **81,** 2433.
1882. A. J. Packard, iron; W. J. Harris, p. extension, **83,** 1940.
1886. G. Elias & Bro., timber; M. S. Vosburgh, st., **87,** 2366.
1889. McCollum & Lee, dr., 20¢ c. y., **89,** 2397.

DOCUMENTS. (Not published in reports.)
Ex. D. 62, 33d, 1st, **68,** 48.

ENGINEERS.

Chief of Engineers. **R., 68,** 48; **73,** 49; **75,** 58; **76,** 110; **77,** 117; **78,** 135; **79,** 175; **80,** 230; **81,** 316; **82,** 310; **83,** 318; **84,** 322; **85,** 346; **86,** 341; **87,** 306; **88,** 280; **89,** 331; **90,** 300; **91,** 376; **92,** 355; **93,** 408; **94,** 382; **95,** 417; **96,** 375; **97,** 471; **98,** 463; **99,** 543; **00,** 612; **01,** 592; **02,** 513; **03,** 564; **04,** 618; **05,** 628; **10,** 900.

In charge:
Lt. Col. C. E. Blunt, 1868. **R., 68,** 288.
Maj. J. M. Wilson, 1873–75; **73,** 391; **75,** 323.
Maj. W. McFarland, 1875–83. **R., 76,** ii, 574; **77,** 975; **78,** 1271; **79,** 1725; (Lt. Col.) **80,** 2205; **81,** 2430; **82,** 2437.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 939; **84,** 2133.
Capt. E. Maguire, 1885–86. **R., 85,** 2268; **86,** 1885.
Capt. C. F. Palfrey, 1886. **R., 87,** 2366.
Capt. F. A. Mahan, 1886–90. **R., 87,** 2366; **88,** 2057; **89,** 2395.
Maj. A. Stickney, 1890–92. **R., 90,** 2842; **91,** 2891.
Maj. E. H. Ruffner, 1892–95. **R., 92,** 2534; **93,** 3114; **94,** 2448; **95,** 3168.
Maj. T. W. Symons, 1896–98. **R., 96,** 3125; **97,** 3126; **98,** 2795.
Capt. G. D. Fitch, 1899–1900. **R., 99,** 3129; **00,** 4161.
Maj. T. W. Symons, 1901–02. **R., 01,** 3353; **02,** 2319.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2147.
1st Lt. P. S. Bond, 1904. **R., 04,** 3319.
Col. H. M. Adams, 1905. **R., 05,** 2389.
Col. W. L. Fisk, **10,** 891.

Assistants:
J. S. Lawrence. **R., 73,** 391.
J. C. Quintus. **R., 95,** 3169.

ESTIMATES. (See Plans and Projects.)

By Lt. Col. Blunt, 1868: 1st proj., $155,000, **68,** 48, 288; 2d proj., $50,000, **68,** 289.
By Maj. Wilson, 1873, $90,000, **73,** 392; **75,** 324; **76,** ii, 575, 576.
By Maj. McFarland, 1877, addl. for dr., $10,000, **77,** 975.

OPERATIONS.

1874-75. Dr. 4,326¼ c. y., **75,** 324.
1875-76. W. p. extended 60 l. f.; e. p. extended 30 l. f., **77,** 975.
1877-78. W. p. extended 120 l. f.; 14,302 c. y. dr., **78,** 131, 1271.
1878-79. Superstr. of e. p. rebuilt, **79,** 1725. Old w. p. breached in fall of 1876; sand and gravel barrier, extending from p. to p., formed in consequence, rendering H. worthless until its removal, **77,** 975.
1881-82. W. p. extended 302 l. f. and e. p. 213′, **82,** 2437.
1882-83. 90 l. f. of p. work placed in extension of w. p.; 3,473 c. y. dr. from chan., **83,** 1939.
1883-84. W. p. extended 30′ and e. p. 120′, **84,** 2133, 2134.
1887-88. 80′ of e. p. rebuilt by hired labor, and minor repairs made to e. and w. ps., **88,** 2057.
1888-89. Constr. of st. protection begun; 150 l. f. of w. p. rebuilt; 24,930 c. y. dr., **89,** 2397.
1891-92. Repairs to lake end of w. p., **92,** 2534.
1896-97. 24,025 c. y. dr., and ps. repaired, **97,** 3127.
1899-00. 10,036 c. y. dr.; e. and w. ps. repaired, **00,** 4162.
1902-03. Most necessary repairs to superstr. and decks of both ps. made, using 12,846′ hemlock timber and planks, **03,** 2147.
1903-04. Necessary repairs made to decking and wall timbers of superstr. of both ps. Bulkhead placed of 10″ x 12″ timber at outer end of w. p.; 84 c. y. filling st. and 11,360′ hemlock timber and plank used in repairs, **04,** 3319–20.

PHYSICAL CHARACTERISTICS.

General, of Twelve mile or Wilsons Cr., **73,** 391.
H. bottom, **73,** 392; **76,** ii, 575.
Description of, **93,** 3115; **95,** 3169.
Chan. believed to be unstable; it fills in quite rapidly with sand driven in by storms, **97,** 3127.
H. at mouth of Twelvemile Cr. In orig. condition there was 1′ on the bar. Max. draft carried into the H., 1901, 8′, **01,** 592.
Chan. bet. p. fills rapidly with sand driven by storms, **02,** 2319.
Chan., 1903, 9½′, m. l. l., and 7′ d., l. w., **03,** 2147.

PLANS. (See Estimates and Projects.)

1852. Plan of imp. submitted, **75,** 323.
By Lt. Col. Blunt, 1868, in case the Niagara Ship Canal should end here; 2 parallel ps. of 1,000 l. f. l., and dr. to 14′; est., $155,000, **68,** 288, 289.

PRIVATE (CORPORATE) WORK.

About $26,000 expended by private enterprise. In 1846 company constr. 2 parallel ps., 150′ apart, extending 360′ into the lake; 540 l. f. of wharfing, and also purchased a dr., **68,** 48; **73,** 391; **75,** 323; **76,** ii, 575.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Blunt, extension of each p. 400 l. f. and dr.; est., $50,000, **68,** 288, 289.
By Maj. Wilson, 1873, extension of both ps. to 12′, repairs and dr.; est., $90,000, **73,** 392; **75,** 58, 323; **76,** ii, 575, 576. Transfer of the old ps. to the U. S. necessary before beginning operations, **73,** 393.

* Allotment.

By Lt. Col. McFarland, 1877, dr., increasing est. to $100,000, **77,** 975.

By Capt. Fitch, 1899, applying app. of 1899 to mainten., p. repairs, and redr. 10′ chan. 60′ w., extreme l. w., **99,** 3130.

Jan. 10, 1900, proj. modified to obtain and maintain 10′ at extreme l. w. without further extension of ps. for the "present," **01,** 592.

Owing to insignificance of this port, and its proximity to Niagara R. and Olcott, suggested to abandon it as a port to be maintained by U. S., **02,** 2320.

Act Mar. 7, 1905, repealed all previous provisions for work at this H., and directed that unexpend. funds be turned into Treas., **05,** 2389.

SURVEYS.

By Maj. Turnbull, 1852, **75,** 323; **76,** ii, 575.

By Lt. Col. Blunt, 1868, **68,** 48.

Directed by Maj. Wilson, made by J. S. Lawrence, 1873, **73,** 49, 391; **75,** 323; **76,** ii, 575.

Memoranda of soundings, **73,** 392; **75,** 323; **76,** ii, 575.

Comparison of surs. of 1852–73, **76,** ii, 575.

Minor surs., etc., **97,** 3127; **99,** 3129.

Pre. ex. au. act Mar. 3, 1909. **R.** by Col. Fisk, May 1, 1909 (H. D. 393, 61st, 2d) (unfav.), **10,** 900.

Maps:
76, ii, 574; **89,** 2398.
Of the H. June 30, 1879, **79,** 1725.

RR–28 OLCOTT HARBOR, N. Y.[1]

APPROPRIATIONS.

1867,	$60,000,	**67,** 32.
1870,	10,000,	**70,** 52.
1871,	5,000,	**71,** 49.
1872,	10,000,	**72,** 46.
1873,	10,000,	**73,** 46.
1874,	10,000,	**74,** 53.
1875,	10,000,	**75,** 58.
1881,	3,000,	**81,** 2434.
1886,	10,000,	**86,** 1886.
1888,	5,000,	**88,** 2061.
1890,	30,000,	**90,** 2846.
1902,	15,000,	**02,** 2322.
1911,	* 1,500,	**11,** 2529.

Total, 179,500 (less $332.45 returned to Treas., $179,167.55, **12,** 2736).

COMMERCE.

H. of refuge, importance as, **66,** iv, 158; **67,** 241; **74,** 238; **76,** ii, 577.

Benefits of imp., **66,** iv, 158, 159; **67,** 241.

Local C. small, **67,** 241; **68,** 250; **74,** 238; **76,** ii, 577.

Demands of C., **70,** 199.

C. trifling and requirements limited, **86,** 1886.

Line of SS. estab. from Olcott to Thousand Isld. points, **02,** 2322.

C. of Olcott small but increasing, **02,** 515; not increasing, **12,** 1126.

Rates not affected by proj., **11,** 944; **12,** 1126.

1911, 3 t. only; passenger traffic, 60,000, **12,** 1127.

CONTRACTS.

1867. T. Parsons,[2] materials, **67,** 241, 243. A. Dodge,[2] materials and labor; also dr., at 34¢ c. y., **67,** 241, 243. L. B. Coates, materials, **70,** 199.

1869. Pratt & Co., materials, **70,** 199. C. P. Morse, dr., **70,** 190.

1871. J. D. Cooper, materials and labor, **71,** 222, 224; **72,** 249.

1872. J. D. Cooper, materials and labor, **72,** 249.

1873. H. J. Mowry, materials and labor, **73,** 354, 357.

1874. O. J. Jennings, r. excavation, **75,** 326–328.

1875. Case & Jennings, r. excavation, **75,** 326, 327; **76,** ii, 576.

1887. M. S. Vosburger, timber, $24.90 M feet, and st., $1.22 c. y., **87,** 2368.

1889. McCollum & Lee, r. removal, $1.75, and dr., 25¢ c. y., **89,** 2401.

1891. I. Farnsworth, superstr. reconstr., $9,266, **91,** 2895. Hingston & Woods, r. removal, $1.24 c. y., and dr., 24¢ c. y., **91,** 2895.

1903. Daly & Hannan Dr. Co., dr., 17.3¢ c. y., **03,** 2151.

ENGINEERS.

Chief of Engineers. **R.,** **66,** iii, 15, 30; **67,** 32; **68,** 44; **69,** 40; **70,** 51; **71,** 49; **72,** 46; **73,** 46; **74,** 53; **75,** 58; **76,** 110; **77,** 117; **78,** 132; **79,** 175; **80,** 230; **81,** 316; **82,** 310; **83,** 318; **84,** 322; **85,** 347; **86,** 341; **87,** 307; **88,** 280; **89,** 332; **90,** 301; **91,** 377; **92,** 356; **93,** 408; **94,** 382; **95,** 417; **02,** 514; **03,** 566; **04,** 621, 630; **05,** 629; **06,** 703; **11,** 944; **12,** 1126, 1137.

Boards. BERH., July 27, 1903, revised **Rs.** of Maj. Symons on ex. and sur. (H. D. 232, 58th, 2d) (see Surveys), **04,** 3358.

In charge:

Capt. J. A. Tardy, 1866–67. **R.,** **66,** iv, 157, 166.

Lt. Col. C. E. Blunt, 1867–69. **R.,** **67,** 241; **68,** 249.

Maj. M. D. McAlester, 1869; **69,** 39.

Capt. F. Harwood, 1869; **74,** 239.

Maj. N. Bowen, 1869–70; **69,** 39. **R.,** **69,** 180; **70,** 199, 213.

Lt. B. D. Greene, 1870; **71,** 49.

Maj. J. M. Wilson, 1870–75. **R.,** **71,** 222; **72,** 248; **73,** 354; **74,** 238; **75,** 326.

Maj. W. McFarland, 1875–83. **R.,** **76,** ii, 576; **77,** 976; **78,** 1272; **79,** 1726; (Lt. Col.), **80,** 2205; **81,** 2433; **82,** 2442.

Lt. Col. H. M. Robert, 1883–85. **R.,** **83,** 1940; **84,** 2135.

Capt. E. Maguire, 1885–86. **R.,** **85,** 2269; **86,** 1885.

Capt. C. F. Palfrey, 1886; **87,** 2368.

Capt. F. A. Mahan, 1886–90. **R.,** **87,** 2368; **88,** 2059; **89,** 2400.

Maj. A. Stickney, 1890–92. **R.,** **90,** 2844; **91,** 2893.

Maj. E. H. Ruffner, 1892–95. **R.,** **92,** 2536; **93,** 3116; **94,** 2450; **95,** 3171.

Maj. T. W. Symons, 1902. **R.,** **02,** 2322.

Maj. Theo. A. Bingham, 1903. **R.,** **03,** 2151.

1st Lt. P. S. Bond, 1904. **R.,** **04,** 3331.

Col. H. M. Adams, 1905–06. **R.,** **05,** 2391; **06,** 1941.

Capt. W. L. Guthrie, 1911. **R.,** **11,** 2529.

Col. J. G. Warren, 1912–. **R.,** **12,** 2735.

Assistants:

J. S. Lawrence, **66,** iv, 159, 167.

Capt. W. A. Jones, **68,** 44; **70,** 51, 198.

Lt. B. D. Greene, **70,** 51, 198.

W. P. Judson, **70,** 213.

ESTIMATES. (See Projects.)

By Capt. Tardy, p. extension and dr., $117,927.32, **66,** iii, 15, iv, 159; **67,** 241; **74,** 240.

By Maj. Wilson, addl. for completion, $50,000, **72,** 248; **74,** 239, 240, 241; **75,** 327.

* Allotment.

[1] Sur.—**R.,** Mar. 20, 1838, est., $52,764. (H. D. 482, 55th, 2d.)

[2] Annulled, **69,** 180; **74,** 239; **76,** ii, 577.

OPERATIONS.[1]

1867-68. 1,500 c. y. dr.; 100 l. f. old p. rebuilt, **68,** 44, 249; **76,** ii, 577.

1868-69. E. p., 60 l. f. crib p. built; w. p., 345 l. f. crib p. and 275 l. f. superstr. built; dr. in chan. and for cribs; **69,** 40, 180; **70,** 51; **74,** 239; **76,** ii 577.

1869-70. E. p., 376 l. f. crib built; w. p., 100 l. f. crib p. built; 13,183 c. y. dr.; partial reconstr. of e. p.; average cost for dr., 37¢ c. y., **70,** 51, 199; **74,** 239; **76,** ii, 577.

1870-71. E. p., 150 l. f. crib p. built; w. p., 180 l. f. crib p. built; work by hired labor; repairs, **71,** 49, 222; **76,** ii, 578.

1871-72. E. p., 140 l. f. crib p. and 160 l. f. superstr. built; w. p., 90 l. f. crib p. and 198 l. f. superstr. built; 215 l. f. superstr. on e. and 236′ on w. p. planked and filled with st., **72,** 46, 248; **74,** 249; **76,** ii, 578.

1872-73. E. p., 120 l. f. crib p. built; w. p., 90 l. f. crib p. and 90 l. f. superstr. built; superstr. on cribs sunk in 1872, **73,** 46, 354; **74,** 239; **76,** ii, 578.

1873-74. E. p., 120 l. f. superstr. built; 13,428 c. y. sand, and 2,386 c. y. r. dr.; obstr. removed; dr. to 7′ and 9′, **74,** 53, 240; **76,** ii, 578.

1874-75. 4,630 c. y. r. dr.; average cost c. y. of excavation, $1.98; d. of water, 12′, **75,** 58, 326.

1875-76. 23,000 c. y. sand, and 5,000 c. y. r. dr.; repairs, **76,** 110, ii, 576.

1881-82. 305 l. f. of w. p. rebuilt from water line and 90 l. f. of shore arm constr., **82,** 2442.

1887-88. 368 l. f. of w. p. and 371 l. f. of e. p. rebuilt by hired labor, **88,** 2060.

1889-90. 20,398 c. y. mud and 721 c. y. of r. removed, **90,** 2845.

1902-03. 14,180 c. y. sand, mud, etc., removed by U. S.; 20,198 c. y. r. and 40,661 c. y. soft material removed under contract; repairs made to ps., **03** 2151.

1903-04. Repairs to ps., **04,** 3331.

1905-06. Ps. repaired, **06,** 1941.

1911-12. Ps. repaired, **12,** 2735.

PHYSICAL CHARACTERISTICS.

General, of Eighteenmile Creek, **66,** iv, 157, 158.
Injurious effect of e. p., **66,** iv, 158.
Direction of prevailing storms, **70,** 199.
Underlying bed of r., **72,** 46, 248; **76,** ii, 578.
Description of, **88,** 2061.
Damage to work by storms, **03,** 2152.

PRIVATE WORK.

Previous to 1846. P. 250 l. f., **74,** 238. "Short ps. at entrance of cr. built many years ago, but now (1866) completely gone," **66,** iv, 157.

Repairs made by Buffalo, Lockport & Rochester Transit Co. to portion of e. p. occupied by them under permit, **12,** 2736.

PROJECTS. (See Estimates.)

By Col. Turnbull, 1848, **74,** 238; **76,** ii, 577.

By Capt. Tardy, 1866, 2 parallel crib ps., 200′ apart, each 1,000 l. f. in l., and extending to 11′ of water in the lake, and dr. in chan. and bet. ps.; est, $117,927, **66,** iii, 15, iv, 158, 159; **67,** 32; **74,** 239; **76,** ii, 577.

By Maj. Bowen, completion of operations by hired labor, **69,** 40, 181.

By Maj. Wilson, removal of r. and dr., **72,** 46, 248; **74,** 239.

Résumé of plans and projs., **74,** 238; **76,** ii, 577.

Original proj. was adopted in 1866 and proposed to connect d. w. in Lake Ontario with d. w. in Eighteen mile Creek by the extension of 2 parallel ps. from the mouth of the creek to the 11′ curve in the lake, with the formation of a dr. chan. bet. the ps.; est, $117,-927, **66,** iii, 15, iv, 158, 159; **74,** 239; **76,** ii, 578; **81,** 2434.

Proj. was modified in 1872 to provide for the removal of r. in the chan. bet. the ps., **72,** 46, 248; **74,** 239; also in 1881 to provide for addl. p. extension, at an est. cost of $30,000 in excess of the orig. est., **81,** 2434.

In 1890, after a total expend. of $163,000, it was est. that $33,065 would be required for p. repair and w. of the chan., **90,** 2846.

Proj. completed in 1892, **92,** 2537.

DO. recom. certain necessary imps., **03,** 2152.

SURVEYS.

By Col. Turnbull, 1846, **74,** 238; **76,** ii, 577.

Under direction of Capt. Tardy, by J. S. Lawrence, 1866, **66,** iii, 15, iv, 157; **74,** 239.

Under direction of Maj. Bowen, by W. P. Judson, 1870, **70,** 213; **76,** ii, 577.

Under direction of Maj. Wilson, 1872, **72,** 248; **76,** ii, 578. Memoranda of soundings, **70,** 199; **74,** 239; **76,** ii, 577, 578.

Pre. ex. and sur. au. act June 13, 1902. **R.** by Maj. Symons, Jan. 12 and Apr. 14, 1903; plan of imp. at est. cost of $60,000 presented (H. D. 232, 58th, 2d), but BERH. concludes undertaking not warranted at present time, **04,** 630, 3354, 3358–3359.

Pre. ex. and sur. au. act June 25, 1910, view to securing increased d. **R.** by Col. Warren, Mar. 28, 1911, and Jan. 16, 1912; est., $3,000, and $2,500 for mainten. of w. p. for 5 years, subject to certain local cooperation (H. D. 780, 62d, 2d), **12,** 1137.

Maps. (H. D. 780, 62d, 2d.) **76,** ii, 576. Map of H. June 30, 1879, **79,** 1726; **81,** 2434; **91,** 2893.

RR–31 OAK ORCHARD HARBOR, N. Y.[2]

APPROPRIATIONS.

1836,	$5,000	**66,** iii, 30.
1837,	5,000	
1838,	5,000	
1844,	5,000	
1852,	10,500	
1867,	87,000,	**67,** 32.
1870,	8,000,	**70,** 52.
1871,	10,000,	**71,** 50.
1872,	2,500,	**72,** 46.
1873,	10,000,	**73,** 47.
1874,	10,000,	**74,** 54.
1875,	10,000,	**75,** 58.
1876,	2,000,	**76,** 110.
1878,	2,000,	**78,** 132.
1879,	1,000,	**79,** 175.
1880,	500,	**80,** 2206.
1882,	3,000,	**82,** 2444.
1884,	5,000,	**84,** 2136.
1886,	$12,500,	**86,** 1886.
1888,	6,000,	**88,** 2064.
1890,	5,000,	**90,** 2848.
1902,	*2,250,	**03,** 2150.
Total,	207,250	

COMMERCE.

Important, 1st, as a H. of refuge, **66,** iii, 30, iv, 160; **68,** 249; 2d, as a C. point, **67,** 241.

Small, **97,** 3314.

1903, 445 t., **04,** 3327.

Insignificant. (H. D. 412, 61st, 2d.)

CONTRACTS.

1867. Harrington & Moore, materials; A. A. Dodge,[3] materials and labor; Thomas Parsons, materials, **67,** 246; Edward Allen, dr., 29¢, **67,** 256.

1869. James Caldwell,[2] materials, **69,** 180.

* Allotment.

[1] History of operations, **74,** 238; **76,** ii, 577, 578. Abstracts of material used and work done, **74,** 240. Provisions of the law with respect to app. the cause of delay in operations, **67,** 32.

[2] Sur.—**R.,** Oct. 17, 1836. (H. D. 482, 55th, 2d.)

[3] Contracts canceled, **69,** 179; **70,** 201.

1871. H. J. Mowry, materials; E. H. French, dr., 17¾¢, **71,** 225.
1872. E. H. French, dr., 75¢, **72,** 252.
1874. O. J. Jennings, r. excavation, **75,** 328.
1875. Case & Jennings, r. excavation and dr., **75,** 329.
1888. McCollum & Lee, dr., 50¢ c. y., **89,** 2406.
1891. Hingston & Woods, r. excavation, $1.40 c. y., and sand, clay, and gravel, 34¢ c. y., **91,** 2897.

DOCUMENTS. (Not published in reports.)
S. D. 16, 34th, 3d. **R.** of Lt. Col. Graham, 1856. S. D. 42, 35th, 1st., p. 136.

ENGINEERS.
Chief of Engineers. R., 66, 7, ii, 41, iii, 16, 30; **67,** 32; **68,** 44; **69,** 40; **70,** 52; **71,** 50; **72,** 46; **73,** 47; **74,** 53; **75,** 58; **76,** 110; **77,** 117; **78,** 132; **79,** 175; **80,** 230; **81,** 317; **82,** 311; **83,** 319; **84,** 322; **85,** 347; **86,** 342; **87,** 307; **88,** 281; **89,** 333; **90,** 301; **91,** 377; **92,** 356; **93,** 408; **94,** 383; **95,** 418; **97,** 483; **02,** 514; **03,** 565; **04,** 619; **05,** 628.

Boards:
1857. Referred to, as devising plan and making an est. for imp. of H. S. D. 42, 35th, 1st, p. 127.
BERH. in a special **R.** recom. discontinuance of imp., owing to insignificance of H. commercially (H. D. 208, 58th, 2d), **04,** 3328.

In charge:
Maj. W. Turnbull, 1853; **74,** 243.
Lt. Col. J. D. Graham, 1856. **R.,** S. D. 42, 35th, 1st, p. 127.
Capt. J. A. Tardy, 1866–67; **66,** ii, 41. **R., 66,** iv, 159.
Lt. Col. C. E. Blunt, 1867–69. **R., 67,** 241, 246, 247; **68,** 249.
Maj. M. D. McAlester, 1869; **69,** 170.
Capt. F. Harwood, 1869; **69,** 170.
Maj. N. Bowen, 1869–71; **69,** 170. **R., 69,** 179; **70,** 201.
Maj. J. M. Wilson, 1871–75. **R., 71,** 224; **72,** 250; **73,** 358; **74,** 243; **75,** 328.
Maj. W. McFarland, 1875–83. **R., 76,** ii, 579; **77,** 977; **78,** 1272; **79,** 1727; (Lt. Col.) **80,** 2206; **81,** 2435; **82,** 2443.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1941; **84,** 2136.
Capt. E. Maguire, 1885–86. **R., 85,** 2270; **86,** 1886.
Capt. C. F. Palfrey, 1886; **87,** 2369.
Capt. F. A. Mahan, 1886–90. **R., 87,** 2369; **88,** 2062; **89,** 2403.
Maj. A. Stickney, 1890–92. **R., 90,** 2847; **91,** 2896.
Maj. E. H. Ruffner, 1892–95. **R., 92,** 2537; **93,** 3117; **94,** 2451; **95,** 3172.
Maj. W. S. Stanton, 1897. **R., 97,** 3314.
Maj. T. W. Symons, 1902. **R., 02,** 2321.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2149.
1st Lt. P. S. Bond, 1904. **R., 04,** 3326.
Col. H. M. Adams, 1905. **R., 05,** 2390.

Assistants:
W. S. Malcolm, captain U. S. steam dr. on Lake Ontario, 1857. S. D. 42, 35th, 1st, p. 128, etc.
W. P. Judson, **69,** 213. **R., 97,** 3318.
J. S. Lawrence, **74,** 245.

ESTIMATES. (See Projects.)
By Maj. McFarland, for occasional dr. and repairs, $1,000, **79,** 1727.

OPERATIONS.
1836. 650′ w. break'r built, **74,** 243.
1838. 300 l. f. e. and 300 l. f. w. chan. ps. built; 100′ e. break'r built, **74,** 243; **76,** ii, 580.
1844. 425 l. f. e. and 210 l. f. w. chan. ps. built, **74,** 243.
1853. 290 l. f. w. chan. p. built; repairs to w. p., **74,** 243.
1857. 11,116 c. y. dr.; condition of ps.; S. D. 42, 35th, 1st, pp. 127, 129.
1866. Condition of ps., **66,** iii, 16, iv, 159.
1868–69. 300 l. f. e. chan. p. built; chan. dr.; repairs, **69,** 40, 179.
1869–70. 313 l. f. e. and 150 l. f. w. chan. ps. built; 72,829 c. y. dr.; total l. of w. p., 836′; 300′ superstr. on e. p., **70,** 52, 201.
1870–71. 150 l. f. e. and 180 l. f. w. chan. ps. built; 40′ superstr. on w. p.; repairs to superstr., **71,** 50, 225.
1871–72. 150 l. f. e. and 120 l. f. w. chan. ps. built; 8,418 c. y. dr.; 969′ superstr. completed, **72,** 46, 230.
1872–73. 8,019 c. y. dr.; general repairs, **73,** 47, 358.
1873–74. 3,503 c. y. r. removed and 1,958 c. y. dr.; method of doing work, **74,** 53, 245, 246.
1874–75. 10,960 c. y. r. removed and 10,011 c. y. dr.; repairs to w. p., **75,** 58, 328, 329.
1875–76. 200 c. y. r. removed, **76,** 110, ii, 579.
1877–79. Repairs, **78,** 133, 1272; **79,** 175, 1727.
1881–82. 129 l. f. of outer part of e. p. leveled up, filled, and redecked; vacant space filled with cribwork; 69′ of inner part of w. p. rebuilt, **82,** 2443.
1884–85. 1,072 l. f. of w. p. superstr. rebuilt and redecked, **85,** 2270.
1887–88. E. p. rebuilt by hired labor, **88,** 2063.
1888–89. 91 l. f. of timber and st. shore protection built, **89,** 2405.
1889–90. 10,230 c. y. dr. from chan., and slight repairs made to e. p., **90,** 2847.
1891–92. 3,388 c. y. dr., **92,** 2538.
1892–93. Proj. deemed completed, **93,** 3118.
1902–03. Repairs to superstr. and decks of both p., **03,** 2149.
1904–05. Repairs to ps., **05,** 2390.

PHYSICAL CHARACTERISTICS.
Character of bottom of H., **72,** 250, 251.
General description of Oak Orchard Creek, **74,** 243.
Description of, **88,** 2063; **97,** 3315.
H. Oak Orchard Creek, which flows into Lake Ontario 32 m. w. from Genesee R., **97,** 3315.

PRIVATE WORK.
$1,000 raised and expend. by citizens of Oak Orchard for dr. H., under direction of U. S. officials, S. D. 42, 35th, 1st, pp. 127, 131, **74,** 244.

PROJECTS. (See Estimates.)
BE., 1857, dr. chan. to 12′, and extension of ps. to 15′ curve; est., $51,761.90.
By Lt. Col. Graham, repairs, to cost $9,736.65, S. D. 42, 35th, 1st, pp. 127, 136, 137.
By Capt. Tardy, p. extension, dr., and repairs; est., $86,587.66, **66,** iv, 160.
Increased $50,000 by Maj. Bowen, completion, **69,** 40. Correspondence relative to imps., S. D. 42, 35th, 1st, p. 128 et seq.
By Maj. Wilson, dr. chan. and repairing ps.; est., $30,000, **72,** 251.
To contract entrance of H., 1838, by break'rs, approaching each other, leaving opening of 200′, and then to define the chan. by parallel ps. extending from outer ends of break'rs into lake, **74,** 243.
1836 to 1880, incl., $173,500 app. and applied to extension of 2 ps., dr. in chan. bet. ps., and repairs, **74,** 243; **76,** ii, 579; **80,** 2206.
In 1881 Lt. Col. McFarland proposed further extension of both lines of 500′, or to 12′ curve in Lake Ontario, d. chan. bet. ps. to 12′ by dr.; est, $100,000, **81,** 2435.
Maj. Stanton est., 1897, $10,500 or $38,000 to imp. H., **97,** 3315, 3316.
Act Mar. 3, 1905, repeals all previous provisions for work at this H., and directs all unexpend. funds be turned into Treas., **05,** 2390.

SURVEYS.
Mentioned, 1836, **74,** 243.
By Capt. Tardy, 1866, **66,** iv, 159.
By W. A. Judson, 1870–72, **70,** 213. **R., 72,** 251.
Sur. au. act June 3, 1896; made by Maj. Stanton, 1896 (**R.** unfav.). (See Projects.) **97,** 3314.
Ex. au. Mar. 3, 1909. **R.** by Col. Fisk, May 1, 1909 (unfav.). (H. D. 412, 61st, 2d.) **10,** 900.

Maps:
Of Oak Orchard Creek, **76,** ii, 579.
Of H., June 30, 1879, **79,** 1727.

RR-32(b) TROUTBERG (Troutburg), N. Y. (Harbor of refuge at.)

ENGINEERS.

Chief of Engineers. **R., 89,** 337.

In charge. Capt. C. F. Palfrey, 1888. **R., 89,** 2426.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2426.

PLANS.

By Capt. Palfrey, 1889, H. of refuge at Troutberg, with an e. and a w. p., and by dr. chan. entrance to 18′, and the H. basin to 16′ m. l. w.; est., $450,000, **89,** 2427.

SURVEY.

Ex. for H. of refuge au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (**R.** unfav.), **89,** 2426.

Maps. **89,** 2426.

RR-39 CHARLOTTE HARBOR, MOUTH OF GENESEE RIVER, N. Y.[1]

APPROPRIATIONS.[2]

1828,	$300.00 (sur.), act May 23
1829,	10,000.00, **66,** iii, 30.
1830,	13,335.00, **66,** iii, 30.
1831,	16,670.00, **66,** iii, 30.
1832,	16,000.00, **66,** iii, 30.
1833,	15,000.00, **66,** iii, 30.
1834,	20,000.00, **66,** iii, 30.
1835,	2,390.00, **66,** iii, 30.
1836,	20,000.00, **66,** iii, 30.
1837,	10,000.00, **66,** iii, 30.
1838,	25,000.00, **66,** iii, 30.
1844,	10,000.00, **66,** iii, 30.
1852,	20,000.00, **66,** iii, 30.
1853,	176.10, **66,** iii, 30.
1864,	*25,000.00, **66,** iii, 30.
1866,	75,607.30, **66,** iii, 30.
1868,	*1,100.00, **69,** 22; act July 25.
1869,	*1,000.00, **69,** 23; act Apr. 10.
1870,	12,000.00, **70,** 53.
1871,	10,000.00, **71,** 50.
1875,	5,000.00, **75,** 59.
1878,	1,000.00, **78,** 132.
1879,	1,000.00, **79,** 175.
1880,	5,000.00, **80,** 2207.
1881,	2,500.00, **81,** 2437.
1882,	35,000.00, **82,** 2445.
1884,	20,000.00, **84,** 2137.
1886,	26,250.00, **86,** 1888.
1888,	45,000.00, **88,** 2072.
1890,	25,000.00, **90,** 2852.
1892,	25,000.00, **92,** 2556.
1894,	15,000.00, **95,** 3186.
1896,	12,000.00, **96,** 3136.
1899,	7,000.00, **99,** 3131.
1900,	*3,048.37, **01,** 3358; **09,** 2165.
1902,	30,000.00, **02,** 2324.
1904,	23,000.00, **04,** 3336.
1905,	80,000.00, **05,** 2394.
1907,	88,500.00, **07,** 2116.
1909,	*9,000.00, **09,** 2165.
1910,	71,680.00, **10,** 2326.
1911,	50,000.00, **11,** 2530.
Total,	883,556.77 (incl. sales, $883,610.33, **12,** 2738).

COMMERCE.

Important, **66,** iii, 30; **67,** 241; **68,** 249.

Charlotte, the port of entry for Rochester, **69,** 179.

Total value of freight, 1896, est. at $1,570,000; 58,235 passengers carried, **96,** 3136.

Chiefly coal, 1899, **99,** 3131.

Large and growing, **04,** 3335.

Imp. materially affects rates, **07,** 726.

Statement showing increase, 1901 to 1910, **11,** 945; **12,** 1128.

1910, 973,000 t.; 1911, 940,000 t. (but vessel tonnage, 1911, 3,811,000, an inrease of 624,000 over v. t. of 1910), **12,** 2739.

CONTRACTS.

1866. R. Allen, materials, **66,** iv, 166. Syracuse Iron Works, materials, **66,** iv, 166. Thomas Parsons, materials, **66,** iv, 166.

1867. T. Parsons, materials, **67,** 243. W. Burke & Co., materials, **67,** 243. Jennings & Hart, labor, **67,** 243. R. Gorsline, labor, **67,** 243.

1872. J. McLean, materials and labor, **72,** 253.

1875. Hunter & Cunningham, materials and labor, **75,** 331.

1882. A. J. Packard, iron for p. extension, **83,** 1943. J. W. Dennis, labor and materials (except iron) for 600 l. f. of extension, **83,** 1942; completed, **84,** 2137.

1884. J. B. Donnelly, 350 l. f. of p. extension, **85,** 2271; extended, **85,** 2272; completed, **86,** 1887.

1911. Buffalo Dredging Co., dr., 16.4¢ c. y., s. m.; Universal Portland Cement Co., furnishing 2,200 bbls. American Portland cement, 34¾¢ per sack of one-quarter barrel, **12,** 2738.

ENGINEERS.

Chief of Engineers:

Transmits est. for d. lake Hs., **67,** 252.

R., 66, 4; ii, 39, 41; iii, 16, 30; **67,** 32; **68,** 45; **69,** 40; **70,** 52; **71,** 50; **72,** 46; **73,** 47; **74,** 54; **75,** 58; **76,** 110; **77,** 117; **78,** 132; **79,** 175; **80,** 231; **81,** 317; **82,** 311; **83,** 319; **84,** 323; **85,** 348; **86,** 342; **87,** 308; **88,** 282; **89,** 333; **90,** 302; **91,** 378; **92,** 357; **93,** 409; **94,** 384; **95,** 418; **96,** 376; **97,** 474; **98,** 463; **99,** 544; **00,** 612; **01,** 593; **02,** 515; **03,** 567; **04,** 621; **05,** 630; **06,** 704; **07,** 726; **08,** 771; **09,** 806; **10,** 891, 900; **11,** 945; **12,** 1127.

In charge:

Capt. T. W. Maurice, 1828; **74,** 247.

Capt. A. Canfield, 1842; **74,** 248; **76,** ii, 584.

Maj. W. Turnbull, 1853–56. S. D. 42, 35th, 1st, pp. 3, 22, 138.

Maj. J. D. Graham, 1857. **R.,** S. D. 42, 35th, 1st, p. 138.

Capt. J. A. Tardy, 1865–67; **66,** 4; ii, 41; iii, 15. **R., 66,** 51; iv, 161, 164.

Lt. Col. C. E. Blunt, 1867–69; **67,** 32. **R., 67,** 240, 243, 245; **68,** 249.

Maj. M. D. McAlester, 1869; **69,** 170; **76,** ii, 584.

Maj. F. Harwood, 1869; **69,** 170; **76,** ii, 585.

Maj. N. Bowen, 1869–71; **69,** 170. **R., 69,** 178; **70,** 202; **71,** 228.

Maj. J. M. Wilson, 1871–76. **R., 72,** 252; **73,** 359; **74,** 247; **75,** 330.

Maj. W. McFarland, 1876–83. **R., 76,** ii, 582; **77,** 978; **78,** 1273; **79,** 1727; **80,** 2207; **81,** 2436; **82,** 2444.

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* Allotment.

[1] Sur.—**R.,** Jan. 22, 1829; est. $53,919.16. (H. D. 428, 55th, 2d.)

[2] Total to and including 1875, according to reports, $308,578.40. According to H. D. 120, 44th, 1st, $307,178.40.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1942; **84,** 2137.
Capt. E. Maguire, 1885–86. **R., 85,** 2271; **86,** 1887.
Capt. C. F. Palfrey, 1886–90. **R., 87,** 2371; **88,** 2069; **89,** 2407.
Maj. M. B. Adams, 1890–91. **R., 90,** 2849, 2854.
Capt. D. C. Kingman, 1891–95. **R., 91,** 2899; **92,** 2551; **93,** 3132; **94,** 2455; **95,** 3183.
Maj. W. S. Stanton, 1896–98. **R., 96,** 3131; **97,** 3269; **98,** 2799.
Capt. G. D. Fitch, 1899–1900. **R., 99,** 3130; **00,** 4163.
Maj. T. W. Symons, 1901–02. **R., 01,** 3355; **02,** 2323.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2153.
Lt. P. S. Bond, 1904. **R., 04,** 3332.
Col. H. M. Adams, 1905–07. **R., 05,** 2392; **06,** 1942; **07,** 2115.
Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2189; (Col.) **09,** 2163.
Capt. W. L. Guthrie, 1910–11. **R., 10,** 2325; **11,** 2530.
Col. J. G. Warren, 1912–. **12,** 2737.

ESTIMATES. (See also Projects.)

By Maj. Turnbull, 1853, repairs, $24,000, **76,** ii, 584.
By Lt. Col. Blunt, d. H. to 14′ at mouth of Genesee R., $25,000, **67,** 252.
By Maj. McFarland, rebuilding superstr. of ps., $45,000, **79,** 1728. Excess of app. over est. accounted for, **74,** 249.

OPERATIONS.[1]

1829–33. Constr. of e. and w. ps. 2,407′ and 2,305′ l., resp., **74,** 247.
1833–34. Ps. extended to l. of 2,876′ each, **74,** 247.
1842. 60′ of both ps. carried away, **74,** 248.
1852–53. Repairs; condition of ps. S. D. 42, 35th, 1st, p. 138.
1857. E. p. is 2,034′ l., w. p. 1,943′ l. S. D. 42, 35th, 1st, p. 138.
1864–65. Repairs, e. p. 2,400′ l.; condition of ps., **66,** 51.
1865–67. Repairs to w. p., **66,** ii, 39, iv, 161; **67,** 32, 240.
1867–69. Repairs in general, **68,** 45, 249; **69,** 40, 179.
1869–70. Repairs completed; e. p. 2,345′ l., w. p. 2,454′ l., **70,** 52, 202.
1870–71. Superstr. raised; 2 cribs (60′) sunk in extension of e. p., **71,** 50, 228.
1871–77. Repairs; e. p. 2,450′ l. and w. p. 2,700′ l., **72,** 46, 253; **73,** 47, 259; **74,** 54; **75,** 58, 330; **76,** 110, ii, 582; **77,** 117, 978.
1878–79. Repairs; e. p. 2,425′ l., **79,** 175, 1727.
1879–80. Repairs to e. and w. ps., **80,** 2207.
1880–81. Repairs to w. p.; 707′ of superstr. of e. p. rebuilt, **81,** 2436.
1881–82. 43′ of e. p. superstr. rebuilt, **82,** 2444.
1883–84. 16 cribs (30′ l.) placed in e. and w. ps. and 600 l. f. superstr. built over same, **84,** 2137.
1884–85. One and one-half cribs framed, **85,** 2272.
1885–86. 350 l. f. of p. extension completed, **86,** 1887.
1886–87. 800 l. f. superstr. e. p. built, **87,** 2372.
1887–88. 1,400 l. f. of w. p. superstr. rebuilt; breaches in w. p. repaired; pocket in e. p. reballasted; 156 detached piles removed; work done by hired labor, **88,** 2070.
1888–89. 20,000 c. y. dr.; repairs to e. and w. ps., **89,** 2409.
1889–90. 98,377 c. y. dr., **90,** 2851.
1890–91. Superstr. of section E of e. j. rebuilt for 995 l. f.; repairs to outer end of e. p.; 18,680 c. y. dr. from chan., **91,** 2901.
1891–92. 83,513 c. y. dr.; w. j. superstr. renewed; repairs to superstr. on e. and w. js., **92,** 2555.
1892–93. 54,960 c. y. dr.; and extension of w. j. in progress, **93,** 3134.
1893–94. In connection with previous year the w. j. extended 365′, **94,** 2458.
1894–95. 67,650 c. y. dr., **95,** 3186.
1895–96.[1] E. p. extended 121′, **96,** 3135; 1,920 c. y. dr. and repairs made to ps., **96,** 3135.
1896–97. Over 18,840 c. y. dr. and w. p. repaired, **97,** 3270.
1897–98. 49,973 c. y., s. m., dr., **98,** 2799; and minor repairs made to the js., **98,** 2800.
1898–99. Repair and fitting out of dr. plant, **99,** 3131.
1899–00. 53,865 c. y. dr., e. and w. ps. repaired, **00,** 4163.
1900–01. 145 cords st. deposited in pockets of e. and w. ps.; 14,790 c. y. removed from entrance to H. by U. S. dr. plant, **01,** 3356.
1901–02. 7,675 c. y. removed, completing chan. 15′ x 80′; planking replaced in deck of w. p., **02,** 2323.
1902–03. 55,969 c. y., s. m., removed, resulting in a chan. 16½′ x 150′ m. l. w. for entire l. of ps., and 220′ w. outside of ps.; repairs made to superstr. of ps., **03,** 2153.
1903–04. 301′ of w. p. rebuilt with concrete; decking and deck crossties renewed in e. and w. ps.; dr. *Frontenac* removed 12,835 c. y. of material, **04,** 3332, 3334.
1904–05. 316′ of w. p. reconstr. with concrete; breach repaired in e. p.; dr. *Frontenac* removed 15,095 c. y. from chan., **05,** 2392.
1905–06. 541 l. f. of w. p. and 297 l. f. of e. p. rebuilt; minor repairs made to timber work of ps. and breach in e. p. closed; dr. *Frontenac* removed 12,675 c. y. from entrance chan., **06,** 704, 1942.
1906–07. 583 l. f. of w. p. and 240 l. f. of e. p. reconstr. with concrete, completing work under proj. of 1905; dr. *Frontenac* removed small shoal to 16′, **07,** 726, 2115.
1907–08. 270 l. f. of e. p. rebuilt, and 1,000 l. f. of cribs sunk; dr. *Frontenac* assisted in p. repairs and also removed 10,835 c. y. from chan., **08,** 2189.
1908–09. 460 l. f. of new cribs sunk and concrete superstr. placed on 811 l. f. of cribs sunk 1907 and 1908; 58 l. f. of timber superstr. under fog-signal house replaced with concrete; dr. *Frontenac* removed 36,070 c. y. from chan., **09,** 2163.
1909–10. Dr. *Frontenac* removed 54,830 c. y. from chan., **10,** 2325.
1910–11. 9,850 c. y. removed, making chan. bet. ps. 16′ x 150′, and completing proj.; specifications prepared for excavating 160,000 c. y. under proj. of June 25, 1910, **11,** 2530.
1911–12. 90,410 c. y. dr.; 150 l. f. concrete superstr. on w. p. and 30 l. f. on e. p. completed; oil house for Lighthouse Service reset on p., **12,** 2738.

PHYSICAL CHARACTERISTICS.

Injuries to ps. by collisions and gales, **75,** 331.
Shoal off outer end of e. p., **73,** 359.
Effect of p. extension upon d. of chan., **74,** 247; **76,** ii, 583.
Advance of shore line, **76,** ii, 585.
Description of, **74,** 247; **88,** 2072; **96,** 3134; **97,** 3270.
Good H. of refuge near middle of the American shore of the lake and about midway bet. the Niagara and St. Lawrence Rs., **97,** 3271; on Lake Ontario, 7 m. below Rochester, N. Y., **12,** 1127.
The sediment deposited by freshets of the Genesee R., on which the H. is situated, necessitates more or less dr. an. to maintain d. of 16′ in chan., **98,** 2800.
Silt, currents, and freshets, **01,** 3356.
Shoaling of chan. and condition of ps., **04,** 3334, 3335; **09,** 2164.
Storm of Oct. 29, 1906, carried away 90 c. y. of st. filling and displaced 10 concrete blocks from e. p., **07,** 2115.
Filling, limiting d. to 15′, **11,** 2530; **12,** 1128.

PROJECTS. (See Estimates.)

By Capt. T. W. Maurice, 1829, constr. of parallel ps., **74,** 247.
For masonry superstr., 1836, to supersede wooden one; ultimately abandoned, **74,** 247.
By Maj. J. D. Graham, 1857, general rebuilding of e. p.; est., $41,084.34. S. D. 42, 35th, 1st., p. 138.
By Capt. J. A. Tardy, 1865, repairs and dr.; est., $75,607.30; increased by Lt. Col. Blunt to $85,607.30, **66,** 4, 51; **67,** 33.

[1] History of operations from 1829, **96,** 3131.

By Maj. N. Bowen, extension of e. p.; est., $45,000, **69,** 40, 179; **70,** 203.

By Maj. J. M. Wilson, repairs to cost $5,000, **74,** 249; **75,** 59.

By Maj. W. McFarland, an. repairs to ps., $1,000, **76,** ii, 582.

Proj of 1829–80, modified, 1881, by Maj. McFarland, to provide for extension of the ps. to the 15′ curve in the lake, with formation, by dr., of a chan. bet. the ps. 15′ d.; est., $154,000, **81,** 2437; **86,** 343. Modified in 1889 to provide for mainten. of existing works and of a chan. 16′ x 200′ at extreme l. w. Est. for completion, incl. app. of 1890, $31,400, **90,** 2852.

By Capt. Kingman, 1891, to secure and maintain, by p. extension and dr., chan. of navigable w. and 15′ d. at extreme l. w.; est. for completion, $109,650, **92,** 2556.

By the Chief of Engineers, 1896, for modification of the proj. to obtain and preserve d. of 16′ at l. w. by dr. without further extension of the ps. at that time, **97,** 3270; **98,** 2799.

By Capt. Fitch, 1899, for applying app. of 1899 to redr. chan. bet. ps. to provisional w. of 150′, and to repairs of ps., **99,** 3131.

By Maj. Symons, 1901, to reduce cross section of R. by laying mattresses lengthwise bet. ps., sink and cover with st. to 7′ below l. w. and fill behind with dr. material; est., $15,000, **01,** 3357; **02,** 2323.

Act June 13, 1902, au. laying 3,600′ of mattress and st.; narrowing chan. to 200′ abandoned at request of C. interests and app. ($15,000) turned over to mainten., **03,** 2153.

Act Mar. 3, 1905, au. expend. of $80,000 in reconstr. of 865 l. f. of w. p. and 363 l. f. of e. p. by day labor and purchase of material, **05,** 2393.

By Col. Adams, 1907, rebuilding 1,300 l. f. of e. p. by hired labor, au. Mar. 26, 1907, **07,** 2115.

By Capt. Guthrie, 1909, chan. 20′ (for vessels with draft of 18′) d. below l. w. zero of Oswego gauge; au. act June 25, 1910 (H. D. 342, 61st, 2d); est., $41,800, **10,** 891. (This is a modification of previous projs.)

SURVEYS.

By Capt. T. W. Maurice, 1828, **74,** 247.

By Maj. J. M. Wilson, **73,** 359; **74,** 248.

Minor surs., **94,** 2459; **97,** 3270; **98,** 2800; **99,** 3131; **00,** 4163.

By Col. Fisk, indicates chan. shoaling to d. of 15′, **09,** 2164.

Au. act Mar. 3, 1909; made by Capt. Guthrie; est., $31,680 (H. D. 342, 61st, 2d), **10,** 900.

Minor sur., Apr., 1911, showed filling had limited d. to 15′, **11,** 2530.

Maps. (H. D. 342, 61st, 2d.)
Of Genesee R. H., **76,** ii, 582.
H., June 30, 1879, **79,** 1728.
81, 2436; **94,** 2458.
Plan of concrete superstr., w. p., **04,** 3332.

RR–40(a) GENESEE RIVER, N. Y.

ENGINEERS.

Chief of Engineers. **R., 89,** 337.

In charge. Capt. C. F. Palfrey, 1888. **R., 89,** 2424.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (**R.** unfav.), **89,** 2424.

RR–40(b) NEW YORK HARBORS. (Harbors on the southern shore of Lake Ontario, between Genesee and Oswego Rivers.)

APPROPRIATION.

May 23, 1828, $400 (sur.).

RR–41 IRONDEQUOIT BAY, LAKE ONTARIO, N. Y.

COMMERCE.

That of adjacent ports not large enough to warrant imp. of the B. to make a H. of refuge, **90,** 2854.

Description of, **95,** 3225.

ENGINEERS.

Chief of Engineers. **R., 89,** 337; **90,** 2853; **95,** 424.

In charge:
Capt. C. F. Palfrey. **R., 89,** 2425.
Maj. M. B. Adams, 1890. **R., 90,** 2854.
Capt. D. C. Kingman, 1895. **R., 95,** 3222.

PHYSICAL CHARACTERISTICS.

Description of. B. is on the s. side of Lake Ontario, about midway bet. the mouth of Niagara R. and head of the St. Lawrence; of irregular shape, extends inland for about 4 m., and is separated from the lake by a bar at its mouth, the latter being about 6,000′ w., **95,** 3223.

PLANS.

In 1889 Capt. Palfrey did not consider, in view of the neighborhood of Charlotte H., that a H. of refuge was a necessity at Irondequoit B., **89,** 2426.

SURVEYS.

Ex. for H. of refuge au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (see Plans), **89,** 2425.

Special **R.** on probable advantages of the B. as a H. of refuge to aid the C. of adjacent ports called for by H. of R., Apr. 5, 1890; made by Maj. Adams, 1890 (**R.** unfav.), **90,** 2853.

Ex. for chan. to connect with Lake Ontario au. act Aug. 17, 1894; made, 1895, by Capt. Kingman (**R.** unfav.), **95,** 3222.

RR-41(b) BEAR CREEK HARBOR, LAKE ONTARIO, N. Y.

COMMERCE.

Entirely local, **73,** 385–387.

ENGINEERS.

Chief of Engineers. **R.,** **72,** 48; **73,** 49.

In charge. Maj. J. M. Wilson, 1872–73, **72,** 48. **R.,** **73,** 385.

Assistant. J. S. Lawrence. **R.,** **73,** 386.

ESTIMATES.

By Maj. Wilson, p. extension and r. excavation, $250,181.93, **73,** 386, 388.

PHYSICAL CHARACTERISTICS.

General, of Bear Creek, **73,** 385, 386.

PRIVATE (CORPORATE) WORK.

Imp. by a H. company, **73,** 386, 387. Two ps. 60′ apart, constr., **73,** 386.

PLANS.

By Maj. Wilson, extending w. p. to 12′ of water; removing e. p. and constr. new one parallel to and 200′ from w. p.; also, excavating r. bet. the ps. and in the creek to 12′; est., $250,181.73, **73,** 385–388.

SURVEY.

Under the direction of Maj. Wilson, by J. S. Lawrence, 1872. **R.,** **73,** 386.

RR-42 PULTNEYVILLE HARBOR, N. Y.[1]

APPROPRIATIONS.

1870,	$5,000,	**70,** 53.
1871,	5,000,	**71,** 50.
1872,	10,000,	**72,** 47.
1873,	10,000,	**73,** 47.
1874,	10,000,	**74,** 54.
1875,	10,000,	**75,** 59.
1876,	3,000,	**76,** 111.
1878,	5,000,	**78,** 133.
1879,	4,000,	**79,** 176.
1880,	3,000,	**80,** 2209.
1881,	2,000,	**81,** 2439.
1882,	4,000,	**82,** 2446.
1890,	2,000,	**91,** 2905.
1892,	1,000,	**92,** 2562.
1894,	1,500,	**95,** 3191.
1896,	1,500,	**96,** 3139.
1899,	2,000,	**99,** 3133.
1907,	6,000,	**07,** 2118.
Total,	85,000	

COMMERCE.

C. facilities of Pultneyville, **67,** 239, 240.
Important, **67,** 240.
Small, **97,** 3273.
Insignificant, **01,** 3360.
Proj. has had no effect on rates, **07,** 727.

CONTRACTS.

1871. H. J. Mowry, materials and labor, **71,** 229.

1872. E. H. French, materials and labor, **73,** 360.

1873. C. A. Harrington, materials and labor, **73,** 360.

1874. T. Keeler, materials and labor, **75,** 332.

1875. Case & Jennings, dr., 70¢; H. J. Mowry, materials and labor, **75,** 333.

1879. C. F. Dunbar, dr., 18¢ c. y., **80,** 2208.

1881. F. B. Gay, iron; W. J. Harris, p. extension and material; W. D. Taylor, iron, **81,** 2440.

ENGINEERS.

Chief of Engineers. **R.,** **67,** 33; **70,** 53; **71,** 50; **72,** 46; **73,** 47; **74,** 54; **75,** 59; **76,** 110; **77,** 117; **78,** 132; **79,** 176; **80,** 231; **81,** 317; **82,** 312; **83,** 320; **84,** 324; **85,** 349; **86,** 343; **87,** 309; **91,** 379; **92,** 358; **93,** 410; **94,** 384; **95,** 419; **96,** 377; **97,** 474; **99,** 544; **00,** 613; **01,** 594; **07,** 727; **08,** 772; **09,** 808; **10,** 892; **11,** 946; **12,** 1128.

In charge:

Capt. T. W. Maurice, 1828; **74,** 249.
Maj. W. Turnbull, 1846; **74,** 250.
Lt. Col. C. E. Blunt, 1867. **R.,** **67,** 238.
Maj. N. Bowen, 1870–71. **R.,** **70,** 203.
Lt. B. D. Greene, 1871; **71,** 49.
Maj. J. M. Wilson, 1871–75. **R.,** **71,** 228; **72,** 255; **73,** 360; **74,** 249; **75,** 332.
Maj. W. McFarland, 1875–83. **R.,** **76,** ii, 585; **77,** 979; **78,** 1274; **79,** 1728; **80,** 2208; **81,** 2437; **82,** 2445.
Lt. Col. H. M. Robert, 1883–85. **R.,** **83,** 1944, **84,** 2138.
Capt. E. Maguire, 1885–86. **R.,** **85,** 2273; **86;** 1889.
Capt. C. F. Palfrey, 1887–91. **R.,** **87,** 2374; **88,** 2073.
Capt. D. C. Kingman, 1891–95. **R.,** **91,** 2903; **2,** 2557; **93,** 3163; **94,** 2460; **95,** 3188.
Maj. W. S. Stanton, 1896–97. **R.,** **96,** 3137; **97,** 3272.
Capt. G. D. Fitch, 1899–1901. **R.,** **99,** 3132; **00,** 4165.
Maj. T. W. Symons, 1901. **R.,** **01,** 3359.
Col. H. M. Adams, 1906–08. **R.,** **07,** 2117.
Lt. Col. W. L. Fisk, 1908–09. **R.,** **08,** 2192; (Col.) **09,** 2166.
Capt. W. L. Guthrie, 1909–11. **R.,** **10,** 2327; **11,** 2531.
Col. J. G. Warren, 1911–. **R.,** **12,** 2739.

Assistants:

Capt. C. J. Allen and J. S. Lawrence, **67,** 239.

ESTIMATES. (See Plans and Projects.)

By Capt. Maurice, 1829, ps., $30,896, **74,** 249; **76,** ii, 586.

OPERATIONS.

1871-72. 180 l. f. w. p. extension; 180′ w. superstr. completed, **72,** 47, 255.

1872-73. 180 l. f. e. p. extension; 180′ e. superstr. completed, **73,** 47, 360.

1873-74. 212 l. f. e. p. extension, **74,** 54, 250.

1874-75. 230 l. f. w. p. extension; 14,189 c. y. dr.; 110′ w. superstr. completed, **75,** 59, 333.

1875-76. 9,873 c. y. dr.; 120′ w. superstr. completed, **76,** 110, ii, 585, 587.

1877-78. 90 l. f. e. p. extension; repairs, **78,** 132, 1274.

1879-80. W. p. extended 92′; gap of 86′ bet. e. p. and Reynolds's wharf closed by p. work; 20,000 c. y. sand and st. dr. from chan. entrance, **80,** 2208.

1881-82. W. p. extended 183′, **82,** 2445.

1884-85. Repairs to w. p., **85,** 2273.

1891-92. 200 l. f. of sand-tight sheet pile j. constr., **92,** 2561.

[1] Sur.—**R.,** Jan 22, 1829: est. $30,896.69. (H. D. 482, 55th, 2d.)

1892-93. 10,706 c. y. dr., **93,** 3138.
1894-95. Extension of sand-catch bulkhead in progress, **95,** 3190.
1895-96. Work of previous year continued, **96,** 3138.
1896-97. E. and w ps. redecked and repairs made to both, **97,** 3273.
1899-00. 12,022 c. y. dr., **00,** 4165.
1900-01. 3,390 c. y. dr., **01,** 3360.
1907-08. Repairs to ps., and chan. 8′ x 14′ dr., using centrifugal pump on float, **07,** 2192–93.
1908-09. Repairs to ps., **09,** 2166.

PHYSICAL CHARACTERISTICS.

General description of Salmon Creek, **67,** 239; **76,** ii, 586.
Iron ore beds in vicinity, **67,** 240.
Description of, **96,** 3137.
Chan. very unstable, **01,** 3360.
Condition of works and depths, **01,** 594, 3360; **07,** 727, 2117; **08,** 772, 2192, 2193; **09,** 808; **10,** 892; **12,** 1129.
H. at mouth of Salmon Creek, 22 m. e. of Charotte H., **12,** 1128.

PLANS. (See Estimates and Projects.)

By Capt. Maurice, 1829, system of ps. inclosing a portion of the lake, **74,** 249; **76,** ii, 586.

PRIVATE WORK.

$30,000 had been expend. by private enterprise for the imp. of the H., by which several small cribs and one long wharf, jutting boldly into the lake, had been constr., but the works failed to be permanent, **67,** 240; **74,** 250.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Blunt, ps. and dr. in the chan.; est., $87,000, **67,** 33, 239.
By Maj. Bowen, 1872, p. to be connected with the w. shore by a break'r, both to be 20′ w.; also dr.; est, $27,000. Modified, 1872, by addition of e. p. parallel to and 200′ from the w. p., **72,** 255. Orig. proj. for H. est. to cost $59,000, **74,** 250; increased in 1875 to $71,000, **75,** 334; **84,** 2138.
By Capt. Fitch, 1899, application of app. 1899 to redr. 8′ chan. bet. the ps., with w. of 40′ m. l. w., **99,** 3133.
By Col. Adams, 1907, application of app. 1907 to general repairs of ps., filling space bet. inner end of e. p. and shore with st., and dr. about 7,500 c. y. from chan., **07,** 2118.

SURVEYS.

Included in the ex. of the s. shore of Lake Ontario, and made separately in 1829 by Capt. Maurice, **74,** 250.
Resur. by Maj. Turnbull, 1846, **74,** 250.
By Lt. Col. Blunt, 1867, **67,** 238.
By Maj. Wilson, 1873–75, **74,** 250; **75,** 333.
Ex. of the chan. made, 1894, by Capt. Kingman, **94,** 2462.

Maps:
Of Pultneyville H., **76,** ii, 586.
Of the H., June 30, 1879, **79,** 1728; **80,** 2208; **81,** 2440; **94,** 2462.

RR–44 GREAT SODUS HARBOR, N. Y.[1]

APPROPRIATIONS.

1829,	$12,500.00	**66,** iii, 29, 30.
1830,	15,280.00	
1831,	17,450.00	
1832,	17,000.00	
1833,	15,000.00	
1834,	15,000.00	
1835,	11,790.00	
1836,	12,600.00	
1837,	12,000.00	
1838,	10,000.00	
1844,	5,000.00	
1852,	10,000.00,	act Aug. 30; S. D. 42, 35th, 1st, p. 139.
1866,	53,151.80,	**66,** iii, 16.
1867,	80,000.00,	**67,** 33.
1870,	5,000.00,	**70,** 53.
1872,	15,000.00,	**72,** 47.
1874,	15,000.00,	**74,** 54.
1875,	10,000.00,	**75,** 59.
1876,	5,000.00,	**76,** iii.
1878,	5,000.00,	**78,** 133.
1879,	2,000.00,	**79,** 176.
1880,	3,000.00,	**80,** 2210.
1881,	5,000.00,	**81,** 2442.
1882,	25,000.00,	**82,** 2448.
1884,	10,000.00,	**84,** 2141.
1886,	16,875.00,	**86,** 1890.
1888,	24,000.00,	**88,** 2078.
1890,	10,000.00,	**90,** 2857.
1892,	15,000.00,	**92,** 2571.
1894,	15,000.00,	**95,** 3197.
1896,	8,000.00,	**96,** 3143.
1899,	14,000.00,	**99,** 3134.
1902,	5,000.00,	**02,** 2326.
1904,	*1,250.00,	**04,** 3338.
1906,	1,588.00,	**06,** 1945; **12,** 2741.
1907,	50,000.00,	**07,** 2120.
1910,	30,000.00,	**10,** 2329.
1911,	30,000.00,	**11,** 2532.
Total,	607,784.80	(Incl. misc., and less $12 returned to Treas. in 1907, $607,489.75, **12,** 2741).

COMMERCE.

Does not warrant hasty action, **66,** iv, 171.
Importance of Great Sodus B. C., S. D. 42, 35th, 1st, p. 140; **66,** iv, 174–175; **79,** 1730. As a H. of refuge, S. D. 42, 35th, 1st, p. 140; **66,** iv, 174, 175; **69,** 178.
C. interests mainly local, **69,** 178.
98% of C. in 1895, 42,669 t. of coal, **96,** 3139; value of the total C., $169,847±, **96,** 3143. In 1896, 34,540 t. of coal shipped, **97,** 3274. Total C., 1897, 53,548 t., **98,** 2802.
Coal chiefly, **99,** 3134.
Not large, **03,** 2156.
Imp. had material effect on freight rates on bulk commodities, such as coal, grain, lumber, and ore, **06,** 705.
1911, 55,693 t., increase over 1910 of 24,000± t., **12,** 1130.

CONTRACTS.

1866. A. P. Grant, dr.; J. W. P. Allen, towing scows; Ontario Iron Works, materials; J. N. Collins & Co., materials; R. N. Gere, materials and labor, **66,** iv, 178.
1867. R. N. Gere, dr., 24¢, **67,** 243. T. Parsons, dr., 24¢; W. Burke, dr., 24¢; R. R. Dodge, dr., 24¢; Caldwell & French, labor, **68,** 253.
1868. Z. Moore, removal of wreck, **68,** 250.
1870. C. P. Morse, removal of wreck; C. P. Morse & Co., dr., 24¢, **70,** 207.
1872. C. P. Morse & Co., repairs to break'r; E. H. French, dr., 35¢, **73,** 364.
1874. H. J. Mowry, dr., 22½¢; C. J. De Graw, break'r extension, **75,** 337.
1875. S. B. Robinson, repairs to break'r, **75,** 338.
1881. C. F. Dunbar, dr., 23¢ c. y., **81,** 2443.
1882. G. Kellogg & Co., p. constr., **83,** 1946.
1883. A. J. Packard, iron, **83,** 1946.
1884. A. F. Chapman, p. extension, **86,** 1890.
1886. W. S. Malcolm, dr., 16¢ c. y., **87,** 2377.

* Allotment.
[1] Sur.—**R.,** Jan. 22, 1829; est. $71,931.20. (H. D. 482, 55th, 2d.)

ENGINEERS.

Chief of Engineers. **R., 66,** 4, ii, 41, 42, iii, 16, 29; **67,** 33; **68,** 45; **69,** 40; **70,** 53; **71,** 50; **72,** 47; **73,** 47; **74,** 54; **75,** 59; **76,** 111; **77,** 118; **78,** 133; **79,** 176; **80,** 231; **81,** 318; **82,** 312; **83,** 320; **84,** 324; **85,** 349; **86,** 344; **87,** 309; **88,** 282; **89,** 334; **90,** 303; **91,** 380; **92,** 358; **93,** 411; **94,** 385; **95,** 420; **96,** 377; **97,** 475; **98,** 464; **99,** 545; **00,** 614; **01,** 594; **02,** 516; **03,** 568; **04,** 622; **05,** 631; **06,** 705; **07,** 727; **08,** 772; **09,** 808; **10,** 893; **11,** 946; **12,** 1129.

In charge:

Capt. T. W. Maurice, 1828; **74,** 253.

Capt. J. L. Smith, 1836; **74,** 253.

Maj. W. Turnbull, 1853–56; S. D. 42, 35th, 1st, p. 139; **74,** 254.

Maj. J. D. Graham, 1856; **66,** 4. **R.,** S. D. 42, 35th, 1st, p. 139.

Maj. C. E. Blunt, 1866–69; **66,** ii, 41, 42. **R., 66,** iv, 170; **67,** 238, 243, 256; **68,** 248, 250, 253.

Maj. M. D. McAlester, 1869; **69,** 170.

Capt. F. Harwood, 1869; **69,** 170.

Maj. N. Bowen, 1869–71; **69,** 170. **R., 69,** 178; **70,** 204; **71,** 232.

Maj. J. M. Wilson, 1871–75. **R., 72,** 256; **73,** 364; **74,** 253; **75,** 337.

Maj. W. McFarland, 1875–83. **R., 76,** ii, 588; **77,** 980; **78,** 1275; **79,** 1729; **80,** 2209; **81,** 2441; **82,** 2446.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1945; **84,** 2140.

Capt. E. Maguire, 1885–87. **R., 85,** 2274; **86,** 1890.

Capt. C. F. Palfrey, 1887–90. **R., 87,** 2376; **88,** 2075, 2078; **89,** 2411.

Maj. M. D. Adams, 1890–91. **R., 90,** 2855.

Capt. D. C. Kingman, 1891–95. **R., 91,** 2906; **92,** 2564; **93,** 3140; **94,** 2464; **95,** 3192.

Maj. W. S. Stanton, 1896–98. **R., 96,** 3139; **97,** 3274; **98,** 2801.

Capt. G. D. Fitch, 1899–1901. **R., 99,** 3133; **00,** 4166.

Maj. T. W. Symons, 1901–03. **R., 01,** 3360; **02,** 2325.

Maj. T. A. Bingham, 1903–04. **R., 03,** 2155.

1st Lt. P. S. Bond, 1904. **R., 04,** 3337.

Col. H. M. Adams, 1904–08. **R., 05,** 2395; **06,** 1944; **07,** 2119.

Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2194; **09,** 2167.

Capt. W. L. Guthrie, 1910–11. **R., 10,** 2328; **11,** 2531.

Col. J. G. Warren, 1912–. **R., 12,** 2740.

Assistants:

W. S. Malcolm, captain of U. S. dr. boat on Lake Ontario, 1857, S. D. 42, 35th, 1st, p. 142 et seq.

Capt. J. A. Smith, 1866, **66,** iv, 170.

ESTIMATES. (See Projects.)

Est., 1838, masonry superstr., $50,000, **74,** 254.

By Maj. Bowen, dr., $35,000; repairs, $10,000; closing the entrance bet. e. p. and e. shore, $30,000, **69,** 41, 178.

By Maj. McFarland, dr., $15,000; an. repairs, $2,000, **79,** 1730.

EXPENDITURES.

1857. Repairs to dr. and scows, $164.44, S. D. 42, 35th, 1st, p. 140.

OPERATIONS.[1]

1829–33. 640′ of w. p., 80′ e. p., 150′ j., and a portion of the break'rs constr., **74,** 253.

1833–35. Ps. completed; 300′ crib protection built; dr. in H., **74,** 253.

1835–38. Dr., **74,** 253, 254.

1844–45. Repairs; operations suspended, **66,** 4; **74,** 254.

1852–53. Repairs to e. chan. and H. ps.; condition of the work, S. D. 42, 35th, 1st, pp. 139, 145; **74,** 254.

1856–57. 6,233 c. y. dr., S. D. 42, 35th, 1st, pp. 140, 144.

1866–67. 400′ w. p. rebuilt; dr.; condition of work, **66,** iii, 16; **67,** 238.

1867–68. 440′ w. p. rebuilt; wreck removed from chan., **68,** 45, 248.

1868–69. 776′ w. p. rebuilt; dr. in chan., **69,** 40, 178.

1869–70. 6,209 c. y. dr.; 130′ added to w. p.; condition of ps., **70,** 53, 204, 205.

1870–71. 312′ e. break'r rebuilt; repairs, **71,** 50, 232.

1872–73. 24,891 c. y. dr.; 433′ e. break'r rebuilt, **73,** 47, 364.

1873–74. 16,808 c. y. dr.; 158′ e. break'r rebuilt, **74,** 54, 254.

1874–75. 44,977 c. y. dr.; 353′ e. break'r rebuilt; condition of work, **75,** 59, 337, 338.

1875–77. Repairs; sand-catcher constr., **76,** 111, ii, 588; **77,** 118, 980.

1877–78. 200′ w. p. rebuilt; sand-catcher constr., **78,** 133, 1275.

1879–80. 825 l. f. w. p. superstr. rebuilt, **80,** 2209.

1880–81. 13,000 c. y. sand dr., **81,** 2441.

1881–82. 29,000 c. y. sand dr.; 100 l. f. catch-sand fence built, **82,** 2446, 2447.

1882–83. Foundations for cribs and constr. of same in progress; 1,245 c. y. dr., **83,** 1945.

1883–84. 330 l. f. p. extension built; 1,991 c. y. dr., **84,** 2140.

1884–85. 200 l. f. p. extension completed, **85,** 2275.

1885–86. 200 l. f. p. superstr. completed; sand fences repaired, **86,** 1890.

1886–87. 13,224 c. y. dr. and ps. extensively repaired, **87,** 2377.

1887–88. Dr. by centrifugal pump; reconstr. of e. p. superstr. begun by hired labor, **88,** 2076.

1888–89. E. break'r deck completed; repairs to scow, and to e. and w. ps., **89,** 2412.

1889–90. Renewal of w. p. superstr. completed; 23,386 c. y. dr., **90,** 2856.

1890–91. 500 l. f. of superstr. renewed on e. p.; repairs to outer end of w. p.; minor repairs to existing works, **91,** 2907.

1891–92. 640 l. f. of e. break'r superstr. renewed; repairs to lighthouse crib on w. j.; 11,219 c. y. dr., **92,** 2570.

1892–93. 94,071 c. y. dr., **93,** 3144; and 800 trees planted on the beach w. of the js., **93,** 3145.

1893–94. 16,379 c. y. dr., **94,** 2462.

1894–95. 355 l. f. superstr. of w. break'r renewed and dr. plant repaired, **95,** 3196.

1895–96. 45,783 c. y. dr., **96,** 3143.

1896–97. 48,620 c. y. dr., **97,** 3274.

1897–98. 1,000 c. y. dr., and repairs and alterations made to dr. plant., **98,** 2802.

1898–99. E. and w. ps. repaired; nearly 5,000 c. y. dr., **99,** 3133.

1899–00. 3,305 c. y. dr., repair of ps. completed, and dr. plant repaired, **00,** 4166.

1900–01. 21,602 c. y. dr.; ps. repaired, **01,** 3361.

1901–02. 19,505 c. y. dr.; ps. repaired, **02,** 2325.

1902–03. 6,060 c. y. dr.; ps. repaired, **03,** 2155–2156.

1903–04. 10,045 c. y. dr.; ps. repaired, **04,** 3337–3338.

1904–05. 14,260 c. y. dr.; ps. repaired, **05,** 2396.

1905–06. Repairs to ps. and e. break'r, **06,** 1944.

1906–07. 7,380 c. y. dr., **07,** 2119.

1907–08. Repairs to ps., **08,** 2194.

1908–09. Repairs to ps., **09,** 2167.

1909–10. Repairs to ps. and plant; 4,815 c. y. dr., **10,** 2328–2329.

1910–11. Repairs to ps.; 6,885 c. y. dr., **11,** 2531–2532.

1911–12. Repairs to ps.; 19,125 c. y. dr.; building of material scow begun, **12,** 2740.

PHYSICAL CHARACTERISTICS.

Bar at entrance of B., as shown by sur. of 1828, **74,** 253.

Shoaling as shown by surs. of 1844 and 1848, **74,** 254.

Formation of bar and spit of sand, **66,** iii, 16, iv, 170; **75,** 338. Cause of formation of spit, **66,** iv, 172.

[1] History of work, **74,** 253; **76,** ii, 588.

Character of bed of H., **73,** 364.
The principal obstacle to the mainten. of chan. the sand borne into its outer end by the prevailing nw. winds, **97,** 3274.
Condition of works, and d. of water, **01,** 3361; **06,** 705, 1945; **11,** 2532.
Shoaling; limiting d. 12′ m. l. w., **12,** 2740.
Nearly landlocked B., 27 m. w. of Oswego H.; 2½ m. l., ½ to 1½ m. w., with d. 18′-40′, connected with Lake Ontario by chan. 1,800′ l., bet. and beyond parallel ps., **12,** 1130.

PLANS. (See Projects.)
For a masonry superstr., 1838, **74,** 254.
By Maj. Bowen, renewal of all decayed superstr., finishing e. break'r, completion of shore end of w. p., and dr. chan. to 12′, **70,** 205.
By Maj. McFarland, dr. chan. to 12′, and for an. repairs to eventually replace the superstr., **79,** 1730. Correspondence relative to the imp., S. D. 42, 35th, 1st, pp. 142–147.

PRIVATE WORK.
Dr. in front of Northern Central Railway Co. coal trestle done; 700 c. y. removed by U. S. dr. *Frontenac,* cost paid by RR. co., **12,** 2740.

PROJECTS. (See Plans.)
By Capt. T. W. Maurice, 1828, 2 break'rs from the e. and w. shores, 1,400′ and 2,200′, respectively, approaching each other, leaving an opening of about 500′; and parallel ps. from the ends to define channelway; est., $71,931.26, **76,** ii, 589. Results expected not realized, **74,** 253. 1833, for dr. chan. 15′ x 150′ x 1,500′; est., $20,000, **74,** 253.
By Maj. J. D. Graham, 1857, repairs to existing ps. and for dr.; est., $40,806, S. D. 42, 35th, 1st, pp. 139, 141, 176; $53,151.80, **66,** 4. Modified by Maj. Blunt to extend the w. p. and dr. chan. to 12′; est., $80,000, in addition to Maj. Graham's est., **66,** iv, 171, 173, 174; **67,** 238.
After app. $351,771.80, Maj. McFarland proposed, 1881, extension of the e. and w. ps. to 15′ curve and d. chan. to 15′ by dr.; est., $100,000, **81,** 2442; **87,** 2376.
In 1889 Capt. Palfrey est. that for mainten. of existing works, dr. entire space bet. ps. to hard bottom, giving a chan. 15′ x 200′ e. l. w., would require over and above prior app., $54,000, **89,** 2413, 2414.
In 1891 Capt. Kingman est. $58,000 for completion of proj., **91,** 2908.
By Chief of Engineers, 1896, modification of proj. to provide that when the 2 ps. had been extended to 539′, d. of 15′ was to be obtained and maintained by dr. without further extension of the ps.; funds then available to be applied to dr. 15′ x 150′ bet. the ps., flaring to 250′ at the 15′ curve; and for mainten. of ps. and the U. S. dr. plant, **97,** 3274; **98,** 2801, 2802.
By Capt. Fitch, 1899, redr. 15′ x 150′, e. l. w., flaring to 250′ at the 15′ curve; and for repairs to ps.; est., $9,300. Remainder of app. of 1899 intended for mainten., **99,** 3133.
By Col. Adams, 1907, rebuilding with concrete superstr. of about 584′ of w. p. and 854′ of e. p.; est., $42,500, **07,** 2119.

SURVEYS.
By Capt. Maurice, 1828, **74,** 253; 1844 and 1848, **74,** 254.
Ex. by Capt. Smith, **66,** iv, 170. Results, **66,** iv, 174.
By Maj. Wilson, **72,** 256; **75,** 338.
Soundings by Capt. Kingman, 1894, **94,** 2468.
Minor surs., **98,** 2802; **99,** 3133.
Pre. ex. and sur. au. act June 25, 1910, of Great Sodus B., N. Y., **12,** 1137.

Maps:
Of Great Sodus B. H., **76,** ii, 588; June 30, 1879, **79,** 1730.
81, 2442; **94,** 2468.
8 charts. of H. in Lake Survey also.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1130.

RR–45(b) BLACK CREEK SHOAL, LAKE ONTARIO.

ENGINEERS.
Chief of Engineers. **R., 92,** 420.

In charge. Capt. D. C. Kingman, 1892. **R., 92,** 3428.

Assistant. W. P. Judson. **R., 92,** 3429.

PHYSICAL CHARACTERISTICS.
4 m. w. of Little Sodus.

SURVEY.
Sur. of Black Creek Shoal, made 1891, by Capt. Kingman, **92,** 3428.

RR–46 LITTLE SODUS BAY HARBOR, N. Y.[1]

APPROPRIATIONS.

1852,	[2] $10,000.00,	**66,** iii, 29.
1864,	[3] 4,101.36, act Apr. 9.	
1866,	33,840.41,	**66,** iii, 16, 29.
1867,	50,000.00,	**67,** 33.
1869,	*1,500.00, act Apr. 10.	
1870,	5,000.00,	**70,** 53.
1871,	15,000.00,	**71,** 51.
1872,	15,000.00,	**72,** 47.
1873,	15,000.00,	**73,** 48.
1874,	15,000.00,	**74,** 55.
1875,	10,000.00,	**75,** 59.
1876,	5,000.00,	**76,** 111.
1878,	10,000.00,	**78,** 133.
1879,	5,000.00,	**79,** 176.
1880,	20,000.00,	**80,** 2211.
1881,	20,000.00,	**81,** 2445.
1882,	25,000.00,	**82,** 2449.
1884,	$10,000.00,	**84,** 2142.
1886,	12,500.00,	**86,** 1892.
1888,	16,000.00,	**88,** 2082.
1890,	13,000.00,	**90,** 2861.
1892,	6,000.00,	**92,** 2579.
1894,	8,000.00,	**95,** 3203.
1896,	8,000.00,	**96,** 3149.
1899,	5,500.00,	**99,** 3136.
1902,	25,000.00,	**02,** 2328.
1904,	*2,000.00,	**04,** 3340.
1905,	30,000.00,	**05,** 2398.
1907,	75,000.00,	**07,** 2121.
1910,	30,000.00,	**10,** 2331.
1911,	30,000.00,	**11,** 2534.
Total,	530,441.77 (incl. misc., $530,464.47 **12,** 2742).	

* Allotment.
[1] Sur.—**R.,** Jan. 2, 1829, est. $32,327.59. (H. D. 482, 55th, 2d.)
[2] S. D. 42, 35th, 1st, p. 147.
[3] Relief claims.

COMMERCE.

Important, S. D. 42, 35th, 1st, p. 148; **66,** iv, 175; **67,** 238.

Availability as a H. of refuge, S. D. 42, 35th, 1st, p. 148; **68,** 248; **69,** 175.

C. importance of Little Sodus B., **66,** iv, 170; **68,** 248; **75,** 342; **79,** 1731.

E. ps. not deemed necessary, **66,** iv, 170, 172, 175.

The value of the C., 1895, $268,800, **96,** 3149.

63,501 t. of coal shipped, 1896, **97,** 3276.

In 1897, 68,888 t., **98,** 2804.

Chiefly coal, **99,** 3136.

Decrease, owing to coal miners' strike, **01,** 3363.

Proj. has had material effect in controlling rates on bulk commodities, **12,** 1131.

1902, 53,000± t.; 1905, 105,000± t.; 1908, 154,000± t.; 1911, 134,000± t., **12,** 1131.

CONTRACTS.

1866. A. P. Grant, dr.; J. W. P. Allen, towing scows; R. Nelson Gere, materials and labor; Ontario Iron Works, materials and labor; J. N. Collins & Co., materials and labor, **66,** iv, 177.

1867. W. J. Baker, dr., 24¢, **67,** 243. J. N. Collins & Co., materials; S. B. Robinson, labor; C. R. Parsons, materials; R. R. Dodge, materials, **68,** 252.

1868. R. R. Dodge, materials; R. R. Dodge, materials and labor; Hart & Jennings, materials, **68,** 251.

1869. Hart & Jennings, materials and labor; John King, materials and labor, **69,** 177.

1871. E. H. French, materials and labor; E. H. French, dr., **71,** 233.

1872. Post & Henderson, materials; C. J. De Graw, materials, **72,** 257. H. J. Mowry, materials, **73,** 367.

1873. T. B. Hart, materials, **73,** 367.

1874. C. J. De Graw, materials and labor, **75,** 341.

1875. C. J. De Graw, materials and labor, **75,** 342.

1879. C. F. Dunbar, dr., 18¢ c. y., **80,** 2212.

1880. W. D. Taylor, iron, **81,** 2446. R. J. Myers and H. C. Post, timber, **81,** 2446.

1881. D. W. McConnell, dr., 17¾¢ c. y.; R. J. Myers and H. E. Post, timber; W. D. Taylor, iron, **81,** 2446.

1882. Kelly & Bennerman, p. extension, **83,** 1947. A. J. Packard, iron, **83,** 1946.

1895. E. J. Hingston, dr. 10,000 c. y., at 47¢ c. y., p. m., **95,** 3202.

1897. W. J. Daly, dr., 49.9 and 18¢ c. y., s. m., **97,** 3277.

1903. Buffalo Dredging Co., extending e. p., unit prices listed, **03,** 2159.

DOCUMENTS. (Not published in reports.)

S. D. 16, 34th, 3d. **R.** of Maj. J. D. Graham for 1855–56. S. D. 42, 35th, 1st, p. 148.

ENGINEERS.

Chief of Engineers:

Letter to officer in charge, directing him to carry out the wishes of the "Ontario Bay Harbor Imp. Assn.," S. D. 42, 35th, 1st, p. 150.

R., 66, 4, ii, 41, 42, iii, 1629; **67,** 33; **68,** 45; **69,** 41; **70,** 53; **71,** 51; **72,** 47; **73,** 47; **74,** 54; **75,** 59; **76,** 111; **77,** 118; **78,** 133; **79,** 176; **80,** 132; **81,** 318; **82,** 312; **83,** 321; **84,** 325; **85,** 350; **86,** 344; **87,** 310; **88,** 283; **89,** 335; **90,** 303; **91,** 380; **92,** 359; **93,** 412; **94,** 386; **95,** 421; **96,** 378; **97,** 475; **98,** 464; **99,** 545; **00,** 614; **01,** 595; **02,** 516; **03,** 569; **04,** 624; **05,** 632; **06,** 706; **07,** 728; **08,** 773; **09,** 809; **10,** 894; **11,** 947; **12,** 1130.

In charge:

Capt. T. W. Maurice, 1828; **74,** 256.

Maj. W. Turnbull, 1845; S. D. 42, 35th, 1st, pp. 3, 22; **74,** 256.

Maj. J. D. Graham, 1857; **66,** 4. **R.,** S. D. 42, 35th, 1st, p. 147.

Maj. C. E. Blunt, 1866–69; **66,** ii, 41. **R., 66,** iv, 170, 172, 175; **67,** 237, 243, 257; **68,** 247, 251, 252.

Maj. M. D. McAlester, 1869; **69,** 170.

Capt. F. Harwood, 1869; **69,** 170.

Maj. N. Bowen, 1869–71; **69,** 170. **R., 69,** 175; **70,** 207.

Maj. J. M. Wilson, 1871–76. **R., 71,** 233; **72,** 257; **73,** 367; **74,** 255; **75,** 341.

Maj. W. McFarland, 1876–83. **R., 76,** ii, 591; **77,** 981; **78,** 1276; **79,** 1781; **80,** 2210; **81,** 2443; **82,** 2448.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1946; **84,** 2142.

Capt. E. Maguire, 1885–87. **R., 85,** 2276; **86,** 1891.

Capt. C. F. Palfrey, 1887–90. **R., 87,** 2379; **88,** 2079; **89,** 2415.

Maj. M. B. Adams, 1890. **R., 90,** 2858.

Capt. D. C. Kingman, 1891–95. **R., 91,** 2909; **92,** 2572; **93,** 3146; **94,** 2470; **95,** 3198.

Maj. W. S. Stanton, 1896–98. **R., 96,** 3145; **97,** 3276; **98,** 2804.

Capt. G. D. Fitch, 1899–1901. **R., 99,** 3135; **00,** 4168.

Maj. T. W. Symons, 1901–03. **R., 01,** 3363; **02,** 2327.

Maj. T. A. Bingham, 1903–04. **R., 03,** 2157.

1st Lt. P. S. Bond, 1904. **R., 04,** 3339.

Col. H. M. Adams, 1904–08. **R., 05,** 2397; **06,** 1946; **07,** 2121.

Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2196; (Col.) **09,** 2168.

Capt. W. L. Guthrie, 1909–11. **R., 10,** 2330; **11,** 2533.

Col. J. G. Warren, 1912–. **R., 12,** 2742.

Assistants:

Lt. B. D. Greene, 1870, **70,** 208.

1st Lt. W. L. Guthrie, **09,** 806.

ESTIMATES. (See Plans and Projects.)

By Maj. Bowen, repairs, $25,000, **69,** 41, 175.

By Maj. McFarland, p. extension, $60,000, **79,** 1731.

OPERATIONS.

1854. 240 l. f. w. p.; dr., S. D. 42, 35th, 1st, p. 147, **74,** 256.

1866–67. 60 l. f. w. p.; dr., **67,** 237.

1867–68. 650 l. f. w. break'r and 500 l. f. w. p.; dr., **68,** 46, 247.

1868–69. 300 l. f. w. p.; dr., **69,** 41, 175.

1869–70. 120 l. f. w. p.; repairs, **70,** 53, 207.

1870–71. 210 l. f. w. break'r; 100′ of superstr.; repairs, **71,** 51, 233.

1871–72. 30 l. f. w. p.; 22,625 c. y. dr.; repairs to w. p. and break'r, **72,** 47, 257.

1872–73. 270 l. f. e. p.; 1,783 c. y. dr.; 210′ of superstr., **73,** 47, 367.

1873–74. 240 l. f. e. break'r and 243 l. f. e. p.; 170′ of superstr.; dr., **74,** 55,258.

1874–75. 540 l. f. e. break'r; 1,592 c. y. dr.; 130′ of superstr.; repairs, **75,** 59, 341.

1875–76. 660 l. f. e. break'r; 795′ of superstr., **76,** 111, ii, 591.

1876–77. Repairs, **77,** 118, 981.

1877–78. 150 l. f. e. p.; repairs, **78,** 133, 1276.

1878–79. Repairs, **79,** 176.

1879–80. Filling placed in e. p.; 1,000 l. f. w. p. superstr. built; 9,678 c. y. dr., **80,** 2210.

1880–81. Work on ps. and dr. continued, **81,** 2444.

1881–82. E. p. extended 757′ and w. p. 242′; 40,000 c. y. sand dr. from chan. bet. ps., **82,** 2448.

1882–83. E. p. extended 360′ and w. p. 150′, **83,** 1946.

1883–84. W. p. extended 120′, e. p. 240′, **84,** 2142.

1884–85. 100 l. f. cribwork added to w. p. and riprap foundation laid for remainder of extension, **85,** 2277.

1885–86. W. p. extended 100′ and 200 l. f. superstr. built, and st. dike built bet. end of e. break'r and shore, **86,** 1891.

1887–88. 200 l. f. of stake and fascine shore revet. built; 512 l. f. of e. p. superstr. rebuilt; outer end of w. p. repaired, and minor repairs to deck of e. break'r, **88,** 2081.

1888–89. 3 pockets in w. p. reballasted and 1,020 l. f. of superstr. renewed; 980 l. f. of e. break'r superstr. renewed, **89,** 2416.

1889–90. Repairs to e. and w. ps., **90,** 2859.

1891–92. 800 l. f. of e. break'r superstr. built; 541 c. y. of hardpan and 7,257 c. y. of sand dr., **92,** 2579.

1893–94. 14,367 c. y. dr., **94,** 2474.
1895–96. (History of works of imp., **96,** 3145.) 10,638 c. y. dr., **96,** 3145.
1896–97. 21,080 c. y. dr., **97,** 3276.
1897–98. 28,384 c. y. dr. and minor repairs made to both ps., **98,** 2804.
1898–99. Over 8,000 c. y. dr.; e. and w. ps. repaired, **99,** 3135.
1899–00. Dr. plant repaired, **00,** 4168.
1900–01. 7,950 c. y. dr., **01,** 3363.
1901–02. 5,440 c. y. dr.; decking of both ps. repaired, **02,** 2327.
1902–03. 19,345 c. y. dr.; work on repair and extension of ps., **03,** 2157.
1903–04. Work on p. extension in progress, **04,** 3339.
1904–05. P. extension work in progress; repairs to ps. and break'r made; 4,210 c. y. dr. from e. side of chan., **05,** 2397.
1905–06. Extension of 300′ e. p. completed; replacing of 635′ superstr. completed; repairs made to old ps.; 18,335 c. y. sand dr., **06,** 1947.
1906–07. Minor repairs made to ps., **07,** 2121.
1907–08. 150′ concrete superstr. placed on w. p. and 120′ placed on e. p., **08,** 2196.
1908–09. 176′ superstr. placed on w. p., 150′ on e. p., and 60 l. f. old superstr. torn out on e. p., **09,** 2168.
1909–10. 21,780 c. y. dr.; 418 l. f. superstr. put in w. p. and 362 l. f. in e. p., **10,** 2330.
1910–11. 27,875 c. y. dr.; 540 l. f. superstr. placed in w. p., **11,** 2533.
1911–12. 150 l. f. concrete superstr. placed in e. p. and 150 l. f. in w. p.; 17,240 c. y. dr.; repairs to floating plant, **12,** 2742.

PHYSICAL CHARACTERISTICS.

General description, S.D. 42, 35th, 1st, p. 148.
Condition of the B. as shown by the sur. of 1828, **74,** 256.
D. of water, **66,** iii, 16, iv, 175.
Chan. requires more or less dr. an. because of sand movement, **00,** 4168.
Description of, **01,** 595.
Chan. d. 15′, m. l. w., **07,** 2121.
High seas washed 16 face-wall blocks from e. and w. ps. into lake, 15 of which were recovered, **08,** 2196.
Nearly landlocked B., 13 m. w. of Oswego, 2 m. x 1–8 m. x 18–50′, connected with Lake Ontario by chan. 2,300′ l., and beyond parallel ps., **12,** 1130.

PLANS. (See Estimates and Projects.)

By Maj. Bowen, restoration of ps. and the rebuilding of the break'rs, **69,** 41, 175.
By Maj. McFarland, extension of ps. to 12′ curve, **79,** 1731.

PRIVATE (CORPORATE) WORK.

Organization of Ontario Bay Harbor Imp. Assn., 1857, to aid in the imp. of Little Sodus B., by joining its capital (about $6,000) to the U. S. app., S. D. 42, 35th, 1st, pp. 148, 150, 152, 153.

PROJECTS. (See Estimates and Plans.)

By Capt. Maurice, 1829, to close one of 2 openings into the B. by a dike 130 y. long; also for the constr. of 2 parallel ps., each 290 y. long; est., $32,327.59, **74,** 256.
By Maj. Graham, 1857, (1) completion of w. p.; (2) constr. of an e. p., with cribs 10′ x 20′ x 32′; (3) dr. chan. to 12′; est., $52,602.18, S. D. 42, 35th, 1st, pp. 147, 148; **76,** ii, 592.
By Maj. Blunt, extension of w. p. and connection with w. shore and dr. a chan. 12′ x 400′ (deeming an e. p. unnecessary); est., $80,000, **66,** iii, 16, iv, 170, 175.
By Maj. Bowen, constr. of an e. p. parallel to and 250′ from the w. p., connected at its inner end with the e. shore by a break'r; est., $62,100, **71,** 234; **72,** 257.
The proj., adopted in 1881, was an expansion of the earlier proj., and proposed to furnish a chan. of entrance not less than 15′ by the closure of one side of the B. by a lateral p. of cribwork filled with st., in connection with 2 parallel ps. extending out into the lake, **79,** 1731; **81,** 2444; **87,** 2379. Amount est. to complete proj., $32,500, **86,** 344, 1892; **87,** 2381. Increased to $46,600 in 1889, **89,** 2417; and to $58,500 in 1891, **91,** 2911.
In 1896 the Chief of Engineers au. that the then available funds might be applied to redr. in mainten. to 15′ x 150′ bet. the ps. and 170′ through a hardpan shoal toward the outer ends and in advance of them, and to making necessary repairs to and mainten. of ps. and break'r, and to dr. plant, **98,** 2804.
Act June 13, 1902, au. extension of e. p. 300′, **02,** 2328.
Act Mar. 3, 1905, au. rebuilding 600′ e. p., **05,** 2397.
Act Mar. 2, 1907, au. rebuilding 1,747′ w. p. and 461′ e. p. with concrete; est., $70,000, **07,** 2121.
At 1912, ps. 250′ apart; w. p. 1,747′ l., e. p. 1,810′ l., projecting beyond shore 1,550′ and 1,810′, resp.; w. break'r 469′ l., but entirely buried in sand and not maintained; e. break'r 1,680′ l., **12,** 1131.

SECRETARY OF WAR.

Circular from War Dept. stating conditions upon which operations may be carried on under direction of the officer in charge to the limit of funds provided by the State, by municipal, or private parties, S. D. 42, 35th, 1st, p. 151.

SURVEYS.

Included in sur. of Hs. on the s. shore of Lake Ontario, bet. the Genesee and Oswego Rs., made by Capt. Maurice, 1828, **74,** 255, 256; **76,** ii, 591.
By Maj. Turnbull, 1845, **74,** 256.
Resur., 1852, **74,** 256.
Soundings, 1866, **66,** iv, 175.
By Lt. Greene, 1870, **70,** 208.
By Maj. Wilson, 1872, **74,** 257.
Minor surs., **95,** 3202; **97,** 3276; **99,** 3135; **00,** 4168.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1132.

Maps:
Of Little Sodus H., **76,** ii, 591; June 30, 1879, **79,** 1731.
81, 2446.

RR–48 OSWEGO HARBOR, N. Y.[1]

APPROPRIATIONS.

1826,	[2] $200.00, act May 20.	
1827,	[3] 33,348.64	**66,** iii, 29.
1828,	9,583.39	
1829,	7,472.00	
1831,	[4] 22,016.84	
1832,	19,000.00	
1833,	8,400.00	
1834,	$30,000.00	**66,** iii, 29.
1836,	20,000.00	
1837,	15,000.00	
1838,	46,067.00	
1844,	20,000.00	
1852,	40,000.00	
1860,	[5] 30,000.00, **74,** 263; **76,** ii, 599.	
1864,	*25,000.00, **66,** ii, 40, 41.	

* Allotment.
[1] Sur.—**R.,** Jan. 22, 1829, est. $18,615.46. (H. D. 482, 55th, 2d.)
[2] Sur. [4] Four app.
[3] Imp. [5] Mentioned in reports but not in acts of Congress. Probably an allotment.

1866,	$45,000.00,	**66,** iii, 17.
1867,	60,000.00,	**67,** 34.
1868,	*20,000.00,	**68,** 46.
1869,	*22,275.00,	**69,** 22.
1870,	50,000.00,	**70,** 54.
1870,	*6,000.00,	**71,** 51; **74,** 264.
1871,	100,000.00,	**71,** 51.
1872,	100,000.00,	**72,** 47.
1873,	100,000.00,	**73,** 48.
1874,	75,000.00,	**74,** 55.
1875,	90,000.00,	**75,** 60.
1876,	90,000.00,	**76,** 111; **77,** 119.
1878,	90,000.00,	**78,** 133.
1879,	90,000.00,	**79,** 177.
1880,	90,000.00,	**80,** 2217.
1881,	50,000.00,	**81,** 2449.
1882,	80,000.00,	**82,** 2456.
1884,	80,000.00,	**84,** 2145.
1886,	71,250.00,	**86,** 1893.
1888,	100,000.00,	**88,** 2085.
1890,	30,000.00,	**90,** 2867.
1892,	40,000.00,	**92,** 2593.
1894,	37,000.00,	**95,** 3213.
1896,	60,000.00,	**96,** 3157.
1899,	60,000.00,	**99,** 3144.
1901,	*10,000.00,	**01,** 3369.
1902,	51,000.00,	**02,** 2331.
1905,	100,000.00,	**05,** 2401.
1907,	100,000.00,	**07,** 2124.
1909,	100,000.00,	**09,** 2171.
1909,	*40,000.00,	**09,** 2171.
1910,	125,000.00,	**10,** 2333.
1911,	85,000.00,	**11,** 2537.
1912,	85,000.00,	**12,** 2746.
Total,	2,658,612.87	(incl. misc., $2,662,089.64, **12,** 2746).

COMMERCE.

Importance as a H. of refuge, S. D. 42, 35th, 1st, 154; **66,** iv, 169; **67,** 237; **68,** 46, 247; **69,** 172; **70,** 214, 218, 267; **71,** 237, 238, 242; **72,** 261, 266; **73,** 372.

Oswego 7th in rank in the collection of U. S. customs, **70,** 215.

2 d in rank, **79,** 1737.

Public right of free access to new H., **70,** 221.

Discussion of expediency of increasing d. of H. so as to admit vessels of 14′ draft, **67,** 257.

In 1895 the extension of d. w. up the R. had increased the number of vessels visiting the H., **95,** 3211; and Oswego considered the most important H. on Lake Ontario, its C. being greater than all the other American ports put together, **95,** 3214.

In 1896 a BE. considered that for the safety of vessels entering the H., as well as for the convenience of vessels and the transaction of business in the inner H. during storms, the proj. for constr. an e. break'r was a worthy one, but the board did not believe that any increase in C. had taken place at the H. during the past few years; on the contrary, that a decrease had occurred, there having been a falling off of about one-half, approx., **97,** 3281.

In 1897, 706,805 t.; entered and cleared, **98,** 2807. Chiefly coal, **99,** 3144.

Declining, **04,** 3367.

Proj. reported to have material effect in controlling rates on bulk commodities, **07,** 730.

Diagram showing relation bet. C. and app., **11,** 2538.

1910, 758,196 t., 1911, 869,965 t., **12,** 1134.

CONTRACTS.

1866. A. P. Grant, dr., material, and labor; J. W. P. Allen, towing scows; H. Gleason, hire of scows; Ontario Iron Works, materials; J. N. Collins & Co., materials, **66,** iv, 177.

1867. Edwin Allen, dr., removing old crib and st., **67,** 242.

1868. D. C. Gunn, materials, **68,** 250.

1869. W. M. Platt, materials; Pratt & Co., materials, James Caldwell, materials, **69,** 174.

1870. Post & Henderson, materials, **70,** 211.

1871. T. Keeler, labor and materials; E. H. French (declined to accept), labor and materials; R. N. Gere, labor and materials, **71,** 337, 240; Leverich & Gardiner, timber; C. J. De Graw, timber; J. King, materials; J. Caldwell, materials, **72,** 260.

1872. H. J. Mowry, p. constr., **73,** 371, 377; **74,** 267.

1881. J. H. Case, timber and st. filling, $1.10 c. y., and dr., 75¢ c. y. F. B. Gay, iron. G. Kellogg, removal of r., $7 c. y., and other material, 70¢ c. y., resp. G. Kellogg, timber and st. filling, $1.35 c. y., and dr., $1.25 c. y.. F. Wilson, iron, **81,** 2451.

1882. F. Wilson, iron, **83,** 1948.

1883. F. Lee, dr., 30¢ c. y., **84,** 2143.

1884. Post & Henderson, timber, **84,** 2146.

1893. Hingston, Rogers & O'Brien, 3,000 c. y. r. excavation, $2.75 c. y., p. m., **93,** 3160.

1894. Hingston, Rogers & O'Brien, r. excavation, $2.75 c. y., p. m. ($9,215.25), **95,** 3211.

1897. W. J. Daly, 4,600 c. y. r. excavation, $3 c. y.; dr. 21,500 c. y., at 15¢ c. y., **98,** 2806.

1904. Daly & Hannan Dredging Co., r. excavation, $3.90 c. y., **05,** 2400.

1906. Post & Henderson Co., timber, $34.90 M f. b. m., **06,** 1949.

1909. Adams & Duford Co., riprap st., 70¢ t., **09,** 2171. John J. Sullivan, 15,000 net t. riprap st. (contract annulled subsequently for nonfulfillment), **10,** 2332–2333.

1910. A. W. Adams, 10,809.21 net t. riprap st., 70¢ t.; A. R. Hinckley, to transport st. from quarry, at 35¢ t., **11,** 2535. Picton Island Red Granite Co., 75,000 t. riprap st., 65¢ t., **11,** 2537.

DEFENSE.

Ft. Ontario, situated on e. side of H., completely commands entrance, S. D. 42, 35th, 1st, p. 154, **70,** 210. Break'r wanted to form a H. for U. S. Navy in time of war, **76,** ii, 599.

DOCUMENTS. (Not published in reports.)

H. D. 20, 41st, 2d, **70,** 209; H. D. 263, 41st, 2d, **70,** 209.

ENCROACHMENTS.

Constr. of coal trestle by Delaware, Lackawanna & Western RR. Co. in H. formed by w. break'r, **83,** 1949.

ENGINEERS.

Chief of Engineers. R., **66,** 2, 4, 55, ii, 40, 41, iii, 17, 29, iv, 171; **67,** 33, 252; **68,** 46; **69,** 41; **70,** 54, 291; **71,** 51, 242, 246, 247; **72,** 47, 269; **73,** 48; **74,** 55; **75,** 59; **76,** 111; **77,** 118; **78,** 133; **79,** 176; **80,** 232; **81,** 319; **82,** 313; **83,** 321; **84,** 325; **85,** 350; **86,** 345; **87,** 310; **88,** 284; **89,** 335; **90,** 304; **91,** 382; **92,** 360; **93,** 412; **94,** 386; **95,** 421; **96,** 379; **97,** 476; **98,** 456; **99,** 546; **00,** 615; **01,** 595; **02,** 517; **03,** 570; **04,** 625, 631; **05,** 633; **06,** 707; **07,** 729; **08,** 775; **09,** 811; **10,** 895; **11,** 948; **12,** 1132.

Boards:

Board recom., 1853, enlargement of H. by 2 detached break'rs, 700′ in advance and parallel to the orig. work, and 400′ apart, and afterwards to be connected with the shore, **74,** 263. (Lt. Col. Kearney and Majs. Long, Bache, and Turnbull.)

Board considered, 1870, that the existing H. works were insufficient for the accom. and protection of C., and that wharf room could only be obtained by a new outer H., and recom. Maj. Bowen's proj., **70,** 54, 219–222. (Lt. Col. Woodruff and Majs. McFarland and Bowen.)

Board recom., 1871, that the work be commenced on e. sec. and extended w. to shore, **71,** 245. (Lt. Col. Woodruff, Maj. Wilson, and Capt. Harwood. Maj. Wilson dissenting, submits minority **R.,** **71,** 248.)

Board reconvened, 1871, to consider the expediency of beginning work on the proposed p. at the w. end. Board recom. that request of the town of Oswego (viz, that the work be commenced at the w. end) be acceded to, although still adhering to their

* Allotment.

opinions as to the advantage of beginning at the e. end, **71,** 242. **R., 71,** 243–246. (Lt. Col. Woodruff, Maj. Wilson, and Capt. Harwood.)

Convened, New York, Feb. 15, 1887, to report upon removal of e. break'r in Oswego H. **R., 87,** 2390. (Cols. Casey and Abbot and Lt. Col. Houston.)

BERH., June 6, 1903, reviewed **R.** of Maj. Symons on pre. ex. (see Surveys), **04,** 3369. Review of **R.** of Maj. Bingham on est. of cost, Sept. 14, 1903, **04,** 3371.

In charge:
Capt. Wm. Smith, 1827; **76,** ii, 596.
Capt. T. W. Maurice, 1829; **74,** 261.
Lt. R. C. Smead, 1833; **74,** 261; **76,** ii, 596.
J. W. Judson, 1838; **74,** 262.
Capt. Canfield, 1839; **74,** 262.
Maj. Wm. Turnbull, 1857; **76,** ii, 598.
Maj. J. D. Graham, 1857–65; **66,** 4, iii, 16; **76,** ii, 599. **R.,** S. D. 42, 35th, 1st, 153, 158, 165.
Maj. C. E. Blunt, 1865–69; **66,** ii, 41; **67,** 32; **68,** 44; **69,** 39; **74,** 263; **76,** ii, 599, 600. **R., 66,** 2, 55, 56; ii, 40; iv, 169, 173, 177; **67,** 236, 257; **68,** 246, 254.
Maj. M. D. McAlester, 1869, died Apr. 23, **69,** 39.
Capt. F. Harwood, temporarily in charge, **69,** 170.
Maj. N. Bowen, 1869–70; **69,** 39; **70,** 51; **71,** 49. **R., 69,** 171; **70,** 208, 213.
Lt. B. D. Greene, 1870–71; **71,** 49.
Maj. J. M. Wilson, 1871–76; **71,** 49; **72,** 46; **73,** 46; **74,** 53; **75,** 58; **76,** 110. **R., 71,** 237, 246, 247, 248; **72,** 259, 265; **73,** 371; **74,** 261; **75,** 345; **76,** ii, 595.
Maj. W. McFarland, 1875–83; **76,** 110; **77,** 117; **78,** 129; **79,** 174. **R., 76,** ii, 594; **77,** 982; **78,** 1277; **79,** 1732; (Lt. Col.) **80,** 2212; **81,** 2447; **82,** 2449; **83,** 1951.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1948; **84,** 2143, 2147; **85,** 2278.
Capt. E. Maguire, 1885–86. **R., 85,** 2278; **86,** 1892.
Capt. C. F. Palfrey, 1886–90. **R., 87,** 2381, 2386; **88,** 2082; **89,** 2417.
Maj. M. B. Adams, 1890. **R., 90,** 2862.
Capt. D. C. Kingman, 1891–95. **R., 91,** 2912; **92,** 2581; **93,** 3152; **94,** 2476; **95,** 3204, 3213.
Maj. W. S. Stanton, 1896–98. **R., 96,** 3150; **97,** 3278; **98,** 2806.
Capt. G. D. Fitch, 1899–1901. **R., 99,** 3138; **00,** 4170.
Maj. T. W. Symons, 1901–02. **R., 01,** 3365; **02,** 2330; **04,** 3364.
Maj. T. A. Bingham, 1903–04. **R., 03,** 2160; **04,** 3372.
1st Lt. P. S. Bond, 1904. **R., 04,** 3342.
Col. H. M. Adams, 1904–08. **R., 05,** 2400; **06,** 1948; **07,** 2123.
Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2198; (Col.) **09,** 2170.
Capt. W. L. Guthrie, 1910–11. **R., 10,** 2332; **11,** 2535.
Col. J. G. Warren, 1911–. **R., 12,** 2744.

Assistants:
Capt. Canfield, **74,** 262.
R. J. Dickson, **70,** 213.
W. P. Judson. **R., 82,** 2452; **92,** 2594; **93,** 3161; **95,** 3216; **96,** 3157.

ESTIMATES. (See Projects.)

1829. Capt. Maurice, break'r and pierhead, $12,720, **74,** 261.
1833. Col. J. G. Totten, paving break'r and pierhead, $43,000, **74,** 262.
1833. Col. J. G. Totten, masonry superstr. for p., $56,802, **74,** 262.
1836. Lt. Smead, completing break'r and superstr., $111,942, **74,** 262; **76,** ii, 597.
1857. Maj. Graham, for repairs of break'r, $46,391, S. D. 42, 35th, 1st, pp. 154–156.
1861. Maj. Graham, an outer break'r, $463,765, **76,** ii, 599.
1861. W. S. Malcolm, repairs of U. S. dr., $545, S. D. 42, 35th, 1st.
1866. Maj. Blunt, for an. repairs, $10,000 to $12,000, **66,** iv, 173; **67,** 34, 237.
1866. Maj. Blunt, dr. to 12′, $100,000 to $120,000, **66,** iv, 173.
1867. Maj. Blunt, d. H. to 15′, $25,000, **67,** 252, 257.
1867. Maj. Blunt, extension of lighthouse p., $50,000, **67,** 237; **68,** 46, 246.
1869. Maj. Bowen, new H. break'r, $2,500,000, **69,** 172.
1870. Maj. Bowen, new H. break'r, $1,650,000, **70,** 219.
1870. BE., new H. break'r, per l. f., $232.89, **70,** 221.
1870. Maj. Bowen, new H. break'r, per l. f., $275, **74,** 264.
Statements of est., 1827 to 1874; **74,** 261–264.

EXPENDITURES.
Repairs, $14,588.17, **66,** ii, 40.
Repairs, $17,420.96, **66,** ii, 40.
Repairs and dr., $35,705; **67,** 237.
Repairs, **79,** 1736.

LEGAL PROCEEDINGS.
Title to land of isld. bet. Schuyler and Van Buren Sts. ready for transfer to U. S., **99,** 3139; **00,** 4171.

LEGISLATION.
Of New York, 1861, ceding jurisdiction to the U. S. of land on which masonry p. and storehouses stand, **76,** ii, 599.

OPERATIONS.[1]
1827. Break'r commenced, **74,** 261.
1829. Break'r completed, **74,** 261.
1830. St. break'r commenced, **74,** 261.
1831. St. break'r continued and counterforts built, **74,** 261.
1833. St. break'r raised as high as top of p., **74,** 261.
1835. 1,115 t. of limest. pavement added to break'r, **74,** 262.
1836. 600′ of break'r finished, **74,** 262.
1837. Work in progress, **74,** 262.
1838. Superstr. completed, break'r and p. repaired, **74,** 262.
1844. Both pierheads rebuilt from water line; face of ps. repaired, **74,** 263.
1845. 155′ of superstr. on w. p. built, **94,** 263.
1853–55. Repairs continued, **74,** 263.
1855. Breach fully repaired; 420′ of w. p. to be rebuilt, **74,** 263.
1857. Repairs as far as funds would permit, S. D. 42, 35th, 1st, p. 153.
1858. Repairs continued, **74,** 263.
1860–63. 800′ of p. rebuilt and cribwork protection thrown around the angle, **74,** 263.
1864. Repairs continued; 30 new cribs put in and ballasted; 500′ of p. planked, and 150′ raised and leveled, **66,** 55.
1865. 3 new cribs put in section of old works; 649′ of plank placed on outer face; 70′ of p. raised and leveled; 300′ of new cribwork, **66,** ii, 40.
1866. Repairs and dr. in progress; chan. and H. partially available for vessels, **67,** 33, 236; **74,** 263.
1867–68. Repairs and dr. in progress; greater part of H. will have 12′ d., **68,** 246; **74,** 264.
1868–69. Repairs and dr. continued; work on extension of p. commenced, **69,** 41, 171; **74,** 264.
1869–70. 437′ of cribwork completed and leveled up for superstr., excepting 60′ at end; repairs of old break'r, **70,** 54, 208, 209.
1870–71. One crib completed; old break'r repaired; lighthouse p. finished, **71,** 51, 237.

[1] Statements of material used, **72,** 261; **73,** 372; **74,** 265, 266; **75,** 345–347; **76,** ii, 594, 595. Average cost for the first 600′ of p. for a d. of 19′, $70 l. f., next 1,705′ of p. for a d. of 20′ to 28′, $159 l. f., **74,** 265; **75,** 346; **78,** 1279. Cost per l. f., 1874, 21′ to 22′ in d., $105, **74,** 265; **75,** 346; **78,** 1279. U. S. dr. sold, 1861, for want of funds to work it, **76,** ii, 599.

1871-72. 1,059′ of cribwork and 640′ of superstr. completed; old p. repaired; short break'r placed in angle, **72,** 47, 259–261.

1872-73. 750′ cribwork and 570′ superstr.; old p. fully repaired, **73,** 48, 371, 372.

1873-74. 400′ of cribwork and 1,125′ of superstr. completed; counterforts built; old p. repaired; sur. made, **74,** 55, 264–266.

1874-75. 1,025′ of cribwork and 494′ of superstr. completed; counterforts built; 300′ addi. superstr. partially finished, **75,** 59, 345–347.

1875-76. 445′ of cribwork and 470′ of superstr. completed; also 300′ of superstr. partly finished; repairs of old and new ps.; counter forts built, **76,** 111, ii, 594, 595.

1876-77. 210′ of superstr. built; repairs of old and new ps.; counterforts built, **77,** 118, 982.

1877-78. 423′ of superstr. completed; repairs of old and new ps.; counterforts built, **78,** 133, 1277, 1278.

1878-79. 430′ of cribwork and 250′ of superstr.; new and old break'r repaired, **79,** 176, 1732–1737.

1879-80. 747 l. f. cribwork sunk in extension of new break'r and 677 l. f. of same covered with superstr.; minor repairs made to new break'r, se. portion of old break'r heavily riprapped; 400 l. f. of n. half rebuilt from foundation up, and 220′ more repaired; also repairs to derricks and working plant, **80,** 2212, 2216.

1880-81. 463 l. f. of cribwork added to e. break'r, **81,** 2447.

1881-82. 441 l. f. cribwork added to w. break'r, completing the same; 7 cribs sunk in extension of the e. break'r; chan. d. by dr. to 15′ on w. side of R., **82,** 2450.

1882-83. Extensive repairs to break'r, U. S. wharf, and Engineer property; 5,000 c. y. dr. from inner H., **83,** 1948.

1883-84. 32,194 c. y. dr. from inner H.; repairs to break'r and breaches therein, **84,** 2144.

1884-85. 1,929 c. y. dr. from inner H.; w. break'r spur built; breach in break'r arrested by constr. of bulkheads on either side of the injured portion, **85,** 2278, 2280.

1885-86. 2 partial breaches in break'r repaired; buttress built against parapet in H. face, **86,** 1892.

1886-87. Lake face of w. break'r parapet strengthened; superstr. on shore arm repaired; repairs to lake arm and e. break'r, **87,** 2383.

1887-88. 846 l. f. of shore-arm superstr. renewed; breaches in break'r closed and minor repairs to ps. and break'r, **88,** 2084.

1888-89. Minor repairs to outer w. break'r; repair and extension of lighthouse p., **89,** 2419.

1889-90. Spur crib built and placed on lake front of outer break'r; 277 c. y. riprap placed; repairs to breaches, decking, and lake arm of outer break'r; work done by hired labor, **90,** 2864, 2866.

1890-91. 1,300 l. f. of outer break'r superstr. rebuilt; repairs to wharf and outer break'r, **91,** 2914.

1891-92. 170 l. f. of outer break'r superstr. rebuilt; 26,845 c. y. dr.; repairs to outer break'r, **92,** 2581.

1892-93. Minor repairs made to ps. and break'r, **93,** 3159. Superstr. on the lighthouse p. extension renewed, **93,** 3159, 3160. H. lines estab., About 2,500 c. y. r. excavated, **93,** 3160.

1893-94. About 1,000 c. y. r. excavated, 2,806 c. y. dr., and break'r repaired, **94,** 2482, 2483.

1894-95. 3,351 c. y. r. excavated, and repairs made to outer break'r, **95,** 3211, 3212.

1895-96. Break'r repaired, **96,** 3156, 3157.

1896-97. Dr. in progress, face of the break'r cleared and superstr. of the s. part rebuilt, and outer break'r repaired, **97,** 3278, 3279. Some loose st. removed from the chan. and r. excavation in progress, **97,** 3279.

1897-98. 976 c. y. r. excavated; 14,320 c. y. dr.; outer break'r repaired; 35′ of inner break'r rebuilt, and minor repirs made, **98,** 2806.

1898-99. About 8,000 c. y. dr.; 3,602 c. y. r. excavated; outer break'r repaired, and p. repairs in progress, **99,** 3138.

1899-00. W. spur crib cut down to extreme l. l.; narrowing of opening in outer break'r in progress; preparations made for removal of isld. in H.; plant repaired, **00,** 4170, 4171.

1900-01. Reduction of breach and general repairs to outer break'r, and removal of portion of upper isld. in progress, **01,** 3366–67.

1901-02. Removal of upper portion of isld. completed; 5,196 c. y. gravel and bowlders removed; repairs to break'r and floating plant, **02** 2330.

1902-03. Repairs to break'rs; 21,445 c. y. dr. in outer H. by U. S. plant; 87 c. y. bowlders and loose st. removed near head of upper isld., **03,** 2160.

1903-04. Repairs to break'rs and lighthouse p.; 7,285 c. y. dr., **04,** 3342–43.

1904-05. Repairs to break'rs; 5 shoals removed by U. S. dr.; 2,500 c. y. r. removed under contract, **05,** 2400.

1905-06. Repairs to break'rs; new storehouse built, **06,** 1948–49.

1906-07. Repairs to break'r; dr. repaired and scows built, **07,** 2123.

1907-08. Temporary repairs to break'r under plan B.; 5,154.9 t. rubblest. and 356 t. capping st. placed under plan A, **08,** 2199.

1908-09. Repairs to break'r, under plan A, 5,585 t. rubblest., 5,127 t. capping st., and 14,092 t. riprap placed; concrete blocks built and placed; timber work repaired, **09,** 2171.

1909-10. 38,471.9 c. y. riprap placed; 86 c. y. concrete placed; floating plant repaired and new scows built, **10,** 2332–33.

1910-11. 25,130 t. riprap placed; plant repaired, marine ry. built, st. crusher purchased and installed; repairs to inner break'r and p., **11,** 2535–37.

1911-12. 35,561.16 t. riprap placed on outer break'r; crib built for narrowing breach; redr. outer H.; plant repaired; new dr. under constr.; inner break'r repaired, **12,** 2744–45.

PHYSICAL CHARACTERISTICS.

Force of storms, S. D. 42, 35th, 1st, p. 154, **66,** 56; iii, 17; iv, 169; **72,** 267; **73,** 371; **74,** 265; **76,** ii, 595; **79,** 1735.

Advance of shore line, **68,** 246; **70,** 54, 209, 210, 214, 217, 218; **72,** 260, 266; **74,** 261; **75,** 345; **76,** ii, 595.

Water curve of Lake Ontario, **73,** 372, 373.

Great changes in d., **74,** 262.

Local prevailing winds from w. to nw., **72,** 267.

Measurements of height, velocity, and force of waves, **85,** 2279.

Description of, **95,** 3214; **96,** 3150; **97,** 3282.

The H. a most difficult one to make in certain winds, and a great many wrecks have occurred about the entrance, **95,** 3214.

Inadequacy of break'r to resist wave action during storms, **04,** 3364–3366.

Damage by storms, **07,** 2123; **08,** 2198.

H. e. of Charlotte H., comprises lower part of Oswego R., **12,** 1132.

PLANS.

By BE., 1853. (See Board of Engineers.)

For extending lighthouse p. n. into the lake 400′ to 500′; not recom. by Maj. Blunt, **67,** 237.

PRIVATE (CITY AND STATE) WORK.

City voted $10,000 for dr. H., S. D. 42, 35th, 1st, p. 166.

1846-55. Repairs of ps. and dr. by city of Oswego, **74,** 263.

Description of, **95,** 3211; **97,** 3279.

Dr. done by N. Y., **97,** 3279.

PROJECTS. (See Estimates.)

Early proj. since 1827, **74,** 261, 262.

By J. W. Judson, 1838, removing shoal in chan.; recom. that the constr. of the break'r be discontinued and the st. applied to the superstr. of p., **74,** 262; **76,** ii, 596.

By Maj. Graham, 1857, repairs and preservation of H., extension of wooden p. 600′, repair of w. p. and dr.; est., $46,391; S. D. 42, 35th, 1st, p. 154. Repairs required an.; amount an. for mainten., $10,000 to $12,000, **66,** 55, ii, 40, iv, 169, 173; **67,** 34, 237, 263; **68,** 46.

For repairs to preserve lighthouse and dr., 1866, to give at least 12′ d.; est., $100,000 to $120,000, **66,**

56, iv, 169. For a small experimental j. to detain moving material, **66,** iv, 169.

By Maj. Blunt, 1867, extension of lighthouse p. n.; est., $50,000, **68,** 46, 247, 254; **69,** 41, 171.

By Maj. Bowen, 1869, repairs of old break'r, completion of new p. and commencement of work on new outer H., by a break'r of cribwork (cribs of same model as old ones) 6,000′ l., giving 100 acres of anchorage bet. break'r and 12′ curve; est., $2,500,000, **69,** 172; **70,** 209, 210. Est. revised to $1,650,000, **70,** 219. Recom. by BE., **70,** 54, 220.

By Maj. Bowen, 1870, break'r 5,800′ l. on the line generally to and about 1,100′ in advance of the present w. p., leaving an entrance of 700′ bet. the e. end of the new work and lighthouse p. now building. Approv. by BE.; est., $1,650,000, **70,** 54, 220, 221; **74,** 264; **76,** ii, 600.

By Maj. Wilson, 1872, constr. a H. on the e. side of the Oswego R.; small H. room on e. side of R.; various considerations involved, **72,** 265–269.

By Maj. McFarland, 1878, constr. of e. break'r, **79,** 177, 1734, 1735; **86,** 345.

The BE. of 1887 recom. removal of the part of the break'r already built, **87,** 2391.

In 1889 Capt. Palfrey est. $192,000 as required for completion of the proj., including the constr. of parapet superstr. and general repairs to existing works, **89,** 2421.

By Capt. Kingman, 1893, imp. the inner H. by the removal of r. to afford d. of 15′, extreme l. w. for several hundred f. up the R., **93,** 3152; and in 1894 for the removal of about 3,000 c. y. r. from the inner H., **95,** 3211.

In 1895 Capt. Kingman est. $197,000 to imp. the H. (**95,** 3216) by building an e. break'r 1,435′ l., **96,** 3156; the plan of. imp. adopted.

By Chief of Engineers, 1896, reducing the breach in the outer break'r from about 100′ to about 75′ in w., at a cost of $17,000; to reduce the exposure of the wharves opposite and yet permit circulation bet. the lake and H. essential to prevent stagnation of water in the latter with attendant ill effects, **96,** 3156.

By Congress for w. and d. the inner H. by r. excavation, **96,** 3156; **97,** 3280. (Not definite, but the Chief of Engineers au. excavation of about 4,000 c. y., **97,** 3280.)

The proj., 1899, was (1) for e. break'r, 1,435′ l.; est., $197,000; (2) the narrowing of the breach of 1884 in outer break'r from 175′ to 75′; est., $18,500; (3) removal of r. from the R. beyond the limits fixed, 1897, and also for such dr. as might be necessary to increase the H. capacity; and (4) removal of part of an isld. bet. Schuyler and Van Buren Sts. to 15′ d., and also the excavation of r. and dr. bet. the isld. and the w. bank; est., $12,000, **99,** 3138.

By Capt. Fitch, 1899, repairing outer break'r; est., $8,500; cutting down w. crib (spur) to extreme l. w., **99,** 3139; also partial removal of isld. near Schuyler St. (est., $8,000) and partial closing of breach of 1884 (est., $10,000), the balance of the app. of 1899 to be held for contingencies and repairs of outer break'r, **99,** 3139.

Description and history of outer break'r, and condition at 1899 (drawings), **99,** 3140, 3141.

In 1899 Capt. Fitch est. cost, by 4 methods, from $676,300 to $887,700, to place outer break'r in a stable condition (drawings), **99,** 3143.

Proj. outlined by Lt. Bond, 1904, for extension of d. w. area farther upstream, **04,** 3344.

Act Mar. 3, 1905, makes app. for continuing repairs to break'r under existing method printed as plan B (see Surveys), **04,** 3368; **05,** 634, 2401.

Act Mar. 2, 1907, au. further repairs under plan A, which contemplates a st. superstr. and sea slope, at est. cost of $900,000 (see Surveys), **04,** 3368; **07,** 730, 2123.

Modification of plan, 1910, provides for concrete superstr. and riprap sea slope, **10,** 896.

SURVEYS.

By Capt. Canfield, 1839, **74,** 262.
Of H. by R. J. Dickson, 1861, **70,** 213; **74,** 264.
Resur. and soundings, 1866, **66,** iii, 17, iv, 173.
Sur. made through the ice, 1873, **74,** 262.
Minor surs., etc., **95,** 3213; **00,** 4171.

Pre. ex. and sur. au. act June 13, 1902, with view to ascertaining cost of necessary repairs to outer break'r. **R.** on pre. ex. by Maj. Symons, Feb. 3 and Apr. 9, 1903, and supple. **R.** by Maj. Bingham, with detailed est. of cost, Aug. 31, 1903. Plan A for imp. at est. cost of $900,000 presented; also alternative plan B for repairs under existing method, at est. cost of from $60,000 to $100,000 (H. D. 55, 58th, 2d), **04,** 631, 3363–3378.

Maps:
Of Oswego H., **66,** 5; **76,** ii, 594.
Water curves of Lake Ontario, 1859–73, **73,** 372.
Of the H., June 30, 1879, **79,** 1736.
Oswego H., **80,** 2216; **81,** 2450.
93, 3164; **95,** 3220; **97,** 3284; **99,** 3144; (photographs, **00,** 4172); **03,** 2160; **11,** 2536.
Chart of H. in sur. of nw. lakes, 225.

RR–49(b) OSWEGO CANAL, N. Y.

COMMERCE.

In 1896 canal navigated by boats wider than the boats for whose passage provision was contemplated by Congress, and Maj. Stanton believed that, therefore, no alteration would have to be made to permit the passage of torpedo boats, etc., **97,** 3325.

ENGINEERS.

Chief of Engineers. R., 97, 483.

In charge. Maj. W. S. Stanton, 1896–97. **R., 97,** 3324.

PHYSICAL CHARACTERISTICS.

Description of. Oswego Canal joins the Erie Canal at Syracuse and connects it with Lake Ontario through the mouth of the Oswego R. at Oswego, N. Y., **97,** 3324.

SURVEYS.

In 1896 the Chief of Engineers ordered that a report be made as to the practicability and cost of a proj. contained in House bill, 54th, 1st, for w. the locks of the Oswego Canal to permit the passage of modern torpedo boats and war vessels of similar size. **R.** by Maj. Stanton, 1896 (see Commerce), **97,** 3324.

RR–50(a) MEXICO BAY. N. Y.

COMMERCE.

In 1892 Capt. Kingman thought value of a H. of refuge at this place was measured by value of the entire C. on Lake Ontario, but the DE. and the Chief of Engineers did not consider the work a worthy one for the U. S. to undertake, **93,** 3169, 3173, 3174.

ENGINEERS.

Chief of Engineers. **R., 93,** 3169.

In charge. Capt. D. C. Kingman, 1893. **R., 93,** 3169.

PHYSICAL CHARACTERISTICS.

Description of: B. comprises that part of Lake Ontario lying e. of a straight line joining Stony Pt. with Ninemile Pt. e. of Oswego, **93,** 3169.

SURVEYS.

Ex. for H. of refuge au. act July 13, 1892; made by Capt. Kingman, 1892 (see Commerce), **93,** 3169.

RR–50(b) SANDY CREEK (Big), N. Y.

APPROPRIATION.

1828 (sur.), $300, act May 23.

COMMERCE.

Benefits as a H. of refuge, **76,** ii, 604, 605.
Local C. interests, **76,** ii, 604.

ENGINEERS.

Chief of Engineers. **R., 76,** 112.

In charge:
Capt. T. W. Maurice, 1828; **76,** ii, 603.
Maj. J. M. Wilson, 1876. **R., 76,** ii, 603.

Assistant. W. P. Judson. **R., 76,** ii, 606.

PHYSICAL CHARACTERISTICS.

General, of Big Sandy Creek, **76,** ii, 604–606.
Velocity of current, **76,** ii, 605.
Dangers of Mexico B., **76,** ii, 604.

PLAN.

By Maj. Wilson, H. of refuge; 2 parallel crib ps. 150′ apart, and each 1,800′ l., 500 l. f. pile revet., and 80 l. f. pile protection; est., $182,600, **76,** ii, 605, 606.

SURVEYS.

For H. at the mouth of the creek. (Treas. D. 373, 1882.)
Sur.—**R.,** Jan. 22, 1829; est., $36,465.30. (H. D. 482, 55th, 2d.)
By Capt. Maurice, 1828, **76,** ii, 603.
Under direction of Maj. Wilson, by W. P. Judson, 1875. **R., 76,** ii, 606.

RR–51 PORT ONTARIO HARBOR (Salmon River),[1] N. Y.

APPROPRIATIONS.

1836,	$5,000,	act July 4.
1837,	10,000,	act Mar. 3.
1838,	30,000,	act July 7.
1844,	5,000,	act June 11.
Total,	50,000	

COMMERCE.

Heavy expend. not warranted by the wants of C. and navigation, **68,** 47.
Importance of the imp. as a H. of refuge, **68,** 292; **71,** 251.

ENGINEERS.

Chief of Engineers. **R., 68,** 47; **70,** 32, 55; **71,** 52; **85,** 352; **89,** 337.

In charge:
Lt. R. C. Smead, U. S. Army, 1836; **68,** 290, 292.
Lt. Col. C. E. Blunt, 1868. **R., 68,** 289.
Maj. N. Bowen, 1870. **R., 70,** 211.
Maj. J. M. Wilson, 1871. **R., 71,** 251.
Lt. Col. H. M. Robert, **85,** 2291.
Capt. C. H. Palfrey, 1888–89. **R., 89,** 2427.

Assistant. Lt. B. D. Greene. **R., 71,** 252.

OPERATIONS.

Former operations referred to, **68,** 290. Condition of old ps., **71,** 252.

PHYSICAL CHARACTERISTICS.

General, of Salmon R., **68,** 290; **71,** 252.
Action of drifting sands, **68,** 290.
Character of R. bed, **71,** 253.
Description of. Enters Mexico B., Lake Ontario, about 20 m. e. of Oswego. Port Ontario and Selkirk are situated on this R. **89,** 2428.

PLANS.

By Lt. Col. Blunt, closing chan. with dike; cutting new chan. through sandspit to 12′; protection of sides of cut with cribwork; extension of 2 ps. into lake, 200′ apart; dr. chan. of R., and also middle of Selkirk Pond to 10′, so increasing H. and anchorage room; est., $209,000, **68,** 290, 291; **71,** 52.
By Lt. Greene, to omit dr. Selkirk Pond, reducing est. to $113,000, **71,** 252, 253.

SURVEYS.

Sur.—**Rs.:** Nov. 30, 1829, est., $17,060.95; Sept. 20, 1836, est., $72,081.13. (H. D. 482, 55th, 2d.)
Ex. by Lt. Col. Blunt, 1868, **68,** 47. **R., 68,** 289.
By Lt. Greene, 1870, **71,** 52. **R., 71,** 252.
History of previous surs., **85,** 2291.
Ex. au. act July 5, 1884; made by Lt. Col. Robert (**R.** unfav.), **85,** 2291.
Ex. for H. of refuge au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (**R.** unfav.), **89,** 2427.
Maps. **89,** 2428.

[1] This R. enters Mexico B., Lake Ontario, about 20 m. e. of Oswego. There is another Salmon R. in the State, which empties into St. Lawrence R.

RR–58 SACKETTS HARBOR, N. Y.

APPROPRIATIONS.

1826,	$3,000	Treas. D. 373, 1882.
1828,	3,000	
1882,	7,000, **83,** 1953.	
1888,	2,000, **88,** 2087.	
1894,	5,000, **95,** 3221.	
Total,	20,000	

COMMERCE.

In 1895, $65,000, **96,** 3161.

In 1897 C. small, but H. thought of use as H. of refuge for small craft plying bet. Lake Ontario and the St. Lawrence R., **97,** 3265.

CONTRACTS.

1883. W. J. Daly, dr., 20¢ c. y., **83,** 1954.

ENGINEERS.

Chief of Engineers. R., 81, 321; **82,** 314; **83,** 322; **84,** 326; **85,** 352; **86,** 346; **87,** 312; **88,** 285; **89,** 336; **90,** 305; **91,** 382; **92,** 361; **93,** 414; **94,** 388; **95,** 423; **96,** 380; **97,** 477; **98,** 466.

In charge:

Lt. Col. W. McFarland, 1881–83. **R., 82,** 2489.

Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1953; **84,** 2151.

Capt. E. Maguire, 1885–87. **R., 85,** 2282; **86,** 1894.

Capt. C. F. Palfrey, 1887–90. **R., 87,** 2391; **88,** 2086; **89,** 2422.

Maj. M. B. Adams, 1890–91. **R., 90,** 2868.

Capt. D. C. Kingman, 1891–95. **R., 91,** 2918; **92,** 2597; **93,** 3166; **94,** 2486; **95,** 3221.

Maj. W. S. Stanton, 1896–. **R., 96,** 3160; **97,** 3285; **98,** 2809.

Assistant. M. Kingsley. **R., 82,** 2490.

OPERATIONS.

1882–83. 8,510 c. y. dr., **83,** 1953.

1883–84. 15,500 c. y. dr., **84,** 2151.

1884–85. 18′ crib built and placed upon e. end of Ship-House Pt. Shoal, **85,** 2282.

1888–89. 164 l. f. of stake and fascine work built, **89,** 2422.

1896–97. 2 groins of st. built at entrance, **97,** 3285.

1897–98. 23,494 c. y. dr., **98,** 2809.

PHYSICAL CHARACTERISTICS.

Description of, **96,** 3160; **97,** 3285.

PLANS.

In 1890 Maj. Adams reported existing needs of H. satisfied by existing works, **90,** 2868.

PROJECTS.

In 1826 and 1828 $6,000 expend. in clearing wrecks from the H., **87,** 312.

By Lt. Col. McFarland, 1881, imp. by dr. the area to within 50′ of the wharf line to 12′ d. at l. w.; est., $22,000, **82,** 2490.

Modified in 1883 by a crib placed near end of Ship-House Pt., **83,** 1953; **87,** 2391; **92,** 2597.

By the Chief of Engineers, 1896, modification of the proj. to provide for building 2 low groins of st. perpendicular to the line of the beach instead of a wall parallel to it, **96,** 3160.

SURVEYS.

Au. act Mar. 3, 1881, made, 1881, by Lt. Col. McFarland, **82,** 2489.

Minor surs., **96,** 3161; **97,** 3285.

Maps. **98,** 2808.

RR–59 (a) BLACK RIVER, N. Y.[1]

APPROPRIATIONS.

1836,	$5,000, **73,** 378.	
1837,	10,000, act Mar. 3.	
1838,	22,401, act July 7.	
1844,	*3,000, **73,** 378.	
1873,	5,000, **73,** 48.	
Total,	45,401	

COMMERCE.

Unimportance of, **73,** 380; **97,** 3308.

CONTRACTS.

C. Daly, dr., 35¢ c. y., **73,** 379.

ENGINEERS.

Chief of Engineers. R., 73, 48; **74,** 55; **89,** 2429; **97,** 482.

In charge:

Lt. J. E. Johnston, 1839, **73,** 378.

Capt. Canfield, 1842, **73,** 378.

Col. J. J. Abert, 1844, **73,** 378.

Maj. J. M. Wilson, 1873–74. **R., 73,** 378; **74,** 268.

Capt. C. F. Palfrey, 1888–89. **R., 89,** 2429.

Maj. W. S. Stanton, 1896–97. **R., 97,** 3306.

Assistants:

W. P. Judson. **R., 73,** 380; **97,** 3309.

M. T. Stockton, **73,** 378.

OPERATIONS.

1837–38. N. p. extended 2,719 l. f.; s., 2,408 l. f., **73,** 378.

1839. N. p. extended 1,260 l. f.; s., 300 l. f., **73,** 378.

1844. S. p. extended 390 l. f., **73,** 378.

1873–74. 11,500 c. y. dr., **74,** 55, 268.

PHYSICAL CHARACTERISTICS.

Description of, **73,** 380; **74,** 268; **89,** 2429; **97,** 3307.

R. a succession of rapids, **73,** 379.

R. flows into Black R. B., an arm of Lake Ontario, joining the lake 15 m. from the head of the St. Lawrence R., **97,** 3307. The sandy soil which the R. carries down with its swift currents causes shoals in the B. which must ever be contended against in the mainten. of a navigable chan., **97,** 3308.

PROJECTS.

1837–38. For prolonging the banks of the R. by ps. to d. w. in the B., **73,** 378.

1873. By Maj. Wilson, extension of the s. p. 6,800′, and of the n. p. 4,200′; also repairs and dr.; est., $214,000, **73,** 379; **74,** 268.

SURVEYS.

By M. T. Stockton, 1836, **73,** 378.

By W. P. Judson, 1873. **R., 73,** 380.

Resur., **74,** 268.

Ex. au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (**R.** unfav.), **89,** 2429.

Ex. of the R. to Dexter au. act June 3, 1896; made in that year by Maj. Stanton (**R.** unfav.), **97,** 3306.

*Allotment. [1] Ex.—**R.** (fav.), July 15, 1829. Sur.—**R.,** 1836; est. $26,998.77. (H. D. 482, 55th, 2d.)

RR–59(b) BLACK RIVER, AND DEXTER HARBOR, N. Y.

ENGINEERS.
Chief of Engineers. **R., 06,** 712.

SURVEYS.
Ex. of mouth and Dexter H. made, au. act Mar. 3, 1905 (**R.** unfav.) (H. D. 157, 59th, 1st), **06,** 712.

RR–63 ST. LAWRENCE RIVER.

Part.	Title.	Periods.	Appropriations.
a	St. Lawrence R. (Galops Rapids)	1882	
b	St. Lawrence R.	1889–1907	$68,000.00
c	St. Lawrence R., Long Sault Isld.	1901–1905	48,000.00
	Total		116,000.00

Part (a), RR–63 St. Lawrence River. (Effect of deepening channel at Galops Rapids.)

NOTE.—Complaint made by Canadians that U. S. imp. of Galops Rapids would lower level of Lake Ontario. Maj. McFarland reported in mathematical detail on slopes of St. Lawrence, etc., showing the complaint unfounded.

ENGINEERS.
Chief of Engineers. **R., 82,** 314.

In charge. Lt. Col. Comstock and Maj. McFarland. **R., 82,** 2470–2489.

Part (b), RR–63 St. Lawrence River, N. Y.

APPROPRIATIONS.

1890,	$5,000,	**91,** 2922.
1892,	10,000,	**92,** 2600.
1894,	8,000,	**95,** 3229.
1896,	25,000,	**96,** 3164.
1899,	20,000,	**99,** 3148.
Total,	68,000	

COMMERCE.
Description of, **97,** 3291–3292.
1896, C., 1,133,200 t., 77% of it in American vessels, **97,** 3292. 1899, 1,394,780 t., **99,** 3148.
Benefited by imp., **03,** 573.

CONTRACTS.
1891. W. J. Daly, r. excavation, 247 c. y., at $16 c. y., p. m., **93,** 3188.
1892. W. Johnson, r. excavation, $10.75 c. y. ($3,870), **93,** 3189.
1895. Lynch & Hannan, r. excavation, $8.49 c. y. ($5,094), **95,** 3228.
1897. W. J. Daly, r. excavation, 3,562 c. y. $7.25 c. y., **98,** 2811.
1899. W. J. Daly, ledge removal, $7 c. y. ($16,590), **99,** 3148.

ENGINEERS.
Chief of Engineers. **R., 89,** 344; **91,** 383; **92,** 362; **93,** 415; **94,** 389; **95,** 424; **96,** 381; **97,** 478; **98,** 467; **99,** 548; **00,** 617; **01,** 597; **02,** 519; **03,** 573; **04,** 628; **05,** 635; **06,** 709, 712; **07,** 733.

In charge:
Maj. M. B. Adams, 1888–92. **R., 89,** 2462; **91,** 2922; **92,** 2599.
Capt. S. S. Leach, 1893–96. **R., 93,** 3188; **94,** 2489; **95,** 3227; **96,** 3163.
Maj. W. S. Stanton, 1897–98. **R., 97,** 3290; **98,** 2810.
Capt. G. D. Fitch, 1899–01. **R., 99,** 3147; **00,** 4175.
Maj. T. W. Symons, 1901–02. **R., 01,** 3373; **02,** 2334.
Maj. T. A. Bingham, 1903. **R., 03,** 2165.
1st Lt. P. S. Bond, 1904. **R., 04,** 3352.
Col. H. M. Adams, 1905–06. **R., 05,** 2405; **06,** 1952.

Assistants:
F. M. Barstow. **R., 89,** 2463.
J. C. Churchill, jr. **R., 01,** 3393.

OPERATIONS.
1892-93. 424 c. y. r. excavated, **93,** 3188.
1893-94. 277 c. y. r. excavated, **94,** 2490.
1895-96. 676 c. y. r. excavated, **96,** 3164.
1897-98. 3,562 c. y. r. excavated, **98,** 2811.
1899-00. Ledge removal in progress, **00,** 4176.
1900-01. 4 ledges removed, **01,** 3374.

PHYSICAL CHARACTERISTICS.
Description of, **89,** 2462; **97,** 3290.
Detailed description of shoals, **97,** 2790.

PROJECTS.
By Maj. Adams, 1889, removal of 3 r. shoals in the chan. to 18′ l. w., est. $43,305, **91,** 2922; **93,** 3188; and for the removal of other shoals discovered while excavating those first mentioned, **93,** 3188; and the est. increased to $54,772, **93,** 3189.

By Capt. Leach, 1895, expend. of available funds in the removal of several small dangerous shoals discovered after the above proj. was au., **95,** 3228.

By Maj. Stanton, 1897, removal of Dark Isld. and Blind B. ledges to 18′ below zero of the Oswego gauge; est., $60,000 in addition to the funds available, **97,** 3291.

By Capt. Fitch, 1899, removal of ledges in U. S. waters, about 2,370 c. y., to 18′ d., Oswego gauge, **99,** 3148. Consent of Canadian govt. asked, 1899, to removal by U. S. of ledges in Canadian waters, **99,** 3148. Permission given, **00,** 4176.

SURVEYS.

Of shoals bet. Sister Islds. and Crossover Light, au. act Aug. 11, 1888; made, 1889, by Maj. Adams, **89,** 2463.

Surs. made of several of the shoals in the R. in 1898 by Maj. Stanton, **98,** 2811.

Ex. and sur. au. act Mar. 3, 1905, near Thousand Isld Park, N. Y. **R.** by Col. Adams, 1905, and 1906 (H. D. 177, 59th, 2d) (unfav.), **07,** 733.

Maps. **97,** 3292.

Part (c), RR–63 St. Lawrence River at the Head of Long Sault Island, N. Y.

APPROPRIATIONS.

1902, $48,000, **02,** 2337. (See 2d paragraph, Projects.)

ENGINEERS.

Chief of Engineers. R., 01, 599, 3389, 3391; **02,** 520; **03,** 574; **04,** 630; **05,** 637.

In charge:
Capt. G. D. Fitch, 1901. **R., 01,** 3389, 3391.
Maj. T. W. Symons, 1902. **R., 02,** 2337.
Maj. T. A. Bingham, 1903. **R., 03,** 2168.

Assistant. J. C. Churchill, jr. **R., 01,** 3393.

PHYSICAL CHARACTERISTICS.

Character of bottom and velocity of current (about 7 m. an hour) render it reasonably certain that if a chan. were once dr. through shoal it would maintain its d., **01,** 3392.

PRIVATE WORK.

St. Lawrence River Power Co. decides to dr. chan. at its own expense. Sec. of War, Mar. 20, 1903, au. work, **03,** 2168.

PROJECTS.

Act June 13, 1902, au. imp. on condition that the St. Lawrence River Power Co. agree to the use of their canal for navigation, free from tolls or charges and if a waterway connecting said canal with Grasse R. be constr. in future by U. S., that right to constr. locks and dams be given, and au. to operate same without cost to U. S., **02,** 2337.

Owing to St. Lawrence River Power Co. not agreeing to conditions above named and having obtained au. from Sec. of War to dr. chan., proj. abandoned by U. S., and funds ($48,000) carried into Treas., **05,** 637.

SURVEYS.

Pre. ex. and sur. au. act June 6, 1900, with view to securing 20′ at head of Long Sault Isld. **R.** by Capt. Fitch, Aug. 2 and Dec. 1, 1900; est., $48,000 (H. D. 201, 56th, 2d), **01,** 599, 3389.

Map. Chart of locality issued in sur. of northern and northwestern lakes, index No. 42, **03,** 575.

RR–64 CAPE VINCENT HARBOR, N. Y.

APPROPRIATIONS.

1896,	$25,000,	**96,** 3162.
1899,	25,000,	**99,** 3146.
1902,	48,000,	**02,** 2333.
1905,	30,000,	**05,** 2403.
1910,	36,000,	**10,** 2335.
Total,	164,000	

COMMERCE.

C. not large; proj. has made navigation more safe for craft plying bet. Lake Ontario and the St. Lawrence R.; thus effects rates, **09,** 813; **11,** 951.

CONTRACTS.

1899. J. B. Donnelly, timber crib break'r constr. (timber, ironwork, excavation, and st.), $35,993.33, **00,** 4174.

1903. Buffalo Dredging Co., break'r extension, **03,** 2164.

1905. John Henrich, building extension to break'r, **05,** 2404.

1911. Inland Waterways Co., constr. extension to break'r; prices listed, **12,** 2748.

ENGINEERS.

Chief of Engineers. R., 89, 337; **96,** 381; **97,** 477; **98,** 466; **99,** 547; **00,** 616; **01,** 597; **02,** 518; **03,** 572; **04,** 627; **05,** 634; **06,** 708; **07,** 731; **08,** 776; **09,** 813; **10,** 897; **11,** 951; **12,** 1134.

In charge:
Capt. C. F. Palfrey, 1888–89. **R., 89,** 2432.
Maj. W. S. Stanton, 1896–98. **R., 96,** 3162; **97,** 3286; **98,** 2809.
Capt. G. D. Fitch, 1899–1900. **R., 99,** 3145; **00,** 4173.
Maj. T. W. Symons, 1901–02. **R., 01,** 3370; **02,** 2332.
Maj. Theo. A. Bingham, 1903. **R., 03,** 2162.
Lt. P. S. Bond, 1904. **R., 04,** 3349.
Col. H. M. Adams, 1905–07. **R., 05,** 2402; **06,** 1950; **07,** 2125.
Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2202; (Col.) **09,** 2172.
Capt. W. L. Guthrie, 1910–11. **R., 10,** 2335; **11,** 2539.
Col. J. G. Warren, 1912–. **12,** 2747.

Assistant. J. C. Churchill, jr. **R., 97,** 3289.

OPERATIONS.

1899-00. About 5,000 c. y. dr. for break'r crib foundations; over 1,400 y. st. laid in excavation, **00,** 4173.

1900-01. Under contract, foundation trench was filled with st., 4 R. arm cribs each 90′ l., and a shore-arm crib 50′ l. built; work completed, **01,** 3371.

1901-02. Oak fender placed on outer face of break'r and cast-iron mooring cleat placed on parapet, **02,** 2332.

1902-03. Excavation of trench for 300 l. f. bulkhead extension completed; placing of st. begun, **03,** 2162.

1903-04. Placing of foundation st. completed, 4,892 c. y. being placed; 3 cribs 100′ l. completed; repairs made to cribs damaged by vessels, **04,** 3349.

1904-05. 300 l. f. extension completed except repairing of damage to crib fender, **05,** 2402.

1905-06. Crib fenders repaired; 2 100′ cribs sunk and filled under new contract, and placing of concrete superstr. in progress, **06,** 1950.

1906-07. 200′ of break'r extension completed, **07,** 2125.

1907-08. Minor repairs to fenders, at cost of $21.77, **08,** 2202.

1910-11. 1,523 c. y. mud, clay, and sand removed in excavating a trench for foundation of proposed break'r extension; 897.36 t. st. placed in foundation trench, **11,** 2539.

1911-12. 2,606 t. st. placed in foundation of break'r; constr. of first crib 110′ l. begun, **12,** 2747. Proj. about three-fourths completed, **12,** 1135.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2432; **97,** 3286, 3287; **01,** 3370.

Cape Vincent, on St. Lawrence R., 2½ m. below its head at the foot of Lake Ontario; chan. in that distance nearly three-fourths to 1¼ m. w., straight and clear, **97,** 3287; dangerous to navigate at night, **97,** 3288.

PROJECTS.

By Capt. Palfrey, 1889, break'r 1,600′ parallel to and 600′ from the front of the RR. dock; est., $320,000, **96,** 3162.

By Maj. Stanton, 1897, for a timber crib break'r 1,500′ l., incl. 100′ return at the upper end; cribs to be 22′ x 27′ x 100′, each to be ballasted with about 2,500 t. of st. (drawings); est., $200,000, **97,** 3287; **99,** 3145.

By Capt. Fitch, 1899, for application of available funds to constr. of about 350′ of break'r, **99,** 3145.

SURVEYS.

Ex. for break'r, au. act Aug. 11, 1888; made, 1889, by Capt. Palfrey (Chief of Engineers' **R.** unfav.), **89,** 2432.

Sur. of site for break'r made by Maj. Stanton in 1896–97, **97,** 3286.

Maps, **97,** 3288; **03,** 2164.

Drawings, **99,** 3146.

RR–65 CLAYTON HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. R., 06, 712.

In charge. Col. H. M. Adams, 1906, **06,** 703.

PHYSICAL DATA.

Clayton is trans. terminus of N. Y. C. & H. R. RR. for Thousand Islds. passenger traffic, in Jefferson Co. and on St. Lawrence R., about 17½ m. from its head. (H. D. 71, 59th, 1st.)

SURVEY.

Pre. ex. au. Mar. 3, 1905. **R.,** Col. Adams, July 11, 1905 (unfav.) (H. D. 71, 59th, 1st), **06,** 712.

RR–67 ALEXANDRIA BAY, N. Y. (Harbor at.)

COMMERCE.

Place a popular summer resort; C. large passenger traffic and transportation of supplies for the hotels, etc., **97,** 3312.

ENGINEERS.

Chief of Engineers. R., 97, 482.

In charge. Maj. W. S. Stanton, 1897. **R., 97,** 3312.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 3312.

Alexandria B. a village on the banks of the St. Lawrence, about 28 m. below Lake Ontario, containing about 1,200 inhabitants, **97,** 3312.

SURVEY.

Ex. au. act June 3, 1896; made, 1897, by Maj. Stanton (**R.** unfav.), **97,** 3312.

RR–70 MORRISTOWN HARBOR, N. Y.

ENGINEERS.

Chief of Engineers. R., 06, 712.

In charge. Col. H. M. Adams, **06,** 703.

PHYSICAL DATA.

Village of Morristown, St. Lawrence Co., is on St. Lawrence R., about 12 m. above Ogdensburg. (H. D. 66, 59th, 1st.)

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.,** Col. Adams, July 17, 1905 (H. D. 66, 59th, 1st) (unfav.), **06,** 712.

RR–72 OGDENSBURG HARBOR, N. Y.[1]

APPROPRIATIONS.

1852,	$3,000.00,	sur., act Aug. 30.
1867,	40,000.00,	**67,** 34.
1870,	15,000.00,	**70,** 55.
1871,	25,000.00,	**71,** 250.
1872,	10,000.00,	**72,** 48.
1873,	6,000.00,	**73,** 49.
1874,	6,000.00,	**74,** 56, 272.
1875,	5,000.00,	**75,** 60, 348.
1882,	10,000.00,	**82,** 2462.
1884,	15,000.00,	**84,** 2153.
1886,	10,000.00,	**86,** 1897.
1888,	15,000.00,	**88,** 2091.
1890,	42,000.00,	**90,** 2872.
1892,	40,000.00,	**92,** 2602.
1894,	20,000.00,	**95,** 3231.
1896,	20,000.00,	**96,** 3165.
1899,	15,000.00,	**99,** 3150.
1902,	20,000.00,	**02,** 2336.
1903,	15,000.00,	**05,** 2406.
1906,	*9,938.29,	**06,** 1953.
1906,	75,000.00,	**07,** 2128.
1910,	100,000.00,	**10,** 2337.
1912,	20,000.00,	**12,** 2749.
Total,	536,938.29	

COMMERCE.

Important, **67,** 236; **68,** 258, 259, 261, 263, 264, 265, 267, 268.

Detailed description of, **97,** 3293.

In 1898 it amounted to 645,201 t., chiefly coal, grain, and lumber, **99,** 3150; in 1899 to 670,383 t., **00,** 4178.

Rates on bulk shipments controlled, **06,** 711; **10,** 899; **12,** 1136.

Tonnage, 1911, less than in 1910 by 204,630 t.; t., 1911, 799,587, **12,** 1136, 2750.

CONTRACTS.

1867. Albert A. Dodge,[2] dr., 17¢ c. y., **67,** 242; **68,** 245.

1868. Cornelius Daly, dr., $1.45 and 20¢ c. y., **69,** 170; **70,** 212.

1871. Cornelius Daly, dr., 19¢ c. y., **71,** 249; Cornelius Daly, dr., 15¢ c. y.; Cornelius Daly, removing bowlder, at $125; William S. Malcom,[3] dr., 15¢ c. y., **72,** 264.

1872. Cornelius Daly, dr., $1.25 and 37½¢ c. y., **73,** 381, 382.

1873. Cornelius Daly, dr., 39¢ and 37¢ c. y., **73,** 383.

1874. Cornelius Daly, dr., 24¢ c. y., **75,** 347.

1875. Edwin H. French, dr., 17¢ c. y., **75,** 348; **76,** ii, 601.

1882. F. Lee, dr., 22¢ c. y., **83,** 1955.

1892. W. J. Daly, dr., 44.9¢ c. y. ($32,328), **93,** 3191.

1894. W. J. Daly, 10¢ and 35¢ c. y. ($17,750), **95,** 3231.

1897. W. J. Daly, 13¢ and 40¢ c. y., **97,** 3294.

1899. W. J. Daly, dr., hardpan 35¢, other material 11¢ c. y. ($9,887.50), **00,** 4178.

1902. Daly & Hannan Dredging Co., dr. hardpan and bowlders 39$\frac{9}{10}$¢ c. y., and sand 18¢ c. y., **03,** 2167.

1905. Daly & Hannan Dredging Co., dr., 25¢ c. y., **05,** 2406.

1907. Central Dredging Co., dr. 310,000 c. y., 16$\frac{45}{100}$¢ c. y., **08,** 2203; **09,** 2175.

1911. Duluth Marine Contracting Co., dr., 13¢ c. y., **12,** 2749.

ENCROACHMENTS.

Deposit of sawmill refuse in Oswegatchie R. by mill owners, **85,** 2294.

ENGINEERS.

Chief of Engineers. R., 66, ii, 41, iii, 18, 29, iv, 178, 179; **67,** 34; **68,** 46; **69,** 41; **70,** 55; **71,** 52; **72,** 47; **73,** 48; **74,** 55; **75,** 60; **76,** 111; **77,** 119; **78,** 134; **79,** 177; **80,** 233; **81,** 319; **82,** 313; **83,** 323; **84,** 327; **85,** 353; **86,** 346; **87,** 312; **88,** 285; **89,** 338; **90,** 305; **91,** 383; **92,** 362; **93,** 415; **94,** 389; **95,** 425; **96,** 382; **97,** 479; **98,** 468; **99,** 548; **00,** 618; **01,** 598; **02,** 519; **03,** 573; **04,** 629; **05,** 636; **06,** 710; **07,** 732; **08,** 777; **09,** 814; **10,** 898; **11,** 951; **12,** 1135.

Boards:

Convened June 18, 1867, to consider plans for imp. The board consider that for the present the imp. should be confined to dr. selected chans. and removing therefrom all bowlders, etc. **R., 67,** 248. (Col. Hartman Bache, Lt. Cols. Thom and Blunt.)

Convened May 15, 1868, to devise a plan of imp.; members not all present, **68,** 255. Reconvened May 16, 1868. Resolve that Lt. Col. Blunt be requested to make a new sur., etc., **68,** 256. Reconvened May 18, 1868. Submit a pre. report upon the operations considered immediately necessary, recom.: (1) Dr. at the wharves of the Northern RR. and Northern Transportation Co. to 12′ at the lowest stage of water; also dr. the bar about 400 y. n. of the lighthouse, to obtain chan. 12′ x 300′ at lowest stage of water; (2) dr. the chan. of the Oswegatchie R. below the br., bet. the wharf lines, to 12′ l. w., **68,** 257. The board are of the opinion that the dr. at the wharves should be done by the owners, **68,** 257.

Reconvened June 24, 1868; recom., in addition to pre. **R.** of May 18, 1868: (1) The excavation of a chan. 12′ x 50′ from the mouth of the Oswegatchie to the St. Lawrence; (2) constr., if it proved necessary, of 2 ps., **68,** 270. **R., 68,** 255, 256, 258, 270. (Lt. Cols. Newton and Blunt, Maj. Houston, and Capt. Holgate.)

In charge:

Capt. C. B. Reese, 1866–67, **66,** ii, 41, iii, 17; **67,** 233. **R., 66,** iv, 180, 181.

Lt. C. J. Allen, temporarily in charge, 1866, **66,** iv, 178.

Lt. Col. C. E. Blunt, 1867–69, **67,** 32, 233; **69,** 39, 170. **R., 67,** 236, 242; **68,** 245, 260, 265, 269.

Maj. M. D. McAlester, 1869, **69,** 170.

Capt. F. Harwood, 1869, **69,** 170.

Maj. Nicolas Bowen, 1869–70, **71,** 49. **R., 69,** 170; **70,** 211.

Lt. B. D. Greene, 1870–71, **71,** 49.

Maj. J. M. Wilson, 1871–75, **71,** 49; **76,** 110. **R., 71,** 249; **72,** 264; **73,** 381; **74,** 269; **75,** 347.

Maj. W. McFarland, 1875–82, **76,** 110. **R., 76,** ii, 601; **77,** 983; **78,** 1280; **79,** 1737; (Lt. Col.) **80,** 2218, 2219; **81,** 2451; **82,** 2461.

Lt. Col. Robert, 1883–85. **R., 83,** 1954; **84,** 2153.

Maj. M. B. Adams, 1885–92. **R., 85,** 2293; **86,** 1895; **87,** 2393; **88,** 2089; **89,** 2440; **90,** 2871; **91,** 2923; **92,** 2601.

Capt. S. S. Leach, 1892–96. **R., 93,** 3190; **94,** 2491; **95,** 3229; **96,** 3164.

Maj. W. S. Stanton, 1897–98. **R., 97,** 3292; **98,** 2812.

Capt. G. D. Fitch, 1899–1901. **R., 99,** 3149; **00,** 4177.

Maj. T. W. Symons, 1901–03. **R., 01,** 3374; **02,** 2335.

Maj. Theo. A. Bingham, 1903. **R., 03,** 2165.

1st Lt. Paul S. Bond, 1904. **R., 04,** 3353.

Col. H. M. Adams, 1905–07. **R., 05,** 2405; **06,** 1952; **07,** 2127.

Lt. Col. W. L. Fisk, 1908–09. **R., 08,** 2203; **09,** 2174.

Capt. W. L. Guthrie, 1910–11. **R., 10,** 2336; **11,** 2540.

Col. J. G. Warren, 1912–. **R., 12,** 2749.

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* Allotment.

[1] Sur.—**R.** (information obtained from map; no **R.**), Nov. 19, 1855. (H. D. 482, 55th, 2d.)

[2] Contract abandoned, **68,** 46, 245, 263.

[3] Contract annulled, **72,** 264.

Assistants:
Lt. B. D. Greene, **70,** 213.
F. T. Hampton. **R., 80,** 2220.
M. Kingsley. **R., 80,** 2222.
W. P. Judson. **R., 80,** 2224.
1st Lt. W. L. Guthrie, **09,** 806.

ESTIMATES. (See Projects.)

By Capt. Reese, dr. Oswegatchie Chan., removing obstrs., and constr. of ps., $81,313.34. For increasing the w. of the Oswegatchie Chan. to 150′ by dr., $44,162.80, **66,** iv, 184.

By BE., dr. and p. constr., $100,000, **68,** 271.

By Maj. Bowen, for completion of existing proj., $175,000, **69,** 170.

LEGAL PROCEEDINGS.

Judgment for $500 damages obtained by city of Ogdensburg against mill owners on Oswegatchie R. for obstr. of same by refuse matter, **85,** 2294.

OPERATIONS.

1867-68. 1 bowlder removed and 12,469 c. y. dr., **68,** 265, 267.
1868-69. 7,127 c. y. dr., **70,** 212.
1869-70. 11,431 c. y. dr., **70,** 212.
1870-71. 69,204.14 c. y. dr., **71,** 249.
1871-72. 1 bowlder removed and 73,669.12 c. y. dr., **72,** 264.
1872-73. 95,841.9 c. y. dr., **73,** 381, 382.
1873-74. 9,130 c. y. dr., **74,** 55, 271.
1874-75. 21,560¾ c. y. dr., **75,** 347.
1875-76. 24,004 c. y. dr., **76,** ii, 602.
1882-83. 9,648 c. y. dr. from the chan., **83,** 1954.
1883-84. 25,697 c. y. dr. from the chan., completing the 1882 contract, **84,** 2153.
1884-85. 48,194 c. y. removed from chan., **85,** 2295.
1885-86. 14,988 c. y. dr. from chan., **86,** 1897.
1886-87. Dr. in progress along the city front, **87,** 2394.
1887-88. Excavation continued in chan. along city front, **88,** 2090.
1889-90. Dr. in the H. resumed, **90,** 2872.
1890-91. Dr. in progress, **91,** 2924.
1891-92. 108,455 c. y. dr., and 9,286 c. y. of hardpan removed, **92,** 2602.
1893-94. About 70,000 c. y. dr., **93,** 3191; **94,** 2491.
1894-95. 61,395 c. y. dr., **95,** 3230.
1895-96. 87,375 c. y. dr., **96,** 3165.
1896-97. 23,951 c. y. dr., **97,** 3293.
1897-98. 107,621 c. y. dr., **98,** 2812.
1899-00. 89,860 c. y. dr. and 793 c. y. hardpan and bowlders removed, **00,** 4177.
1900-01. 20,000 c. y. sand dr., **01,** 3375.
1902-03. 47,775 c. y. soft material and 18,979 c. y. hardpan and bowlders dr., **03,** 2166.
1903-04. Dr. of all chan. completed, 2,971 c. y. hardpan and 3,241 c. y. sand, mud, clay, etc., removed, **04,** 3353.
1905-06. 56,000 c. y. dr. for mainten., **06,** 1953.
1906-07. 42,496 c. y. dr., **07,** 2127.
1907-08. 158,937 c. y. dr., **08,** 2203.
1908-09. 143,420 c. y. dr., **09,** 2174.
1909-10. 38,643 c. y. dr., **10,** 2336.
1910-11. All chans. sur. in May, 1911. Advertisement made inviting bids for dr., **11,** 2540.
1911-12. 380,518 c. y. dr., **12,** 2749.

PHYSICAL CHARACTERISTICS.

Extensive alluvial deposits, **66,** iv, 182.

Description of bottoms of the St. Lawrence and Oswegatchie Rs., **68,** 261, 262; **74,** 270.

Description of, **97,** 3292.

Condition of works and d. of water, **01,** 598; **12,** 1136.

On St. Lawrence R., 62 m. from Lake Ontario, **12,** 1135.

PRIVATE (CORPORATE) WORK.

BE. of opinion that dr. at wharves should be done by the owners, **68,** 257.

Suits by the city to prevent mill owners from depositing their refuse in the R., **73,** 382.

PROJECTS.

By Capt. Reese, dr. the chan. of the Oswegatchie, removing obstr. at the Northern RR. depot, and building ps. to aid in keeping the chan. open, **66,** iv, 182, 183, 184.

By BE., d. chan. at wharves of Northern RR. & Northern Transportation Co., and dr. chan. of the Oswegatchie below the br., **68,** 257, 270. Connecting the mouth of the Oswgatchie with the St. Lawrence, and the constr. of 2 ps., if necessary to keep the chan. open, **68,** 270.

From 1852 to 1881, incl., $110,005.56 was app., **82,** 2461.

In 1882 proj. modified to provide for 15′ in the Oswegatchie and St. Lawrence chans. and 16′ on the outer bar. Est., $76,000, **82,** 2461; **85,** 2294. Increased in 1885 to $108,000; **85,** 2295; **87,** 2394.

In 1890 Maj. Adams proposed to afford 16.5′ in all the chans., involving the removal of 362,000 c. y. of hardpan and solid r., est., $158,950, **90,** 2872; **92,** 2602. In 1897 the Chief of Engineers au. d. of 16′ below the zero of the Oswego gauge in the 2 lower entrance chans.; est. of proj. of 1890 not being increased thereby, **97,** 3293.

By Capt. Fitch, 1899, dr. and redr. various parts of the H., including the removal of hardpan at the mouth of the Oswegatchie R., **99,** 3149.

Act June 25, 1910, au. d. the several chans. of the H. to 19′ below zero of Ogdensburg gauge, and removing middle ground bet. lower entrance chans. to same d.; est., $187,970 (H. D. 920, 60th, 1st) (see Surveys), **10,** 899.

SURVEYS.

Sur. au. act June 23, 1866, **66,** ii, 40, 41, iii, 29.

By Capt. C. B. Reese, 1866, **66,** iv, 180, 182; **74,** 269.

By W. P. Judson, 1855, **66,** iv, 180. Accuracy of, considered doubtful, **68,** 260, 266.

By Lt. B. D. Greene, **70,** 213.

By Maj. Turnbull, 1855, **74,** 269.

Resur. au. act Mar. 3, 1879; made, 1880, by Lt. Col. McFarland, **79,** 177; **80,** 2219.

Minor surs., **95,** 3230; **97,** 3293; **99,** 3149.

Pre. ex., with view to obtaining d. of 19′, au. act Mar. 2, 1907. **R.** by Lt. Col. Fisk, Apr. 22 and Aug. 2, 1907; est., $187,970 (H. D. 920, 60th, 1st), **08,** 779.

Maps. (H. D. 920, 60th, 1st.)
Of H., **76,** ii, 601.
Of the H. June 30, 1879, **79,** 1737; **80,** 2218; **81,** 2452; **87,** 2394; **98,** 2814; **03,** 2166; **11,** 2540

RR–73 WADDINGTON HARBOR, N. Y.

APPROPRIATIONS.

1873,	$10,000,	**73,** 49.
1874,	10,000,	**74,** 56.
1875,	5,000,	**75,** 60.
1878,	5,000,	**78,** 134.
1880,	3,000,	**80,** 2226.
1881,	2,500,	**81,** 2453.
Total,	35,500	

COMMERCE.

Local interests, **73,** 389; **76,** ii, 607, 609.

Prospective benefits of imp., **76,** ii, 608, 609.

Correspondence, **76,** ii, 610.

Early in the century there were manufactories, but owing to lack of rail transportation for their products they declined, and in 1894 the an. t. 3,000 t., **95,** 3243.

CONTRACTS.

1873. H. J. Mowry, dr., $1.24, **73,** 384.
1874. C. Daly, dr., 24¢ and $1, **75,** 350.
1875. E. H. French, dr., 34¢, **75,** 350.
1880. C. Daly, dr., with and without blasting, $5 and 50¢ c. y., resp., **80,** 2227.

ENGINEERS.

Chief of Engineers. **R., 72,** 48; **73,** 49; **74,** 56; **75,** 60; **76,** 112; **77,** 119; **78,** 134; **79,** 177; **80,** 233; **81,** 319; **82,** 313; **83,** 323; **87,** 317; **95,** 429.

In charge:
Maj. J. M. Wilson, 1872–76. **R., 73,** 384, 388; **74,** 272; **75,** 349; **76,** ii, 607.
Maj. W. McFarland, 1876–83. **R., 76,** ii, 602; **77,** 984; **78,** 1280; **79,** 1738; **80,** 2225; **81,** 2452; **82,** 2462.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1955.
Maj. M. B. Adams, 1885–87. **R., 87,** 2414.
Capt. S. S. Leach, 1895. **R., 95,** 3242.

Assistants:
J. S. Lawrence. **R., 75,** ii, 609.
F. T. Hampton. **R., 82,** 2464
J. C. Churchill. **R., 87,** 2415.

ESTIMATES. (See Plans and Projects.)

By Maj. Wilson, canal, locks, etc., $246,558.40, **76,** ii, 608, 610; **79,** 1738.

LEGISLATION.

1808. Right to constr. dam with locks, etc., granted to D. A. Ogden by New York, **76,** ii, 607, 608.

OPERATIONS.

1873-74. 8,728 c. y. dr., **74,** 56, 272.
1874-75. 14,764 c. y. dr., **75,** 60, 350.
1875-76. 12,000 c. y. dr., **76,** 112, ii, 603.
1879-80. 2,200 c. y. dr. from chan., **80,** 2225.
1881-82. 650 c. y. r. blasted and removed, **82,** 2466.

PHYSICAL CHARACTERISTICS.

General description of Little R. and Rapide du Plat; velocity of current; fall of R., **73,** 388, 389.

Situated on the St. Lawrence R., about 18 m. below Ogdensburg; dam across the R. at Waddington that furnishes excellent water power, **95,** 3242.

PLANS. (See Estimates and Projects.)

By Maj. Wilson, canal with 1 lock of a lift of 11½′ (12′) x 45′ x 270′, and imp. of approaches by dr. to gain 13′ x 100′ chan. **76,** ii, 607–610. Comparison bet. proposed canal and Morrisburg Canal on the Canadian side, **76,** ii, 608.

PRIVATE WORK.

St. dam 800′ l., a small lock, "now" abandoned, and a canal carrying water to the mills constr., **73,** 389.

Wing dams, to furnish water power, built by the citizens, 1806, **76,** ii, 607.

Counterdam, 650′ l.; a st. dam, connecting Ogdens Isld. with the American shore, and a small st. lock, subsequently partly destroyed, all constr., 1809, **76,** ii, 607.

PROJECTS. (See Estimates and Plans.)

Orig. proj. by Maj. Wilson was for opening chan. through bar at head of Little R., and to carry it to the docks by dr.; est., $17,000, **73,** 390; **74,** 272; also for cleaning chan. by dr. and r. excavation; est., $5,000, **75,** 60, 350. Est. increased, 1880, by Maj. McFarland to $22,000 for completion, on account of the character of r. developed, **78,** 1280; **79,** 1739; **80,** 2226.

Maj. Adams, 1886, reports a general imp. unadvisable in view of the requirements of C., **87,** 2415.

SURVEYS.

Ex. by Maj. Wilson, 1872. **R., 73,** 388.

Under the direction of Maj. Wilson, an ex. of the practicabilities attending the constr. of a canal around the rapids at Waddington made by J. S. Lawrence, 1875. **R., 76,** ii, 607, 609.

By Maj. McFarland, 1878, **79,** 1738.

Ex. au. act Aug. 5, 1886; made, 1886, by Maj. Adams, **87,** 2414.

Ex. au. act Aug. 17, 1894; made, 1894, by Capt. Leach (**R.** unfav.), **95,** 3242.

Maps. **79,** 1738; **81,** 2452; **82,** 2468.

RR–75 GRASSE RIVER, MASSENA, N. Y.

APPROPRIATIONS.

1882,	$3,000.00,	**83,** 1956.
1890,	6,000.00,	**90,** 2875.
1894,	.30,	act Aug. 23.
Total,	9,000.30	

COMMERCE.

None demanding immediate imp.; proposed manf. establishments would be materially benefited by d. of 12′, **01,** 3378 et seq.

CONTRACTS.

1888. W. J. Daly, dr., $8 per hour, **89,** 2442.
1890. Daly Bros., dr., **91,** 2927.

ENGINEERS.

Chief of Engineers. **R., 80,** 233; **81,** 320; **83,** 323; **84,** 327; **85,** 353; **86,** 347; **87,** 313; **88,** 286; **89,** 338; **90,** 306; **91,** 384; **01,** 599.

In charge:
Maj. W. McFarland, 1880–83. **R., 81,** 2457.
Lt. Col. H. M. Robert, 1883–85. **R., 83,** 1956; **84,** 2154.
Maj. M. B. Adams, 1885–91. **R., 85,** 2296; **86,** 1898; **87,** 2396; **88,** 2092; **89,** 2442; **90,** 2874; **91,** 2926.
Maj. T. W. Symons, 1901–. **R., 01,** 3377.

Assistants:
F. T. Hampton. **R., 81,** 2458.
J. C. Churchill. **R., 01,** 3386.

OPERATIONS.

1888-89. 1,670 c. y. dr., **89,** 2442.
1890-91. 5,165 c. y. dr., **91,** 2927.

PHYSICAL CHARACTERISTICS.

Description of, **01,** 3379, 3387.

PROJECTS.

By Maj. McFaland, 1881, R. mouth to Haskells Wharf, dr. 4′ l. w., est., $12,000, **81,** 2458.
Increased, 1885, $7,000, **85,** 2297.
Increased, 1886, $1,600, **86,** 1899; **87,** 2396.
By Capt. G. D. Fitch, 1900, 12′ from a pt. about 1,400′ below St. Lawrence Power Co.'s power house at Massena to confluence of Grasse R. with St. Lawrence R., **01,** 3378.

SURVEYS.

Au. act June 14, 1880; made, 1881, by Maj. McFarland, **81,** 2457.

Pre. ex. and sur. au. act June 6, 1900, from confluence with St. Lawrence R. to Massena, for 21′, made by Capt. G. D. Fitch. **Rs.,** Aug. 2 and Nov. 29, 1900, resp.; est., $200,000 for 12′ (**H. D.** 151, 56th, 2d), **01,** 599, 3377, 3384, 3386.

RR–78 SALMON RIVER, N. Y. (Below Fort Covington, N. Y.)

ENGINEERS.

Chief of Engineers. **R., 85,** 352; **89,** 344.

In charge:
Col. H. M. Robert. **R., 85,** 2286.
Maj. M. B. Adams, 1888–89. **R., 89,** 2460.

Assistants:
L. Y. Schermerhorn. **R., 85,** 2289.
F. M. Barstow. **R., 89,** 2461.

PHYSICAL CHARACTERISTICS.

Description of locality. Tributary of St. Lawrence R.; discharging into the latter about 5 m. below Ft. Covington. **85,** 2287; **89,** 2461.
Character of R. bed, **85,** 2289.

PLANS.

By Lt. Col. Robert, 1884, dr. chan. 75′ x 12′, Salmon St. in Ft. Covington to U. S. boundary line; est., $40,000, **85,** 2288, 2290.
By Maj. Adams, 1888, 7′ chan. 75′ w., RR. br. at Ft. Covington to international line; est., $20,000, **89,** 2460.

SURVEYS.

Au. act July 5, 1884; made by Lt. Col. Robert, **85,** 2286.
Au. act Aug. 11, 1888; made, 1889, by Maj. Adams, **89,** 2461.

Maps:
Below Ft. Covington, **85,** 2290.
89, 2460.

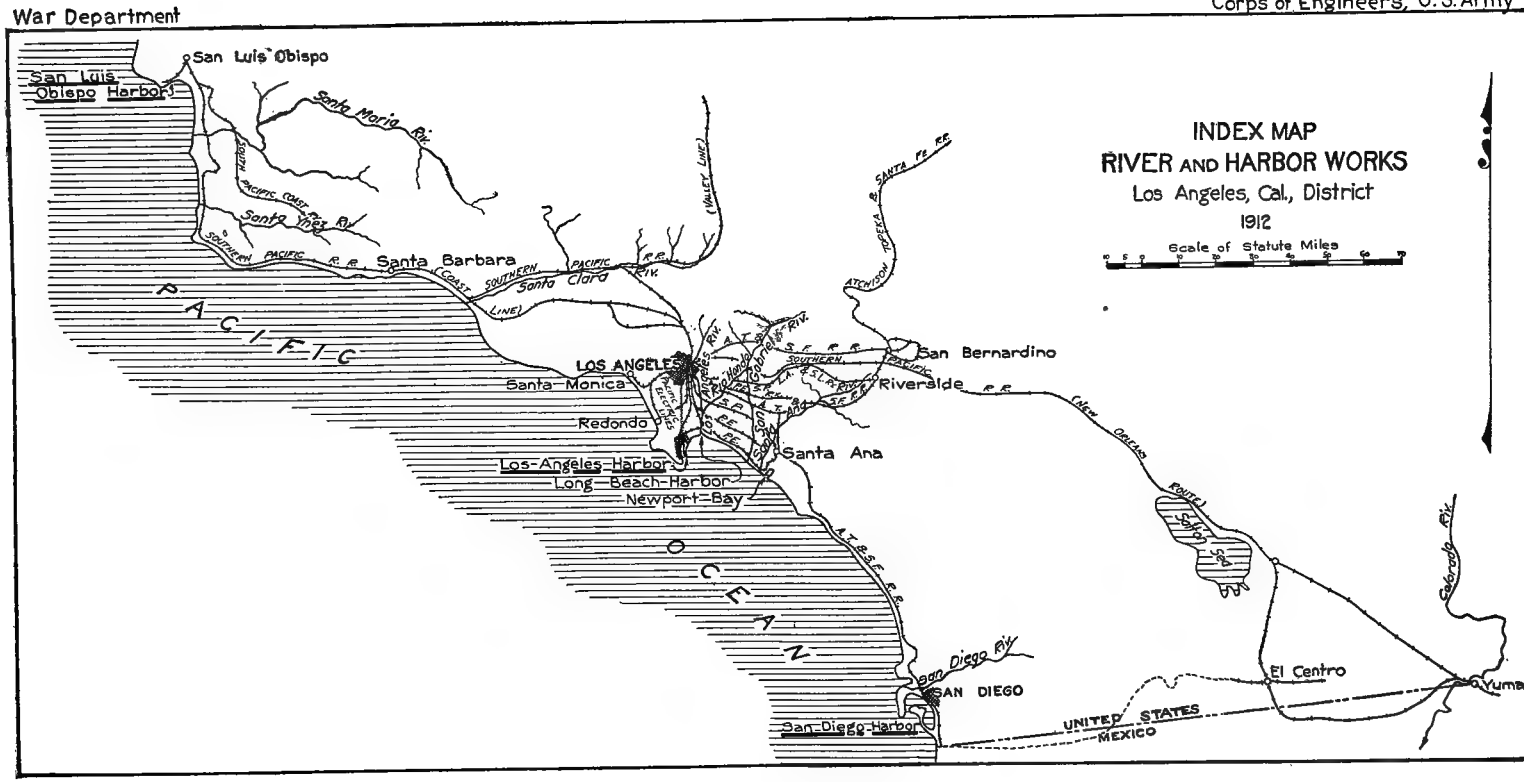
RIVER AND HARBOR WORKS.

PACIFIC COAST.

SS.—LOS ANGELES, CAL., DISTRICT.

War Department

Corps of Engineers, U. S. Army



SS.—LOS ANGELES, CAL., DISTRICT.

In charge of U. S. Engineer Office,
Los Angeles, Cal.

SS [1] 1 Colorado R. (Gulf of California.)
SS 2 Gila R., Ariz. (1)
SS 3 Bill Williams Fork, Ariz. (1)
SS 4 Little Colorado R., Ariz. (1)
SS 5 Rio San Juan R., Utah, Colo., N. Mex. (1)
SS 6 Grand R., Utah and Colo. (1)
SS 7 Green R., Utah, Colo., and Wyo. (1)
SS 8 Virgin R., Nev., Ariz., and Utah. (1)
SS 9 Pacific Ocean.
SS 10 San Diego B., Cal. (9)
SS 11 San Diego, Cal. (10)
SS 12 San Diego R., Cal. (9
SS 13 Newport B., Cal. (9)
SS 14 Santa Ana R., Cal. (13)
SS 15 Alamitos B., Cal. (9)
SS 16 San Gabriel R., Cal. (15)
SS 17 Rio Hondo, Cal. (16) (19)
SS 18 Long Beach H., Cal. (9)
SS 19 Los Angeles R., Cal. (9)
SS 20 Los Angeles H. (formerly San Pedro and Wilmington Hs.) Cal. (9)
SS 21 Redondo, Cal. (9)
SS 22 Santa Monica Bay, Cal. (9)
SS 23 Santa Clara R., Cal. (9)
SS 24 San Buenventura, Cal. (9)
SS 25 Santa Barbara, Cal. (9)
SS 26 Santa Ynez R., Cal. (9)
SS 27 Santa Maria R., Cal. (9)
SS 28 San Luis Obispo H., Cal. (9)
SS 29 Esteros B., Cal. (9)
SS 30 San Simeon B., Cal. (9)

SS-1 COLORADO RIVER, ARIZ., CAL., AND NEV.[2]

APPROPRIATIONS.

1884, $25,000, **85,** 2367.
1892, 10,000, **93,** 3235.

Total, 35,000

COMMERCE.

Unimportant, **69,** 68; **79,** 1773, 1774, 1778, 1780; **96,** 3187; **97,** 3340.

Bet. Rioville and Eldorado Canyon practically none; bet. Yuma and Mexican boundary very small; about 7,000 t. in, 2,500 t. out, **04,** 3393, 3398.

CONTRACTS.

1893. Baker & McKeown, levee, 53,807 c. y., at 12½¢ c. y., **94,** 2522.

ENGINEERS.

Chief of Engineers. R., 67, 53; **68,** 76, 1195; **69,** 68; **76,** 120; **78,** 137; **79,** 180; **85,** 363; **86,** 356; **87,** 324; **89,** 348; **91,** 393; **93,** 424; **94,** 397; **95,** 435; **96,** 388; **97,** 487; **01,** 603, 3402; **04,** 636.

Boards. BERH., reviews Capt. Jadwin's **Rs.** on ex.; concurs as to inadvisability of imp. R. at sections covered, **04,** 3395, 3399.

In charge:
Lt. J. C. Ives, 1857–58. **68,** 1195.
Maj. R. S. Williamson, **68,** 76. **R., 68,** 1190.
Capt. S. M. Mansfield, **68,** 76. **R., 68,** 1188.
Lt. G. M. Wheeler, **76,** 120.
Lt. Col. C. S. Stewart, **78,** 137; **79,** 180. **R., 79,** 1773.
Capt. A. H. Payson, 1884–87. **R., 85,** 2365; **86,** 1929; **87,** 2449.
Lt. Col. W. H. H. Benyaurd, 1888–95. **R., 89,** 2481; **91,** 2974; **93,** 3234; **94,** 2521; **95,** 3278.
Lt. C. L. Potter, 1896. **R., 96,** 3186.
Maj. C. E. L. B. Davis, 1896. **R., 97,** 3339.
Capt. J. L. Meyler, 1901. **R., 01,** 3403.
Capt. Edgar Jadwin, 1904. **R., 04,** 3392, 3394, 3396.

Assistants:
Lt. E. Bergland, **76,** 120. **R., 76,** iii, 329.
Lt. A. H. Payson. **R., 79,** 1774.
Lt. S. W. Roessler. **R., 85,** 2367.
L. C. Easton. **R., 01,** 3406.

ESTIMATES. (See Plans and Projects.)

By Lt. Payson, removal of obstr. and rectification of chans., $97,269; not recom. by Lt. Col. Stewart, **79,** 1774, 1780.

LEGISLATION.

To aid Capt. Trueworthy in perfecting navigation of Colorado R. below Callville, **68,** 1195.

OPERATIONS.

1884–85. 1,074 t. st. removed from R. bed; 614 l. f. cobble dam built, **85,** 2367.

1885–86. 2,848 l. f. cobble dam built; top of Explorer's Rock blasted off; 1,240 t. r. removed, **86,** 1931.

1886–87. Property and supplies sold at auction and proceeds turned in to Treas., **87,** 2449.

1893–94. 53,807 c. y. material placed in levee, **94,** 2521; proj. considered completed, **95,** 3278.

[1] The list of U. S. waterways at this point begins with the waterways of the Pacific coast, after finishing with the waterways of the Great Lakes system on the preceding pages.
[2] Colorado River of the West.

PHYSICAL CHARACTERISTICS.[1]

Description, **68,** 1188–1190, 1194, 1195; **79,** 1773, 1775, 1776; **91,** 2975; **93,** 3235; **96,** 3186; **97,** 3339.

R. navigable to Callville by light craft, **68,** 1188; **79,** 1779.

Description by C. C. Parry, geologist, **68,** 1191.

Descriptive narrative of R., **68,** 1192, 1193.

Topography, **76,** iii, 343–345.

Table of distances, **79,** 1776.

Slope and discharge of R., **79,** 1776, 1777.

List of obstr., **79,** 1782.

Yuma, situated at the junction of the Gila and Colorado Rs., subject to floods of those Rs., **93,** 3234.

For a considerable part of the year the R. bed of the Gila at Yuma is dry, **93,** 3235.

Country bordering on R. rich in mineral deposits; gold, gypsum, silver, and copper existing, **04,** 3393.

Irrigation of bottom lands expected to produce large growth in population and C., **04,** 3399.

PLANS. (See Estimates and Projects.)

By Lt. Bergland, 1876, diverting Colorado R. for purposes of irrigation, **76,** iii, 337.

PRIVATE WORK.

To protect village of Yuma from floods the au. several years previous to 1892 built small levees along the banks of the two Rs., **93,** 3234.

PROJECTS. (See Estimates and Plans.)

By Lt. Payson, 1879, removing obstr., protecting banks, and constr. chan.; est., $97,269, **79,** 1780.

In 1886 it was reported that any noteworthy imp. would be at an enormous cost not required by C., **86,** 1932; **87,** 2449.

By Lt. Col. Benyaurd, 1893, levee 3,200′ l. with average h. of 10′ along margin of slough near the e. boundary of Yuma, starting from Penitentiary Hill and connecting with an old embankment of the Southern Pacific RR. near the s. limits of town, to confine the waters of the 2 Rs. to their chans., **93,** 3235.

SURVEYS.[1]

By Lt. Ives, exploration, 1857, **68,** 1188, 1191, 1195.

Ex. by Lt. Bergland, **76,** 120, iii, 329.

Sur., by Lt. Col. Stewart, to El Dorado Canyon, **79,** 180, 1773, 1774.

Ex. Camp Mohave to El Dorado Canyon, Ariz., au. act Aug. 11, 1888; made, 1888, by Lt. Col. Benyaurd (**R.** unfav.), **89,** 2481.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Benyaurd (**R.** unfav.), **91,** 2974.

Sur. made, 1892, by Lt. Col. Benyaurd, **93,** 3234.

Ex. of the R., mouth of the Virgin R. to Yuma, au. act Aug. 17, 1894; made, 1895, by Lt. Potter (**R.** unfav.; cost too great), **96,** 3186.

Ex. au. act June 3, 1896 (**R.** unfav.); submitted, 1896, by Maj. Davis, **97,** 3339.

Ex. El Dorado Canyon to Rioville, Nev., au. act June 6, 1900; made by Capt. Meyler (**R.** unfav.) (H. D. 67, 56th, 2d), **01,** 603, 3403.

Pre. ex. au. act June 13, 1902, El Dorado Canyon to Rioville, Nev.; **R.** by Capt. Jadwin, 1903 (unfav.) (H. D. 237, 58th, 2d), **04,** 636, 3392.

Pre. ex. au. act June 13, 1902, Yuma to Mexican boundary line; **R.** by Capt. Jadwin, 1903 (unfav.) (H. D. 204, 58th, 2d), **04,** 636, 3395.

Maps:

Topographical sketches, **76,** iii, 332, 339.

Sketch and section, **76,** iii, 341, 343, 345.

Profiles, **76,** iii, 336; **85,** 2368.

SS-6 GRAND RIVER, UTAH.

ENGINEERS.

Chief of Engineers. R., 10, 910.

In charge:

Capt. A. A. Fries, **10,** 900.

1st Lt. C. T. Leeds, **10,** 900.

SURVEY.

Pre. ex., mouth to Moab (jointly with Green R., Utah), au. act Mar. 3, 1909. **R.,** 1st Lt. Leeds, 1909 and 1910 (unfav.) (H. D. 953, 61st, 2d), **10,** 910.

SS-7 GREEN RIVER, UTAH.

ENGINEERS.

Chief of Engineers. R., 10, 910.

In charge:

Capt. A. A. Fries, **10,** 900.

1st Lt. C. T. Leeds, **10,** 900.

SURVEY.

Pre. ex., mouth to town of Greenriver, Utah, au. act Mar. 3, 1909 (jointly with Grand R., Utah). **R.,** 1st Lt. Leeds, 1909 and 1910 (unfav.) (H. D. 953, 61st, 2d), **10,** 910.

[1] Navigable from a short distance below Yuma, Ariz., to the Laguna Dam, 11 m. above Yuma. Above the Laguna Dam it is also navigable at certain stages of the R. up to the Grand Canyon, and also in short stretches through the Grand Canyon. Its tributaries are the Gila R., Bill Williams Fork, Little Colorado R., Rio San Juan, Grand, Green, and Virgin Rs., none of which are navigable except the Grand and Green and perhaps the Virgin for a short distance above its mouth. The Grand R. is navigable from its junction with the Green R. to form the Colorado R., to Moab, a distance of 65 m. The Green R. is navigable from its junction with the Grand R. to Greenriver Station, a distance of 125 m. The navigable portions of these Rs. lie wholly within the State of Utah. In 1910 a pre. ex. and sur. was made of the Grand and Green Rs. with view to their imp. by the U. S., reports of which are printed in H. D. 953, 61st, 2d. A report relative to the diversion of water from the Green R. for irrigation purposes was submitted to the dept. Dec. 21, 1912 (86717/9). The waters of the Colorado R. are used principally for irrigation, there being little or no commerce on the R.

SS-11 SAN DIEGO HARBOR, CAL.

APPROPRIATIONS.

1852,	$30,000,	**68,** 886.
1875,	80,000,	**75,** 124.
1879,	1,000,	**79,** 179, 1764.
1886,	[1] 5,000,	**87,** 2433.
1888,	1,000,	**88,** 2114.
1890,	60,500,	**90,** 2903.
1892,	50,000,	**92,** 2629.
1894,	50,000,	**95,** 3275.
1896,	50,000,	**96,** 3185.
1899,	65,000,	**99,** 3155.
1902,	75,000,	**02,** 2342.
1903,	192,850,	**03,** 2172.
1905,	10,000,	**05,** 2410.
1907,	20,000,	**07,** 2132.
1909,	30,000,	**09,** 2178.
1910,	125,000,	**10,** 2339.
Total,	845,350 (not incl. apps. of 1852 and 1886, for San Diego R., etc., $810,350, **12,** 2752).	

COMMERCE.

Requirements of C. would not justify the imp., **70,** 513.

Benefits of imp. to C., **76,** ii, 622; **77,** 121, ii, 999.

Increasing, **00,** 620.

In 1911, 395,634 t., **12,** 1139.

CONTRACTS.

1876. G. A. Johnson and H. Schuyler, earth and st. work for constr. of levees, **76,** ii, 622.

1893. S. R. Smith, j. constr.—trestle, $5.91 l. f.; mattresses, $2.53 c. y., p. m.; st., $1.62½ l. t.; office building, $550, **94,** 2516.

1894. Powell & Mitchell, spur and shore revet. constr., approx. total of $21,515; j. constr., $42.07½ l. f., **95,** 3275, 3276.

1896. Goodbody & Roesner, levee repair; cost of $4,217.61, **97,** 3337. W. S. Waterman, j. constr., $64.23 l. f. ($39,822.60), **97,** 3337.

1899. Healy, Tibbitts & Co., j. constr. (brush and st.), delivered from barges; est., total, $61,240, **00,** 4185.

1901. Fred Osburn, removing 200 trestle bents, $8 per bent for 160 and $5.50 per bent for 40 bents, **01,** 3396.

1902. A. A. Polhamus, dr., 28½¢ c. y., **03,** 2172.

1903. A. E. Babcock, completing j., st. $1.85 t., **03,** 2172.

1904. A. A. Polhamus, dr., 22½¢ c. y., **04,** 3385.

1906. North American Dredging Co., dr., 60¢ c. y., **07,** 2132.

1907. North American Dredging Co., dr., 51¢ c. y., **08,** 2208.

1910. California Reclamation Co., dr., $0.2874 c. y., **10,** 2339. Standard American Dredging Co., dr., $0.1489 c. y., **11,** 2544.

ENGINEERS.

Chief of Engineers. **R., 68,** 73; **70,** 83; **72,** 97; **73,** 108; **74,** 119; **75,** 124; **76,** 114; **77,** 121; **78,** 136; **79,** 179; **80,** 236; **81,** 324; **82,** 318; **83,** 330; **84,** 334; **85,** 360; **86,** 353; **87,** 320; **88,** 293; **89,** 347; **90,** 313, 334; **91,** 392; **92,** 369, 399; **93,** 424; **94,** 396; **95,** 434; **96,** 387; **97,** 487; **98,** 470; **99,** 549; **00,** 619; **01,** 599; **02,** 521; **03,** 575; **04,** 631; **05,** 638; **06,** 712; **07,** 733; **08,** 779, 785; **09,** 815; **10,** 900; **11,** 953; **12,** 1137.

Boards:

Recom., 1853 or 1854, that the old R. chan. be reopened and a bulkhead built from a point just s. of Old San Diego to the hills on the other side of the sand flat, **70,** 514. BE. for the Pacific coast considered that no injurious changes had taken place in the chan. of the upper part of San Diego H. since 1856, **72,** 998, 999. (Lt. Col. Alexander, president of BE. for Pacific coast.)

BE. for the Pacific coast met to consider the plan of Lt. Col. Stewart for imp. of San Diego H. by turning the San Diego R. into False B. Approve of the modified plan of Lt. Col. Stewart. **R., 76,** ii, 630, 631. (Lt. Cols. Alexander and Stewart and Maj. Mendell; Lt. Weeden, recorder. Maj. Mendell dissents.)

Convened, San Francisco, Mar. 14, 1890, to report upon estab. of H. lines in front of San Diego and Coronado. **R., 90,** 2905; **92,** 2640. (Col. Mendell, Lt. Col. Benyaurd, and Maj. Heuer.)

In charge:

Maj. R. S. Williamson, 1870. **R., 70,** 507, 511.

Lt. Col. B. S. Alexander, 1872–74 (current observations). **R., 72,** 999, 1000; **74,** ii, 372.

Maj. G. H. Mendell, 1873. **R., 73,** 1142.

Lt. Col. C. S. Stewart, 1875–87. **R., 75,** ii, 723; **76,** ii, 621, 624; **77,** 997; **78,** 1301; **79,** 1763; (Col.) **80,** 2247; **81,** 2525; **82,** 2641; **83,** 1995; **84,** 2213; **85,** 2349; **86,** 1917.

Maj. W. H. H. Benyaurd, 1887–95. **R., 87,** 2431; (Lt. Col.) **88,** 2114; **89,** 2477; **90,** 2902, 2904; **91,** 2960; **92,** 2628; **93,** 3231; **94,** 2514; **95,** 3273.

Maj. C. E. L. B. Davis, 1896–98. **R., 96,** 3183; **97,** 3337; **98,** 2927.

Capt. J. J. Meyler, 1899–. **R., 99,** 3153; **00,** 4181; **01,** 3395.

Lt. Col. C. E. L. B. Davis, **02,** 521.

Lt. Col. T. H. Handbury, **02,** 521.

Capt. Edgar Jadwin, 1902–03. **R., 02,** 2341.

Maj. J. H. Willard, 1903. **R., 03,** 2171.

Capt. C. H. McKinstry, 1903–05. **R., 04,** 3383; **05,** 2409, **06,** 712.

Col. W. H. Heuer, **06,** 712.

Capt. A. A. Fries, 1906–09. **R., 06,** 1955; **07,** 2131; **08,** 2207; **09,** 2177.

1st Lt. C. T. Leeds, 1909–11. **R., 10,** 2339; (Capt.) **11,** 2543.

Capt. W. P. Stokey, **11,** 953.

Lt. Col. C. H. McKinstry, 1912–. **R., 12,** 2751.

Assistants:

Lt. G. H. Derby, **70,** 514.

Lt. W. H. Heuer, **70,** 507, 511. **R., 70,** 512.

Capt. T. H. Handbury. **R., 72,** 1001.

J. F. Lewis, **72,** 1002.

Lt. J. H. Weeden. **R., 74,** ii, 373.

C. J. Fox, **75,** ii, 724.

F. C. Turner. **R., 94,** 2516; **95,** 3276.

D. E. Hughes. **R., 00,** 4186.

1st Lt. C. T. Leeds, **09,** 815.

1st Lt. A. R. Ehrnbeck, **09,** 815.

ESTIMATES. (See Plans and Projects.)

For changing the course of the San Diego R. into False B.:

By Lt. Heuer, $92,428, **70,** 515.

By Capt. Handbury, $61,167 (coin), **72,** 1005.

By Maj. Mendell, $80,000, **73,** 1144.

By Lt. Col. Stewart, $23,000; **76,** ii, 622, 631.

By Lt. Col. Stewart, $74,300, $86,500, $111,900, $157,950, **76,** ii, 627, 628.

By Maj. Benyaurd, $394,400, **88,** 2117.

OPERATIONS.

1853–54. Levee built across San Diego R. to divert it into its former chan. in False B., **68,** 886. Levee carried away, **73,** 1143.

1876–77. Work completed by contract; 7,734.6′ of levee built, **77,** 121, 999.

1877–78. Levee damaged by rain repaired, **78,** 1301.

1878–79. Repairs of damages to levees, **79,** 179, 1764.

1879–89. Repairs to levee embankments, **80,** 2247; **81,** 2525; **82,** 2641; **83,** 1995; **84,** 2213; **85,** 2349; **89,** 2477.

1890–91. Repairs to levee embankment and dr. in progress at Middle Ground, **91,** 2961.

1891–92. Chan. 250′ x 22′ completed through the Middle Ground, **92,** 2629.

1893–94. Over 1,860′ of j. constr., **94,** 2515.

[1] Sur. of San Diego, Newport, and San Luis Obispo Hs.

1894–95. Over 600′ of j. constr., **95,** 3274.
1895–96. At the end of the year the j. had been carried 3,347′ seaward, **96,** 3184.
1896–97. Dike across the mouth of the old R. repaired and j. extended over 600′, **97,** 3337.
1899–00. 2,544 c. y. brush mattress laid, and 5,613 t. st. placed, **00,** 4182.
1900–01. 22,408 t. st. deposited in j., completing contract; 200 bents of trestle removed, **01,** 3396.
1902–03. Preparations made for commencing work on j., quarry opened, and 1,050′ single-track RR. constructed, **03,** 2172.
1903–04. 104,850 t. st. for j. delivered; 123,567 c. y. dr. from outer bar and 34,343 c. y. from Middle Ground, **04,** 3383.
1904–05. 3,887 t. st. for j. delivered, completing contract, and 52,745 c. y. dr. from Middle Ground, **05,** 2409.
1906–07. 15,625 c. y. dr. from outer bar, **07,** 2131.
1907–08. 37,750 c. y. dr. from outer bar, **08,** 2207.
1909–10. 100,904 c. y. dr. from outer bar, **10,** 2339.
1910–11. 88,593 c. y. dr., **11,** 2543.
1911–12. 700,548 c. y. dr., completing contract, **12,** 2751.

PHYSICAL CHARACTERISTICS.

San Diego R. not navigable. Formerly flowed into San Diego B., creating a delta. Diverted into False B. by dike built by U. S. in 1876.
Current observations, **72,** 999, 1000; **74,** ii, 372.
Table of rainfall, **74,** ii, 375.
Description of the H. entrance and outer bar, **88,** 2114.
Description of, **72,** 1003; **93,** 3232.
Changes in d. effected by constr. of j., **95,** 3274; **97,** 3337.
Considerable changes at the entrance since 1888 shown by Coast and Geodetic Sur. of 1898 to be of a fav. nature, **99,** 3154.
Trestle piles eaten away by the teredo and limnoria, **01,** 3396.
Increase in velocity of tide over bar, **02,** 2341.
Erosion, **03,** 2171.
Storm causes outer bar chan. to shoal, **05,** 638.

PLANS. (See Estimates and Projects.)

By Lt. Derby, turning San Diego R. into its old chan. in False B., **70,** 514.
By Lt. Heuer, turning San Diego R. into False B. by means of a bulkhead and canal, **70,** 515.
By Capt. Handbury, changing course of R. by means of a dam and dr., **72,** 1005.
By Lt. Col. Stewart, changing the course of the R. by means of a system of js., **76,** 631.

PRIVATE WORK.

Residents in the vicinity of the levee, in 1895, piled up sandbags to secure it from danger during a high flood in that year, **95,** 3275.

About $1,000, raised by chamber of commerce, expend., 1899, in an attempt to increase the d. on the bar with water jets. Different opinions as to the success of the method, **99,** 3153.

PROJECTS.

By Lt. Col. Stewart (as modified by BE.), imp. of San Diego H. by changing the course of San Diego R. into False B. by cutting a new chan. and closing the old one by an earthen embankment 6′ x 23′ at the top, riprapped with st., **76,** ii, 631.
Proj. of 1875 proposed the imp. of San Diego H. by changing the R. back into one of its former outlets in False B. by cutting a new chan. and closing the old one by an embankment, **76,** ii, 630. Proj. completed, 1877, **77,** 999. Subsequent operations confined to repairs to embankments, **86,** 1917; **87,** 2431; **90,** 2902.
By Lt. Col. Benyaurd, 1888–93, j. 7,500′ l. at Zuninga Shoals at the entrance to the H., to gain 26′ m. l. w. over the outer bar; mainten. of chan. of 24′ m. l. w. through the middle ground; and repair of the dike across the mouth of the San Diego R. to divert the waters of that stream into False B.; est., $394,400, **88,** 2116, 2117; **93,** 3231, 3232.
By Maj. Davis, 1896, extension of j. and repairs to dike, **97,** 3337.
Capt. Meyler est., 1900, $267,850 then to complete the proj.; the increase over the orig. est. being $148,450, on account of scour, **00,** 4183.
Act June 25, 1910, au. dr. chan. through outer bar 30′ x 600′ and through middle ground to 30′ x 400′ at s. end, and w. out at n. end to accommodate vessels using U. S. Navy coaling station at La Playa (H. D. 961, 60th, 1st), **10,** 901.

SECRETARY OF WAR.

Approves recom. of BE., **76,** ii, 629.
Harbor lines modified, **12,** 1139.

SURVEYS.

By Lt. Derby, 1853, **70,** 514.
By Lt. Heuer, 1869. **R., 70,** 512.
By Capt. Handbury, 1872. **R., 72,** 1001.
By Lt. Weeden, 1875, **75,** ii, 724.
Au. act Aug. 5, 1886; made, 1888, by Lt. Col. Benyaurd, **88,** 2114.
Ex. of the dike, 1892–93, by Lt. Col. Banyaurd, **93,** 3233.
The U. S. Coast and Geodetic Sur. sur. H. in winter of 1898, **99,** 3154.
Pre. ex. and sur. au. act Mar. 2, 1907. **R.** by Capt. Fries, May 7 and Oct. 22, 1907; submits plan to dr. chan. 30′ across outer bar and middle ground; est., $259,250 (H. D. 961, 60th, 1st), **08,** 785.
Map. (H. D. 961, 60th, 1st.) **11,** 2544.

SS-13 NEWPORT HARBOR, CAL.

ENGINEERS.

Chief of Engineers. R., 88, 293; **08,** 785; **12,** 1150.

In charge:
Maj. W. H. H. Benyaurd, 1886. **R., 88,** 2118.
Capt. A. A. Fries, **08,** 779.
Capt. Chas. T. Leeds, **12,** 1137.
Capt. W. P. Stokey, **12,** 1137.
Lt. Col. C. H. McKinstry, **12,** 1137.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 2118.

PLANS.

By Maj. Benyaurd, 1888, imp. H. entrance, securing a navigable chan. 8′ d. at m. l. w. by revet. head of sand spit, and constr. e. j. of st. 2,200′ l. and a w. j. 3,000′ l.; est., $1,520,000, **88,** 2120.

SURVEYS.

Au. act Aug. 5, 1886; made, 1888, by Maj. Benyaurd, **87,** 320, 2433; **88,** 2118.
Ex. au. act Mar. 2, 1907. **R.,** Capt. Fries, May 9, 1907 (H. D. 82, 60th, 1st) (unfav.), **08,** 785.
Pre. ex. au. act Feb. 27, 1911 (**R.** to come), **12,** 1150.

SS-16 SAN GABRIEL R., CAL.[1]

[1] Navigable for small boats for a distance of about 7 miles. Flows to Alamitos Bay, but there is a flood channel (called the Rio Hondo) which leaves the San Gabriel River near Azusa and joins the Los Angeles River near Workman.

SS-18 LONG BEACH HARBOR, CAL.

ENGINEERS.

Chief of Engineers. R., 11, 964.

In charge. Capt. C. T. Leeds, **11,** 953.

SURVEY.

Pre. ex. au. act June 25, 1910. **R.,** Capt. Leeds, Oct. 10, 1910 (H. D. 27, 62d, 1st) (unfav.), **11,** 964.

SS-19 LOS ANGELES RIVER, CAL.[1]

SS-20 LOS ANGELES HARBOR, CAL.[2]

Part.	Title.	Period.	Appropriations.
a	Wilmington H., Cal	1859–1912	$2,333,000
b	San Pedro H., Cal	1882–1912	3,420,250
	Total		5,753,250

Part (a), SS-20 Wilmington Harbor, Cal.[2]

APPROPRIATIONS.

1871, $200,000, **71,** 99, 939.
1872, 75,000, **72,** 97.
1873, 150,000, **73,** 108.
1875, 30,000, **75,** 122.
1878, 20,000, **78,** 135, 1294.
1879, 12,000, **79,** 178, 1746, 1749.
1880, 35,000, **80,** 2233.
1881, 33,000, **81,** 2469.
1882, 100,000, **82,** 2533.
1884, 50,000, **84,** 2187.
1886, 75,000, **86,** 1914.
1888, 90,000, **88,** 2113.
1890, 34,000, **90,** 2901.
1892, 51,000, **92,** 2627.
1896, 50,000, **96,** 3182.
1902, 250,000, **02,** 2344.
1905, 100,000, **05,** 2415.
1906, 100,000, **06,** 1960.
1907, 163,000, **07,** 2137.
1909, 20,000, **09,** 2182.
1910, 400,000, **11,** 2547.
1911, 270,000, **11,** 2547.
1912, 25,000, **12,** 2755.

Total, 2,333,000

COMMERCE.

Cost of lighterage very great, **69,** 482; **71,** 943; **74,** ii, 370.

Rapid increase of, **74,** ii, 370; **75,** ii, 692.

Advantages of imp., **79,** 1748.

1893, C. appeared to demand that an interior basin should be dr. bet. H. lines to d. sufficient for any vessel that could enter the H., **93,** 3230.

Description of. Future probably to be very great, **00,** 4198.

30% increase in 1903 over previous year, **04,** 635.

1911, 1,720,711 t., principally lumber, crude oil, and general merchandise, **12,** 1145.

Effect of the imp. shows an increase in C. of about 300% in 10 years, **12,** 1145.

CONTRACTS.

1872. E. M. Benjamin, 3,700′ of break'r, **72,** 1006; failed, **72,** 1006. G. W. Prescott & Co., timber, **72,** 1007. Benton, Smith & Co., timber, **72,** 1006.

1873. G. D. Nagle, st., **73,** 1131.

1874. Mr. Boschke, dr.; contract extended twice, **75,** ii, 693.

1878. Mappa & Gay, st., **79,** 1747, 1749; annulled, **79,** 1747. T. B. Hays, st., **79,** 1747.

1880. J. Hackett, reef and sand removal, $3 and 50¢ c. y., resp., **81,** 2469.

1881. Tilford & Terkelson Bros., st., $2.50 t., **81,** 2469.

1882. Pacific Coast & Reclamation Co., reef and sand removal, $2.49 and 50¢ c. y., resp., **83,** 1967.

1885. E. A. Von Schmidt, st., $1.97 t., **85,** 2336.

1886. A. W. Von Schmidt, dr., 29$\frac{8}{10}$¢ c. y., **87,** 2430. E. A. Von Schmidt, st., $2.23 t., **87,** 2430.

1890. R. Axman, dr., 55¢ c. y., **90,** 2901. P. O'Neil, r., $2.27 t., **91,** 2957.

1891. A. A. Polhamus, r., $2.09 t., **91,** 2958.

1892. P. O'Neil, st., $1.77 t. ($31,860), **93,** 3231.

1903. F. D. Lanterman, repair of e. j., $3,564.69; R. A. Perry, dr. division A 50¢ c. y. and division B 16¢ c. y., **03,** 2176.

1904. Ellicott Machine Co., constr. dr., $98,400; H. E. Carse, hardware for pontoons, $1,049.09; Baker Iron Works, 2,048′ 20″ discharge pipe and 4 elbows, $3,023.08; New Jersey Car Spring & Rubber Co., 25 rubber sleeves, $1,275; H. E. Carse, gasoline launch, $1,732.50, **04,** 3389. W. S. Miller (3 contracts), 3,000 gals. gasoline, $375; lubricating oils, $1,410.70; 16,000 bbls. crude oil for fuel for dr., $9,920, **05,** 2416. W. S. Miller (2 contracts), 13,068 bbls. oil, 46¢ bbl., and 1,108 gals. gasoline, $138.50, **06,** 1960.

1905. A. A. Polhamus, dr., 46¢ c. y., **06,** 1960.

1906. H. T. Harper, 8,500 bbls. crude oil, 48¢ bbl., **06,** 1960. A. A. Polhamus, dr. 52,500 c. y. 46¢ c. y.; H. T. Harper, 21,000 bbls. crude oil, 50¢ bbl., **07,** 2137.

[1] Navigable for small boats for a short distance only. Under Department permit of March 19, 1906 (57525/29), the mouth of the river has been improved by the Los Angeles Dock & Terminal Co. and now forms part of Long Beach Harbor, with depths of water of 18 feet at mean lower low water.

[2] Designated Los Angeles, June 4, 1910. See also footnotes, p. 1549 of this Index.

1907. H. S. Botsford, 20,000 bbls. oil for fuel, 85¢ bbl., **08,** 2213.
1908. H. S. Botsford, 20,000 bbls. oil for fuel, 90¢ bbl., **09,** 2182.
1909. H. S. Botsford, 20,000 bbls. oil for fuel, $1 bbl., **10,** 2343.
1910. H. S. Botsford, 20,000 bbls. oil for fuel, $1 bbl.; Tacoma Dredging Co., dr. 2 20′ lateral chans., $0.089725 c. y.; Standard American Dredging Co., dr. 30′ chan., 42¢ c. y., **11,** 2548.
1911. Standard American Dredging Co., dr., $0.415 c. y., **12,** 2756.

ENGINEERS.

Chief of Engineers. **R., 69,** 64; **71,** 98; **72,** 97; **73,** 108; **74,** 118; **75,** 122; **76,** 113; **77,** 120; **78,** 135; **79,** 178; **80,** 234; **81,** 321; **82,** 315; **83,** 327; **84,** 331; **85,** 358; **86,** 351; **87,** 319; **88,** 292; **89,** 346; **90,** 312; **91,** 391; **92,** 368; **93,** 423; **94,** 395; **95,** 433, 3268; **96,** 387; **97,** 486; **98,** 471; **99,** 551, 553; **00,** 622, 624; **01,** 601; **02,** 523; **03,** 577; **04,** 634; **05,** 641; **06,** 715; **07,** 736; **08,** 782; **09,** 818, 822; **10,** 904, 910; **11,** 957; **12,** 1142.

In charge:
Maj. R. S. Williamson, 1869. **R., 69,** 479.
Maj. G. H. Mendell, 1871–86. **R., 71,** 939; **72,** 1005; **73,** 1129; **74,** ii, 369; **75,** ii, 692; **76,** ii, 615; **77,** 989; **78,** 1291; **79,** 1746; (Lt. Col.) **80,** 2232; **81,** 2465; **82,** 2531; **83,** 1966; **84,** 2186; **85,** 2333; **86,** 1911.
Maj. W. H. H. Benyaurd, 1886–95. **R., 87,** 2429; (Lt. Col.) **88,** 2111; **89,** 2474; **90,** 2900; **91,** 2956; **92,** 2626; **93,** 3229; **94,** 2511; **95,** 3268.
Maj. C. E. L. B. Davis, 1896–98. **R., 96,** 3181, **97,** 3335; **98,** 2931.
Capt. J. J. Meyler, 1899–1901. **R., 99,** 3158; **00,** 4191, 4194, 4199; **01,** 3399.
Lt. Col. C. E. L. B. Davis, **02,** 521.
Lt. Col. T. H. Handbury, **02,** 521.
Capt. Edgar Jadwin, 1901–03. **R., 02,** 2344.
Maj. J. H. Willard, 1903. **R., 03,** 2175.
Capt. C. H. McKinstry, 1903–06. **R., 04,** 3387; **05,** 2413.
Col. W. H. Heuer, **06,** 712.
Capt. A. A. Fries, 1906–09. **R., 06,** 1959; **07,** 2135; **08,** 2210; **09,** 2179.
1st Lt. C. T. Leeds, 1909–11. **R., 10,** 2342; (Capt.) **11,** 2545.
Lt. Col. C. H. McKinstry, 1912–. **R., 12,** 2753.

Assistants:
Lt. C. B. Sears. **R., 73,** 1132; **75,** ii, 692.
W. I. Smith, **76,** ii, 617.
A. J. Swift. **R., 83,** 1967.
A. Boschke. **R., 84,** 2187.
W. P. Smith. **R., 85,** 2336.
Lt. J. J. Meyler. **R., 91,** 2958.
F. C. Turner. **R., 00,** 4209.
R. A. Crawford. **R., 03,** 2177.

ESTIMATES. (See Plans and Projects.)

By Maj. Williamson, break'r, $891,959, **69,** 481.
By E. A. Flint, cribwork, $627,000, **69,** 484.
By Maj. Mendell, 6,700′ of break'r, $400,000, **71,** 947. Protection of the work, $30,000, **74,** ii, 370. Completion, $100,000, **76,** ii, 617.
By Lt. Col. Benyaurd, dr., etc., $392,725, **95,** 3272.
By Capt. Meyler, dr., etc., $2,159,100, **00,** 4206; $550,000, **00,** 4207.

OPERATIONS.

1871-72. 830 l. f. break'r and 8 wings built, **72,** 1008.
1872-73. 3,700 l. f. break'r built, 18,561 t. st. deposited, 360 l. f. washed away, 120 l. f. of wings repaired with st., flood gates put in, 350 l. f. crib and 300′ st. wings built, 24,000 c. y. gravel riprap, **73,** 108, 1130, 1132.
1873-74. 25,778 t. st. deposited, 1,680 l. f. of js. break'r ballasted with st., **74,** 118, ii, 369.
1874-75. 24,087 c. y. dr., 4,075 t. st. deposited, flood gates closed, head of work riprapped, 192 l. f. crib wings built, **75,** 122, ii, 693.
1875-76. 21,888 c. y. dr., 3,610 t. st. deposited, dr. by contract, **76,** ii, 616.
1876-77. 11,435 c. y. dr., 3,249 t. st. deposited, st. and clay dr. used to extend training wall, **77,** 120, 989.
1877-78. 330 l. f. of the timber work seriously damaged by teredo navalis; js. injured by sea; d. of water, 9′, **78,** 135, 1292.
1878-79. 6,166 t. st. deposited, timber line protected with st., main j. raised, extending w. training wall, filling crib groins, **79,** 178, 1747.
1879-80. 4,483 t. st. deposited on the H. js., **80,** 2232.
1880-81. 13,242 c. y. dr. from reef, 1,448 t. st. delivered on js., **81,** 2466.
1881-82. 11,492 t. st. delivered and placed on lines of work, repairs made on 970 l. f. of inner portion of timber j., wreck of *A. Cooper* removed from chan., **82,** 2531, 2532.
1882-83. 26,550 c. y. hard material and 1,870 c. y. sand removed from reef, 1,313 c. y. sand dr. upon inner bar, **83,** 1967, 1968.
1883-84. 11,851 c. y. dr. from chan., **84,** 2186.
1884-85. 5,284 t. st. delivered and placed in work, **85,** 2334.
1885-86. 12,011 t. st. delivered in e. j., extending same 280′, **86,** 1913.
1887-88. 8,198 t. st. delivered in w. j., dr. of inner chan. begun, **88,** 2112.
1888-89. Part of j. on e. side of H. raised and strengthened, repairs to plant, **89,** 2475.
1889-90. 13,498 c. y. dr. from inner chan., **90,** 2901.
1890-91. 62,295 c. y. dr., 15,123 t. st. delivered in w. j., **91,** 2957.
1891-92. 21,309 t. of r. deposited in extending e. j. and in strengthening w. j., **92,** 2626.
1892-93. 7,458 t. of st. placed in e. j., **93,** 3229.
1893-94. 12,385 t. of st. placed in e. and w. j., completing j. constr., **94,** 2511, 2512.
1894-95. A new chart of the approv. H. lines made to replace 1st chart, **95,** 3268.
1902-03. 320′ e. j. repaired, 19,146 c. y. material removed from division A, and 104,589 c. y. from division B, **03,** 2175.
1903-04. 89,588 c. y. removed from division A and 144,751 c. y. from division B; work on constr. of dr., barges, and pipe pontoons in progress, **04,** 3387.
1904-05. Constr. of 20″ suction dr. and of 30′ gasoline launch completed; 24 pontons and 3 barges constr., 4 skiffs built, boat landing 106′ l. built, 2 sets inclined ways built, and U. S. warehouse repaired by day labor; 14,236 c. y. dr., under contract, from division A, completing contract; 243,914 c. y. removed by U. S. dr., **05,** 2413–14.
1905-06. 180,500 c. y. dr. under contract, and 702,810 c. y. by U. S. dr., **06,** 1959.
1906-07. 52,315 c. y. dr. by contract and 827,320 c. y. by U. S. dr.; repairs to floating plant, **07,** 2135.
1907-08. 843,785 c. y. dr. by U. S. dr., and floating plant repaired, **08,** 2211.
1908-09. 819,234 c. y. dr. by U. S. dr., and floating plant repaired, **09,** 2180.
1909-10. 885,298 c. y. dr. by U. S. dr., and floating plant repaired, **10,** 2342.
1910-11. 779,471 c. y. dr. by contract and 764,250 c. y. dr. by U. S. dr., **11,** 2545.
1911-12. 910,780 c. y. dr. by contract and 692,087 c. y. dr. by U. S. dr., **12,** 2753.

PHYSICAL CHARACTERISTICS.

Description of, **71,** 944; **94,** 2512; **95,** 3269; **00,** 4197, 4199, 4207.
Current observations were made in 1893–94, **94,** 2512.

PLANS. (See Estimates and Projects.)

By Maj. Williamson, imp. of Wilmington H. by closing 2 sloughs, and to build an artificial bank of st. or granite on the s. end of Rattlesnake Isld., **69,** 480.
By E. A. Flint, 7,000′ of break'r, cribwork filled with st., **69,** 483, 484.

PROJECTS. (See Estimates and Plans.)

By Lt. Col. Mendell, 1871, protection of H. and chan. entrance at Wilmington by constr. of 6,700 l. f.

of timber and st. break'r; est., $400,000, **71,** 947. Protection of work, $30,000, **74,** ii, 370. Completion, $100,000, **76,** ii, 617; **80,** 2232.

By Lt. Col. Mendell, 1881, increase in chan. d. from 10′ to 15′ at l. w. by excavation of reef to w. of 400′, extension of js. beyond Deadmans Isld. in the B. of San Pedro to a d. of 18′, excavation of sand bet. js., and the elevation of existing works to 2′ above h. w.; est., $291,766, **81,** 2467; **86,** 1912. Causes for increased cost, **85,** 2335, 2336; **86,** 1913. From 1871 to 1886, incl., $780,000 has been app.; est. cost of completion of proj., $175,000, **86,** 1914; **87,** 2430.

By Lt. Col. Benyaurd, 1894, 18′ chan.; est., $392,-725. Congress app. $50,000, but provided that no work should be done if H. of refuge would, on recom. of BE., be constr. at San Pedro, **95,** 3272; **96,** 387.

Capt. Meyler est., 1900, it would cost $2,159,100 to imp. H. further, or $550,000 for the first 3 years after commencing the work, **00,** 4206, 4207.

Act June 13, 1902, au. securing chan. 20′ x 400′ from ocean to lower end of wharves, 24′ bet. H. lines from lower to upper end of wharves, dr. turning-basin 1,600′ in diameter bet. upper end of wharves to lower end of Mormon Isld., to 24′, repairs to e. j., and building restraining dike at head of lagoon (H. D. 357, 56th, 1st). Constr. or purchase of suitable dr. au., **02,** 2344.

Capt. McKinstry recom. dr. material deposited in chan. from time to time, thus doing away with restraining dike, **04,** 3388.

Act June 25, 1910, au. d. chan. to 30′ up to and incl. turning-basin, and for dr. 2 chans. 20′ x 200′ from turning-basin into e. and w. basins (H. D. 114, 60th, 2d, and H. D. 768, 61st, 2d), **10,** 905.

SURVEYS.

Incl. in Coast Survey, 1859, **69,** 479, 483.
By Maj. Williamson, 1868, ex., **69,** 479; **71,** 98.
By Mr. White, 1871, **71,** 944.
By Lt. Sears, 1874, **74,** ii, 369.
Hydrographic sur. of H. made, 1888, by Lt. Col. Benyaurd, **88,** 2112.
Misc. surs., etc., **93,** 3230; **94,** 2512.
Ex. and sur. au. act Mar. 3, 1899; made, 1900, by Capt. Meyler (**R.** fav.), **00,** 4205; DE. recom. that imp. be deferred, **00,** 4209. (See Projects.)
R. by BERH., Feb. 7, 1907, in pursuance with resol. of R. and H. C. to consider advisability of increasing d. to 30′. Board feels it is not advisable to increase d., and renders unfav. opinion. (R. and H. C. D. 16, 59th, 2d.)
Ex. and sur. au. act Mar. 2, 1907, with view to obtaining increased d. **R.** by Capt. Fries, Apr. 24 and Dec. 17, 1907; est., $420,000 (H. D. 1114, 60th, 2d), **09,** 822.
Ex. and sur. au. act Mar. 3, 1909, with view to obtaining chan. 20′ x 200′. **R.** by Capt. Fries, May 21, 1909, and Lt. Leeds, Jan. 10, 1910; est., $390,000 (H. D. 768, 61st, 2d), **10,** 910.
Maps. (H. D. 768, 61st, 2d.). **03,** 2176; **06,** 1960.

Part(b), SS-20 San Pedro Harbor, Cal.[1]

APPROPRIATIONS.

1890,	[2] $5,000,	**92,** 2631.
1892,	[2] 10,000,	**93,** 3238.
1896,	[2] 50,000,	**98,** 2929.
1898,	400,000,	**98,** 2929.
1899,	200,000,	**99,** 3157.
1901,	146,000,	**01,** 3399.
1902,	311,085,	**02,** 2343.
1903,	500,000,	**03,** 2174.
1904,	350,000,	**04,** 3386.
1905,	460,000,	**05,** 2412.
1906,	290,000,	**06,** 1958.
1907,	92,915,	**07,** 2134.
1909,	100,000,	**09,** 2179.
1910,	178,000,	**11,** 2547.
1912,	327,250,	**12,** 2755.
Total,	3,420,250	(incl. misc., and less $15,000 for sur., $3,405,250.05, **12,** 2755).

COMMERCE.

C. and naval relations, **93,** 3239.

C. history of possible locations for d. w. H. considered by the board of 1892, **93,** 3245.

Advantages of the compared sites for arrival and departure, for shelter, and for handling freight, **93,** 3253; communication with the C. center, **93,** 3255.

BE., 1892, preferred the anchorage at the w. side of San Pedro B., about Pt. Fermin, as a site for the location of a H. of refuge, on account of its w. and capacity to accommodate the largest ocean vessels, and the benefit to be derived by the C. and naval interests of the country, **93,** 3259.

Diagram, freight value and tonnage in comparison with app., **11,** 2548.

CONTRACTS.

1898. Heldmaier & Neu, break'r constr.; est., $1,303,198.54, **99,** 3156. Annulled, **00,** 4189.

1900. California Construction Co., break'r constr.; substr., 84.4¢ t.; superstr., $3.10 t.; concrete, $6 c. y.; est., $2,375,546.05, **00,** 4190.

1910. California Constr. Co., supple., extension of superstr. to w. end of break'r, **10,** 2341.

1911. W. S. Russell, constr. of break'r extension, $230,000, **11,** 2547.

ENGINEERS.

Chief of Engineers. **R., 84,** 334; **88,** 293; **91,** 426; **92,** 370, 399; **93,** 425; **98,** 470; **99,** 550; **00,** 621; **01,** 600; **02,** 522; **03,** 576; **04,** 632; **05,** 639; **06,** 714, **07,** 735; **08,** 780; **09,** 816; **10,** 902; 904, 906; **11,** 955; **12,** 1140, 1150.

Boards:

Convened, San Francisco, Dec. 8, 1891, to determine upon location for a d. w. H. on the Pacific coast. **R., 92,** 2631. (Col. Mendell and Lt. Cols. Gillespie and Benyaurd.)

Convened, San Francisco, July 8, 1892, S. O. No. 20, to report upon the estab. of H. lines at San Pedro in Wilmington H. **R., 91,** 2976; **92,** 2638. (Col. Mendell, Lt. Col. Benyaurd, and Maj. Heuer.)

Convened, San Francisco, Sept. 2, 1892, S. O. No. 33, to consider and report upon a proposed d. w. H. at San Pedro or Santa Monica Bs. **R., 93,** 3238. (Col. W. P. Craighill, Lt. Col. H. M. Robert, Lt. Col. P. C. Hains, Maj. C. W. Raymond, and Maj. T. H. Handbury.)

BE. (Rear-Admiral J. G. Walker, U. S. Navy, chairman; Aug. F. Rodgers, Richard P. Morgan, Wm. H. Burr, and Geo. S. Morison) au. act June 3, 1896, to decide on a location for a d. w. H. for C. and refuge on the Pacific coast. Board, Mar. 1, 1897, decided on San Pedro and submitted est. only for break'r ($2,901,787). (See S. D. 18, 55th, 1st.)

In charge:

Lt. Col. G. H. Mendell. **R., 84,** 2209.
Lt. Col. Benyaurd, 1886–93. **R., 88,** 2122; **92,** 2630; **93,** 3238.
Maj. C. E. L. B. Davis, 1898. **R., 98,** 2929.
Capt. J. J. Meyler, 1899–1901. **R., 99,** 3156; **00,** 4187; **01,** 3397.
Lt. Col. C. E. L. B. Davis, **02,** 521.

[1] On account of consolidation of San Pedro city with Los Angeles, app. 1910, 1911, and 1912 made under name of "Los Angeles Harbor." Prior to 1910 designated "San Pedro" and "Wilmington" Hs.

[2] $65,000 for sur. of San Pedro and Santa Monica Bs., and expenses of board for selection of deep water harbor, San Pedro or Santa Monica Bays.

Lt. Col. T. H. Handbury, **02,** 521.
Capt. Edgar Jadwin, 1902–03. **R., 02,** 2342.
Maj. J. H. Willard, 1903. **R., 03,** 2173.
Capt. C. H. McKinstry, 1903–05. **R., 04,** 3385; **05,** 2411.
Col. W. H. Heuer, **06,** 712.
Capt. A. A. Fries, 1906–09. **R., 06,** 1956; **07,** 2133; **08,** 2209; **09,** 2178.
1st Lt. C. T. Leeds, 1909–11. **R., 10,** 2340; (Capt.) **11,** 2544.
Capt. W. P. Stokey, **11,** 953; **12,** 1137.
Lt. Col. C. H. McKinstry, 1912–. **R., 12,** 2753.

OPERATIONS.

1898–99. 5,561 t. st. placed, **99,** 3156.
1899–00. 79,020 t. st. placed, **00,** 4189.
1900–01. 190,260 t. st. placed and 2,837′ double-track trestle built, **01,** 3398.
1901–02. 454,889 t. st. placed, **02,** 2343.
1902–03. 473,634 t. st. placed in substr. and 21,242 t. granite placed in superstr., **03,** 2173.
1903–04. 447,310 t. st. placed in substr. and 22,034 t. in superstr., and double-track trestle extended 1,666′, **04,** 3385.
1904–05. 321,454 t. st. placed in substr., 28,889 t. in superstr., and double-track trestle extended 672′, **05,** 2411.
1905–06. 79,657 t. st. placed in substr. and 49,100 t. in superstr., **06,** 1957.
1906–07. 2,576 t. granite placed in substr. and 48,129 t. in superstr., **07,** 2133.
1907–08. 68,437 t. st. placed in substr., 38,372 t. in superstr., and 11,469 t. placed as berm at slope of superstr., **08,** 2209.
1908–09. 168,153 t. granite placed in substr., 14,272 t. in superstr., and 1,015 t. as a berm at slope of superstr., **09,** 2178.
1909–10. 25,993 t. granite placed in substr., 7,233 t. in superstr., and 1,034 t. as berm; concrete block built at outer end of break'r, **10,** 2341.
1910–11. 26 t. granite placed in substr., 3,370 t. in superstr., and 80 t. as a berm, completing constr. of break'r. Work on extension of break'r commenced, 15,155 t. st. placed, **11,** 2545.
1911–12. 114,207 t. st. placed in break'r extension, **12,** 2753.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 2124; **92,** 2631.
Topography, **93,** 3241.
Hydrography, **93,** 3242.
Meteorological conditions, **93,** 3242.
Possible locations for a d. w. H., **93,** 3244–3245.
Comparison of break'r sites, **93,** 3251–3252; adaptability for constr. and mainten., **93,** 3255.
Damages to contractor's plant and operations by severe storms, **06,** 1957.

PLANS. (See Projects.)

In 1882 Lt. Col. Mendell, in view of the fact that the locality had no C., did not consider the imp. a public necessity, **84,** 2210.
By Maj. Benyaurd, 1888, imp. of San Pedro B. by forming a protected anchorage ground through the constr. of a w. st. break'r 3,300′ l. and an e. one 2,500′ l.; est., $4,045,700; **88,** 2125.
By BE., 1891, of a d. w. H. at San Pedro by constr. of a rubble and concrete break'r; cost, $4,594,494; or one entirely of rubblest.; cost $4,137,591, **92,** 2636. Col. Mendell and Lt. Cols. Gillespie and Benyaurd.

PRIVATE WORK.

Permit given to build wharves, ps., warehouses, etc., to private parties, **06,** 1958.
Wharves, warehouses, etc., constr. by Outer Harbor Dock & Wharf Co., and the Pacific Wharf & Storage Co., **12,** 1142.

PROJECTS. (See Boards of Engineers; Plans.)

1892, BE. est. $2,885,324 to constr. of st. at San Pedro B. a break'r 10′ above highest h. w. and a w. of 20′ on top, with an interior and exterior slope of 1 on 0.75, the cross-section to be subject to modification if found necessary during the progress of the work, (see Plans) **93,** 3262.
BE. appointed under act June 3, 1896, decided in fav. of d. w. H. at San Pedro B. (S. D. 18, 55th, 1st) (see Boards of Engineers), **98,** 2929.
Act June 25, 1910, au. extension of break'r by 1,887′ **11,** 956.
Act June 25, 1912, au. proj. for dr. to 35′ in outer H., **12,** 1141.

SURVEYS.

Ex. Santa Monica B. au. act Aug. 2, 1882; made by Lt. Col. Mendell, **84** (**R.** unfav.) (see Plans), 2209.
Ex. of San Pedro B. au. act Aug. 5, 1886; made, 1888, by Maj. Benyaurd (see Plans), **88,** 2124.
Ex. for imp. by extending break'r to shore, au. act Mar. 2, 1907. **R.** by Capt. Fries, Apr. 30 and June 20, 1907; est., $178,000 to $284,800 (H. D. 969, 60th, 1st), **08,** 786.
Pre. ex. au. act June 25, 1910, with view to obtaining increased d. **R.** by Capt. Stokey, Oct. 14, 1910 (H. D. 267, 62d, 2d) (unfav.), **12,** 1150.
Reex. au. act Feb. 27, 1911. **R.,** by Lt. Col. McKinistry, Apr. 3 and 10, 1912; est., $327,250 (H. C. D. 8, 62d, 2d), **12,** 1150.
Map. **11,** 2546.

SS-21 REDONDO BEACH HARBOR, CAL.

ENGINEERS.

Chief of Engineers. **R., 91,** 393.

In charge. Lt. Col. W. H. H. Benyaurd, 1890. **R., 91,** 2972.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2972.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1891, by Lt. Col. Benyaurd (**R.** unfav.), **91,** 2972.

SS-24 SAN BUENAVENTURA HARBOR, CAL.

COMMERCE.

Loss of vessels and SS. at this H., **79,** 1771.

ENGINEERS.

Chief of Engineers. **R., 78,** 137; **79,** 180; **89,** 348.

In charge:
Lt. Col. C. S. Stewart. **R., 79,** 1770.
Maj. W. H. H. Benyaurd, 1888–89. **R., 89,** 2479.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2479.

PLAN.

By Lt. Col. Stewart, break'r; est., $5,801,248, **79,** 1771. **H.** of refuge unnecessary at this point, **79,** 1772.

SURVEYS.

Ex. au. act June 18, 1878; assigned to Lt. Col. Stewart, **78,** 137. **R.** (unfav.; see Plans), **79,** 1770.
Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Benyaurd (**R.** unfav.), **89,** 2479.
Maps. Of the H., 1870, and sketch of plan and section of break'r, **79,** 1772.

SS-25 SANTA BARBARA CHANNEL AND HARBOR, CAL.

COMMERCE.

Not large, **75,** ii, 725; **79,** 1769.
H. of refuge not necessary, **79,** 1770.

ENGINEERS.

Chief of Engineers. **R., 75,** 124; **78,** 137; **79,** 180; **12,** 1150.

In charge:
Lt. Col. C. S. Stewart, 1875–79. **R., 75,** ii, 724; **79,** 1769.
Capt. C. T. Leeds, **12,** 1137.

PLANS.

No plan submitted in 1875, as Lt. Col. Stewart considered the making of a permanent available H. at this point as hopeless, **75,** ii, 725.
By Lt. Col Stewart, break'r 1,320 y. l.; est., $3,571,232, **79,** 1770.

SURVEY.

Ex. by Lt. Col. Stewart (see Plans), **79,** 1769.
Pre. ex. au. act Feb. 27, 1911. **R.** by Capt. Leeds. July 28, 1911 (H. D. 464, 62d, 2d) (unfav.), **12,** 1150,
Map. (H. D. 464, 62d, 2d.) Of Santa Barbara, 1870, and sketch of plan and section of break'r, **79,** 1770.

SS-25(b) EL ESTERO (Estero Bay) (near Santa Barbara), CAL.

COMMERCE.

Unimportant, **73,** 1149, 1150.

ENGINEERS.

Chief of Engineers. **R., 73,** 109.

In charge. Lt. Col. C. S. Stewart. **R., 73,** 1148, 1149.

PHYSICAL DATA.

About 1 m. from Santa Barbara. This waterway is distinct from Estero B.

PLANS.

By Lt. Col. Stewart, excavating basin, st. js., break'r, and fender piling, $8,145,954 to $9,537,454, **73,** 1150.

SURVEY.

Ex. by Lt. Col. Stewart, **73,** 1148.

SS-25(c) POINT SAL, CAL. (Harbor of refuge.)

COMMERCE.

None, except that passing on the coast, **68,** 888.

ENGINEERS.

Chief of Engineers. **R., 67,** 17; **68,** 74.

In charge. Maj. R. S. Williamson. **R., 68,** 887.

Assistant. Lt. W. H. Heuer, **68,** 887.

ESTIMATES.

Est., by Maj. Williamson, 2 break'rs, $9,944,438, **68,** 889.

PHYSICAL CHARACTERISTICS.

To make a H., 2 arms would have to be built out into the sea, probably costing $10,000,000, **68,** 888.

PROJECTS. (See Physical characteristics.)

SURVEY.

Proj. and est. called for 1867. Submitted by Maj. Williamson, **68,** 887.

SS-28 SAN LUIS OBISPO HARBOR, CAL.

APPROPRIATIONS.

1888,	$25,000,	**88,** 292.
1890,	40,000,	**90,** 2900.
1892,	30,000,	**92,** 2625.
1894,	40,000,	**95,** 3267.
1896,	40,000,	**96,** 3180.
1899,	55,000,	**99,** 3160.
1902,	50,000,	**02,** 2346.
1905,	25,000,	**05,** 2419.
1907,	63,660,	**07,** 2138.
1908,	60,000,	**08,** 2214.
1909,	30,000,	**09,** 2183.
1911,	64,000,	**11,** 2550.
Total,	522,660	(incl. misc., $522,660.95, **12,** 2758).

COMMERCE.

Loss of vessels and steamers, **79,** 1768.
In 1895 break'r as far as constr. at that time was of great benefit to C., **95,** 3266.
Influence of proj. on rates; shipments of oil, **05,** 643.
Diagram of app., freight, tonnage, and value, etc., **11,** 2550.

CONTRACTS.

1888. R. Axman, furnishing and placing st. in break'r, $3.44 t., **89,** 2474.
1890. San Francisco Bridge Co., break'r constr., $3.38 t., **91,** 295c.
1893. A. A. Polhamus, r., $1.94 l. t., **93,** 3226.
1895. P. O'Neil, r., $2.23 l. t., p. m., **95,** 3266; annulled in 1896, **97,** 3334.
1897. City Street Improvement Co., 22,613 t. st., $1.99 l. t., **97,** 3335.
1899. A. A. Polhamus, break'r constr., 31,590 t. st., $1.66 t., **99,** 3159.
1903. A. A. Polhamus, st., $1.86 t., **03,** 2180.
1905. City Street Improvement Co., st., $2.65 t., **05,** 2420.
1907. San Francisco Bridge Co., st., $1.57 t., **08,** 2215.

ENGINEERS.

Chief of Engineers. **R., 78,** 137; **79,** 180; **81,** 324; **87,** 320; **88,** 292, 293; **89,** 346; **90,** 311; **91,** 391; **92,** 368; **93,** 422; **94,** 394; **95,** 432; **96,** 386; **97,** 485; **98,** 472; **99,** 552; **00,** 623; **01,** 602; **02,** 524; **03,** 578; **04,** 635; **05,** 642; **06,** 717; **07,** 738; **08,** 784; **09,** 820; **10,** 908; **11,** 962; **12,** 1147.

In charge:
Lt. Col. C. S. Stewart. **R., 79,** 1765; **81,** 2526.
Maj. W. H. H. Benyaurd, 1887–95. **R., 87,** 2433; (Lt. Col.) **89,** 2473; **90,** 2899; **91,** 2955; **92,** 2624; **93,** 3226; **94,** 2509; **95,** 3265.
Maj. C. E. L. B. Davis, 1896–98. **R., 96,** 3179; **97,** 3333; **98,** 2932.
Capt. J. J. Meyler, 1899–1901. **R., 99,** 3159; **00,** 4192; **01,** 3401.
Lt. Col. C. E. L. B. Davis, **02,** 521.
Lt. Col. T. H. Handbury, **02,** 521.
Capt. Edgar Jadwin, 1902–03. **R., 02,** 2345.
Maj. J. H. Willard, 1903. **R., 03,** 2179.
Capt. C. H. McKinstry, 1903–06, 1912–. **R., 04,** 3390; **05,** 2419; (Lt. Col.) **12,** 2757.
Col. W. H. Heuer, **06,** 712.
Capt. A. A. Fries, 1906–09. **R., 06,** 1961; **07,** 2138; **08,** 2214; **09,** 2183.
1st Lt. C. T. Leeds, 1909–11. **R., 10,** 2345; (Capt.) **11,** 2549.
Capt. W. P. Stokey, **12,** 1137.

Assistants:
Lt. A. H. Payson. **R., 81,** 2527.
1st Lt. C. T. Leeds, **10,** 900.
1st Lt. A. R. Ehrnbeck, **10,** 900.

OPERATIONS.

1888-89. 2,812 t. r. deposited in break'r, **89,** 2473.
1889-90. 3,784 t. r. deposited in break'r, **90,** 2899.
1891-92. 7,870 t. of r. placed in break'r, **92,** 2624.
1892-93. Over 2,812 t. of st. placed in break'r, **93,** 3226.
1893-94. 9,620 t. placed, **94,** 2510.
1894-95. In connection with previous year, 3,875 t. st. placed, **95,** 3266.
1895-96. 7,524 t. st. placed, **96,** 3180.
1896-97. About 2,758 t. placed, **97,** 3333.
1897-98. 22,595 t. st. placed in break'r for extension and repair, **98,** 2932.
1899-00. 12,888 t. st. placed, **00,** 4193.
1900-01. 18,180 t. st. delivered, finishing contract, **01,** 3400.
1902-03. 4,711 t. st. placed in break'r, **03,** 2179.
1903-04. 20,476.5 t. st. placed in break'r, **04,** 3390.
1905-06. 8,835 t. st. placed in break'r, **06,** 1961.
1908-09. 9,205 t. st. delivered, **09,** 2183.
1910-11. 16,837 t. st. delivered, closing chan. entrance to Morro B., **11,** 2549.
1911-12. 60,309 t. st. placed, **12,** 2757.

PHYSICAL CHARACTERISTICS.

Conditions changed for the better after the end of the break'r had been slued round by heavy sea, **99,** 3159.

PLANS. (See Projects.)

By Lt. Col. Stewart, for break'r; est., $7,269,476, **79,** 1767. Did not consider a H. of refuge at this point necessary, **79,** 1769.
In 1879 Col. Stewart est. imp. would cost over $7,000,000, and that a H. of refuge at this point was not required, **79,** 1767.
In 1881 the same views were repeated, **81,** 2526; **87,** 2434.

PROJECTS. (See Plans.)

By Lt. Col. Benyaurd, 1887, st. break'r, about 2,300′ l., along the sunken reef near Whalers Isld., extending from Pt. San Luis to Whalers Isld., thence to a point where the outer reef rises above h. w.; the purpose of the break'r to afford a protected anchorage and landing at Port Harford; est., $284,898, **87,** 2434, 2435; **90,** 2899.
In 1893 Lt. Col. Benyaurd est. $538,660 to constr. proposed break'r, using a trestle or other similar structure, **93,** 3227.

SURVEYS.

Ex. au. act June 18, 1878; assigned to Lt. Col. Stewart, **78,** 137. **R., 79,** 1765.
Ex. au. act Mar. 3, 1881; made by Col. Stewart, **81,** 2526.
Sur. au. act Aug. 5, 1886; made by Maj. Benyaurd, **87,** 2432.
Maps. Of the B. and H., and plan and sections of break'r, **79,** 1766.

SS-29 EL MORO HARBOR, ESTERO BAY, CAL.

COMMERCE.

Not large, **73,** 1141.
C. unimportant, but in 1895 the locality was thought worthy of imp. by U. S., on account of the large supply of st. to be obtained from it for R. and H. work at a comparatively low cost if the H. were imp., **95,** 3281.

ENGINEERS.

Chief of Engineers. **R., 73,** 108; **95,** 435.

In charge:
Maj. G. H. Mendell. **R., 73,** 1140.
Lt. Col. W. H. H. Benyaurd, 1895. **R., 95,** 3278.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3279.
Situated about the middle of the coast boundary of San Luis Obispo County, about 200 m. s. from San Francisco B. The basin which forms the H. is about 4 m. l. **95,** 3279.
Description of changes effected in the H. since sur. by Col. Mendell in 1873, **95,** 3279.

PLANS.

By Maj. G. H. Mendell, closing the s. chan., **73,** 1141.

SURVEY.

Pre. ex. au. act June 10, 1872; made, 1872, by Maj. Mendell, **R.,** Sept. 23 (unfav.), H. D. 421, 57th, 2d, **73,** 1140.
Ex. au. act Aug. 17, 1894; made by Lt. Col. Benyaurd (**R.** fav.), **95,** 3278.

SS-30 SAN SIMEON BAY, CAL.

ENGINEERS.

Chief of Engineers. **R., 89,** 348; **91,** 393.

In charge. Maj. W. H. H. Benyaurd, 1888. **R., 89,** 2480; **91,** 2971.

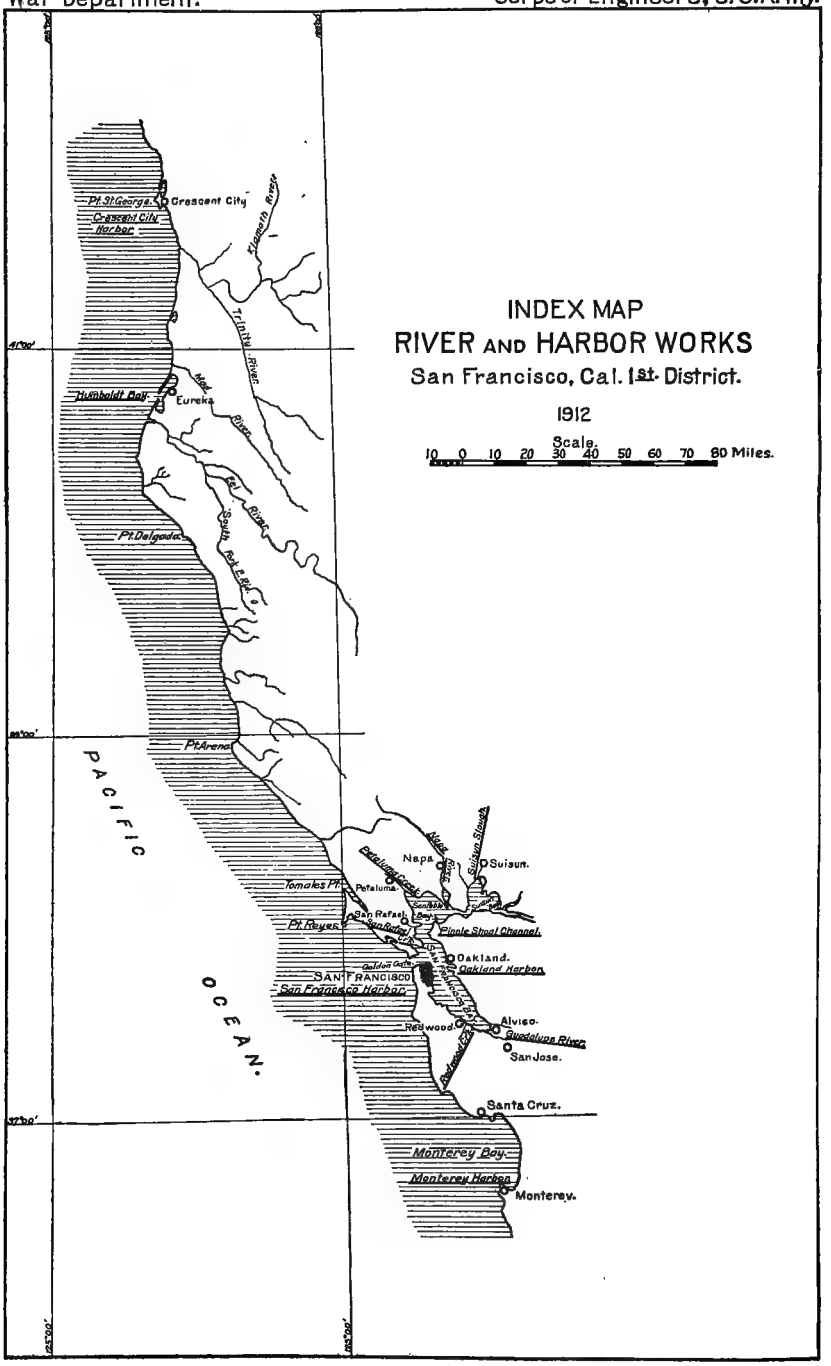
SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Benyaurd (**R.** unfav.), **89,** 2480.
Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Benyaurd (**R.** unfav.), **91,** 2972.

RIVER AND HARBOR WORKS—PACIFIC COAST.

TT.—1st SAN FRANCISCO, CAL., DISTRICT.

War Department. Corps of Engineers, U. S. Army.



TT.—1st SAN FRANCISCO, CAL., DISTRICT.[1]

In charge of U. S. Engineer Office, 1st District,
San Francisco, Cal.

TT 1 Pacific Ocean.
TT 2 Big Sur R., Cal. (1)
TT 3 Little Sur R., Cal. (1)
TT 4 Carmel B., Cal. (1)
TT 5 Carmel R., Cal. (4)
TT 6 Monterey B., Cal. (1)
TT 7 Monterey H., Cal. (6)
TT 8 Salinas R., Cal. (6)
TT 9 Pajaro R., Cal. (6)
TT 10 Soquel R., Cal. (6)
TT 11 Santa Cruz H., Cal. (6)
TT 12 Pescadero Cr., Cal. (1)
TT 13 San Gregorio Cr., Cal. (1)
TT 14 Halfmoon B., Cal. (1)
TT 15 San Francisco H. and B., Cal. (1)
TT 16 Islais Cr., Cal. (15)
TT 17 San Bruno Cr. (S. San Francisco H)., Cal. (15)
TT 18 San Mateo Cr., Cal. (15)
TT 19 San Mateo Slough, Cal. (15)
TT 20 Belmont Slough, Cal. (15)
TT 21 Angelo Slough, Cal. (20)
TT 22 Oneil Slough, Cal. (20)
TT 23 Sternbergen Slough, Cal. (15)
TT 24 Phelps Slough, Cal. (23)
TT 25 Corkscrew Slough, Cal. (23)
TT 26 Redwood Cr., Cal. (15)
TT 27 Corkscrew Slough, Cal. (26)
TT 28 Westpoint Slough, Cal. (26)
TT 29 Deepwater Slough, Cal. (26)
TT 30 Ravenswood Slough, Cal. (15)
TT 31 Charleston Slough, Cal. (15)
TT 32 Mountainview Slough, Cal. (15)
TT 33 Jagel Slough, Cal. (15)
TT 34 Indigo Slough, Cal. (15)
TT 35 Guadalupe R., Cal. (15)
TT 36 Alviso Slough, Cal. (15)
TT 37 Gray Goose Slough, Cal. (15)
TT 38 Coyote R., Cal. (15)
TT 39 Mud Slough, Cal. (15)
TT 40 Agua Caliente Creek, Cal. (39)
TT 41 Moury Slough, Cal. (15)
TT 42 Plummer Cr., Cal. (15)
TT 43 Newark Slough, Cal. (15)
TT 44 Beard Cr., Cal. (15)
TT 45 Hill Slough, Cal. (15)
TT 46 Tennion Slough, Cal. (15)
TT 47 Coyote Hill Slough, Cal. (15)
TT 48 Mallard Slough, Cal. (47)
TT 49 Patterson Slough, Cal. (47)
TT 50 Plummer Slough, Cal. (47)
TT 51 Teal Slough, Cal. (47)
TT 52 Alameda Cr., Cal. (15)
TT 53 Mount Eden Slough, Cal. (15)
TT 54 San Lorenzo Cr., Cal. (15)
TT 55 San Leandro B., Cal. (15)
TT 56 San Leandro Cr., Cal. (55)
TT 57 San Antonio Cr. (Oakland H.), Cal. (15)
TT 58 Tidal Canal, Cal. (57)
TT 59 Sausal Cr., Cal. (55)
TT 60 Ellis Slough, Cal. (15)
TT 61 San Pablo B., Cal. (15)
TT 62 San Pablo Cr., Cal. (61)
TT 63 Pinole Cr., Cal. (61)
TT 64 Rodeo Cr., Cal. (61)
TT 65 Carquinez Strait, Cal. (61)
TT 66[1] Suisun B., Cal. (65)
TT 67 Hastings Cr., Cal. (66)
TT 68 Seal Cr., Cal. (67)
TT 69 Mallard Slough, Cal. (66)
TT 70 Willow Cr., Cal. (66)
TT 71 New York Slough, Cal. (66)
TT 72 Middle Slough, Cal. (66)
TT 73 San Joaquin and Sacramento Rs., Cal. (66)
TT 74 Montezuma Cr., Cal. (73, 84)
TT 75 Roaring R., Cal. (74)
TT 76 Howard Slough, Cal. (75)
TT 77 Spoonbill Cr., Cal. (66)
TT 78 Honker B., Cal. (66)
TT 79 Rock Cr., Cal. (78)
TT 80 Mud Slough, Cal. (78)
TT 81 Noyce Slough, Cal. (66)
TT 82 Suisun Cut-off, Cal. (66)
TT 83 Grizzly B., Cal. (66)
TT 84 Montezuma Slough, Cal. (66)
TT 85 Tree Slough, Cal. (84)
TT 86 Island Slough, Cal. (84)
TT 87 Frost Slough, Cal. (84)
TT 88 Cross Slough, Cal. (84)
TT 89 Luco Slough, Cal. (84)
TT 90 Cut-off Slough, Cal. (84)
TT 91 Suisun Slough, Cal. (66)
TT 92 Cut-off Slough, Cal. (91)
TT 93 Spring Branch Slough, Cal. (90)
TT 94 McCoy Slough, Cal. (91)
TT 95 Duck Slough, Cal. (91)
TT 96 Peytonia Slough, Cal. (91)
TT 97 Boynton Slough, Cal. (91)
TT 98 Wells Slough, Cal. (91)
TT 99 Frank Horan Slough, Cal. (98)
TT 100 Twin Sloughs, Cal. (91)
TT 101 Cordelia Slough, Cal. (91)
TT 102 Goodyear Slough, Cal. (91)
TT 103 Hill Slough, Cal. (94)

[1] See footnote on page 1577 of this Index.

TT 104 San Pablo B., Cal. (15). (See TT 61)
TT 105 Mare Isld. Strait, Cal. (61)
TT 106 Napa R., Cal. (105)
TT 107 Whites Cr., Cal. (106)
TT 108 The Slough, Cal. (106)
TT 109 Suscol Cr., Cal. (106)
TT 110 Asylum Slough, Cal. (106)
TT 111 Carneros Slough, Cal. (106)
TT 112 Napa No. 1, Slough, Cal. (106)
TT 113 Napa No. 2, Slough, Cal. (106)
TT 114 Navy Yard Slough, Cal. (106)
TT 115 Boat Cut-off Slough, Cal. (106)
TT 116 Napa Slough, Cal. (104)
TT 117 Sonoma Cr., Cal. (104)
TT 118 Midshipman Slough, Cal. (104)
TT 119 Tolay Cr., Cal. (118)
TT 120 Mode Cr., Cal. (104)
TT 121 Petaluma Cr., Cal. (104)
TT 122 False B., Cal. (121)
TT 123 San Antonio Cr., Cal. (121)
TT 124 Novato Cr., Cal. (104)
TT 125 Gallinas Cr., Cal. (104)
TT 126 San Francisco B., Cal. (1). (See TT 15 above)
TT 127 San Rafael Cr., Cal. (126)
TT 128 Corte Madera Cr., Cal. (126)
TT 129 Raccoon Straits, Cal. (126)
TT 130 Richardson B., Cal. (126)
TT 131 Bolinas B., Cal. (1)
TT 132 Drakes B., Cal. (1)
TT 133 Bodega B., Cal. (1)
TT 134 Tomales B., Cal. (133)
TT 135 Salmon Cr., Cal. (1)
TT 136 Russian R., Cal. (1)
TT 137 Gualala R., Cal. (1)
TT 138 Garcia R., Cal. (1)
TT 139 Brush Cr., Cal. (1)
TT 140 Alder Cr., Cal. (1)
TT 141 Stewart Cr., Cal. (1)
TT 142 Navarro R., Cal. (1)
TT 143 Albion R., Cal. (1)
TT 144 Little R., Cal. (1)
TT 145 Mendocino B., Cal. (1)
TT 146 Big R., Cal. (145)
TT 147 Caspar Cr., Cal. (1)
TT 148 Mitchell Cr., Cal. (1)
TT 149 Hare Cr., Cal. (1)
TT 150 Noyo R., Cal. (1)
TT 151 Ten Mile R., Cal. (1)
TT 152 Gordons Cr., Cal. (1)
TT 153 Hardys Cr., Cal. (1)
TT 154 Ussal Cr., Cal. (1)
TT 155 Shelter Cove Cr., Cal. (1)
TT 156 Horse Mountain Cr., Cal. (1)
TT 157 Gitchell Cr., Cal. (1)
TT 158 Buck Cr., Cal. (1)
TT 159 Shipman Cr., Cal. (1)
TT 160 Big Cr., Cal. (1)
TT 161 Hadleys Cr., Cal. (1)
TT 162 Frasers Cr., Cal. (1)
TT 163 Kinseys Cr., Cal. (1)
TT 164 Spanish Cr., Cal. (1)
TT 165 Reynolds Cr., Cal. (1)
TT 166 Cooskie Cr., Cal. (1)
TT 167 Four Mile Cr., Cal. (1)
TT 168 Mattole R., Cal. (1)
TT 169 Domingos Cr., Cal. (1)
TT 170 Bear R., Cal. (1)
TT 171 Eel R., Cal. (1)
TT 172 Salt R., Cal. (171)
TT 173 Eastlake Slough, Cal. (171)
TT 174 McNultys Slough, Cal. (171)
TT 175 Humboldt B., Cal. (1)
TT 176 South B., Cal. (175)
TT 177 Hookton Slough, Cal. (176)
TT 178 Salmon Slough, Cal. (176)
TT 179 Elk R., Cal. (175)
TT 180 Eureka Slough, Cal. (175)
TT 181 Freshwater Slough, Cal. (180)
TT 182 Jacobi Cr., Cal. (175)
TT 183 Mad R. Slough, Cal. (175)
TT 184 Mad R., Cal. (1)
TT 185 Little Trinidad R., Cal. (1)
TT 186 Luffie Waltz Cr., Cal. (1)
TT 187 Trinidad H., Cal. 1
TT 188 Big Lagoon, Cal. (1)
TT 189 Pitcher Cr., Cal. (188)
TT 190 Maple Cr., Cal. (188)
TT 191 Redwood Cr., Cal. (1)
TT 192 Prairie Cr., Cal. (191)
TT 193 Klamath R. and tributaries. (1)
TT 194 McGarvey Cr., Cal. (193)
TT 195 Ahpah Cr., Cal. (193)
TT 196 Blue Cr., Cal. (193)
TT 197 Turwar Cr., Cal. (193)
TT 198 Hoppow Cr., Cal. (193)
TT 199 Maynot Cr., Cal. (193)
TT 200 Hunter Cr., Cal. (193)
TT 201 Wilsons Cr., Cal. (1)
TT 202 Damnation Cr., Cal. (1)
TT 203 Nickel Cr., Cal. (1)
TT 204 Cushing Cr., Cal. (1)
TT 205 Elk Cr., Cal. (1)
TT 206 Crescent City H., Cal. (1)
TT 207 Lake Earl, Cal. (1)
TT 208 Smith R. and tributaries (no names) Cal. (1)
TT 209 [1] Winchuck R., Cal. (1)

TT-1(a) PACIFIC COAST—HARBOR OF REFUGE.

APPROPRIATIONS.

1879, [2] $150,000, **81**, 2621.

COMMERCE.

C. requirements and benefits discussed, **77**, 1055.
List of marine disasters, **81**, 2637, 2668.
Interest of C. in a H. of refuge, **81**, 2640, 2698.

ENGINEERS.

Chief of Engineers. **R.**, **77**, 123; **81**, 333, 2679.

Boards:

BE. for Pacific coast met Aug., 1876, to ex. the Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, with view of estab. break'r and H. of

[1] See footnote on page 1577 of this Index.
[2] By act of June 3, 1896, the remainder was made available for wharf at Graveyard Point, Port Orford.

refuge. Board reported H. of very limited capacity could be built at Mendocino. **R., 77,** 1052. That a H. at Mack Arch, Oreg., would be small but tolerably secure, **77,** 1054. That Bodega B., Cal., is not well adapted for H. of refuge on account of the frequent fog, **77,** 1051. That a safe H., ½ m. sq., could be made at Cape Gregory, Oreg., **77,** 1055. That when the C. increases it may be necessary to constr. H. at Drakes B., but not "at present," **77,** 1051. That it would be almost impossible to constr. a break'r or js. at Humboldt B., **77,** 1052; **79,** 1785. That H. at Crescent City is not well adapted for a H. of refuge, **77,** 1053; **79,** 1785. That Trinidad H., for a H. of refuge, is preferable over any other site bet. San Francisco and Puget Sound, **77,** 1052. That Port Orford is well located for H. of refuge, the objections being the great d. of water on line of proposed break'r and the danger of approach from the n. due to Orford Reef, **77,** 1054. (Lt. Cols. Alexander, Williamson, and Stewart, and Maj. Mendell.)

BE. for Pacific coast reported upon proposed H. of refuge bet. Straits of Fuca and San Francisco, **81,** 2621, 2681. (Lt. Cols. Stewart, Williamson, and Mendell, and Maj. Gillespie. Minority report of Lt. Col. Williamson, **81,** 2651.)

PHYSICAL CHARACTERISTICS.

Description of n. Pacific coast, **81,** 2626.
Storms of the coast, **81,** 2634.
Description of Port Orford, **81,** 2647.

PLANS.

By BE., break'r at Mendocino, Cal., est., $3,455,100, **77,** 1052, 1058; Mack Arch, Oreg., est., $5,748,875, **77,** 1059; Bodega B., Cal., est., $6,614,300, **77,** 1058; Cape Gregory, Oreg., est., $3,710,168, **77,** 1059; Drakes B., Cal., est., $6,785,800, **77,** 1058; Crescent City, Cal., est., $6,022,940, **77,** 1059; Trinidad, Cal., est., $7,694,500, **77,** 1058; Port Orford, Oreg., est., $10,507,343, **77,** 1059.

By. Lt. Heuer, break'r at Crescent City, Cal., est., $2,178,008, **67,** 518.

By Lt. Col. C. S. Stewart, break'r at Trinidad, est., $13,432,320 to $19,000,000, **73,** 1147.

By Maj. Robert, break'r at Port Orford, Oreg., est., $2,902,000, **73,** 1127, 1129.

By Maj. Wilson, break'r at Port Orford, Oreg., est., $3,427,000, and $9,405,000, **79,** 1804, 1805.

Comparison of sites, **81,** 2643, 2647.

BE. recom. Port Orford as site of H. of refuge, **81,** 2648, 2694.

Minority report, Lt. Col. Williamson, **81,** 2651.

TT-6 MONTEREY BAY AND HARBOR, CAL.

APPROPRIATIONS.

1912, $200,000, **12,** 2769.

COMMERCE.

Insignificant, **75,** ii, 709.
In 1911, 615,014 t., **12,** 2770.

ENGINEERS.

Chief of Engineers. R., 75, 123; **06,** 719; **10,** 926; **11,** 983; **12,** 1161.

In charge:
Maj. G. H. Mendell. **R., 75,** ii, 707.
Maj. C. H. McKinstry, **06,** 712.
Lt. Col. John Biddle, **10,** 910; **11,** 983.
Maj. S. A. Cheney, 1912–. **R., 12,** 2769.

PHYSICAL CHARACTERISTICS.

H. 3,000′ l. x 1,700′ w., with varying d. from 18′ inner to 60′ outer. About 125 m. from San Francisco, **12,** 1161.

PLANS.

By Maj. G. H. Mendell: (1) break'r 2,640′ l. and j. 1,650′ l.; est. cost, $7,680,000; (2) break'r 3,300′ l., with a j. 1,000′ l.; est., $9,540,000; (3) break'r 3,300′ l., with a j. 1,650′ l.; est., $11,988,000, **75,** ii, 709. Acreage of sites suggested, **75,** ii, 708.

PRIVATE WORK. (See Projects.)

PROJECTS.

Act July 25, 1912, au. proj. for break'r 2,000′ l., 10′ above m. l. w., and 15′ w. at top; est, $800,000; $200,000 contributed by local interests with condition that rail connection be provided bet. Monterey and San Joaquin Valley shortly (H. D. 557, 59th, 1st; H. D. 1084, 61st, 3d), **12,** 1161.

SURVEYS.

Included in Coast Sur., **75,** ii, 707.

Pre. ex. and sur. of Monterey H. au. act Mar. 3, 1905. **R.,** Maj. McKinstry, July 31, 1905, and Jan. 22, 1906 (H. D. 557, 59th, 1st) (unfav.), **06,** 719.

R. by BERH. Jan. 11, 1907, and Feb. 17, 1908, in pursuance of resol. of R. and H. Com. for constr. of break'r. As it does not appear essential to development of port, break'r constr. is not recom. (R. and H. C. D. 10, 59th, 2d; R. and H. C. D. 25, 61st, 2d.)

Pre. ex. and sur. of Monterey B. au. act Mar. 3, 1909. **R.,** Lt. Col. Biddle, June 17 and Dec. 16, 1909; est., $800,000, local interests to contribute $200,000 (H. D. 1084, 61st, 3d), **11,** 983.

TT-11 SANTA CRUZ BAY, CAL.

COMMERCE.

Whole C. of the coast would be greatly benefited by the imp., **71,** 920.

Water rates about 15% less than R. R., rates.

ENGINEERS.

Chief of Engineers. R., 71, 97; **74,** 119; **91,** 393, 2968; **04,** 637.

Boards. BERH. concurs in Capt. Jadwin's **R.** on undesirability of imp. this place, **04,** 3403.

In charge:
Maj. R. S. Williamson. **R., 71,** 917.
Lt. Col. C. S. Stewart. **R., 74,** ii, 376.
Lt. Col. W. H. H. Benyaurd, 1891. **R., 91,** 2968.
Capt. Edgar Jadwin. **R., 04,** 3400.

ESTIMATES. (See Plans.)

By commission appointed by the legislature, for a break'r, $5,702,400, **71,** 919.

LEGISLATION.

Act of Cal., Feb. 11, 1870, appointing a commission to ex. the H. of Santa Cruz. **R., 71,** 918.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2968.

PLANS. (See Estimates.)

By commission, break'r of st., three-fourths of a m. l., **71,** 919.

By Lt. Col. Stewart, break'r, $11,285,226, **74,** ii, 377.

SURVEYS.

The H. included in the Coast Sur., **71,** 918.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Benyaurd (**R.** unfav.; cost too great), **91,** 2970.

Pre. ex. au. act June 13, 1902. **R.** by Capt. Jadwin, Dec. 27, 1902 (H. D. 214, 58th, 2d) (unfav.), **04,** 637, 3400.

TT-15 SAN FRANCISCO HARBOR, CAL.

Part.	Title.	Period.	Appropriations.
a	San Francisco Bay-Golden Gate	1892–1893	
b	Blossom Rock	1866–1878	$79,927.27
c	Rincon Rock	1872–1877	50,000.00
d	Noonday Rock	1874–1875	25,000.00
e	Patrician, removal of wreck of	1875	
f	H. and interior Bs	1886–1891	11,000.00
g	Rocks in H	1892–1912	350,000.57
	Total		[1] 515,927.84

Part (a), TT-15 San Francisco Bay, Cal. (Entrance to, Golden Gate.)

ENGINEERS.

Chief of Engineers. **R., 93,** 420.

In charge. Col. G. H. Mendell, 1893. **R., 93,** 3221.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3222.

The Golden Gate is opposite and bet. Lime Pt. on the n. and Fort Pt. on the s. side of the entrance to San Francisco H., and is almost exactly 1 m. w. In 1892 the officer in charge thought that nowhere could there be found a better entrance, and because of its excellence considered it was not worthy of imp. by the U. S., **93,** 3222.

SURVEY.

Ex. of the entrance au. act July 13, 1892 (**R.** unfav.), submitted by Col. Mendell, 1892 (see Physical characteristics), **93,** 3221.

Part (b), TT-15 Blossom Rock, San Francisco Harbor, Cal.

APPROPRIATIONS.

1868, *$50,000.00, **68,** 73; **69,** 471.
1869, *[2] 29,927.27, **69,** 64, 471, 473; **71,** 931.

Total, 79,927.27

COMMERCE.

Blossom Rock in the track of vessels approaching the city, **71,** 923, 927.

CONTRACTS.

A. W. Von Schmidt, removal of Blossom Rock, to 24′, $75,000, **69,** 485; **70,** 510; **71,** 922.

ENGINEERS.

Chief of Engineers. **R., 66,** iii, 27, 36; **67,** 51; **68,** 73; **69,** 64; **70,** 83; **71,** 98.

In charge. Lt. Col. R. S. Williamson, 1866–71. **R., 66,** iv, 332; **67,** 507; **68,** 471, 473, 485; **70,** 510; **71,** 905, 922.

Assistant. Capt. W. H. Heuer, **71,** 905. **R., 71,** 924.

ESTIMATES. (See Plans and Projects.)

By T. D. Parkinson, C. E., removal of Blossom Rock, $46,080, **66,** iv, 334.

By Lt. Heuer, removal of Blossom Rock, $60,000, **67,** 51, 507; **68,** 885. Removal of the r. by surface blasting to a d. 25′, $300,022, **68,** 885. Removal by drilling and blasting, $56,228, **68,** 885, 886.

By Lt. Col. Alexander, removal of Blossom Rock by means of shaft and tunnels excavated in the r. through the aid of a cofferdam, $41,132, **69,** 490; **71,** 929.

By A. W. Von Schmidt, C. E., entire removal of Blossom Rock to 24′, $75,000, **69,** 485.

OPERATIONS.

1866-67. $3,148.52 expend. on experiments, **67,** 51,507.

1869-70. Rock removed by contract to 22′, **70,** 510.

1870-71. Continuation of contract and completion of the work to required 24′, **70,** 510; **71,** 922, 934, 937.

PHYSICAL CHARACTERISTICS.

General, of, **71,** 923.

Current observations of San Francisco H., **78,** 34, 1304.

PLANS. (See Estimates and Projects.)

By A. W. Von Schmidt, C. E., removal of Blossom Rock by removing the whole inside of the r. by means of a shaft, heavy charges of powder placed in the chambers and exploded simultaneously, **69,** 485, 490.

PROJECTS.

By Lt. Col. Alexander, removal of Blossom Rock by means of a shaft and tunnels and excavation in the r. through the aid of a cofferdam, heavy charges of powder to be placed in chambers, the whole to be simultaneously exploded by electricity and the r. to be subsequently removed by dr.; est., $41,132, **69,** 485, 486; **71,** 926.

R. subsequently removed under the plan of A. W. Von Schmidt for $75,000, **69,** 485, 490; **71,** 932.

SURVEYS.

By T. D. Parkinson, C. E., 1866. **R., 66,** iv, 333.
By Lt. Heuer, 1867, **67,** 51, 507.
By Capt. Heuer, 1871, **71,** 938.

* Allotment. [1] $3,470.32 of this amount turned into Treas., **12,** 2760. [2] Stated in report as $80,000.

Part (c), TT-15 Rincon Rock, San Francisco Harbor, Cal.

APPROPRIATION.
1872, $50,000, **73,** 108.

COMMERCE.
Rincon Rock a dangerous obstr. to navigation, **73,** 1136.

CONTRACT.
1874. J. N. Risdon, removal of Rincon Rock to 24′, for $43,000, **74,** ii, 371. Contract extended, **74,** ii, 371; **75,** 122, ii, 694. Completed by one of the sureties on his bond, **76,** ii, 617; **77,** 992.

ENGINEERS.
Chief of Engineers. **R.,** **73,** 108; **74,** 119; **75,** 122; **76,** ii, 617; **77,** 120.

In charge. Maj. G. H. Mendell, 1873–77. **R.,** **73,** 1133; **74,** ii, 371; **75,** ii, 694; **76,** ii, 617; **77,** 992.

ESTIMATES. (See Projects.)
By board of underwriters, for the removal of Rincon Rock, $65,000, **68,** 73.
By Maj. Mendell, removal of 1,830 c. y. of Rincon Rock, $45,750, **73,** 1139.

LEGISLATION.
Act of Cal., Mar. 26, 1851, fixing a boundary line for the water front of San Francisco, **73,** 1134.

OPERATIONS.
1873-74. Disastrous explosion; 2 lives lost; large amount of property destroyed; **75,** ii, 695; 1,650 c. y. r. removed, **74,** ii, 371.
1874-75. 1,570 c. y. r. removed, **75,** ii, 695.
1875-76. Operations suspended on account of legal injunction, **76,** ii, 617.
1876-77. Work completed by one of the contractor's sureties, 1,128 c. y. r. removed, **77,** 120, 992.

PROJECT.
By Maj. Mendell, removal of Rincon Rock by drilling and blasting; est., $45,750, **73,** 1137; **74,** ii, 371.

SURVEYS.
Rincon Rock included in the Coast Sur. of 1864, **73,** 1133.
By T. D. Parkinson, C. E., 1866, **68,** 73.
By Maj. Mendell, 1873, **73,** 1133.
By Maj. Mendell, 1875, **75,** ii, 695.
By Maj. Mendell, 1877, **77,** 992.

Part (d), TT-15 Noonday Rock, San Francisco Harbor.

APPROPRIATION.[1]
1874, $25,000, **75,** 123, ii, 716.

COMMERCE.
Noonday Rock dangerous to navigation, **75,** ii, 716.

CONTRACT.
With E. Moore, to remove the r. to 47′, $20,000, **75,** ii, 711, 718.

ENGINEERS.
Chief of Engineers. **R.,** **75,** 123.

In charge:
Lt. Col. B. S. Alexander, 1874; **75,** ii, 716.
Lt. Col. C. S. Stewart, 1874. **R.,** **75,** ii, 711, 715, 720, 722.

Assistant. Lt. J. H. Weeden. **R.,** **75,** ii, 715, 721.

ESTIMATES. (See Projects.)
By Lt. Col. Stewart, removal of Noonday Rock, $20,000, **75,** ii, 716. For sur. of rs. in vicinity of Noonday Rock, $1,500, **75,** ii, 722.
By Lt. Weeden, sur. of rs. near Noonday Rock, $10,000, **75,** ii, 723.

OPERATIONS.
1875-76. Noonday Rock removed to 47′ by contract, **75,** ii, 720.

PHYSICAL CHARACTERISTICS.
Noonday Rock a submerged peak, **75,** ii, 716, 717.

PROJECTS. (See Estimates.)
By E. Moore, removal of Noonday Rock by placing a chain around the r. at the required d., and to suspend therefrom explosives (nitroglycerin) to be exploded simultaneously by electricity, **75,** ii, 719, 720.

SURVEYS.
Included in the Coast Sur., 1863, **75,** ii, 716.
By Lt. Weeden, 1874. **R.,** **75,** ii, 715, 721.

Part (e), TT-15 Patrician, San Francisco Harbor. (Removal of the wreck.)

APPROPRIATIONS. [See TT-15(g).]

ENGINEERS.
Chief of Engineers. **R.,** **75,** 123.

In charge. Lt. Col. C. S. Stewart. **R.,** **75,** ii, 710, 712.

Assistant. Lt. J. H. Weeden. **R.,** **75,** ii, 715.

OPERATIONS.
Wreck of the *Patrician* removed by hired labor, **75,** ii, 714.

PROJECT.
By Lt. Col. Stewart, removal of the wreck of the *Patrician*, by blasting, **75,** ii, 715.

[1] Removal of wrecks and rocks in San Francisco H.

Part (f), TT-15 San Francisco Harbor and interior bays.

APPROPRIATION.

1886, $11,000, **87,** 2426.

ENGINEERS.

Chief of Engineers. R., 87, 318; **88,** 291; **89,** 347; **90,** 311, 334; **91,** 389.

Boards:

Convened, San Francisco, Mar. 11, 1890, by S. O. No. 51, to report upon estab. of H. lines in San Francisco H. and adjacent waters. **R., 90,** 2890. (Col. Mendell, Lt Col. Benyaurd, and Maj. Heuer.)

Convened, San Francisco, June 8, 1891, by S. O. No. 51, to report upon the estab. of H. lines for San Francisco H. and adjacent waters. **R., 91,** 2948. (Col. Mendell, Lt. Col. Benyaurd, and Maj. Heuer.)

In charge:

Col. G. H. Mendell, 1887–89. **R., 87,** 2426; **88,** 2108; **90,** 2890; **91,** 2947, 2948.

Maj. W. H. H. Benyaurd, 1889–90. **R., 89,** 2478.

SURVEY.

Au. act Aug. 5, 1886, **87,** 2426; made, 1888, by Col. Mendell, **88,** 2108; **89,** 2478; **90,** 2890.

Part (g), TT-15 San Francisco Harbor, Cal. (Rocks in.)

APPROPRIATIONS.

1892,	$0.22 (claim).
1893,	.35 (claim).
1899,	100,000.00, **99,** 3162.
1900,	170,000.00, **00,** 4217.
1903,	50,000.00, **03,** 2185.
1911,	30,000.00, **11,** 2552.
Total,	350,000.57

COMMERCE.

Navigation interests largely benefited by removal of r., **03,** 582.

Diagram showing C. and app., **12,** 2760.

1911, 21,305,976 t., **12,** 2761.

CONTRACTS.

1899. R. Axman, blasting and removal of Shag Rock., $253,500, **00,** 4218.

1903. Robert Wakefield, removing Blossom Rock, $45,142, **03,** 2185.

1912. Rudolph Axman, r. removal, $23,000, **12,** 2760.

ENGINEERS.

Chief of Engineers. R., 95, 430, 431; **98,** 469; **99,** 554; **00,** 625; **01,** 604; **02,** 527; **03,** 582; **04,** 640; **05,** 646; **08,** 797; **09,** 834; **10,** 910; **11,** 964; **12,** 1150.

In charge:

Col. G. H. Mendell, 1895. **R., 95,** 3251–3260.

Col. C. R. Suter, 1898. **R., 98,** 2923–2925.

Maj. W. H. Heuer, 1899–1905. **R., 99,** 3162; (Lt. Col.) **00,** 4215; **01,** 3411; **02,** 2348; **03,** 2184; (Col.) **04,** 3408; **05,** 2423.

Lt. Col. John Biddle, 1910–11. **R., 10,** 2347; **11,** 2551.

Lt. Col. T. H. Rees, **12,** 1150.

Maj. S. A. Cheney, 1912–. **R., 12,** 2759.

OPERATIONS.

1899–00. Shag Rocks blasted and almost all the broken st. removed, **00,** 4217.

1900–01. Removal of Shag Rock No. 1 and No. 2 completed; work on Arch Rock commenced, 171 holes 10″ in diam. drilled, **01,** 3411.

1901–02. Arch Rock blasted and dr. commenced to remove broken r., **02,** 2348.

1902–03. Removal of Arch Rock completed and work on Blossom Rock commenced, **03,** 2184.

1903–04. Blossom Rock removed to 30′, **04,** 3408.

1911–12. One of Rincon Rocks removed to grade plane, **12,** 2759.

PHYSICAL CHARACTERISTICS.

Description of r. in H.: Fort Point, **95,** 3252; Mile, **95,** 3253; Arch, **95,** 3254; Noonday, **95,** 3255; Blossom, **95,** 3256; **98,** 2925; **03,** 2185; Mission, **95,** 3257; **98,** 2925; Shag, **95,** 3258; **98,** 2925; Anita, **95,** 3259; **98,** 2924; Brothers, **95,** 3260.

PROJECTS.

In 1897 Col. Suter est. $503,040 to remove Arch Rocks, **98,** 2924; $253,080 to remove Anita Rocks, **98,** 2924; $135,580 to remove Shag Rocks, **98,** 2925; $92,600 to remove Blossom Rocks, **98,** 2925; $122,000 to remove Mission Rocks, **98,** 2926.

Congress, 1899, app. for the removal of Arch and Shag Rocks No. 1 and No. 2, to 30′ m. l. w., **99,** 3162; **00,** 4215.

Act Mar. 3, 1903, au. $50,000 for removal of Blossom Rock, **03,** 2184.

Act June 25, 1910, revises proj. of 1899, to include removal of Centissima Rock, Bonita Chan., to 40′, m. l. w.; est., $110,000; also removal of 2 rs. near Mail Dock to 35′ below l. w.; est., $60,000, **10,** 911.

SURVEYS.

Ex. of Fort Point, Mile, and Arch Rocks au. act Aug. 17, 1894; made by Col. Mendell (**R.** unfav.), **95,** 3251–3253.

Ex. of Noonday, Mission, Blossom, Shag, and Anita Rocks au. act Aug. 17, 1894; made by Col. Mendell (**R.** fav.), **95,** 3254–3260.

Surs. of Arch, Mission, Blossom, Shag, and Anita Rocks au. act of June 3, 1896; made by Col. Suter, **98,** 2924–2925.

Act Mar. 2, 1907, au. ex. and sur., with view to removal of Mission B. Rocks, Packard Rocks, Whitney Rocks, Fifteen-foot Rock, Invincible Rocks, Noonday Rocks, Anita Rocks, Centissima and Sears Rocks, and rs. near Mail Dock in Bonita Chan., **08,** 797. **R.** by Lt. Col. Biddle, 1907 and 1908; est., $170,000 (H. D. 1119, 60th, 2d), **09,** 834.

Maps. (H. D. 1119, 60th, 2d.) Shag Rock No. 1, and photograph of explosion, **00,** 4218.

Arch Rock (progress sheet), **01,** 3412.

Shag Rocks (photographs), **01,** 3412.

TT-16 ISLAIS RIVER (or Creek) (San Francisco Bay), CAL.

ENGINEERS.

Chief of Engineers. R., 85, 2340; **08,** 797.

In charge:

Lt. Col. G. H. Mendell. **R., 85,** 2340.

Maj. W. W. Harts, **07,** 740,

Lt. Col. John Biddle, **08,** 786.

OBSTRUCTIONS.

In 1884, br. obstr. navigation, **85,** 2341.

SURVEY.

Ex. au. act July 5, 1884; made by Col. Mendell (**R.** unfav.), **85,** 2340.

Pre. ex. au. act Mar. 2, 1907. **R.,** Maj. W. W. Harts, Apr. 25, 1907 (unfav.) (H. D. 77, 60th, 1st), **08,** 797.

TT-17(a) SOUTH SAN FRANCISCO HARBOR, CAL.

COMMERCE.

Description of; 432 carloads per year; tonnage by water could not be ascertained, **00,** 4249.

ENGINEERS.

Chief of Engineers. **R., 00,** 633.

In charge. Lt. Col. W. H. Heuer, 1899. **R., 00,** 4248.

PHYSICAL CHARACTERISTICS.

Description of; situated in San Francisco B., about 11 m. from San Francisco. No H. in existence, **00,** 4248.

PRIVATE WORK.

Description of canal built by land company about 1891. Canal wholly silted up, 1900, **00,** 4249.

SURVEY.

Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Heuer (**R.** unfav.), **00,** 4248.

TT-17(b) TWELVEMILE CREEK, SAN FRANCISCO BAY, CAL.

COMMERCE.

Description of; none, **93,** 3236.

ENGINEERS.

Chief of Engineers. **R., 93,** 425.

In charge. Lt. Col. W. H. H. Benyaurd, 1893. **R., 93,** 3235.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3236.

Navigable at high tide for about 2 m.; at low tide slough is bare, **93,** 3236.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Lt. Col. Benyaurd (**R.** unfav.), **93,** 3235.

TT-18 SAN MATEO RIVER, CAL.

ENGINEERS.

Chief of Engineers. **R., 85,** 360.

In charge. Lt. Col. G. H. Mendell. **R., 85,** 2342.

OBSTRUCTIONS.

R. closed by a dam, **85,** 2343.

SURVEY.

Ex. au. act July 5, 1884; made by Lt. Col. Mendell (**R.** unfav.), **85,** 2342.

TT-36 ALVISO CREEK, HARBOR, RIVER, AND SLOUGH, CAL.

APPROPRIATIONS.

1899, $48,000, **99,** 3162.
1904, [1] 10,000, **04,** 3406.

Total, [2] 58,000

COMMERCE.

Description of, **93,** 3238; **97,** 3333.

Carried on by 1 stern-wheel steamer and occasionally lumber schooners; an. tonnage, 27,000, **01,** 604, 3411; very little since 1901, **03,** 580; **05,** 644.

CONTRACTS.

1899. E. V. McCann, dr., 6¢ c. y. ($12,402), expired by limitation, **00,** 4214.

1900. A. C. Aiken, dr., 14.48¢ c. y. ($29,930.16), **00,** 4214.

1900. A. C. Aiken, dr., 14.48¢ c. y., **01,** 604, 3410.

1904-05. Marshall C. Harris, dr., 17¢ c. y., p. m. for material removed from slough, and 35¢ c. y. for removal of hardpan from turning-basin, **05,** 2422.

ENGINEERS.

Chief of Engineers. **R., 91,** 393; **93,** 425; **97,** 488; **99,** 554; **00,** 624; **01,** 603; **02,** 525; **03,** 580; **04,** 637; **05,** 644.

In charge:

Lt. Col. W. H. H. Benyaurd, 1891–93. **R., 91,** 2964; **93,** 3236.

Maj. C. E. L. B. Davis, 1897. **R., 97,** 3343.

Maj. W. H. Heuer, 1899–1905. **R., 99,** 3161; (Lt. Col.) **00,** 4213; **01,** 3410; **02,** 2347; **03,** 2181; **04,** 3406; **05,** 2421.

Assistant. F. C. Turner. **R., 97,** 3346.

LEGAL PROCEEDINGS.

Amount of McCann bond, $10,000, given by U. S. Fidelity & Guaranty Co. turned over to Dept. of Justice, **02,** 525.

OPERATIONS.

1900-01. Work on proj. as au. by Congress completed; chan. 7 x 60′ obtained, 166,263 c. y. removed, **01,** 604, 3410.

1904-05. 134,960 c. y., p. m., dr. from chan., and 6,954 c. y. removed from turning-basin, **05,** 2421. Chan. 70 to 100′ w., 7 to 8′ d. l. w., l. 27,900′ Turning-basin 7′ x 150 x 220′ l. w.; not considered worthy of further imp. on account of small amount of C., **05,** 2422.

[1] From surety of failing contractor, McCann, **04,** 637. (See Legal proceedings.)
[2] $3,706.03 of this covered into surplus fund.

PHYSICAL CHARACTERISTICS.

Details of, **91,** 2964; **93,** 3237; **97,** 3345.

Creek at upper end of San Francisco B.; formerly known as Steamboat Slough; in 1892, from Alviso to the mouth of the slough, 3½ m., there was a good, navigable chan., **93,** 3237.

Max. draft, 1903, l. w., 4′; range of tide, from 7 to 11′, **03,** 580.

Filling from old Guadaloupe R., **04,** 638.

PROJECT.

By Maj. Davis, 1896, dr. chan. with least d. of 7′ and a least w. of 60′; est., $47,855, **97,** 3344; **99,** 3162.

Because of filling, etc., further work on proj. deferred, **04,** 638.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890; Lt. Col. Benyaurd's **R.** unfav., **91,** 2964.

Ex. au. act July 13, 1892; Lt. Col. Benyaurd's **R.** unfav., **93,** 3237.

Sur. au. act June 3, 1896; Maj. Davis's **R.** unfav., **97,** 3343.

Of H., showed addl. filling of over 20,000 c. y. since 1902, **04,** 638.

TT-52 ALAMEDA CREEK, CAL.

ENGINEERS.

Chief of Engineers. **R., 84,** 334.

In charge. Lt. Col. G. H. Mendell. **R., 84,** 2207.

Assistant. Lt. C. F. Palfrey. **R., 84,** 2207.

SURVEY.

Au. act Aug. 2, 1882; made by Col. Mendell, 1882 (**R.** unfav.), **84,** 2207.

TT-57 OAKLAND HARBOR, SAN FRANCISCO BAY, CAL.

APPROPRIATIONS.

1874,	$100,000,	**75,** 122.
1875,	100,000,	**75,** 122.
1876,	75,000,	**76,** ii, 615.
1878,	80,000,	**78,** 135.
1879,	60,000,	**79,** 178, 1744.
1880,	60,000,	**80,** 2231.
1881,	60,000,	**81,** 2464.
1882,	200,000,	**82,** 2529.
1884,	139,600,	**84,** 2179.
1886,	60,000,	**86,** 1910.
1888,	350,000,	**88,** 2107.
1890,	250,000,	**90,** 2889.
1892,	150,000,	**92,** 2619.
1894,	100,000,	**95,** 3249.
1896,	20,000,	**96,** 3175.
1897,	200,000,	**97,** 3330.
1898,	133,000,	**98,** 2936.
1899,	133,000,	**99,** 3164.
1900,	180,000,	**00,** 4220.
1902,	100,000,	**02,** 2351.
1903,	131,000,	**03,** 2188.
1904,	19,000,	**04,** 3410.
1905,	100,000,	**05,** 2426.
1906,	81,000,	**06,** 1965.
1907	68,203 / 23,000	**07,** 2142.
1908,	190,000,	**08,** 2221.
1909	15,000 / 256,000	**09,** 2188.
1910,	250,000,	**10,** 2351.
1911,	150,000,	**11,** 2556.
1912,	130,000,	**12,** 2763.

Total, 3,963,803 (incl. misc., $3,964,151.75, **12,** 2763).

COMMERCE.

Benefits of the imp. to, **74,** ii, 382.

Increase of C., **76,** ii, 612, 613; **77,** 985; **78,** 134, 1284, 1285, 1288.

An. C. passing through js., 1874 to 1891, **92,** 2619.

Description of, **93,** 3220.

In 1892–93 freight by ferry had decreased, and increased by other craft, **93,** 3220.

Enormous increase since beginning of imp., **01,** 3436.

72% overland RR. freight trans. on ferryboats drawing 12′, **06,** 722.

No effect on rates, **07,** 742; **12,** 2764.

Diagram, freight, app., and values, **11,** 2556.

1911, 3,800,000 t., **12,** 2764.

CONTRACTS.

1874. D. Sweeney, 98½¢ t., **75,** ii, 689, 691. Failed to fulfill contract, **75,** ii, 689.

1875. Agreement made with H. F. Williams to furnish st., $1.19 per t., **75,** ii, 690.

1876. R. P. Kelly, st., $1.19 t., **76,** ii, 612. R. P. Kelly, removal of old cribs, **76,** ii, 612. J. A. Ball, dr., 24¢ c. y., **76,** ii, 612. Annulled, **77,** 985.

1877. Western Development Co., dr., 35¢ c. y., **77,** 985, 986. Tilford & Terkelson, st., $1.19 t., **77,** 986.

1880. D. Jordan, j. constr., **81,** 2464.

1881. J. Hackett, dr., 33 and 38¢ c. y., **81,** 2464. Hancock & Kelso, j. constr., **82,** 2530.

1882. Lorenz & J. Terkelson, st., **82,** 2530. A. W. Von Schmidt, dr., 19½¢ c. y., **83,** 1963.

1884. E. W. Emerson, j. constr., **84,** 2180. T. Williams, dr., 43¢ c. y., **85,** 2330. E. J. Lukens, dr., 12¢ c. y., **85,** 2330.

1886. Von Schmidt & McNee, dr., 16¢ c. y., **87,** 2423.

1888. San Francisco Bridge Co., furnishing st., $1.48 t., and laying up st. masonry, 10¢ s. f., **89,** 2471. San Francisco Bridge Co., dr. tidal-basin, 14.7¢, and tidal canal, c. y., **89,** 2471.

1891. Pacific Coast Dredging & Reclamation Co., dr., 14½¢ c. y., **91,** 2946. A. Boschke, dr., 9¾¢ c. y., **91,** 2946. G. Stone, st., $1.52 t., and dry masonry, 11½¢ s. f., **91,** 2946. Ransome & Cushing, concrete br.-p. constr., $4.90 c. y. for concrete and $1.70 c. y. for excavation, **91,** 2946. King Iron Bridge & Manufacturing Co., steel highway drawbr. constr., $31,260, **91,** 2947. San Francisco Bridge Co., dr., 31⅜ ¢ c. y., **92,** 2620.

1892. P. O'Neil, furnishing 20,000 t. st. from U. S. quarries, 83¢ t.; laying 60,000 s. f. masonry, 12¢ s. f., **93,** 3218. J. Hackett, dr. 450,000 c. y., 12 and 40¢ c. y., **93,** 3218.

1894. San Francisco Bridge Co., dr., 19.9 and 37¢ c. y. ($96,073), **95,** 3250.

1898. Same firm, 13 and 47¢ c. y. ($101,500), **98,** 2936.

1899. California Construction Co., drawbr., $24,747, **00,** 4220.

1900. Clark & Henry, diverting chan. of Sausal Cr., $53,748. D. Laydon, drawbr., $53, 759. **00,** 4220.

1900. C. E. Cotton, repaving Park St. Br., $2,357, **01,** 3415.

1901. Atlantic, Gulf & Pacific Co., dr., 19.74¢ c. y., **01,** 3415.

1902. H. Krusi, dr., 10¢ c. y., **02,** 2351. Warren H. Pomeroy, dr., 8.44¢ c. y., **03,** 2188.
1905. Marshall C. Harris, dr., 10.5¢ c. y., **06,** 1965.
1908. San Francisco Bridge Co., dr., 18.8¢ c. y., **08,** 2221.
1909. N. R. Harris, dr., 29.7¢ c. y., **09,** 2189. Mervy-Elwell Co., repairing br., unit prices given; total cost, $8,905.95, **10,** 2352.
1910. San Francisco Bridge Co., dr. about 1,289,200 c. y., 11.4¢ c. y.; Frederick C. Roberts & Co., placing 3 drawbrs. across Tidal Canal in satisfactory condition for operation, $16,100, **11,** 2557.
1911. N. R. Harris, dr. ($135,000), 14¢ c. y., **12,** 2764.

ENGINEERS.

Chief of Engineers. R., 74, 119; **75,** 121; **76,** 112; **77,** 119; **78,** 134; **79,** 177; **80,** 234; **81,** 320; **82,** 314; **83,** 326; **84,** 330; **85,** 357; **86,** 350; **87,** 317; **88,** 290; **89,** 344; **90,** 310; **91,** 388; **92,** 365; **93,** 419; **94,** 392; **95,** 429; **96,** 384; **97,** 484; **98,** 473; **99,** 554; **00,** 626, 634; **01,** 605, 613, 3434; **02,** 527; **03,** 582; **04,** 640; **05,** 646; **06,** 720; **07,** 740; **08,** 786; **09,** 822; **10,** 913, 926; **11,** 968; **12,** 1153.

Boards. Convened, San Francisco, Mar. 24, 1873, for making ex. of San Antonio Creek, Cal. (Oakland H.), recom. (1) constr. of 2 submerged training walls, with dr. chan. bet., est., $479,094; (2) excavation of canal bet. San Antonio Estuary and San Leandro B.; (3) constr. of dam at mouth of San Leandro B.; (4) excavation of tidal basin. **R., 74,** ii, 378. Est. cost of items 2, 3, and 4, $1,335,435.20, **74,** ii, 383. (Lt. Cols. C. S. Stewart and B. S. Alexander, and Maj. Mendell.)

In charge:
Maj. G. H. Mendell, 1875–95. **R., 75,** ii, 689; **76,** ii, 611; **77,** 985; **78,** 1283; **79,** 1741; (Col.) **80,** 2229; **81,** 2461; **82,** 2527; **83,** 1961; **84,** 2177, 2183, 2185; **85,** 2327; **86,** 1907; **87,** 2420; **88,** 2105; **90,** 2886; **91,** 2943; **92,** 2617; **93,** 3217; **94,** 2501; **95,** 3247.
Maj. W. H. H. Benyaurd, 1889. **R., 89,** 2468.
Col. Chas. R. Suter, 1896–97. **R., 96,** 3173; **97,** 3327.
Maj. W. H. Heuer, 1898–1906. **R., 98,** 2935; **99,** 3163; (Lt. Col.) **00,** 4218; **01,** 3413, 3435, 3445; **02,** 2349; **03,** 2186; (Col.) **04,** 3409; **05,** 2424; **06,** 1964.
Lt. Col. John Biddle, 1907–11. **R., 07,** 2141; **08,** 2217; **09,** 2185; **10,** 2350; (Col.) **11,** 2554.
Maj. S. A. Cheney, 1912–. **R., 12,** 2762.

Assistant. L. J. Leconte, **76,** ii, 614. **R., 78,** 1287; **79,** 1744; **83,** 1963; **84,** 2180; **85,** 2330; **01,** 3439.

ESTIMATES. (See Projects.)
BE., for 2 training walls, $479,094; for canal, dam, and tidal basin, $1,335,435.20, **74,** ii, 383.

LEGAL PROCEEDINGS.
Opinion of Atty. Gen. as to rights of U. S., **81,** 2462.

LEGISLATION.
Provision of act of Mar. 3, 1879, requiring release to title of certain lands, **80,** 2229.
Release from building br. at Washington Ave., secured by payment of $50,000 to Central Pacific Ry. Co., **01,** 605.
U. S. district atty. decided U. S. had no title to land purchased, 1882, from A. A. Cohen; land condemned and purchased again, **03,** 2186.

OBSTRUCTIONS.
Complaint made, 1895–96, that drawbrs. crossing H. at Webster and Alice Sts. were obstr. navigation, and Sec. of War after public hearing ordered brs. should be reconstr. with draws of 150′ clear span, to be operated by other than hand power, **96,** 3175.
New county br. opened, and old Alice St. RR. br. removed, **00,** 4219.

OPERATIONS.
1875-76. 9,400 l. f. n. training wall and 10,807 l. f. s. training wall built, 12,451 c. y. dr., **76,** 112, ii, 612.
1876-77. 400 l. f. s. training wall built, 196,465 c. y. dr., **77,** 986.
1877-78. 540 l. f. n. training wall and 960 l. f. s. training wall built, 13,420 c. y. dr., **78,** 134, 1285, 1288.
1879-80. No operations in consequence of failure to close negotiations with Oakland Water Front Co., **80,** 2229.
1880-81. 33,900 t. st. delivered in work, raising n. wall to h. w. mark for 5,700′ and s. wall to 5′ above l. w. for 9,300′; 42,300 c. y. dr. from chan., **81,** 2462.
1881-82. 46,552 t. st. delivered in js.; 243,735 c. y. dr. from chan., **82,** 2529.
1882-83. 32,351 t. st. delivered in js.; 92,055 c. y. excavated from channelway and tidal basin, **83,** 1965.
1883-84. 12,586 t. st. delivered and placed in j.; 503,223 c. y. dr. from channelway and tidal basin, **84,** 2178.
1884-85. 16,685 t. st. delivered in js.; 59,089 c. y. dr. from ship chan. and 30,047 c. y. from tidal basin, **85,** 2331.
1885-86. 698,312 c. y. dr. from tidal basin, **86,** 1909.
1886-87. 322,882 c. y. dr., **87,** 2420.
1888-89. 126,548 c. y. dr. from tidal basin; 96,530 c. y. excavated from tidal canal; 116,748 c. y. dr. from j. chan.; 3,954 t. st. delivered on s. j.; 15,489 s. f. dry masonry laid, **89,** 345, 2469.
1889-90. 495,387 c. y. dr. from tidal basin; 5,446 t. st. placed in js.; 25,197 s. f. dry masonry laid and 450,000 c. y. excavated from tidal canal, **90,** 310, 2887.
1890-91. 250,820 c. y. dr. from e. end of canal; 3,552 t. of rubblest. delivered upon n. j., and 30,101 s. f. of masonry laid, **91,** 2944.
1891-92. 9,815 t. st. delivered upon n. j. and 31,528 s. f. of masonry laid; constr. of concrete br. ps. and highway br. completed; 142,088 c. y. dr., **92,** 2618.
1892-93. 418,733 c. y., p. m., dr.; 20,684 s. f. masonry laid on s. j.; tide water admitted to canal in front of town of Alameda, and 30,078 s. f. canal revetted with st. laid 12″ thick, **93,** 3217, 3218.
1893-94. 28,206 s. f. masonry laid on s. j.; 144,854 c. y., p. m., dr., **94,** 2502. 1,410 t. of st. placed in s. j., **94,** 2503.
1894-95. 350,017 c. y., p. m., dr., **95,** 3248.
1895-96. 174,480 c. y., p. m., dr., **96,** 3174.
1896-97. Floor of Park St. Br. renewed, **97,** 3328.
1898-99. 647,715 c. y. dr. and placed behind s. j. in inclosure built by Southern Pacific Co., **99,** 3163.
1899-00. High St. and Fruitvale Ave. Brs. under constr., and diversion of chan. of Sausal Creek under way, **00,** 4219.
1900-01. High St. and Fruitvale Ave. Brs., and Sausal Creek Chan. completed; Park St. Br. refloored, **01,** 3413.
1901-02. 1,100,861 c. y. dr. from tidal canal; 31,733 c. y. dr. from San Leandro B., **01,** 2350.
1902-03. 198,000 c. y. dr. from j. chan.; 336,535 c. y. dr. from tidal canal, **03,** 2187.
1903-04. 1,376,239 c. y. dr., **04,** 3410.
1904-05. 1,192,331 c. y. dr.; small repairs made to bulkhead and Fruitvale Ave. Br.; borings made, **05,** 2424.
1905-06. 708,317 c. y. dr.; Fruitvale Ave. Br. and small washout at High St. Br. repaired, **06,** 1964.
1906-07. 674,977 c. y. dr., **07,** 2141.
1907-08. 658,848 c. y. dr., **08,** 2217.
1908-09. 1,301,725 c. y. dr., **09,** 2185. High St. Br. damaged by fire, **09,** 2188.
1909-10. 870,976 c. y. dr.; High St. Br. repaired, **10,** 2350.
1910-11. 561,778 c. y. dr.; in addition 125,400 c. y. allowed for overdepth; repairs to 3 U. S. brs. across tidal canal begun; 6 systems of automatically operated highway gates installed with equipment; machinery overhauled, cleaned, and put in good order; electrical machinery control house installed on each br.; flooring of Fruitvale Ave. Br. patched

and renewed; reflooring of Park St. Br. in progress, **11,** 2554–2555.

1911-12. 744,991 c. y. dr., d. the 25′ chan. to 30′, and extending 30′ contour in San Francisco B. to Webster St. Drawbr.; 3 drawbrs. across tidal canal placed in good working order, and after their completion custody tendered to au. of Alameda Co., in accordance with act of June 25, 1910, but they declined acceptance until pile dolphins had been placed to protect draw spans and abutments (U. S. not obliged to do this work); 391,130 c. y. dr. from along s. side of Oakland Chan., **12,** 2762–2763.

PHYSICAL CHARACTERISTICS.

General, of Oakland H., **74,** ii, 380; **96,** 3173.

Description of, **01,** 3435, 3446.

Difficult dr. caused by hard sandst. foundation of H. bottom, **04,** 3410.

Shoaling in main ship chan., in chans. around tidal basin, and in chan. e. and w. of Webster St. Drawbr., **11,** 2555.

PRIVATE (CITY AND CORPORATE) WORK.

By city of Oakland, 2 lines of cribs, each 500′ or 600′ l., and filled with st. Subsequently partly removed to make place for js., **76,** ii, 612.

In 1896 Sec. of War ordered Southern Pacific Co. to build new RR. br. at Harrison St.; work in progress, 1898. Alameda Co. authorities commenced in 1898 the work of reconstr. Webster St. Br., **98,** 2936.

PROJECTS. (See Estimates.)

By BE., 1874, ship-chan. entrance 18′ to 20′ d. l. w. by constr. of 2 training walls extending from shore to d. w. in San Francisco B., formation of a tidal basin at head of H., and connection by a canal of the Oakland Estuary with that of San Leandro for purpose of increasing tidal basin; est., $1,814,529, **74,** ii, 382, 383.

Subsequent development of Oakland C. necessitated excavation of chan. bet. the js., and an extension of the d.-w. chan. along water front of Oakland. W. of Oakland Estuary and the San Leandro Canal also increased 300′ to 400′, **86,** 1907, 1908. In 1887 Col. Mendell est. $1,590,074 as amount required for completion of revised proj., **87,** 2422.

By Col. Suter, 1896, leaving out of the existing proj. constr. of canal to San Leandro B., thereby reducing est. cost of whole proj. by $512,000, **97,** 3328.

Letters concerning proposed imp. from John L. Howard, Balfour, Guthrie & Co., Oakland Board of Trade, E. C. Sessions, and Edson F. Adams, **01,** 3441–3444.

By Col. Heuer, 1900, imp. by extending s. j. 550′ and dr. from San Francisco B. up to and around tidal basin; 3 alternate ests. submitted for w. of 300′ and 500′ and d. varying from 12′ to 25′—No. 1, $646,293; No. 2, $1,687,818; No. 3, $968,203 (H. D. 262, 56th, 2d), **01,** 3448. Congress not having specified which plan it approv., Col. Heuer recom., 1902, that app. be expended on work common to the 3 plans, **03,** 2187. Act Mar. 3, 1905, approv. plan No. 3; est., $968,203, calling for chan. from San Francisco B. to Chestnut St., Oakland, 25′ x 500′; thence 300′ w., 25′ d., to Fallon St., and 17′ d. up to and 12′ d. around tidal basin, **05,** 647. Act Mar. 2, 1907, au. proj. (No. 3) as recom. by BERH., but extended as follows: Extending s. j. 500′, w. chan. up to Fallon St. to 500′, d. chan. up to tidal basin to 25′, and around tidal basin to tidal canal and along Alameda to 10th St. to 17′; est. addl. cost, $500,000, **07,** 741; **08,** 2218.

Building of dr. recom., **09,** 2187.

Lt. Col. Biddle recom., 1908, that br. over tidal canal be turned over to local authorities on account of demand for more water front, **08,** 2220.

Act June 25, 1909, au. turning over brs., also for installing electric operating machinery; est., $17,-150, **10,** 2350.

By Col. Biddle, 1909, for securing chan. 30′ x 500′ B. to tidal basin, 25′ x 300′ around tidal basin, and 18′ d. in tidal canal; est., $1,100,000, and $25,000 an. mainten.; 30′ chan. to drawbr. ($600,000) to be constr. first, and remainder as C. demands (H. D. 647, 61st, 2d), **10,** 915, 926. This is the "present" proj. and is au. by act June 25, 1910.

Act Feb. 27, 1911, made a provision that, should the bids for dr. be unreasonable, so much of the app. of $150,000 as may be necessary may be expended for purchase or constr. of a suitable dr. plant, **11,** 969.

SURVEYS.

Sur. of entrance to San Leandro B. and a line for a tidal canal, 1874, **74,** ii, 378.

By L. J. Leconte, 1878, **78,** 1287, 1288.

Hydrographic sur. of entrance and vicinity, **81,** 2462.

Ex. of chan. bet. js. and in front of Oakland, **81,** 2462.

Hydrographic sur. of entrance, **82,** 2529.

Hydrographic surs. made, 1892–94, by Col. Mendell, **93,** 3218; **94,** 2501; **95,** 3248.

Surs. made, 1895–96, by Col. Suter, **96,** 3174; and, 1897–98, by Maj. Heuer, **98,** 2936.

Au. act June 6, 1900; made, 1900, by Col. Heuer (H. D. 262, 56th, 2d), **01,** 3434.

R. by BERH., Jan. 11, 1907, in pursuance with R. and H. Com.'s request for information as to which projs. should be changed or eliminated from present undertakings. Board is of opinion that all work included in adopted projs. be completed, and any amounts still required be provided. (R. and H. Com. D. 9, 59th, 2d.)

Au. act Mar. 3, 1909; made, 1909, by Col. Biddle (H. D. 647, 61st, 2d), **10,** 926.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1154.

Maps. **96,** 3176; **11,** 2556.

TT-82 SUISUN CREEK (or Channel), CAL.

APPROPRIATION.

1910, $12,500, **10,** 2353.

COMMERCE.

Description of, **95,** 3284; **97,** 3342; **00,** 4252.

In 1894 not important, **95,** 3284.

Up to 1896 the competition of the RRs. made it difficult for sailing vessels to compete, **97,** 3343.

In 1899 average an. shipments to Suisun and from there was 16,000 t., **00,** 4252.

Increasing, **10,** 917.

In 1911, 83,444 t., **12,** 1158.

CONTRACTS.

1912. N. R. Harris, dr. cut-off, 4.49¢ c. y., **12,** 2766.

ENGINEERS.

Chief of Engineers. **R., 95,** 435; **97,** 488; **00,** 633; **08,** 797; **09,** 834; **10,** 917; **11,** 972; **12,** 1157.

In charge:

Lt. Col. W. H. H. Benyaurd, 1895. **R., 95,** 3283.

Maj. C. E. L. B. Davis, 1897. **R., 97,** 3341.

Lt. Col. W. H. Heuer, 1899–1900. **R., 00,** 4250.

Lt. Col. John Biddle, 1909–11. **R., 10,** 2353; (Col.) **11,** 2558.

Lt. Col. T. H. Rees, **12,** 1157.

Maj. S. A. Cheney, 1911–. **R., 12,** 2763.

Assistant. Lt. C. L. Potter. **R., 95,** 3284.

LEGAL PROCEEDINGS.

Title to land secured by U. S., **12,** 2765.

OPERATIONS.

1911-12. 8,000 c. y. dr., **12,** 2765.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 3341; **00,** 4251.

A tidal inlet from Suisun B., 18 m. l., **95,** 3284.

PROJECTS.

Act June 25, 1910, au. H. 6′ x 150′ x 1,400′, a cut-off 80′ x 3,000′ on bottom, and 6′ d. from the basin to Peytonia Slough; est., $25,000, and $2,000 an. mainten.; land required to be deeded free to U. S., **10,** 917.

SURVEYS.

Ex. au. act Aug. 17, 1894; made by Lt. Col. Benyaurd (**R.** unfav.), **95,** 3283.

Ex. au. act June 3, 1896; made by Maj. Davis (**R.** fav. for sur.), **97,** 3341.

Ex. au. act Mar. 3, 1899; made by Lt. Col. Heuer, 1899 (**R.** unfav.), **00,** 4250.

Ex. and sur. au. act Mar. 2, 1907. **R.** by Lt. Col. Biddle, Mar. 18 and Aug. 24, 1908; est., $25.000 (H. D. 1110, 60th, 2d), **09,** 834.

Maps. (H. D. 1110, 60th, 2d.)

TT-104 SAN PABLO BAY, CAL.

APPROPRIATIONS.

1902,	$100,000.00,	**02,** 528.
1903,	200,000.00,	**03,** 2190.
1906,	53,168.41,	**06,** 1967.
1911,	400,000.00,	**11,** 2557.
1912,	122,000.00,	**12,** 2765.
Total,	875,168.41	

COMMERCE.

Great, **00,** 4259.

No effect on rates, **06,** 723.

Benefits to C. of Carquines Straits and Port Costa, and to vessels going to and from Mare Isld. Navy Yard, **07,** 2144.

CONTRACTS.

1902. Rudolf Axman, dr., 11.44¢ c. y., **03,** 2189–2190. Annulled, **04,** 3412.

1904. North American Dredging Co., dr., 2,285,000 c. y., 14.48¢ c. y., **05,** 2427.

1911. San Francisco Bridge Co., dr., 2,506,000 c. y., 18 ⅞¢ c. y., **12,** 2765.

ENGINEERS.

Chief of Engineers. R., 00, 634; **02,** 527; **03,** 583; **04,** 641; **05,** 648; **06,** 722; **07,** 742; **08,** 789; **09,** 825; **10,** 916; **11,** 971; **12,** 1156.

Boards. Joint Army and Navy Board appointed, June 8, 1908, to consider approach from San Francisco B. to Mare Isld. Navy Yard; submitted proj. for chan. through San Pablo B. 30′ x 500′, to be made in connection with imp. of Mare Isld. Strait, **08,** 789.

In charge:

Lt. Col. W. H. Heuer, 1899–1906. **R., 00,** 4259; **03,** 2189; (Col.) **04,** 3411; **05,** 2426; **06,** 1966.

Maj. W. W. Harts, **07,** 740.

Lt. Col. John Biddle, 1907–11. **R., 07,** 2143; **08,** 2222; **09,** 2189; **10,** 2352; (Col.) **11,** 2557.

Brig. Gen. C. E. L. B. Davis (retired), U. S. agent, **11,** 964.

Maj. S. A. Cheney, 1912–. **R., 12,** 2764.

OPERATIONS.

1902–03. 97,629 c. y. dr., **03,** 2189.

1903–04. Total dr. to end of fiscal year, 1904, 196,000 c. y., **04,** 3412.

1904–05. 1,110,176 c. y. dr., **05,** 2427.

1905–06. 1,067,101 c. y. dr., completing chan., **06,** 1966.

1911–12. 561,195 c. y. dr., **12,** 2764.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 4259.

Shoaling of completed chan., **07,** 2143; **09,** 2189; **10,** 2352.

Sur., 1910, showed chan. totally obliterated, but general d. over shoal 2′ or 3′ greater than prior to dr., **11,** 972.

PROJECTS.

Maj. Heuer est., 1899, $381,000 to obtain imp. desired by act 1899, and also $16,000 an. for mainten., **00,** 4262.

Act. June 13, 1902, au. proj. for constr. chan. bet. Strait of Carquines and the Golden Gate, off Pt. Pinole, Pt. Wilson, and Lone Tree Pt., 30′ d. x 300′ (H. D. 89, 56th, 1st), **02,** 528.

Lt. Col. Biddle est., 1910, shoaling in excavated chan. since completion, 1906, amounted to 1½ million c. y. Est. cost to restore chan., $217,500. Regards locality worthy of further imp., but not along lines of orig. proj. on account of speedy and extensive deterioration. Invites attention to **R.** of June 8, 1908, of Joint Army and Navy Board, submitting proj. for chan. through San Pablo B. to Mare Isld. Navy Yard, 30′ d. x 500′, **10,** 2352.

Act Feb. 27, 1911, au. proj. for imp. of chan. over Pinole Shoal in accordance with plan for chan. 30′ x 500′; est., $510,000 first cost; for constr. and operation of dr. plant, $250,000, and $100,000 an. mainten. (H. D. 1103, 60th, 2d), **11,** 972.

SURVEYS.

Ex. and sur. of Pt. Pinole, Pt. Wilson, and Lone Tree Pt. for chan. 30′ x 300′, au. act Mar. 3, 1899. **R.** fav., submitted, 1899, by Maj. Heuer. **00,** 4258.

Maps. (H. D. 1103, 60th, 2d.)

TT-105 MARE ISLAND STRAIT, CAL.

COMMERCE.

Mare Isld. Navy Yard requires unobstr. access for all classes of vessels, **97,** 3353.

ENGINEERS.

Chief of Engineers. R., 97, 488.

In charge. Maj. C. E. L. B. Davis, 1896–97. **R., 97,** 3352.

PHYSICAL CHARACTERISTICS.

Description of, **97,** 3354.

PROJECTS.

In 1896 Maj. Davis est. $318,950 to imp. the strait as recom. by the Sec. of Navy, **97,** 3352.

SURVEYS.

Sur. au. act of June 3, 1896; made, 1896, by Maj. Davis (see Projects), **97,** 3352.

TT-106 NAPA RIVER, CAL.

APPROPRIATIONS.

1888, $7,500.00, **88,** 290.
1890, 10,000.00, **90,** 2886.
1894, 4,000.00, **95,** 3264.
1896, 4,000.00, **96,** 3178.
1902, *3,000.00, **03,** 2199.
1904, *4,429.36, **05,** 2438; **06,** 1971.
1905, *1,000.00, **05,** 2438.
1907, 8,000.00, **07,** 2149.
1909, *[1]5,000.00, **09,** 2195.
1910, 5,000.00, **10,** 2363.
1911, 4,000.00, **11,** 2566.
1912, 3,000.00, **12,** 2768.

Total, 58,929.36 (incl. misc. rects. and less $2,000 withdrawn, $56,973.81, **12,** 2768).

COMMERCE.

Description of, **96,** 3178.

In 1894 the importance of Mare Isld. Navy Yard warranted an imp. of the strait to allow access to it by all kinds of craft, **95,** 3286.

In 1895, 56,773 t. of freight, a slight decrease from the amount of the preceding year, **96,** 3178.

Rates reasonable, due to mainten. of navigation, **10,** 923.

1911, 207,709 t., **12,** 1160.

CONTRACTS.

1888. San Francisco Bridge Co., removal of snags and gravel, $3,900, **89,** 2468.

1891. T. H. Williams, dr. and snag removal, $8,035, **91,** 2952.

1895. E. Williams, dr., 29¢ c. y., **95,** 3264.

1899. Golden Gate Dr. & Reclamation Co., dr., 12.45¢ c. y. ($2,054.25), **00,** 4235.

1900. Willis G. Witter and Marshall C. Harris, dr., 12.45¢ c. y., **01,** 3428.

1904. Pacific Reclamation Co., dr., 20¢ c. y., p. m., **04,** 3421, 3422.

1905. Bay & River Dredging Co., dr., 14¾¢ c. y., **05,** 2438.

1907. R. A. Perry, dr., 17¾¢ c. y., **08,** 2227.

1910. J. C. Franks, dr., 11¾¢ c. y.; removing snags, $10 per snag; lease of clam shell dr., $125 per day of 22 hours, **10,** 2363.

1911. J. D. Harris, dr. about 24,000 c. y., 10¢ c. y., and for removing logs, stumps, snags, piles, sheet piling, etc., prices listed, **12,** 2768.

ENGINEERS.

Chief of Engineers. **R.,** **85,** 360; **E8,** 290; **89,** 344; **90,** 309; **91,** 389; **92,** 367; **93,** 421; **94,** 393; **95,** 431, 436; **96,** 385; **97,** 491, 494; **98,** 476; **99,** 558, 561; **00,** 630, 633; **01,** 609; **02,** 532; **03,** 590; **04,** 648, 651, 3427; **05,** 654; **06,** 728; **07,** 746; **08,** 794; **09,** 831; **10,** 922; **11,** 978; **12,** 1158.

Boards. BERH. **R.,** **04,** 3430.

In charge:

Lt. Col. G. H. Mendell. **R.,** **85,** 2343.

Maj. W. H. H. Benyaurd, 1889–95. **R.,** **89,** 2467; **91,** 2952; **92,** 2622; (Lt. Col.) **93,** 3223; **94,** 2507; **95,** 3263, 3285.

Col. G. H. Mendell, 1890. **R.,** **90,** 2885.

Maj. C. E. L. B. Davis, 1896–97. **R.,** **96,** 3177.

Capt. C. E. Gillette, 1897. **R.,** **97,** 3364, 3374.

Maj. W. H. Heuer, 1898–1906. **R.,** **98,** 2946; **99,** 3182; (Lt. Col.) **00,** 4234, 4253, 4255; **01,** 3428; **02,** 2359; **03,** 2198; (Col.) **04,** 3421, 3428; **05,** 2437; **06,** 1971.

Lt. Col. John Biddle, 1907–11. **R.,** **07,** 2148; **08,** 2227; **09,** 2195; **10,** 2362; (Col.) **11,** 2565.

Maj. S. A. Cheney, 1912–. **R.,** **12,** 2768.

Assistant. L. J. Le Conte. **R.,** **85,** 2346.

LEGAL PROCEEDINGS.

Local au. to furnish necessary land free of cost for right of way for each cut-off, one at Car Bend and the other at Jacks Bend, **11,** 2565.

OPERATIONS.

1888–89. 116 snags and stumps, 458 c. y. r., and 7 bowlders removed under contract, **89,** 2468.

1890–91. 729 c. y. dr., **91,** 2952.

1891–92. 21,972 c. y. dr. and 32 snags removed **92,** 2622.

1893–94. H. lines estab., **94,** 2508.

1895–96. 12,065 c. y. dr., **96,** 3178.

1898–99. 25 dangerous snags blasted and removed, **99,** 3182.

1900–01. 27,648 c. y. dr., **01,** 3428.

1904–05. 27,682 c. y. dr., **05,** 2437.

1905–06. Chan. 75 x 4′ completed, **06,** 1971.

1907–08. 20,362 c. y. dr., **08,** 2227.

1908–09. Obstr. removed, **09,** 2195.

1909–10. 31,977 c. y. dr.; rocky shoal broken up and removed, **10,** 2362.

1910–11. 9 trees removed from portion of sliding bank, **11,** 2565.

1911–12. 24,456 c. y. dr., 79 stumps, logs, and snags, and 62 l. f. sheet piling removed; full proj. dimensions of au. chan. recovered, **12,** 2768.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 2344; **94,** 2508; **95,** 3264, 3286; **97,** 3374; **00,** 4255; **04,** 3428.

In 1895 the officer in charge did not believe a permanent imp. could be effected. Any chan. dr. would be liable to obliteration by the floods of the succeeding winter, **95,** 3264; **99,** 3182; **00,** 4234.

Strip of R. bet. North and South Vallejo known as Mare Isld. Strait. It connects Napa Creek with the Strait of Karquinez, and the latter affords communication with the Bay of San Francisco. Mare Isld. Navy Yard is on the w. bank of the strip, **95,** 3286.

A tidal stream. At Napa City the tides vary from 5 to 7′; thought to give the R. a permanent value for navigation, **97,** 3374.

An. freshets add detritus to old, and form new bars, **03,** 2199.

Car Bend and Jack Bend are pronounced bends, and consequently make navigation difficult even with good d.; shoaling at these bends, **11,** 2565.

PROJECTS.

By Col. Mendell, 1885, formation, by dr. and removal of obstr., of chan. 4 x 75′, mouth of R. to Napa City; est., $27,600, **85,** 2346; **88,** 290. Proj. completed in 1892; cost, $17,500, **92,** 2622.

Maj. Heuer est., 1899, $3,600 to make chan. through several bars, **00,** 4255.

SURVEYS.

Au. act July 5, 1884; made by Lt. Col. Mendell, **85,** 2343.

Ex., with view to imp. of R. bet. North and South Vallejo, au. act Aug. 17, 1894; made, 1894, by Lt. Col. Benyaurd (**R.** fav.), **95,** 3286.

Ex., 1895, by Lt. Col. Benyaurd, **95,** 3264.

Ex. with view to straightening chan. from Napa to a point s. of Carrs Bend, and to making cut through Carrs Bend, au. act June 3, 1896; made, 1896, by Maj. Davis (**R.** fav. to limited imp.), **97,** 3374.

Ex. for imp. and submission of plan and est., au. act Mar. 3, 1899; made, 1899, by Maj. Heuer (**R.** fav.; see Projects), **00,** 4253.

Au., with view to straightening chan. above Mare Isld. Navy Yard, by act June 13, 1902; **R.** by Lt. Col. Heuer (unfav.) (H. D. 178, 58th, 2d), **03,** 2198; **04,** 651, 3427.

Minor surs., **04,** 3421; **07,** 2148; **10,** 2362.

Ref. to ex. and sur. reports, **12,** 1160.

* Allotment. [1] $2,000 of this amount withdrawn and allotted to Petaluma Creek, Cal., **09,** 2195.

TT-117 SONOMA CREEK, CAL.

COMMERCE.

Description of. 18,250 t. carried in a little schooner with tonnage of 38 t., **00,** 4257.

ENGINEERS.

Chief of Engineers. R., 00, 633.

In charge. Lt. Col. W. H. Heuer, 1900. **R., 00,** 4256.

PHYSICAL CHARACTERISTICS.

Description of, **00,** 4256.

SURVEY.

Ex. au. act Mar. 3, 1899; made, 1899, by Maj. Heuer (**R.** fav.), **00,** 4256.

TT-121 PETALUMA CREEK, CAL.

APPROPRIATIONS.

1880,	$8,000,	**80,** 2243.
1881,	8,000,	**81,** 2479.
1882,	14,000,	**82,** 2539.
1888,	2,000,	**88,** 2134.
1890,	4,000,	**90,** 2918.
1892,	10,000,	**92,** 2656.
1894,	15,000,	**97,** 3365.
1899,	4,000,	**99,** 3184.
1902,	3,000,	**03,** 2198.
1905,	2,000,	**05,** 2437.
1907,	15,239,	**07,** 2148.
1909,	{ 10,000 / [1] 2,000 }	**09,** 2194.
1910,	5,000,	**10,** 2361.
1911,	7,000,	**11,** 2564.
1909,	*16,659,	**12,** 2767.
1912,	6,000,	**12,** 2767.
Total,	131,898	

COMMERCE.

"Present" imp., 1883, of great benefit to C., **83,** 1982; **84,** 2199.

Description of, **94,** 2539; **96,** 3206; **97,** 3365.

1893, 120,000 t., **93,** 3277.

Chan. dr. with app. 1892 of great benefit to C., **94,** 2539.

RR. rates influenced by imp., **97,** 3365.

149,943 t., valued at $4,957,383, 1907, **08,** 793.

1911, 223,403 t., **12,** 1159.

Water trans. has aided in development and prosperity of continguous country and has effected material reduction in rates, **12,** 1159.

CONTRACTS.

1880. E. Hackett, dr., 29¢ and 45¢ c. y., **81,** 2480.
1882. W. Gwynn, dr., 25½¢ c. y., **83,** 1983.
1891. M. J. Miller, dr., 15¢ c. y., **91,** 3119.
1899. W. N. Concanon, dr., 14.98¢ c. y. ($3,295), **00,** 4236.
1904. Pacific Reclamation Co., dr., 8¢ c. y., **04,** 3420, 3422.
1907. Bay & River Dredging Co., dr.—sec. 1, 8.4¢, and sec. 2, 14.8¢ c. y., **08,** 2226.
1909. J. S. McAnany, dr., 13½¢ c. y. and 17½¢ c. y., **09,** 2194.
1910. N. R. Harris, dr. 65,307 c. y., 11.74¢ c. y., **11,** 2564.
1912. N. R. Harris, dr. 200,000 c. y., 9.94¢ c. y., **12,** 2767.

ENGINEERS.

Chief of Engineers. R., 80, 235; **81,** 322; **82,** 316; **83,** 329; **84,** 332; **85,** 359; **87,** 323; **88,** 295; **89,** 351; **90,** 315; **91,** 397; **92,** 373; **93,** 429; **94,** 400; **95,** 438; **96,** 390; **97,** 492, 494; **98,** 477; **99,** 559; **00,** 631; **01,** 610; **02,** 532; **03,** 589; **04,** 647; **05,** 654; **06,** 727, 731; **07,** 745; **08,** 793; **09,** 829; **10,** 921; 11, 977; **12,** 1158.

In charge:

Lt. Col. G. H. Mendell, 1879–85. **R., 80,** 2242; **81,** 2478; **82,** 2539; **83,** 1982; **84,** 2198; **85,** 2339.

Capt. A. H. Payson, 1887. **R., 87,** 2446.

Maj. W. H. Heuer, 1888–95, 1898–1906. **R., 88,** 2133; **89,** 2488; **90,** 2917; **91,** 3119; **92,** 2655; **93,** 3276; **94,** 2538; **95,** 3308; **98,** 2947; **99,** 3183; (Lt. Col.) **00,** 4236; **01,** 3429; **02,** 2358; **03,** 2197; (Col.) **04,** 3420; **05,** 2436; **06,** 1971.

Capt. C. E. Gillette, 1896–97. **R., 96,** 3205; **97,** 3365, 3375.

Lt. Col. John Biddle, 1907–11. **R., 07,** 2147; **08,** 2226; **09,** 2193; **10,** 2360; **11,** 2563.

Maj. S. A. Cheney, 1912–. **R., 12,** 2766.

OPERATIONS.

1880–81. 21,135 c. y. dr. from cut-offs and chan., **81,** 2478.
1882–83. 25,290 c. y. dr., **83,** 1982.
1883–84. 43,267 c. y. dr., completing proj., **84,** 2198.
1887–88. Dr. chan. completed under contract, **88,** 2134.
1891–92. 37,025 c. y. dr., **92,** 2656.
1892–93. 37,171 c. y. dr., **93,** 3276.
1893–94. 50,864 c. y. dr., **94,** 2538.
1895–96. 172,517 c. y. dr., **96,** 3206.
1899–00. 22,562 c. y. dr., **00,** 4236.
1901–02. 26 old piles removed, **02,** 2358.
1904–05. 31,250 c. y. dr., **05,** 2436.
1907–08. About 40,000 c. y. dr., **08,** 2226.
1908–09. Dr. under contract with Bay & River Dredging Co. completed Oct. 21, 1908; 159,063 c. y. removed, of which 32,080 c. y. removed prior to June 30, 1908, at 8.4¢ c. y., and the remainder, 104,519 c. y., were at 8.4¢ and 22,464 c. y. at 14.8¢ c. y.; total cost, $14,717.48, **09,** 2193.
1909–10. Dr. under contracts with J. S. McAnany completed, 10,247 c. y. dr. under 1st at 13.5¢ and 12,000 c. y. dr. under 2d contract at 17.5¢ c. y., **10,** 2360.
1910–11. 80,862 c. y. dr., obtaining full proj. w. and d., **11,** 2563.
1911–12. 247,340 c. y. dr. from shoal in San Pablo B. at mouth of creek, **12,** 2766.

PHYSICAL CHARACTERISTICS.

Description of, **80,** 2243.

Stream subject to shoaling, **95,** 3309; **97,** 3365, 3376.

Depths not permanent; winter floods an. cause dr. chan. to partly refill, **03,** 2197.

Deterioration due to ordinary shoaling in chan., **10,** 2360.

PLANS. (See Projects.)

By Maj. Heuer, 1888, increasing chan. d. to 4 or 5′ by removal of about 60,000 c. y. of material; est., $30,000, **88,** 2134.

PROJECTS. (See Plans.)

By Lt. Col. Mendell, 1879, imp. below Petaluma by dr. chan. to 3′ l. w., and also shortening existing chan. 5,820′ by a cut 3′ x 50′ l. w.; est., $25,868. Total expend. to completion of work in 1884, $27,656, **85,** 2339; **87,** 2446.

By Maj. Heuer, 1892–93, using U. S. dr. to excavate chan. 50′ w. and as long and deep as available funds would permit, **93,** 3276.

* Allotment.

[1] Allotted by trans. of funds.

In 1897 Capt. Gillette est. $50,000 to straighten chan. bet. RR. br. and Donohue Landing, **97,** 3376.

Lt. Col. Heuer est., 1900, it would cost $4,000 every 2 years for mainten., **00,** 4236.

Enlarged by act Mar. 2, 1907, to provide for dr. chan. 6′ x 50′ at bottom, mouth to McNears Canal, and 4′ x 50′ thence to head of navigation; est. (addl. cost), $15,239 (H. D. 387, 59th, 1st), **08,** 793.

SURVEYS.

Au. act Mar. 3, 1879, **79,** 179; made, 1879, by Lt. Col. Mendell, **80,** 2243.

Minor sur., **93,** 3276; **99,** 3183.

Ex. with view to straightening chan. from RR. br. to Donohue Landing, au. act June 3, 1896; made by Capt. Gillette, 1897 (**R.** unfav.), **97,** 3375.

Pre. ex. and sur. au. act Mar. 3, 1905, with view to straightening and otherwise imp. creek. **R.** by Lt. Col. Heuer, July 27 and Dec. 26, 1905; est., $15,239, and $2,600 an. mainten. (H. D. 387, 59th, 1st), **06,** 731.

Minor surs., **04,** 3420; **07,** 2147.

Ex. and sur. in San Pablo B. at mouth of Petaluma Creek, **09,** 830.

Maps. (H. D. 387, 59th, 1st.)

TT-127 SAN RAFAEL (River) CREEK, CAL.

COMMERCE.

Description of, **95,** 3283.

In 1895, unimportant, **95,** 3283.

ENGINEERS.

Chief of Engineers. **R.,** **91,** 393; **95,** 435; **06,** 731.

In charge:

Lt. Col. W. H. H. Benyaurd, 1891–95. **R.,** **91,** 2963; **95,** 3281.

Col. W. H. Heuer, **06,** 719.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 2963; **95,** 3282.

Creek empties into B. of San Francisco about midway bet. San Quentin and San Pedro, about 15 m. from San Francisco, **95,** 3282.

PRIVATE WORK.

Bet. 1891 and 1894 persons interested in adjacent lands excavated a canal from the lower landing to a point 3,000′ nearer the town, **95,** 3282.

SURVEYS.

Ex. au. act Sept. 19, 1890; made, 1890, by Lt. Col. Benyaurd (**R.** unfav.), **91,** 2963.

Ex. au. act Aug. 17, 1894; made, 1894, by Lt. Col. Benyaurd (**R.** unfav.), **95,** 3281.

Pre. ex. au. act Mar. 3, 1905. **R.** by Col. Heuer, June 9, 1905 (H. D. 67, 59th, 1st) (unfav.), **06,** 731.

R. by BERH., June 21, 1909, in pursuance of resolution of R. and H. Com. to review former report on pre. ex. As C. is insignificant, and no evidence of extensive manf. interests or industries, in the opinion of the board it is inadvisable to recom. imp. (R. and H. Com. D. 14, 61st, 2d.)

TT-129 (b) BELVEDERE HARBOR, SAN FRANCISCO BAY, CAL.

COMMERCE.

Place a site for residence only. Tiburon, in vicinity, had water traffic, 1903, of 168,000 t., **04,** 3426.

ENGINEERS.

Chief of Engineers. **R.,** **04,** 651, 3424.

Boards. BERH. **R.** (unfav.), **04,** 3426.

In charge. Col. W. H. Heuer, 1904. **R.,** **04,** 3426.

PHYSICAL CHARACTERISTICS.

Details, **04,** 3425.

10′ imp. would require removing 3,000,000 c. y., **04,** 3426.

SURVEY.

Pre. ex. au. act June 13, 1902; **R.,** Col. Heuer, Feb. 26, 1903 (unfav.) (H. D. 246, 58th, 2d), **04,** 651, 3425, 3426.

TT-131(a) CALIFORNIA, NORTH COAST—FORT ROSS, FISKS MILL, FISH ROCK, SHELTER COVE, TRINIDAD, ETC., CAL. (Harbor moorings at.)

ENGINEERS.

Chief of Engineers. **R.,** **89,** 353.

In charge. Maj. W. H. Heuer, 1888. **R.,** **89,** 2498.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2498.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Heuer (**R.** unfav.), **89,** 2498.

TT-132 DRAKES BAY, CAL.

ENGINEERS.

Chief of Engineers. **R.,** **77,** 123.

Board. For the Pacific coast, met Aug. 6, 1876, to ex. certain Hs. on the Pacific coast, with a view to estab. a H. of refuge. Board reported, when C. increases it may be necessary to build a H., **77,** 1051.

PLANS.

By BE. for break'r 1 m. l.; est., $6,785,800, **77,** 1058.

TT-133 BODEGA BAY, CAL.

ENGINEERS.

Chief of Engineers. **R., 77,** 123.

Boards:

Of the Pacific coast, met Aug. 1876, to ex. Hs. of Mendocino, Humboldt B., Trinidad, Crescent City, Cal., with a view of estab. break'r and H. of refuge. Board did not consider Bodega B., Cal., well adapted for that purpose on account of the frequent fogs. **R., 77,** 1051.

(Lt. Cols. R. S. Williamson, B. S. Alexander, C. S. Stewart, and Maj. G. H. Mendell.)

ESTIMATES.

By BE., break'r, $6,614,300, **77,** 1058.

TT-142 NAVARRO RIVER, CAL.

COMMERCE.

Description of, **93,** 3305.

ENGINEERS.

Chief of Engineers. **R., 93,** 3304.

In charge. Maj. W. H. Heuer, 1893. **R., 93,** 3304.

PHYSICAL CHARACTERISTICS.

Description of the mouth, **93,** 3304.

The mouth at its narrowest place from 30 to 40′ w. with a max. d. of 8′. In freshets the mouth as w. as 600′, **93,** 3305.

Other places in the vicinity that could be imp. at less cost and would be as valuable to C., **93,** 3307.

SURVEY.

Ex. of the mouth au. act July 13, 1892; made, 1892, by Maj. Heuer (**R.** unfav.), **93,** 3304.

TT-145 MENDOCINO BAY (Harbor), CAL.

COMMERCE.

Description of; in 1895 est. cost break'rs would be greater than the benefits to C., **95,** 3330, 3331.

ENGINEERS.

Chief of Engineers. **R., 77,** 123; **95,** 440.

Boards. For the Pacific coast, met Aug., 1876, to ex. the Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, Cal., for break'r and H. of refuge. Board reported that "H. of limited capacity could be built." **R., 77,** 1052. (Lt. Cols. Williamson, Alexander, and Stewart, and Maj. Mendell.)

In charge. Maj. W. H. Heuer, 1895. **R., 95,** 3330.

Assistant. Lt. H. Deakyne. **R., 95,** 3331.

ESTIMATES.

By BE., break'r, $3,455,100, **77,** 1058.

PHYSICAL CHARACTERISTICS.

Description of. Nearly midway bet. San Francisco and Humboldt Bs. Safe H. during nw. storms; unsafe in winter. **95,** 3330.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1895, by Maj. Heuer (**R.** unfav.), **95,** 333.

TT-171 EEL RIVER, CAL.

ENGINEERS.

Chief of Engineers. **R., 89,** 352.

In charge. Maj. W. H. Heuer, 1888. **R., 89,** 2493.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2493.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Heuer (**R.** unfav.), **89,** 2493.

TT-171(b) CALIFORNIA. (Inland waterway.)

ENGINEERS.

Chief of Engineers. **R., 10,** 926.

In charge. Lt. Col. John Biddle, 1910. **10,** 910.

SURVEY.

Sur. for constr. of continuous inland waterway in State of California bet. suitable points on Humboldt B. and Eel R., etc., au. act Mar. 3, 1909. **R.** by Lt. Col. Biddle, 1909 (H. D. 683, 61st, 1st), **10,** 926.

TT-175 HUMBOLDT HARBOR AND BAY, CAL.

APPROPRIATIONS.

1881,	$40,000,	**81,** 2481.
1882,	40,000,	**82,** 2540.
1884,	62,500,	**84,** 2200.
1886,	[1] 75,000,	**86,** 1921.
1888,	125,000,	**88,** 2135.
1890,	80,000,	**90,** 2921.
1892,	150,000,	**92,** 2659.
1893,	522,000,	**93,** 3281.
1895,	225,000,	**95,** 3317.
1896,	225,000,	**96,** 3211.
1897,	350,000,	**97,** 3367.
1898,	100,000,	**98,** 2950.
1899,	193,115,	**99,** 3186.
1907,	[2] 83,000,	**07,** 2151.
1910,	[3] 150,000,	**10,** 2364.
1911,	[2] [4] 185,000,	**11,** 2567.
1912,	[3] 250,000,	**12,** 2771.

Total, 2,855,615 (incl. misc. rects., $2,855,671.06, **12,** 2771, 2773).

COMMERCE.

Expected benefit of imp., **83,** 1985.

Freight and passenger travel to be influenced by imp., **91,** 3124.

The bulk of the C. seeking the H. goes to Eureka, **97,** 3378.

C. and population increasing, **05,** 657.

Decrease in freight rates, but no rail competition, **08,** 796; **12,** 1163.

In 1911, 771,000± t., **12,** 1163.

CONTRACTS.

1881. W. B. English, dr., 34¢ c. y., **81,** 2481.

1882. J. Hackett, dr., 25¢ c. y., **83,** 1984.

1884. W. B. English, dr., 48¢ c. y., **84,** 2200.

1888. American Bridge & Building Co., training wall constr., $171,350, **89,** 2490.

1891. Simpson & Brown, j. constr., $157,950, **91,** 3121.

1892. J. C. Bull, j. constr., total, $740,660. Single track, $2.50 f.; double, $5 f. Trestle with double track, $8 f. Brush mats in place, $1.34 c. y. Rock, $1.34 t. Single track on s. j., $2.50 f. Moving old track, 30¢ f. **93,** 3279. (Continuous contract.)

1899. W. N. Concanon, dr., 12.36¢ c. y. ($50,000) **00,** 4246.

1908. San Francisco Bridge Co., dr., 24.48¢ c. y., **08,** 2229.

1912. W. G. Corbaley, 519,000 t. st. for js.; prices given, **12,** 2771.

ENGINEERS.

Chief of Engineers. **R., 77,** 123; **78,** 136; **79,** 180; **80,** 236; **81,** 323; **82,** 317; **83,** 330; **84,** 333; **85,** 361; **86,** 353; **87,** 323; **88,** 296; **89,** 351; **90,** 316; **91,** 397, 427; **92,** 373; **93,** 429; **94,** 401; **95,** 439; **96,** 391; **97,** 492, 494; **98,** 477; **99,** 559; **00,** 632; **01,** 611; **02,** 533; **03,** 591; **04,** 649; **05,** 656; **06,** 730, 731; **07,** 748; **08,** 795, 797; **09,** 832; **10,** 924, 926; **11,** 980; **12,** 1162.

Boards:

Of the Pacific coast, met Aug., 1876, to ex. Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, Cal., with view of estab. H. of refuge. BE. did not deem it necessary to make any plan or est.; almost impossible to build a break'r or js. at this place. **R., 77,** 1052; **79,** 1785. (Lt. Cols. R. S. Williamson, B. S. Alexander, and C. S. Stewart, and Maj. G. H. Mendell.)

Convened, San Francisco, Cal., Oct. 13, 1882, to **R.** upon imp. of Humboldt B., **83,** 1992. (Col. Stewart, Lt. Cols. Mendell, Craighill, and Comstock, and Capt. Powell.)

Convened, San Francisco, Mar. 13, 1891, by S. O. No. 72, to consider and **R.** upon proj. for imp. of Humboldt B. **R., 91,** 3129. (Col. Mendell, Lt. Col. Benyaurd, and Maj. Heuer.)

Convened, San Francisco, June 8, 1891, by S. O. No. 55, to **R.** upon estab. of H. lines, Humboldt B. **R., 91,** 3141. (Col. Mendell, Lt. Col. Benyaurd, and Maj. Heuer.)

BE., 1890, reconvened Dec. 16, 1892, to consider and **R.** upon change suggested by Maj. Heuer in proj. for imp. of Humboldt H. **R., 93,** 3288.

In charge:

Lt. Col. B. S. Alexander, 1878. **R., 79,** 1786.

Lt. Col. G. H. Mendell, 1880–85. **R., 81,** 2480, 2481; **82,** 2539; **83,** 1983, 1986; **84,** 2199.

Capt. A. H. Payson, 1885–87. **R., 85,** 2351; **86,** 1919; **87,** 2447.

Maj. W. H. Heuer, 1888–95; 1898–1906. **R., 88,** 2135; **89,** 2490; **90,** 2918; **91,** 3120, 3138, 3140; **92,** 2656; **93,** 3278; **94,** 2540; **95,** 3310; **98,** 2948; **99,** 3185; (Lt. Col.) **00,** 4237; **01,** 3431; **02,** 2360; **03,** 2199; (Col.) **04,** 3422; **05,** 2439; **06,** 1972.

Capt. C. E. Gillette, 1896–97. **R., 96,** 3207; **97,** 3366, 3377.

Maj. W. W. Harts, **07,** 740, 748.

Lt. Col. John Biddle, 1907–11. **R., 07,** 2149; **08,** 2228; **09,** 2197; **10,** 2364; **11,** 2566.

Lt. Col. T. H. Rees, **12,** 1150, 1162.

Maj. S. A. Cheney, 1912–. **R., 12,** 2770, 2772.

Assistants:

A. Boschke. **R., 82,** 2540; **83,** 1984; **84,** 2200.

Lt. H. Deakyne. **R., 94,** 2543; **95,** 3317; **96,** 3211.

Lt. J. J. Meyler. **R., 97,** 3369.

D. E. Hughes. **R., 98,** 2951.

1st Lt. Douglas MacArthur, **05,** 644; **06,** 719.

OPERATIONS.

1881-83. 95,744 c. y. dr. from Eureka and Arcata Chans.; protection from erosion of n. spit by brush js., **82,** 2539, 2541.

1882-83. 75,904 c. y. dr. from Arcata, Hookton, and Eureka Chans., **83,** 1984.

1883-84. 26,080 c. y. dr. from Eureka Chan., **84,** 2200.

1888-89. 1,152 l. f. shore protection built, containing 1,672 c. y. brush and 2,748 t. r., **89,** 2491.

1889-90. 24,512 t. r. and 14,669 c. y. brush delivered in the j., and 2,767 l. f. of p. built, **90,** 2919.

1890-91. 8,168 t. r. placed in j.; wharf and approaches built on s. spit, **91,** 3122.

1891-92. 300 l. f. of brush and st. shore protection built at n. spit; 8,777 c. y. brush mattress and 15,930 t. st. placed in n. j.; 4,759 c. y. brush mattress and 30,778 t. st. placed in s. j.; 1,486 l. f. trackway laid in st., and trestle and track over the water extended 1,480′, **92,** 2658.

1892-93. Repairs made to n. spit protection work, **93,** 3278; and n. j. extended to 2,293′, **93,** 3280.

1893-94. N. j. extended to 5,178′, and spurs built at s. j. to prevent encroachment of chan., **94,** 2542.

1894-95. Extension of s. j. in progress, and mainten. of j. carried on, **95,** 3312, 3313; n. j. completed for 6,329′, **95,** 3316. (Summary of constr. by months on n. and s. js. for the year, **95,** 3316.)

1895-96. N. j. work carried to about 8,100′, and various repairs made, **96,** 3209, 3210; work on s. j. carried to about 5,000′, and various repairs made to it, **96,** 3210.

1896-97. N. j. completed; portions of s. j. rebuilt, **97,** 3366; and s. j. work carried to about 5,500′ from shore, **97,** 3367.

1897-98. 67,755 t. of st. placed in s. j. for its extension, **98,** 2949.

1898-99. 228,211 t. r. placed in s. j., **99,** 3185.

1899-00. 26,179 t. st. placed in s. j.; 8,733 t. placed in n. j. (brief history of j. work—r. and brush delivery, method of building js., etc.); 387,265 c. y. dr., **00,** 4237–4243.

1900-01. Minor repairs to property, **01,** 3431.

1907-08. 65,000 c. y. dr., **08,** 2228.

1908-09. 278,407 c. y. dr., **09,** 2196.

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[1] See proviso of act of 1866, **87,** 2447.

[2] Chan. front of Eureka.

[3] Rebuilding js.

[4] $15,000 for chan. front of Eureka.

1910-11. Plant for st. work on rebuilding j. under constr., **11,** 2567.

1911-12. Constr. of plant completed; 1,695′ of s. j. rebuilt, **12,** 2771.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 2482; **83,** 1987; **91,** 3129; **93,** 3279; **95,** 3317; **97,** 3377; **00,** 4238.

Damage to js. by action of waves and teredo, **03,** 2200.

Deterioration of chan. by bar formation, **05,** 656.

Chan. depths, **09,** 833.

H. 272± m. n. of San Francisco; max. draft, 1912, over shoalest part of chan., 21′ m. l. w. Length of j. chan., 1⅝ m. Head of navigation is principally at Eureka, **12,** 1162, 1163.

PROJECTS.

By Lt. Col. Mendell, 1881, securing, by dr., chan. 13 x 200′ to the upper end of Eureka wharves, with chan. 10 x 100′ to Arcata and Hookton; est., $135,220, **81,** 2480, 2485; **87,** 2447.

In 1882, after app. of $80,000, Lt. Col. Mendell proposed increased d. of chan. across the outer bar by a training wall 6,000′± l. from the s. spit, running in a n. direction; est., $600,000, **83,** 1991. Approv. by BE. of 1882, **83,** 1992; **87,** 2447.

In 1890 existing proj. modified to embrace shore-protection work on n. spit, and the constr. of a j. starting from there and running seaward nearly parallel to the j. on the s. spit, both js. to extend out to the 18′ contour, and be raised to the plane of h. w.; est. for completing proj., $1,715,115, **91,** 3121; **92,** 2658.

By BE., 1892, modification of existing proj. to provide for relocation of the n. j. in such a way as to utilize the shore protection built on the n. side of the entrance and make it a part of the proposed n. j.; also its constr. out to a point sufficient to arrest erosion before the completion of the s. j., after which both js. were to be carried out simultaneously to the 18′ curve, **93,** 3278, 3289.

The Chief of Engineers, 1898, est. $75,000 to imp. the H. by dr. at Eureka, **98,** 2956.

By Maj. Heuer, dr. 15′ l. w. chan. 8,900′ l. in front of the city wharves, Eureka, 200′ w., **99,** 3185; **00,** 4237.

Secs. of completed js., **00,** 4243.

Act Mar. 2, 1907, au. enlarging chan. in front of Eureka, 18 x 300 x 6,200′; cost, $83,000, **08,** 796.

Act June 25, 1910, au. restoring js. to their orig. condition; est., $1,037,400, **10,** 924.

SURVEYS.

Ex. BE. **R., 77,** 1052. Ex. au. act June 18, 1878, assigned to Lt. Col. Alexander, **78,** 136. **R., 79,** 1785.

Au. act June 14, 1880; made, 1880, by Lt. Col. Mendell, **81,** 2481.

Sur., 1894, by Maj. Heuer, **95,** 3317.

Complete sur. entrance to B. made, 1895–96, by Capt. Gillette, and also in 1897, **96,** 3210; **97,** 3367; and a sur. of the Eureka water front made, 1895–96, by the same officer to ascertain the extent of the shoaling of the chan., **96,** 3211.

Ex. for dr. along the city (Eureka) front au. act June 3, 1896; made, 1897, by Capt. Gillette (**R.** fav.), **97,** 3377.

Complete sur. entrance to B. made, 1897–98, by Maj. Heuer, **98,** 2949.

Sur. entrance made by Maj. Heuer, 1898–99 (maps), **99,** 3185.

Chan. over bar entrance and inner H. resur. front of Eureka; chan. 31 x 250′, **03,** 2200.

Pre. ex. and sur. for enlarging chan. in and from said B. to Eureka, au. act Mar. 3, 1905. **R.,** Col. Heuer, 1905, plan submitted for 18 x 300 x 6,200′; est., $83,000 (H. D. 228, 59th, 1st), **06,** 731.

Pre. ex. and sur. au. act Mar. 2, 1907. **R.,** Lt. Col. Biddle, 1907 and 1908; plan for rebuilding js. (see Projects) (H. D. 950, 60th, 1st), **08,** 797.

Pre. ex. and sur. au. act Mar. 3, 1909, of South B. Chan., for removal of obstr. to navigation to wharf at Fields Landing. **R.,** Lt. Col. John Biddle, May 6 and July 30, 1909; est., $10,000 (H. D. 204, 61st, 2d), **10,** 926.

Pre. ex. au. act Mar. 3, 1909, for increased d. Eureka to Arcata. **R.,** Lt. Col. Biddle, May 13 and July 30, 1909; est., $56,000 (H. D. 326, 61st, 2d), **10,** 926.

Sur. for constr. inland waterway in Cal. bet. points on Humboldt B. and Eel R., etc. **R.,** Lt. Col. Biddle, 1909 (unfav.) (H. D. 683, 61st, 2d), **10,** 926.

Maps. (H. D. 204, 61st, 2d; H. D. 228, 59th, 1st.) **91,** 3122, 3131; **95,** 3324; **96,** 3218; **97,** 3368; **98,** 2954; **99,** 3186; **00,** 4246.

TT-180 EUREKA HARBOR, CAL.

ENGINEERS.

Chief of Engineers. R., 71, 98.

Boards. Convened, Sept. 12, 1871, San Francisco, Cal., to consider practicability of imp. entrance, Humboldt B. and Eureka H., Cal. **R.**— Impractical to build any permanent imp. at this point. **R., 71,** 921. (Lt. Cols. Stewart and Alexander and Maj. Williamson.)

SURVEYS.

Included in Coast Sur., **71,** 951.

TT-187 TRINIDAD HARBOR, CAL.

COMMERCE.

Unimportant, **73,** 1147.

Prospective C. importance of Trinidad as a H. of refuge, **80,** 2249.

ENGINEERS.

Chief of Engineers. R., 73, 109; **77,** 123; **79,** 180; **80,** 237.

Boards. Convened, Aug., 1876, to ex. Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City with view to estab. break'r and H. of refuge. The Board, with information before it, gave preference to Trinidad H. **R., 77,** 1052. (Lt. Cols. Williamson, Alexander, and Stewart, and Maj. Mendell.)

In charge. Lt. Col. C. S. Stewart. **R., 80,** 237.

ESTIMATES. (See Plans.)

By Lt. Col. Stewart, sea wall, $13,432,320, or $19,000,000, **73,** 1147.

By BE., break'r, $7,694,500, **77,** 1058.

PLANS. (See Estimates.)

By Lt. Col. Stewart, 1880, H. of refuge at Trinidad, with st. and concrete break'r from Trinidad Head to Pilot Rock, 900 y. Est., $5,293,227, **80,** 2250.

SURVEY.

Au. act Mar. 3, 1879; made, 1880, by Lt. Col. Stewart, **80,** 237.

Maps. **80,** 2250.

TT-191 REDWOOD CREEK AND HARBOR, CAL.

APPROPRIATIONS.

1884, $3,000, **85,** 2339.
1886, 5,000, **86,** 1915.
1888, 7,400, **88,** 2108.
1890, 8,000, **91,** 2954.
1902, 8,400, **02,** 526.
1910, 12,000, **10,** 2349.

Total, 43,800

COMMERCE.

Description of, **97,** 3350.
1896–97 C. of upper part of the stream of small value, **97,** 3350.
1911, 51,495 t., **12,** 2762.

CONTRACTS.

1887. M. J. Madison, dr., 24¢ c. y., **87,** 2425.
1903. W. G. Witter, dr., 11¢ c. y., **03,** 2183.
1911. J. C. Franks, dr., 9.73¢ c. y., **11,** 2553.

ENGINEERS.

Chief of Engineers. **R., 84,** 334; **85,** 358; **86,** 352; **87,** 318; **88,** 291; **89,** 345; **90,** 311; **91,** 390, 393, 2966; **92,** 367; **93,** 421; **94,** 394; **95,** 432; **97,** 488; **02,** 526; **03,** 581; **04,** 638; **05,** 645; **06,** 719; **10,** 912, 926; **11,** 966; **12,** 1152.

In charge:
Lt. Col. G. H. Mendell, 1882–1889. **R., 84,** 2204; **85,** 2338; **86,** 1914; **87,** 2424; (Col.) **88,** 2108.
Lt. Col. W. H. H. Benyaurd, 1889–1895. **R., 89,** 2472; **90,** 2897; **91,** 2953, 2966; **92,** 2623; **93,** 3225; **94,** 2509; **95,** 3265.
Maj. C. E. L. B. Davis, 1897. **R., 97,** 3349.
Lt. Col. W. H. Heuer, 1902–06. **R., 03,** 2182; (Col.) **04,** 3407; **05,** 2423; **06,** 1963.
Lt. Col. John Biddle, 1910–11. **R., 10,** 2348; (Col.) **11,** 2553.
Brig. Gen. C. E. L. B. Davis, **11,** 964.
Lt. Col. T. H. Rees, **12,** 1151.
Maj. S. A. Cheney, 1912–. **R., 12,** 2761.

Assistants:
Lt. C. F. Palfrey. **R., 84,** 2204.
F. C. Turner. **R., 97,** 3351.

OPERATIONS.

1886-87. 19,000 c. y. dr., **87,** 2424.
1887-88. 10,000 c. y. dr., **88,** 2108.
1888-89. 36,000 c. y. dr., **89,** 2472.
1889-90. 16,600 c. y. dr., **90,** 2898.
1891-92. 40,845 c. y. dr., **92,** 2623.
1892-93. About 13,000 c. y. dr., **93,** 3225.
1902-03. 44,882 c. y. dr., **03,** 2183.
1903-04. 27,272 c. y. dr., completing contract, **04,** 3407.
1910-11. 68,650 c. y. dr., **11,** 2553.
1911-12. 36,101 c. y. dr., completing proj., **12,** 2761.

PHYSICAL CHARACTERISTICS.

Shoals in creek, **04,** 638.
Chan. again shoaling, **05,** 2423.
Deposit of detritus during freshets caused deterioration, **10,** 2348.

PROJECTS.

By Col. Mendell, 1882, chan. city of Redwood to San Francisco B., 1 m., h. w. d. of 7′; est., $15,000 **84,** 2204.
By Lt. Col. Benyaurd, 1890, chan. 50′ x 3′ m. l. w., lower end of Tannery Bend to wharves at Redwood, **91,** 2967; **93,** 3225.
In 1896 Maj. Davis est. $8,400 to imp. the creek., **97,** 3350.
Act June 13, 1902, au. dike constr. and dr.; est., $8,400 to obtain 5′ chan., **02,** 526.
Injudicious to build dam; would interfere with tidal movement, **03,** 2183.
Act June 25, 1910, au. chan. 5′ x 150′ up to city dock, **10,** 912.

SURVEYS.

Ex. au. act Aug. 2, 1882; made, 1882, by Lt. Col. Mendell, **84,** 2204.
Ex. of Redwood Creek au. act Sept. 19, 1890; made, 1890, by Lt. Col. Benyaurd (**R.** unfav.), **91,** 2966.
Ex. 1892–93 by Lt. Col. Benyaurd, **93,** 3225.
Sur. au. act June 3, 1896; made, 1896, by Maj. Davis (see Projects), **97,** 3349.
Ex. and sur. au. act Mar. 3, 1909. **R.** by Col. Biddle, July 2 and Sept. 27, 1909; est., $12,000 (H. D. 307, 61st, 2d), **10,** 926.
Maps. (H. D. 307, 61st, 2d.)

TT-193 KLAMATH RIVER, CAL.

COMMERCE.

Unimportant, **89,** 2497.

ENGINEERS.

Chief of Engineers. **R., 89,** 352.

In charge. Maj. W. H. Heuer, 1888. **R., 89,** 2495.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2495.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Heuer (see Commerce), **89,** 2495.

TT-206 CRESCENT CITY, CAL.

COMMERCE.

Description of, **93,** 3311.
In 1891 freight on seagoing shipments amounted probably to $60,000, **93,** 3313.

ENGINEERS.

Chief of Engineers. **R., 67,** 51; **77,** 123; **78,** 136; **79,** 180; **87,** 324; **93,** 432; **95,** 441; **00,** 634; **12,** 1165.

Boards. Of the Pacific coast met Aug., 1876 to "ex. the Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, Cal., with a view of estab. a break'r and H. of refuge." Board did not consider it well adapted for a H. of refuge. **R., 77,** 1053. (Lt. Cols. Williamson, Alexander, and Stewart, and Maj. Mendell.)

In charge:
Maj. R. S. Williamson. **R., 67,** 515.
Lt. Col. B. S. Alexander. **R., 79,** 1785.
Capt. A. H. Payson, 1887. **R., 87,** 2454.
Maj. W. H. Heuer, 1893–95; 1899. **R., 93,** 3308; **95,** 3339; **00,** 4262.
Capt. Chas. T. Leeds, 1911. **12,** 1137.

Assistant. Lt. W. H. Heuer. **R., 67,** 517.

ESTIMATES. (See Plans and Projects.)

By Lt. W. H. Heuer, break'r, $2,178,008, **67,** 518.
By BE., break'r, $6,022,940, **77,** 1059.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3310; description of rs. at entrance to H., **95,** 3340.

A town situated on the ocean beach, and the only shipping port at which seagoing vessels touch in Del Norte Co. B. is an open roadstead, very contracted, being little more than 1½ m. in extent e. and w., and ¾ m. n. and s., **93,** 3311.

PLANS. (See Estimates and Projects.)

By Lt. W. H. Heuer, break'r of st., 3,767' l., **67,** 518. Compared with European break'rs, **67,** 516.
By BE., break'r, **77,** 1059.

PROJECTS. (See Estimates and Plans.)

In 1895 Maj. Heuer est. $285,000 to remove rs. in entrance to H., **95,** 3341.

SURVEYS.

Included in the Coast Sur., **67,** 517.
Ex., BE., **77,** 1053.
Ex. au. act June 18, 1878; assigned to Lt. Col. Alexander, **78,** 136. **R., 79,** 1785.
Ex. of H. with view to a sea wall, Battery Pt. to Flat Rock, au. act Aug. 5, 1886; made, 1887, by Capt. Payson (**R.** unfav.), **87,** 2454.
Ex. au. act July 13, 1892; made by Maj. Heuer (**R.** unfav.), **93,** 3309.
Sur. au. act Aug. 17, 1894; made, 1895, by Maj. Heuer (**R.** unfav.; see Projects), **95,** 3339.
Ex., Crescent B., au. act Mar. 3, 1899. **R.** (unfav.) on Crescent City H. by Maj. Heuer, 1899, **00,** 4262.
Pre. ex. au. act Feb. 27, 1911; made by Capt. Leeds; **R.** dated July 8, 1911, submitted and reviewed by BERH. (**R.** unfav. until other contiguous sites be ex.) (H. D. 720, 60th, 2d), **12,** 1165.

TT-208 SMITHS RIVER, CAL. (Mouth.)

ENGINEERS.

Chief of Engineers. **R.,** 87, 324.

In charge. Capt. A. H. Payson. **R., 87,** 2450, 2452.

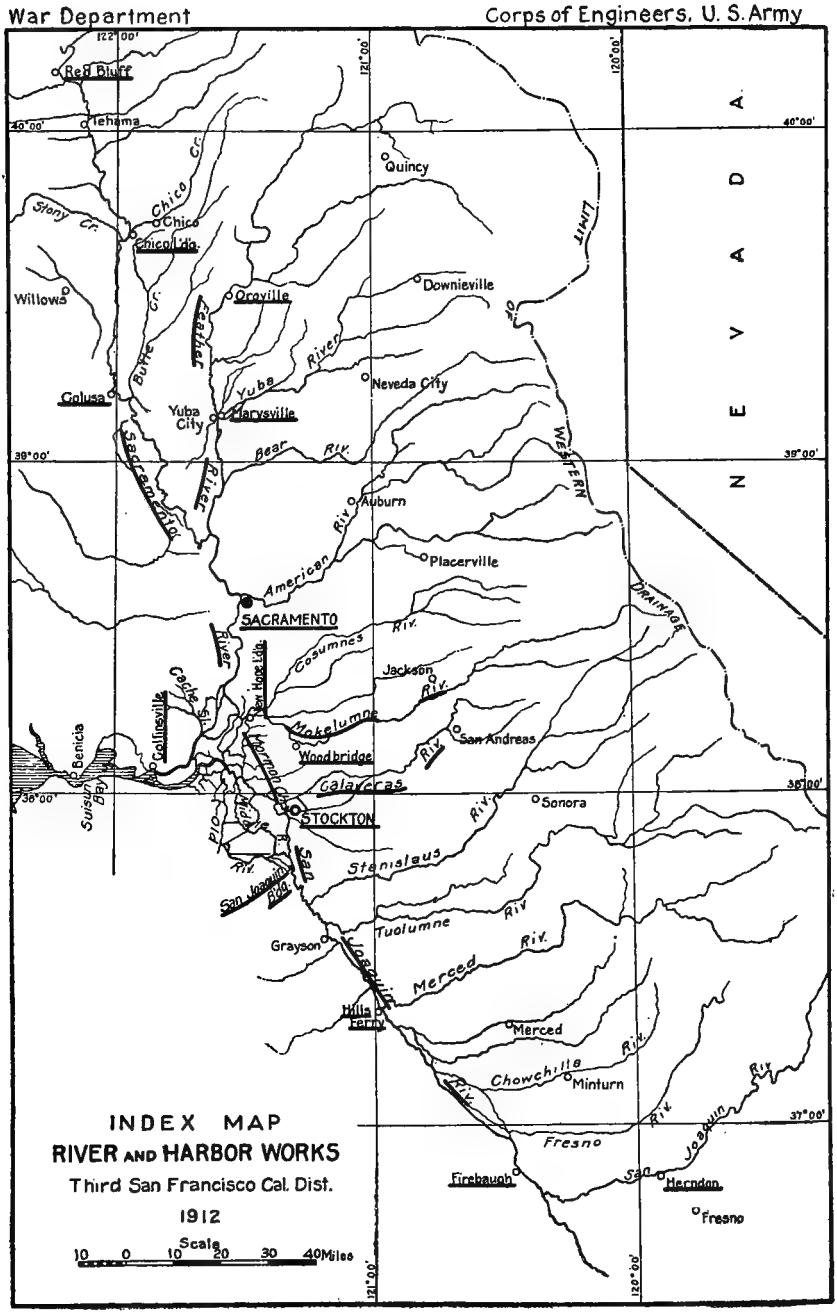
Assistant. A. Boschke. **R., 87,** 2451.

SURVEY.

Ex. au. act Aug. 5, 1886; made by Capt. Payson (**R.** unfav—cost too great), **87,** 2450.

RIVER AND HARBOR WORKS—PACIFIC COAST.

UU.—3d SAN FRANCISCO, CAL., DISTRICT.


War Department
Corps of Engineers, U. S. Army
INDEX MAP
RIVER AND HARBOR WORKS
Third San Francisco Cal. Dist.
1912
Scale
10 0 10 20 30 40 Miles
Red Bluff
Tehama
Quincy
Chico
Chico L'd'g.
Stony Cr.
Willows
Oroville
Downieville
Feather River
Butte Cr.
Yuba River
Neveda City
Colusa
Yuba City
Marysville
Bear Riv.
Sacramento River
Auburn
American Riv.
Placerville
SACRAMENTO
Cosumnes Riv.
Jackson
Mokelumne Riv.
San Andreas
Woodbridge
Calaveras Riv.
Benicia
Collinsville
Cache Sl.
New Hope L'd'g.
Suisun Bay
Old Riv.
Mid Riv.
STOCKTON
Sonora
Stanislaus Riv.
San Joaquin Bdg.
Tuolumne Riv.
Grayson
Merced Riv.
Hills Ferry
Merced
Chowchilla Riv.
Minturn
Fresno Riv.
Firebaugh
San Joaquin Riv.
Herndon
Fresno
LIMIT OF WESTERN DRAINAGE
NEVADA
122°00'
121°00'
120°00'
40°00'
39°00'
38°00'
37°00'

UU.—THIRD SAN FRANCISCO, CAL., DISTRICT.[1]

In charge of U. S. Engineer Office, 3d District,†
San Francisco, Cal.

UU 1 Pacific Ocean.
UU 2 San Francisco B., Cal. (see TT) (1)
UU 3 San Pablo B., Cal. (see TT) (2)
UU 4 Suisun B., Cal. (see TT) (3)
UU 5 New York Slough, Cal. (4)
UU 6 San Joaquin R., Cal. (4) †
UU 7 Dutch Slough, Cal. (6)
UU 8 False R., Cal. (6)
UU 9 Taylor Slough, Cal. (8) (7)
UU 10 Piper Slough, Cal. (9) (14)
UU 11 Fishermans Slough, Cal. (6) (8)
UU 12 Old R., Cal. (6)
UU 13 Washington Slough, Cal. (12) (8)
UU 14 Sand Mound Slough, Cal. (12) (9)
UU 15 Rock Slough, Cal. (12) (14)
UU 16 Indian Slough, Cal. (12) (15)
UU 17 Italian Slough, Cal. (12)
UU 18 Tom Paines Slough, Cal. (12)
UU 19 Paradise Cut,[2] Cal. (12)
UU 20 Salmon Slough, Cal. (12) (25)
UU 21 Grant Line Canal,[2] Cal. (12)
UU 22 North Union Canal,[2] Cal. (12) (25)
UU 23 Victoria-Woodward Canal,[2] Cal. (12) (25)
UU 24 Orwood-Middle R. Canal,[2] Cal. (12) (25)
UU 25 Middle R., Cal. (6)
UU 26 Connection Slough, Cal. (25) (12)
UU 27 Empire Cut,[2] Cal. (25) (28)
UU 28 Whiskey Slough, including Turner Cut,[2] Cal. (6)
UU 29 Burns Cut-off, Cal. (6)
UU 30 Fresno Slough, Cal. (6)
UU 31 Merced R., Cal. (6)
UU 32 Tuolumne R., Cal. (6)
UU 33 Stanislaus R., Cal. (6)
UU 34 French Camp Slough, Cal. (33) (6)
UU 35 Walker Slough, Cal. (6) (34)
UU 36 Stockton Chan., Cal. (6) (see UU 6)
UU 37 Mormon Chan., Cal. (36) (see UU 6)
UU 38 Fremont Chan. and McLeod Lake, Cal. (36)
UU 39 Smiths Canal,[2] Cal. (6)
UU 40 Calaveras R., Cal. (6)
UU 41 Fourteenmile Slough, Cal. (6)
UU 42 Disappointment Slough, Cal. (6) (41)
UU 43 Little Connection Slough, Cal. (6) (44)
UU 44 Potato Slough and White Slough, Cal. (6) (46)
UU 45 Mokelumne R., including North Fork of Mokelumne R., Cal. (6)
UU 46 South Fork Mokelumne R., Cal. (45)
UU 47 Sycamore Slough, Cal. (46)
UU 48 Hog Slough, Cal. (46)
UU 49 Beaver Slough, Cal. (46)
UU 50 Cosumnes R., Cal. (45)
UU 51 Snodgrass Slough, Cal. (45)
UU 52 Georgiana Slough, Cal. (45) (55
UU 53 Sevenmile Slough, Cal. (45) (6) (54)
UU 54 Threemile Slough, Cal. (45) (6) (55)
UU 55 Sacramento R., Cal. (4) †
UU 56 American R., Cal. (55)
UU 57 Feather R., Cal. (55)
UU 58 Bear R., Cal. (57)
UU 59 Yuba R., Cal. (57)
UU 60 Sutter Slough, Cal. (55) (61)
UU 61 Steamboat Slough, Cal. (55)
UU 62 Cache Slough, Cal. (55)
UU 63 Miners Slough, Cal. (62) (60)
UU 64 Prospect Slough, Cal. (62)
UU 65 Shag Slough, Cal. (62)
UU 66 Hass Slough, Cal. (62)
UU 67 Lindsey Slough, Cal. (62)

UU-6. SAN JOAQUIN RIVER, CAL.

Part.	Title.	Period.	Appropriations.
a	San Joaquin R	1875–1912	725,670
b	San Joaquin R.—Stockton and Mormon Chans	1898–1911	280,395
c	San Joaquin R.—Old River Branch	1892–1915	.....
	Total [see also UU-6 (d, e, f) on p. 1580 of this index]	.....	1,006,065

† NOTE.—The California Débris Commission exercises control over hydraulic mining on the entire water sheds of the Sacramento and San Joaquin Rs. (See Gazetteer of the Surface Waters of California, Parts I and II, W. S. P., 295–6.)

[1] The "second" district is concerned principally with defensive matters. The waterways of the 3d District are interior of the waterways of District TT (1st San Francisco), the list above beginning and ending at Suisun Bay. Hence, the list of waterways of VV District begins with the waterway following the last waterway of District TT.

[2] Artificial canals over which U. S. has not assumed control.

Part (a), UU-6 San Joaquin River, Cal.

APPROPRIATIONS.

1876, $20,000, **77,** 122.
1880, 20,000, **80,** 236.
1881, 40,000, **81,** 2474.
1882, 40,000, **82,** 2538.
1884, 20,000, **84,** 2197.
1886, 18,750, **86,** 1923.
1888, 25,000, **88,** 2131.
1890, 75,000, **90,** 2911.
1892, 65,000, **92,** 2650.
1894, 50,000, **95,** 3292.
1896, 57,750, **96,** 3192.
1899, 20,000, **99,** 3166.
1902, 18,000, **02,** 2353.
1904, *35,170, **04,** 3414.
1905, 20,000, **05,** 2429.
1907, 30,000, **07,** 2144.
1909, 20,000, **09,** 2190.
1910, 75,000, **10,** 2355.
1911, 25,000, **11,** 2559.
1912 { 40,000 / [1] 11,000 } **12,** 2779.

Total, 725,670 (incl. $11.25 received by Treas. settlement, $725,681.25, **12,** 2779).

COMMERCE.

Description of, **93,** 3291, 3293; **96,** 3191, 3222; **99,** 3190.

Trade bet. Stockton and San Francisco very important and increasing, **93,** 3268.

1892, C. of the upper R. insignificant, **93,** 3293.

1895, C. of the region above Stanislaus R. in the vicinity of the San Joaquin was carried by rail at excessive rates; but probable cost of imp. this portion of the R. est. to be more than would be justified by the prospective benefits to C., **96,** 3223.

Decreasing, **11,** 974.

1911, 600,128 t., **12,** 2780.

CONTRACTS.

1877. J. Hackett, dr., **78,** 1302.

1880. B. C. Jackson, cut-off excavation, 23¢ c. y., **81,** 2475.

1881. Oakland Dredging Co., cut-off excavation, 33¢ c. y.; T. H. Williams, dr., 45¢ c. y.; A. Gall, dr., 46¢ c. y., **81,** 2475. N. H. Eaton, snagging, $62.50 per snag; J. M. Lemon, brush-dam constr., **82,** 2539.

1882. A. Gall, dr., 40¢ c. y.; A. McKinnon, barrier constr., $3,50 l. f., **83,** 1975.

1883. W. Gwynn, dr., 16¢ c. y., **83,** 1975. J. Hackett, dr., 23¢ c. y., **84,** 2198.

1884. T. H. Williams, dr., 15¢ c. y.; Von Schmidt & McNee, dr., 17.49¢ c. y., **85,** 2355.

1886. H. Lynch, dr., 23¾¢ c. y., **87,** 2440.

1891. C. L. Bigelow, pile and brush dam constr., $5,013, **91,** 2983. J. W. Ferris, reconstr. of submerged dam, $18,800, **91,** 2984.

1893. J. Hackett, dr. 110,093 c. y., 15¢ c. y.; San Francisco Dredging Co., dr. 204,422 c. y., 8.74¢ c. y., **94,** 2529.

1894. A. McKinnon, dam repairs; actual cost, $4,251.10, **95,** 3294.

1895. T. J. Moynihan, new boiler for dr., 2,495; W. E. Tretheway, repairs to machinery of dr., $1,275, **95,** 3294.

1897. J. C. Smith, dr., 5½¢ c. y. ($14,798.52), **98,** 2938.

1899. Golden Gate Dredging & Reclamation Co., dr., 6¢ c. y. ($2,978.94), **99,** 3166; 4.45¢ c. y. ($2,544.23), **00,** 4223.

1901. Golden Gate Dredging & Reclamation Co., dr., 4.74¢ c. y., **01,** 3419. A. C. Hamilton, dr., 12¢ c. y., **02,** 2353.

1902. Bay & River Dredging Co., dr., $4,986.08, **03,** 2192.

1903. Bay & River Dredging Co., dr., $12,040.68, **03,** 2192; **04,** 3414.

1904. M. C. Harris, dr., 7½¢ c. y., **04,** 3414. Thomas Thomson, repairs to dam (prices given), **05,** 2429.

1905. North American Dredging Co., dr. 14¾¢ c. y.; M. C. Harris, dr., 14¢ c. y., **05,** 2429.

1906. Bay & River Dredging Co., dr., 6.7¢ c. y., **06,** 1967.

1907. San Francisco Bridge Co., dr., 6.48¢ c. y., **07,** 2145.

1908. M. C. Harris, dr., 10½¢ c. y., **08,** 2222.

1909. Standard American Dredging Co., dr., 10.74¢ c. y.; lease of dr. *Plutus* for dr., $80 per day of 22 hours, **10,** 2356.

1910. Lease of dr. *Golden Gate* for dr., $135 per day of 22 hours, **10,** 2356. Antioch Dredging Co., dr., 6.89¢ c. y., **11,** 2559.

1912. J. C. Frank, dr., $160 per day of 22 hours, **12,** 2779.

ENGINEERS.

Chief of Engineers. R., 75, 124; **77,** 122; **78.** 136; **79,** 179; **80,** 236; **81,** 322; **82,** 316; **83,** 328, **84,** 332; **85,** 361; **86,** 354; **87,** 321; **88,** 293; **89;** 348; **90,** 313; **91,** 394; **92,** 370; **93,** 426, 460; **94,** 398; **95,** 436, 441; **96,** 388, 392; **97,** 488; **98,** 473, **99,** 555, 561; **00,** 627, 634; **01,** 606, 613; **02,** 528; **03,** 584; **04,** 642; **05,** 649; **06,** 723; **07,** 743; **08;** 789; **09,** 826, 834; **10,** 918; **11,** 973; **12,** 1169, 1176,

In charge:

Lt. Col. C. S. Stewart, 1875–81. **R., 75,** ii, 726; **77,** 999; **78,** 1302; **79,** 1764; **80,** 2248.

Lt. Col. G. H. Mendell, 1881–85. **R., 81,** 2476; **82,** 2536; **83,** 1973; **84,** 2195.

Capt. A. H. Payson, 1885–87. **R., 85,** 2353; **86,** 1921; **87,** 2437.

Maj. W. H. Heuer, 1888–95, 1898–1907. **R., 88,** 2129; **89,** 2484; **90,** 2909; **91,** 2981; **92,** 2645; **93,** 3265, 3290; **94,** 2527; **95,** 3291; **98,** 2938; **99,** 3166, 3188; (Lt. Col.) **00,** 4223; **01,** 3416, 3450, 3454; **02,** 2352; **03,** 2190; **04,** 3413; **05,** 2428; **06,** 1967.

Capt. C. E. Gillette, 1896-97. **R., 96,** 3189, 3219; **97,** 3357.

Maj. W. W. Harts, **07,** 740.

Lt. Col. John Biddle, 1907–12. **R., 07,** 2144; **08,** 2222; **09,** 2190; **10,** 2354; (Col.) **11,** 2559.

Maj. S. A. Cheney, 1912–. **R., 12,** 2778.

Assistants:

Lt. J. H. Weeden. **R., 75,** ii, 727.
W. P. Smith. **R., 78,** 1302; **83,** 1976; **85,** 2356.
Lt. H. Deakyne. **R., 96,** 3220.
L. C. Easton. **R., 99,** 3192.
H. L. Demeritt. **R., 01,** 3457.

OPERATIONS.

1877-78. Work done by contract; 23,013 c. y. dr., **78,** 1302.

1880-81. 8,760 c. y. dr. from Stockton Slough, **81,** 2473.

1881-82. 81,708 c. y. dr. from Stockton and Mormon Sloughs under contract; 21,142 c. y. dr. from Stockton Slough by city of Stockton; 111 snags removed; brush dams built at 4 localities, **82,** 2536, 2537.

1882-83. 17,580 c. y. dr. from Mormon Slough; 350 l. f. of timber barrier built; 89 snags removed from R. bed, **83,** 1973, 1974.

1883-84. 77,233 c. y. dr. at Mormon Slough and Devils Elbow; 6 snags removed and 230 l. f. of brush dam built on upper R., **84,** 2195.

1884-85. 158,930 c. y. dr.; sunken dr. removed from lower approach; 98 snags removed, **85,** 2354.

1886-87. 18,819 c. y. dr. and 86 snags removed, **87,** 2438.

1887-88. 144,975 c. y. dr. from Stockton Slough by hired labor, **88,** 2130.

1888-89. 82,150 c. y. dr. from Stockton Slough by hired labor; dam built by contract for partial closure of Paradise Cut, **89,** 2484.

* Allotment. [1] For McLeod Lake and Fremont Chan.

1889-90. 120,960 c. y. dr. from Stockton Slough by hired labor, **90,** 2910.

1890-91. 138,242 c. y. dr. from Stockton Slough **91,** 2982.

1891-92. Dam completed across Lairds Slough under contract, **92,** 2647. Brush and pile dam completed across Paradise Cut, **92,** 2648. 226,932 c. y. dr., **92,** 2649.

1892-93. 130,605 c. y. dr., **93,** 3266. Dams at Lairds Slough and Paradise Cut repaired, **93,** 3267.

1893-94. 374,431 c. y. dr., **94,** 2529.

1894-95. Lairds Slough dam repaired, **95,** 3293; 100,986 c. y. dr., and dr. repaired, **95,** 3294; about 1,000 snags and other obstr. removed, **95,** 3294-3295; 3 wing dams built at San Joaquin Br., 100, 113, and 255 l. f. in l., resp., and dam at Paradise Cut repaired, **95,** 3295.

1895-96. 6,507 c. y. dr., **96,** 3190-3191; and over 500 snags and other obstr. removed, **96,** 3191.

1896-97. 181,900 c. y. dr., and some obstr. removed, **97,** 3357-3358.

1897-98. 385,478 c. y. dr., some obstr. removed, and a temporary wing dam built at Grayson, **98,** 2938.

1898-99. 47,409 c. y. dr. from Stockton Chan., and over 1,000 snags and other obstr. removed, **99,** 3166.

1899-00. 219,695 c. y. dr., from Stockton and Mormon Chans., **00,** 4223.

1900-01. 245,222 c. y. dr. from Stockton and Mormon Chans., **01,** 3417.

1901-02. 171,096 c. y. dr., **02,** 2352.

1902-03. 203,891 c. y. dr., **03,** 2190.

1903-04. 123,400 c. y. dr., **04,** 3413.

1904-05. 154,880 c. y. dr., and repairs made to brush and r. weir, **05,** 2428.

1905-06. 122,690 c. y. dr., **06,** 1967.

1906-07. 227,501 c. y. dr., **07,** 2144.

1907-08. 284,990 c. y. dr., **08,** 2222.

1909-10. 185,830 c. y. dr., **10,** 2354.

1910-11. 275,285 c. y. dr., **11,** 2559.

1911-12. 267,000 c. y. dr. from Mormon Chan., **12,** 2779.

PHYSICAL CHARACTERISTICS.

General, of San Joaquin R., **75,** ii, 728.

Description of, Hills Ferry to Firebaughs Ferry, **93,** 3290; above the mouth of the Stanislaus R., **96,** 3220.

Water-gauge record taken at San Joaquin Br., **95,** 3296.

In 1895 its l. w. flow was thought too small to permit of any imp. for l. w. navigation, **96,** 3220.

Description of, Stockton and Mormon Chans., **99,** 3192.

Description of sloughs leading from San Joaquin R. and its tributaries, **01,** 3457.

PLAN. (See Projects.)

By Lt. Weeden, 1875, imp. of the San Joaquin R. by dr. Stockton Chan., excavation of a canal at Turkey Bend, and closing secondary chans., $55,000, **75,** ii, 729.

PRIVATE (CITY AND STATE) WORK.

3 cut-offs, au. by Sec. of War, made by Cal., **99,** 556; **00,** 4224.

M. C. Harris, under contract to fill a certain area, dr. Mormon Chan. east of Yosemite St., to 16″ x 600′; **08,** 2223.

PROJECTS. (See Plan.)

General proj. under which work has been carried on has for its object the imp. of the San Joaquin R. by removal of snags and points of land, excavation of cut-offs, and dr. Stockton Chan., **75,** ii, 729; **78,** 1302. Also mainten. by dr., of a 9′ l. w. chan. 100′ w. through tidal parts of the R. below Stockton, a 4′ l. w. chan. 80′ w., Mormon Slough to Miller's warehouse, and temporary imp. in the l. w. chans. of upper R. to Hills Ferry, **81,** 2476; **86,** 1921.

In 1887 est. $139,000 would be required for imp. of Paradise Cut and cut-offs, **87,** 2439; **90,** 2909.

In 1891 it was proposed to maintain 9′ up to Stockton, to form a cut-off at Twentymile Slough, to increase the cut at Head Reach, and to remove snags and constr. wing dams; total cost, $136,750, **91,** 2895.

By Maj. Heuer, 1892, extending dam at Laird Slough and closing a crevasse caused by heavy floods, **93,** 3267.

In 1893 Maj. Heuer est. $5,000 to remove a sand bar obstr. navigation near Stockton Chan., **93,** 3268.

In 1898 Maj. Heuer est. $255,016 for further imp. of Stockton and Mormon Chans., **99,** 3191.

Act June 25, 1910, au. chan. Suisun B. to Stockton 9′ x 200′, with 2 cutoffs; est., $240,000, and $25,000 an. mainten. (H. D. 1124, 60th, 2d), **10,** 918.

Act July 25, 1912, au. dr. in Fremont Chan. and McLeod Lake to 9′; est., $11,000, and $500 an. mainten. (H. D. 581, 62d, 2d), **12,** 1171.

SURVEYS.

By Lt. Weeden, 1875. **R.,** **75,** ii, 727.

By W. P. Smith, **78,** 1302.

Sur. of R. below Stockton, 1877, by Lt. Col. Stewart, **79,** 1764.

Ex. Hills Ferry to Firebaugh Ferry incl. closure of sloughs above Stockton, au. act July 13, 1892; made, 1892, by Maj. Heuer (**R.** unfav.), **93,** 3290.

Ex. above the mouth of Stanislaus R. with view to imp., incl. closure of sloughs to a h. sufficient to maintain current in main chan. during l. w. period, au. act Aug. 17, 1894; made, 1895, by Maj. Heuer (**R.** fav. to removal of snags only), **96,** 3219.

Sur. of Stockton and Mormon Chans. made under au. of joint resol. of July 1, 1898, by Maj. Heuer, 1898 (see Projects), **99,** 3188.

Pre. ex. au. act June 6, 1900, above mouth of Stanislaus R., to determine advisability of closing mouths of certain sloughs. **R.** by Lt. Col. Heuer, Sept. 11, 1900 (H. D. 69, 56th, 2d) (unfav.), **01,** 613, 3454.

Pre. ex. and sur. au. act June 6, 1900, of R. and waters connecting same with the Strait of Carquines, extending from town of Antioch to Suisun Pt. **R.** by Lt. Col. Heuer, Aug. 21 and Dec. 12, 1900 (H. D. 261, 56th, 2d) (unfav.), **01,** 613, 3450.

Pre. ex. and sur. au. act Mar. 2, 1907, of R. and Stockton Chan. from San Francisco B. to Stockton. **R.** by Lt. Col. Biddle, July 25, 1907, and Oct. 6, 1908; est., $240,000 and $25,000 an. maintenance (H. D. 1124, 60th, 2d), **09,** 834.

Pre. ex. au. act Feb. 27, 1911, of Fremont Chan. and McLeod Lake. **R.** by Col. Biddle, May 20, 1911, and Maj. Cheney, Oct. 6, 1911; est., $11,000 and $500 an. mainten. (H. D. 581, 62d, 2d), **12,** 1176.

Pre. ex. au. by act Feb. 27, 1911, up to a point at or near Herndon for imp. by locks and dams, **12,** 1176.

Maps. (H. D. 1124, 60th, 2d; H. D. 581, 62d, 2d.)

Part (b), UU-6 San Joaquin River, Cal., Stockton and Mormon Channels.

APPROPRIATIONS.

1902,	$50,000,	**02,** 529.
1903,	50,000,	**03,** 2193.
1904,	75,000,	**04,** 3415.
1905,	49,316,	**05,** 2430.
1909,	56,079,	**09,** 2192.
Total,	280,395	(Total, including $8.33 received by Treasury settlement, $280,403.33.

CONTRACTS.

1908. California Reclamation Co., excavating material and building embankments, changing 2 brs., and extending 1 (prices given); Standard American Dredging Co., excavating material, building embankments and dam, and building brs. (prices given), **10,** 2358.

1909. Mervy-Elwell Co., building highway br. and grading approaches to same (prices given), **10,** 2358.)

ENGINEERS.

Chief of Engineers. R., 02, 529; **03,** 585; **04,** 643; **05,** 650; **06,** 725; **07,** 744; **08,** 791; **09,** 827, 834; **10,** 919; **11,** 975; **12,** 1173.

In charge:
Lt. Col. W. H. Heuer, 1902–07. **R., 03,** 2193; (Col.) **04,** 3415; **05,** 2430; **06,** 1968.
Maj. W. W. Harts, **07,** 740.
Lt. Col. John Biddle, 1907–11. **R., 07,** 2146; **08,** 2224; **09,** 2191; **10,** 2357; (Col.) **11,** 2560.
Maj. S. A. Cheney, 1912–. **R., 12,** 2780.

LEGISLATION.

California, 1903, app. money with which to acquire right of way for diverting canal, to be given to U. S., **03,** 2193; June, 1906, California Legislature passed act to transfer, **06,** 1968. Transfer, **08,** 2224.

OPERATIONS.

1908–09. Work on diverting canal in progress; Calaveras sec. about four-fifths completed and canal sec. about one-tenth, **09,** 2191.

1909–10. Work on diverting canal in progress; Calaveras section completed, 120,043 c. y. dr. during fiscal year; 735,280 c. y. dr. from canal section; highway brs. built, **10,** 2357.

1910–11. Work on diverting canal completed, a total of 1,465,563 c. y. having been excavated in its constr., 1 ry. and 6 highway brs. built, and 1 R. R. br. extended, **11,** 2560.

1911–12. Minor repairs to works, **12,** 2780.

PHYSICAL CHARACTERISTICS.

Stockton Chan. connects Stockton with San Joaquin R. Mormon Chan. flows through city and enters Stockton Chan. at westerly edge of Stockton, **99,** 3190.

PROJECTS.

In 1898 Maj. Heuer est. $255,016 for further imp. of Stockton and Mormon Chans. by diversion of waters of Mormon Slough (H. D. 152, 55th, 3d), **99,** 3191.

Act June 13, 1902, au. imp. by diversion of waters of Mormon Slough with dam, and constr. of canal 150′ x 24,850′ at bottom, to n. branch of Calaveras R., **02,** 529.

SURVEYS.

Sur. of Stockton and Mormon Chans., 1898, made under au. of joint resol. of July 1, 1898, by Maj. Heuer, **99,** 3188.

Ex. and sur. au. act Mar. 2, 1907, of Stockton Chan., in connection with San Joaquin R. **R.** by Lt. Col. Biddle, July 25, 1907, and Oct. 6, 1908; est., $240,000 (H. D. 1124, 60th, 2d), **09,** 834.

Maps. (H. D. 1124, 60th, 2d.)

Part (c), UU-6 San Joaquin River, Old River Branch, Cal.

COMMERCE.

Description of, limited, **93,** 3296.

In 1895 C. averaged nearly 5,000 t. of wheat and barley yearly, **95,** 3339.

ENGINEERS.

Chief of Engineers. R., 93, 431; **95,** 441.

In charge. Maj. W. H. Heuer, 1893–95. **R., 93,** 3294; **95,** 3338.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3295; **95,** 3339.

A stream a little over 50 m. l., leaving the San Joaquin R. some 10 m. above Stockton, and rejoining it some 30 m. below, embracing bet. it and the San Joaquin R. an area containing, approx., 150 sq. m., **93,** 3295.

PROJECT.

1895, Maj. Heuer est. $2,000 to remove the shoal at Naglees Bar, **95,** 3339.

SURVEYS.

Ex. au. act July 13, 1892; made, 1892, by Maj. Heuer (**R.** fav. to limited imp.), **93,** 3294.

Sur. au. act Aug. 17, 1894; made, 1895, by Maj. Heuer (see Projects), **95,** 3338.

UU-6 (d-e-f) CALIFORNIA DÉBRIS COMMISSION.

(For further correlated matter see UU-6, UU-56, UU-59, UU-59.)

Part.	Title.	Period.	Appropriation.
d	Expenses of, and general work in supervising hydraulic mining	1888–1912	$270,124.09
e	Restraining barriers	1896–1912	400,000.00
f	General project for the control of débris and floods and improvement of navigation in the Sacramento and Feather Rs	1910–1912	800,000.00
	Total		1,470,124.09

Part (d), UU-6 California Débris Commission—Expenses of.

APPROPRIATIONS.

1888, $10,000.00, act Oct. 1, 1888.
1893, 15,000.00, **94,** 3175.
1896, 15,000.00, **96,** 3862.
1897, 15,000.00, **97,** 3963.
1897, [1] 111.70 (claims), act July 19, 1897.
1898, 15,000.00, **98,** 3551.
1898, $0.40 (claims), act July 7, 1898.
1899, 15,000.00, **99,** 3749.
1900, 15,000.00, **00,** 5009.
1901, 4.37 (claims), act Nov. 3, 1901.
1901, 15,000.00, **01,** 3629.
1902, 1.52 (claims), act Feb. 14, 1902.
1902, 15,000.00, **02,** 2444.

[1] H. D. 482, 55th, 2d.

1903, $15,000.00, **03,** 2368.
1904, 15,000.00, **04,** 3700.
1905, 15,000.00, **05,** 2590.
1906, [1] 5,000.00, **07,** 811, 2254.
1906, 15,000.00, **07,** 811, 2254.
1907, 15,000.00, **07,** 812, 2254.
1908, 15,000.00, **08,** 862, 2339.
1909, 15,000.00, **09,** 907.
1910, 6.10 (urgent deficiencies), act Feb. 25, 1910.
1910, 15,000.00, **10,** 1013.
1911, 15,000.00, **11,** 1072.

$270,124.09

CONTRACTS.

1905. B. P. Oliver, office rooms, Flood Building, San Francisco, $70 per month, **05,** 2602.

1906. Elizabeth J. Kennedy, rent rooms, 1773 Pine St., San Francisco, $45 per month, **06,** 2078. Thos. P. McEldowney, rent room, $5 per month; Mary Schimpf, rent of house, $15 per month; Jennie S. Bates, rent office room, $6 per month; John T. Stoll, rent office room, $5 per month, **07,** 2261, 2262.

1908. Abstract of leases for hire of houseboats, launches, rent of office rooms, etc., **09,** 2300.

ENGINEERS.

Chief of Engineers. R., 94, 421; **95,** 470; **96,** 421; **97,** 528; **98,** 530; **99,** 618; **00,** 696; **01,** 656; **02,** 577; **03,** 638; **04,** 706; **05,** 714; **06,** 792; **07,** 809; **08,** 859; **09,** 905; **10,** 1010; **11,** 1068; **12,** 1283.

In charge:

Commission. **R., 94,** 3169; **95,** 4049, 4062; **96,** 3861; **97,** 3961; **98,** 3549; **99,** 3747; **00,** 5007; **01,** 3625; **02,** 2443; **03,** 2367; **04,** 3693; **05,** 2585; **06,** 2069; **07,** 2253; **08,** 2339; **09,** 2295; **10,** 2617; **11,** 2927; **12,** 3449.

Col. G. H. Mendell, 1894–95.
Lt. Col. Benyaurd, 1894–95; 1898–1900.
Col. W. H. Heuer, 1894–1907.
Col. C. S. Suter, 1896–98.
Maj. C. E. L. B. Davis, 1896–97.
Capt. C. E. Gillete, 1896–97.
Capt. H. Deakyne, 1898–1901.
Col. S. M. Mansfield, 1899–1901.
Col. J. A. Smith, 1901.
Lt. Col. D. P. Heap, 1901–03.
Lt. R. P. Johnston, 1901–03.
Lt. Col. T. H. Hanbury, 1903–05.
Capt. Wm. W. Harts, 1903–07.
Maj. C. H. McKinstry, 1905–09; (Lt. Col.), 1912.
Lt. Col. J. Biddle, 1907–10; (Col.), 1911.
Capt. T. H. Jackson, 1907–11.
1st Lt. C. T. Leeds, 1909–12.
Maj. S. A. Cheney, 1911–12.
Lt. Col. T. H. Rees, 1911–12.

LEGAL PROCEEDINGS.

Rules and instructions governing applicants for au. to mine, **94,** 3176.

Judicial proceedings and judicial decisions, **94,** 3180; **95,** 4056, 4065.

LEGISLATION.

Acts of Congress and of California relating to mining, **00,** 5064, 5070.

OPERATIONS.

Synopsis of applications for au. to mine given in each an. report up to and including an. report for 1902.

PHYSICAL CHARACTERISTICS.

Immense quantities of gravel, sand, and clay washed down by hydraulic mining in mountains lodged in R. chans. to detriment of navigation, etc., **04,** 3693.

PROJECTS.

Act Mar. 1, 1893, created the commission with a view to its regulation of hydraulic mining in California. Its jurisdiction defined to extend to hydraulic mining in the territory drained by the Sacramento and San Joaquin R. systems, **94,** 3169.

SURVEYS.

Sur. of Yuba R. from site of barriers to the mouth including settling basin made, **05,** 2589. Maps of same destroyed by fire of April, 1906, **06,** 2070.

Sur. of Bear R. from mouth in Feather R. to Long Bar made in 1905. Report and maps destroyed by fire of April, 1906, **06,** 2069–70.

Sur. made of lower 16 m. of Yuba R., **07,** 2253.

Sur. made of lower 27 m. of American R., **07,** 2253.

Part (e), UU-6 California Débris Commission—Restraining barriers.

APPROPRIATIONS.

1896, [2] $250,000.00, **97,** 3962; **00,** 5009.
1902, [3] 150,000.00, **02,** 578, 2245.

Total, 400,000.00

CONTRACTS.

1903. Atlantic, Gulf & Pacific Co., constr. of a portion of barrier No. 1, Yuba R., Cal.; prices listed, **03,** 2370.

1904. Atlantic, Gulf & Pacific Co. (supple.), furnishing materials in connection with original contract; Samuel Montgomery, building portions of barriers Nos. 1 and 2, Yuba R. (contract terminated by supple. agreement Mar. 2, 1904, which provides that contractor be paid certain amounts for materials furnished); Lewis Moreing, building earth embankment at barrier No. 1, Yuba R.; Edward Malley, excavating cut at Daguerre Pt., Yuba R.; Lewis Moreing, for building portions of barrier No. 1, Yuba R., **04,** 3707, 3708.

1905. Hugh McGuire, erecting pile-driver derrick and delivering piles for constr. portion of barrier No. 1 (pile driver, $630; 400 piles, at 31½¢ l. f.); Palmer & McBryde, driving piles for portion of barrier No. 1 (piles, at $7.60 each, and furnishing and placing 5,000 lbs. cast-iron pile shoes, at 6¢ lb.); Western Fuel Co., 12,000 sacks cement, 56½¢ sack, with 5¢ each as rebate for return of sacks; George S. Risher, hauling cement, 12,000 sacks, at 18⅜¢ sack; Palmer & McBryde, building portion of barrier No. 1 (excavation work and material); Lewis Moreing, furnishing 11,000 c. y. sand and gravel, 35¢ c. y.; and 400 y. brush protection, 35¢ sq. y.; Anson B. Munsen, constr. 200,000 y. embankment fill, 12$\frac{4}{10}$¢ c. y., **05,** 2600–02. Western Fuel Co., 10,000 sacks cement, 56½¢ sack, with 5¢ each rebate for empty sacks returned, **06,** 2076, 2077. George S. Risher, unloading and hauling 10,000 sacks cement, 10½¢ sack; B. Barrie, piles, 26½¢ l. f.; Palmer & McBryde, building inlet wall at Daguerre Pt. (prices and quantities listed), **06,** 2077.

1906. Western Fuel Co., 12,000 sacks cement (rebate 5¢ for each sack returned), 62½¢ per sack; George Risher, unloading and hauling 12,000 sacks cement, 17.225¢ sack; Edward Malley, excavating 12,000 c. y. earth from spillway and placing large r. (prices listed), **06,** 2077–2078. Halsey H. Dunning,

[1] To restore property and records destroyed by fire in April, 1906.
[2] California app. $250,000.00 to be used with the above amount, **97,** 3963.
[3] California app. $150,000.00 to be used with the above amount, **02,** 578, 2444.

reinforced concrete culverts for gates at settling basin, etc. (prices listed), **07,** 2260.

1907. Edward Malley, enlarging spillway, and building portion of barrier No. 1 (quantities and prices listed), **07,** 2261.

1908. Contracts on barrier No. 1 terminated by reason of serious damage caused by floods; Edward Malley, furnishing and placing 100,000 c. y. earth, 16¢ c. y., in a portion of proposed settling basin on Yuba R., **08,** 2344.

1909. J. A. Baumann & Co., excavating and constr. outlet for proposed settling basin on s. side of Yuba R. below Hammonton, Cal., **09,** 2300. Yuba Consolidated Gold Fields, strengthening about 5,200 l. f. of n. training wall below Daguerre Pt., Yuba R., $45,000, **10,** 2621.

ENGINEERS.

Chief of Engineers. R., 97, 528; **98,** 530; **99,** 618; **00,** 696; **01,** 656; **02,** 578; **03,** 638; **04,** 706; **05,** 715; **06,** 793; **07,** 810; **08,** 859; **09,** 905; **10,** 1010; **11,** 1068; **12,** 1283.

In charge. Commission. **R., 97,** 3962; **98,** 3550; **99,** 3749; **00,** 5008; **01,** 3628; **02,** 2444; **03,** 2368; **04,** 3700; **05,** 2590; **06,** 2070; **07,** 2254; **08,** 2340; **09,** 2295; **10,** 2618; **11,** 2929; **12,** 3450.

Assistant. H. Visher. **R., 00,** 5035.

LEGAL PROCEEDINGS.

Action, looking to sale of land, deferred by War Dept.; judicial proceeding and decisions as to sale of land, **11,** 2931.

OPERATIONS.

1900-01. Sites being acquired for constr. of dams for impounding débris; deeds for about one-quarter of the land obtained, **01,** 3628.

1901-02. Titles acquired for most of land required for restraining works; plans and specifications prepared for constr. of portion of dam known in proj. of 1900 as barrier No. 1, **02,** 2444.

1902-03. Barrier No. 1, Yuba R., contract awarded and work commenced; difficulty experienced in driving Wakefield sheet piling in hard bottom in accordance with terms of contract; plans revised and supple. contract prepared, **03,** 2368.

1903-04. Work under contract on barrier No. 1 continued; work on barrier No. 2, Yuba R., commenced under contract; excavation at Daguerre Pt., Yuba R., commenced and 197,000 c. y. removed, **04,** 3700–06.

1904-05. First step and apron of barrier No. 1 completed, and work continued under contract; contract let for second step of barrier No. 1; excavation at Daguerre Pt. continued, **05,** 2590–99.

1905-06. Work on constr. of barrier No. 1 continued, in placing materials in and below first step and apron; excavation completed at Daguerre Pt. cut, **06,** 2070, 2073.

1906-07. On account of damage to barrier No. 1 by floods of Mar., 1907, contract work with Mr. Malley stopped; work of constr. gravel embankment extending downstream along n. bank of Yuba R. from Daguerre Pt., under contract, continued, 85,917 c. y. of embankment having been constr.; constr. of reinforced concrete culverts for gates at entrance to proposed settling basin near Daguerre Pt., Yuba R., was in progress during year, and contract completed Jan. 25, 1907, **07,** 2256–59. Constr. of spillway at s. end of barrier No. 1, and placing large r. below apron, was in progress and was completed Dec. 14, 1906, **07,** 2255.

1907-08. Work of constr. barrier No. 1 abandoned, and settlement made June 25, 1907, with Edward Malley for r. and earth excavated; contractor claimed reimbursement of $6,396.33, expenses for plant, etc., and supple. agreement approv. by War Dept. au. payment by U. S. and California, each paying $3,198.17, **08,** 2340. Work in progress on embankment, to be built under contract, of a portion of the s. and w. sides of proposed settling basin, 72,188.81 c. y. being placed in embankment, **08,** 2342.

1908-09. Embankment work continued; contract on a portion of s. and w. side of settling basin completed Aug. 27, 1908, **09,** 2296–97.

1909-10. Outlet for settling basin completed; 6,600 c. y. earth placed by hired labor in revet. the inside slope of dr. embankment, **10,** 2618, 2619.

1910-11. Constr. of training walls at Daguerre Pt. continued; trees and brush removed from R. from Daguerre Pt. to Marysville, **11,** 2929, 2930.

1911-12. Trees and brush removed from Yuba R.; additions made to concrete apron and training walls by hired labor, **12,** 3451.

PHYSICAL CHARACTERISTICS.

600′ of barrier No. 1 destroyed by flood of Mar., 1907; not considered advisable to rebuild, **07,** 2256, 2257.

PRIVATE WORK.

1906-07. Mr. Hammon and associates constr., in vicinity of Daguerre Pt., gravel embankments, and under agreements, have thrown up and completed 8,000′ of gravel embankment during year; these embankments are constr. for the U. S. and California in exchange for right to extract gold from gravel used, **07,** 2257.

1907-08. 4,300′ gravel embankment constr. in vicinity of Daguerre Pt., and 2,500′ below Daguerre Pt., **08,** 2340, 2341.

1908-09. Work of constr. gravel embankments in vicinity of Daguerre Pt. and below Daguerre Pt. continued; 2,500′ and 1,600′, resp., placed during year, **09,** 2296.

1909-10. Work on gravel embankments in vicinity of Daguerre Pt. continued, consisting of strengthening completed embankment by additional parallel embankments; work on embankment below Daguerre Pt. continued, 800′ placed during year; 6,500 c. y. earth placed in raising Linda levee, near old State dam, by Yuba Consolidated Gold Fields, without cost to U. S., under terms of deed from James O'Brien to U. S., dated Dec. 6, 1901, **10,** 2618, 2619.

1910-11. Gravel embankment in vicinity of Daguerre Pt. continued during year, 800 l. f. constr.; strengthening completed portion of training wall below Daguerre Pt., by means of additional parallel embankments completed, 560 l. f. of embankment strengthened during year; constr. of gravel embankment below Daguerre Pt. remained suspended during year awaiting completion of a new dr., **11,** 2929, 2930; **12,** 3451.

PROJECTS.

Proj. for impounding the mining débris, Yuba R., to imp. the Sacramento and Feather Rs., **00,** 5030. The plans provided for building various works in the Yuba R., at an est. total cost of $800,000. One-half of this sum, 1900, app. by U. S., and one-half by Cal., **00,** 5009.

Act June 25, 1910, eliminates proposed settling basin in Yuba R., and gives au. to sell 1,818 acres of land, **11,** 2930.

SURVEYS.

H. Visher, engaged in sur. and mapping lands to be acquired for restraining works, **01,** 3625.

MAPS.

Barrier No. 1, Yuba R., **04,** 3708; **05,** 2602; **06,** 2078.

Inlet wall at Daguerre cut, **06,** 2078.

PHOTOGRAPHS.

Barrier No. 2, Yuba R., **04,** 3708.

Barrier No. 1, Yuba R., **05,** 2602; **06,** 2078.

Inlet wall at Daguerre cut, **06,** 2078.

Part (f), UU-6 California Débris Commission—General project for control of débris and floods and improvement of navigation in the Sacramento and Feather Rivers.

APPROPRIATIONS.

1910, $400,000.00, **10,** 1013.
[1] 400,000.00, **11,** 2932; **12,** 1285, 3453.

Total, 800,000.00

COMMERCE.

Mainten. of navigation on Sacramento and San Joaquin R. systems important; 1,000,000 t. and 300,000 pass. carried an., **08,** 860.

CONTRACTS.

1912. Ellicott Machine Co., two 20″ suction dr., $353,600, **12,** 3453.

ENGINEERS.

Chief of Engineers. R., 10, 1011; **11,** 1069; **12,** 1284.

In charge. Commission. **R., 10,** 2620; **11,** 2931; **12,** 3451.

LEGAL PROCEEDINGS.

Titles to land deeded to U. S.; work of securing land in progress, **12,** 3452.

LEGISLATION.

California app., Mar. 1, 1909, $400,000 for purpose of imp. in flood and débris control in Sacramento and Feather Rs., in accordance with recom. of Commission made June 30, 1907, **09,** 906.

OPERATIONS.

2 suction dr. and other plant being constr., **12,** 3452.

PLANS.

Report of Commission with regard to future operations for control of mining débris, imp. navigability, and providing for controlling of floods on the Sacramento and Feather Rs.; commission recom. that for direct imp. in Feather and Sacramento Rs., and toward the control of débris and floods, an app. of $400,000 be made, contingent upon an equal app. by California, these sums to be expended in the constr. and operation of 2 hydraulic dr., **07,** 2262, 2269.

PRIVATE WORK.

Sacramento and San Joaquin R. Imp. Assn. organized to acquire necessary rights of way and furnish same to U. S. free of cost, **10,** 2620.

PROJECTS.

Act June 25, 1910, app. $400,000, in accordance with recom. of commission in report dated June 30, 1907, provided that California app. a like amount (app. by State, Mar. 1, 1909); and provided further that all rights of way be furnished U. S. free of cost, **10,** 2620.

SURVEYS.

Sur. by commission along Sacramento and Feather Rs. to obtain data of movement of mining débris, and for use in preparing proj. for control of Rs. at all stages; proj. submitted June, 1907, recom. app. of $400,000 for direct imp. of Sacramento and Feather Rs. toward controlling débris; such app. again recom., **08,** 2340, 2343; **09,** 2295.

Made of several sites for reservoirs; also of Sacramento and Feather Rs., **10,** 2617.

Commission continued making minor surs. since submission of proj. in 1910, to obtain data in connection with proj., and with work of widening Sacramento R. near mouth, **11,** 2929.

R. by Cal. Débris Com. in relation to flood control of the Sacramento and San Joaquin Valleys. (See Sacramento and San Joaquin Rs.) Recom. that U. S. contribute one-third and State of California two-thirds of cost and upon completion U. S. transfer all flood-control works to State of California. (Lt. Col. J. Biddle, Capt. Thos. H. Jackson, Lt. C. T. Leeds.) (H. D. 81, 62d, 1st.)

UU-6(g) SAN JOAQUIN, TULARE, AND SACRAMENTO VALLEYS, CAL. (Irrigation of.)

COMMERCE.

Statistics, H. D. 290, 43d, 1st, p. 89.

ENGINEERS.

Chief of Engineers. R., 74, 126.

Boards. Commission of 1873. (See Plans.) H. D. 290, 43d, 1st, **74,** 126. (Lt. Col. Alexander, Maj. Mendell, and Prof. Davidson.)

ESTIMATES. (See Plans.)

Est., irrigation, $10± acre, H. D. 290, 43d, 1st, **73,** 77.

LEGISLATION.

Concerning irrigation, H. D. 290, 43d, 1st, p. 89.

PHYSICAL CHARACTERISTICS.

Necessity for irrigation in California, H. D. 290, 43d, 1st, p. 7. Influence of irrigation on the navigation of Rs., H. D. 290, 43d, 1st, p. 30.

PLANS. (See Estimates.)

Commission favored a general system of irrigation, to be designed by the U. S. or by association of capital, the work to be under the supervision of the State. The board considered extensive irrigating works could not be built by private enterprise alone, and recom. careful instrumental sur. before beginning the work, **74,** 126, 127. System of irrigation: what is irrigation? Existing and hypothetical canals; general considerations, H. D. 290, 43d, 1st, pp. 27, 34, 37, 38. History, description, and statistics of irrigation in foreign countries, H. D. 290, 43d, 1st, p. 40.

SURVEYS.

Pre. reconnoissance; necessity of sur., H. D. 290, 43d, 1st, pp. 5, 26.

Maps:
Map of valleys; rain charts of U. S., H. D., 43d, 1st, pp. 6, 92.
Sketch of system at the R. Cavery, in the Madras Presidency.
Map of tank system in India, H. D. 290, 43d, 1st.

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[1] App. by California, Mar. 1, 1909, for proj. of 1910, and deposited in Treasury of U. S., July 1, 1911.

UU-31 MERCED RIVER, CAL.

COMMERCE.

Description of; small, **93,** 3298.

ENGINEERS.

Chief of Engineers. **R., 93,** 431.

In charge. Maj. W. H. Heuer, 1893. **R., 93,** 3297.

PHYSICAL CHARACTERISTICS.

Description of; crooked branch of the San Joaquin R., 60± m. l., heading in the Yosemite Valley and emptying into the San Joaquin at Hills Ferry, **93,** 3297.

SURVEY.

Ex. au. act July 13, 1892; made by Maj. Heuer (**R.** unfav.), **93,** 3297.

UU-32 TUOLUMNE RIVER, CAL.

COMMERCE.

Description of, 1892, limited, **93,** 3300.

ENGINEERS.

Chief of Engineers. **R., 93,** 431.

In charge. Maj. W. H. Heuer, 1893. **R., 93,** 3299.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3299.

About 100 m. l., drains area of about 1,635 sq. m., and empties into San Joaquin R. near Grayson. Has min. flow of 30 c. f. per second and a max. flow of 22,900 c. f. per second. **93,** 3299.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Maj. Heuer (**R.** unfav.), **93,** 3299.

UU-33 STANISLAUS RIVER, CAL.

COMMERCE.

Description of, **93,** 3303.

ENGINEERS.

Chief of Engineers. **R., 93,** 431.

In charge. Maj. W. H. Heuer, 1893. **R., 93,** 3301.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3302.

Tributary to San Joaquin R., 100 m. l. Flows through country rich in mining and agriculture. Has min. flow of 21 c. f. per second and a max. flow of 11,000 c. f. per second. **93,** 3302.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Maj. Heuer (**R.** unfav.), **93,** 3301.

UU-45 MOKELUMNE RIVER, CAL.

APPROPRIATIONS.

1884,	$8,500,	**85,** 2359.
1886,	2,500,	**86,** 1924.
1888,	2,000,	**88,** 2131.
1892,	2,500,	**92,** 2652.
1894,	2,500,	**95,** 3298.
1905,	2,500,	**05,** 2432.
1907,	2,500,	**07,** 2147.
1910,	2,000,	**10,** 2359.
1911,	5,000,	**11,** 2562.
Total,	30,000	

COMMERCE.

Productions of adjacent country, **82,** 2640.

Description of, **93,** 3270; **94,** 2532; **95,** 3298; **96,** 3194; **01,** 608.

In 1893 there was a saving for the year of $50,250 in rates by the imp. of R.; in 1894, $42,000, **94,** 2533; in 1895, $41,000, **95,** 3298.

In 1898 there was little or no navigation above New Hope Landing, **98,** 2941.

Amounted in 1898 to about 50,000 t. an., **99,** 3168.

Economy of water transportation on R., **04,** 644.

Freight consists mostly of fresh vegetables, canned goods, lumber, live stock, etc.; 1911, 29,000 t., **12,** 2782.

CONTRACTS.

1895. J. W. Ferris, dr. 30,184 c. y., 12¢ c. y., **96,** 3194.

1910. N. R. Harris, lease of dr., $125 per day of 22 hrs., **10,** 2359.

ENGINEERS.

Chief of Engineers. **R., 81,** 324; **82,** 318; **85,** 362; **86,** 355; **87,** 321; **88,** 294; **89,** 349; **90,** 314; **91,** 395, 399; **92,** 372; **93,** 427; **94,** 399; **95,** 437; **96,** 389; **97,** 489; **98,** 475; **99,** 546; **00,** 627; **01,** 607; **02,** 529; **03,** 586; **04,** 644; **05,** 651; **06,** 725; **07,** 745; **08,** 792; **09,** 828; **10,** 920; **11,** 976; **12,** 1174–76.

In charge:

Lt. Col. G. H. Mendell, 1881–85. **R., 82,** 2037; **87,** 2441.

Capt. A. H. Payson, 1885–87. **R., 85,** 2358; **86,** 1924.

Maj. W. H. Heuer, 1887–95; 1898–1900. **R., 88,** 2131; **89,** 2485; **90,** 2911; **91,** 2986, 3133, 3135; **92,** 2651; **93,** 3269; **94,** 2531; **95,** 3297; **98,** 2941; **99,** 3168; (Lt. Col.) **00,** 4226.

Capt. C. E. Gillette, 1896–97. **R., 96,** 3193; **97,** 3359.

Lt. Col. W. H. Heuer, 1901–06. **R., 01,** 3419; **02,** 2354; **03,** 2193; (Col.) **04,** 3415; **05,** 2430; **06,** 1968.
Lt. Col. John Biddle, 1907–11. **R., 07,** 2146; **08,** 2225; **09,** 2192; **10,** 2358; (Col.) **11,** 2562.
Maj. S. A. Cheney, 1912–. **R., 12,** 2781.

Assistants:
C. D. Rhodes. **R., 82,** 2639.
Lt. S. W. Roessler. **R., 85,** 2359.
W. D. Woodbury. **R., 91,** 3137.

OBSTRUCTIONS.

Benson Ferry Br. declared obstr. to navigation, **04,** 3416.

OPERATIONS.

1884–85. 160 snags and 312 overhanging trees removed bet. Bensons Ferry and Snodgrass Slough, **85,** 2358.
1885–86. 718 snags, logs, and trees removed from same chan., **86,** 1925.
1886–87. 174 snags and 183 trees cut and removed, **87,** 2441.
1888–89. 107 snags and 72 overhanging trees cleared from R. by hired labor, **89,** 2486.
1895–96. 30,184 c. y. dr. from point of land opposite New Hope Landing acquired without cost to the U. S., and a small amount of revet. work done to aid in maintaining the chan. dr. About 2,000 obstrs. removed. **96,** 3194.
1903–04. Repairs on snag boat *Seizer*, **04,** 3416.
1905–06. 140 snags and other obstrs. removed, **06,** 1968.
1907–08. Snags removed, cut-offs made, and sand bars removed, **08,** 2225.
1909–10. 14,000 c. y. dr. by leased dr., **10,** 2359.
1910–11. 16,000 c. y. dr., cutting chan. through sand bars, and removing overhanging limbs and trees, **11,** 2562.
1911–12. Hardpan reef across chan. at mouth of Whitakers Slough broken up by blasting; a clamshell dr. removed from the chan. approx. 40,000 c. y. material, obstr. snags, and about 300 overhanging trees; dr. of reclamation district No. 551 engaged for work, after inviting proposals, **12,** 2781.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 2639; **05,** 2430.
Imp. valuable in facilitating flood control; general condition better than in previous years, **11,** 2562.
L. w. d. over portions of reef at Whitakers Slough before blasting, 5′, and afterwards 10′ at l. w., **12,** 2781.

PRIVATE WORK.

$40,000 spent by individuals and $10,000 by State in imp. R. and clearing obstr., **05,** 2431.
State of California and private parties did work above the Galt-New Hope Br., the upper limit of "present" proj., making navigable chan. 2 or 4 m. l., **11,** 2562.
Private parties constr. levees of material obtained from the blasted hardpan reef, **12,** 2781.

PROJECTS.

By Lt. Col. Mendell, 1881, Bensons Ferry to Snodgrass Slgouh, 10 m., removal of snags, logs, and similar obstr., and also excavation of shoals near mouth of the Cosumnes; est., $8,250, **82,** 2639. Both forks of the R. cleared to head of navigation, at cost of $10,960, **88,** 2131. Proj. imp. completed, **89,** 2486.
In 1890 Maj. Heuer proposed further imp. by closing canal entering the R., and dr. sand bar formed at junction, and also one at North Fork, to 6′, m. l. w.; also removal of snags and overhanging trees; est., $9,100, **91,** 3135, 3136; **92,** 2651.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, 1881, by Lt. Col. Mendell, **82,** 2637.
Au. act Sept. 19, 1890; made, 1890, by Maj. Heuer, **91,** 3135.
Ex., 1895, by Maj. Heuer, above New Hope Landing to ascertain obstr. in the R., **95,** 3298.
Sur. of R. by Lt. Col. Biddle, **10,** 2358.
Pre. ex. and sur. au. act Feb. 27, 1911, with view to its imp. from Galt-New Hope Br. to a point at or near Woodbridge, **12,** 1176.

UU-52 GEORGIANA SLOUGH, CAL.

COMMERCE.

Description of; 1894, 11,600 t.; of sufficient importance to warrant a removal of obstr., **95,** 3329.

ENGINEERS.

Chief of Engineers. **R., 95,** 440.

In charge. Maj. W. H. Heuer, 1895. **R., 95,** 3228.

Assistant. Lt. G. D. Fitch. **R., 95,** 3329.

PHYSICAL CHARACTERISTICS.

Description of; branch of the Sacramento R. connecting it with the Mokelumne R., 12± m. l., and a w. 120′–250′; ample d. of 15′, **95,** 3329.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Maj. Heuer (**R.** fav. to removing obstr.), **95,** 3328.

UU-55 SACRAMENTO AND FEATHER RIVERS, CAL.

Part.	Title.	Period.	Appropriation.
a	Sacramento and Feather Rs.	1841–1912	$1,002,000
b	Sacramento R.—Mouth to city of Sacramento	1896 1901	90,000
c	Feather R., Cal.	1894–1895	.....
	Total [See UU-6 (d. e. f.)]		1,092,000

Part (a), UU-55 Sacramento and Feather Rivers, Cal.

APPROPRIATIONS.

1875,	$15,000,	**75,** 123.
1878,	15,000,	**78,** 136.
1879,	[1] 20,000,	**79,** 215, 1749, 1756.
1880,	[1] 45,000,	**80,** 2236.
1881,	[1] 60,000,	**81,** 2472.
1882,	250,000,	**82,** 2534.
1884,	40,000,	**84,** 2192.
1888,	20,000,	**88,** 2133.
1890,	30,000,	**90,** 2916.
1892,	150,000,	**92,** 2654.
1894,	115,000,	**95,** 3306.
1902,	25,000,	**02,** 2356.
1904,	*22,000,	**04,** 3419.
1907,	50,000,	**07,** 2155.
1909,	*25,000,	**09,** 2201.
1910,	30,000,	**10,** 2370.
1911,	25,000,	**11,** 2573.
1912,	65,000,	**12,** 2778.
Total,	1,002,000	(incl. $90,000 carried under head of Sacramento R., from city of Sacramento to the mouth, and $1,942.07 recd. from sales, $1,093,-942.07, **12,** 2778).

COMMERCE.

R. d. sufficient for the "present" demands of C., **71,** 917.

Rapid increase of C., **75,** ii, 697; **76,** ii, 619.

Principal traffic, **77,** 993.

C. of the R., **80,** 2235.

Freight movement on the upper and lower Sacramento, **92,** 2654.

Description of, **93,** 3274; **94,** 2536; **95,** 3306; **96,** 3198, 3199, 3201.

For 10 years previous to 1892 no boat had been above McIntosh Landing, and in 1892–93, after the removal of obstr., $1,125 saved to shippers by the low rates by water, **93,** 3272.

Description of, Sacramento R.; over 141,600 t. carried an. for 10 years preceding 1899, above city of Sacramento; 405,817 t. below city, **99,** 3178.

Description of, Feather R.; average for the 3 years preceding 1899, 6,096 t., **99,** 3180.

Large, varies according to wheat crop; slight falling off during 1903, **04,** 647.

Average t. for 11 years previous to 1906, 429,528 t., **06,** 726.

Importance of R. to surrounding territory, **09,** 836.

CONTRACTS.

1875. A. Foster, removal of snags in the Sacramento R., **75,** 123, ii, 697; **76,** ii, 618.

1879. A. Foster, removal of snags in the Sacramento R., **79,** 1750, 1757. J. R. Rideout, removal of snags in the Feather R., **79,** 1750.

1880. S. D. Stevens, snag removal, $39.50 per snag, **80,** 2236. A. Foster, snag removal, $55 per snag, **80,** 2236. S. H. Davis, snag-boat constr., $29,774, **81,** 2472. A. Hay, barge constr., $11,980, **83,** 1971.

1890. J. Simpson, closing break in levee by pile and brush constr., $16,265, **90,** 2915.

1891. W. Elliott. repair of levees, 27½¢ c. y., **91,** 2988.

1893. R. Tibbitts, closure of slough ($9,862), **93,** 3272. California Construction Co., dr. and revet. work—dr., 17¾¢ c. y., mattresses, $1 c. y., r., $3.40 t. ($47,790), **94,** 2535.

1894. H. Tibbitts & Co., wing-dam constr. ($8,275), **95,** 3302.

1895. Risdon Iron & Locomotive Works, boiler for snag boat, $2,194, **95,** 3301.

1902. Darby Laydon, repairing wing dams on lower R., prices given, **03,** 2194.

1903. Gratto & Reimers, repairing U. S. snag boat *Seizer*, $10,139.08, **04,** 3419.

1905. Darby Laydon (2 contracts), repairs to wing dams on lower R., **06,** 1970.

1907. W. A. Boole & Son, constr. of snag scow, $4,270, **08,** 2234.

1908. Golden Gate Dredging Co., dr., 4½¢ c. y., **09,** 2200.

1909. Lindley & Co., furnishing groceries, etc., $1,096.52; Schmidt & Parker Packing Co., furnishing meats, etc., $1,096.75; Wm. A. Curtis, furnishing vegetables, etc., $740.36; J. B. Smith, furnishing coal, $7.50 t., **09,** 2201.

ENCROACHMENTS.

Injury to R. from hydraulic mining, **87,** 2444.

ENGINEERS.

Chief of Engineers. **R., 70,** 31, 84; **71,** 97; **75,** 123; **76,** 114; **77,** 121; **78,** 135; **79,** 178; **80,** 235, 236; **81,** 321; **82,** 315; **83,** 327; **84,** 331; **85,** 362; **86,** 355; **87,** 322; **88,** 295; **89,** 350; **90,** 314; **91,** 396, 399; **92,** 372; **93,** 428; **94,** 399; **95,** 437, 441; **96,** 390, 393; **97,** 490; **98,** 475; **99,** 557; **00,** 628; **01,** 608; **02,** 530; **03,** 587; **04,** 645; **05,** 652; **06,** 726, 732; **07,** 749; **08,** 797, 800; **09,** 835, 838; **10,** 927, 930; **11,** 983, 986; **12,** 1166.

Boards:

Convened, San Francisco, Feb. 3, 1891, by S. O. No. 66, to consider Sacramento and Feather Rs. with view to their future imp. **R., 91,** 2990. (Col. Mendell, Maj. Mackenzie, and Capt. Kingman.)

Convened, San Francisco, Feb. 9, 1891, by S. O. No. 56, to report upon mining débris question in California. **R., 91,** 2996. (Lt. Col. Benyaurd and Majs. Heuer and Handbury.)

Convened, San Francisco, by S. O. No. 61, Dec. 20, 1894, to consider and report upon imp. of Sacramento R. bet. Red Bluff and Redding. **R., 96,** 3199. (Lt. Col. Benyaurd, Maj. Heuer, and Capt. Gillette.)

Under au. act June 3, 1896, BE. appointed by S. O. No. 18, July 27, to have charge of the imp. of the Sacramento and Feather Rs. and their tributaries, Cal. (Col. C. R. Suter, Maj. Heuer, and Maj. C. E. L. B. Davis.) **R., 98,** 2944; **99,** 3171. Col. J. A. Smith, Lt. Col. Heuer, and Lt. Col. C. E. L. B. Davis). **R., 01,** 3423. Lt. Cols. D. P. Heap, W. H. Heuer, and T. H. Handbury. **R., 02,** 2355; **03,** 2194; **04,** 3417; **05,** 2433; **06,** 1969. Lt. Col. John Biddle, Maj. C. H. McKinstry, and Capt. T. H. Jackson. **R., 07,** 2153; **08,** 2231; **09,** 2199; **10,** 2367; Col. John Biddle, Maj. S. A. Cheney, Capt. T. H. Jackson, and Capt. Chas. T. Leeds, **11,** 2569. Col. John Biddle, Lt. Col. T. H. Rees, Lt. Col. C. H. McKinstry, Maj. S. A. Cheney, and Capt. Chas. T. Leeds. **R., 12,** 2775.)

Act Mar. 3, 1905, appoints board of 3 Engineer officers to make ex. of Sacramento, San Joaquin; and Feather Rs., with view to controlling overflow, **05,** 653. **R.,** Sept. 25, 1905, H. D. 262, 59th, 1st, **06** 732.

Ex. and sur. from Sacramento to Red Bluff; recom. an. expend. of $25,000, **11,** 986.

In charge:

Maj. R. S. Williamson, 1870. **R., 71,** 914.

Maj. G. H. Mendell, 1875–85. **R., 75,** ii, 696; **76,** ii, 619; **77,** 992; **78,** 1294; **79,** 1749; (Lt. Col.) **80,** 2233; **81,** 2470; **82,** 2533; **83,** 1969; **84,** 2191.

Capt. A. H. Payson, 1885–87. **R., 85,** 2360; **86,** 1926; **87,** 2441.

Maj. W. H. Heuer, 1887–95, 1898–1906. **R., 88,** 2132; **89,** 2486; **90,** 2912; **91,** 2987; **92,** 2652; **93,** 3271; **94,** 2533; **95,** 3299; **98,** 2942; **99,** 3169; (Lt. Col.) **00,** 4227; **01,** 3420; **02,** 2355; (Col.) **03,** 2194; (Col.) **04,** 3417; **05,** 2433; **06,** 1969.

Capt. C. E. Gillette, 1896–97. **R., 96,** 3195, 3223; **97,** 3360.

Capt. T. H. Jackson, 1907–11. **R., 07,** 2153; **08,** 2231; **09,** 2199; **10,** 2369.

Maj. S. A. Cheney, 1911–. **R., 11,** 2570; **12,** 2776.

* Allotment.

[1] Sacramento R. only.

Assistants:
Lt. W. H. Heuer. **R., 71,** 915.
L. J. Le Conte. **R., 75,** ii, 700; **79,** 1757.
Lt. A. H. Payson. **R., 77,** 994.
Mr. Bradford, **79,** 1752.
W. P. Smith. **R., 82,** 2534.
Capt. C. F. Palfrey. **R., 83,** 1971.
Lt. S. W. Roessler. **R., 84,** 2192.
A. Boschke. **R., 85,** 2361.
1st Lt. Douglass MacArthur, **05,** 644; **06,** 719.
Capt. W. P. Stokey, **10,** 926; **11,** 983.

ESTIMATES. (See Plans and Projects.)

By Lt. Heuer, constr. of wing dams and repairs, $7,385, **71,** 917.

By L. J. Le Conte, removal of snags, constr. of wing dams, and dr. Sacramento R. bet. Tehama and Colusa, $51,985, **75,** ii, 704. Constr. of wing dams and removal of snags in the Feather R. bet. Marysville and Fremont, $15,785, **75,** ii, 706.

By Maj. Mendell, amount required an. for maintaining Sacramento R., $10,000, **77,** 992.

By Lt. Payson, removal of obstr. in Georgiana Slough, $15,000, **77,** 995.

By Maj. Mendell, bank of brush and st. at Heacocks Shoal, and wing dam at Ironhouse Shoal, $25,000, **79,** 1754.

LEGISLATION.

Communications bet. Capt. Payson and the Atty. Gen. with view to regulation of hydraulic mining, **87,** 2444.

Act Mar. 3, 1905, au. exp. of available balance of app. for Sacramento and Feather Rs., and Sacramento R. above and below Sacramento, to be used on any portion of said R., **05,** 2434.

OBSTRUCTIONS.

In 1896 an iron br. at Red Bluff, without draws, barred navigation above that point, and 2 other brs. existed—one at Anderson, 40 m. above Red Bluff; the other just below the town of Redding—both without draws. **96,** 3199.

OPERATIONS.

Sacramento River:

1875–76. 180 snags removed, **76,** 114.
1878–79. 154 snags removed, **79,** 1750.

Feather River:

1875–76. 24 snags removed, 1,820 l. f. wing dams built, **76,** 114.
1878–79. 9 snags removed, **79,** 1750.

Sacramento and Feather Rivers:

1879–80. 154 snags removed from R. bed by contract, **80,** 2234.

1880–81. 336 snags removed, clearing the R. from Sacramento Colusa; 724 l. f. of wing dam built; snag boat built under contract, **81,** 2470.

1881–82. 1,151 snags removed; 661 trees felled; 5 wing dams built, aggregating 950 l. f.; 2 sunken barges and 1 drawbr. p. removed, **82,** 2534, 2535.

1882–83. 1,166 snags and 249 trees removed, **83,** 1972.

1883–84. 1,138 snags and 35 trees removed; brush wing dam built at Moons Isld., and repairs made on Calls Bend Dam, **84,** 2191.

1884–85. 1,322 snags and 754 trees removed; dams strengthened at Parrotts Chute and Calls Bend; br. p. removed, **85,** 2360.

1885–86. 650 snags and 139 trees removed, and as much dam building done as stage of water rendered possible, **86,** 1926.

1886–87. 1,029 snags removed and 250 trees cut down; dr. built by contract, **87,** 2442, 2443.

1887–88. 283 snags removed, and 550 l. f. wing dams built by hired labor, **88,** 2132.

1888–89. 658 snags removed by hired labor, **98,** 2486.

1889–90. Break in levee below Sacramento city closed under contract, **90,** 2915.

1890–91. 855 snags removed by hired labor; 3 levee breaches, aggregating 480′ l., repaired under contract, **91,** 2988.

1891–92. 974 snags removed, and 536 l. f. of wing dams built in the upper Sacramento R., **92,** 2652.

1892–93. Snags and other obstr. removed from 138 m. of R., and boat repaired, **93,** 3272.

1893–94. Over 900 snags and other obstr. removed, 270 l. f. wing dams built, **94,** 2534, 2535; a levee 2,690′ l. and 15′ w. built to close Jacob Slough, **94,** 2535; 238,990 c. y. dr., and a revet. constr., in the formation of a new mouth for the Yuba, **94,** 2536.

1894–95. 1,055 l. f. wing dams built, 684 snags and other obstr. removed, a wing dam constr. at Sacramento city, **95,** 3300; over 1,000 l. f. wing dams constr. at Heacock Shoals, and dam at Jacob Slough repaired, **95,** 3303.

1895–96. 1,312 l. f. wing dams built, over 1,000 snags and other obstr. removed, **96,** 3196; and levee at Parrott Bend in course of constr., **96,** 3197.

1896–97. About 1,500 snags and other obstr. removed, 703 l. f. wing dams built, and snag boat repaired; Parrott Bend levee completed and repaired, and a small wing dam constr. at Yuba R. near Daguerre Pt., **97,** 3360.

1897–98. 1,469 l. f. wing dams built, over 1,000 snags and other obstr. removed, and dam at Parrott Bend repaired, **98,** 2942.

1898–99. About 1,000 snags, etc., removed, and 7 wing dams built, **99,** 3169, 3182.

1899–00. 10 wing dams built, and about 1,000 snags, etc., removed, **00,** 4227.

1900–01. 860 snags and 537 trees removed and cut, and wing dam built by U. S. boat crew on upper R., **01,** 3421.

1901–02. 33 wing dams constr. on lower R., **02,** 2355.

1902–03. Repairs to snag boat, 748 snags removed, 658 l. f. wing dams built, and the moorings of 3 flying ferries removed from upper R.; repairs to wing dam and caving bank, and snags removed from lower R., **03,** 2195.

1903–04. Repairs to wing dam above Sacramento; also to snag boat, **04,** 3418.

1904–05. Repairs to wing dam and removal of snags above Sacramento, **05,** 2434.

1905–06. Removal of snags on upper R.; repairs to wing dams and removing obstr. on lower R., **06,** 1969.

1906–07. Two wing dams constr., and snags, etc., removed from upper R., **07,** 2154.

1907–08. Snags and other obstr. removed from upper R. and new snag scow put into commission; snags, etc., removed from lower R., **08,** 2232–2233.

1908–09. Repairs to snag boat and removing obstr. on upper R.; 66,680 c. y. dr. from bar in lower R., **09,** 2200.

1909–10. Obstr. removed from lower and upper R., **10,** 2369.

1910–11. 17,549 c. y. dr. from shoal at Sacramento, 2 temporary wing dams constr., snags and other obstr. removed from upper R., and repairs made to snag boat, **11,** 2570–72. 29,100 c. y. dr., 11 wing dams built, and snags and other obstr. removed from lower R., **11,** 2571–72.

1911–12. 44,480 c. y. dr., 3 wing dams built, and repairs made to one on upper R., **12,** 2776. 59 obstr. removed, wing dams built, dr., etc., on lower R., **12,** 2776–77.

PHYSICAL CHARACTERISTICS.

Sacramento River:

Large number of shoals, **71,** 915.
Banks of R. covered with rich soil, **71,** 915.
Difference bet. h. and l. w., **71,** 915.
Floods, **71,** 916.
Effect of tide on R., **75,** ii, 698.
Velocity of current, **79,** 1759.
Table of samples of sediment, **79,** 1752; method of obtaining, **79,** 1757, 1758.

Feather River:

General, of Feather R., **75,** ii, 705.
Effect of mining on the R., **78,** 1297.
Of upper R., **80,** 2237.

Sacramento and Feather Rivers:

Description of, **93,** 3274; **96,** 3198, 3199.

During 1892–93 the flood stage was far above the average and of long duration, **93,** 3274.

Water-gauge records, **95,** 3306; **97,** 3360.

Description of Bear R., a tributary of the Feather, **95,** 3305.

Data in figures concerning profile of the Sacramento R. from Sacramento to Red Bluff, **96,** 3197.

Description of Sacramento R. bet. Redding and Red Bluff, **96,** 3200.

Description of Steamboat Chan., **96,** 3224.

Flood discharge of Steamboat Chan. considered an important factor in the entire drainage system of the Sacramento Valley. Detailed description of, **96,** 3225.

Description of, Sacramento, **99,** 3173; Feather, **99,** 3178.

L.-w. profile of the Sacramento R., **99,** 3177.

BE. of 1896 satisfied that no permanent imp. of Feather R. at reasonable or advisable cost could be made until the flow of the detritus from Yuba and Bear Rs. would be stopped, **99,** 3180.

During floods a very large volume of water pours over the State of California weir (see Private work) and thus relieves the levees on both sides of the R., **00,** 4228.

Constr. of wing dams has beneficial effect on water d.; no l. w. since completion, **01,** 3424.

Chan. d., **01,** 609; **03,** 2195; **09,** 836.

Severe flood, 1904, caused break in levee and large damages to surrounding land by flooding, **04,** 3417.

Description of, after ex. made by BE., **05,** 2433.

PLANS. (See Estimates and Projects.)

By Maj. Williamson, constr. of dam at Eagle Nest 500′ l. also one at Sutterville 700′ l., **71,** 97.

By L. J. Le Conte, removal of snags and the constr. of wing dams on the Sacramento and Feather Rs., **75,** ii, 704, 706.

By Maj. Mendell, bank of st. and brush 2,500′ l. at Heacocks Shoal, and a wing dam 300′ l. at Ironhouse Shoal, **79,** 1754. For snag boat for upper R., **79,** 1755.

By State authorities for a relief canal tapping the R. 35 m. above city of Sacramento, to carry off the flood waters and discharge them into Suisun B., **79,** 1750.

PRIVATE (CORPORATE AND STATE) WORK.

Wing dams and dr. by California Steam Navigation Co., **71,** 97, 916. Snag boat owned and operated by the navigation company, **75,** ii, 699.

1876–77. 58 snags removed by private parties, **77,** ii. 993.

Several wing dams built by State of California under au. of Sec. of War, **99,** 3170.

Weir 2,000′ l. built by State of California about 15 m. above Sacramento, **00,** 4228.

State of California allotted $5,000 to remove snags from upper R., **03,** 2195.

Repairs to damaged levee, caused by flood, made by State reclamation district, **04,** 3417.

PROJECTS. (See Estimates and Plans.)

The proj. of Lt. Col. Mendell, 1874, imp. of Sacramento and Feather Rs., proposed snag removal and wing-dam constr. continued throughout; the amount app. from 1880 to 1886, $445,000. Imp. made to include, in 1880, the upper Sacramento for 100 m. above Colusa. Projs. have for their object the temporary imp. of the l. w. chan., and consist of snagging, dam constr., and bar scraping, carried on by hired labor and the U. S. snag boat. **75,** ii, 700; **80,** 2234; **86,** 1926.

In 1891 the BE. proposed further imp. of Sacramento and Feather Rs., (1) a specific an. app. of $25,000 for snagging, wind-dam constr., etc., above Sacramento city; (2) app. of $275,000 for removal of obstr. in the lower Sacramento R., and $25,000 for closure of Jacobs Slough above Sacramento city; (3) an app. of $300,000 for treatment of Yuba R. at and above Marysville; (4) an. app. of $20,000 for imp. navigable chan. of Feather R., **91,** 2988, 2989.

By Maj. Heuer, 1892, existing proj. modified and increased to include closure of Jacobs Slough, a large crevasse above city of Sacramento; mainten. of navigation on Feather R. by means of wing dams to remove shoals, and constr. of new mouth for Yuba R. near and above Marysville, **93,** 3271.

BE., 1894, est. $7,500,000 to imp. Sacramento R. bet. Redding and Red Bluff, **96,** 3204.

BE., 1896, est., 1897, $280,000 to imp. Sacramento R. from Sacramento to mouth of the R., **98,** 2946.

"Present" proj. for imp. au. act Mar. 3, 1899, and by subsequent acts, provides for obtaining and maintaining d. of 7′ from mouth of R. to Sacramento, 4′ from Sacramento to Colusa, and 3′ from Colusa to Red Bluff; est., $280,000 and $25,000 an. mainten. **12,** 1167.

Act July 25, 1912, modified proj. for upper Sacramento R. to provide for securing and maintaining 4′ from Sacramento to Colusa, 3′ from Colusa to Chico Landing, and such d. as practicable from Chico Landing to Red Bluff, at an. cost of $25,000, **12,** 1167.

SURVEYS.

Ex. of Sacramento R. by Capt. Wilkes, 1841, **79,** 1752.

Ex. of bar in Sacramento R. by Lt. Heuer, 1871, **71,** 97. **R., 71,** 915.

By L. J. Le Conte, 1875, **R., 75,** ii, 700.

Ex. of Georgiana Slough by Lt. Payson, 1877, **77,** 121.

Of lower Sacramento R., under direction of W. H. Hall, State engineer, by I. W. Smith, C. E., 1878, **79,** 1750.

Ex. of Sacramento R. by L. J. Le Conte. **R.,** 1879, **79,** 1757.

Of Suisun B. by Mr. Bradford, 1879, **79,** 1752.

Au. act Mar. 3, 1879, **79,** 179; made, 1880, by Lt. Col. Mendell, **80,** 2237.

Surs. made, 1892, by Maj. Heuer, of Jacobs Slough, **93,** 3272, and of Yuba and Feather Rs., **93,** 3273.

Misc. surs. and borings, **94,** 2536; **95,** 3301, 3303; **96,** 3196; **97,** 3360.

Ex. of Steamboat Chan. and from its junction thereof with Sacramento R. to mouth of said R., with view to imp. and enlarging navigable chan., and to increasing capacity for flood discharge, au. act Aug. 17, 1894; made by Capt. Gillette, 1896 (**R.** unfav.), **96,** 3223.

Act June 3, 1896, required formation of a BE., who should make surs. and exs. of Rs., and submit most feasible plan for imp. of the streams, and for mainten. of navigation. **R.,** 1898. **99,** 3173.

Ex. by board with view to controlling floods, with recom. and cost. **R.,** Sept. 25, 1905 (H. D. 262, 59th, 1st), **06,** 732.

Ex. and sur. of Sacramento R., up to Feather R., au. act Mar. 2, 1907. **R.,** by Capt. Jackson, 1907 and 1908; est., $67,000 (H. D. 1123, 60th, 2d), **09,** 838.

Ex. of Feather R., up to Marysville, by BE. **R.,** Mar. 31, 1909 (H. D. 76, 61st, 1st) (unfav.), **09,** 834.

Ex. and sur. au. act Mar. 3, 1909, of Sacramento R., from Sacramento to Red Bluff. **R.** by BE., including report on sur. from mouth of Feather R. to Chico Landing, 1909 and 1910. Recom. an expend. of $25,000 bet. Sacramento and Red Bluff with view to chan. 4′, Sacramento to Colusa, 3′ from Colusa to Chico Landing, and such d. as is practicable from Chico Landing to Red Bluff (H. D. 76, 62d, 1st), **10,** 930; **11,** 986.

Maps (H. D. 262, 59th, 1st; H. D. 1123, 60th, 2d):

Sketch of wing dams, **76,** ii, 619. Diagram of sediment bottle, and sketch of manner of collecting samples of sedimentary waters, **79,** 1757, 1758. Sketches showing relative form and dimensions of "sand dunes," and break in the levee, **79,** 1759, 1760. **86,** 1927; **96,** 3204.

Part (b), UU-55 Sacramento River from City of Sacramento to the Mouth, Cal.[1]

APPROPRIATIONS.

1899,	$30,000,	**99,** 3170.
1900,	60,000,	**00,** 4231.
Total,	90,000	

CONTRACTS.

1899. City Street Improvement Co., wing-dam constr. (piles, brush, and st.), $7,656, **00,** 4232.

1901. Darby Lydon, constr. wing dams, prices given, **01,** 3426.

ENGINEERS.

Chief of Engineers. **R., 00,** 629; **01,** 609.

Boards. Board of 1896 (see Sacramento and Feather Rivers, Cal.). **R., 00,** 4232; **01,** 3423.

In charge. Lt. Col. W. H. Heuer, 1899–1901. **R., 00,** 4230; **01,** 3421.

OPERATIONS.

1899–00. 3 wing dams built and 1 under way, **00,** 4230.

1900–01. 8 wing dams constr., and 35′ extension added to dam already built, **01,** 3422.

PROJECTS.

By board of 1896, wing dams at shoal places below Sacramento, to be supple. by dr. if required, at est. of $280,000, and mainten. of navigation on upper R. as far as Red Bluff, by concentration works and the removal of snags, at an est. an. expense of $25,000, **00,** 4233.

Part (c), UU-55 Feather River.

COMMERCE.

1895, No. C. above Marysville, **95,** 3327.

ENGINEERS.

Chief of Engineers. **R., 95,** 440.

In charge. Maj. W. H. Heuer, 1895. **R., 95,** 3325.

PHYSICAL CHARACTERISTICS.

Description of; R. rises in Sierra Nevada Mts.; flows s. to the Sacramento R.; joins it 21 m. above Sacramento, **95,** 3326.

SURVEY.

Ex. above Marysville au. act Aug. 17, 1894; made by Maj. Heuer (**R.** unfav.), **95,** 3326.

UU-56 AMERICAN RIVER, CAL.

COMMERCE.

Unimportant, **95,** 3337.

ENGINEERS.

Chief of Engineers. **R., 95,** 440.

In charge. Maj. W. H. Heuer, 1895. **R., 95,** 3335.

Assistant. Lt. H. Deakyne. **R., 95,** 3337.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3336.

In 1895 R. not considered navigable. It had about 15 rapids. Number of bars existed, caused by material washed into it by mining operations; this material in flood periods flowed into the Sacramento, R., **95,** 3336.

PROJECT.

In 1895 Maj. Heuer est. $1,077,500 to prevent an inflow of sand into the Sacramento R., **95,** 3337.

SURVEYS.

Ex. with view to preventing sand flow into the Sacramento R., au. act Aug. 17, 1894; made, 1895, by Maj. Heuer (**R.** unfav.), **95,** 3335.

UU-59 YUBA RIVER, CAL.

ENGINEERS.

Chief of Engineers. **R., 85,** 363.

In charge. Capt. A. H. Payson. **R., 85,** 2373.

SURVEY.

Ex. au. act July 5, 1884; made by Capt. Payson (**R.** unfav.), **85,** 2373.

UU-62(a) CLEAR LAKE, CAL.

ENGINEERS.

Chief of Engineers. **R., 84,** 334.

In charge. Lt. Col. G. H. Mendell. **R., 84,** 2210.

Assistant. Lt. C. F. Palfrey. **R., 84,** 2210.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 2211.

SURVEY.

Ex. au. act Aug. 2, 1882; made by Col. Mendell (**R.** unfav.), **84,** 2210.

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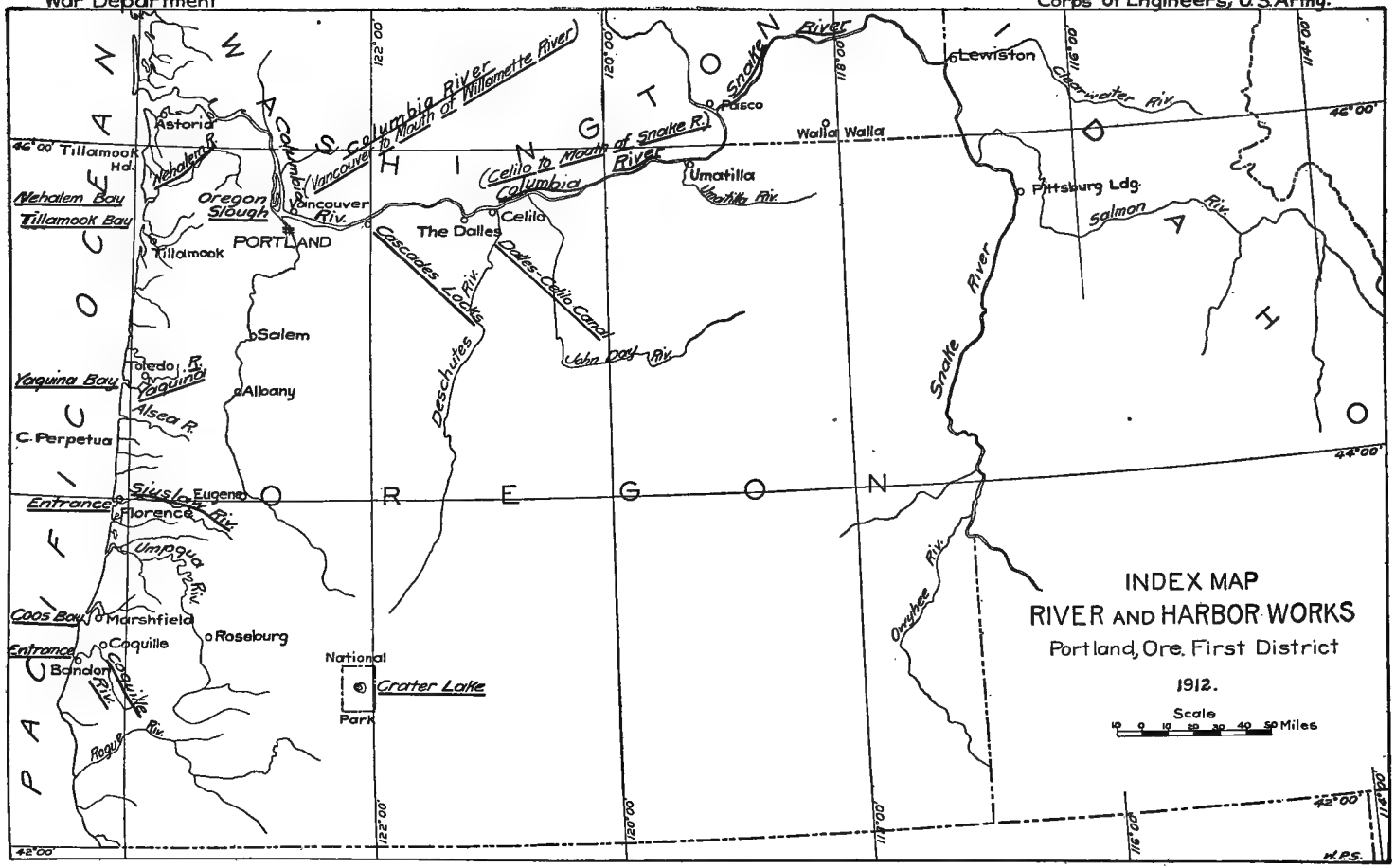
[1] Continued, after 1901, under head of Sacramento and Feather Rs.

RIVER AND HARBOR WORKS—PACIFIC COAST.

VV.—1st PORTLAND, OREG., DISTRICT.

War Department

Corps of Engineers, U.S. Army.



VV.—1st PORTLAND, OREG., DISTRICT.

In charge of U. S. Engineer Office, 1st District,[1]
Portland, Oreg.

VV 1 Pacific Ocean.
VV 2 Klamath Lake, Oreg. (TT 191)
VV 3 Wood R., Oreg. (2)
VV 4 Chetco Cove, Oreg. (1)
VV 5 Chetco R., Oreg. (4)
VV 6 Pistol R., Oreg. (1)
VV 7 Hunter Cove, Oreg. (1)
VV 8 Rogue R., Oreg. (1)
VV 9 Illinois R., Oreg. (8)
VV 10 Port Orford, Oreg. (1)
VV 11 Coquille R. Entrance, Oreg. (1)
VV 12 Coquille R., Oreg. (11)
VV 13 North Fork of Coquille R., Oreg. (12)
VV 14 Beaver Slough, Oreg. (12)
VV 15 Randolph Slough, Oreg. (12)
VV 16 Coos B., Oreg. (1)
VV 17 South Slough, Oreg. (16)
VV 18 Pony Slough, Oreg. (16)
VV 19 Mill Slough, Oreg. (16)
VV 20 Coal Bank Slough, Oreg. (16)
VV 21 Isthmus Slough, Oreg. (16)
VV 22 Catching Slough, Oreg. (16)
VV 23 Coos R., Oreg. (16)
VV 24 Coos R., North Fork, Oreg. (23)
VV 25 Coos R., South Fork, Oreg. (23)
VV 26 Willanch Slough, Oreg. (16)
VV 27 Kentuck Slough, Oreg. (16)
VV 28 Haynes Slough, Oreg. (16)
VV 29 North Slough, Oreg. (16)
VV 30 Umpqua R. Entrance, Oreg. (1)
VV 31 Winchester B., Oreg. (30)
VV 32 Umpqua R., Oreg. (31)
VV 33 Schofield R., Oreg. (32)
VV 34 Smith R., Oreg. (32)
VV 35 Otter Cr., Oreg. (34)
VV 36 Siuslaw R. Entrance, Oreg. (1)
VV 37 Siuslaw R., Oreg. (36)
VV 38 South Slough, Oreg. (37)
VV 39 Duncan Slough, Oreg. (37)
VV 40 North Fork, Siuslaw R., Oreg. (37)
VV 41 Alsea B., Oreg. (1)
VV 42 Alsea R., Oreg. (41)
VV 43 Indian Slough, Oreg. (41)
VV 44 Yaquina B., Oreg. (1)
VV 45 Yaquina R., Oreg. (44)
VV 46 Kings Slough, Oreg. (44)
VV 47 Pool Slough, Oreg. (45)
VV 48 Big Elk R., Oreg. (45)
VV 49 Olalla Slough, Oreg. (45)
VV 50 Depot Slough, Oreg. (45)
VV 51 Mill Four Slough, Oreg. (45)
VV 52 Boone Slough, Oreg. (45)
VV 53 Siletz B., Oreg. (1)
VV 54 Siletz R., Oreg. (53)
VV 55 Scow Slough, Oreg. (54)
VV 56 Salmon R., Oreg. (1)
VV 57 Nestucca B., Oreg. (1)
VV 58 Nestucca R., Oreg. (57)
VV 59 Little Nestucca R., Oreg. (58)
VV 60 Netarts B., Oreg. (1)
VV 61 Tillamook B., Oreg. (1)
VV 62 Hoquarten Slough, Oreg. (61)
VV 63 Tillamook R., Oreg. (62)
VV 64 Trask R., Oreg. (62)
VV 65 Dougherty Slough, Oreg. (62)
VV 66 Wilson R., Oreg. (61)
VV 67 Kilchis R., Oreg. (61)
VV 68 Miami R., Oreg. (61)
VV 69 Nehalem B., Oreg. (1)
VV 70 Nehalem R., Oreg. (69)
VV 71 Nehalem R., North Fork, Oreg. (70)
VV 72 Boones Slough, Oreg. (70)
VV 73 Necanicum R., Oreg. (1)
VV 74 Wauhanna R., Oreg. (73)
VV 75 Neacoxie R., Oreg. (73)
VV 76 [2]Columbia R., Oreg. and Wash. (1) (see WW)
(Tributary waters of Columbia from the mouth to Willamette R. are listed on p. 1615.)
VV 77 [2]Oregon Slough (N. Portland H.), Oreg. (76)
VV 78 [2]Sandy R., Oreg. (76)
VV 79 [2]Hood R., Oreg. (76)
VV 80 Deschutes R., Oreg. (76)
VV 81 John Day R., Oreg. (76)
VV 82 Umatilla R., Oreg. (76)
VV 83 Walla Walla R., Oreg. and Wash. (76)
VV 84 Snake R., Oreg., Wash., and Idaho (76)
VV 85 Grande Ronde R., Oreg. and Wash. (84)
VV 86 Imnaha R., Oreg. (84)
VV 87 Powder R., Oreg. (84)
VV 88 Melheur R., Oreg. (84)
VV 89 Owyhee R., Oreg. (84)

[1] This engineering district does not have jurisdiction over the waters of the Columbia River below the mouth of the Willamette, which is in the 2d Portland district, nor Columbia River above the mouth of the Snake, which is in the Seattle district. Columbia Slough, a branch of the Willamette River, at its mouth, is in the 1st Portland district.

[2] The Columbia watershed, from the mouth to Willamette R. is in charge of the 2d Portland office, see p. 1615.

VV 90 Boise R., Idaho (84)
VV 91 Weiser R., Idaho (84)
VV 92 Salmon R., Idaho (84)
VV 93 Clearwater R., Idaho (84)
VV 94 Clearwater R., South Fork, Idaho (93)
VV 95 Clearwater R., Middle Fork, Idaho (93)
VV 96 Clearwater R., North Fork, Idaho (93)
VV 97 Palouse R., Wash. and Idaho (84)
(Tributaries of Columbia R. above Snake R. are listed on p. 1656.
(The following tributaries are on the right bank of the Columbia between Snake R. and Willamette R.)
VV 98 Klickitat R., Wash. (76)
VV 99 Wind R., Wash. (76)
VV 100 White Salmon R., Wash. (76)
VV 101 Washougal R., Wash. (76)
VV 102 La Camas Slough, Wash. (76)

VV-1(a) OREGON AND WASHINGTON, COAST OF. (Dredging plant.)

APPROPRIATION.
1907, $100,000, **07,** 2168.

CONTRACTS.
1908. Portland Iron Works, constr. and delivering one 18″ hydraulic dr., $81,274, with extra parts **08,** 2244.

ENGINEERS.
Chief of Engineers. R., 04, 663; **05,** 668; **06,** 743; **07,** 758; **08,** 806; **09,** 844; **10,** 938.

In charge:
Maj. W. C. Langfitt, 1904–05. **R., 04,** 3468; **05,** 2454.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1984; **07,** 2168; **08,** 2243.
Maj. J. F. McIndoe, 1909. **R., 09,** 2211.
Maj. J. J. Morrow, 1910. **R., 10,** 2380.

OPERATIONS.
1907–08. Hull launched and considerable progress made on machinery, **08,** 2243.
1908–09. Dr. completed and towed to Coos B., where operations were in progress, **09,** 2211.
1909–10. After completion of work for private interests at Coos B., dr. worked from July 1 to Sept. 3, excavating in chan. bet. Standard Oil Dock and North Bend; dr. 528,644 c. y. oyster shells, sand and clay, **10,** 2380–2381.

PHYSICAL CHARACTERISTICS.
Navigation of various Hs. on coast often delayed by formation of shoals, material being of a nature that it could not be easily handled with dipper drs., **06,** 743.

PRIVATE WORK.
Funds subscribed by C. interests of Coos B., operated the plant by hired labor up to May 1, 1909, **10,** 939.

PROJECTS.
New proj., based on letter by DO., June 7, 1904, approv. by Chief of Engineers, au. constr. of dr. plant by U. S. for Tillamook B. and Bar, Yaquina B., Siuslaw R., Coos B. and H. (incl. Coos R.), and Coquille R., Oreg.; est., $50,000 for 1 dipper and suction dr. with 2 dump scows, **04,** 3469. Est. increased to $60,000, **06,** 1984; to $100,000, and au. obtained for expert to prepare plans, etc., **07,** 2168.
R. by Chief of Engineers concurring in revised est. of $100,000 for a 18″ suction dr. (R. and H. Com., D. 45, 61st, 2d.)
Cost of operation and mainten. of dr. est. at $5,000 per month for first 3 years and $6,000 per month thereafter, **08,** 807.
Dr. named *Oregon*, **10,** 2380.

VV-2(a) LINK RIVER, OREG.

ENGINEERS.
Chief of Engineers. R., 88, 304.

In charge. Capt. C. F. Powell, 1887. **R., 88,** 2179.

PHYSICAL CHARACTERISTICS.
Description of, **88,** 2179.

SURVEY.
Ex. au. act Aug. 5, 1886, **87,** 330; made, 1887, by Capt. Powell (**R.** unfav.), **88,** 2179.

VV-3 WOOD RIVER, OREG.

ENGINEERS.
Chief of Engineers. R., 88, 304; **10,** 950.

In charge:
Capt. C. F. Powell, 1887–88. **R., 88,** 2177.
Maj. J. B. Cavanaugh, **10,** 950.

PHYSICAL CHARACTERISTICS.
Description of, **88,** 2178.

SURVEY.
Ex. au. act Aug. 5, 1886, **87,** 330; made, 1887, by Capt. Powell (**R.** unfav.), **88,** 2177.
Pre. ex. au. act Mar. 3, 1909, from Klamath Lake to head of navigation. **R.** by Maj. Cavanaugh, Nov. 3, 1909 (H. D. 477, 61st, 2d) (unfav.), **10,** 950.

VV-4(a) MACK ARCH, OREG.

ENGINEERS.

Chief of Engineers. **R., 77,** 1053.

Boards. For the Pacific coast, met Aug., 1876, to "ex. the Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, Cal., with view of estab. break'r and H. of refuge." Board reported H. at Mack Arch, Oreg., would be small, but tolerably secure. **R., 77,** 1054. (Lt. Cols. Williamson, Alexander, and Stewart, and Maj. Mendell.)

PHYSICAL CHARACTERISTICS.

Details: A few m. n. of lat. 42° (or n. boundary of Cal.), **77,** 1053.

ESTIMATES.

By BE., break'r, $5,748,875, **77,** 1059.

VV-5 CHETCO RIVER, OREG.

COMMERCE.

Inappreciable, **93,** 3430.

ENGINEERS.

Chief of Engineers. **R., 93,** 444.

In charge. Capt. T. W. Symons, 1893. **R., 93,** 3429.

Assistant. Lt. F. R. Shunk. **R., 93,** 3431.

PHYSICAL CHARACTERISTICS.

Small stream entering the Pacific Ocean about 3 m. n. of the boundary line bet. Oregon and California, about 30 or 35 m. l.; practically no tidal compartment, and its greatest w. at the mouth 60′, **93,** 3430.

SURVEY.

Ex. au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** unfav.), **93,** 3429.

VV-8 ROGUE RIVER, OREG.

COMMERCE.

No C. to be benefited, **79,** 1858, 1860–1863.
Dangerous character of adjacent coast, **79,** 1858.
Description of, interested, **93,** 3434.

ENGINEERS.

Chief of Engineers. **R., 78,** 139; **79,** 183; **93,** 445.

In charge:
Maj. J. M. Wilson. **R., 79,** 1823.
Maj. G. L. Gillespie. **R., 79,** 1856.
Capt. T. W. Symons, 1893. **R., 93,** 3433.

Assistants:
P. G. Eastwick. **R., 79,** 1858.
Lt. F. R. Shunk. **R., 93,** 3435.

PHYSICAL CHARACTERISTICS.

Description, **79,** 1823, 1824, 1857–1863; **93,** 3433.
High freshets, **79,** 1861, 1862.
Discharge of R., **79,** 1862.
Mineral deposit, **79,** 1861.
In 1892 the R. and valley was thought second in importance only to the Willamette R. and valley in w. Oregon. R. drains the w. slope of the Cascade Mts. into the Pacific Ocean, is about 300 m. l., and not navigable. Grants Pass is a town at the head of Rogue R. Valley. **93,** 3434.

PLAN.

By P. G. Eastwick, 1879, removal of r. and gravel from rapids and shoals and building 900 l. f. of wing dam; est., $18,600. Maj. Gillespie did not advise imp. **79,** 1863.

SURVEYS.

By Maj. Wilson, ex., mouth to Scottsburg, **78,** 139.
By P. G. Eastwick, pre. ex., **79,** 183, 1856.
Ex. Grants Pass to mouth, au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** unfav.), **93,** 3433.

VV-10 PORT ORFORD, OREG.

COMMERCE.

Availability as a H. of refuge, **73,** 1126; **77,** 1054; **79,** 1805, 1806.
Description of, **95,** 3497.
In 1895 the imports were limited; exports, $64,730, **95,** 3498.
In 1898 C. insignificant when compared with the large sum required to adequately protect the H. from storms, **98,** 3006.

ENGINEERS.

Chief of Engineers. **R., 73,** 107; **77,** 123; **78,** 139; **79,** 183; **91,** 411; **95,** 458; **96,** 393; **97,** 494; **98,** 479, 502; **99,** 562; **00,** 634.

Boards:
Convened, 1876, to ex. various Hs., with view to estab. H. of refuge; reported main objection the great d. of water on the line of proposed break'r, and also presence of Orford Reef off the coast, making the approach from the n. dangerous. **R. 77,** 1054. (Lt. Cols. Williamson, Alexander, and Stewart, and Maj. Mendell.)
Convened, San Francisco, Oct. 27, 1890, by S. O. No. 66, to consider and report upon the proposed H. of refuge at Port Orford, Oreg. **R., 91,** 3305. (Col. Mendell, Maj. Handbury, and Capt. Symons.)

In charge:
Maj. H. M. Robert, 1872. **R., 73,** 1123.
Maj. J. M. Wilson, 1878. **R., 79,** 1802.
Capt. T. W. Symons, 1895. **R., 95,** 3491.
Capt. W. L. Fisk, 1896–98. **R., 96,** 3228; **97,** 3379; (Maj.) **98,** 2958, 3003.
Capt. W. W. Harts, 1899–1901. **R., 99,** 3199; **00,** 4265.

Assistants:
F. H. West, **73,** 1123.
J. G. Kelley. **R., 95,** 3500.

PHYSICAL CHARACTERISTICS.

General, **73,** 1123, 1128; **79,** 1803, 1805; **95,** 3493.
Rocky islets of the coast, **77,** 1054; **79,** 1803.
Tides, **79,** 1803.
Gales, **79,** 1805.
Resources of interior country, **79,** 1806.
Port Orford an open roadstead and village on coast of Oregon, 51½ m. from Oregon and California boundary line. Wide open to sea to the s., direction from which comes the worst storms, **95,** 3493.

PLANS.

By Maj. Robert, constr. of break'r, 500 y. l., in 10 fathoms of water; purchase of land and the constr. of a narrow-gauge RR. to facilitate the process of constr.; est., $2,902,000, **73,** 1127–1129.
BE., 1876, break'r, about 1 m. in l., to protect H. from s. and sw. gales; est., $10,507,343, **77,** 1054.
By Maj. Wilson, constr. of break'r, 2,000′ l.; est., $3,427,000, which could be extended to 5,000′ if necessary; est., $9,405,000, **79,** 1804, 1805.
For plans and est. considered by the board, see **91,** 3306.

PROJECTS.

In 1895 Capt. Symons est. $364,254 or $511,754 to constr. wharves for C. purposes, **95,** 3495–3496.
By Capt. Symons, 1895, constr. wharf 300′ l. of r., etc., from Graveyard Pt. for C. shipping purposes; est., $203,366, **95,** 3495.
Capt. Harts, 1900, reported that existing wharf conditions accommodations were ample for "present" and prospective needs. Chief of Engineers directed that all work be suspended, **00,** 4266.

SURVEYS.

By Maj. Robert, 1872. **R., 73,** 1123.
By Maj. Wilson, 1878. **R., 79,** 1802.
Ex. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **91,** 3305.
Sur. with view to imp. place and making it H. of refuge au. act Aug. 17, 1894; made by Capt. Symons, 1895 (see Projects), **95,** 3491.
Sur. with est. of cost of imp. and importance of place to shipping and C., au. act June 3, 1896; **R.** (unfav.), 1898, by Capt. Fisk, **98,** 3003.

VV-12 COQUILLE RIVER, OREG.

Part.	Title.	Period.	Appropriation.
a	Coquille River, Oreg.	1873–1912	$411,000
b	Coquille River, Oreg. (Coquille City to Myrtle Pt.)	1892–1902	31,000
	Total		442,000

Part (a), VV-12 Coquille River, Oreg.

APPROPRIATIONS.

1880,	$10,000,	**80,** 241.
1882,	10,000,	**82,** 2683.
1884,	10,000,	**84,** 2271.
1886,	20,000,	**86,** 2004.
1888,	25,000,	**88,** 2140.
1890,	30,000,	**90,** 2927.
1892,	25,000,	**92,** 2665.
1894,	20,000,	**95,** 3344.
1896,	20,000,	**96,** 3229.
1899,	40,000,	**99,** 3201.
1902,	30,000,	**02,** 2364.
1905,	55,000,	**05,** 2443.
1907,	60,000,	**07,** 2158.
1910,	56,000,	**10,** 2372.

Total, 411,000 (incl. $10.45 received from sales, $411,010.45, **12,** 2785).

COMMERCE.

Methods of transportation, **74,** ii, 366; **79,** 1807, 1809.
Description of, **79,** 1808; **85,** 2401.
Increasing at 1900, **00,** 638.
Principal articles, lumber and coal taken to San Francisco by small vessels for market, **01,** 615.
R. and ocean form only means for transportation, **04,** 652.
Imp. increases carrying capacity of vessels and has effect of reducing freight rates, **09,** 839; **10,** 931; **12,** 1178.
Tonnage, 1911, 130,781 t., **12,** 1178.

CONTRACTS.

1891. W. R. Panter, piles, 5¢ l. f. E. Fahy, lease of quarry, $100 per an. Capt. Parker, furnishing scows and steamboat, and towing r. from the quarry to the wharf, $1 c. y., **91,** 3147.
1895. Nickum & Jacobsen, j. constr.; piles, 8¢ l. f.; lumber, $9.50 1,000′; ironwork, 3 and 4½¢ lb.; brush mattresses, 35¢ c. y.; st., 58¢ t.; **95,** 3345.
1896. D. Kern, j. constr.; piles, 8½¢ l. f.; lumber, $9 1,000′; ironwork, 3, 4, and 5¢ lb.; mattresses, 35¢ c. y.; st., 63¢ t.; **97,** 3382.
1899. J. Kiernan, j. constr. and tramway repair (piles, lumber, ironwork, mattresses, st.), $33,568, **00,** 4270.
1902. John Kiernan, extending n. j. seaward about 555′, building tramway that distance on line of work, laying foundation mattresses of brush fascines, and enrocking n. j.; weights of st. given; contractor allowed use of U. S. plant; John Kiernan (supple.), for rebuilding Parker Wharf and extending single track from it to n. j., **03,** 2206, 2208. John Kiernan, to secure and transfer to the U. S. right of way and occupancy of certain land in addition to repair of wharf; price of all supple. work, $1,300, **04,** 3438.
1905. John Kiernan, mattress, pile and r. work, n. j., r. to be taken from Tupper Rock quarry near Bandon, prices listed, **06,** 1974, 1975.
1907. Robert Wakefield, j. work (n. j.), prices listed, **07,** 2158, 2159.
1911. Chris & Nels Rasmussen, hire and lease of 1 room, $7.50 per month, **12,** 2785.

ENGINEERS.

Chief of Engineers. R., 73, 108; **74,** 118; **78,** 139; **79,** 183; **80,** 241; **81,** 330; **82,** 322; **83,** 336; **84,** 339; **85,** 366; **86,** 362; **87,** 325, 330; **88,** 296; **89,** 353; **90,** 317; **91,** 399; **92,** 375; **93,** 432; **94,** 402; **95,** 441; **96,** 394; **97,** 495; **98,** 480; **99,** 563; **00,** 636; **01,** 614; **02,** 535; **03,** 593; **04,** 651, 663; **05,** 657, 668; **06,** 732, 743; **07,** 751, 758; **08,** 800, 806; **09,** 838; **10,** 930, 950; **11,** 987; **12,** 1176.

In charge:
Maj. H. M. Robert, 1873; **73,** 108. **R., 74,** ii, 364.
Maj. N. Michler, 1874; **74,** 117. **R., 74,** ii, 364.
Maj. J. M. Wilson, 1878–79; **78,** 139; **79,** 183. **R., 79,** 1806.
Maj. G. L. Gillespie, 1880–82. **R., 81,** 2596.
Capt. C. F. Powell, 1882–87. **R., 82,** 2682; **83,** 2068; **84,** 2270; **85,** 2398; **86,** 2003; **87,** 2458, 2498.
Capt. W. Young, 1888–90. **R., 88,** 2137; **89,** 2503.
Capt. T. W. Symons, 1890–95. **R., 90,** 2924; **91,** 3146; **92,** 2662; **93,** 3324; **94,** 2553; **95,** 3344.
Capt. W. L. Fisk, 1896–98. R., **96,** 3228; **97,** 3380; (Maj.) **98,** 2958.
Capt. Harts, 1899–1901. **R., 99,** 3200; **00,** 4266.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3464; **02,** 2363; (Maj.) **03,** 2205; **04,** 3436; **05,** 2441.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1973, 1984; **07,** 2157, 2168; **08,** 2235, 2243.
Maj. J. F. McIndoe, 1909. **R., 09,** 2203.
Maj. Jay J. Morrow, 1910–. **R., 10,** 2371; **11,** 2575; **12,** 2783.

Assistants:
C. M. Bolton, **79,** 1806. **R., 79,** 1809.
R. S. Littlefield. **R., 81,** 2598; **83,** 2070; **85,** 2400; **92,** 2667; **93,** 3326; **94,** 2556; **95,** 3346.
J. S. Polhemus. **R., 96,** 3230.
Capt. A. A. Fries, **06,** 732.
Capt. Henry H. Robert, **12,** 1176.

ESTIMATES.

By Maj. Michler, canal from Low's place to Coos B., $349,592, **74,** ii, 368.
By Maj. Wilson, dams and training walls at mouth, $164,200, **79,** 1808, 1810.

OPERATIONS.

1880–81. 50 l. f. of riprap j., with central core of timber boxes constr., **81,** 2597.
1881–82. Addition of 100 l. f. to j. and temporary elevation to high-water line by addition of plank parapet; cribs riprapped, **82,** 2682, 2683.
1882–83. Jetty extended by 370 l. f. piling and 58 l. f. riprap, **83,** 2069.
1884–85. 442 l. f. close piling driven; 860 c. y. st. ballast quarried and placed in j., **85,** 2399.
1886–87. Extension of pile j. to 1,626′, **87,** 2458.
1887–88. Jetty extended 300 l. f. by 14,235 l. f. of piling and 3,384 c. y. of st., **88,** 2138.
1888–89. 4,000 c. y. st. quarried and placed in j., and 1,944′ of tramway built, **89,** 2504.
1889–90. Rock removed and snagging, **90,** 2925.
1890–91. 327 snags and 69 scow loads of drift cleared from the R.; plant repaired for extension of n. j., **91,** 3147.
1891–92. 1,500 c. y. st. placed in j.; erection of buildings and constr. of plant, **92,** 2663.
1892–93. N. and s. js. strengthened and repaired, **93,** 3325.
1893–94. S. j. strengthened and n. j. repaired, **94,** 2555.
1894–95. Preparations made for commencement of j. constr., **95,** 3346.
1895–96. S. j. strengthened and extended 224′, **96,** 3229.
1896–97. Extension of s. j. in progress. **97,** 3381.
1897–98. In connection with previous year, s. j extended 270′ (total l. of j., 2,387′), **98,** 2959.
1899–00. S. j. tramway repaired and extended. 19,739 short t. st. placed in j. Unsuccessful attempt made to remove large r. **00,** 4267–4269.
1900–01. S. j., 2,700′ l., n. j. tramway and n. j., each 510′ l., completed; costs and quantities of materials placed in each with deductions for rent of U. S. plant by contractor, inspection, etc., given, **01,** 3464, 3465. Brush mattresses placed as foundations for n. j. and tramway described, **01,** 3465. Method of depositing st. taken from Tupper Rock described, **01,** 3465, 3466. Since rebuilding of n. j., d. in new bar chan. has ranged from 7′ to 13′ at m. l. t.; attempt to remove chan. r. by surface blasting failed, **01,** 3466.
1902–03. Quantities of materials placed in n. j. given; placing of these resulted in extension of n. j. 360′ in partly completed state, **03,** 2206.
1903–04. Quantities of material placed in n. j. given; placing of these resulted in extension of n. j. seaward 195′; contract completed; total l. of n. j. now 1,065′; 515′ to be constr., **04,** 3436.
1904–05. Repairs to and mainten. of plant, and constr. of sur. boat; some of plant from Siuslaw R. added, **05,** 2442.
1905–06. Tramway, with j., rebuilt and extended 225′, foundation of brush mattress laid to the end and 31,850 t. st. placed along j.; crest of enrockment now 2′ to 3′ above ordinary h. w.; amount of materials placed given, **06,** 1974.
1906–07. No active operations, plant cared for by watchman; receiving wharf and approach to n. j. incl. land on which located, purchased from former contractors for $1,355, **07,** 2158.
1907–08. Tramway repaired; 22,840 t. st. placed in n. j., raising enrockment to level of h. t. for further distance of 150′, **08,** 2336.
1908–09. 8,587 t. st. dumped, extending n. j. further distance of 135′; total st. placed in n. j. under Wakefield contract, 31,427 t., extending j. 285′ seaward; contract completed; work under this contract and work done in former years resulted in constr. of s. j. 2,700′ l., and n. j. 1,575′ l.; sea ends of js. are 600′ apart; l. w. d. on bar increased from 3′ to 10′, **09,** 2203, 2204.
1909–10. Port Siuslaw R. Commission permitted to use old U. S. plant, and greater part towed to Siuslaw, **10,** 2372.
1910–11. Work on removal of Rock "E" commenced by snag boat and drill scow; rocks E and D drilled and rock E blasted, resulting in reduction of r. from 2′ above to 5′ below m. l. w.; dr. *Oregon* removed 28,504 c. y. from Bandon Shoal, **11,** 2576.
1911–12. 606 snags removed by U. S. snag boat and hired labor; 101,516 c. y. material dr. by dr. *Oregon*, and a cut through Strangs Shoal made by bucket dr.; subaqueous rockwork continued during year; 1,200 c. y. r. dr.; proj. practically completed, **12,** 2784.

PHYSICAL CHARACTERISTICS.

Description of, **74,** ii, 365, 366, 367; **79,** 1806, 1807, 1809.
Fertility of valley tributary to R., **74,** ii, 365; **79,** 1807, 1809.
High-water marks, **74,** ii, 367; **79,** 1807.
Effect of incomplete js., **99,** 3200.
Unusually heavy storms, 1899–1900, **00,** 4268.
The least l.-t. d. in the chan., sur. of 1899, 6′, **00,** 4269.
90′ of sea end of completed s. j. beaten down by heavy seas, **01,** 3466; **02,** 2364. N. j. remains same as left last year, **02,** 2364.
Max. draft carried over bar at m. l. w., 7′; average range of tide on bar, 4.2′, **04,** 652.
150′ of sea end of n. j. carried away by storms and crest of enrockment lowered; outer end of s. j. beaten down by heavy seas; shoals formed in R. above Bandon; l.-w. d. in bar chan., 8′ to 9′, **04,** 3436, 3437.
N. j. much deteriorated, and tramway broken down, **06,** 1974. Ocean bed scoured away along n. j. from 4′ or 5′ d. to 14′ to 16′ at m. l. w., **06** 1975.
D. of water on shoals, **10,** 931.
D. of water on bar, 9′, **11,** 2576.
All dr. cuts have shoaled some: erosion of the sandy n. shore inside the entrance from n. j. e. has continued; a considerable portion of the n. j. tramway approach washed out, **12,** 2784.
R. rises in Coast Range, flows 100 m. nw.: flows into Pacific at Bandon, Oreg., about 375 m. n. of San Francisco, **12,** 1176.

PLANS. (See Projects.)

By Maj. Michler, 1874, canal from Low's place, on Coquille R., to Coos B., 4′ x 30′ x 27,180′ l.-w. mark; est., $349,592, **74,** ii, 367, 368.
By Maj. Wilson, 1878, imp. mouth of R. by continuing work on dams and training walls commenced by private parties, object to produce scouring effect on the inlet; est., $164,200, **79,** 1808, 1810.
By Capt. Powell, 1887, snagging, Coquille City to Myrtle Pt.; cost, $5,000, **87,** 2499.

PRIVATE WORK.

Private parties began dam 600′ below mouth, with training walls to produce scouring; work suspended, **79,** 1808, 1809.

Elevation of j. by private work, **83,** 2068.

In connection with n. j., contractor built receiving wharf and 1,100′ of elevated tramway, which under the contract became the property of the U. S., **01,** 3466.

PROJECTS. (See Plans.)

By Maj. Wilson, 1878, imp. of bar at mouth to give chan. 10′ d. m. l. w., with training walls; est., $164,200, **79,** 1808, 1810; **81,** 2599.

In 1891 Capt. Symons est. cost of completing the proj. at $130,000, incl. extension of the s. j. 700′, and completion of the n. j. to equal l., making total revised cost of proj. $228,000, **91,** 3148.

(Given in 1912 report as follows: Orig. proj. adopted 1878—2 converging high-tide js. of rubblest., 800′ apart, located to make R. flow into sea ½ m. n. of orig. mouth, js. to maintain 12′ at l. t. In 1880, d. reduced to 10′; in 1888, to 8′; and in 1891, plan was changed to make js. 600′ apart, **12,** 1176.)

In 1892 Capt. Symons est. cost of completing proj. at $180,718, **92,** 2665.

By Capt. Symons, 1894–95, to abandon old system of single track and close pile tramway, replacing it with regular open work pile bent, double track tramway, and building the enrockment on a brush mattress, **95,** 3345.

Capt. Harts est., 1899, $75,000, if app. at one time, to complete n. j., **00,** 4269.

Capt. Langfitt proposed to extend n. j. seaward for 1,000′; est., $75,000, **01,** 3466, 3467.

By Maj. Langfitt, to remove r. in chan., by blasting, to 8′ below m. l. w., or build spur j. bet it and s. j.; est. for either, $6,000, **03,** 2207.

By Maj. Langfitt, constr. of dr. plant; est., $50,000, **04,** 663, 3468; **05,** 668, 2455.

By Lt. Col. Roessler, combined dr.; est., $60,000, **06,** 1984.

By Maj. McIndoe, au. act June 25, 1910; removal of snags, removal of mid-chan. r. and rs. near mouth, dr. chans. 100′ and 140′ w., and 9′ and 10′ d., through shoals and constr. regulating works; est., $50,000, and $6,000 an. mainten. (H. D. 673, 61st, 2d), **10,** 930, 931, 2372.

Maj. Morrow recom. that washing away of the shore should be arrested by extending the n. j. shoreward, or by constr. some form of beach protection, **12,** 2784.

SURVEYS.

Ex. of navigable outlet au., **73,** 108; **74,** 118; made by Maj. Michler, **74,** ii, 364.

Sur. au.; completed by C. M. Bolton, **78,** 139; **79,** 183, 1809.

Made, 1880, by Maj. Gillespie, **81,** 2596.

Ex. into condition of chan. and j., **84,** 2270.

Ex. au. bet. Coquille and Myrtle Pt. by act Aug. 5, 1886; made, 1887, by Capt. Powell, **87,** 2499.

Sur. of to gain complete knowledge of conditions made, 1894, by Capt. Symons, **95,** 3350+.

Sur. of the mouth to ascertain the effect of incomplete js. made, 1899, by Capt. Harts, **00,** 4269.

Made, 1905, by Maj. Langfitt, showing d. of 8′, m. l. w., in bar chan., **05,** 2442.

Ex. and sur. at and near mouth, au. act Mar. 2, 1907; made, 1907, by Lt. Col. Roessler (R. fav.); est., $27,840 (H. D. 399, 60th, 1st), **08,** 817.

Ex. and sur. au. act Mar. 3, 1909, from mouth, incl. the bar, up to Myrtle Pt.; made, 1909–10, by Maj. McIndoe (**R.,** fav., except to part bet. Myrtle Pt. and mouth of North Fork) (H. D. 673, 61st, 2d), **10,** 950.

Pre. ex. and sur. au. act June 25, 1910, of North Fork, for 17 m. upstream from mouth; and of East Fork, for 8 m. upstream from mouth (**R.** to come), **12,** 1206.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1178.

Maps. (H. D. 399, 60th, 1st.) **82,** 2682; **83,** 2072; **84,** 2270; **85,** 2400. Mouth, **86,** 2003; **91,** 3151; **93,** 3324; **00,** 4270; **05,** 2442; **06,** 1974.

Photographs. Jetties, **99,** 3200.

Part (b), VV-12 Coquille River, Oreg. (Coquille City to Myrtle Point).

APPROPRIATIONS.

1892,	$5,000,	**93,** 3329.
1894,	5,000,	**95,** 3349.
1896,	12,000,	**96,** 3232.
1899,	9,000,	**99,** 3202.
Total,	31,000	

COMMERCE.

In 1894 navigable importance of R. under imp. liable to decrease on account of the constr. and operation of a RR. bet. Coquille City and Myrtle Pt., **94,** 2559.

Boats being built, 1900, for shallow navigation of the stream, **00,** 4273.

Tonnage, 1896, 3,000 t.; 1901, 4,000 t., **02,** 537.

CONTRACTS.

1897. Noble & Saunders, dr., constr. dikes, etc.; piles, 12½¢ l. f.; lumber, $12.50 M f.; ironwork, 7½¢ lb.; brush, $2.25 cord; st., $1 t.; sand excavation, 10 and 15¢ c. y.; snagging, $25 per day ($14,295), **97,** 3384.

ENGINEERS.

Chief of Engineers. **R., 93,** 433; **94,** 403; **95,** 442; **96,** 394; **97,** 496; **98,** 481; **99,** 565; **00,** 638; **01,** 615; **02,** 536.

In charge:

Capt. T. W. Symons, 1893–95. **R., 93,** 3329; **94,** 2558; **95,** 3348.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3231; **97,** 3383; (Maj.) **98,** 2961.

Capt. W. W. Harts, 1899–1900. **R., 99,** 3202; **00,** 4271.

Capt. W. C. Langfitt, 1901–02. **R., 01,** 3468; **02,** 2365.

Assistants:

D. B. Ogden. **R., 95,** 3351.

R. S. Littlefield. **R., 95,** 3355.

OPERATIONS.

1892–93. About 1,000 snags removed and 200′ of wing dam built, **93,** 3330.

1894–95. About 375 snags removed and about 500′ of wing dam built, **95,** 3350.

1895–96. Few obstr. removed, **96,** 3232.

1896–97. Some snagging done, **97,** 3383.

1897–98. 3,700′ of pile and brush dikes built; 2,200 l. f. pile, brush, and lumber shore protection built, and some dr. done, **98,** 2962.

1899–00. About 300 snags, etc., removed; over 8,000 c. y. dr., **00,** 4272.

1900–01. Operations carried on by hired labor and U. S. plant; 21,134 c. y. dr. and 304 logs and 579 small snags removed, resulting in l. w. chan. 4 x 50′ through shoals for 5,310′, **01,** 3468, 3469. Six cross dikes, aggregate l., 585′, constr., connecting 2 rows of pile dikes built, 1898, to banks of R.; operations for year suspended on account of small balance available Oct. 25, 1900, **01,** 3469. New stern-wheel SS. *Welcome* completed and placed in commission, **01,** 3470.

1901–02. Care of U. S. plant, and removal of piles obstr. navigation, **02,** 2365.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3329; **95,** 3350; **01,** 616, 3470; **02,** 537.

In 1893 navigation obstr. bet. Coquille City and Myrtle Pt. by snags and other obstr., **93,** 3329.

Condition of stream bet. Rackliffs Landing and Myrtle Pt. worse each year. Wing dams to remove sediment of but little benefit. **00,** 4273.

Considerable shoaling, **02,** 537.

PROJECTS.

By Capt. Symons, 1892–93, removal of bad snags obstr. navigation and tending to form bars; contraction of R. into chan. 50′ w. where shoals have formed in order to scour out desired d.; est., $26,000, **93,** 3329.

By Maj. Symons, 1895, revising proj. to provide for confining waters of R. bet. pile dikes about 60′ apart, or bet. a pile dike and strongly revetted shore; dr. chan. 4′ x 50′ l. w. and depositing dr. material behind pile dikes; and constr. of wing dams below Roberts Landing to scour out shoals at that point; cost, $43,176.48, **95,** 3350.

SURVEYS.

Sur. made, 1894, by Capt. Symons, **95,** 3350.
Maps. **95,** 3356.
Photographs. **00,** 4272.

VV-15(b) CAPE GREGORY, OREG.

ENGINEERS.

Chief of Engineers. **R., 77,** 123.

Boards. Of the Pacific coast, met Aug., 1876, to "ex. the Hs. of Mendocino, Humboldt B., Trinidad, and Crescent City, Cal., with a view of estab. a break'r and H. of refuge." Board reported that a safe H. ½ sq. m. could be made at Cape Gregory. **R., 77,** 1055. (Lt. Cols. Alexander, Stewart, and Williamson, and Maj. Mendell.)

ESTIMATES.

By BE., break'r, $3,710,168, **77,** 1059.

VV-16 COOS BAY AND HARBOR, OREG.

Part.	Title.	Period.	Appropriation.
a	Coos B., Oreg.	1894–1906	$45,890.00
b	Coos B. and H., Oreg.	1879–1912	1,378,750.00
	Total		1,424,640.00

Part (a), VV-16 Coos Bay, Oreg. (Dredging).

APPROPRIATIONS.

1894,	$13,000,	**95,** 3369.
1896,	14,390,	**96,** 3235.
1903,	*10,000,	**04,** 656, 3444.
1904,	*3,500,	**04,** 656, 3444.
1905,	*5,000,	**05,** 662, 2447.
Total,	45,890	(incl. $9.75 received from other sources, $45,899.75, **06,** 1978).

COMMERCE.

In the 2 years preceding 1900 the C. averaged about 125,000 t. per an., **00,** 644.

Benefited by imp. in B., **01,** 618.

Given in report for imp. entrance to Coos B. and H., Oreg., **04,** 656.

CONTRACTS.

1899. W. N. Concanon, dr., 19⅞ ¢ c. y., p. m., **99,** 3207 ($20,828.60), **00,** 4281.

ENGINEERS.

Chief of Engineers. **R., 95,** 444; **96,** 396; **97,** 497; **98,** 484; **99,** 568; **00,** 642; **01,** 618; **04,** 655; **05,** 661; **06,** 736.

In charge:

Capt. T. W. Symons, 1890–95. **R., 95,** 3367.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3235; **97,** 3387; **98,** 2966.

Capt. W. W. Harts, 1899–1900. **R., 99,** 3205; **00,** 4280.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3476; (Maj.) **04,** 3442; **05,** 2446.

Lt. Col. S. W. Roessler, 1906. **R., 06,** 1978.

OBSTRUCTIONS.

Raft cradle, owned by unknown persons, a hindrance to free navigation, removed, 1900, **00,** 4282.

OPERATIONS.

1898-99. 75,770 c. y. dr. (maps), **99,** 3206.

1899-00. 30,000 c. y. dr.; raft cradle removed; small dike built, **00,** 4280–4282.

1900-01. Proj. completed during fiscal year ending June 30, 1900; unexpended balance returned to Treas., **01,** 618, 3476.

1903-04. Plant previously used overhauled, and new hull built and old machinery installed thereon for dr.; 2 old scows converted into dump scows; 10,210 c. y. removed from stretch of 11′ x 60′ x 750′, over Pony Slough Shoal; d. maintained since beginning, **04,** 656, 3443.

1904-05. 12,190 c. y. excavated from shoal at mouth of Pony Slough, resulting in cut 14′ x 100′ m. l. t., **05,** 662, 2447.

1905-06. Plant fitted up for work of redr. chan. through shoal opposite Marshfield to 13′ x 150′ m. l. w.; 7,500 c. y. removed and dumped in deep hole out of the chan., **06,** 737, 1978.

* Allotment.

PHYSICAL CHARACTERISTICS.

Description of. In the upper part of Coos B. and its tributary sloughs in 1895 there were a number of shoals which interfered with navigation, the principal of which was situated just below the town of Marshfield, situated at the upper end of the B., **95,** 3367.

No deterioration of imp., except slight shoaling in chan. at mouth of Coos R., **01,** 3476.

Shoal found at mouth of Pony Slough, **04,** 656, 3443.

Max. draft carried bet. Marshfield and mouth, 13′ l. t., **06,** 737.

PROJECTS.

By Capt. Symons, 1891, building dr. to dr. a chan. 10′ d. through 2 shoals in H.; est., $27,390, **95,** 3367.

Existing proj. amended by Congress, 1899, to dispense with necessity of purchasing dr. boat and scows, that dr. might be done by contract or otherwise, **99,** 3205.

By Capt. Harts, 1899, dr. 13′ chan., 150′ w., through 3 shoals near Marshfield, and a 13′ chan., 100′ w., through 4th shoal in same locality, **99,** 3205.

By Capt. Harts, 1899, dike across chan. s. of an isld. in the H.; est., $500, **00,** 4282.

SURVEYS.

Minor sur., **99,** 3205.

Sur. of chan. opposite Marshfield showed shoaling in one place to 11′ m. l. t., **06,** 1978.

Maps. **99,** 3206.

Part (b), VV-16 Coos Bay and Harbor, Oreg.

APPROPRIATIONS.[1]

1879,	$40,000,	**79,** 182.
1881,	30,000,	**81,** 2585.
1882,	30,000,	**83,** 2677.
1884,	30,000,	**84,** 2261.
1886,	33,750,	**86,** 1992.
1888,	50,000,	**88,** 2143.
1890,	125,000,	**90,** 2933.
1892,	210,000,	**92,** 2674.
1894,	95,000,	**95,** 3361.
1896,	95,000,	**96,** 3234.
1899,	150,000,	**99,** 3204.
1902,	50,000,	**02,** 2367.
1910,	[2] 400,000,	**10,** 2374.
1911,	40,000,	**11,** 2579.

Total, 1,378,750 (less $3,000 trans. to Coos R., and incl. receipts from sales, $1,376,211.08, **12,** 2788).

COMMERCE.

Benefit of imp. to C., **79,** 1854.

Lumber and coal interests, **90,** 2931, 2932; increasing, **06,** 735.

Tabular record of exports from Coos B. from 1879 to 1891, **91,** 3167.

Important and increasing, **93,** 3337; **94,** 2565; **95,** 3361; **07,** 753, 754.

B. and ocean only means of transporting C., **02,** 539.

U. S. imp. increased carrying capacity of vessels and decreased rates, **09,** 841. Ocean-going vessels ascend the B. to Bay City, 14 m. from mouth, **10,** 933.

Tonnage, 1911, 303,000 t., **12,** 1181.

Diagram showing relation of app. to tonnage and value, **11,** 2580.

CONTRACTS.

1889. P. O'Neil, st., $1.39 c. y., **89,** 2508.

1892. P. O'Neil, brush fascines, $2 cord, **92,** 2670. G. W. Loggie, poles, 22¢ ea, **92,** 2671. W. E. Baines, 20,000 t. r., 75¢ t, **92,** 2671.

1892-93. D. Kern, supplying st. from U. S. quarry, 53½¢ t. ($53,500), **93,** 3334.

1894. D. Kern, furnishing st., 63¢ t. ($18,900), **95,** 3359.

1896. Wakefield & Jacobsen, furnishing and placing r., 52½¢ t. ($42,000), **97,** 3386.

1899. Wakefield & Jacobsen, repair of wharf and n. j. tramway, and completion of n. j. (piles, lumber, rails, and other ironwork, st.), $123,710, **00,** 4279.

1904. Willamette Iron & Steel Works, constr. of sur. steamer, $24,490, **04,** 3440, 3441.

1910. F. J. Bingham, hire of scow, $25 per month; Kruse & Banks, hire of scow, $1 per day; S. C. Rogers, hire of steamboat, $10 per day, **11,** 2580. Herbert Lockhart, rent of office room, $10 per month, **12,** 2788.

1911. F. J. Bingham, hire of scow, $25 per month; Kruse & Banks, hire of scow, $40 per month; Lawhorn & Painter, hire of dr. tender, $12 50 per day; The Coos Bay Home Telephone Co., rental of 1 set telephone instruments, $3 per month, **12,** 2788.

1912. Seattle Construction & Dry Dock Co., constr. steel seagoing dr. *Col. P. S. Michie,* $317,430, **12,** 2789.

ENGINEERS.

Chief of Engineers. **R., 78,** 139; **79,** 182, 183; **80,** 240; **81,** 328; **82,** 321; **83,** 334; **84,** 338; **85,** 365; **86,** 361; **87,** 325; **88,** 297; **89,** 354; **90,** 318; **91,** 401, 410; **92,** 376; **93,** 434; **94,** 403; **95,** 443; **96,** 395; **97,** 496; **98,** 483; **99,** 567; **00,** 640; **01,** 616; **02,** 538; **03,** 595; **04,** 653; **05,** 659; **06,** 734; **07,** 752; **08,** 802, 817; **09,** 840; **10,** 932; **11,** 989; **12,** 1179.

Boards. Convened, Portland, Oreg., Nov. 18, 1888, by S. O. No. 58, to ex. and report upon proj. for imp. of Coos B. **R., 89,** 2510; **90,** 2936. (Col. Mendell and Majs. Jones and Handbury.)

In charge:

Maj. J. M. Wilson. **R., 79,** 1791.

Maj. G. L. Gillespie, 1879–82, **79,** 180, 183. **R., 79,** 1854; **80,** 2323; **81,** 2583.

Capt. C. F. Powell, 1882–87. **R., 82,** 2674; **83,** 2055; **84,** 2260; **85,** 2388; **86,** 1989; **87,** 2460.

Capt. W. Young, 1888–90. **R., 88,** 2141; **89,** 2507.

Capt. T. W. Symons, 1890–95. **R., 90,** 2929; **91,** 3154, 3283; **92,** 2669; **93,** 3332; **94,** 2561; **95,** 3357.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3233; **97,** 3384; (Maj.) **98,** 2963.

Capt. W. W. Harts, 1899–1900. **R.,** 3203; **00,** 4274.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3471; **02,** 2366; (Maj.) **03,** 2209; **04,** 3439; **05,** 2443.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1976; **07,** 2160; **08,** 2237.

Maj. J. F. McIndoe, 1909. **R., 09,** 2205.

Maj. J. J. Morrow, 1910–. **R., 10,** 2373; **11,** 2578; **12,** 2786.

Assistants:

C. M. Bolton, **79,** 1791, 1794. **R., 79,** 1795.

Lt. A. H. Payson. **R., 80,** 2326.

R. S. Littlefield. **R., 81,** 2585; **83,** 2058; **84,** 2262; **85,** 2390; **90,** 2933.

J. S. Polhemus. **R., 91,** 3163; **92,** 2674; **93,** 3338; **94,** 2565; **95,** 3361.

J. R. Savage. **R., 92,** 2672.

OPERATIONS.

1879–80. 450 l. f. cribwork sunk, **80,** 2325.

1880–81. 250 l. f. cribwork sunk, **81,** 2583.

1881–82. Shore interval closed by addition of 210 l. f. cribwork; 7,236 c. y. st. placed for j. exten-

[1] $3,000 of app. for this work allotted, in 1905, to Coos R.

[2] $350,000 for constr. of sea going dr. and $50,000 for operating dr. *Oregon.*

sion; 6 dump cars and 1 derrick car constr., **82,** 2675, 2676.

1882–83. Jetty track repaired and extended; 14,063 c. y. st. placed in j., making a total l. of work of 1,645 l. f., **83,** 2056, 2057.

1883–84. 6,856 c. y. r. placed, extending j. 42′; 433 c. y. r. placed in inside part of j., **84,** 2260.

1884–85. Enrockment advanced 72′; quarrying and sluicing operations carried on, **85,** 2389.

1886–87. Clearing quarry for use, **87,** 2460.

1887–88. 7,000 c. y. of earth removed in quarry sluicing, **88,** 2142.

1888–89. 3,314 c. y. st. placed in foundation of j. extension, **89,** 2508.

1889–90. 38,845 c. y. st. placed in extension of j., **90,** 2930–2933.

1890–91. 1,841 c. y. r. deposited in j.; 1.600 l.f. of st. trestle built, and plant constr. for commencement of n. j. work, **91,** 3165, 3164.

1891–92. 3,200 l. f. of j. tramway built; 23,923 t. r. placed in the j.; 4.336 l. f. of mattress work placed, **92,** 2671.

1892–93. 41,000 tons of st. placed in n. j., **93,** 3335. Reclamation of sand dunes in progress, **93,** 3336.

1893–94. 117,340 t. of st. placed in n. j. and some repairs made, **94,** 2562, 2564.

1894–95. About 98,000 t. of st. placed in n. j. and some repairs made, **95,** 3359, 3360.

1895–96. Mainten. of work already done, **96,** 3234.

1896–97. About 80,000 t. of st. placed in n. j., **97,** 3385.

1897–98. 67,728 t. of st. placed in n. j., **98,** 2964.

1899–00. Wharf and n. j. tramway repaired; 105,500 t. st. placed in n. j. (photographs); grass planted in an apparently successful effort to check sand movement at entrance of B., **00,** 4276, 4278.

1900–01. Piles, lumber, and rails placed, resulting in rebuilding 80′ of n. j. tramway; 104,130.2 t. rubblest., at 57½¢ t., dumped therefrom, raising j. to proj. h. throughout its l.; contract completed; since then 600′ tramway carried away by storm, at sea end, and j. beaten down for several hundred feet, **01,** 3472. Erosion of shore stopped by 80 cords brush mattress and 500 t. st. Small quantity of Holland grass (Arundo arenaria) planted to hold shifting sands; it thrived during year, **01,** 3473.

1901–02. Care of U. S. plant and planting 27 acres, s. end of n. sand spit, with Holland grass; contract for st. completed Mar. 15, 1901, after having delivered 209,629 t., of which 145.570 t. were placed on outer 768′ of j.; pieces of r. averaged about 4 t. each; some weighed 17 t; r. mentioned raised crest enrockment 20 to 29′ above m. l. w.; w. at top 35′ at l. w. 100′, at base 175 to 200′, **02,** 2366.

1902–03. Care of U. S. plant, planting 62 acres with Holland grass roots, **03,** 2209.

1903–04. Buildings repaired and plant gone over; some of equipment thoroughly overhauled for use in dr.; 30 acres planted with Holland roots, **04,** 3439.

1904–05. Repairs made to buildings, plant, etc., old rails remaining on tramway together with plant brought to place of safety and stored, 700′ tramway beyond h.-w. shore line having been carried away; small SS. *Arago* completed and put in commission, **05,** 2444.

1905–06. Watching and caring for plant and works; 70 acres of Holland grass roots planted, **06,** 735, 1976.

1906–07. Planting of 57 acres with Holland grass, **07,** 753, 2160.

1907–08. Pipe line suction dr. for use on this and other Hs. of Oregon and Washington under constr., **08,** 803. Planting of 50 acres on n. spit with Holland grass, **08,** 2237.

1908–09. 320,000 c. y. removed by U. S. dr. *Oregon,* at cost of about 6½¢ c. y., paid for by C. interests, and 90,000 c. y. removed under U. S. funds at cost of about 5½¢ c. y., resulting in chans. 150′ to 250′ w., 16′ to 18′ d. l. w., with lengths of 1,400′ at Pony Shoal, and 7,500′ from C. A. Smith's sawmill to cold-storage works at Marshfield; material pumped behind bulkheads and placed on adjoining lands, **09,** 2206.

1909–10. 119,000 c. y. dr. to 16′ at l. w. over a w. of 160′ for 6,000′; at upper part of cut the material pumped ashore behind bulkheads, and at lower part deposited on shoals to e. of chan.; dr. towed to sea and arrived at Astoria Sept. 20, **10,** 932, 2374.

1910–11. 10,000 c. y. removed by dr. *Oregon* and hired labor from Pony Slough Shoal; 332,437 c. y. dr. from proj. chan. and deposited behind bulkheads built by private parties on w. shore of B.; 30,170 c. y. removed from North Slough Shoal and pumped along edge of w. shore, **11,** 2578. 45,546 c. y. removed from Pony Slough Shoal and pumped along e. and w. shores; resulting in chan. 17′ x 160 m. l. w. up B. to above Marshfield; dr. *Oregon* towed to Coquille, **11,** 2579.

1911–12. 155 acres sands planted with Holland grass roots (Arunda arenaria); 632,324 c. y. dr., of which 266,331 c. y. paid for by C. interests, **12,** 2787.

PHYSICAL CHARACTERISTICS.

C. Bay a tidal estuary about 180 m. s. of Columbia R. Next to Humboldt H., Cal., it is principal H. bet. Col. R. and San Francisco. Tidal area, 15 sq. m., incl. 900 acres of anchorage not less than 18′ m. lower l. tide, **12,** 1179.

Description of, **79,** 1792, 1793, 1795; **94,** 2563; **95,** 3359.

Tides and currents, **79,** 1793.

Description of obstr. in Coos B., **80,** 2324.

Influence exerted by js., **81,** 2583.

Benefit conferred by imp., **86,** 1995, 1996, 1997.

Description of locality, **90,** 2930, 2938, 2944.

Tidal capacity of Coos B., **90,** 2940.

Movement of sand, **90,** 2941; **91,** 3158.

Unusually heavy storms during winter of 1899–1900 caused temporary shoaling, **00,** 4277.

Storms, winter of 1900, caused erosion along shore end of j.; bar chan. shoaled to 16′, but immediately afterwards the least d. found at l. t. 25′; average during year, 20′ l. t.; portions of tramway deteriorated by ravages of teredo, **01,** 3473.

Max. draft across bar, 18′; range of tide, 4.8′ **02,** 538.

Heavy seas flattened down 700′ outer end of j. to from 1 to 12′ below l. t., **02,** 2366.

Heavy seas beat down outer 650′ j. enrockment to from 1 to 20′ below l. w., **03,** 2209.

Very little change in condition of j.; d. on crest of bar, 17′, **04,** 3440.

Guano r. broken off by sea; small portion, 2′ above m. l. w., **05,** 2444.

Part of j. tramway honeycombed by teredo and carried away; condition of n. j. but slightly changed enrockment slightly beaten down by sea, **06,** 1976.

Entire j. tramway and wharf destroyed by teredo and decay, **07,** 2160.

Dr. material; mud, sand, silt, mixed with oyster shells, **09,** 2206.

Dr. work increased d. from 12′ to 17′ l. w. over many shoals, **12,** 1180.

PLANS.

By Maj. Wilson, 1879, imp. entrance with 2 st. training walls to obtain chan. 22′ l. w.; est., $972,000, **79,** 182, 1796. Referred to BE., **79,** 1793, 1794, 1795, 1796, 1854.

By Capt. Symons, 1891, imp. of upper H. at Coos B. by dr. chan. through shoal at the lower end of Marshfield and one above the coal bunkers in Isthmus Slough to 10′ l. w. and a bottom w. of 100′; est., incl. constr. of dr. and equipment, $27,390, **91,** 3285.

PRIVATE WORK.

Continuation of operations during season of 1881–82 after funds had been exhausted through materials and labor furnished by citizens, **82,** 2676.

C. interests of Coos B. raised fund of $21,270.41, with which U. S. dr. *Oregon* was towed from Portland, Oreg., to Coos B. and operated from Oct. 13, 1908, to Apr. 30, 1909, **09,** 840.

365,993 c. y. dr. by U. S.

266,331 c. y. dr. by U. S. and paid for by port of Coos B. (253,863 c. y.) and C. A. Smith Lumber Co. (12,468 c. y.), **12,** 2787.

PROJECTS.

By Maj. Gillespie, 1879, for half-tide j., from near Fossil Pt., in a curved line toward Coos Head, to open and maintain d. and more direct chan. across

outer bar; est., $600,000, **80,** 2323; **83,** 2055; **87,** 2460; **88,** 2142.

By BE., 1889, imp. of B., securing a l. w. d. of 20′ through the bar at its entrance with 2 parallel js. of riprap st. upon mattress foundation, crossing bar 1,500′ apart; n. j. to be 9,600′; the s. j. 4,200′; both js. to be brought to h. w. level, and to have a top w. of 10′; est., $2,466,412, **90,** 2941, 2942.

Projected low-tide d. of 20′ on bar at entrance probably not to be obtained through agency of the n. j. alone, **99,** 3203.

Certain tracts of land reserved for the use of the imp. of the B. and H. restored to the public domain, **00,** 4278.

By Capt. Langfitt, restoring j.; est. $153,223.90, **01,** 3473; to change character of constr. of j. and use larger pieces of st. or concrete blocks, **02,** 2366, 2367; recom. that funds available be withheld, approv., and constr. of sur. SS. au., **03,** 2209.

Lt. Col. Roessler proposed that so much of balance of funds as may be necessary be made available for dr., **06,** 735, 1976, 1977.

Act June 25, 1910, au. constr. and operating seagoing hydraulic dr. to secure more d. over bar without addl. js.; and dr. chan. within B. to 18′, up to Marshfield; est. $500,000, and mainten. $60,000 an. (H. D. 958, 60th, 1st), **10,** 932, 2374.

SURVEYS.

Ordered and in progress, **78,** 139.

Of entrance completed by C. M. Bolton, **79,** 183, 1791, 1795.

Ex. into condition of j., chan., and sand spits, **85,** 2389.

Sur. of entrance and outer H., 1886, **86,** 1989.

Surs. of lower Coos B. made, 1889, by Capt. Young, **90,** 2948.

Sur. of Coos B. for imp. of the upper H. made, 1891, by Capt. Symons, **91,** 3284.

Surs. bar chan. were made by Capt. Symons in 1894, **94,** 2563; in 1895, **95,** 3359.

Sur. of the entrance made, 1899, by Capt. Harts (maps), **00,** 4277.

Ex. of bar showed 17′ m. l. w., **03,** 2209.

Resur. of H. lines, field work completed, **04,** 654, 3440.

Sur. of bar chan., 1904, showed about 19′ x 500′ straight to sea; and this could be carried to Empire, 4 m. inside; vessels drawing 14′ to 16′ could reach Bay City, 14 m., on high tide, **05,** 661, 2444.

Ex. and sur. au. act Mar. 2, 1907, of B. and bar; **R.,** 1907 and 1908; est. $500,000 (H. D. 958, 60th, 1st), **08,** 817.

Pre. ex., Coos Bay and entrance, Oreg., incl. removal of Guano Rock, au. act June 25, 1910; **R.,** Maj. Morrow, 1910 (unfav.) (H. D. 284, 62d, 2d), **12,** 1204.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1181.

Maps. **82,** 2676; **83,** 2060; **84,** 2264; **85,** 2390; **86,** 1989; **91,** 3163; **93,** 3336; **94,** 2568; **95,** 3366; **00,** 4278; **05,** 2444; **08,** 2238.

Photographs. **00,** 4278.

VV-23 COOS RIVER, OREG.

APPROPRIATIONS.

1896,	$5,000,	**96,** 3236.
1899,	3,000,	**99,** 3209.
1902,	2,000,	**02,** 2369.
1905,	*[1] 3,000,	**05,** 2448.
1907,	3,000,	**07,** 2162.
1910,	3,000,	**10,** 2376.
1912,	3,000,	**12,** 2790.
Total,	22,000,	**12,** 2790.

COMMERCE.

Increasing at 1900, **00,** 645.

Stream only means of transporting C., in small boats, to Marshfield, where ocean vessels touch, **01,** 619.

Mostly farm and dairy products, logs, and lumber. **05,** 663.

Mainten. of imp. is a benefit to navigation, **09,** 842.

Tonnage, 1909, 45,000 t.; 1911, 68,000 t., **12,** 1183

ENGINEERS.

Chief of Engineers. R., 93, 445; **95,** 459; **96,** 396; **97,** 498; **98,** 485; **99,** 570; **00,** 644; **01,** 618; **02,** 539; **03,** 597; **04,** 656; **05,** 662; **06,** 737; **07,** 54; **08,** 804; **09,** 842; **10,** 934; **11,** 991; **12,** 1182.

In charge:

Capt. T. W. Symons, 1893–95. **R., 93,** 3437; **95,** 3502.

Capt. W. L. Fisk, 1896. **R., 96,** 3236; **97,** 3388; (Maj.) **98,** 2966.

Capt. W. W. Harts, 1899–1900. **R., 99,** 3208; **00,** 4283.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3476; **02,** 2368; (Maj.) **03,** 2211; **04,** 3444; **05,** 2448.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1979; **07,** 2162; **08,** 2239.

Maj. J. F. McIndoe, 1909. **R., 09,** 2208.

Maj. J. J. Morrow, 1910–. **R., 10,** 2376; **11,** 2581; **12,** 2789.

Assistants:

J. S. Polhemus. **R., 93,** 3439; **95,** 3503.

Capt. Henry H. Robert, **12,** 1176.

OPERATIONS.

1896-97. A limited amount of snagging done and a small training dike constr., **97,** 3388.

1897-98. 1,050 t. r. used in constr. of dike 400′ l. and about 1,600 snags and other like obstr. removed; 862 bowlders removed; proj. completed, **98,** 2966.

1898-99. Nearly 1,000 snags, etc., removed, **99,** 3208.

1899-00. About 1,000 snags, etc., removed; proj. completed; snag scow strengthened and fitted with dr. bucket, **00,** 4284.

1903-04. Confined to snagging and fitting up plant; new hull built for combined snag and dr. scow; 912 snags and other obstr. removed, freeing North and South Forks, **04,** 657, 3444. Operations for mainten. resulted in clear chan. with least d. of 1½′ l. t.; variation 2½′, 5′ at mouth, **04,** 657.

1905-06. Fitting up snag boat and plant for work by hired labor; 657 snags removed from North Fork, and 510 snags removed from South Fork and placed on bank to be burned, **06,** 1979.

1906-07. Obstr. snags removed by hired labor and use of U. S. plant, Aug. 16, 1906; winter freshets carried obstr. into chan. and caused shoaling; snagging operations resumed and continued to end of year, **07,** 2162.

1907-08. Work carried on by hired labor and snag scow until Sept. 27, 1907, resulting in clearing chan. to head of navigation on both North and South Forks; dr. bucket rigged on scow and chan. dr. to 3′ l. w. at Carpenter and Yokam Bars on South Fork, and to same d. at Piper, Blaine, and Edwards Landing Shoals on North Fork; chans. cut 40′ w. and material placed along sides, **08,** 2239. 1,163 snags and other obstr. removed, and 13,407 c. y. dr., **08,** 2240.

1908-09. Proj. may be considered completed; work has resulted in safer and better chan. for small craft, **09,** 842.

1910-11. 558 snags removed by hired labor, 2,200 c. y. dr. from Island Shoal, South Fork; chan., North Fork, dr. for 600′ downstream, **11,** 2581.

1911-12. 8,956 c. y. sand and silt removed **12,** 2790.

* Allotment. [1] From "Imp. of Coos B. and H., general imp."

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3438; **95,** 3502.

R. the chief tributary of Coos B., being about 6 m. l., then separating into 2 forks, up which the tide ranges for about 8 m. from the junction. Valley along the streams in a good state of cultivation, **93,** 3438.

Imp. chan. deteriorated, **01,** 3477.

Shoalest parts under imp. varied from 1′ to 2′ at m. l. w.; average rise of tide 5′, **02,** 540.

Condition of R. good, no difficulty experienced in navigating it, **03,** 597.

Description of, **07,** 754; **08,** 804.

Chans. snagged and dr. shoaled to some extent, **09,** 2208.

Some shoaling has taken place and a number of snags deposited by freshets of "past" two winters, **10,** 2376.

PROJECTS.

In 1895 Capt. Symons est. $5,000 to imp. R., **95,** 3502; by removal of snags and other like obstr., cutting through bars where necessary to secure chan. 50′ w., mouth of R. to head of navigation in North and South Forks, incl. 5½ m. of main R. and about 8½ m. of each fork. The proj. adopted, **96,** 3236.

By Capt. Fisk, 1898, chan. 50′ w., free of bowlders and obstr. snags from R. mouth in Coos B. to head of tide, on the South and North Forks; est., $3,000; **98,** 2966; **99,** 3208. (Probably subproject or continuance of proj.)

In 1900 Capt. Harts est. $1,500 every 2 years for mainten., **00,** 4284.

By Capt. Langfitt, to restore chan. by removing snags, logs, etc., and dr. bar at mouth; est., $3,000, **01,** 3477.

By Maj. Morrow, to expend $3,000 au. act June 25, 1910, in fitting up plant and snagging, and removing obstrs. from chan.; est. that mainten. work au. act would cover needs for 2 years, **10,** 2376.

SURVEYS.

Ex. of navigable tidewater chans. of R. with view to removal of snags and other obstrs. au. act of July 13, 1892: made, 1892, by Capt. Symons (**R.** fav.), **93,** 3437.

Sur. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3502.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1183.

VV-30 UMPQUA RIVER, OREG.

APPROPRIATIONS.

1871,	$22,500.00,	**71,** 97, 902; **72,** 96, 986.
1886,	1.47,	**86,** 443.
1888,	2,000.00,	**88,** 2145.
1890,	9,000.00,	**90,** 2966.
1896,	6,000.00,	**96,** 3236.
Total,	39,501.47	

COMMERCE.

Amount saved on imports of the valley for 1 year would more than pay for the imp., **71,** 914. No further imp. recom., **72,** 986, 991.

Description of, **95,** 3449; **98,** 2992–2994; **04,** 3508.

1895, unimportant, **95,** 3449.

1897, chan. at entrance ample for needs of C., **98,** 2994.

CONTRACTS.

1871. W. Turnbull, who failed to sign, declared forfeited, **72,** 989; awarded to W. B. Clark, removal of submerged r., $6.95 c. y., **72,** 986.

1897. Normile & Fastabend, r. excavation, $8 c. y. ($4,000), **97,** 3390.

ENGINEERS.

Chief of Engineers. **R., 70,** 32, 84; **71,** 97; **72,** 96; **74,** 118; **75,** 125; **76,** 116; **79,** 183; **80,** 242; **86,** 363; **87,** 326, 330; **88,** 298; **89,** 355, 357, 358; **90,** 319, 324; **91,** 402; **92,** 377; **93,** 435; **94,** 404; **95,** 444–456; **96,** 397; **97,** 498; **98,** 486, 501; **99,** 571; **04,** 671; **10,** 950; **12,** 1204.

Boards. BERH. reviews **R.** of Maj. Langfitt and concurs in his opinion that cost of imp. is not justifiable, **04,** 3510.

In charge:

Maj. R. S. Williamson, 1870. **R., 71,** 909.

Maj. H. M. Robert, 1870–72. **R., 71,** 902; **72,** 986, 988.

Maj. G. L. Gillespie, 1879–80. **R., 80,** 2333.

Capt. C. F. Powell, 1886–87. **R., 86,** 2005; **87,** 2463, 2499.

Capt. W. Young, 1887–90. **R., 88,** 2144; **89,** 2511, 2572.

Capt. T. W. Symons, 1890–95. **R., 90,** 2965, 3005; **91,** 3169; **92,** 2679; **93,** 3342; **94,** 2569; **95,** 3369, 3448.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3236; **97,** 3389; (Maj.) **98,** 2967, 2991.

Capt. W. W. Harts, 1899. **R., 99,** 3209.

Capt. W. C. Langfitt, 1904. **R., 04,** 3506.

Maj. J. F. McIndoe, **10,** 950.

Maj. J. J. Morrow, **12,** 1204.

Assistants:

F. H. West, **72,** 986.

R. A. Habersham. **R., 80,** 2234.

J. S. Polhemus. **R., 87,** 2463.

R. Warrack. **R., 90,** 3008.

Lt. G. D. Fitch. **R., 94,** 2571.

ESTIMATES. (See Plans and Projects.)

By Maj. Williamson, 1871, imp. of Umpqua R. by removal of obstr. to h. w. navigation, $22,549.33 (currency), **71,** 914; detailed est., **71,** 913.

OPERATIONS.

1871–72. 1,920 c. y. of r. removed from chan., **72,** 96, 992; details of operations, **72,** 992; milldam at Kellogg's cut through, **72,** 986.

1885–86. Blasting and r. removal commenced on R. under app. of 1871, **86,** 2006.

1886–87. Rock removal in progress on reefs below Scottsburg, **87,** 2463.

1889–90. 700 t. of r. drilled, blasted, and removed from the chan., **90,** 2966.

1891–92. 955 t. of r. blasted and removed, **92,** 2679.

1893–94. Over 252 t. of r. removed, **94,** 2570.

1897–98. Over 633 c. y. r. removed, **98,** 2968.

PHYSICAL CHARACTERISTICS.

Umpqua divided in many places at l. w. into half a dozen streams, separated from each other by walls of r., **71,** 910.

A series of rapids, **71,** 910; **72,** 989.

Bed of R. coarse gravel or solid bed r., **71,** 910.

No sand bars in the R., **71,** 910.

Current too rapid to be navigated profitably, **72,** 96, 990.

Description of, **80,** 2334; **87,** 2499; **95,** 3449; **98,** 2992; **04,** 3506.

Largest R. in s. Oregon. Entrance from sea one of the best along the coast. Stream navigable for 25 m. above its mouth, to Scottsburg. Navigation of the whole R. difficult. **95,** 3448.

In 1897 the H. throat proper had a min. d. of about 30′ and w. of 900′ at l. tide. Average d. on crest of the bar was seldom less than 13′ at l. w. or 19′ at h. w. No serious obstr. existed. **98,** 2993.

PLANS. (See Estimates and Projects.)

By Maj. Gillespie, 1879, imp. of Umpqua R. bet. Scottsburg and its mouth by removal of bars at Brandy and Echo Islds. and Deans Creek, involving constr. of 3,100 l. f. of crib j.; est., $11,110, **80,** 2336.

In 1887, Capt. Powell, formation of a 4′ chan. from Gardner to Scottsburg by contraction works on 2

bars, removal of bowlders, and completion of "present" proj. at Scottsburg Reefs; est., $30,000, **87,** 2500.

PRIVATE (CORPORATE) WORK.

President of the Merchants & Farmers' Navigation Co. tendered the use of a SS. to Maj. Robert to make a trial trip up the R.; offer accepted; stockholders protest against the offer of the president; trip abandoned, **72,** 986, 989, 990.

PROJECTS. (See Estimates and Plans.)

By Maj. Williamson, imp. of Umpqua R. by removal of obstr. to a h. w. navigation, Scottsburg to Roseburg; est., $22,549, **71,** 912, **86,** 2005.

In 1886, proj. proposed expend. of balance of app. of 1871, at and below Scottsburg, in excavation of chan. 3′ x 50′ l. w. through 5 r. ledges; est., $4,056, **86,** 2005; **87,** 326; **88,** 2144.

By Capt. Symons, 1889, formation of a chan. 4′ x 50′ l. w., Scottsburg to mouth, by removal of ledge r. and bowlders; est., $9,000, **90,** 3007; **91,** 3169.

In 1894 Capt. Symons est. $6,000 to complete proj., **94,** 2571.

Unexpend. funds, $259.18, returned to Treas., 1899, as proj. was practically completed, **99,** 3209.

SURVEYS.

Ex. au., 1870, **70,** 32, 84.

Ex. rapids by Maj. Williamson, **71,** 97, 902.

Ex. by F. H. West, 1871, **72,** 986.

Sur. au. act Mar. 3, 1879, assigned to Maj. Wilson, **79,** 183; made, 1879, by Maj. Gillespie, **80,** 2333.

Ex. au. act Aug. 5, 1886; made, by Capt. Powell, **87,** 2499.

Ex. bet. Scottsburg and Harts Rapids au. act Aug. 11, 1888; made, 1889, by Capt. Young (**R.** unfav.), **89,** 2527.

Sur. of R. bet. Scottsburg and the mouth au. act Aug. 11, 1888; made, 1890, by Capt. Symons, **90,** 3007.

Surs. of rs. and reefs along proj. chan., made by Capt. Symons, 1893–94, **94,** 2570.

Ex. au. Scottsburg to Elkton Rapids au. act Aug. 17, 1894; made, 1894–1895, by Capt. Symons (**R.** unfav.), **95,** 3448.

Ex. of bar and entrance au. act June3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 2991.

Pre. ex. and sur. au. act June 13, 1902. **R.,** by Maj. Langfitt, Mar. 9 and Oct. 22, 1903; plan presented at est. cost of $892,563.12 ("locality unworthy of such a large expend.") (H. D. 310, 58th, 2d), **04,** 672, 3505.

Pre. ex. of bar au. act Mar. 3, 1909. **R.,** by Maj. McIndoe, Jan. 31, 1910 (H. D. 811, 61st, 2d), (unfav.) **10,** 950.

Pre. ex. au. act June 25, 1910, Scottsburg to Roseburg, Oreg. **R.** by Maj. Morrow, Nov. 23, 1910 (H. D. 276, 62d, 2d) (unfav.), **12,** 1204.

VV-36 SIUSLAW RIVER (and Bay and Bar), OREG.

APPROPRIATIONS.

1890,	$50,000,	**91,** 3175.
1892,	20,000,	**92,** 2687.
1894,	25,000,	**95,** 3373.
1896,	27,000,	**96,** 3238.
1899,	30,000,	**99,** 3211.
1902,	35,000,	**02,** 2370.
1910,	50,000,	**10,** 2378.
1911,	50,000,	**11,** 2583.
1912,	40,000,	**12,** 2793.
Total,	327,000	($24,838 carried to surplus fund, 1908, and recpts. from sales $150.10=$302,312.10, **12,** 2793).

COMMERCE.

Detailed description of the resources of the country, **93,** 3348. Transportation and mail facilities poor and imperfect, **93,** 3349.

Insignificant, **03,** 2237.

C. limited; country being thinly settled and trans. facilities primitive, **12,** 1185.

CONTRACTS.

1895. D. Kern, jetty constr.: Piles, 7¢ l. f.; lumber, $9 M f.; bolts, 5 and 15¢ each; brush mattresses, 25¢ c. y.; st., 72¢ t. ($11,252.50), **95,** 3373.

1897. Wakefield & Jacobsen, jetty constr.: Piles, 10¢ l. f.; lumber, $11 M f.; driftbolts, 3¢ lb.; bolts and washers complete, 21¢ each; brush mattresses, 20¢ c. y.; st. 51½¢ ton ($12,086.10), **97,** 3392.

1899. Hale & Smith, repair and extension of n. j. tramway and extension of U. S. wharf (piles, lumber, ironwork, brush, and st.), $23,737, **00,** 4290.

1911. Johnson-Anderson Co., constr. receiving wharf and extending n. j. ($200,686), **12,** 2793.

1912. Johnson-Anderson Co., supple. contract, making face of wharf longer to permit operating of 2 derricks ($507.28), and formal contract for extending s. j. 400′ ($43,275.70), **12,** 2794.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 242; **81,** 332; **87,** 330; **89,** 358; **90,** 324; **91,** 402; **92,** 378; **93,** 435; **94,** 405; **95,** 445; **96,** 397; **97,** 498; **98,** 487; **99,** 572; **00,** 645; **01,** 619; **02,** 540; **03,** 598; **04,** 657; **05,** 663; **06,** 738; **07,** 755; **10,** 950; **10,** 935; **11,** 992; **12,** 1183.

Boards:

Convened, Portland, Oreg., June 11, 1891, by S. O. No. 23, to report upon proj. for imp. mouth of Siuslaw R. **R.,** **91,** 3175. (Maj. Handbury, Capt. Symons, and Lt. Burr.)

BERH. reviews Capt. Langfitt's **R.** on continuing imp.; "undesirable," **03,** 2235.

In charge:

Maj. G. L. Gillespie, 1879. **R.,** **81,** 2617.

Capt. C. F. Powell, 1886. **R.,** **87,** 2493.

Capt. W. Young, 1888–91. **R.,** **90,** 2999, 3002.

Capt. T. W. Symons, 1891–95. **R.,** **91,** 3173; **92,** 2681; **93,** 3344; **94,** 2573; **95,** 3372.

Capt. W. L. Fisk, 1896–98. **R.,** **96,** 3237; **97,** 3391; (Maj.) **98,** 2970.

Capt. W. W. Harts, 1899–1900. **R.,** **99,** 3210; **00,** 4286.

Capt. W. C. Langfitt, 1900–05. **R.,** **01,** 3478; **02,** 2370; (Maj.) **03,** 2213, 2229; **04,** 3446; **05,** 2449.

Lt. Col. S. M. Roessler, 1905–07. **R.,** **06,** 1980; **07,** 2163.

Maj. J. F. McIndoe, **10,** 930.

Maj. J. B. Cavanaugh, **10,** 930.

Capt. Arthur Williams, **10,** 930.

Maj. J. J. Morrow, 1910–. **R.,** **10,** 2377; **11,** 2582; **12,** 2791.

Assistants:

J. S. Polhemus. **R.,** **81,** 2618.

Lt. E. Burr. **R.,** **87,** 2494.

G. A. Lyell. **R.,** **90,** 3004; **92,** 2687.

E. Ricksecker. **R.,** **93,** 3347.

J. S. Polhemus. **R.,** **96,** 3239.

Capt. A. A. Fries, **06,** 732.

Capt. Arthur Williams, **10,** 930.

Lt. H. H. Robert, **10,** 930; **11,** 987; (Capt.) **12,** 1176.

LEGAL PROCEEDINGS.

Steps taken to acquire title to land required for use of imp., **00,** 4289.

Pt. Terrace st. quarry purchased for $700; boundaries and land described, **01,** 3480.

Land required for use of imp. purchased for $500; boundaries described, **01.** 3480.

Bond submitted by port of Siuslaw to insure its proportion of the cost of work acceptable, 1911, **12,** 2791.

OPERATIONS.

1891-92. Constr. and preparation of plant, **92,** 2687, 2691.

1892-93. 6,540 t. r. placed in the n. j., **93,** 3346.

1895-96. N. j. extended 500′, **96,** 3238.

1896-97. Extension of n. j continued, **97,** 3391.

1897-98. N. j. extended to 911′, **98,** 2970.

1899-00. U. S wharf and tramway repaired, and latter extended; 11,674 t. st. and 305 c. y. mattresses placed in j., **00,** 4287.

1900-01. N. j. tramway extended 90′, j. crest raised to its completed height, and contract completed, **01,** 3478, 3479.

1909-10. Preparations in progress for commencing work on js., **10,** 2377.

1911-12. N. j. wharf and 3,300 l. f. tramway finished; s. j. tramway extended 315′ and 12,607 t. st. placed in j.; detailed statement of material used in work, **12,** 2792.

PHYSICAL CHARACTERISTICS.

Description of locality, **81,** 2617; **87,** 2493; **90,** 3002; **91,** 3177; **03,** 2230.

Bar changeable, **93,** 3346; **94,** 2575; **95,** 3373.

Scour a cause of delay in extending n. j., **00,** 4288.

Unusually heavy storms, 1899–1900, interfered with j. work, **00,** 4288.

Landslide fills st. quarry with mass of débris, **01,** 3479.

PLANS. (See Projects.)

By Capt. Young, 1889, 2 high-tide st. js. converging until w. bet. is about 500′, then running out to sea parallel to each other for sufficient distance to open and maintain chan. over bar with l. w. d. of 10′; est., $280,190, **90,** 3003.

PRIVATE WORK.

Port of Siuslaw assists U. S. in constr. js. by contrib. $100,000, **10,** 2377.

Port of Siuslaw extended s. j. 1,935′ by placing about 63,500 t. st., **11,** 2583.

PROJECTS. (See Plans.)

By BE., 1891, imp. of Siuslaw R. at its mouth with 2 converging js. extending from R.'s mouth out across ocean bar; js. to be of rubblest. raised to full h. tide with brush-mattress foundation; n. j. to be 7,500′ l. and s. j. 5,700′ l.; est., incl. constr. of plant for building n. j., $751,850, **91,** 3180.

Act. Mar. 3, 1905, au. closing out work and distributing property on other works where active operation in progress, **05,** 2449.

Act June 25, 1910, au. proj. for constr. 2 mean h. tide rubblest. js., to be 750′ apart at extremities; est., $426,000, with $5,000 an. mainten., **10,** 935.

SURVEYS.

Locality deemed worthy of sur., **81,** 2618.

Ex. of B. au. act Aug. 5, 1886; made, 1886, by Capt. Powell, **87,** 2493. **R.** unfav.

Au. act of Aug. 11, 1888; made, 1899, by Capt. Young, **90,** 3002.

Minor sur. made, 1899 (maps), **00,** 4289.

Pre. ex. and sur. au. act June 13, 1902, of R. mouth and shoals near Florence to provide for imp. locality at less cost than existing proj. **R.** by Capt. Langfitt, Feb. 5, 1903 ("commerce does not warrant continuance of imp."), **03,** 2229, 2239.

Pre. ex. and sur. au. act Mar. 3, 1909, of R. at the mouth. **R.** by Maj. McIndoe, July 23, 1909, and Jan. 7, 1910; est., $426,000 and $5,000 an. mainten. (H. D. 648, 61st, 2d), **10,** 950.

Maps. (H. D. 648, 61st, 2d.) **91,** 3175, 3178; **93,** 3346; **00,** 4290.

Photographs. **00,** 4290.

VV-41 ALSEA BAY, HARBOR, AND RIVER, OREG.

APPROPRIATION.

1896, $3,000, **96,** 3241.

COMMERCE.

Description of, **93,** 3441.

C. of the country in 1892 small, **93,** 3442; **98,** 2995.

CONTRACTS.

1897. C. P. Church, removal of obstr., $1,475, **97,** 3393.

ENGINEERS.

Chief of Engineers. **R.,** **76,** 116; **78,** 139; **79,** 183; **80,** 242; **91,** 409; **93,** 445; **95,** 459; **96,** 398; **97,** 499; **98,** 488, 501; **99,** 574.

In charge:

Maj. N. Michler, 1876, **76,** 116. **R.,** **76,** ii, 644.

Maj. J. M. Wilson, 1878–79, **78,** 138; **79,** 183. **R.,** **79,** 1810.

Lt. Col. G. L. Gillespie. **R.,** **80,** 2336.

Capt. T. W. Symons, 1891–95. **R.,** **91,** 3246; **93,** 3440; **95,** 3505.

Capt. W. L. Fisk, 1896–98. **R.,** **96,** 3241; **97,** 3393; (Maj.) **98,** 2972–2995.

Capt. W. W. Harts, 1899. **R.,** **99,** 3212.

Assistants:

G. F. Cramer, **76,** ii, 645.

R. A. Habersham, **79,** 1810. **R.,** **79,** 1812; **80,** 2337.

J. S. Polhemus. **R.,** **91,** 3246.

J. R. Savage. **R.,** **93,** 3443.

H. V. Baker, **R.,** **95,** 3506.

OPERATIONS.

1897-98. Obstr. removed from 31 m. of the lower part of the R., **98,** 2972.

PHYSICAL CHARACTERISTICS.

Description of, **76,** ii, 645; **79,** 1810, 1811, 1812; **80,** 2337; **91,** 3248; **93,** 3441; **95,** 3506; **98,** 2996.

R. rises in the Coast Range, Oreg., is about 50 or 55 m. l., and empties into the Pacific Ocean about 12 m. s. of Yaquina B. Alsea B. and that portion of the R. affected by the tides have an area of 3.7 sq. m. About 45 m. from its mouth it divides into 2 forks. It has a number of tributaries. **93,** 3441.

The country adjacent to the forks constitutes the upper Alsea Valley, or the prescribed head of the ex. of 1897, **98,** 2996.

PROJECTS.

In 1895 Capt. Symons est. $3,000 to imp. the lower part of the R., by the removal of rs. and other obstr. for 31 m., the plan of imp. au., **95,** 3506; **96,** 3241.

Proj. having been completed, the unexpend. balance, $1,044.16, was returned to the Treas., 1899, by Capt. Harts, **99,** 3212.

SURVEYS.

Ex. by G. F. Cramer, 1875, **76,** 116, ii, 645.

Sur. 1878–79 by R. A. Habersham, **78,** 139; **79,** 183, 1810.

Sur. 1879 au. of H. and bar, **79,** 183. Made by R. A. Habersham, 1879, **80,** 2337. **R.** of Lt. Col. Gillespie (unfav. to H.), **80,** 2336.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Symons (unfav.), **91,** 3246.

Ex. of the inner navigation of the R. au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** fav.), **93,** 3440.

Sur. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3505.

Ex. from the head of tide water to upper Alsea Valley au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav. to further imp.), **98,** 2995.

VV-44 YAQUINA BAY, OREG.

APPROPRIATIONS.

1880, $40,000, **80,** 241.
1881, 10,000, **81,** 2593.
1882, 60,000, **82,** 2680.
1884, 50,000, **84,** 2266.
1886, 75,000, **86,** 2002.
1888, 150,000, **88,** 2149.
1890, 165,000, **90,** 2970.
1892, 85,000, **92,** 2698.
1894, 50,000, **95,** 3378.
1896, 25,000, **96,** 3242.
1899, 5,000 (sur.) **99,** 3216.

Total, 715,000

COMMERCE.

Results prospective upon imp., **84,** 2269.
Description of, **93,** 3317; **95,** 3380, 3450; **00,** 4298. 1902, 1,152 t., **03,** 2215; 1906, 582 t., **07,** 2165.
Letters of parties interested in further work of imp. of B., **04,** 3456–3465.

CONTRACTS.

1887. R. Ingram, j. st., 62¢ t., **87,** 2466.
1894. Pioneer Sandstone Co., st. (annulled), **95,** 3376.
1895. D. Kern, st., from U. S. quarry, $1.30 t. ($13,000); furnished st., 85¢ t. ($8,500), **95,** 3377.

ENGINEERS.

Chief of Engineers. **R., 80,** 241; **81,** 329; **82,** 322; **83,** 335; **84,** 338; **85,** 365; **86,** 362; **87,** 326; **88,** 299; **89,** 355; **90,** 320; **91,** 403; **92,** 378; **93,** 432, 436; **94,** 405; **95,** 446, 456; **96,** 398, 406; **97,** 499; **98,** 489; **99,** 574, 577; **00,** 646, 649; **01,** 620, 622; **02,** 541; **03,** 600; **04,** 659; **05,** 665; **06,** 740; **07,** 756.

Boards:

Convened, Portland, Oreg., Nov. 13, 1888, S. O. No. 58, to ex. and report upon proj. for imp. of entrance to Yaquina B. **R., '89,** 2517. (Col. Mendell and Majs. Jones and Handbury.)
BE. convened, Portland, Oreg., May 9, 1895, by S. O. No. 7, dated Mar. 14, 1895, to make ex. of bar at Yaquina B. **R., 96,** 3284. (Lt. Col. A. Stickney, Majs. J. C. Post and C. B. Sears.)
BE. convened, Portland, Oreg., Apr. 19, 1899, by par. 3, S. O. No. 14, dated Mar. 16, 1899, to ascertain desirability of prosecuting the work au. act 1896 and cost of whatever work would be recom., **99,** 3215. **R., 00,** 4293. (Col. Mansfield; Capts. Taylor and Harts.)
Convened, S. O. No. 20, Hdq. Corps of Engrs., July 10, 1903, to investigate desirability of continuing or modifying proj. for imp. of Yaquina B. **R., 04,** 3450. BERH. reviews report and recom. app, of $25,000 for mainten. of existing works, and repairs of damages caused by storms (H. D. 158, 58th, 2d), **04,** 3456.

In charge:

Maj. G. L. Gillespie, 1880–82. **R., 81,** 2589.
Capt. C. F. Powell, 1882–87. **R., 82,** 2679; **83,** 2062; **84,** 2265; **85,** 2393; **86,** 1998; **87,** 2465, 2467.
Capt. W. Young, 1888–90. **R., 88,** 2146; **89,** 2513.
Capt. T. W. Symons, 1890–95. **R., 90,** 2967, 2974; **91,** 3182; **92,** 2694; **93,** 3357; **94,** 2576; **95,** 3375, 3450.
Maj. W. H. Heuer, 1893. **R., 93,** 3314.
Capt. W. L. Fisk, 1896–98. **R., 96,** 3241, 3284; **97,** 3394; (Maj.) **98,** 2972.
Capt. W. W. Harts, 1899–1900. **R., 99,** 3212, 3215; **00,** 4291, 4293.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3482, 3485; **02,** 2371; (Maj.) **03,** 2215; **04,** 3448; **05,** 2451.
Lt. Col. S. W. Roessler, 1906–07. **R., 06,** 1981; **07,** 2165.

Assistants:

J. S. Polhemus. **R., 81,** 2593; **82,** 2681; **83,** 2064; **84,** 2267; **85,** 2395; **88,** 2147; **89,** 2514; **90,** 2970.
G. A. Lyell. **R., 91,** 3190.
Lt. G. D. Fitch. **R., 92,** 2698.
J. G. Holcombe. **R., 93,** 3362; **94,** 2581; **95,** 3378; **96,** 3307.

OPERATIONS.

1880-81. Preparations for work and collection of materials; 2,500 l. f. of tramway built; one crib with mattress foundation sunk, **81,** 2592.
1881-82. 90 l. f. of wharf built of cribwork and piling; also hoisting engine and derrick placed in position; 550 l. f. of j. (brush and st.) built, **82,** 2679.
1882-83. Foundation j. mat advanced 1,430′ and the same ballasted and riprapped with 6,600 c. y. st., **83,** 2063.
1883-84. Jetty extended 162′, consuming 9,352 c. y. st. and 650 cords of brush, **84,** 2265.
1884-85. Land gap of 375′ closed by j. constr.; tramway rebuilt; extensive repairs to plant, **85,** 2394.
1886-87. Operations resumed in constr. of j., **87,** 2465.
1887-88. Jetty extended 460′, **88,** 2147.
1888-89. Repairs to plant and main j. tramway; 132 l. f. of wharf built and equipped with turntable; 2,800 l. f. of track laid; 33,000 t. of r. quarried; s. j. extended to 4,265′, and 2,110 l. f. of tramway built for n. j., **89,** 2516.
1889-90. 820 l. f. of tramway built for n. j., and 12,980 t. of st. placed; 18,040 t. st. placed on s. j., **90,** 2969.
1890-91. Preparation and repair of plant; n. j. extended 600 l. f.; 30,327 t. of st. placed upon old and new work; 2,080′ of s. j. tramway built, **91,** 3183, 3185.
1891-92. N. j. extended 840′, and large part of s. j. completed; repairs and constr. of plant, **92,** 2697.
1892-93. 32,085 t. of r. placed in n. j., **93,** 3360; 30,690 t. of r. placed in s. j. and repairs made, **93,** 3361.
1893-94. 16,332 t. of r. placed in s. j., and 5,494 t. in n. j., **94,** 2578.
1894-95. About 10,000 t. of r. placed in n. and s. js., **95,** 3376.
1895-96. About 19,000 t. of r. placed in n. and s. js., **96,** 3242.
1898-99. U. S. tugboat prepared for sur., **99,** 3215.
1900-01. Work during fiscal year confined to removing most n. of 3 rs. beyond sea end of s. j., by hired labor and use of U. S. plant, **01,** 3483.
1901-02. Middle r. and s. r. blasted down to least d. of 12′, m. l. t., by hired labor and use of U. S. plant, **02,** 2372.
1905-07. Act Mar. 3, 1905, au. closing up of works and distributing serviceable property; allows expend. of sufficient amount to maintain work for 2 years, **05,** 666. Period for mainten. completed, **07,** 2165.

PHYSICAL CHARACTERISTICS.

Description of B. and its tidal volume, **86,** 2000; **87,** 2468.
Description of, **89,** 2518; **93,** 3315, 3361; **94,** 2579; **95,** 3451; **96,** 3307; **00,** 4296.
Bed of entrance of solid r., **93,** 3316; **95,** 3451.
Tendency to bar formation at ends of the js., **94,** 2577; **95,** 3376.
In 1895 officer in charge thought it not in power of man to imp. entrance further to make it a H. of safe capacity for deep-draft ships, **95,** 3452.
Current observations and borings, **96,** 3308.
In 1895 there was a d. of 12 to 14′ across the bar, **95,** 3451; and in 1897 a d. of from 14 to 16′, **98,** 2974.
B. a small tidal estuary of about 5 sq. m. area. Lies on Oregon coast about 110 m. s. of mouth of Columbia R. Bar exists in ocean opposite entrance to B. Mean range of tide, about 7′, **01,** 620, 621.
Prior to imp. prevailing d. over bar about 7 or 8′, m. l. t., **01,** 620, 621.
N. and s. js. fairly well maintained, although somewhat beaten down by sea near outer end, **03,** 2215.

PRIVATE WORK.

Funds donated by citizens of Willamette Valley for use on Yaquina imp., **82,** 2679.

PROJECTS.

By Maj. Gillespie, 1880, constr. of high-tide brush mattress and st. j. about 4,000′ l. on s. side of entrance to Yaquina B., to close rock-obstructed chan., and to provide central free chan. of increased d.; d. to be obtained was placed, 1881, at 17′, and subsequently raised to 19′, at m. h. t.; est., $465,000, **81,** 329; **82,** 2680; **87,** 2465.

In 1886, $235,000 having been app. for work, Capt. Powell proposed constr. of n. j., which, with further extension of s. j., est. to cost $308,970 addl. to amount already app., **86,** 2001; **87,** 326, 2465.

By Capt. Young, 1888, constr. of n. mid-tide j. of rubblest. extending from n. head along and behind reef for about 2,300′; also to raise s. j. to full h. w., leaving entrance w. bet. js. of about 1,000′; est., $196,750; approved by BE., 1889, **89,** 2519–2521.

In 1890, $125,000 est. as required for completion of proj., **90,** 2970.

By Capt. Symons, 1892–93, modifying proj. of 1888 to provide for raising n. j. to full h. t., **93,** 3357, and for constr. 5 groins channelwards from s. j., **93,** 3359; in 1894 for extension of one of the groins 300′ and another 100′, **95,** 3376.

By BE., 1895, extension of n. j. 2,100′ and s. j. 2,000′, removal of r. in proj. chan., and constr. of a spur 800′ l. inside existing s. j.; est., $1,025,800, **96,** 3286–3287.

BE., 1899, did not deem H. worthy of further imp., with exception of removal of cluster of rs. near s. j., which could be removed at an est. cost of $20,000 from available funds, **00,** 4291–4294.

BE., convened by S. O. No. 20, report on desirability of continuing or modifying proj. (see Boards), **04,** 3449.

B. not considered worthy of further imp. at "present" time by U. S., **07,** 2165.

SURVEYS.

Comparison of surs. of 1885–86, **87,** 2467.

Ex. of H. with view to 25′ at m. l. w. upon bar at entrance au. act July 13, 1892; made by Maj. Heuer (**R.** unfav.), **93,** 3314.

Sur. of B. made, 1892, by Capt. Symons, **93,** 3361; and of bar and B. in vicinity of js., 1893, **94,** 2578. Several surs. of H. in vicinity of inner bar made by Capt. Symons, 1894–95, **95,** 3376.

Ex. of B. and bar with view to increased d. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** unfav.), **95,** 3450.

Sur. of entrance made, 1893, by BE., 1895, **96,** 3307.

Ex. by BE. au. act Mar. 3, 1899. Sur. made by Board, 1899–1900. **R., 99,** 3215; **00,** 4293. (See Projects.)

Maps. **82,** 2680; **83,** 2066; **84,** 2268; **85,** 2396; **86,** 2000; **87,** 2465; **91,** 3184; **93,** 3360; **00,** 4292.

VV-45 YAQUINA AND BIG ELK RIVERS, OREG.

COMMERCE.

Description of, **98,** 2998.

ENGINEERS.

Chief of Engineers. R., 98, 501; **10,** 950; **12,** 1205.

In charge:
Maj. W. L. Fisk, 1898. **R., 98,** 2997.
Maj. J. F. McIndoe, **10,** 930.
Maj. J. B. Cavanaugh, **10,** 930.
Maj. J. J. Morrow, **10,** 930; **12,** 1176.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 2997.

Yaquina located about 3 m. above entrance to Yaquina B.; head of tide about 23 m. above this point. Big Elk R. joins Yaquina about 4 m. below head of t., and is susceptible to tidal influence to Sunset Quarry, 4 m. above the confluence. **98,** 2997.

SURVEYS.

Ex. of R. from town of Yaquina to head of tide, incl. Big Elk R. to Sunset Quarry, au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 2997, 2998.

Pre. ex. of R. from Yaquina to Elk City au. act Mar. 3, 1909. **R.** by Maj. McIndoe July 31, 1909 (H. D. 351, 61st, 2d) (unfav.), **10,** 950.

Pre. ex. and sur. of R., Toledo to Yaquina, with report upon any proposition for cooperation by local interests, au. by act Feb. 27, 1911. **R.** by Maj. Morrow, Aug. 17 and Dec. 27, 1911; est., $72,000, and $3,000 biennially for mainten., subject to conditions as to cooperation by local interests (H. D. 519, 62d, 2d), **12,** 1205.

Maps. (H. D. 519, 62d. 2d.)

VV-52(b) CAPE FOULWEATHER HARBOR, OREG.

COMMERCE. (See Plans.)

ENGINEERS.

Chief of Engineers. R., 78, 139; **79,** 183.

In charge. Maj. J. M. Wilson, **78,** 138; **79,** 180, 183. **R., 79,** 1796.

Assistant. R. A. Habersham, **79,** 1796. **R., 79,** 1799.

ESTIMATES. (See Plans.)

By R. A. Habersham, 1879, break'r 9,900′ l., $11,462,487, **79,** 1798, 1801.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 1796, 1797, 1799, 1800, 1802.
Tides and fogs, **79,** 1797, 1801.
Direction of prevailing winds, **79,** 1800.

PLANS. (See Estimates.)

By Maj. Wilson, 1879, break'r 4,900′ l., $4,606,132, to form a H. of refuge, **79,** 1798, 1801. Recom. break'r n. of cape instead of s., 600′ l., $656.251, affording 50 to 100 acres of anchorage, **79,** 1798, 1799, 1801, 1802.

SURVEY.

Ex. au., 1878, to ascertain adaptability for H. of refuge, **78,** 139. Completed, 1879, by R. A. Habersham, **79,** 183, 1796.

VV-54 SILETZ RIVER, OREG.

COMMERCE.
Description of. Limited, **98,** 3000.

ENGINEERS.
Chief of Engineers. **R., 98,** 501.

In charge. Maj. W. L. Fisk, 1898. **R., 98,** 2998.

PHYSICAL CHARACTERISTICS.
Description of, **98,** 2999.

Shallow mountain stream emptying into Siletz B., 1½ m. from B. entrance, at which exist ledge rs., **98,** 2999.

SURVEY.
Ex. of the R., bar, and entrance au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 2999.

VV-58 NESTUCCA RIVER, OREG.

APPROPRIATIONS.
1896, $6,000, **96,** 3243.

COMMERCE.
Limited, **93,** 3448.

CONTRACTS.
1897. Normile & Fastabend, r. excavation, $3.75 c. y., p. m. ($3,750), **97,** 3396.

ENGINEERS.
Chief of Engineers. **R., 93,** 445; **95,** 459; **96,** 399; **97,** 501; **98,** 491; **99,** 578.

In charge:
Capt. T. W. Symons, 1893–95. **R., 93,** 3446; **95,** 3509.
Capt. W. L. Fisk, 1896–98. **R., 96,** 3243; **97,** 3396; (Maj.) **98,** 2975.
Capt. W. W. Harts, 1898–. **R., 99,** 3216.

Assistant. J. R. Savage. **R., 93,** 3449.

OPERATIONS.
1896-97. Removal of r. in progress, **97,** 3396.
1897-98. In connection with previous year 1,388 c. y. r. removed, **98,** 2975.

PHYSICAL CHARACTERISTICS.
Description of, **93,** 3446; **95,** 3510.
R. enters Pacific Ocean about 25 m. s. of the entrance to Tillamook B.; about 45 m. l., and has a tidal area of about 2 sq. m. The portion above the influence of the tide entirely unfit for navigation, flowing mostly through a narrow valley which is in places almost a gorge. **93,** 3446, 3447.

PROJECTS.
By Capt. Symons, 1895, removal of a rocky reef at the entrance to the B., est., $6,000, **95,** 3509; **96,** 3243.
Unexpend. balance, $257.12, returned to the Treas., 1899, by Capt. Harts; imp. having been completed, **99,** 3216.

SURVEYS.
Ex. from Woods to the ocean, au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** unfav.), **93,** 3446.
Sur. of the same part of the R. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3509.
Sur. of the work of r. removal in progress made, 1897, by Capt. Fisk, **97,** 3396.

VV-59(b) CAPE LOOKOUT, OREG.

ENGINEERS.
Chief of Engineers. **R., 98,** 502.

In charge. Maj. W. L. Fisk, 1898. **R., 98,** 3001.

PHYSICAL CHARACTERISTICS.
Description of, **98,** 3002.
One of the prominent promontories of the Oregon coast, situated 60 m. s. of the mouth of the Columbia R. The bottom is hard, poor holding ground for anchorage, and unsuited for a H. of refuge, **98,** 3002.

PROJECT.
In 1897 Capt. Fisk est. $10,725,000 to constr. break'r, **98,** 3003.

SURVEY.
Ex. with view to the constr. of a H. of refuge and to ascertain its cost, au. act June 3, 1896; made, 1897 by Capt. Fisk (**R.** unfav.) (see Projects), **98,** 3001.

VV-61 TILLAMOOK BAR AND BAY, OREG.

APPROPRIATIONS.

1888,	$5,200,	**88,** 300.
1890,	500,	**90,** 2980.
1892,	15,000,	**92,** 2702.
1894,	16,000,	**95,** 3385.
1896,	17,000,	**96,** 3245.
1899,	25,000,	**99,** 3218.
1902,	27,000,	**02,** 2374.
1905,	10,000,	**05,** 2453.
1907,	$10,000,	**07,** 2167.
1909,	*5,000,	**09,** 2210.
1910,	*1,500,	**10,** 2379.
1910,	5,000,	**10,** 2379.
1911,	5,000,	**11,** 2585.
1912,	105,000,	**12,** 2795.
Total,	247,200 (recd. from sales, $20=$247,220,	**12,** 2795).

*Allotment.

COMMERCE.

Description of, **91,** 3201; **98,** 3008; **03,** 2243, 2245–2246.

In 1897 believed that condition of chan. in no way hindered development of C. in existence then, **98,** 3008.

Consists of lumber and dairy products shipped to Portland and San Francisco, and general merchandise brought in by coasting vessels.

1911, 26,024 t., **12,** 1188.

CONTRACTS.

1889. R. L. Hall, brush and st. dike constr., $2 running f., **89,** 2522.

1892. J. E. Howard, dike constr.: Piles, 8¢ l. f.; lumber, $12 M f.: bolts complete, 16¢ each; spikes and wire, 4 and 3½¢ lb.; brush, $2.50 cord; st., 58¢ t. ($7,514), **93,** 3369.

1895. C. Ewing, dike constr.: Piles, 6¢ l. f.; lumber, $8.50 M f.; bolts, 12¢ each; spikes and wire, 2½¢ lb.; brush, $1.90 cord; st., 46¢ t. ($13,385.75), **95,** 3384.

1896. Wakefield & Jacobsen, dike constr.: Piles, 8½¢ l. f.; lumber, $10 M f.; bolts, 18¢ each; ironwork, 4 and 4½¢ lb.; brush, $2.30 cord; st., 50¢ t.; excavation, 25¢ c. y. ($12,104.50), **97,** 3399.

1899-00. Informal contracts for repair and extension of dikes, and for mattresses, **00,** 4217.

1907. O. P. Graham, furn. and delivering launch, **07,** 2167.

ENGINEERS.

Chief of Engineers. R., 88, 300; **89,** 357; **90,** 321; **91,** 404, 411; **92,** 379, 384; **93,** 437; **94,** 406; **95,** 447; **96,** 399; **97,** 501; **98,** 492, 502; **99,** 578; **00,** 650; **01,** 622; **02,** 543; **03,** 601; **04,** 661, 663; **05,** 667, 668; **06,** 741, 743; **07,** 757, 758; **08,** 805, 806, 817; **09,** 843, 844; **10,** 937; **11,** 994; **12,** 1187, 1205.

Boards. BERH. reviewed, Aug. 3, 1903, report on sur. of ocean bar (see Surveys), **03,** 2245.

In charge:

Capt. W. Young, 1888–90. **R., 88,** 2150, 2152; **89,** 2522.

Capt. T. W. Symons, 1890–95. **R., 90,** 2979; **91,** 3200; **92,** 2701, 2752, 2744; **93,** 3368; **94,** 2585; **95,** 3382.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3244; **97,** 3397; (Maj.) **98,** 2976, 3007.

Capt. W. W. Harts, 1898–1901. **R., 99,** 3217; **00,** 4314.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3485; **02,** 2373; (Maj.) **03,** 2216, 2239; **04,** 3466, 3468; **05,** 2452, 2454.

Lt. Col. S. W. Roessler, 1905–08. **R., 06,** 1982, 1984; **07,** 2166, 2168; **08,** 2241, 2243.

Maj. J. F. McIndoe, 1908–10. **R., 09,** 2209, 2211.

Maj. J. B. Cavanaugh, **10,** 930.

Capt. Arthur Williams, **10,** 930.

Maj. J. J. Morrow, 1910–. **R., 10,** 2378; **11,** 2583; **12,** 2794.

Assistants:

Lt. E. Burr. **R., 88,** 2151.

W. H. Wood. **R., 91,** 3201.

A. J. McMillan. **R., 92,** 2743, 2746.

J. R. Savage. **R., 92,** 2751.

D. B. Ogden. **R., 96,** 3245.

J. G. Holcombe. **R., 97,** 3399.

Capt. A. A. Fries, **04,** 651; **06,** 732.

Capt. Arthur Williams, **09,** 838; **10,** 930.

Lt. H. H. Robert, **10,** 930; **11,** 987; (Capt.) **12,** 1176.

LEGAL PROCEEDINGS.

Purchase of 1 acre of land for storing and mooring U. S. plant, **00,** 4318; **01,** 3486, 3487.

Public lands withdrawn from sale for use in connection with imp., **01,** 3487.

Port of Tillamook declared illegal by courts, **12,** 2795.

OPERATIONS.

1889-90. 1,148 l. f. of sheet pile dike and 448 l. f. of pile and brush revet. built at Dry Stocking Bar, **90,** 2979.

1892-93. Dike constr. in progress, **93,** 3369.

1893-94. In connection with previous year, about 2,000′ of dike built, **94,** 2586.

1894-95. Dike constr. in progress, **95,** 3384.

1895-96. About 7,000′ of dikes and shore protection built, **96,** 3245.

1896-97. About 4,000′ of dikes and shore protection built, and some obstr. removed, **97,** 3398.

1898-99. Completed dikes kept free from drift, **99,** 3217.

1899-00. Snag scow built under contract; tender bought; over 10,000 c. y. dr.; 5 spur dikes built, 3 under way, and several repaired; about 400 snags, etc., removed, **00,** 4315, 4318.

1901-02. Dr. shoals and building and repairing dikes, **01,** 3485–3486.

1902-03. Snagging and dr., **03,** 2216.

1903-04. 40,000 c. y. dr., 376 large and 770 small snags removed, and js. repaired, **04,** 3466.

1904-05. 16,750 c. y. dr., snagging operations continued, plant repaired, etc., **05,** 2452–2453.

1905-06. 44,000 c. y. dr., and 154 small and 895 large snags removed, **06,** 1983.

1906-07. Snagging operations continued, **07,** 2166.

1907-08. In connection with work of preceding year, 2,734 snags and 48 overhanging trees removed, and 34,058 c. y. removed from shoals, **08,** 2241–2242. Constr. of dr. for work on Oregon coast Hs. in progress, **08,** 806, 2243.

1908-09. 196 large and 1,191 small snags and trees removed, **09,** 2209. Dr. for work on Oregon coast Hs. completed, **09,** 844, 2211.

1909-10. 44,824 c. y. dr., and part of expense connected therewith borne by port of Tillamook, **10,** 2378.

1910-11. Snags removed, 104,421 c. y. dr., partly with funds furn. by port of Tillamook, **11,** 2583–2584.

1911-12. 8,320 c. y. dr. by U. S. and 73,763 c. y. by port of Tillamook, using U. S. plant; 260 snags removed and dr. repaired, **12,** 2794.

PHYSICAL CHARACTERISTICS.

Description of, **88,** 2152; **94,** 2587; **95,** 3384; **98,** 3007; **03,** 2239, 2240.

Chan. changeable, **98,** 3008.

Small ocean vessels drawing up to 8′, 1899, could reach Tillamook City at extreme high tide; 3 small shoals hindered this passage, **99,** 3217.

Condition of works and d. of water, **02,** 543; **03,** 601, 2216; **04,** 662, 3466; **05,** 667, 668; **06,** 742, 1983; **07,** 758, 2166; **08,** 805, 2242; **09,** 844, 2209; **10,** 937, 2378; **12,** 1188.

Unusual freshets in 1904, **04,** 3466.

PRIVATE WORK.

Dr. by private interests in 1908–09, using U. S. plant; expenses of operation paid by people interested, **09,** 2209.

Dr. by port of Tillamook, using U. S. plant, **10,** 2378; **11,** 2583, 2584; **12,** 2794, 2795.

PROJECTS.

By Capt. Powell, 1888, dr., removal of snags and similar obstr., and closing with brush and st. dams 2 small outlets, giving 3′ over Dry Stocking Bar at m. l. t.; est., $5,192.19, **88,** 2153.

In 1890, the unfinished work under the prior proj. having been destroyed, Capt. Symons est. cost of longitudinal and spur dikes and shore protectiom, to d. water across Dry Stocking Bar, at $6,000, **90,** 2980.

By Capt. Symons, 1891, making navigable pass from n. to middle chan., for imp. of Junction Bar by building dike to deflect waters from s. chan. into middle chan., and for imp. of Hoquarton Slough at Dry Stocking Bar by closing up one of the 2 chans. at that place; est., $100,000, **92,** 2745, 2746; **93,** 3368.

By Capt. Symons, 1895, modifying proj. outlined above to provide for constr. of dikes at head of South Fork of Trask R., North Fork, upper mouth of Wilson R., Kilchis R. chan., and across head of middle chan., and for removal of jams from North Fork of Trask R., **95,** 3384.

In 1897 Capt. Fisk est. $1,200,000 to imp. bar and entrance further, **98,** 3007.

Photographs showing general character of structures erected, and excavations made in the R., **99,** 3218.

Act July 25, 1912, au. proj. which contemplates constr. of n. j. at entrance to B.; dr. chan. to Bay City 16′ x 200′, increasing at entrance and at curves; est., $814,000, with $5,000 an. for mainten.; local interests to contribute one-half of cost and to create and maintain 9′ at h. tide bet. Bay City and Tillamook (H. D. 349, 62d, 2d), **12,** 1187–1188.

SURVEYS.

Ex. au. act Aug. 5, 1886; made, 1888, by Capt. Powell, **88,** 2152.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **92,** 2744.

Surs. of network of sloughs and Rs. in head of Tillamook B. made, 1894–95, by Capt. Symons, **95,** 3384.

Two comparative surs. made of the B., 1895–96, by Capt. Fisk, **96,** 3245.

Sur. of bar and entrance au. act June 3, 1896; made, 1897, by Capt. Fisk (see Projects), **98,** 3007.

Sur. of ocean bar with view to making est. of securing chan. across it of 15′ and 20′, resp., au. act June 13, 1902. **R.** by Capt. Langfitt, Apr. 13, 1903, presenting plan for imp. by js.; est., $855,789.08 for 15′ chan., and $1,417,169.46 for 20′ chan. R. and H. Board of opinion, concurred in by Chief of Engineers, that imp. to extent of providing either 15′ or 20′ chan. undesirable "at present," **03,** 602, 2216, 2239–2246.

Pre. ex. and sur. of B. and bar up to town of Tillamook, au. act Mar. 2, 1907. **R.** by Lt. Col. Roessler, Mar. 27, 1907, and Feb. 13, 1908, presenting plan for imp. at est. of $5,000 (H. D. 965, 60th, 1st), **08,** 817. At request of BERH. reex. made July, 1909, by Maj. McIndoe with view to determining if conditions had changed since former reports made (R. and H. Com. D. 13, 61st, 2d). **R.** July 30, 1909 that only work warranted by existing C. is expend. of $5,000 for urgent mainten. work necessary and $5,000 thereafter an. for mainten. of existing chan. (H. D. 965, 60th, 1st), **10,** 2378.

Act June 25, 1910, au. pre. ex. by BE. with view to securing 15 to 20′, with report on any proposition for cooperation by the localities affected. Plan and est. Dec. 30, 1910 (H. D. 349, 62d, 2d), **11,** 2584. Supple. **R.** by Maj. Morrow, June 14, 1911, presenting plan of imp. at est. of $814,000, with $5,000 an. mainten. (H. D. 349, 62d, 2d) (see Projects), **12,** 1205.

Maps. (H. D. 349, 62d, 2d). **95,** 3386; **96,** 3248; **99,** 3218; **03,** 2216.

Photographs showing general character of structures erected and excavations made in the R., **99,** 3218.

VV-69 NEHALEM BAY (Bar and River), OREG.

APPROPRIATIONS.

1890,	$10,000,	**91,** 3205.
1912,	100,000,	**12,** 2809.
Total,	110,000	

COMMERCE.

Extensive timber lands, **90,** 2995.

In 1897 not sufficient to justify imp. of the entrance of the stream by U. S., **98,** 3012.

In 1911, 18,199 t., **12,** 2809.

ENGINEERS.

Chief of Engineers. **R.,** **76,** 116; **85,** 368; **87,** 330; **89,** 358; **90,** 324; **91,** 405; **92,** 380; **93,** 437; **94,** 407; **95,** 448; **98,** 503; **12,** 1202, 1205, 1206.

In charge:

Maj. N. Michler. **R.,** **76,** ii, 639.

Capt. C. F. Powell. **R.,** **85,** 2409; **87,** 2496.

Capt. W. Young, 1888. **R.,** **90,** 2993, 2995.

Capt. T. W. Symons, 1891–95. **R.,** **91,** 3205; **92,** 2703; **93,** 3371; **94,** 2588; **95,** 3386.

Maj. W. L. Fisk, 1898. **R.,** **98,** 3009.

Maj. J. J. Morrow, 1912–. **R.,** **12,** 2808.

Assistants:

J. J. Gilbert, U. S. C. S. **R.,** **76,** ii, 640.

P. G. Eastwick. **R.,** **85,** 2411.

Lt. E. Burr. **R.,** **87,** 2497.

J. S. Polhemus. **R.,** **90,** 2993.

G. A. Lyell. **R.,** **90,** 2998.

OPERATIONS.

1911-12. No work done, proj. being adopted by Congress subsequent to close of fiscal year, **12,** 2808.

PHYSICAL CHARACTERISTICS.

Description of, **76,** ii, 640; **85,** 2410; **90,** 2994; **98,** 3010; **12,** 1202.

Chan. erratic, **98,** 3010.

PLANS.

By Capt. Young, 1889, imp. bar at the entrance to Nehalem B. with 2 high-tide converging shore js., each 3,350′ l., with a least distance apart of 500′; also for imp. of the chan. opposite Lazarus Isld. at the head of the B. by snagging and dam constr.; est., $331,927, **90,** 2998.

In 1892 Capt. Symons est. j. constr., n. location, n. j. 4,200′ l. and s. j. 4,500′ l., at $806,700; for j. constr., s. location, n. j., 6,800′ l. and s. j. 2,700′ l., at $761,860, **92,** 2707.

PROJECTS.

In 1897 Capt. Fisk est. $610,500 to imp. entrance, **98,** 3012.

SURVEYS.

By Maj. Michler, 1875. Ex. at the mouth, **76,** 116.

Sur. by J. J. Gilbert, U. S. C. S., 1875, **76,** ii, 639.

Ex. of entrance au. acts July 5, 1884, and Aug. 5, 1886; made by Capt. Powell (**R.** unfav.), **85,** 2409, **87,** 2496.

Sur. of B. and bar au. Aug. 11, 1888; made, 1889, by Capt. Young, **90,** 2995; **92,** 2704.

Sur. for modified plan of imp. au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.) (see Projects), **98,** 3009.

Pre. ex. and sur. of Nehalem Bar au. act Feb. 27, 1911, for imp. of same in cooperation with local interests. **R.,** Maj. Morrow, 1911 and 1912; est., $632,350, for first constr., half of which ($316,175), incl. cost of work already done, to be contrib. by local interests (H. D. 623, 62d, 2d), **12,** 1205–06.

Pre. ex. and sur. of Nehalem R. au. act Feb. 27, 1911. **R.** to come, **12,** 1206.

Maps. (H. D. 623, 62d, 2d.)

VV-84 SNAKE RIVER, OREG., WASH., AND IDAHO.

Part.	Title.	Period.	Appropriations.
a	Snake R. (above Lewiston)	1881–1885	
b	Snake R., Asotin to Pittsburg Landing	1899–1900	
c	Snake R. (upper)	1890–1896	$45,000.00
	Total		45,000.00

Part (a), VV-84 Snake River, Wash. (above Lewiston).

ENGINEERS.

Chief of Engineers. **R., 81,** 332; **82,** 324; **85,** 372.

In charge:
Capt. C. F. Powell. **R., 82,** 2716.
Maj. W. A. Jones. **R., 85,** 2440.

Assistants:
Lt. T. W. Symons. **R., 82,** 2718.
F. J. Carrel. **R., 85,** 2441.

PHYSICAL CHARACTERISTICS.

Description of R., **82,** 2716, 2718; **85,** 2441.

PLANS.

By Capt. Powell, 1881, imp., Lewiston to Salmon R., by removal of rs. bowlders, and gravel, to give navigation from 4 to 6 months of the year; est., $32,604, **82,** 2718, 2722.

SURVEYS.

Lewiston to mouth of Salmon R. au. act Mar. 3, 1881, **81,** 332; made by Capt. Powell, 1881, **82,** 2716.

Bet. Lewiston and mouth of Boise R. au. act July 5, 1884; made by Maj. Jones, 1884, **85,** 2440.

Part (b), VV-84 Snake River, Oreg. and Wash.

COMMERCE.

None at 1899, and none looked for for years to come, **00,** 4342.

ENGINEERS.

Chief of Engineers. **R., 00,** 665.

In charge. Capt. W. W. Harts, 1899. **R., 00,** 4338.

PHYSICAL CHARACTERISTICS.

Description of. A long, crooked mountainous stream rising in Yellowstone Park and emptying into the Columbia, with a total fall bet. Pittsburg Landing and Asotin, a distance of 74 m., of about 530′, with at least 1 rapid to every mile, **00,** 4339.

SURVEY.

Ex. from Asotin, Wash., to Pittsburg Landing, Oreg., au. act Mar. 3, 1899: made, 1899, by Capt. Harts (**R.** unfav.), **00,** 4338.

Part (c), VV-84 Snake (Upper) River, Idaho. (Between Huntington Bridge and Seven Devils mining district.)

APPROPRIATIONS.

1892,	$20,000,	**93,** 3373.
1894,	25,000,	**95,** 3390.
Total,	45,000	

COMMERCE.

Navigation impracticable in 1892, **93,** 3373.

ENGINEERS.

Chief of Engineers. **R., 91,** 411; **93,** 438; **94,** 407; **95,** 448; **96,** 416.

In charge:
Capt. T. W. Symons, 1891–95. **R., 91,** 3285, 3288; **93,** 3372; **94,** 2589; **95,** 3388.
Capt. H. Taylor, 1896. **R., 96,** 3387.

Assistants:
A. J. McMillan. **R., 91,** 3286.
Wm. Cuthbert. **R., 91,** 3289.
P. G. Eastwick. **R., 93,** 3374.

OPERATIONS.

1892–93. 2,143 c. y. r. removed, **93,** 3373.
1894–95. 1,858 c. y. r. removed, **95,** 3390.
1895–96. Obstr. below Eagle Rock and at the head of Shoo Fly Rapids partly removed. Work of imp. abandoned, **96,** 3387.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3286.

In 1893 it was thought that navigation of the R. would always be difficult and dangerous in spite of all that could be done by way of imp., **93,** 3373.

PROJECTS.

By Capt. Symons, 1891, removal of obstr. rs. and reefs from selected chan. 150′ w., and for putting in ringbolts and iron posts for convenience of loaded boats lining up over the worst rapids, est., $80,000, **93,** 3372.

By Col. Mendell, DE., 1895, abandoning all work of imp., and sale of barges and other similar property engaged in the work, any other property to be trans. to other works of imp., **96,** 3387.

SURVEY.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **91,** 3288.

Maps. **91,** 3291; **92,** Atlas, 121, 122, 123.

VV-94 CLEARWATER RIVER, IDAHO.

APPROPRIATIONS.

1879,	$5,000,	**79,** 183.
1880,	5,000,	**80,** 2330.
1882,	5,000,	**82,** 2678.
1896,	25,000,	**96,** 3388.
1899,	10,000,	**99,** 3232.
Total,	[1] 50,000	(deduct $12,294.41, unexpended balance, trans. to Snake R., making right total $37,705.59).

COMMERCE.

Benefit of imp. to C., **79,** 1817, 1822, 1855; to timber interest, **80,** 2329.

Increasing and of growing importance, **96,** 3389.

Limited, with ample RR. facilities paralleling the stream, which, together with dangers of navigation, have caused SS. to abandon stream, **01,** 629; **02,** 551.

CONTRACTS.

1880. S. R. Smith, r. removal, $38 c. y., **80,** 2330.

1881. Holmes & Chalmers, r. and st. removal, $31 and $4, resp., c. y., **81,** 2589.

1883, M. A. Smith, r. and st. removal, $26 and $4 resp., c. y.; **83,** 2062.

ENGINEERS.

Chief of Engineers. R., 78, 139; **79,** 182, 183; **80,** 240; **81,** 329; **82,** 322; **83,** 335; **84,** 341; **85,** 371; **86,** 360; **87,** 332; **88,** 306; **96,** 416; **97,** 521; **98,** 500; **99,** 588; **00,** 664; **01,** 628; **02,** 550; **06,** 751; **10,** 950; **11,** 1007.

In charge:

Maj. J. M. Wilson, 1878. **78,** 138; **79,** 180, 183. **R., 79,** 1813.

Maj. G. L. Gillespie, 1879–81. **79,** 180, 183. **R., 79,** 1855; **80,** 2328; **81,** 2587.

Capt. C. F. Powell, 1881–85. **R., 82,** 2678; **83,** 2061; **84,** 2279.

Maj. W. A. Jones, 1885–88. **R., 85,** 2439; **86,** 1952; **87,** 2523; **88,** 2189.

Capt. H. Taylor, 1896–97. **R., 96,** 3388; **97,** 3465.

Maj. W. L. Fisk, 1898. **R., 98,** 2989.

Capt. W. W. Harts, 1899–1900. **R., 99,** 3231; **00,** 4337.

Capt. W. C. Langfitt, 1901–02. **R., 01,** 3501; **02,** 2385.

Lt. Col. S. W. Roessler, 1906. **06,** 732.

Maj. Jay J. Morrow, 1911. **11,** 987.

Assistants:

P. G. Eastwick, **79,** 1813. **R., 79,** 1817; **84,** 2281.

Lt. Henry H. Robert, **11,** 987.

OPERATIONS.

1879–80. Chan. 60 x 4½′ at l. w. excavated by blasting through Reubens Rapids, **80,** 2328, 2329.

1880–81. 97.5 c. y. solid r. and 250 c. y. cobblest. removed, **81,** 2588.

1883–84. 154 c. y. r. excavated, **84,** 2279.

1896–97. Rock removal in progress, **97,** 3465.

1897–98. Rock removal continued, **98,** 2990.

1901–02. Capt. Langfitt, 1902, states R. is believed to be unworthy of further imp., **02,** 2385.

PHYSICAL CHARACTERISTICS.

Description of, **79,** 1814–1822, 1855; **96,** 3388.

Obstr., **79,** 1815–1821.

Freshets, **79,** 1816, 1821, 1822.

Discharge of R., **79,** 1818, 1819, 1821.

R. is formed by junction of the Middle and South Forks; former rising in the Bitter Root and the latter in the Salmon River Mts., and after very circuitous courses uniting about 69 m. from mouth of R. R. bed is of gravel, cobblest., and bowlders, with here and there a reef of rs. extending into the chan. In 1879 numerous gravel bars and shoals existed. **96,** 3388.

PLANS. (See Projects.)

By P. G. Eastwick, 1879, upper R., removal of r. and bowlders, to 3′ l. w., **79,** 1815, 1823; considered impracticable, **79,** 1855.

By Capt. Powell, 1884, r. removal and wing-dam constr., mouth to Clearwater Forks, 40 m.; est., $87,000. **84,** 2280.

PROJECTS.

By Maj. Wilson, 1878, removal of r. and bowlders, Lewiston to mouth of North Fork, forming chan. 60 to 75′ w., with d. of 4 to 5′ at l. w.; est., $34,424 **79,** 1816, 1823; **80,** 240; **87,** 2523.

By Capt. Taylor, 1897, revising existing proj. to obtain h. instead of l. w. navigation; est., $35,000; **97,** 3465.

As result of conditions reported to Sec. of War, July 6, 1899, all work ceased, and app. of $10,000 of Mar. 3, 1899, held in Treas. awaiting developments, **01,** 629.

SURVEYS.

Ex. au. and in progress, **78,** 139. Completed by P. G. Eastwick, **79,** 183, 1813, 1817.

At Reubens Isld. Rapids and Kents Chute, 1883, **83,** 2061.

Sur. from junction of the Middle and South Forks to mouth made by Capt. Taylor, 1896–97, **97,** 3465.

Au. act Mar. 3, 1905; Col. Roessler's **R.** unfav. (H. D. 476, 59th, 1st), **06,** 751.

Pre. ex. mouth to Kamiah, au. act Mar. 3, 1909, **R.,** Maj. Jay J. Morrow, Apr. 4, 1910, unfav. (H. D. 1083, 61st, 3d), **10,** 950; **11,** 1007.

Maps. **80,** 2328; **81,** 2588.

VV-98 NORTH PALOUSE RIVER, WASH.

ENGINEERS.

Chief of Engineers. R., 89, 364.

In charge. Maj. W. A. Jones, 1888. **R., 89,** 2592.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Maj. Jones (**R.** unfav.), **89,** 2592.

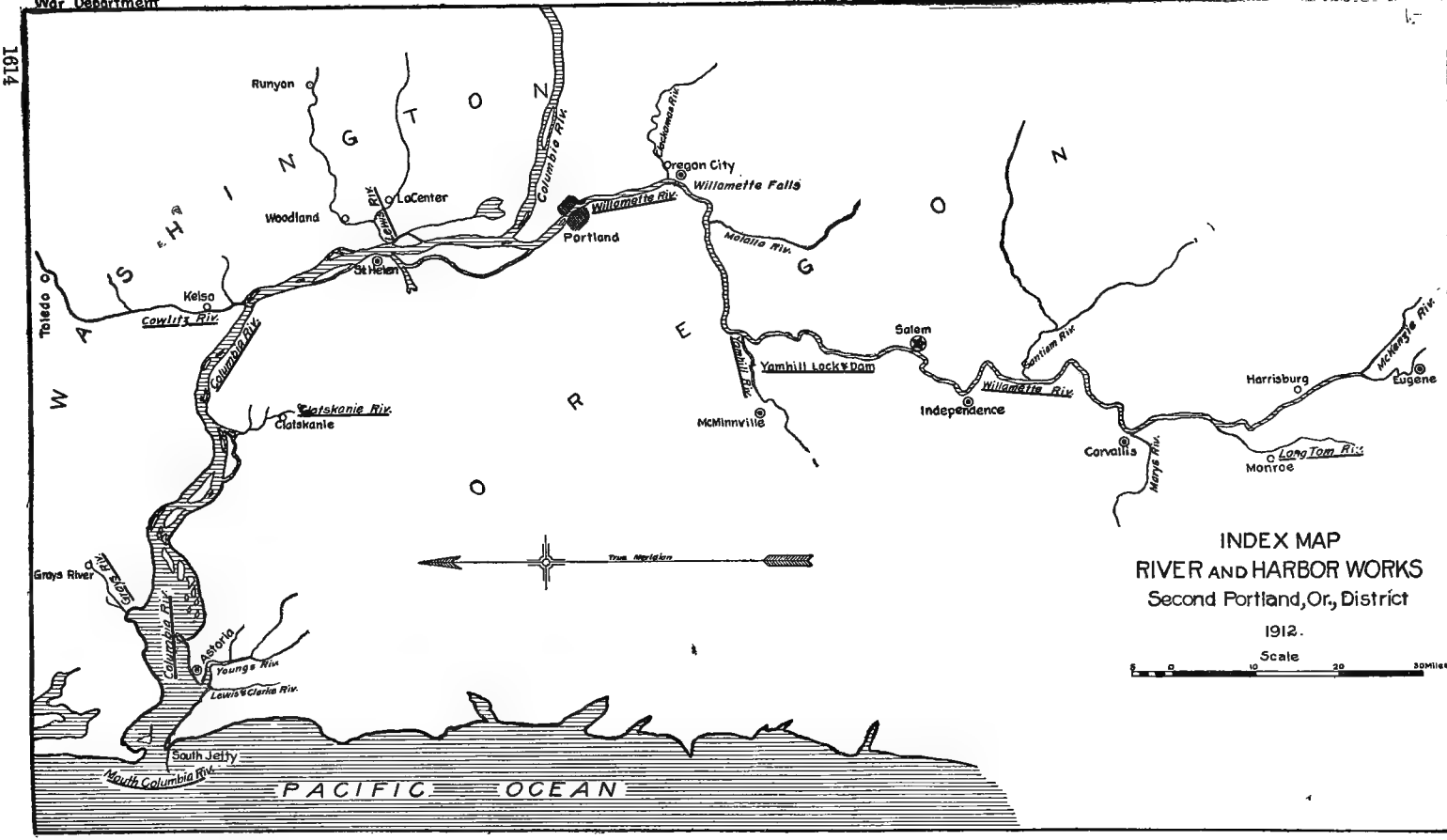
[1] Unexpend. balance of $12,294.41 made available for imp. of upper Columbia and Snake Rs., Oreg. and Wash., by act June 13, 1902.

RIVER AND HARBOR WORKS—PACIFIC COAST.

WW.—2d PORTLAND, OREG., DISTRICT.

War Department

Corps of Engineers, U.S. Army.



WW.—2d PORTLAND, OREG., DISTRICT.

In charge of U. S. Engineer Office, 2d District,
Portland, Oreg.

WW 1 Pacific Ocean.
WW 2 [1]Columbia R., Oreg. and Wash.
WW 3 Skipanon Cr. (Skeppernawin Cr.), Oreg. (2)
WW 4 Youngs B., Oreg. (2)
WW 5 Lewis and Clark R., Oreg. (4)
WW 6 Youngs R., Oreg. (4)
WW 7 Klaskanine R., Oreg. (4)
WW 8 Waluski R., Oreg. (4)
WW 9 John Day R., Oreg. (2)
WW 10 Prairie Chan., Oreg. (2)
WW 11 Svensen Slough, Oreg. (10)
WW 12 Warrens Cr., Oreg. (10)
WW 13 Blind Slough, Oreg. (10)
WW 14 Gnat Cr., Oreg. (13)
WW 15 Clifton Chan., Oreg. (2)
WW 16 Driscoll Slough, Oreg. (2)
WW 17 Westport Slough, Oreg. (2)
WW 18 Wallace Isld. Chan., Oreg. (2)
WW 19 Beaver Slough, Oreg. (18)
WW 20 Clatskanie R., Oreg. (19)
WW 21 Bradbury Slough, Oreg. (2)
WW 22 Rinearson Slough, Oreg. (2)
WW 23 Tide Cr., Oreg. (2)
WW 24 Deer Isld. Slough, Oreg. (2)
WW 25 Willamette Slough, Oreg. (2)
WW 26 Scappoose B., Oreg. (25)
WW 27 Gilbert R., Oreg. (25)
WW 28 Cunningham Slough, Oreg. (25)
WW 29 Sturgeon Lake (outlet), Oreg. (2)
WW 30 Willamette R., Oreg. (2)
WW 31 Willamette Slough, Oreg. (30)
WW 32 Tualatin R., Oreg. (30)
WW 33 Yamhill R., Oreg. (30)
WW 34 Luckiamute R., Oreg. (30)
WW 35 Marys R., Oreg. (30)
WW 36 Long Tom R., Oreg. (30)
WW 37 McKenzie R., Oreg. (30)
WW 38 Santiam R., Oreg. (30)
WW 39 Molalla R., Oreg. (30)
WW 40 Clackamas R., Oreg. (30)
WW 41 Columbia Slough, Oreg. (30)
(Tributaries of Columbia above mouth of Willamette R. to Snake R. are included in 1st Portland district.) See p. 1593.
WW 42 Bachelors Isld. Slough, Wash. (2)
WW 43 Lake R., Wash. (2)
WW 44 Lewis R., Wash. (2)
WW 45 East Fork of Lewis R., Wash. (44)
WW 46 Martin Isld. Slough, Wash. (2)
WW 47 Kalama R., Wash. (2)
WW 48 Carrollton Chan., Wash. (2)
WW 49 Cowlitz R., Wash. (2)
WW 50 Coweman R., Wash. (49)
WW 51 Toutle R., Wash. (49)
WW 52 Big Slough, Wash. (2)
WW 53 Solo Slough, Wash. (52)
WW 54 North Solo Slough, Wash. (53)
WW 55 Cut-Off Slough, Wash. (52)
WW 56 Coal Creek Slough, Wash. (52)
WW 57 Nequally Cr., Wash. (2)
WW 58 Mill Cr. (Negisticook Cr.), Wash. (2)
WW 59 Cathlamet Chan., Wash. (2)
WW 60 Elochoman Slough, Wash. (59)
WW 61 Elochoman R., Wash. (60)
WW 62 Steamboat Slough, Wash. (2)
WW 63 Skamokawa Cr., Wash. (2)
WW 64 Brooks or Alger Slough, Wash. (63)
WW 65 Jim Crow Cr., Wash. (2)
WW 66 Grays B., Wash. (2)
WW 67 Grays R., Wash. (66)
WW 68 Deep R. (Alamicut R.), Wash. (66)
WW 69 Bakers B., Wash. (2)
WW 70 Chinook R., Wash. (69)
WW 71 Wallicut R., Wash. (69)

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[1] The Columbia watershed from the mouth of the Columbia to the Willamette is in charge of the 2d Portland engineering district. See p. 1593.

WW-2 COLUMBIA RIVER, OREG., WASH., AND IDAHO.

Part.	Title.	Period.
a	Plan of presenting data	
b	Index to point named in following abstracts	
c	List of notable points, mouth to headwaters	
d	Appropriations	1866–1912
e	Gauging	1893–1912
f	Columbia (and Willamette R.), below Portland, Oreg. (see p. 1642 of this index)	1792–1912
g	Columbia R., mouth	1879–1912
h	Columbia R., below Tongue Pt. and in front of Astoria, Oreg.	1894–1907
i	Columbia R., between Vancouver, Wash., and Willamette R.	1890–1912
j	Columbia R., Oregon Slough	1910–1912
k	Columbia R., Cascades	1874–1912
l	Columbia R., Cascades (operating and care of canal)	1896–1912
m	Columbia R., vicinity of Hood R.	1909–1910
n	Columbia R., Dalles to Celilo Falls	1879–1912
o	Columbia R., Dalles (upper Columbia) to Snake R.	1866–1912
p	Columbia R., Celilo Falls to Snake R. (and tributaries)	1905–1912
q	Columbia R., Snake R. to Wenatchee	1909–1912
r	Columbia R. (upper), Priest Rapids, etc.	1888–1895
s	Columbia R., Rock Island Rapids to Foster Creek	1894–1897
t	Columbia R., Wenatchee to Bridgeport	1905–1912
u	Columbia R., Bridgeport to Kettle Falls	1905–1912
v	Columbia R., Clarks Fork	1890–1891

Part (a), WW-2 Plan of presenting data relating to Columbia River.

The works of improvement on the Columbia are in charge of three separate offices. (See VV, WW, XX.) Because of this, and of the varying limits specified by many acts of Congress over a considerable period of time, it is believed to be better to collect data concerning this waterway under one head, as herein. The list of parts above gives a comprehensive view of what is included under the head "Columbia River." The abstracts, Parts f–v, are arranged in the order determined by the list of notable points, Part c, beginning at the mouth of the river.

Part (b), WW-2 Index to points named, Columbia River, abstracts a-v.

Albany Falls, Mont., 1618.
Asotin, 1636.
Asotin to Lewiston, 1636.
Astoria, 1616, 1618, 1620, 1621, 1623, 1627, 1628.
Astoria to Smiths Pt., 1628.
Bachelor Isld. Slough, 1618.
Baker B., 1618.
Beaver Slough, 1618.
Big Bend, 1618.
Big Blackfoot R. to International Line, 1639.
Big Eddy, 1634.
Big Eddy to Celilo, 1634; **to Dalles,** 1633; **to Portland,** 1633.
Biggs Rapids, 1637.
Big Slough, 1618.
Blind Slough, 1618.
Bonners Ferry, 1618.
Box Canyon, 1618 (see Nos. 74 and 88).
Bradbury Slough, 1618.
Bradfords Isld., 1630.
Bridgeport, 1618.
Bridgeport to Kettle Falls, 1616, 1620, 1639.
Bridgeport to Wenatchee, 1616, 1620, 1639.
Bugby Light, 1626.
Burke Slough, 1623.
Bybees Isld. to Percys, 1622.
Cabinet Rapids, 1618, 1637, 1638.
Cape Disappointment, 1627.
Cascades, 1616, 1618, 1619, 1629, 1630, 1632.
Cathlamet, 1618, 1621.
Cathlamet B., 1623.
Celilo, above, 1633.
Celilo Canal, 1618.
Celilo Falls, 1618, 1634, 1636.
Celilo Falls to Dalles, 1616, 1620, 1633, 1634; **to Fivemile Rapids,** 1633, 1634; **to mouth,** 1634; **to Snake R.,** 1616, 1620, 1637; **to Tenmile Rapids,** 1634; **to Threemile Rapids,** 1633.
Celilo to Big Eddy, 1634; **to Dalles,** 1636; **to Lewiston,** 1634, 1636, 1637; **to Pittsburg Ldg.,** 1637; **to Snake R.,** 1636.
Central Dock, 1621.
Chelan Rock, 1639.
Chinook R., 1618.
Clarks Fork, 1616, 1618, 1639.
Clatskanie R., 1618.
Clatsop Spit, 1626, 1627.
Clearwater R., 1619.
Clifton Chan., 1618.
Coast to Portland, 1622; **western coast,** 1623.
Columbia City, 1624.
Columbia R. pts. to Portland, 1621.
Columbia Falls, 1618.
Columbia R., lower, 1621, 1623, 1624, 1625.
Columbia R., upper, 1619, 1620, 1629, 1634, 1635, 1636, 1638.
Columbia Slough, 1622, 1624.
Coon Isld. Slough, 1622, 1623, 1624.

Coon Isld. to Sauvies I., 1622, 1624.
Cottonwood Rocks, 1636.
Cowlitz R., 1618, 1621.
Crabtree Coulee, 1618.
Cunningham Slough, 1618.
Dalles Rapids, 1634, 1636.
Dalles, The, 1618, 1629, 1632, 1634, 1636.
Dalles, above, 1636.
Dalles to Big Eddy, 1633; **to Celilo,** 1616, 1620, 1633, 1634, 1636; **to mouth of Snake R.,** 1616, 1635.
Deep R., 1618.
Deer Isld. Slough, 1618.
Demassville, 1618.
Deschutes R., 1618.
Devils Bend, 1636.
Diamond Crossing, 1636.
Driscolls Slough, 1618.
Elliott Pt., 1621.
Elochoman Slough, 1618.
Entrances, Col. R., and New York Harbor, 1623.
Eureka to Riparia, 1637.
Eutiat Rapids, 1639.
False Palouse Rapids, 1635, 1637.
First Rapids, 1637.
Fishhook Rapids, 1635, 1637.
Fivemile Rapids, 1635, 1637.
Fivemile Rapids to Celilo Falls, 1633, 1634.
Flathead Lake, 1618.
Flathead R., 1618.
Ft. Stevens, 1621, 1623, 1627.
Ft. Stevens to Harrington Pt., 1625.
Foster Cr., 1618.
Foster Cr. to Rock Island Rapids, 1616, 1620, 1638.
Foster Cr. Rapids, 1639.
Gauging, 1620, 1621, 1623, 1625, 1631.
Gerome, 1618.
Gifford, 1618.
Gilbert R., 1618.
Goble to Portland, 1625.
Goose Isld., 1636.
Grand Rapids, 1639.
Grays R., 1618.
Grays B., 1618.
Harrington Pt. to Ft. Stevens, 1625.
Hayden Isld., 1628, 1629; **to Vancouver,** 1628.
Hell Gate, N. Y., 1631, 1636.
Hogs Back Bar, 1622, 1623, 1625.
Holly Road Dock, 1621.
Homly Rapids, 1635, 1636, 1637.
Hood R., 1616, 1618, 1632.
Imnaha R. to Pittsburg Ldg., 1636, 1637; **to Lewiston,** 1636, 1637.
International Line to Big Blackfoot R., 1639; **to Okanogan R.,** 1638; **to Rock Isld. Rapids,** 1620, 1636, 1638; **to Wallula,** 1638.
Ione, 1618.
Isld. No. 5, 1637.
Jim Crow Cr., 1618.
Jim Fords Isld., 1635.
Jocko R., 1618.
John Day R., 1618 (Nos. 9 and 59, Part c—two different rivers).
John Day Rock, 1635, 1636.
Kalama, 1621.
Kalama R., 1618.
Kalispel, 1618.
Kennewick to Priest Rapids, 1637.
Kettle Falls, 1618.
Kettle Falls to Bridgeport, 1616, 1620, 1639; **to Wenatchee,** 1639.
Klickitat R., 1618.
Kootenai R., 1618.
La Du Landing, 1623.
Lake Chelan, 1618.
Lake R., 1618.
Lewis and Clarke R., 1618.
Lewis R., 1618.
Lewiston, 1636; **above,** 1636; **below,** 1636; **to Asotin,** 1636; **to Celilo,** 1634, 1636, 1637; **to Imnaha R.,** 1636, 1637; **to Pittsburg Ldg.,** 1636; **to Portland,** 1634; **to Riparia,** 1634, 1635, 1636.
Linton, 1621.
Little Goose Rapids, 1635.
Log Cabin Rapids, 1635, 1636.
McDonald Lake, 1618.
Marcus, 1618.
Martin Isld. or Martins Slough, 1618, 1623, 1624.
Martins Bluff, 1621.
Metaline, 1618.
Methow Rapids, 1618, 1638.
Mill Cr., 1618.
Missoula R., 1618.
Monumental Rapids, 1635, 1637.
Mt. Sheep Rapids, 1636.
Mouth Columbia R., 1616, 1618, 1619, 1620, 1623, 1625.
Mouth to Celilo Falls, 1634; **to Pittsburg Ldg.,** 1636; **to Portland,** 1623, 1624, 1625, 1628; **to Snake R.,** 1619; **to Willamette,** 1624, 1625.
Negually Cr., 1618.
Nespilem Canyon, 1618.
Nespilem R., 1618.
Newport, Wash., 1618.
Nigger Tom Isld., 1622, 1624.
Northport, 1618.
North Portland H., 1629.
Okanogan R., 1618; **to International Line,** 1638; **to Rock Isld. Rapids,** 1638.
Oregon Slough, 1616, 1618, 1629.
Palouse Rapids, 1635, 1637.
Peacock Spit, 1626, 1627.
Pend Oreille, 1618.
Percys Isld., 1624.
Percys Slough, 1622, 1624.
Percys to Bybees Isld., 1622.
Pine Tree Rapid, 1635, 1637.
Pittsburg Landing, 1636; **to Celilo,** 1637; **to Imnaha R.,** 1636, 1637; **to Lewiston,** 1636; **to mouth,** 1636.
Pt. Adams, 1623, 1625, 1626, 1627.
Portland, Oreg., 1621, 1622, 1623, 1625, 1629; **below,** 1616, 1620, 1623, 1625; **to Big Eddy,** 1633; **to Columbia R. pts.,** 1621; **to Goble,** 1625; **to Lewiston,** 1634; **to mouth,** 1623, 1624, 1625, 1628; **to mouth of Willamette,** 1624; **to the sea,** 1622; **to Willamette R. pts.,** 1627.
Port of Portland, 1621, 1623, 1624.
Post Office Bar, 1623, 1624, 1625.
Prairie Chan., 1618.
Priest Rapids, 1616, 1618, 1636, 1638; **to Kennewick,** 1637.
Priest R., Mont., 1618.
Puget Isld., 1618.
Rickey Rapids, 1639.
Rinearson Slough, 1618.
Riparia, 1619, 1634, 1636; **to Eureka,** 1637; **to Lewiston,** 1634, 1635, 1636; **to mouth of Snake R.,** 1636.
Rock Isld. Rapids, 1618, 1638; **to Foster Cr.,** 1616, 1620, 1638; **to International Line,** 1620, 1636, 1638; **to Okanogan R.,** 1638.
Rocky Beach, 1638, 1639.
Ross Isld., 1623.
St. Helen, 1618, 1622.
St. Helens Bar, 1622, 1623, 1624, 1625.
St. Helens Jetty, 1623.
St. Johns, 1623.
Sand Isld., 1623, 1625, 1627.
San Poil R., 1618.
Sauvies Islds., 1622, 1623; **to Coon Isld.,** 1622, 1624.
Scappoose B., 1618.
Seventh Rapids, 1637.
Sheridan Pt., 1631.
Sixth Rapids, 1637.
Skamokawa Cr., 1618.
Skipanon Cr., 1618.
Slaughterhouse Dam, 1636.
Slaughters Bar, 1621.
Smiths Pt. to Astoria, 1628.
Snag Isld., 1123.
Snake R., 1618, 1619, 1634, 1635, 1636, 1637; **above,** 1636; **below,** 1636; **to Celilo Falls,** 1616, 1620, 1636, 1637; **to Dalles,** 1616, 1635; **to mouth,** 1619; **to Riparia,** 1636; **to Wenatchee,** 1616, 1637.
Spokane R., 1618.
Steamboat Slough, 1618.
Stella, 1621.
Sturgeon Lake Outlet, 1618.
Summit Pt., 1631.

Svenson Slough, 1618.
Swan Isld., 1622, 1623, 1624, 1625; **to St. Johns,** 1623.
Sylvia de Grasse, 1623, 1627, 1628.
Taylor Sands, 1623; **below,** 1623.
Tenmile Rapids, 1633; **to Celilo,** 1634.
Texas Rapids, 1635, 1637.
Third Rapids, 1637.
Threemile Rapids, 1620, 1633, 1634; **to above Celilo Falls,** 1633.
Three Tree Pt., 1623.
Tide Cr., 1618.
Tongue Pt., 1619; **below,** 1616, 1620, 1627, 1628; **to Woody Isld.,** 1625.
Tributaries, 1620, 1623, 1637.
Umatilla Rapids, 1618, 1635, 1636, 1637.
U. S., western coast, 1623.
Usk, 1618.
Vancouver, 1618, 1628, 1629; **to Hayden Isld.,** 1628; **to Willamette,** 1616, 1620, 1628, 1629.
Walkers Isld., 1623, 1624.
Wallace Isld. Chan., 1618.
Wallula to International Line, 1638.
Warrens Cr., 1618.
Warrior Rock, 1621, 1622, 1624.
Waterford, 1621.
Wenatchee, 1618; **to Kettle Falls,** 1639; **to Snake R.,** 1616, 1637.
Wenatchee to Bridgeport, 1616, 1620, 1639.
Westport Slough, 1618.
White Bluffs, 1618.
Whites Ferry, 1635.
Wild Goose Dike, 1635.
Wild Goose Isld., 1636.
Wild Goose Rapids, 1635.
Willamette Bar, 1622.
Willamette (lower), 1620, 1621, 1622, 1623, 1624, 1625, 1628.
Willamette R., 1618, 1622, 1623; **mouth,** 1620, 1624, 1625; **pts. on, to Portland,** 1621, 1624; **to Vancouver,** 1616, 1620, 1628, 1629.
Willamette Slough, 1618, 1622, 1624, 1625.
Willow Bar, 1621.
Woody Isids. to Tongue Pt., 1625.
Yakima, 1618, 1637.
Youngs R., 1618.

Part (c), WW-2 List of notable points, mouth to headwaters.

1 Pacific Ocean.
2 Mouth.
3 Baker B., Wash.
4 Chinook R., Wash.
5 Skipanon Cr., Oreg.
6 Lewis and Clark R., Oreg.
7 Youngs R., Oreg.
8 Astoria, Oreg.
9 John Day R., Oreg.
10 Grays B., Wash.
11 Deep R., Wash.
12 Grays R., Wash.
13 Svenson Slough, Oreg.
14 Warrens Cr., Oreg.
15 Prairie Chan., Oreg.
16 Jim Crow Cr., Wash.
17 Blind Slough, Oreg.
18 Skamokawa Cr., Wash.
19 Skamokawa, Wash.
20 Steamboat Slough, Wash.
21 Clifton Chan., Oreg.
22 Elochoman Slough, Wash.
23 Cathlamet, Wash.
24 Puget Isld., Wash.
25 Driscoll Slough, Oreg.
26 Westport Slough, Oreg.
27 Wallace Isld. Chan., Oreg.
28 Beaver Slough, Oreg.
29 Clatskanie R., Oreg.
30 Mill Cr., Wash.
31 Negually Cr., Wash.
32 Bradbury Slough, Oreg.
33 Big Slough, Wash.
34 Rinearson Slough, Oreg.
35 Cowlitz R., Wash.
36 Kalama R., Wash.
37 Tide Cr., Oreg.
38 Deer Isld. Slough, Oreg.
39 Martin Isld. Slough, Wash.
40 St. Helen, Oreg.
41 Lewis R., Wash.
42 Lake R., Wash.
43 Scappoose B., Oreg.
44 Cunningham Slough, Oreg.
45 Bachelor Isld. Slough, Wash.
46 Willamette Slough, Oreg.
47 Gilbert R., Oreg.
48 Sturgeon Lake Outlet, Oreg.
49 Willamette R., Oreg. (Portland).
50 Vancouver, Wash.
51 Oregon Slough, Oreg.
52 Cascades Locks, Oreg.
53 Hood R., Oreg.
54 Klickitat R., Wash.
55 The Dalles, Oreg.
56 Dalles, Celilo Canal, Oreg.
57 Celilo, Oreg.
58 Deschutes R., Oreg.
59 John Day R., Oreg.
60 Umatilla, Oreg.
61 Snake R., Wash.
62 Yakima R., Wash.
63 White Bluffs, Wash.
64 Priest Rapids, Wash.
65 Crabtree Coulee, Wash.
66 Cabinet Rapids, Wash.
67 Rock Isld. Rapids, Wash.
68 Wenatchee, Wash.
69 Lake Chelan, Wash.
70 Methow R., Wash.
71 Okanogan R., Wash.
72 Bridgeport, Wash.
73 Foster Cr., Wash.
74 Box Canyon, Wash.
75 Nespilem Canyon, Wash.
76 Nespilem R., Wash.
77 San Poil R., Wash.
78 Big Bend, Wash.
79 Spokane R., Wash.
80 Gerome, Wash.
81 Gifford, Wash.
82 Kettle Falls, Wash.
83 Marcus, Wash.
84 Northport, Wash.
85 Kootenai R. and Bonners Ferry. (Name of river in its continuation from Canada).
86 Pend Oreille R.
87 Metaline, Wash.
88 Box Canyon, Wash.
89 Ione, Wash.
90 Usk, Wash.
91 Newport, Wash.
92 Albany Falls, Mont.
93 Priest R., Mont.
94 Clarks Fork, Mont.
95 Missoula R., Mont.
96 Jocko R., Mont.
97 Flathead R., Mont.
98 Flathead Lake, Mont.
99 Demassoille, Mont.
100 Kalispel, Mont.
101 Columbia Falls, Mont.
102 McDonald Lake, Mont.

Part (d), WW-2 Appropriations.

Columbia (upper) and Snake Rivers, Oreg., Wash., and Idaho:

1878,	$20,000.00,	**78,** 138.	
1879,	20,000.00,	**79,** 181.	
1880,	15,000.00,	**80,** 2292.	
1881,	15,000.00,	**81,** 2562.	
1882,	6,000.00,	**82,** 2663.	
1884,	20,000.00,	**84,** 2231.	
1886,	10,000.00,	**86,** 1950.	
1888,	10,000.00,	**88,** 2189.	
1890,	20,000.00,	**90,** 2983.	
1892,	15,000.00,	**92,** 2715.	
1894,	5,000.00,	**95,** 3393.	
1896,	5,000.00,	**96,** 3384.	
1899,	7,500.00,	**99,** 3219.	
1902	40,250.00	**02,** 2376.	
	[1] 12,294.41		
1902,	*[2] 5,500.00,	**04,** 3471.	
1905,	25,000.00,	**05,** 2457.	
1907,	[3] 10,000.00,	**07,** 2170.	
1909,	*5,000.00,	**09,** 2212.	
1909,	*10,000.00,	**10,** 2383.	
1910,	25,000.00,	**10,** 2383.	
1911,	15,000.00,	**11,** 2587.	
1912,	25,000.00,	**12,** 2798.	
	341,544.41	(incl. sales and $85,000 app. by State of Washington ($100,000 was app. originally, but final requisition for $15,000 of this amount was not honored by State auditor for the reason that it had lapsed on Apr. 30, 1909, prior to the requisition), **10,** 939; $427,370.11, **12,** 2798).	$341,544.41

Columbia River, Oreg. (canal around the Cascades):

1876,	$90,000.00,	**77,** 123, 1046, 1049.	
1878,	150,000.00,	**78,** 138, 1337, 1338.	
1879,	100,000.00,	**79,** 182, 1849.	
1880,	100,000.00,	**80,** 2301.	
1881,	100,000.00,	**81,** 2567.	
1882,	265,000.00,	**82,** 2667.	
1884,	150,000.00,	**84,** 2248.	
1886,	187,500.00,	**86,** 1945.	
1888,	300,000.00,	**88,** 2164.	
1890,	435,000.00,	**90,** 3054.	
1892,	326,250.00,	**92,** 2822.	
1893,	1,239,653.00,	**93,** 3508.	
1896,	229,597.00,	**96,** 3269.	
1899,	75,000.00,	**99,** 3224.	
1902,	30,000.00,	**02,** 2377.	
1905,	$30,000.00,	**05,** 2461.	
1905,	*1,000.00,	**06,** 1994.	
1910,	5,000.00,	**10,** 2391.	
	3,814,000.00	(incl. $11,629.48 received from sales, $3,825,629.48, **12,** 2805).	$3,814,000.00

Cascades Canal (operating and care):

1897,	$2,434.72,	**97,** 3423.	
1898,	4,533.79,	**98,** 2983.	
1899,	6,683.62,	**99,** 3225.	
1900,	5,296.13,	**00,** 4332.	
1901,	5,433.91,	**01,** 3496.	
1902,	10,881.33,	**02,** 2380.	
1903,	6,840.31,	**03,** 2224.	
1904,	5,090.87,	**04,** 3493	
1905,	8,931.67,	**05,** 2464.	
1906,	17,996.38,	**06,** 1996.	
1907,	9,954.81,	**07,** 2178.	
1908,	14,569.34,	**08,** 2253.	
1909,	15,953.83,	**09,** 2219.	
1910,	14,379.39,	**10,** 2393.	
1911,	14,007.73,	**11,** 2596.	
1912,	10,920.79,	**12,** 2806.	
	[4] 153,908.62		153,908.62

Columbia River, Oreg. and Wash., mouth of:

1878,	$5,000.00,	**79,** 182, 1791.	
1879,	5,000.00,	**79,** 182.	
1882,	7,500.00,	**83,** 2010.	
1884,	100,000.00,	**84,** 2224.	
1886,	187,500.00,	**86,** 1976.	
1888,	500,000.00,	**88,** 2158.	
1890	75,000.00		
	475,000.00,	**90,** 3016.	
1892,	350,000.00,	**92,** 2811.	
1894,	338,180.00,	**95,** 3554.	
1900,	250,000.00,	**00,** 4362.	
1902.	500,000.00,	**02,** 2402.	
1903,	1,000,000.00,	**03,** 2274.	
1905,	400,000.00,	**05,** 2488.	
1906	400,000.00	**06,** 2015.	
	300,000.00		
1907,	750,244.00,	**07,** 2201.	
1908,	1,450,000.00,	**08,** 2272.	
1909	*700,000.00,	**09,** 2238.	
	250,000.00,	**09,** 2238.	
1910,	1,200,000.00,	**10,** 2408.	
1911,	950,000.00,	**11,** 2613.	
1912,	1,000,000.00,	**12,** 2827.	
	[5] 11,193,424.00	(less $50,000 trans. to imp. below Tongue Pt., and incl. receipts from sales, $11,145,294.94, **12,** 2827).	11,193,424.00

* Allotment.
[1] Trans. from Clearwater R., Idaho.
[2] Allotted from app. for mainten. of R. and H. imp., act June 13, 1902.
[3] From app. of $130,000, $120,000 of which is for imp. of Columbia R. to mouth of Snake R., and $10 000 for imp. of Snake R. above Riparia.
[4] Expend. under act July 5, 1884, and Mar. 3, 1909, for operating and care of canals, etc.
[5] $50,000 of this made available by act June 3, 1896, for imp. below Tongue Pt.

Columbia River, Oreg. (gauging of waters):

1882,	$500.00, **83,** 2076.	
1884,	1,000.00, **84,** 2292.	
1886,	1,000.00, **86,** 2010.	
1888,	2,500.00, **89,** 2566.	
1894,	1,000.00, **95,** 3596.	
1896,	1,000.00, **96,** 3284.	
1899,	1,000.00, **99,** 3250.	
1902,	1,000.00, **02,** 2408.	
1905,	1,000.00, **05,** 2496.	
1910,	1,000.00, **10,** 2416.	
1911,	1,000.00, **11,** 2623.	
1912,	1,000.00, **12,** 2839.	
	13,000.00	$13,000.00

Columbia River (upper), Wash.:

1890,	[1] $70,000.00, **91,** 3229.	
1897,	15.65, act July 19.	
	70,015.65	70,015.65

Columbia River, at Threemile Rapids, boat railway from The Dalles Rapids to Celilo Falls, and construction of locks and dams:

1888,	[2] $15,000.00, **90,** 3030.	
1892,	[2] 20,000.00, act July 13.	
1894,	100,000.00, **95,** 3591.	
1896,	150,000.00, **96,** 3281.	
1904,	100,000.00, **04,** 3474.	
1905,	50,000.00, **05,** 2460.	
1906,	250,000.00, **06,** 1992.	
1907,	100,000.00, **07,** 2174.	
1908,	336,000.00, **08,** 2250.	
1909,	164,000.00, **09,** 2216.	
1910,	600,000.00, **10,** 2388.	
1911,	600,000.00, **11,** 2592.	
1912,	700,000.00, **12,** 2803.	
	3,185,000.00 (less $35,000 app. for sur. in 1888 and 1892, and incl. $1,005.93 received from sales, $3,151,005.93, **12,** 2803).	3,185,000.00

Columbia River, between Vancouver, Wash., and mouth of Willamette River:

1892,	$33,000.00, **93,** 3504.	
1896,	67,000.00, **96,** 3264.	
1901,	*8,000.00, **01,** 3500.	
1902,	2,000.00, **02,** 2384.	
1905,	30,000.00, **05,** 2468.	
1906,	13,000.00, **06,** 2000.	
1909,	*5,000.00, **09,** 2223.	
1910,	10,000.00, **10,** 2395.	
1911,	3,000.00, **11,** 2598.	
	171,000.00	171,000.00

Columbia River, below Tongue Point and in front of Astoria, Oreg.:

1899,	$71,000.00, **99,** 3245.	
	[3] 71,000.00	71,000.00

Columbia and lower Willamette Rivers, below Portland, Oreg.:

1866,	[4] $15,000.00, act June 23; **66,** ii, 36.	
1867,	[4] 30,000.00, **67,** 50.	
1868,	* [4] 21,000.00, **68,** 73.	
1869,	* [4] 13,365.00, act Apr. 10.	
1870,	[4] 31,000.00, **70,** 83.	
1872,	[4] 50,000.00, **72,** 96, 984.	
1873,	20,000.00, **73,** 1119.	
1874,	20,000.00, **74,** 117.	
1875,	20,000.00, **75,** 125, ii, 755.	
1876,	20,000.00, **76,** 36, 115, ii, 652.	
1878,	30,000.00, **78,** 137.	
1879,	45,000.00, **79,** 181.	
1880,	45,000.00, **80,** 2258.	
1881,	45,000.00, **81,** 2538.	
1882,	100,000.00, **82,** 2652.	
1884,	100,000.00, **84,** 2220.	
1886,	75,000.00, **86,** 1939.	
1888,	100,000.00, **88,** 2187.	
1890,	100,000.00, **90,** 3061.	
1892,	150,000.00, **92,** 2833.	
1894,	50,000.00, **95,** 3565.	
1896,	100,000.00, **96,** 3260.	
1899,	150,000.00, **99,** 3241.	
1902,	225,000.00, **02,** 2395.	
1904,	*15,000.00, **04,** 3539.	
1905,	100,000.00, **05,** 2479.	
1906,	125,000.00, **06,** 2009.	
1907,	300,000.00, **07,** 2193.	
1909,	*100,000.00, **09,** 2233.	
1910,	175,000.00, **10,** 2404.	
1911,	350,000.00, **11,** 2607.	
1912,	380,000.00, **12,** 2820.	
	3,100,365.00 (incl. sales, $3,105,135.47, **12,** 2820).	$3,100,365.00

Columbia River and tributaries, above Celilo Falls to mouth of the Snake River, Oreg. and Wash.:

1872,	$50,000.00, **73,** 107.	
1874,	20,000.00, **74,** 117.	
1875,	35,000.00, act Mar. 3, **76,** ii, 637.	
1876,	15,000.00, **76,** 116.	
1907,	120,000.00, **07,** 2169.	
1910,	90,000.00, **10,** 2385.	
1911,	25,000.00, **11,** 2589.	
1912,	50,000.00, **12,** 2801.	
	405,000.00 (not incl. $25,000 app. by State of Washington).	405,000.00

Columbia River, between Wenatchee and Bridgeport, Wash.:

1907,	$42,000.00, **07,** 2226.	
1910,	25,000.00, **10,** 2433.	
	67,000.00 (incl. sales, $67,852.50, **12,** 2862).	67,000.00

Columbia River, between Bridgeport and Kettle Falls, Wash.:

1910,	$100,000.00, **10,** 2434.	
1912,	25,000.00, **12,** 2863.	
	125,000.00 (incl. sales, $125,003.15, **12,** 2863).	125,000.00

Grand total ..... [5] 22,710,257.68

* Allotment.

[1] Of this $10,000 was for sur. bet. International Line and Rock Isld. Rapids and unexpended balance ($8,220.92) was au. for bet. Rock Isld. Rapids and Foster Co. Rapids. (H. D. 421, 57th, 2d.)

[2] Survey.

[3] Unexpended balance of app. for imp. of mouth of Columbia R., Oreg. and Wash., $50,000 au. by act June 3, 1896, to be applied under this head also. (H. D. 421, 57th, 2d.)

[4] Lower Willamette.

[5] See also Part j, p. 1629 of this Index, for an addition of $50,000.

Part (e), WW-2 Columbia River, Oreg. (Gauging of waters.)

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Much benefited by the gauges estab., **93,** 3528.

ENGINEERS.

Chief of Engineers. R., 93, 457; **94,** 418; **95,** 466; **96,** 405; **97,** 507; **98,** 509; **99,** 598; **00,** 675; **01,** 640; **02,** 561; **03,** 620; **04,** 685; **05,** 691; **06,** 765; **07,** 779; **08,** 830; **09,** 870; **10,** 967; **11,** 1025; **12,** 1230.

In charge:

Maj. T. H. Handbury, 1888–93. **R., 93,** 3528.
Maj. S. C. Post, 1894–95. **R., 94,** 2664; **95,** 3596.
Capt. W. L. Fisk, 1896–99. **R., 96,** 3283; **97,** 3432; (Maj.) **98,** 3042; **99,** 3250.
Capt. W. C. Langfitt, 1899.
Capt. W. W. Harts, 1899–1900. **R., 00,** 4368.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3576; **02,** 2408; (Maj.) **03,** 2321; **04,** 3558; **05,** 2496.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2020; **07,** 2208; **08,** 2279.
Maj. J. F. McIndoe, 1909–. **R., 09,** 2243; **10,** 2416; **11,** 2622; **12,** 2839.

OPERATIONS.

Daily bulletins issued for benefit of shipping interests.

1904–05. R. gauge estab. at mouth of Willamette, and daily records of readings kept, **05,** 691.

1910–11. In Mar., 1911, staff gauges estab. at Willow Bar, Warrior Rock, Martins Bluff, Kalama, Slaughters Bar, Stella, Waterford, Cathlamet, and Elliott Pt.; also at mouth of Willamette R. and Linton, **11,** 2622.

1911–12. Reading of gauges, **12,** 2838.

PROJECTS.

Gauge removed from Astoria to Ft. Stevens, 1899. for more economical mainten, **00,** 4368.

Part (f), WW-2 Columbia and lower Willamette Rivers, below Portland, Oreg.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Lower Willamette:

C. importance of Portland, **66,** iv, 329; **71,** 900; **72,** 987. Benefit of imp., **67,** 507; **68,** 873; **69,** 470; **70,** 509; **79,** 1829. Extensive fire in Portland, 1872; 20 blocks burned, **73,** 1117; **74,** ii, 352, 362. Table of distances from Portland to various points on the Willamette and Columbia Rs., **75,** ii, 756, 781. Shipping interests constantly increasing, **75,** ii, 751; **79,** 1829.

Lower Columbia:

Rapid increase of C., **71,** 900; **75,** ii, 749. Only one vessel lost since the tug boat service estab. (1869), **75,** ii, 749.

List of vessels navigating the R., **80,** 2273; **83,** 2009.

List of SS. plying on upper and lower Willamette, Columbia, and Cowlitz Rs., **92,** 2835.

1895, steadily increasing, **95,** 3564.

1897 remarkable for the number of cargoes that passed down Columbia, **98,** 3032.

Traffic, 1899, 1,489,708 t. Probably to be great in future. **00,** 4354, 4427.

Willamette and Columbia:

New transportation line, operating 3 ships, estab., **01,** 634.

Value and importance of waterway, **02,** 554.

Imp. reduced delays to shipping, **03,** 613.

Dr. of great benefit to deep-sea vessels, **11,** 1014.

Diagram of freight value and app., **12,** 2821.

1911, 8,000,914 t., value $83,157,608, principally grain and lumber for exports; oriental products, cement, coal, lime, sulphur, etc., for imports, **12,** 1216.

Traffic statement for 1901–11 given, **12,** 1217.

CONTRACTS.

Willamette and Columbia:

1878. Bailey & Taylor, furnishing steam tug. Wilson Bros., furnishing steam tug. **78,** 1325; **79,** 1831.

Lower Willamette:

Agreement made with city of Portland for use of its dr. apparatus free of charge, the U. S. to keep it in repair, **67,** 50, 506.

1879. R. Watson, hire of steam tug, **80,** 2260. Pacquit & Smith, pile dike near Swan Isld., **80,** 2259. Pacquit & Smith, pile dam across Willamette Slough, **80,** 2259.

1880. Holmes & Sweeney, pile dike, **81,** 2538.

1887. J. F. Steffen, snag boat, $19,560, **88,** 2186.

1891. Hoffman & Bates., l. w. brush and r. dam, $27,274.87, **92,** 2834.

1892. J. F. Steffen, hydraulic dr. and machinery, $25,750, **93,** 3520. T. G. Davison and H. B. Borthwick, about 2,500 l. f. of st., pile, and brush dike, $14,420.02, **93,** 3521.

1893. R. Hoyt, materials for dike constr.—r., 47½¢ s. t.; fascines, $2.14 cord; wire, 3½¢ lb. ($6,112.50), **93,** 3520.

Willamette and Columbia:

1901. Joseph Supple, 2 barges, $9,500, **02,** 2395.

1902. Newton Poston, coal (prices listed); Geo. W. Sanborn, coal (prices listed), **02,** 2395. Port of Portland Commission, hire of 30-inch suction dr. manned and equipped, **03,** 2267–2268.

1903. Willamette Iron & Steel Works, furnishing pump castings for dr. *Wm. S. Ladd,* $950, **03,** 2267–2268.

1904. Geo. W. Sanborn, coal (prices listed); Joseph Supple, repairs to barge, $735; Astoria Iron Works, replacing steam boiler on tugboat, $4,560, **04,** 3540. Port of Portland, Oreg., hire of dr., $155 and $235 per day, **05,** 2480.

1905. Geo. W. Sanborn, coal (prices listed), **05,** 2480. J. W. Holmes, coal, 1,500 t., $5.65 t., **06,** 2010.

1906. Port of Portland, hire of 30-inch suction dr., $265 per day, **07,** 2193, 2194.

1907. S. Elmore & Co., coal, $7 t.; Geo. W. Sanborn, coal, $7.10 t., **07,** 2193, 2194.

1908. Pacific Bridge Co., hire of dipper dr. and 2 scows, $170 and $10 per day, **08,** 2266. Geo. W. Sanborn, coal, $6.40 t., **09,** 2233.

1909. Geo. W. Sanborn, coal (prices listed); F. P. Kendall, hire and lease of Holly Rood Dock, $15 per mo.; M. C. Banfield, hire and lease of Central Dock, $30 per mo., **10,** 2404.

1911. Thos. J. Shea, furnishing and installing fuel-oil tank, $7,685; port of Portland, hire and lease 30-inch dr. with tender, $350 per day of 24 hours; Associated Oil Co., fuel oil, 75¢ bbl. of 42 gals., **11,** 2608. Thos. J. Shea, installing oil-burning system on U. S. dr. *Clatsop,* $15,000; Jos. Supple, reconstr. tugboat *G. H. Mendell,* $25,750, **12,** 2821.

ENGINEERS.

Chief of Engineers. R., 66, iii, 26, iv, 331; **67,** 50; **68,** 72, 876; **69,** 63; **70,** 83; **71,** 96; **72,** 95; **73,** 106; **74,** 117; **75,** 124; **76,** 114; **77,** 122; **78,** 137;

79, 180, 183 1863; **80,** 237; **81,** 324; **82,** 318; **83,** 331, 337; **84,** 334, 341; **85,** 364, 368; **86,** 357, 365; **87,** 331; **88,** 303, 304; **89,** 361, 362; **90,** 327, 329; **91,** 416, 3374; **92,** 389, 394; **93,** 452; **94,** 416; **95,** 461; **96,** 401; **97,** 503; **98,** 505; **99,** 592; **00,** 669, 676; **01,** 633; **02,** 554; **03,** 612; **04,** 675; **05,** 681; **06,** 754; **07,** 771; **08,** 820; **09,** 859; **10,** 955; **11,** 1012; **12,** 1213.

Boards:

BE. for Pacific coast convened, Portland, Oreg., in Aug., 1876, to consider and report upon proj. of Maj. Wilson for imp. of Willamette and Columbia Rs., Portland, Oreg., to sea. Recom. further sur. and ex. **77,** 1019.

Reconvened, San Francisco, Cal., Jan. 17, 1877; recom. (1) to close chan. on s. side of Swan Isld. by dike 7,000′ l., running from upper end of Swan Isld. to s. shore; est., $51,000; (2) to close Willamette Slough, except chan. 100′ w. in middle, sides of chan. to be protected by cribs; est., $28,000; (3) to close Coon Isld. Slough by dike running from Sauvies Isld. to Coon Isld., head of the latter to be revetted; constr. of dike from Nigger Tom Isld. to main shore above mouth of Columbia Slough, head of Nigger Tom Isld to be revetted, and if necessary, a dike from its lower end into the Columbia R. for 600′; est., $100,950; (4) to constr. 2 dikes across St. Helens Bar on each side of "present" ship canal, about half a mile below lower end of Sauvies Isld., the dikes to be each 950′ l., flaring at upper end to 800′ and narrowing to 300′ at lower end; est., $87,000, **77,** 1019–1025. **R., 77,** 1019. (Lt. Cols. Alexander and Stewart and Majs. Mendell and Wilson.)

Maj. Wilson coincides with views of board except in reference to closing the South Swan Isld. Chan., **77,** 1025.

Recom. of BE., approved by Chief of Engineers, **77,** 1026.

Convened, New York, Oct. 14, 1891, to report upon proj. for 25′ chan., Portland, Oreg., to sea. **R., 92,** 2864. (Cols. Abbot, Comstock, and Houston, and Lt. Col. Gillespie.)

In charge:

Maj. R. S. Williamson, 1866–71. **R., 66,** iv, 327; **67,** 506, 511, 513; **68,** 872; **69,** 468, 472; **70,** 508; **71,** 904.

Maj. H. M. Robert, 1871–73. **R., 71,** 898, 899; **72,** 982, 988; **73,** 1116, 1123; **74,** ii, 362.

Maj. N. Michler, 1873–75. **R., 74,** ii, 351, 355; **75,** ii, 730, 737; **76,** ii, 632.

Maj. J. M. Wilson, 1875–78. **R., 76,** ii, 646, 649; **77,** 1001; **78,** 1319; **79,** 1787, 1791.

Maj. G. L. Gillespie, 1878–81. **R., 79,** 1825, 1853, 1864; **80,** 2253; **81,** 2531.

Capt. C. F. Powell, 1881–86. **R., 82,** 2643; **83,** 1997, 2076; **84,** 2215, 2290; **85,** 2376, 2408.

Maj. W. A. Jones, 1886–90. **R., 86,** 1938, 2010; **87,** 2507; **88,** 2185; **89,** 2571.

Maj. T. H. Handbury, 1888–93. **R., 88,** 2177; **89,** 2565; **90,** 3058, 3064; **91,** 3362, 3374; **92,** 2829; **93,** 3515.

Maj. J. C. Post, 1894–95. **R., 94,** 2654; **95,** 3561.

Capt. W. L. Fisk, 1896–99. **R., 96,** 3257; **97,** 3407; (Maj.) **98,** 3031; **99,** 3239.

Capt. W. C. Langfitt, 1899.

Capt. W. W. Harts, 1899–1900. **R., 00,** 4352, 4416, 4418.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3557; **02,** 2393; (Maj.) **03,** 2263; **04,** 3534; **05,** 2475.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2006; **07,** 2189; **08,** 2264.

Maj. J. F. McIndoe, 1909–. **R., 09,** 2230; **10,** 2402; **11,** 2605; **12,** 2817.

Assistants:

Lt. W. H. Heuer. **R., 66,** iv, 328; **69,** 478.

F. H. West, **68,** 874; **69,** 496; **72,** 993.

R. B. Randall, **73,** 1118; **74,** ii, 355.

Lt. A. H. Payson. **R., 79,** 1869.

D. W. Taylor, **79,** 1869.

R. A. Habersham. **R., 77,** 1007; **80,** 2260; **81,** 2541; **83,** 2005.

Lt. P. M. Price. **R., 81,** 2538; **82,** 2653.

J. S. Polhemus. **R., 84,** 2292.

R. Warrick. **R., 97,** 3410; **98,** 3036.

ESTIMATES. (See Plans and Projects.)

Lower Willamette:

By Lt. Heuer, dr., $30,000, **66,** iii, 36.

By Maj. Williamson, addl. for completion, $25,000, **67,** 51. 1870. For completion of work at Swan Isld., $26,000, **70,** 509.

Willamette and Columbia:

By Maj. Wilson, 1876, closing chan. n. of Swan Isld., $148,300, **76,** ii, 646, 651. For partly closing Willamette Slough, $29,910, **76,** ii, 647, 651. For closing Coon Isld. Slough, with accessory dikes, $67,550, **76,** ii, 648. For removing part of Warrior Rock, with accessory dikes, $52,900, **76,** ii, 650, 651. Total for imp. Willamette and Columbia Rs., Portland, Oreg., to sea, $328,526, **76,** ii, 651.

By Maj. Wilson, 1876, closing chan. on s. side of Swan Isld., $87,000, **76,** ii, 647, 651.

By BE., 1877, dike across chan. on s. side of Swan Isld., $51,000, **77,** 1021. Closing Willamette Slough, except chan. 100′ w., $28,000, **77,** 1022, 1025. For closing Coon Isld. Slough, revet. of Coon Isld., dike from upper end of Nigger Tom Isld. to main shore; also dike from lower end of Nigger Tom Isld. to d. w. in Columbia, $100,950, **77,** 1024. 2 dikes across St. Helens Bar, each 950′ l., $87,000, **77,** 1025. Total est. as approv. for imp. of Willamette and Columbia Rs. from Portland, Oreg., to sea, $298,974, **77,** 122, 1025.

OPERATIONS.

Lower Willamette:

1867-68. 25,504 c. y. dr.; work done by hired labor with apparatus furnished by city of Portland; repairs to dr., **68,** 72, 872.

1868-69. 30,940 c. y. dr.; work done by hired labor; 31 snags removed, **69,** 469, 471.

1869-70. 13,887 c. y. dr.; 27 snags removed; work done by hired labor, **70,** 508.

1870-71. 25,165 c. y. dr., **71,** 899, 904.

1871-72. 27,258 c. y. dr.; snags, trees, etc., removed, **72,** 95, 982; **75,** ii, 750.

1872-73. 25,725 c. y. dr.; Swan Isld. Cut completed; dr. to 17′ at l. w.; snags removed, **73,** 1116; **75,** ii, 758.

1873-74. 17,300 c. y. dr.; 5 spar buoys placed in position at Swan Isld. Cut; U. S. dr. completed, **74,** ii, 352, 362; **75,** ii, 758. Dr. and dump scows built by U. S. to be used on Willamette and Columbia Rs., **74,** ii, 351. Dam constr. across narrowest part of Percys Slough, bet. Percys and Bybees Isld., **75,** ii, 736. Dam washed away, **75,** ii, 736.

Willamette and Columbia:

1874-75. Willamette, 13,450 c. y. dr.; Columbia, 3,750 c. y. dr.; chan. scraped through Hogs Back Bar, **75,** ii, 758.

1875-76. Willamette, 11,200 c. y. dr.; Columbia, 15,402 c. y. dr., **76,** ii, 633, 647, 649, 650.

1876-77. Willamette, 21,285 c. y. dr., **77,** 122, 1002.

1877-78. Willamette, 10,805 c. y. dr.; Columbia, 14,320 c. y. dr.; repairs to U. S. dr., **78,** 1319, 1320.

1878-79. Willamette, 28,845 c. y. dr.; repairs to U. S. dr., **79,** 1788, 1826.

1879-80. Constr. of pile, fascine, and st. dam across Willamette Slough, **80,** 2254, 2261. Shore protection and constr. of dike at Coon Isld., **80,** 2254, 2263. 20,795 c. y. dr. from mouth of the Willamette, St. Helens, and Swan Isld. Bars, **80,** 2255, 2260.

1880-81. Partial completion of pile dike closing Coon Slough; revet. of right bank of Willamette Slough; 14,550 c. y. dr. from Swan Isld. and Willamette Bars, **81,** 2532, 2533, 2544.

1881-82. Completion of Coon Island Slough Dike; repairs to Willamette Slough Dam; 7,735 c. y. dr. from St. Helens and Swan Isld. Bars, **82,** 2644, 2646. Constr. of a new dr., **82,** 2648.

1882-83. Deepening of chan. over St. Helens Bar by private enterprise, **83,** 1998. 47,650 c. y. dr. from Swan Isld. Bar by U. S. dr., **83,** 2000. 12,812 l. f. of revet. and dams built bet. Portland

and mouth of R., **83,** 2001, 2005. Gauging lower Columbia R., **83,** 2076.

1883-84. Deepening chan. of St. Helens Bar by private enterprise, **84,** 2217. 29,445 c. y. removed by U. S. dr. from Swan Isld. Bar, **84,** 2218. Mainten. of structures and removal of snags, **84,** 2218. Gauging Columbia R. and principal tributaries, **84,** 2290.

1884-85. Slucing on St. Helens Bar by SS. *Walla Walla,* **85,** 2377, 2380. 54,161 c. y. dr., Post Office, Upper and Lower Bar, by U. S. drs., **85,** 2379, 2380. Constr. and repair of dikes and shore protection, **85,** 2378. Gauging operations continued, **85,** 2408.

1885-86. Repairs to dike at St. Helens; willow planting on Sauvies Isld.; repairs to tug *Lincoln,* **86,** 1938. Gauging operations continued, **86,** 2010.

1886-87. Repairs to dike at St. Helens Bar and 1,112 l. f. of dike extension; propeller dr. on St. Helens Bar; removal of snags, **87,** 2507, 2510.

1887-88. 20,000 c. y. dr. from St. Helens Bar, and 60 c. y. r. blasted and removed, Ross Isld. chan, **88,** 2185, 2186.

1888-89. 33,130 c. y. dr.; St. Helens Jetty extended 1,026′, **89,** 2573.

1889-90. 131,600 c. y. dr., **90,** 3058, 3059.

1890-91. 54,940 c. y. dr.; 448 cords of brush and 1,255 t. of r. placed in dams at Martin and Burke Sloughs; 1,157 l. f. of cross dike built, **91,** 3364, 3365.

1891-92. Break in dam at head of Martin Slough repaired; dam at Burke Slough strengthened; chute behind Swan Isld. in the Willamette R. closed by a pile, brush, and st. dam; 21,860 c. y. dr. from Swan Isld. Bar. The following works were completed by the city of Portland: Bet. foot of Swan Isld. and St. Johns, 4,000′ of diking; at Post Office Bar, 6,300′ of diking; in the Columbia R., 11,750′ of diking built at Walkers Isld.; 15,000′ of diking at Snag Isld., in Cathlamet B.; 97,580 c. y. dr. at foot of Swan Isld. and St. Johns, from Post Office Bar, and from bar at Walkers Isld., **92,** 2830, 2833.

1892-93. 45,887 c. y. dr., snagging done, and 2,500 l. f. dike built at Martin Isld. Bar, **93,** 3516; 1,600 l. f. addl. dike built at St. Helens Bar, and a hydraulic dr. built, **93,** 3517.

1893-94. 391,900 c. y. dr., **94,** 2656.

1894-95. 423,372 c. y. dr., **95,** 3563.

1895-96. 228,951 c. y. dr., **96,** 3258; snagging done, **96,** 3259.

1896-97. Repairs made to dr. machinery, and 366,788 c. y. dr., **97,** 3408.

1897-98. 373,089 c. y. dr., **98,** 3031.

1898-99. 374,669 c. y. dr.; dr. repaired, **99,** 3239.

1899-00. 413,576 c. y. dr., **00,** 4352.

1900-01. 483,306 c. y. removed by dr. *Wm. S. Ladd;* 41 snags removed, **01,** 3558.

1901-02. 507,953 c. y. removed by dr. *Wm. S. Ladd,* **02,** 2393. Cut dr. across estuary from below Taylor Sands toward Oregon Railway & Navigation Co.'s dock at Astoria, chan. completed 19½′ d. and 150′ w. and in use, thus avoiding Sylvia de Grasse Reef, **02,** 2394.

1902-03. U. S. dr. *W. S. Ladd* removed 683,208 c. y. and the 30″ suction dr. hired from city of Portland at $235 per day removed 993,389 c. y.; 200′ gaps opened up through Swan Isld. Dike by snag boat *Mathloma,* **03,** 2263–2265.

1903-04. Dr. *W. S. Ladd* removed 666,037 c. y.; hired dr. *Columbia* removed 1,238,142 c. y.; U. S. dipper dr. *No. 1* removed Swan Isld. Dike for 200′ to 6′, removing 2,937 c. y., and from Coon Isld. revet. removed 2,374 c. y., **04,** 3535. Snag boat *Mathloma* removed piles in Coon Isld. Dike and blasted r. reef in chan. near La Du Landing to 19′; imp. of tract of land purchased on Willamette R. opposite St. Johns continued, **04,** 3534.

1904-05. Dr. *W. S. Ladd* removed 536,920 c. y.; hired dr. *Columbia* removed 1,089,076 c. y.; U. S. dr. *No. 1* removed 1,114 l. f. of old revet. at Coon Isld., and new revet. placed for 900′; mainten. of plant; work done in connection with fish traps and booms, **05,** 2477–2478.

1905-06. Dr. *W. S. Ladd* removed 668,413 c. y.; hired dr. *Columbia* removed 532,253 c. y.; mainten. of plant continued at U. S. moorings, **06,** 2006.

1906-07. Dr. *W. S. Ladd* removed 519,607 c. y.; hired dr. *Columbia* removed 658,726 c. y.; repairs to plant, **07,** 2190–2192.

1907-08. 2,515 l. f. of Coon Isld. Dike removed to 23′ to 33′; 4,458 c. y. r. placed in Coon Isld. Dike; dr. *W. S. Ladd* removed 472,998 c. y.; new dr. under constr., **08,** 2264.

1908-09. Dr. *W. S. Ladd* removed 341,430 c. y., dr. removed from work as unserviceable; new dr. *Clatsop* arrived at Portland, Oreg., from Philadelphia, Pa., Apr. 21, 1909, overhauled and placed in commission June 25, 1909, and removed 16,504 c. y.; snag boat *Mathloma* removed obstr. from Willamette R., **09,** 2230–2231.

1909-10. Dr. *Clatsop* removed 1,509,490 c. y., increasing d. over various shoals 2′ to 4′; repairs to floating plant; dr. *Ladd* and tug *Lincoln* condemned and sold, **10,** 2402.

1910-11. Dr. *Clatsop* removed 2,353,626 c. y., U. S. dr. *Chinook* 510,351 c. y. in ship chan., and hired dr. *Columbia* 634,800 c. y.; repairs to plant; fuel station erected at Three Tree Pt. Mil. Res.; preparations of plans for new hull for tug *G. H. Mendell,* and alterations to dr. *Clatsop,* **11,** 2605.

1911-12. Dr. Clatsop removed 1,631,088 c. y., dr. *Chinook* 438,150, and hired dr. *Columbia* 138,000 c. y.; dipper dr. *Titan* removed 14,000 c. y. sand, piling, and brush from old dike at head of Swan Isld.; oil burner system installed on dr. *Clatsop;* new hull constr. for tug *Mendell;* plant repaired and maintained, **12,** 2818.

PHYSICAL CHARACTERISTICS.

Lower Columbia:

Higher than the Willamette during the summer months, **66,** iv, 328. Difference bet. h. and l. w., **66,** iv, 330; **75,** ii, 735. Erosion of shore at Point Adams, mouth of the Columbia, 200′ toward Ft. Stevens, **75,** ii, 749; at Sand Isld., **77,** 1003. Comparison of entrance to Columbia R. with entrance to New York H., **75,** ii, 748; **77,** 1003. Increased height of Hogs Back Bar from 1868 to 1873, 11′, **73,** 1118. Peculiar character of tides on the w. coast of the U. S., **75,** ii, 756. Quicksand bottom at St. Helens Bar, **76,** ii, 633. Velocity and discharge of Columbia R., **77,** 1017. Sand Isld. moved 1,800′ in last 9 years, **77,** 1003; **78,** 1322. Effect of tides on, **75,** ii, 734, 743; **77,** 1003. Tables of h. w. at various localities, **75,** ii, 756, 757, 780; **77,** 1013. Increased elevation of bars on the Willamette and Columbia, **76,** ii, 653. Stages of water, **79,** 1826. Current observations at mouth of Columbia, **79,** 1873.

Lower Willamette:

General, **66,** iv, 328; **75,** ii, 737. Velocity and discharge of, **77,** 1010, 1011.

Stages of water, **79,** 1826.

Description of, **80,** 2266; **92,** 2852; **95,** 3564.

Stages of water at Portland, **80,** 2265; **81,** 2542; **82,** 2651.

Gauging lower R. and principal tributaries, **83,** 2076; **84,** 2290; **85,** 2408; **86,** 2010; **88,** 2177; **89,** 2565; **90,** 3064.

High waters of the Willamette, **90,** 3059.

In 1894 the highest known water in the Rs. occurred, **94,** 2657.

Description of lower Willamette and Columbia Rs. below Portland, **00,** 4416. Of the 114 m. bet. Portland and the sea, 12 lie in the Willamette R. and 102 in the Columbia. In 1889, 8 m. of the Willamette and 96 m. of the Columbia had 25′ d. **00,** 4417.

Willamette and Columbia:

Tendency of chan. to cut through estuary below Taylors sands, **02,** 2394.

Ruling d. bet. Portland and sea, 20′, m. l. w.; increase of 6′ since commencement of imp., **05,** 683.

8′ increase in d. of chan. since commencement of imp., **06,** 756.

Chan. gradually imp.; less work required each year, **10,** 2402.

Variations of water level due to tides, etc. **12,** 1216.

PLANS. (See Estimates and Projects.)

Lower Columbia:

By Maj. Robert, 1871, to cut chan. 18′ d. across St. Helens Bar, **71,** 900; for building a pile dam across Percys (Columbia) Slough at the w. and shallowest part, **74,** ii, 352, 363.

Lower Willamette:

By Lt. Heuer, dr. new chan. 100′ w., d. of 18′, bet. Percys Isld. and main shore (88,000 c. y.), **66,** iv, 328, 331; to dr. Swan Isld. Bar to make chan. 18′ x 100′ (24,444 c. y.), **66,** iv, 328, 331.

By Maj. Wilson, closing chan. on s. side of Swan Isld. by a dike, **76,** ii, 647.

PRIVATE AND CORPORATE WORK.

Lower Willamette:

City of Portland expend. $42,215.50 (coin) for dr. outfit and dr., **66,** iii, 26, iv, 327; details, **66,** iv, 329; **67,** 50. Dr. at Swan Isld. Bar by city of Portland, **66,** iii, 26. Resol. of common council of city of Portland au. mayor to correspond with Col. Williamson and fully inform him of all facts at hand relative to the Willamette R., and cost of work done by city, and to tender him the use of the dr. apparatus owned by the city free of charge, provided it be kept in thorough repair, **67,** 50, 515.

Willamette and Columbia:

Dr. by the Oregon Steam Navigation Co. with U. S. dr., **78,** 1320.

Operations by city of Portland to imp. R. previous to 1866, **80,** 2266. $7,442.50 furnished by city of Portland in 1882 for continuance of work, **82,** 2651. Constr. of dr. by city of Portland in 1883, **83,** 331.

Expend. of $10,000 by private enterprise for imp. of St. Helens Bar, **83,** 331; continued in 1884, **84,** 2217; continued in 1885, **86,** 1939.

Estab. of Portland H. lines, **83,** 2003.

20,000 c. y. dr. from Columbia R. Bar by Portland Board of Trade, **88,** 2185.

Diking and dr. by the city of Portland (see Operations), **92,** 2832, 2833.

By "Port of Portland," a corporation organized for the imp. of port of Portland:

1892-93. 87,150 c. y. dr. and 21,000 l. f. dikes constr., **93,** 3518.
1893-94. 70,679 c. y. dr., **94,** 2656.
1894-95. 64,826 c. y. dr., **95,** 3563.
1895-96. 170,140 c. y. dr., **96,** 3259.
1896-97. 90,200 c. y. dr., **97,** 3409.
1897-98. 185,300 c. y. dr., **98,** 3031.
1898-99. 425,322 c. y. dr., **99,** 3241.
1899-00. 983,249 c. y. dr., **00,** 4354.

Detailed account of work done by the port of Portland previous to 1894 on this imp., with the cost, etc., **94,** 2655.

1900-01. 1,869,667 c. y. removed, **01,** 3559.
1901-02. 872,318 c. y. dr., **02,** 2394.
1902-03. 1,105,082 c. y. dr., **03,** 2265.
1903-04. 1,167,450 c. y. dr., **04,** 3535.
1904-05. 325,082 c. y. dr., **05,** 2476.
1905-06. 365,325 c. y. dr., **06,** 2006.
1906-07. 435,828 c. y. dr., **07,** 2190.
1907-08. 2,012,000 c. y. dr., **08,** 2264.
1908-09. 2,326,568 c. y. dr., **09,** 2231.
1909-10. 1,925,827 c. y. dr., **10,** 2402.
1910-11. 1,755,792 c. y. dr., **11,** 2605.
1911-12. 2,581,152 c. y. dr., **12,** 2818.

PROJECTS. (See Estimates and Plans.)

Lower Willamette:

By Maj. Williamson, dr., to secure chan. at least 18′ x 100′, Portland to mouth of Willamette, **68,** 872.

Willamette and Columbia:

By Maj. Michler, building dam across narrowest part of Percys Slough; est., $5,211.16, **74,** ii, 352; **75,** ii, 736. For imp. of lower Columbia at St. Helens Bar by dr., **75,** ii, 738. For imp. of Willamette near junction of Columbia (1) by building of js. at head of Willamette Slough; (2) closing slough bet. Sauvies and Coon Islds. by a dam; (3) dam across entrance of Percys Slough parallel to thread of R. chan.; (4) j. to extend from lower end of Percys Isld., 2,000′ l., **75,** ii, 733, 734.

By Maj. Wilson, 1876, (1) to build dike from upper end of Swan Isld. to n. shore, closing n. chan. and opening new chan. on s. side of isld.; (2) to build a dike across the head of Willamette Slough, so the lower end shall rest 100′ from shore; (3) to build a dike across the head of Coon Isld. Slough and revet the face of the isld.; also a dike across from main shore just above the outlet of Columbia Slough to Nigger Toms Isld., revet the sides of the latter, and run a dike from its lower end to d. w. in Columbia; (4) to remove portion of Warrior Rock about 100′ back and run a dike from shore below to receive the water and lead it through the new chan. at St. Helens Bar, **76,** ii, 646–651.

By Maj. Wilson, as modified by BE. and approv. by Chief of Engineers, for imp. of Willamette and Columbia Rs., Portland, Oreg., to sea: (1) To close chan. on s. side of Swan Isld. by a dike 7,000′ l., **77,** 1021. (2) To close Willamette Slough by a dam near its head, except a chan. 100′ w. in the middle; the sides of chan. to be protected by cribs, **77,** 1022. (3) To close Coon Isld. Slough at its head by a dike running from Sauvies Isld. to Coon Isld., the face of the latter to be revetted; constr. of a dike from Nigger Toms Isld. to the main shore just above mouth of Columbia Slough, face of Nigger Toms Isld. to be revetted, and, if necessary, a dike from its lower end into d. w. in Columbia, **77,** 1023. (4) To constr. 2 converging dikes across St. Helens Bar on each side of the "present" ship chan., each 950′ l., **77,** 1024.

Amount app. previous to 1877, $240,365, **77,** 1004. Board est. cost of above-named works at $298,974, **77,** 1019–1025; **80,** 2270.

In 1879 BE. recom. substitution of constr. made of piles, fascines, and st. in place of the brush and st. previously recom., **80,** 2253.

At 1882 $265,000 had been app. under this proj.; modified to cover increased cost of work and addl. constr. required; est., $183,635, **82,** 2644; **83,** 1998; **84,** 2216.

At 1885 $365,000 had been app. under proj. of 1877–82; further modified to cover imp. of 3 shoal areas below Columbia City. Amount est. for completion of proj., 1885, $407,000. **85,** 2377; **86,** 357, 1938.

In 1887 est. cost of completion increased $68,000, **87,** 2516.

In 1889 the proj. was extended to embrace the permanent imp. of Walkers Isld. Bar, at a cost of $60,000, Martins Isld. Bar at a cost of $15,000, and Post Office Bar, at a cost of $50,000, **89,** 2575.

By Maj. Handbury, 1891, to make and maintain navigable chan. from city of Portland, Oreg., to sea, bearing a l. w. d. of 25′, by dr. through bars, closing chutes, constr. of dikes and works of contraction and dr.; est., $772,464, **92,** 2860.

Est. cost of proj. to obtain a 25′ chan. changed, as result of sur. of 1899, to $2,796,300, $175,000 for new dr., and $50,000 for yearly mainten., **00,** 4352, 4355, 4425, 4427.

Act June 13, 1902, au. obtaining 25′ chan. to sea by constr. of controlling works, and dr.; est. $2,796,300, with $175,000 as cost of new dr., and $50,000 for mainten. (based on sur. au. act Mar. 3, 1899), **02,** 555.

Act Mar. 2, 1907, au. expend. of $300,000 in constr. and operation of a dr., **07,** 771.

Act June 25, 1910, au. expend. of $175,000 in continuing imp. and mainten., with provision that so much as may be necessary may be expend. in dr. w. chan. at Swan Isld., **10,** 956.

Act Feb. 27, 1911, extended proj. to include constr. of 2 suitable dr. plants; it also au. continuing contracts in further sum of $320,000, yet to be app., **11,** 1013.

Act July 25, 1912, au. proj. for chan. 30′ x 300′, with short auxiliary chan. 8′ x 300′, by constr. of dikes and revets., but chiefly by dr. (H. D. 1278, 61st, 3d), **12,** 1216.

SURVEYS.

Lower Willamette:

Ex. by Lt. Heuer. **R., 66,** iv, 328.

Of Swan Isld. Bar and mouth of the Willamette, by Maj. Williamson, 1867, **68,** 873.

Of Willamette Slough, by F. H. West, 1868, **69,** 469.
Ex. of Swan Isld. Bar, 1876, **76,** ii, 647.
Of Post Office Bar and mouth of the Willamette, by Maj. Wilson, 1878, **78,** 137, 1320.
Of Swan Isld., Post Office Bar, and mouth of the Willamette, by Maj. Wilson, 1877, **78,** 137, 1320.

Lower Columbia:

Under direction of Admiral Vancouver of the English Navy, 1792, **79,** 1866.
By Sir Edward Belcher, 1839, **79,** 1866.
This locality was included in the Coast Sur., 1868–70, **73,** 1118; **75,** ii, 745,749.
Of St. Helens Bar, under direction of Maj. Robert, by F. H. West, 1872, **72,** 96. Resur., 1873, **73,** 1117, 1123.
Of Hogs Back Bar, bet. Tongue Pt. and Woody Isld., by Maj. Michler, 1874, **74,** 117.
Of Hogs Back Bar, under direction of Maj. Michler, by R. B. Randall, 1875, **75,** ii, 742.
Surs. of shore lines of Pt. Adams and Sand Isld., by S. O. L. Potter, 1871–73, under direction of Maj. Robert. Sur. of 1874, **75,** ii, 747, 749.
Of bar at mouth of Columbia R. by Maj. Wilson, 1876, **76,** ii, 651.
Of Sand Isld. and St. Helens Bar, under direction of Maj. Wilson, 1877, **78,** 137, 1320, 1321.

Willamette and Columbia:

Of lower Willamette, Willamette Slough, and lower Columbia, by Maj. Wilson, 1876, **77,** 1001, 1003. **R.,** **77,** 1007. Method of boring, **77,** 1007. Method of gauging, **77,** 1008.
Of St. Helens Bar, **79,** 1827; of Sand Isld., **79,** 1828; of mouth of Columbia, **79,** 182, 1791; by Lt. Payson, 1878. **R.,** **79,** 1869.
Ex. au. Sept. 19, 1890; made by Maj. Handbury (**R.** unfav.), **91,** 3374.
Of the lower Willamette and Columbia Rs. with view to securing 25′ at l. w. from Portland to mouth of the Columbia; made, 1891, by Maj. Handbury, **92,** 2852.
Misc. sur., **94,** 2657; **95,** 3563; **96,** 3259; **97,** 3409; **99,** 3241.
New H. lines approved for Portland, 1900, **00,** 4355.
Ex. and sur. of lower Willamette R. and Columbia R. below Portland, and est. of cost of obtaining 25′ chan., Portland to mouth of Columbia, au. act Mar. 3, 1899. Ex. made by Maj. Fisk, 1899 (**R.** fav.), **00,** 4416. Sur. made, 1900, by Capt. Langfitt (see Projects), **00,** 4418.
10 new triangulation stations estab. bet. Portland and Goble, **01,** 3559.
Minor, **02,** 2394; **03,** 2265.
In connection with fish-trap locations, **06,** 2007.
Ex. and sur. au. act Mar. 3, 1909, with view to securing 30′ chan.; **Rs.** by Maj. McIndoe, Aug. 16, 1909, and Aug. 27, 1910; est., $3,770,000, with $350,000 an. for mainten., subject to cooperation by local interests (H. D. 1278, 61st, 3d), **10,** 2402; **11,** 1026.
Of estuary, Harrington Pt. to Ft. Stevens; details given, stretches of R. triangulated, and monuments replaced, **12,** 2818.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 1015; **12,** 1214.

Maps (H. D. 1278, 61st, 3d):
List of tracings and maps, **75,** ii, 759, 789.
Of lower Willamette and Columbia Rs., **77,** 1006; **03,** 2266; **04,** 3538; **05,** 2478; **06,** 2010; **11,** 2606.

Part (g), WW-2 Columbia River, Oreg. and Wash., mouth of.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

C. to be benefited, **81,** 2537; **83,** 2011, 2031; **84,** 2225; **86,** 1974, 1983; **87,** 2473, 2474.
Delay due to bar, **84,** 2223.
Draft of vessels entering R., **84,** 2223.
Tonnage out and in bound over Columbia R. bar for 1891–92, **92,** 2817.
Comparative statement of principal exports, 1883 to 1892, **92,** 2818.
Description of, **00,** 4433, 4454.
Extensive interests, 1899, would be benefited by imp. of R. mouth, **00,** 4433.
D. of chan. over bar would admit use of larger vessels, and rates on tonnage would be reduced **09,** 864.
Diagram of freight and app., **11,** 2615.

CONTRACTS.

1885. L. W. Holt, wharf and trestle at Pt. Adams, **85,** 2385. J. F. Steffen, 4 st. barges, **85,** 2387. P. F. Fallert, piles, **85,** 2387. L. Michael, riprap st., **85,** 2387.
1886. Oregon Paving Co., piles and st., **87,** 2474.
1889. P. Hinkle, r., 64¢ per t., **89,** 2531. C. P. Church, fascines, $2.74 cord, and poles, 24¢ each, **89,** 2531. Paquet & Smith, 4 barges, $5,870 each, **89,** 2533.
1890. C. P. Church, fascines $2.84 cord, and poles 23¾¢ each, **90,** 3014. J. E. Smith, r., 63½¢ per t., **91,** 3319.
1891. R. Hoyt, fascines $2.70 cord, and poles 22¢ each, **91,** 3319.
1893. W. H. Maxwell and O. Huber st. 63½¢ per s. t. ($63,500), **93,** 3492.
1901. Hale & Kern Contract Co., furnishing 25,000 t. rubblest., 90¢ t.; Jos. Supple, constr. barge, $6,950; scow barge, $2,975, **02,** 2402.
1902. Newton Poston, coal, prices listed, **02,** 2402. Columbia Engineering Works, engine and pile driving machinery; Burnham-Williams Co., 3 locomotives; G. W. Sanborn, coal, as required, **03,** 2274.
1903. Oregon Rafting Co., piles; Corbett-Failing & Robertson, Inc., iron and steel; Warren & Lester, lumber; Northwest Constr. Co., 150,000 t. r., **03,** 2274–75. Northwest Constr. Co., 475,000 t. r., 91¢ t.; J. R. Bowles, structural steel (unit prices listed), **04,** 3550–51.
1904. Northwest Constr. Co. (supple.) reducing quantity of r. to 200,000 t.; Columbia Contract Co., 240,000 t. st., $1.08 t., **04,** 3550–3554. (For list of emergency contracts, see **04,** 3549–54.)
1905. J. W. Sweeney, 110,000 t. st., $1.02 t.; Columbia Contract Co., 450,000 t. st., $1.10 t., **05,** 2492. (For misc. emergency contracts, see **05,** 2489–92.)
1906–08. List of emergency contracts, **06,** 2015–17; **07,** 2201; **08,** 2273–74.
1909. Columbia Contract Co., 380,000 t. st., $1.12 t., **10,** 2409.
1910. Marine Iron Works, repairs, alterations and additions to dr. Chinook, $132,000; list of emergency contracts, **10.** 2409. Columbia Contract Co., st., prices listed, **11,** 2613.
1911. Associated Oil Co., 39,000 bbls. fuel oil, 75¢ bbl. of 42 gals.; list of leases and emergency contracts, **11,** 2614. G. W. Sanborn, coal, $5.70 l. t.; Columbia Contract Co., st., $1.12 s. t.; list of leases given, **12,** 2828.

ENGINEERS.

Chief of Engineers. **R.,** **80,** 240; **83,** 332, 2011; **84,** 335; **85,** 364; **86,** 360; **87,** 327; **88,** 301; **89,** 358; **90,** 325; **91,** 412; **92,** 386; **93,** 447; **94,** 413; **95,** 460; **96,** 400; **97,** 502; **98,** 507; **99,** 595; **00,** 671, 676; **01,** 635; **02,** 556; **03,** 614; **04,** 678; **05,** 685; **06,** 757; **07,** 773; **08,** 822; **09,** 862; **10,** 958; **11,** 1016; **12,** 1218.

Boards:
Convened, New York, Feb. 12, 1881, to consider imp. of mouth of Columbia R. Board did not con-

sider it necessary at that time to submit any plan for imp., **81,** 2548, 2552. (Cols. Tower and Newton and Lt. Col. Abbot.)

Board constituted S. O. No. 82, C. of E., 1882, to report upon plan for permanent imp. of mouth of the R. **R., 83,** 2012. (See also Projects.) (Lt. Cols. Stewart, Craighill, Comstock, and Mendell, and Capt. Powell.)

Convened, Portland, Oreg., by S. O. No. 4, Feb. 11, 1893, for purpose of considering and reporting upon completion of work. **R., 93,** 3499. (Col. G. H. Mendell, Maj. W. H. Heuer, Maj. T. H. Handbury.)

Board constituted by S. O. Nos. 19, July 5, 1902, and 35, Sept. 13, 1902, to consider and report upon proj. for imp.; submits est. of $3,715,000; extension of s. j. 2½ m., constr. n. j., and a dr. (Maj. W. L. Marshall, Capts. Edw. Burr, J. C. Sanford, C. E. Gillette, C. H. McKinstry.) **R., 03,** 2275.

In charge:

Maj. G. L. Gillespie, 1878–81. **R., 80,** 2315, 2318; **81,** 2534, 2536.

Capt. C. F. Powell, 1881–87. **R., 82,** 2647; **83,** 2010; **84,** 2222; **85,** 2382; **86,** 1972; **87,** 2470.

Maj. T. H. Handbury, 1888–93. **R., 88,** 2155; **89,** 2529; **90,** 3011, 3025; **91,** 3314; **92,** 2808; **93,** 3488.

Maj. J. C. Post, 1894–95. **R., 94,** 2631; **95,** 3551.

Capt. W. L. Fisk, 1896–99. **R., 96,** 3250; **97,** 3404; (Maj.) **98,** 3040; **99,** 3246.

Capt. W. C. Langfitt, 1899.

Capt. W. W. Harts, 1899–1900. **R., 00,** 4361, 4430, 4434.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3567; **02,** 2400; (Maj.) **03,** 2271; **04,** 3543; **05,** 2484.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2012; **07,** 2196; **08,** 2270.

Maj. J. F. McIndoe, 1909–. **R., 09,** 2236; **10,** 2406; **11,** 2610; **12,** 2823.

Assistants:

R. A. Habersham. **R., 80,** 2317.

G. M. Jessen. **R., 80,** 2321.

Lt. E. Burr. **R., 86,** 1976.

P. G. Eastwick. **R., 86,** 1980.

G. B. Hegardt. **R., 89,** 2535; **90,** 3017; **91,** 3320; **92,** 2811; **93,** 3492; **94,** 2634; **95,** 3555; **96,** 3253; **00,** 4440.

OPERATIONS.

1879-80. Sur. of mouth, and efforts to increase chan. d. of Sand Isld. Shoal by scraping, **80,** 2315.

1880-81. Sur. of mouth continued; efforts to increase d. over bar by harrowing, **81,** 2534, 2547.

1881-84. Continuation of surs. and studies for plans of imp., **84,** 2222.

1884-85. Constr. and purchase of plant and commencement of work by hired labor on tramway for constr. of j., **85,** 2383.

1885-86. 1,944 c. y. brush mattress and 3,346 c. y. of st. placed in j.; 1,090 l. f. of j. tramway built, **86,** 1973. Methods of constr., **86,** 1981.

1886-87. Difficulties of st. transportation; constr. of tramway in progress, **87,** 2471, 2472.

1887-88. Jetty tramway extended 2,500′; 1,400 l. f. of mattress built; 20,315 t. st. placed in j., **88,** 2156.

1888-89. 63,468 t. r. placed in j.; 4,176 l. f. of tramway built; 4,432 l. f. of mattress built; track and wharf constr. and repairs to plant, **89,** 2535–2540.

1889-90. Mattress foundation and tramway constr. advanced 1.7 m.; constr. of pile driver and repairs to plant; 120,354 t. r. placed in j., **90,** 3012–3014.

1890-91. 115,698 t. r. and 4,399 cords of fascines received and placed in j.; 1,700 l. f. of shore-trestle piling renewed; repairs to tracks, tramways, and plant, **91,** 3314–3317.

1891-92. Tramway extended 1,088′; 30,000 t. of r. dumped in widened portion of end of j.; 25,000 t. r. used in securing root of j.; 1,768 cords of fascines and 3,528 poles used in mattress constr., **92,** 2808, 2809.

1892-93. 131,608 t. r. placed in j., and repairs made, **93,** 3489.

1893-94. 115,734 t. r. placed in j. and groins, **94,** 2632.

1894-95. 136,900 t. r. placed in j., groins, and shore revet., **95,** 3553.

1895-96. 82,791 t. r. placed in j. and shore revet.; work considered as completed, **96,** 3251.

1900-01. Repairs made to j. tracks and shore tracks; platforms for materials erected; rolling stock and tug repaired; ex. for suitable r. supply made, **01,** 3569.

1901-02. 1,888′ j. tramway constr.; 19,794 t. r. dumped in outer portion of j. to prevent scouring; 450′ double track built on storage platform; dump and flat cars rebuilt and wharf repaired; r. quarry opened up near Bugby Light, **02,** 2400.

1902-03. Redriving 1,818′ of destroyed j. tramway; storage platforms constr.; 3 new wells sunk for water supply; U. S. transport *Grant* trans. to district to be used as dr., and fitting up in progress; sand-binding grasses planted to reclaim sand spits, **03,** 2272.

1903-04. 4,858′ j. track extended, 972′ of which washed away during winter storms, and replaced; 207,613 t. st. placed in j.; transport *Grant* (renamed *Chinook*) converted into dr., and removed 256,407 c. y. from bar and Smiths Pt. Shoal, **04,** 3544.

1904-05. 12,143′ j. tramway constr.; 8,275′ destroyed by storms; 325,007 t. st. placed in j.; dr. *Chinook* removed 245,220 c. y.; st.-receiving wharf repaired, **05,** 2484–87.

1905-06. 5,580′ trestle built and 476,121 t. st. placed; 20 new geared dump cars constr., **06,** 2013, 2014. Dr. *Chinook* not operated owing to lack of d. in chan., and boiler defects **06,** 759.

1906-07. 147,840 t. st. placed in j., raising it to low tide, with hopes of it withstanding winter storms, unsuccessful, and most of trestle washed away; 21,106′ trestle rebuilt, made necessary by dry-rot or teredo; plant, docks, and wharves overhauled and rebuilt, **07,** 2196–98.

1907-08. 393,000 t. r. placed in w. and raising j., which protected the j. to such an extent that it withstood winter storms; trestle extended 2,408′; 110 dump cars purchased, **08,** 2270–71.

1908-09. 612,404 t. st. placed in w. and extending j.; 3,960′ of tramway built; plant repaired; proj. 58% completed, **09,** 2236, 2237.

1909-10. 603,289 t. st. placed in raising enrockment over older portion of j. and in tramway extension; storm damage repaired; tracks and plant maintained, **10,** 2406.

1910-11. 660,070 t. st. dumped in j.; work on tracks; 212,080 c. y. dr. by *Chinook;* infirmary for injured employees built; repairs made to buildings; proj. 85% completed, **11,** 2610–2613.

1911-12. 716,420 t. st. placed in j.; tramway extended; piles driven to strengthen trestle; 963,898 c. y. dr. by U. S. from bar and R.; tracks repaired; repairs to plant, etc., **12,** 2824–2825.

PHYSICAL CHARACTERISTICS.

Description of mouth, **83,** 2012.

Movement of shore lines, **80,** 2316, 2317, 2318; **81,** 2540; **83,** 2021; **86,** 1978, 1980.

L. w. cross sec., mouth, **83,** 2012.

Stages of water on the bar, **81,** 2542; **86,** 1979.

Description of ocean bed, **83,** 2026; **86,** 1978.

Tidal velocities, **83,** 2013.

Tidal data, **81,** 2550; **83,** 2027.

Tidal prism, **83,** 2013.

Force and direction of wind, **83,** 2028.

Discharge, **86,** 2010.

Description of, **93,** 3489, 3499; **95,** 3553.

Sur., 1898, showed least d. on bar of 29′, 1′ less than the preceding year; sur., 1899, showed 28′ d., **99,** 3246; sur., 1900, showed 23–24′, **00,** 4361.

Description of mouth, 1899, **00,** 4433. Effect of the j. and cause of shoaling over the bar, **00,** 4436.

Mouth of Columbia the only d. w. H. for 700 m. on the Pacific coast, and the only fresh-water H. there, **00,** 4438.

Shoaling of entrance, and decided movement w. of Peacock Spit and Clatsop Spit, **01,** 636.

An. sur., 1901, showed 23′ across bar, **01,** 636.

Severe storms, Oct., 1901, to Apr., 1902, washed away 1,350′ of j. tramway, **02,** 2400.

H. throat d. increased about 10′; Peacock Spit working seaward tending to obliterate n. chan., **02,** 2401.

Sur. of bar shows slight movement seaward of 24′ inner curve, extension seaward of Clatsop Spit, and building up of Clatsop Spit on n. side; 24′ curve gives indication of breaking through crest, **04,** 680.

Teredo destroying piles; severe storms cause damage to j. tramway, **05,** 2485.

Marked scour indicated inside and outside bar, **06,** 758.

Difficulty in maintaining trestle in exposed position, and effect of gales and heavy seas, and consequent increased cost of completed work (special report of Dec. 2, 1905, referred to), **06,** 758, 759, 2014.

Scour producing 4 distinct chans., **07,** 774.

Scour produced chan. 25½′ x 6,000′ where in the year previous 4 narrow and poorly defined chans. existed, **08,** 824.

Accident to pile driver, causing fatalities, **08,** 2271.

6,000′ w. chan. narrowed to 4,700′ by w. movement of Clatsop Spit, **09,** 2237.

Peacock Spit moving to n. and w., Clatsop Spit to w., indicating influence of j., **09,** 864.

Sur. of 1910 showed that opening through bar bet. 24′ contours increased from 4,700′ in 1909 to 8,000′; condition of Clatsop and Peacock Spits, **10,** 2407.

Details of changes noted during an. sur., **11,** 2611.

Accidents occurring during year to locomotive; schooner *Admiral;* j. tramway afire, **12,** 2825.

Chan. w. to 10,000′; details of an. sur. given, **12,** 2826.

Imp. has given 9′ d. on bar, **12,** 1220.

PLANS. (See Projects.)

By Maj. Gillespie, 1879, dike about 10,000′ l., of large rubblest., extending from inside of Pt. Adams along e. edge of Clatsop Spit to 4-fathom curve in s. chan, the dike to rise about 3′ above l. w. and to have top w. of 25′; est., $4,750,000, **80,** 2320; **81,** 2546.

In 1880 Maj. Gillespie proposed pile dike about 8,000′ l., filled with fascines and st., starting at ne. corner of Ft. Stevens and following 12′ curve around Clatsop Spit; est., $430,000, **81,** 2547, 2548. Plan not app. by BE. of 1881, **81,** 2535, 2552. Board did not consider it necessary to submit any plan for imp., **81,** 2552.

PROJECTS.

By BE., 1882, j., slightly convex to n., extending from shore near Ft. Stevens in a nw. direction toward a point about 3 m. s. of Cape Disappointment; j. to consist of random st. placed on mattress foundation, and to be about 2,400′ in l., with top at l. w., and w. not less than 5′; outer 7,500′ of j. to be faced with beton blocks of from 5 to 20 c. y. each; est., $3,710,000, **83,** 2018; **87,** 2470. Lt. Col. Mendell, differing on some points from the majority of the board, submitted a minority report, **83,** 2034. Congress au. commencement of imp. recom. by majority of board, **84,** 402.

In 1890 cost of completion reduced from $2,423,000, in 1899, to $525,000. **90,** 3016; **91,** 3319.

By BE., 1893, modification of former proj. to provide for raising j., and for constr. of 4 low groins out from the main j. to aid in the increase and permanency of any sand that might accumulate on n. side of j.; est., $583,203.50, **93,** 3502.

In 1896 $50,000 trans. from this work, act June 3, 1896, to proj. for imp. of R. below Tongue Pt., **96,** 3253.

Capt. Langfitt est., 1899, $2,531,140.51 to form 40′ chan. by extending j., if the money were app. at once, **00,** 4439.

Congress, 1900, app. $250,000 for repair of j. at mouth of the R., **00,** 4362.

By BE., 1903, for extension of "present" j., and dr., est., $2,260,000; constr. and operating dr., $250,000; if necessary to constr. a n. j., $1,205,000, **03,** 615, 2275.

Act Mar. 3, 1905, modified proj. of 1899, providing for extension of s. j., and constr. of n. j., if necessary; dr. also recom., **05,** 685.

Act Mar. 3, 1909, au. remodeling dr. *Chinook,* $200,000, **09,** 863.

Revised est. for completion of s. j., $3,529,300, approv. Apr. 17, 1909, **10,** 959.

SURVEYS.

Au. act Mar. 3, 1879, **80,** 2315; made, by Maj. Gillespie, 1879, **80,** 2315, 2318, 2319; continued, **81,** 2538, 2550; **86,** 1976.

Comparison of various surs., **81,** 2549; **83,** 2014, 2021.

Sur. of mouth of R., made, 1891, by Maj. Handbury, **91,** 3325.

Surs. of bar at mouth of R., made, 1892, by Maj. Handbury, **92,** 2810.

Misc. surs., **94,** 2639; **95,** 3553; **96,** 3252; **97,** 3405; **98,** 3040; **99,** 3246.

Ex. and sur. of mouth for 40′ chan. au. act Mar. 3, 1899. Pre. ex. made, 1899, by Maj. Fisk (map), **99,** 3246 (**R.** fav.), **99,** 3246; **00,** 4434. Sur. made by Capt. Langitt, 1899 (see Projects; **R.** fav.), **00,** 4434.

Minor surveys:

Annual, **01,** 636; **02,** 2401; **03,** 2273, 2305–2318; **04,** 3547; **07,** 774; **08,** 824, 2272; **09,** 2237; **10,** 2407; **11,** 2611; **12,** 2826.

Of Sand Isld., concrete monuments placed, **05,** 2487.

Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 1018; **12,** 1219.

Maps. **81,** 2546, 2552; **86,** 1978, 1980; **88,** 2156; **89,** 2534; **90,** 3022; **91,** 3325; **93,** 3496; **94,** 2640; **95,** 3560; **99,** 3246; **00,** 4362; **04,** 3548; **05,** 2488; **06,** 2016; **08,** 2272; **09,** 2238; **10,** 2408; **11,** 2612; **12,** 2826.

Plates (47), **03,** 2316.

Part (h), WW-2 Columbia River, below Tongue Point and in front of Astoria, Oreg.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Large local and foreign C. uses this chan., **95,** 3608.

Chan. used by shipping going to and from wharves and mills along water front, **05,** 684.

CONTRACTS.

1900. E. T. Johnson, r. excavation, $6 c. y.; sand removal, 50¢ c. y., **01,** 3566.

ENGINEERS.

Chief of Engineers. **R., 95,** 468; **96,** 401; **97,** 502; **98,** 507; **99,** 3245; **00,** 4360; **01,** 634; **02,** 556; **03,** 614; **04,** 678; **05,** 684; **06,** 765; **07,** 780.

In charge:

Maj. J. C. Post, 1895. **R., 95,** 3605.

Capt. W. L. Fisk, 1896–99. **R., 96,** 3256; **97,** 3406; (Maj.) **98,** 3039; **99,** 3245.

Capt. W. C. Langfitt, 1899.

Capt. W. W. Harts, 1899–1900. **R., 00,** 4360.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3565; **02,** 2398; (Maj.) **03,** 2270; **04,** 3543; **05,** 2483.

Lt. Col. S. W. Roessler, 1907. **R., 07,** 768.

OPERATIONS.

1896–97. 103,231 c. y. dr., **97,** 3407.

1897–98. 59,150 c. y. dr., **98,** 3039.

1899–00. Preparations made for dr., **00,** 4360.

1900–01. 573 c. y. removed from Sylvia de Grasse Reef, **01,** 3566.

1901–02. 8,246 c. y. r. and 3,321 c. y. sand removed by contract from reef, and 27,676 c. y. sand removed from vicinity of reef by hired labor, **02,** 2399.

1902–03. 3,470 c. y. r. and 1,701 c. y. sand removed, completing contract and a chan. 25′ d. across. Sylvia de Grasse Reef, **03,** 2270.

PHYSICAL CHARACTERISTICS.

Description of: Chan. extends along front of Astoria to Smiths Pt. 5½ m.; forms only navigable connection for vessels of d. draft bet. Columbia R. above Tongue Pt. and the sea, **95,** 3605.
Chan. 24′ d. and 150′ w. obtained, **02,** 556.
Max. draft 20′; variation 6½′ to 7′, **04,** 678.

PROJECTS.

By Maj. Post, 1895, removal of wreck of SS. and an outer portion of the ledge upon which it rested, supple. the work by dr. waterway in front of Astoria 25′ x 250′ at bottom, in accordance with general proj. for imp. of Columbia and lower Willamette from Portland to the sea; est., $121,550, **95,** 3608; **96,** 3256.
By Maj. Fisk, 1899, removal of 63,900 c. y. r. from Sylvia de Grasse Reef, **99,** 3245.

SURVEYS.

Sur. of R. below Tongue Pt. by way of s. chan. in front of Astoria, au. act Aug. 17, 1894; made, 1895, by Maj. Post (**R.** fav.; see Projects), **95,** 3605.
Cross-sectioning, and triangulation of r. area, **01,** 3565.
Ex. and sur. au. act Mar. 3, 1905, of Astoria H.; made by Maj. Langfitt; **Rs.** by latter and Lt. Col. Roessler, Apr. 4, 1905, and Oct. 6, 1906, resp. (unfav.) (H. D. 216, 59th, 2d), **06,** 765; **07,** 780.
Maps. **95,** 3608.

Part (i), WW-2 Columbia River, between Vancouver, Wash., and mouth of the Willamette River.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Principally lumber, **12,** 1201.

CONTRACTS.

1892. Borthwick & Davison, dam work—piles, 8½¢ l. f.; lumber, $12 M f.; bolts and washers, 15¢ and 3½ each; spikes and wire, 4¢ and 3¾ lb.; r., 55¢ t.; fascines, $2.35 cord ($19,954.13), **93,** 3505. Annulled, **94,** 2643.
1894. R. Smith, repairs to dam, etc., aggregate amount of bid, $4,612.85, **94,** 2645.
1897. J. Hale, constr. and repair of dam; aggregate amount of bid, $19,286.30, **98,** 2989.
1899. Wakefield & Jacobsen, dike extension—piles, lumber, ironwork, brush, st., $14,686, **99,** 3231.
1901. E. T. Johnson, dike repairs (unit prices listed), **02,** 2384.
1902. Hale & Kern Contract Co., furnishing 600 c. y. riprap st., **03,** 2229.
1905. Port of Portland, hire of 20-inch suction dr., $155 per day; Robert Wakefield, dike repairs (unit prices listed), **06,** 2000.

ENGINEERS.

Chief of Engineers. R., 91, 421; **92,** 395; **93,** 449; **94,** 414; **95,** 462; **96,** 402; **97,** 504; **98,** 499; **99,** 586; **00,** 661; **01,** 627; **02,** 549; **03,** 608; **04,** 670, 671; **05,** 676; **06,** 750; **07,** 767; **08,** 816; **09,** 854; **10,** 948; **11,** 1006, 1007; **12,** 1200.
Boards. BERH. reviews Maj. Langfitt's **Rs.,** and concurs in his recom. for chan. 20′ x 150′ (see Projects). **R., 04,** 3501, 3503.

In charge:
Maj. T. H. Handbury, 1890–93. **R., 92,** 2865, 2866; **93,** 3503.
Maj. J. C. Post, 1894–95. **R., 94,** 2643; **95,** 3566.
Capt. W. L. Fisk, 1896–98. **R., 96,** 3263; **97,** 3414; (Maj.) **98,** 2987.
Capt. W. W. Harts, 1899–1900. **R., 99,** 3229; **00,** 4334.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3499; **02,** 2383; (Maj.) **03,** 2228; **04,** 3496, 3498, 3504; **05,** 2467.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1998; **07,** 2182; **08,** 2256.
Maj. J. F. McIndoe, 1909. **R., 09,** 2223.
Maj. Jay J. Morrow, 1910–. **R., 10,** 2394; **11,** 2597; **12,** 2807.

OBSTRUCTIONS.

Br. built across Columbia R. at Vancouver by Spokane, Portland & Seattle Ry. Co., **09,** 855.

OPERATIONS.

1892–93. About 2,900′ of dam built, **93,** 3504.
1893–94. Repairs to dam made and revet. constr., **94,** 2644.
1894–95. 103,633 c. y. dr., **95,** 3567.
1897–98. Repair and constr. of dam and revet. in progress, **98,** 2988.
1898–99. Minor repairs made to dam built 1897–98; extension of Hayden Isld. end of dam for about 700′, and constr. of 2 cross dikes to connect the 700′ extension with head of Hayden Isld.; head of isld. protected with revet. (photographs), **99,** 3229, 3230.
1899–00. Dike at head of Hayden Isld. repaired, **00,** 4335.
1900–01. Main dike and 2 cross dikes repaired and maintained; amount and details given, **01,** 3499.
1901–02. Dikes repaired and head of Hayden Isld. revetted; 196 cords brush fascines and 4,730 t. rubblest. placed, **02,** 2384.
1902–03. 635 c. y. rubblest. placed on dike where settled, **03,** 2228.
1905–06. 321,770 c. y. removed, completing chan. 20′ x 150′ from d w. below Hayden Isld. to d w. opposite Vancouver; dike at head of Hayden Isld. refilled and repaired, **06,** 1999.
1906–07. 253,415 c. y. removed by hired dr. *Columbia*, restoring chan. to orig. d. of 20′ and w. of 150′ bet. lower end of Hayden Isld. and Vancouver, **07,** 2182.
1907–08. No dr. done, owing to sinking of dr. *Portland*, only other available dr. tried but found unsuitable, **08,** 2257.
1909–10. 75,000 c. y. removed by dr. *Oregon*, completing cut through shoal 16′ x 125′, **10,** 2394.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 2866; **96,** 3265.
Sur. of 1899 showed that dike at Hayden Isld. had not produced the scour for which it was designed; scour not looked for then until two or three seasons of high and low stages had passed, **00,** 4336.
Dike effected an increase of 1′ in d. over shoals, **02,** 2384.
Max. draft at extreme l. w., 10′, **02,** 550.
Flood of summer of 1902 caused slight settlement of dike at several places, **03,** 2228.
Details of, **04,** 3499.
20′ chan. dr. 1905 shoaled to 14 and 15′ in 1906, **07,** 2182.
Dr. chan. along Hayden Isld. shore shoaled to 10′ at l. w., **09,** 2223.
Chan. next to Hayden Isld. shoaled to 9′ at l. w., **10,** 2394.

PRIVATE WORK.

Chan. 3,600′ l., 75 to 100′ w., and 15′ d. dr. over shoal about 2½ m. below Vancouver by city of Vancouver, **04,** 3497.
Dr. by Columbia Contract Co. to enable transportation of r. for j., **05,** 2467.
Citizens of locality form port district, **12,** 2808.

PROJECTS.

By Maj. Handbury, 1891, closing chute behind Hayden Isld. opposite Vancouver by a pile, brush, and r. dam about 3,000′ l. and 4′ high above l. w., to throw water passing down this chute at this stage into main chan. to remove sand bar bet. mouth of Willamette and Vancouver; est., $33,000, **92,** 2868; **93,** 3503.

By Maj. Post, 1895, completing imp. by extending dam 1,500′, passing head of Hayden Isld. and turning downstream at its outer end, effect of dam to be supple. by dr. in main chan.; est., $67,000, **96,** 3264, 3265.

By Capt. Harts, 1899, extension of main dike downstream for 700′, this extension to be connected by 2 dikes with head of Hayden Isld.; est., $16,000. Revised est., $25,516. **99,** 3229.

By Maj. Langfitt, recom. by BERH., dr. chan. 20′ x 150′; est., $60,000; and mainten. of chan. and dike at Hayden Isld., est., $10,000 an., **04,** 670, 3501, 3503–3504. Adopted act Mar. 3, 1905, **05,** 670.

Maj. Morrow of opinion that such work of mainten. which can not be done without constr. of addl. plant is not worthy of execution until such time as addl. dr. plant may be necessary on chans. leading to Portland, **10,** 2395.

SURVEYS.

Au. act Sept. 19, 1890; made, 1891, by Maj. Handbury, **92,** 2866.

Sur. to determine condition of chan., and to ascertain what further imp. needed, au. by Chief of Engineers, 1895; **R.** submitted by Maj. Post, 1895 (see Projects), **96,** 3264.

Sur., 1899, to ascertain whether dr. provided for by existing proj. would be necessary (see Physical characteristics), **00,** 4335. (Maps.)

Pre. ex. au. act June 13, 1902, to ascertain effect of dikes or other works. **R.,** Maj. Langfitt, July 22, 1902, and Aug. 1, 1903; est., $60,000, with $10,000 an. for mainten. (H. D. 56, 58th, 2d), **04,** 671, 3498.

Minor, **06,** 1999; **09,** 2223.

By Lt. Col. Roessler, Sept., 1906, to determine condition of dr. chan., **07,** 2182.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Morrow, Apr. 9, 1910 (unfav.) (H. D. 42, 62d, 1st), **11,** 1007.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1201.

Maps. **98,** 2988; **99,** 3230; **00,** 4336.
Photographs. **99,** 3230.

Part (j), W-2 Oregon Slough (North Portland Harbor), Oreg.

APPROPRIATIONS.

1912, $50,000, **12,** 2809.

COMMERCE.

1911, 16,508 t., **12,** 1204.

ENGINEERS.

Chief of Engineers. **R., 12,** 1203, 1205, 1206.

In charge. Maj. J. J. Morrow, 1912. **R., 12,** 2809.

PHYSICAL CHARACTERISTICS.

Oregon Slough is that part of former chan. of Columbia R. which separates Hayden Isld. from Oregon mainland, and extends 4½ m. from the head to the foot of Hayden Isld., emptying back into Columbia R. about 1 m. above mouth of the Willamette R. and about 103 m. above mouth of the Columbia R., **12,** 1203.

PROJECTS.

Act July 25, 1912, au. dr. chan. 20′ x 200′, at extreme l. w., from d. w. in Columbia R. to a point above the Portland Union Stock Yards, on the slough; est., $100,000, with $5,000 an. mainten., local interests cooperating to extent of paying one-half the first cost (H. D. 712, 62d, 2d), **12,** 1203.

SURVEYS.

Pre. ex. and sur. au. act June 25, 1910, incl. consideration of any proposition for cooperation by localities affected thereby. **R.** by Maj. Morrow, 1911 and 1912; est., $100,000, with $5,000 an. mainten. (see Projects for addl. details), **12,** 1205–1206.

Maps. (H. D. 712, 62d, 2d.)

Part (k), WW-2 Columbia River, Oreg. (Canal around the Cascades.)

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Ry. portage at Cascades, **76,** ii, 667.
Benefit of imp. to C., **77,** 1049; **78,** 1337.
Uncertainty of benefits of imp., **80,** 2301.
Advantages of imp., **81,** 2566; **82,** 2668; **83,** 2044.
Draft of vessels passing Cascades, **80,** 2312.
Character of "present" navigation, **81,** 2577; **82,** 2673.
Dimensions of vessels on R., **81,** 2580.
Cost of transportation, **86,** 1942, 1944.
In 1893, 5,553 passengers and 7,800 t. freight transported bet. The Dalles and Cascades, **93,** 3508.
Freight rates regulated by imp., **10,** 947.
1911–12, 41,778 t., valued at $3,034,315, consisting of wheat, flour, miscl. grain, cattle, horses, wool, produce, farm and mill machinery, etc., **12,** 1199.

CONTRACTS.

1878. Ball & Platt, materials and labor, **79,** 1790.

1880. Ball & Platt, canal constr., **80,** 2302. Contract abrogated, **80,** 2299.

1882. Chalmers & Holmes, removal of submerged r., $25, and exposed r., $3 c. y., **82,** 2668. Failure of contract system, **83,** 2043.

1886. Portland Construction Co., wharf at canal, **87,** 2480.

1889. F. J. Carrel, granite dimension st., $1.35 c. y., **89,** 2544.

1892. J. G. & I. N. Day, canal imp. and lock constr., earth and r. excavation; furnishing, cutting, and laying st. and masonry; grading, gates, machinery, etc.; aggregate amount of bid, $1,521,265, **93,** 3511.

1899. H. W. Taylor, r. and earth excavation, st., pavements, wire fencing, $51,279, **00,** 4329.

1902. H. W. Taylor, furnishing cut st., concrete, rubble masonry, and grading, $22,089.57, **03,** 2222–2224.

1905. Frederick & Arnold, 5 buildings, $14,030, **06,** 1994.

ENGINEERS.

Chief of Engineers. R., 75, 125; **77,** 123; **78,** 138; **79,** 181; **80,** 239; **81,** 327, 2570; **82,** 321; **83,** 334; **84,** 337; **85,** 370; **86,** 358; **87,** 328; **88,** 301; **89,** 359, 2557; **90,** 326; **91,** 414; **92,** 388; **93,** 450; **94,** 415; **95,** 463; **96,** 403; **97,** 504; **98,** 496; **99,** 584; **00,** 658; **01,** 626; **02,** 547; **03,** 606; **04,** 668; **05,** 673; **06,** 747; **07,** 764; **08,** 813; **09,** 852; **10,** 946; **11,** 1004; **12,** 1198.

Boards:

Convened, Aug., 1877, to report on proj. of Maj. Wilson for canal around Cascades of upper Columbia. Board recom. further exs. and surs. **78,** 1333. Reconvened, San Francisco, Cal., Sept. 22, 1877; and recom. that canal be on left bank, or Oregon side, approv. location and plan of canal as prepared by Maj. Wilson, but recom. that dimensions of locks should be increased to 300′ in l. instead of 250′, and to 50′ in w. instead of 46′, **78,** 138, 1333. **R., 78,** 1340. Approv. by Chief of Engineers. **78,** 138. (Lt. Cols. Alexander, Stewart, and Williamson, and Majs. Mendell and Wilson; Lt. Payson, recorder.)

Convened, Aug., 1879, to consider questions to be submitted by Engineer officer in charge, **80,** 2298, 2305. **R., 80,** 2305. (Lt. Cols. Stewart and Mendell and Maj. Gillespie.)

Reconvened Nov., 1880. **R., 81,** 2572. (Lt. Cols. Stewart, Williamson, and Mendell, Majs. Weitzel, Houston, and Gillespie.)

Convened, Washington, D. C., Feb. 24, 1888, by S. O., No. 7, to consider and report upon plan submitted by Capt. Powell for lock constr. at Cascades. **R., 88,** 2170. (Col. Craighill, Lt. Col. Gillespie, and Maj. Post.)

Convened, Portland, Oreg., Aug. 24, by S. O., No. 28. to consider and report upon modifications in existing proj. proposed by Maj. Handbury. **R., 89,** 2558. (Cols. Mendell and Craighill and Maj. Post.)

Convened, Portland, Oreg., Oct. 15, 1894, under S. O., No. 51, dated Sept. 21, 1894, to consider and report upon modifications in plans for Cascade locks. **R., 95,** 3576. (Col. G. H. Mendell, Col. W. P. Craighill, and Capt. W. L. Marshall.)

In charge:

Maj. N. Michler, 1875–76. **R., 75,** ii, 787; **76,** ii, 639.

Maj. J. M. Wilson, 1876–78. **R., 76,** ii, 666; **77,** 1046; **78,** 1333; **79,** 1790.

Maj. G. L. Gillespie, 1878–81. **R., 79,** 1843; **80,** 2298, 2309, 2311; **81,** 2563.

Capt. C. F. Powell, 1881–87. **R., 82,** 2664; **83,** 2043; **84,** 2246; **87,** 2476.

Maj. W. A. Jones, 1884–86. **R., 85,** 2426; **86,** 1942.

Maj. T. H. Handbury, 1888–93. **R., 88,** 2161; **89,** 2543, 2551; **90,** 3052; **91,** 3328; **92,** 2819; **93,** 3506.

Maj. J. C. Post, 1894–95. **R., 94,** 2645; **95,** 3568.

Capt. W. L. Fisk, 1896–98. **R., 96,** 3266; **97,** 3416; (Maj.) **98,** 2981.

Capt. W. W. Harts, 1898–1900. **R., 99,** 3222; **00,** 4324.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3492; **02,** 2377; (Maj.) **03,** 2222; **04,** 3491; **05,** 2460.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1993; **07,** 2176; **08,** 2252.

Maj. J. F. McIndoe, 1909. **R., 09,** 2218.

Maj. Jay J. Morrow, 1910–. **R., 10,** 2390; **11,** 2594; **12,** 2804.

Assistants:

R. A. Habersham. **R., 75,** 790.

C. M. Bolton, **77,** 1046. **R., 78,** 1338; **79,** 1846.

Lt. C. F. Powell. **R., 79,** 1846; **80,** 2302, 2310; **81,** 2567.

Lt. P. M. Price. **R., 82,** 2669; **83,** 2047.

Lt. W. Young. **R., 84,** 2249; **85,** 2430; **86,** 1945; **87,** 2481.

Lt. E. Burr. **R., 88,** 2165; **89,** 2547; **90,** 3054; **91,** 3332.

Lt. H. Taylor. **R., 92,** 2823; **93,** 3512; **94,** 2648; **95,** 3582.

W. E. Morris. **R., 96,** 3269.

W. G. Brown. **R., 97,** 3420.

ESTIMATES. (See Plans and Projects.)

By Maj. Wilson, 1877, canal around Cascades, navigable at all stages when R. not closed by ice, $1,544,545, **77,** 1047.

By BE., 1877, extension of break'r to upper end of Bradfords Isld., 1½ m., and an addl. lock, $1,000,000, making cost of canal $2,544,545, **78,** 1341, 1343.

By Maj. Wilson, increasing w. of locks from 50′ to 70′, $30,000, **78,** 138.

LEGAL PROCEEDINGS.

Oregon Steam Navigation Co. would sell the land for the canal to the U. S. for $200 per acre, reserving right of way across for RR.; the Sec. of War declined to purchase on these conditions, **78,** 1335. Chief of Engineers ordered the condemnation of the land under laws of Oregon, **78,** 1335. Objections by Oregon Steam Navigation Co. to condemnation of the lands, **78,** 1335.

LEGISLATION.

By Oregon, au. U. S. to take proceedings for condemnation of all land required for canal purposes, provided such property could not be purchased, **78,** 1335.

By Oregon, Oct. 16, 1878, granting U. S. jurisdiction over lands condemned for canal purposes, **79,** 1790.

OBSTRUCTIONS.

Rock reef struck by SS. during l. w. period at upper summit of rapids, below lower entrance to canal, **05,** 2461.

OPERATIONS.

1878–79. 7,228 c. y. earth, 4,316 c. y. loose r., and 8,387 c. y. solid r. excavated; 80,994 lbs. cast-iron pipe furnished, **79,** 1844, 1846.

Delay caused by the death of Mr. Ball, **79,** 1844, 1851.

1879–80. By contract 28,944 c. y. earth, 12,102 c. y. of loose and 26,640 c. y. of solid r. removed from canal prism; 186,292 lbs. iron pipe and 1,398 c. y. of masonry st. delivered. By hired labor, 35,080 c. y. excavated and 273 c. y. masonry laid, **80,** 2300, 2305.

1880–81. Progress on excavation of canal prism by hired labor, **81,** 2568.

1881–82. Progress on canal constr. by hired labor, **82,** 2664, 2669; 4,527 c. y. bowlders removed from area adjacent to canal by contract, and 8,348 c. y. by hired labor, **82,** 2665, 2671. Drilling and blasting by hired labor, **82,** 2666. Cost of r. removal by surface blasting, **82,** 2672.

1882–83. Progress on canal constr. by hired labor, **83,** 2043, 2048. Borings to determine site of lock, **83,** 2044. Rock removal in R. below site of canal, **83,** 2045, 2051. Cost of r. removal, **83,** 2051.

1883–84. Progress on canal constr., **84,** 2246, 2249. Rock removal in R., **84,** 2246, 2251. Records of r. removal, **84,** 2247, 2251, 2253. Cost of r. removal, **84,** 2252.

1884–85. Progress on canal constr., **85,** 2429, 2431. Rock removal in R., **85,** 2434. Cost and details of r. removal, **85,** 2435.

1885–86. Progress on canal constr., **86,** 1945.

1886–87. 58,000 c. y. of r. removed at lock site; st.-cutting, quarrying, and canal paving in progress, **87,** 2482. Cost of r. removal, **87,** 2482.

1887–88. 22,645 c. y. excavated from canal prism and caisson chamber; 12,365 c. y. used in grading; 130′ of wing wall completed; excavation of lock chamber completed and concrete foundation laid; 1,321 c. y. rubble used in paving slopes of upper canal entrance; 132 c. y. st. quarried, **88,** 2165–2168.

1888–89. 95,981 c. y. bed r. and 15,698 c. y. gravel excavated; 1,965 c. y. of canal wall laid; 5,035 c. y. of st. cut; 430 c. y. bowlders quarried; plant constr., **89,** 2547–2550.

1889–90. 6,038 c. y. bed r. and 1,853 c. y. bowlders excavated; 1,636 c. y. concrete made and laid; pivot stones placed; constr. of tail-bay walls begun; 335 c. y. basalt st. quarried, **90,** 3052–3053.

1890–91. 8,711 c. y. of dimension st., 12,520 c. y. of dimension basalt and 42,988 c. f. of faced basalt cut; 1,544 c. f. of st. laid in lock walls; 260 c. y. st. laid in canal walls; 9,614 c. y. of concrete made and placed; 2,085 c. y. bed r. and 4,443 c. y. gravel and

sand excavated in preparation of lock masonry foundations; repairs to plant, **91,** 3329, 3330.

1891–92. 81,320 c. f. dimension granite, basalt, basalt-face st., and dimension st. cut; 604 c. y. rubble quarried; 2,988 c. y. st. laid in lock walls; 260 c. y. st. laid in canal walls; 17,899 c. y. concrete made and laid; 8,033 c. y. excavated and used for filling in behind walls; 21,214 c. y. masonry used in constr. of n. abutment of lower lock and guard gates, and s. wall of lock chamber, **92,** 2820–2824.

1892–93. Preparations made for continuance of work, **93,** 3508.

1893–94. 2,575 c. y. masonry and 15,634 c. y. concrete laid; 20,785 c. y. r. and 35,267 c. y. other material excavated, **94,** 2647.

1894–95. 17,230 c. y. masonry, 27,050 c. y. concrete, and 1,160 c. y. paving laid; 18,483 c. y. r. and 81,946 c. y. loose material excavated. The lower guard and lock gates completed and the upper guard gates put in place, **95,** 3570.

1895–96. 192,894 c. y. r. and earth excavated. Masonry work completed and gates and machinery set, **96,** 3267.

1896–97. Revetting done, portions of n. and s. walls raised, and lock opened to navigation on Nov. 5, 1896, **97,** 3418.

1897–98. Raising of embankment and revetting in progress; st. gathered for completing walls and addl. machinery placed, **98,** 2981, 2982.

1898–99. Revetting in progress; st. quarried for building walls of upper lock, preparations made for constr. of movable dam, paving in progress, 1,417 s. y. facing for slope pavements quarried (photographs showing condition of works), **99,** 3223, 3224.

1899–00. Protection embankment or wing separating the lower entrance to canal from R. rebuilt and slope wall on s. side of lower entrance to canal repaired; movable dam built ready to put in place (plates; photographs), **00,** 4327, 4328.

1900–01. Rebuilding protection embankment at lower entrance and slope wall below guard gate, and laying addl. pavement: summary of work given, **01,** 3492–3493.

1901–02. Cobblest. gutter and tile drain completed, old piling in wharf and abandoned incline removed, 6 fenders placed in n. wall of upper lock; repairs and mainten. work, **02,** 2377.

1902–03. All work on n. side of canal completed (details); feed pipe for handling gate machinery laid; r. points blasted at Sheridan Pt., **03,** 2222, 2223.

1903–04. Graveling ramps on n. side below upper guard gate, and repairing grass slopes on n. side, **04,** 3491.

1904–05. Rock blasted at Sheridan Pt., and grounds graded, **05,** 2461.

1905–06. Unfinished slope revets. completed, grounds graded, and 3 new dwellings completed; r. reef at about ½ m. below lower lock entrance blasted and removed to a d. of 20′, **06,** 1993.

1906–09. Mainten. and care of works, **07,** 2176; **08,** 2252; **09,** 2218.

1909–10. Mainten. and care of plant and buildings; canal opened for traffic, and has been in operation since 1895, but land wall of upper lock and paving and grading never been completed, owing to lack of funds, **10,** 946, 2390.

1910–11. Bet. Summit and Sheridans Pt., several fish leads removed; 170 bowlders broken up; on the Oregon shore, bank smoothed by blasting bowlders and points of reefs, for quarter of m., **11,** 2595.

1911–12. Mainten., **12,** 2805.

PHYSICAL CHARACTERISTICS.

General characteristics, Cascades, **75,** ii, **787.**

Action of ice at Hell Gate, **75,** ii, 780, 788.

Difference bet. extreme h. and l. w., **75,** ii, 789.

Record of flood levels, **75,** ii, 791.

Cascades a series of rapids, with fall of 37.3′ in 5¾ m., **76,** ii, 667.

Velocity of R., **79,** 1851.

Current velocities at Cascades, **80,** 2306.

Movement of earth of rocky slopes about the Cascades, **80,** 2313.

High-water stages, **81,** 2569; **85,** 2429.

Rain-fall records, **83,** 2048; **84,** 2251; **85,** 2433; **86,** 1947; **87,** 2485.

Drainage areas of R., **85,** 2426.

Fall of R. at Cascades, **85,** 2428.

Highest water recorded on the Columbia in 1894, **94,** 2647. **R.** by Maj. Post, **95,** 3572.

PLANS. (See Estimates and Projects.)

By Maj. Michler, 1875, canal and locks around Cascades, through solid r., 2,600′ l.; rise at l. w., 21′; 3 locks, 16½′ x 40′ x 215′; lift of each, 7′; est., $700,000, **75,** ii, 772, 789.

By Maj. Wilson, 1877, canal around Cascades, navigable when R. not higher than 25′ above l. w.; est., $1,188,680, **77,** 1047.

By BE., 1877, extension of break'r to upper end of Bradfords Isld., 1½ m., and addl. lock; est., $1,000,000, **78,** 1341.

PROJECTS. (See Estimates and Plans.)

By Maj. Wilson, 1877, as modified by BE., canal around Cascades, on left bank, or Oregon side, 8′ x 50′ x 7,200′ at l. w., with 2 locks 8′ x 50′ x 300′ l. w., to be navigable at all stages when R. not closed by ice; est., $1,544,545, **77,** 1047; **78,** 138, 1333.

By Maj. Wilson, 1878, increased w. of locks from 50′ to 70′: est., $30,000, **78,** 138, 1338. Approv. by Chief of Engineers and Sec. of War, **78,** 138, 1339. Dimensions of canal, **79,** 1849.

BE., 1879, recom. imp. of l.-w. navigation through reefs below canal before commencement of constr. of lock masonry, **80,** 2307, 2314; **81,** 2571.

In 1880 proj. modified by BE. to provide for navigation from l. w. to stage 20′ above; constr. of single lock near foot of rapids 90 x 462′, with lift of 24′, gates to be 70′ w.; canal prism, about 3,000′ l., 90′ w. at bottom, and 8′ d., **81,** 327, 2564, 2576.

In 1882, to provide for modifications of proj. and imp. of chan. below canal, a revision of est. was made, **82,** 321.

App., 1876 to 1882, $805,000; required to complete proj., $1,655, 397.31, **82,** 2667; total, $2,460,397.31, **83,** 2043.

In 1885, proposed to make widths of gates equal to w. of lock, **85,** 2429.

Increased w. of 90′ approved by BE., 1886, **86,** 1945.

Total amount app. to 1886, $1,142,500, **86,** 1945.

Amount required to complete proj., $1,100,000, **86,** 359.

In 1887 a revision of the est. made total est. cost of work $2,992,500, **87,** 2477, 2480.

In 1888 BE., to which Capt. Powell's plan for lock constr. at Cascades submitted, considered that proj. for constr. of Cascades Canal should be limited to providing for navigation up to stage of 20′ above l. w., giving practically an all-year-round navigation, location and dimensions of lock to remain as proposed by board of 1880, the upper guard gate of the lock to be omitted; w. of canal above lock to be increased to 250′, and below to 140′, **88,** 2170–2174.

In 1888 iron was substituted for wood in constr. of lock gates, **89,** 2558.

In 1890, after completing details in the proj for lock and upper guard gates at Cascades, Maj. Handbury est. cost of completing proj. at $1,745,516, **91,** 3346, 3361.

By BE., 1894, for utilization of part of canal bet. upper gates of lock and upper guard gates as a second lock by putting in concrete floor and side walls, to make canal available for all stages up to 42′ above l. w. of lower gauge; for modifying details of protection works to make them conform to highest flood tide, that of 1894, and for mainten.; est., $413,360, **95,** 3582; **96,** 3266.

By Capt. Fisk, 1896, raising height of n. wall to 34′ and part of s. wall 12′, to enable locks to be safely operated to very nearly highest stage at which boats could reach them through the rapids at foot of Cascades, **97,** 3418.

Outline of modified proj. and status of work under it, **99,** 3222; **00,** 4324.

Act June 13, 1902, au. expend. of $30,000 in continuing imp., and removal of obstr. r. in rapids near locks, **02,** 548.

Act Mar. 3, 1905, au. expend. of $30,000 in completing slope pavement on s. side of canal, removing

old building and grading, soiling and seeding the grounds, and constr. 3 lock-tender's dwellings, **05,** 2460, 2461.

SURVEYS.

Cascades and Dalles of the Columbia, 1874, under direction of Maj. Michler, by R. A. Habersham, **75,** 125; ii, 787; **76,** ii, 639. **R., 75,** ii, 787, 790.

Washington Territory side of Cascades, by C. M. Bolton, **77,** 1047, 1048. **R., 78,** 1338.

Cascades, **81,** 1879–80, 2563.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1199.

Maps:

Of proposed canal, **78,** 1338.

Sketch of profile along center line of canal, showing excavation up to June 30, 1879, **79,** 1846.

Cascades, **83,** 2046; **84,** 2246, 2252; **85,** 2434.

River, **85,** 2426; **89,** 2550.

Photographs, **99,** 3224; **00.** 4328; **06,** 1994.

Part (l), WW-2 COLUMBIA RIVER, OREG. (Cascades, canal, and locks at, care and operation of).

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Description of, **97,** 3424; **98,** 2985.

1911, amounted to 41,778 t., value $3,034,315, consisting of wheat, flour, grain, cattle, horses, wool, produce, merchandise, etc., **12,** 1200.

CONTRACTS.

1901. Cascades Construction Co., dr., 25¢ c. y., **02,** 2380.

1905. Morris Machine Works, dr. machinery, $2,048, **06,** 1995.

1909. J. K. Simpson, lease of steam tug, $17 per day, **10,** 2393.

ENGINEERS.

Chief of Engineers. R., 97, 505; **98,** 498; **99,** 586; **00,** 661; **01,** 627; **02,** 549; **03,** 608; **04,** 669; **05,** 675; **06,** 749; **07,** 766; **08,** 815; **09,** 854; **10,** 947; **11,** 1005; **12,** 1200.

In charge:

Capt. W. L. Fisk, 1897–98. **R., 97,** 3423; (Maj.) **98,** 2983.

Capt. W. W. Harts, 1898–1900. **R., 99,** 3224; **00,** 4329.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3495; **02,** 2378; (Maj.) **03,** 2224; **04,** 3492; **05,** 2462.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1994; **07,** 2177; **08,** 2253.

Maj. J. F. McIndoe, 1909. **R., 09,** 2218.

Maj. Jay J. Morrow, 1910–. **R., 10,** 2391; **11,** 2595; **12,** 2805.

OPERATIONS.

1896-97. Canal and locks formerly opened to navigation Nov. 5, 1896. Repairs made to both lower culvert valves, **97,** 3423.

1897-98. About 2,000 c. y. dr. from lower entrance to canal; culvert repaired, **98,** 2983.

1898-99. Repairs to culverts, **99,** 3225.

1899-00. Sand-blast machine for cleaning lock gates built; cleaning and painting of lock gates in progress; changes made in culverts, **00,** 4330–4331.

1900-01. Steel lock gates cleaned and painted, and steel cables renewed, **01,** 3495, 3496.

1901-02. 30,765 c. y. removed from upper entrance to locks; steel lock gates painted, **02.** 2378.

1902-03. 8,985 c. y. removed from lower entrance and 510 c. y. from upper entrance, and contract completed, **03,** 2224.

1903-04. Voids in wing wall filled with concrete and cement mortar, **04,** 3492, 3493.

1904-05. Sediment in canal entrances removed by dragging anchor over canal floors and sluicing; locks and grounds cared for, **05,** 2462. Repairs made where ground was washed away at toe of protection wall by spring high water; repairs to culvert valve in progress, **05,** 2463.

1905-06. Valve of lower lock gate repaired; 2,629 c. y. dr. from canal entrances; hull of dr. completed, **06,** 1995.

1906-07. Valve repaired, constr. of new dr. continued, fenders placed on lock walls, and break in water main repaired, **07,** 2177, 2178.

1907-08. 22,457 c. y. removed from upper and 555 c. y. from lower entrance; general mainten., **08,** 2253.

1908-09. 27,347 c. y. removed from upper entrance; turbine in power pit repaired; compressor for sand blasting outfit purchased, **09,** 2219.

1909-10. 24.778 c. y. removed by U. S. plant from upper entrance; air compressor plant for sand blast apparatus installed; guide sheaves in cable alleys replaced, **10,** 2392.

1910-11. 34,160 c. y. dr.; steel lock gates, lock houses, etc., cleaned and painted, **11,** 2596.

1911-12. 32,664 c. y. dr.; electric lights installed in quarters and shops; 3 hot-air furnaces installed in lock keeper's quarters, **12,** 2806.

PHYSICAL CHARACTERISTICS.

Meteorological observations and gauge records, **99,** 3228; **00,** 4334.

Soundings indicate deposit of 3 to 5′ above l. w. in upper entrance, **04,** 3493.

(See Operations.)

Part (m), WW-2 Columbia River (in front of town of Hood River, Oreg.).

ENGINEERS.

Chief of Engineers. R., 10, 950.

In charge. Maj. J. B. Cavanaugh, **10,** 930.

Assistant. Capt. Arthur Williams, **10,** 930.

SURVEY.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. Cavanaugh, Nov. 2, 1909 (unfav.) (H. D. 694, 61st, 2d), **10,** 950.

Part (n), WW-2 Columbia River at Threemile Rapids, boat railway from The Dalles Rapids to Celilo Falls, and construction of locks and dams.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Description of, **82,** 2695, 2696; **94,** 2666.
Population and products of the adjacent country rapidly increasing, **94,** 2667.
Large and important; principally wheat, **01,** 3503.
Proposed imp. will develop an enormous amount of C.; details given, **05,** 673.
Business done by State Portage Ry. small, but imp. has a tendency to regulate rail rates, **06,** 1991.
New SS. placed in commission bet. Portland and Big Eddy, **07,** 2173.
2 new SS. placed in commission above Celilo, operating in conjunction with the State Portage road, **09,** 2216.
Rates reduced, **10,** 945.
State Portage Ry. extended from Big Eddy to The Dalles, **11,** 1002.
Large increase since 1905, **12,** 1197.
1911, 67,019 t., **12,** 1197.

CONTRACTS.

1904. Robert Wakefield, excavating and removing r., $1.50 and $6.25 c. y., **04,** 3475.
1905. Smyth & Jones, canal constr., at unit prices for excavation and materials, **06,** 1992.
1908. Caughren, Winters, Smith & Co., constr. of portion of canal (unit prices listed), **09,** 2217.
1909. Robert Wakefield, r. removal near Big Eddy, $2 and $4 c. y., **10,** 2389.
1910. Lewis Investment Co., hire and lease of 9 rooms, $195 per mo., **11,** 2593.
1911. Lewis Investment Co., hire and lease of 2 rooms, $30 per mo.; Pacific Telephone & Telegraph Co., rental of telephone instruments, $11 per mo.; The Home Telephone Co., rental of 1 set telephone instruments, $9 per mo., **12,** 2803, 2804.

ENGINEERS.

Chief of Engineers. **R., 80,** 242; **81,** 332; **90,** 3028; **93,** 458; **94,** 418; **95,** 464; **96,** 404; **97,** 505; **98,** 495; **99,** 582; **00,** 655; **01,** 625, 629; **02,** 546; **03,** 604; **04,** 666; **05,** 671; **06,** 745; **07,** 762; **08,** 811; **09,** 850; **10,** 943; **11,** 1001; **12,** 1194.

Boards:

Convened, Portland, Oreg., Aug. 21, 1888, to report upon proj. for overcoming obstr. to navigation in Columbia R. at The Dalles and Celilo Falls, and at Threemile and Tenmile Rapids. **R., 90,** 3030. (Cols. Mendell and Craighill and Maj. Post.)
BE., 3 members from civil life, convened, San Francisco, Oct. 17, 1892, S. O. No. 177, July 29, 1892, ex. into obstr. of Columbia R. in that portion from navigable waters below Threemile Rapids to navigable waters above Celilo Falls, and to report what they believed to be the best plan for overcoming the difficulties of navigation of the portion of the stream under consideration. **R., 94,** 2664. (Col. G. H. Mendell, Lt. Col. C. R. Suter, Lt. Col. W. R. King, Maj. C. J. Allen, Corps of Engineers; Wm. R. Hutton, Virgil G. Bogue, and E. P. Alexander.)
Appointed, S. O. No. 19, to visit site of proposed works, and request addl. information and est.; soundings, topographical sur. made; gauging of R. shows l. w. discharge of 57,000 c. f. per second. At its 2d meeting, held May 11 to 14, 1903, board requested detailed sur. to be made for continuous canal on Oregon side from Celilo Falls to Fivemile Rapids; sur. in progress, **03,** 2221.
R., BE., with recom. (see Projects). (Lt. Col. W. H. Heuer, Maj. W. L. Marshall, Maj. Edw. Burr, Capt. C. E. Gillette, Capt. C. H. McKinstry.) **R., 04,** 3475.

In charge:

Capt. C. F. Powell. **R., 82,** 2690.
Maj. T. H. Handbury, 1893.
Maj. J. C. Post, 1894–95. **R., 94,** 2664; **95,** 3589.
Capt. W. L. Fisk, 1896–98. **R., 96,** 3279; **97,** 3425; (Maj.) **98,** 2979.
Capt. W. W. Harts, 1898–1900. **R., 99,** 3221; **00,** 4322.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3491, 3501; **02,** 2376; (Maj.) **03,** 2221; **04,** 3473, 3475, 3486; **05,** 2458.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1990; **07,** 2171; **08,** 2248.
Maj. J. F. McIndoe, 1909. **R., 09,** 2214.
Maj. Jay J. Morrow, 1910–. **R., 10,** 2386; **11,** 2590; **12,** 2801.

Assistants:

Lt. E. Burr, **90,** 3044.
(Description of boat ry. and appliances), **94,** 2675.
O. R. Pihl. **R., 97,** 3427.

LEGAL PROCEEDINGS.

Condemnation proceedings to obtain right of way across certain lands; damages awarded, **96,** 3280.
Description of lands obtained by condemnation proceedings, purchase, etc.; damages awarded by new trials, **97,** 3426; **98,** 2980.
Title to some lands secured, **99,** 3221.
Agreement made by which the Oregon R. R.& Navigation Co. surrendered to the U. S. 72.58 acres for boat ry., U. S. to furnish the RR. Co. with 26.75 acres of other land, and to pay the actual cost of the relocation of the tracks of the ry., etc.; est. cost to U. S., $88,493.20. Not approv. at end of fiscal year 1900 by Sec. of War., **00,** 4322.
State land board secured titles to all land for site of canal, except one, to be acquired through condemnation, **04,** 3473.
Oregon app., 1903, $100,000 to acquire right of way for canal to be deeded to U. S. free of cost; total area of land conveyed to U. S., 479 acres, **05,** 2458, 2459.

OBSTRUCTIONS.

Complaints of steamboat men of obstr. in vicinity of Threemile Rapids; investigated and r. removal au., **10,** 944.

OPERATIONS.

1899–00. Repairs made to U. S. SS. *Cascades*, **00,** 4323.
1902–03. Field work, collecting data for proposed canal and locks, **03,** 2221.
1904–05. 19,417 c. y. r. removed from Threemile Rapids, **05,** 2458.
1905–06. 35,197 c. y. r. removed from Threemile Rapids; excavation for foundation of R. wall of lock begun and 3,973 c. y. concrete placed, **06,** 1990, 1991.
1906–07. 2,502 c. y. r. excavated at Threemile Rapids; 31,344 c. y. sand and r. excavated, 4,583 c. y. concrete and 2,520 c. y. riprap placed in lock constr., **07,** 2171–2172.
1907–08. 5,006 c. y. r. removed at Threemile Rapids; completed, 1908; total removed, 50,970 c. y. Work on lock, boat basin, and canal entrance continued, 24,669 c. y. sand, r., and gravel removed, and 14,746 c. y. concrete placed, **08,** 2248–2249.
1908–09. 20,093 c. y. r., sand, and gravel removed and 6,876 c. y. concrete placed in lock and canal constr.; under new contract for constr. of canal, over 2½ m. to w. of first contract, work was begun in Oct., 1908, 495,307 c. y. r., sand, and gravel having been excavated, **09,** 2215–2216.
1909–10. Work continued, under first contract, for constr. of canal entrance, basin, and upper lock, completing contract on May 11, 1910; tabulated list of work done by years, and totals, **10,** 2386. Under second contract for constr. of about 14,000′ of canal, 272,791 c. y. of r., sand, and gravel excavated, completing work except for enrocking embankments; 1,839 c. y. r. removed from Threemile Rapids, **10,** 2387–2388.

1910–11. Second contract for 14,000′ canal completed May 1, 1911; itemized statement of entire work given, **11,** 2591. 8,116 c. y. r. excavated from reefs and main shore of R. at Big Eddy by contract, **11,** 2591; over 435,680 c. y. excavated and 6,000 c. y. concrete placed by hired labor, **11,** 2592.

1911–12. 3,424 c. y. r. excavated from reef near Big Eddy, completing this work Mar. 30, 1912; over 500,000 c. y. excavated from canal by hired labor, and over 15,000 c. y. concrete placed; about 55% of approv. proj. completed, **12,** 1196, 2802.

PHYSICAL CHARACTERISTICS.

Description of, The Dalles, **82,** 2692, 2695.
Gauge readings, **82,** 2702.
R. slope, **82,** 2693.
Current velocities, **82,** 2704.
Description of, **94,** 2665.
In the 12 m. of R. covered by this imp. there is a otal fall of about 80′ at l. w. and 60′ at h. stages, **94,** 2666.
Details of, **01,** 3502.
Solid ice gorge bet. Celilo and Tenmile Rapids, **09,** 2216.

PRIVATE WORK.

Steps taken to build a private portage road by a number of persons, **99,** 3221.
Oregon app., 1903, $165,000 for building a portage road from Big Eddy to Celilo; road completed and opened to traffic June 3, 1905, **05,** 2459.

PROJECTS.

By Capt. Powell, 1882:
(1) To carry the Celilo level by a canal with a lock at upper end to a flight of locks near gauge station No. 4, **82,** 2697.
(2) With lift locks, as in (1), to dam the R., making the overfall into Big Eddy, **82,** 2697.
(3) Open R. imp. for all stages to Celilo Falls, and lockage at the falls, **82,** 2697.
(4) Open R. imp. for lower stages to Celilo Falls; lockage from low to mean h. w. at falls; open passage over falls for higher stages and lockage at Dalles Rapids, **82,** 2697.
Est., l.-w. proj. (1), (2), (3), $7,674,495; ests., h.-w. proj. (1), (2), $2,842,848, **82,** 2699, 2711.
By BE., 1889, removing boats from R. at foot of Dalles Rapids and returning them to R. at head of Celilo Falls by means of hydraulic lifts, one at each terminus, transporting them over the intermediate 8 m. on ry.; also imp. of Threemile Rapid; est., $3,576,356, with an. cost of $80,000 for mainten., **90,** 3042.
By minority of BE. of 1892 for imp. Threemile Rapids below lower terminus of ry., at est. of $170,000; and for constr. of boat ry. beginning at Big Eddy and terminating above Celilo Falls, 9 m. l., for passage of boats, 8 of 600 t. each in each direction in 12 hours, on s. side of Columbia R., ry. to be provided at each terminal with hydraulic lifts, etc., for raising and lowering boats from and to the tracks; est., $2,264,467 (incl. cost of Threemile Rapids imp.), **94,** 2675; **95,** 3590.
Those interested in navigation of the R. preferred a portage road instead of ry., **99,** 3222.
Photographs showing a few of the obstr. which the boat ry. was designed to surmount, **99,** 3222.
Repairs to U. S. boat au. at est. cost of $2,000, **00,** 4323.
Act June 13, 1902, au. constr. canal bet. foot of The Dalles Rapids and head of Celilo Falls, and for imp. of chan. in accordance with H. D. 228, 56th, 2d; est., $3,969,371, but act provides that ex. be made by BE. with view to reduction of cost, **02,** 547.
Sec. of War, Dec. 22, 1903, approv. proj. for removal of submerged rs. and reefs at Threemile Rapids, **04,** 3473.
By BE., 1903, for continuous canal 65′ w. on bottom and 8′ d., with locks, from Big Eddy to Celilo, and the R. imp. of Threemile Rapids, by removal of rs. and straightening and w. chan.; est., $4,125,000, approv. by Sec. of War, Nov. 6, 1903, **04,** 3473, 3476.
Act Mar. 3, 1905, au. expend. of funds app. in constr. of canal and locks at upper or Celilo end, and completion of about 2,500′ of canal, except lock gates and machinery; est., $373,675.50, **05,** 2459.
Col. Roessler of opinion that several radical changes desirable in adopted canal proj., the most important change being constr. of lock at Tenmile Rapids; est., $60,000, **07,** 2173.
Plans for modifying certain details in canal constr. approv. by Chief of Engineers, May 15, 1908. Heavy masonry walls in gravel and sand sections omitted, and replaced by levee embankments lined with concrete; also extra lock provided at Tenmile Rapids, **08,** 2250. Est. cost revised from $4,125,000 to $4,900,000, due to higher price of labor, **08,** 811.

SURVEYS.

Au. act Mar. 3, 1879, **80,** 242; made, 1880, by Maj. Gillespie and Capt. Powell, **82,** 2690.
Line of the RR. definitely located, **96,** 3280.
Ex. and sur. au. act June 6, 1900; made by Capt. Harts, 1900, foot of The Dalles Rapids to Celilo Falls with view to constr. of locks and dams; est., $4,000,000 (H. D. 228, 56th, 2d), **01,** 629, 3502, 3505.
Requested by BE. appointed by S. O. No. 19, July 5, 1902; sur. for continuous canal on Oregon side from above Celilo Falls to Fivemile Rapids in progress, **03,** 605, 2221.
By Maj. Langfitt and BE., for continuous canal bet. Celilo and Big Eddy; est., $4,121,331.46, **04,** 3486–91.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1197.

Maps. **95,** 3590; **05,** 2460; **12,** 2802. Of proposed canal and locks, **04,** 3474.

Part (o), WW-2 Columbia (Upper) and Snake Rivers, Oreg., Wash., and Idaho.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

C. importance of upper Columbia, **67,** 510, 511; **75,** ii, 789.
C. large and increasing, **68,** 875; **72,** 998; **79,** 1840.
Cascades a serious obstr. to navigation, **75,** ii, 772.
C. importance of Snake R., **78,** 1332.
Navigation on upper Columbia, **85,** 2445, 2448.
Important, **93,** 3377; **95,** 3392.
Importance of navigation bet. Riparia and Lewiston continually increasing, **97,** 3457.
In 1898 there was no navigation of importance to be benefited by an imp. of Snake R. from mouth to Riparia, and could be none until Dalles of Columbia R. were made navigable, **98,** 3017.
Will not increase until feasible plan is adopted for passing SS. around obstr. in Columbia R. bet. The Dalles and Celilo, **01,** 624.
Reviving, and competitive rates being estab., **08,** 808.
The Open River Trans. Co. placed in commission 2 SS. operating Lewiston to Celilo, exchanging cargoes with lower R. boats by means of the State Portage road, **09,** 846.
Oregon RR. & Navigation Co. abandoned operation of their line of boats in 1908, but, owing to competition, have again placed their boats in commission, **09,** 847.
Reestab. of water transportation bet. Portland and Lewiston has reduced freight rates 20%, **09,** 847.
The Open River Trans. Co. made reduction of 14% in freight rates; reduction met by rail lines, **10,** 941.

1911, 30,723 t., valued at $1,020,109; farm and mill machinery, grain, fruit, and general merchandise, **12,** 1191.

CONTRACTS.

Upper Columbia River:

1872. J. B. Montgomery, removal of r., **73,** 107, 1121, 1122. Contract extended, **73,** 1121.

1875. Grant & Stone, removal of r., **76,** ii, 637, 663. Contract extended, to cover addl. amount of r. excavation, **76,** ii, 664, **77,** 1041.

1876. J. B. Montgomery, removal of r., **77,** 1041. Contract extended, **77,** 1043. Grant & Stone removal of r., **77,** 1042.

Snake River:

1876. J. B. Montgomery, removal of r., **77,** 1046.

1877. Proposals invited by letter, without advertising, as per letter of au. from Chief of Engineers, **77,** 1041, 1046.

1878. G. J. Ainsworth, removal of r., **79,** 1789, 1842.

Columbia and Snake Rivers:

1880. G. J. Ainsworth, r. removal, $18 c. y., **80,** 2293. J. B. Montgomery, r. removal, $17 and $25 c. y., **81,** 2563.

1883. F. T. Dodge, r. removal, $12; gravel, $2 c. y., **83,** 2042.

1884. J. Kellogg & Co., wing-dam constr., **85,** 2438. Holmes & Spencer, r. removal, and S. R. Smith, r. removal, **85,** 2438.

1900. Informal contract for rubblest. for dike repairs, **00,** 4320.

1904. Joseph Supple, hull and house for dr., $12,065; Columbia Engineering Co., propelling machinery for dr., $11,290; Featherstone Foundry & Machine Co., machinery for dr., $9,400, **04,** 3472.

1906. Marine Iron Works, 1 steam capstan, $626, **06,** 1989.

1907. Joseph Supple, 3 scows, $9,825; Tatem & Bowen, 3 hoisting engines, $4,221; O. F. Graves, 1 gasoline launch, $2,285, **07,** 2170.

ENGINEERS.

Chief of Engineers:

Letter from Chief of Engineers to T. H. Canfield, director of the Northern Pacific RR. Co., **73,** 1122. **R., 66,** iii, 27; **68,** 73; **73,** 107; **74,** 117; **75,** 125; **76,** 115; **77,** 123; **78,** 138; **79,** 181, **80,** 238; **81,** 326; **82,** 320; **83,** 333; **84,** 337; **85,** 370; **86,** 359, 360; **87,** 332; **88,** 305; **89,** 363; **90,** 322; **91,** 405; **92,** 380; **93,** 438; **94,** 408; **95,** 448; **96,** 414; **97,** 518; **98,** 493, 503; **99,** 580; **00,** 652; **01,** 623; **02,** 544; **03,** 602, 2254; **04,** 663; **05,** 669; **06,** 743; **07,** 759; **08,** 807; **09,** 845; **10,** 939; **11,** 996; **12,** 1189.

In charge:

Maj. R. S. Williamson, 1866–71. **R., 66,** iv, 327; **68,** 874.

Maj. H. M. Robert, 1871–73. **R., 72,** 996; **73,** 1121; **74,** ii, 364.

Maj. N. Michler, 1873–75. **R., 74,** ii, 358; **75,** ii, 772; **76,** ii, 637.

Maj. J. M. Wilson, 1875–78. **R., 76,** ii, 662; **77,** 1036; **78,** 1330; **79,** 1789.

Maj. G. L. Gillespie, 1878–81. **R., 79,** 1839; **80,** 2289; **81,** 2558.

Capt. C. F. Powell, 1881–84. **R., 82,** 2660; **83,** 2040; **84,** 2229.

Maj. W. A. Jones, 1884–90. **R., 85,** 2437, 2445, 2452; **86,** 1949, 1953, 1970; **87,** 2520; **88,** 2188; **89,** 2583.

Capt. T. W. Symons, 1890–95. **R., 90,** 2981; **91,** 3210; **92,** 2709, 2721; **93,** 3375; **94,** 2590; **95,** 3391.

Capt. H. Taylor, 1895–96. **R., 96,** 3382; **97,** 3456.

Maj. W. L. Fisk, 1898–99. **R., 98,** 2977, 3013.

Capt. W. W. Harts, 1899–1900. **R., 99,** 3219; **00,** 4319.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3489; **02,** 2375; (Maj.) **03,** 2218, 2254; **04,** 3469; **05,** 2455.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 1985; **07,** 2168; **08,** 2244.

Maj. J. F. McIndoe, 1909. **R., 09,** 2211.

Maj. Jay J. Morrow, 1910–. **R., 10,** 2381; **11,** 2585; **12,** 2796.

Assistants:

Lt. W. H. Heuer. **R., 68,** 877; **69,** 478.

R. B. Randall, **75,** ii, 787; drowned, **75,** ii, 787.

R. A. Habersham. **R., 75,** ii, 790.

R. M. Tabor, **77,** 1043; **79,** 1840.

P. G. Eastwick. **R., 84,** 2232.

Lt. T. Symons. **R., 85,** 2445.

Lt. W. Young. **R., 86,** 1951.

E. T. Voigt. **R., 86,** 1954.

W. H. Wood. **R., 92,** 2712.

W. Cuthbert. **R., 92,** 2723.

J. M. Clapp. **R., 97,** 3458.

F. C. Schubert. **R., 03,** 2248.

ESTIMATES. (See Plans and Projects.)

By Lt. Heuer, removing obstr. in upper Columbia R., $100,000, **66,** iv, 330; $166,686, **69,** 476, 477. For dr., an., $6,000, **69,** 479.

By Maj. Williamson, removing isolated rs. in upper Columbia, Dalles to mouth of Snake R., $132,328, **68,** 74, 874.

By Maj. Robert, removing 1,200 c. y. r., $39,294.44, **72,** 996.

By Maj. Wilson, imp. of upper Columbia and Snake Rs., $132,000, **77,** 1045; **78,** 1332.

OPERATIONS.

Upper Columbia River:

1872-73. 1,213 c. y. r. removed; work done on John Day Rock and Umatilla Rapids, **73,** 107, 1121.

1873-74. 465 c. y. r. removed, **74,** 125.

1874-75. 350 c. y. r. removed; 9 dangerous rs. removed, **75,** 125, ii, 774, 776; **76,** ii, 638.

1875-76. 486 c. y. r. removed, **76,** 115, ii, 663, 664.

1876-77. 268 c. y. r. removed, **77,** 123, 1044.

1877-78. 147 c. y. r. removed, **78,** 1331.

Snake River:

1876-77. 477 c. y. r. removed from R. at Pine Tree Rapid, **77,** 123, 1044.

1878-79. 1,093 c. y. r. removed from Pine Tree, Fivemile, and Fish Hook Rapids, **79,** 1790, 1839–40.

Columbia and Snake Rivers:

1879-80. Rock removal, Monumental, Homly, and Umatilla Rapids, **80,** 2290, 2297.

1880-81. Rock removal, Monumental and Texas Rapids, **81,** 2558, 2560.

1881-82. Rock removal, Texas, Palouse, and False Palouse Rapids, **82,** 2660.

1883-84. Rock removal at Fivemile Rapids, **84,** 2230.

1884-85. Rock removal at Whites Ferry, Jim Fords Isld., and Fish Hook Rapids, **85,** 2437.

1885-86. 645 c. y. r. and gravel removed from rapids, **86,** 1949.

1886-87. Constr. of drilling scow, and r. removal by hired labor at Texas and Little Goose Rapids; constr. of sheer crib on Log Cabin Rapids; sur. of rapids, **87,** 2520, 2522.

1888-89. 2,385 c. y. r. removed, **89,** 2584.

1890-91. Constr. of drill scow and preparation of plant, **91,** 3211.

1891-92. 293 c. y. bedrock and bowlders removed from chan. bet. Riparia and Lewiston, **92,** 2710.

1892-93. Dikes in course of constr. at Wild Goose and Log Cabin Rapids, **93,** 3377.

1893-94. Work on Wild Goose Dike continued, **94,** 2592.

1896-97. Dikes at Wild Goose and Log Cabin Rapids completed and repaired, **97,** 3457.

1897-98. 666′ dike constr. at Wild Goose Rapids, **98,** 2977.

1899-00. U. S. plant repaired; about 1,000 c. y. rubblest. quarried for dike repairs; dike repairs in progress, **00,** 4320.

1903-04. Leased SS. *Norma*, equipped with harrowlike rake, operated for 35 days over gravel shoals, increasing d. from 3½ to 4½′; 945 t. r. placed in repairing dam at Log Cabin Rapids; crew, with leased SS. *Imnaha*, blasted and removed ledge r. and bowlders from chan.; SS. disabled, and party continued work from small boats; 3,000 t. r. re-

moved at Mt. Sheep Rapids, and 700 t. at Cottonwood Rocks; dr. under constr., **04,** 3469–3471.

1904–05. New dr. *Wallowa* placed in commission, 1904, and removed 2,500 c. y. gravel, **05,** 2455.

1905–06. Dr. *Wallowa* in raking gravel shoals and in dr. removed 2,646 c. y. gravel and 71 c. y. bowlders; repairing and extending bowlder dam at Log Cabin Rapids, **06,** 1985, 1986.

1906–07. Shoals raked on Snake R. bet. Lewiston and Riparia; 2,661 c. y. gravel dr. and 475 l. f. dams constr. by dr. *Wallowa*; 3 drill scows being constr. and equipped under funds app. by Washington, **07,** 2169.

1907–08. Dr. *Wallowa* raked gravel bars on Snake R. bet. Lewsiton and Riparia; 2 drill scows built and operated by Washington under app. by State, removed 3,593 c. y. ledge r. from various rapids, **08,** 2244.

1908–09. 1,585 t. st. placed in Slaughter House Dam, and 1,262 c. y. r. blasted from reefs by dr. *Wallowa*; 2,220 c. y. r. removed from rapids by drill scows operated under State app., **09,** 2211, 2212.

1909–10. 1,125 c. y. removed from rapids; 1,755 t. r. placed in dams, and 257 drags made over shoals by SS. *Wallowa* and *Umatilla* and drill scows, **10,** 2381, 2382.

1910–11. 4,198 c. y. r. removed, 4,514 t. st. placed in dams, wing dams built, and dikes repaired, **11,** 2586.

1911–12. 1,289 c. y. r. blasted, 115 t. r. placed in dams, 209 drags made with chan. rake, and repairs made to dr. *Wallowa*, **12,** 2796.

PHYSICAL CHARACTERISTICS.

H. and l. w., **66,** iv, 330; **75,** ii, 772; **76,** ii, 662.

Record of flood levels, **75,** ii, 791.

Cascades a series of rapids, with a fall of 37.3′ in 5¾ m., **75,** ii, 772.

Action of ice at Hell Gate, **75,** ii, 780, 788.

Rapids on upper Columbia, **76,** ii, 662.

Character of bed of R. at Homly Rapids, **76,** ii, 663.

Columbia R. above The Dalles a series of falls and rapids, **75,** ii, 772; **77,** 1037.

Snake R. a succession of rapids, **77,** 1039.

Description of, **80,** 2293; **84,** 2234.

Elevation of water surface, upper Columbia, **86;** 1958.

Current observations, upper Columbia, **86,** 1959. **87,** 2521.

Principal rapids, Celilo to Lewiston, with fall and slope, **91,** 3214.

Description of Snake R., mouth to Riparia, **98,** 3014.

Prior to imp. at Goose Isld. SS. ascending the stream had to be warped up, but beginning in 1898 this method of navigating the stream was dispensed with on account of the better conditions, **98,** 2978.

Tabulated list of shoals, rapids, and prominent bends, **98,** 3018; description of, in detail, **98,** 3019.

Detailed description of shoals, rapids, and prominent points in Snake R. from Lewiston, Idaho, to Riparia, Wash., **01,** 3537.

List of rapids and prominent points in Snake R. from Imnaha R. to Lewiston, Idaho, **03,** 2250.

R. subject to rises during spring and summer, varying from 9 to 26′, **05,** 670.

Of Snake R. from Pittsburg Landing to Imnaha R., as developed by sur. of 1905, **06,** 1986–1988.

Work done provides l. w. chan. bet. Lewiston and Riparia of about 40″, greatly imp. conditions, **09,** 846.

Max. drafts, mouth and Riparia 28″, Riparia and Assotin 40″, Asotin and Pittsburg Landing 24″, **12,** 1190.

PLANS. (See Estimates and Projects.)

By Maj. Williamson, removal of r. from upper Columbia, so largest boats could navigate at all times, **68,** 874.

By Maj. Michler, canal and locks around Celilo Falls, at head of The Dalles, 4,500′ l., with a rise of 36′. **75,** ii, 772.

By Maj. Jones, 1885, Priest Rapids, Columbia R. above Snake, removal of r.; est., $153,240, **86,** 1965.

PRIVATE WORK.

The Dalles-Celilo portage road completed by Oregon June 3, 1905, **05,** 670.

Under funds app. ($100,000) by Washington for imp. of Snake R., Riparia to mouth, 3 drill scows constr. and equipped for removal of r. and bowlders, **07,** 2169.

PROJECTS. (See Estimates and Plans.)

By Maj. Robert, upper Columbia, removal of obstr. (isolated r.) at John Day Rock, Devils Bend, and Umatilla Rapids; est., $39,294, **72,** 996.

By Maj. Robert, imp., Homly Rapids, **73,** 1121.

By Maj. Wilson, removal of 1,500 c. y. r. from chan., **77,** 1036, 1041, 1045.

By Maj. Wilson, Snake R., mouth to Lewiston, removal of 2,900 c. y. r., **77,** 1041, 1045.

Previous to adoption of proj. of 1877 efforts directed to removal of rs. at rapids on upper Columbia below mouth of Snake R., **77,** 1044; **80,** 2294. Proj. of 1877 proposed removal of r. at rapids to give chan. d. of 5½′ on Columbia and 4½′ on Snake R. bet. Celilo on former and Lewiston on the latter, 266 m.; est., $132,000, **77,** 1045; **82,** 2662; **86,** 359; **87,** 2520.

By Capt. Symons, 1892, dike constr. at Wild Goose Isld., Diamond Crossing, and Log Cabin Rapids, with removal of bowlders; est., $29,226, **92,** 2715.

By terms of act of 1892, the upper limit of work extended from Lewiston, Idaho, to Asotin, Wash., 7 m., **93,** 3376.

In 1898, Capt. Taylor est. $165,000 to further imp. Snake R., and that after completion of imp. $3,000 required every 2 years for mainten., **98,** 3017, 3018.

Act 1902 au. completing and maintaining imp. of Snake R., Riparia to Lewiston (H. D. 127, 56th, 2d), and $25,000 for imp., Lewiston to Pittsburg Landing, **02,** 545.

Approv. by Sec. of War, May 29, 1903, for imp. bet. Lewiston and mouth of Imnaha R.; est., $33,690; also incl. constr. of dr. to be paid from available funds, **03,** 603.

By Lt. Col. Roessler, imp. bet. Pittsburg Landing and mouth of Imnaha R.; est., $15,000, **06,** 1988.

Expend. of funds app. by Washington ($100,000) in imp. of Snake R. bet. Riparia and its mouth, by removal of bowlders, ledges, and gravel bars, **07,** 760.

Au. act Mar. 2, 1907, expend. of $400,000 over a series of years, in open R. work in Columbia R., bet. Celilo and mouth of Snake R., which proj. also incl. expend. of $25,000 app. by Washington for imp. of Umatilla Rapids (H. D. 440, 59th, 2d), **07,** 760.

Act June 25, 1910, au. $25,000 in open chan. work. bet. mouth and Pittsburg Landing, in accordance with "present" proj., and **R.,** printed, H. D. 411, 55th, 2d, **10,** 940.

SURVEYS.

By Maj. Williamson, 1867–68, **68,** 75. **R., 68,** 874.

Under direction of Maj. Williamson, by Lt. Heuer **R., 68,** 478.

Of Homly Rapids, by Maj. Michler, 1875, **76,** ii, 637.

Of chan. of upper Columbia, by Maj. Wilson, **76,** ii, 663.

Of upper Umatilla Rapids, by Maj. Wilson, **78,** 138.

Of Dalles of upper Columbia, au. act Mar. 3, 1879, assigned to Maj. Gillespie, **79,** 183.

Ex. of Snake R. by Maj. Michler, **76,** ii, 638. Sur. of, by Maj. Wilson, **77,** 1037.

Of Snake R. below Lewiston, **84,** 2230, 2232.

Of Snake R. above Lewiston. **82,** 2716.

Of Columbia R. above mouth of Snake, **85,** 2445; **86,** 1953.

Sur. of Columbia R. from international boundary line to head of Rock Isld. Rapids, made, 1892, by Capt. Symons, **92,** 2721.

Sur. of Snake R., mouth to Riparia, au. act June 3, 1896; made 1898, by Capt. Taylor (see Projects), **98,** 3013.

Ex. and sur. au. act June 6, 1900, of Snake R., head of navigation to Columbia R., made July-Sept., 1900, by Capt. Langfitt, Riparia up to Lewiston; est. for 5′ chan., $23,000, and $5,000 every 2 years for mainten. (H. D. 127, 56th, 2d), **01,** 3525–3526.

Sur. by Maj. Langfitt, 1902, of Snake R. from Lewiston to mouth of Imnaha R.; est., $33,690, **03,** 2246–2254.
Sur. by Lt. Col. Roessler, 1905, of Snake R., Pittsburg Landing to mouth of Imnaha R.; description of sur. incl., **06,** 1986.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1191.

Maps:
Pine Tree Rapids, **77,** 1043.
Pine Tree Rapids, Fivemile Rapids, and Fish Hook Rapids, on the Snake R., showing positions of rs. removed, **79,** 1842.
Monumental Rapids, **80,** 2296.
Pelouse Rapids, **81,** 2562; **82,** 2662.
Taxas Rapids, **81,** 2562.
False Palouse Rapids, **82,** 2662.
1st, 2d, 3d, 6th, and 7th rapids, **86,** 1964.
Cabinet Rapids, **86,** 1966.
Yakima Region, **86,** 1966.
Of Umatilla Upper Rapids, **78,** 1331.
Of Snake R., Riparia to Eureka, **04,** 3470.
Index map from Celilo to Pittsburg Landing, **06,** 1988.
Photographs of dr. *Wallowa*, **06,** 1986.

Part (p), WW-2 Columbia River and tributaries, above Celilo Falls to mouth of the Snake River, Oreg. and Wash.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

1907, 7,776 t.; value, $450,000; principally wheat, machinery, and general merchandise, **08,** 810.
2 SS. placed in commission bet. Celilo and Lewiston; rates reduced about 20%, **09,** 849.
Open River Transportation Co. made 14% reduction in rates; reduction met by rail lines, **10,** 943.
1911, 16,411 t.; value, $671,294; general merchandise, farm products, etc., **12,** 1193.

CONTRACTS.

1907. Joseph Supple, 3 scows, $9,825: Tatem & Bowen, 3 hoisting engines, $4,221; O. F. Graves, gasoline launch, $2,285, **08,** 2247–48.
1908. Willamette Iron & Steel Co., steamboat, $55,395, **08,** 2247–48.

ENGINEERS.

Chief of Engineers. R., 07, 759; **08,** 809; **09,** 848; **10,** 942; **11,** 999; **12,** 1192.

In charge:
Lt. Col. S. W. Roessler, 1907–08. **R., 07,** 2168; **08,** 2246.
Maj. J. F. McIndoe, 1909. **R., 09,** 2213.
Maj. Jay J. Morrow, 1910–. **R., 10,** 2383; **11,** 2588; **12,** 2798.

OPERATIONS.

1907-08. Light-draft SS. being constr.; drill scow constr. under app. by Washington, and removed from Umatilla Rapids 1,206 c. y. ledge r.; SS. *Wallowa* operated under above-mentioned app. raking gravel bars bet. Kennewick and Priest Rapids, **08,** 2246.
1908-09. SS. *Umatilla* completed and placed in commission Nov., 1908; 210 drags made at Biggs Rapids and 327 drags made and 1,614 t. bowlders removed from Homly Rapids by SS. *Umatilla;* drill scow *No. 1* removed from Umatilla Rapids 1,120 c. y. bowlders, **09,** 2213.
1909-10. 656 c. y. r. removed from Umatilla Rapids, and 276 drags made by SS. *Umatilla* and drill scow *No. 1*, **10,** 2383–84.
1910-11. 3,988 c. y. r. blasted, 1,335 drags made with chan. rake, 959 t. r. placed on dams; detailed summary given, **11,** 2589.
1911-12. Constr. of new dam begun at head of Isld. No. 5; 4,708 c. y. r. blasted, 1,539 t. r. placed in dams: 626 drags with chan. rake made, **12,** 2799–2800.
Proj. about 57% complete, **12,** 1193.

PHYSICAL CHARACTERISTICS.

This stretch of R. is 124 m. l., abounded by rapids and obstr., gravel shoals, bowlders, etc., **08,** 809.
R. in freshet during summer months; variation of water surface about 34′ above l. w., **11,** 1000.
Work accomplished resulted in imp. chan. through some of the most troublesome shoals, **12,** 1193.

PROJECTS.

Act Mar. 2, 1907, au. expend. of $400,000, over series of years, in open R. work in Columbia R. bet. Celilo Falls and mouth of Snake R., which proj. also includes expend. of $25,000 app. by Washington for imp. of Umatilla Rapids (H. D. 440, 59th, 2d), **07,** 760.

SURVEY.

Ex. and sur. au. act Mar. 3, 1905, Columbia R. bet. Celilo Falls and mouth of Snake R., Wash.; **Rs.** by Lt. Col. Roessler, Mar. 31, 1905, and Nov. 27, 1906; est., $400,000, with $30,000 for an. mainten. (H. D. 440, 59th, 2d), **07,** 768, 2169.

Part (q), WW-2 Columbia River, from mouth of Snake River to Wenatchee, Wash.

ENGINEERS.

Chief of Engineers. R., 10, 999; **11,** 1055; **12,** 1267.

In charge. Maj. C. W. Kutz, **12,** 1231.

SURVEY.

Ex. and sur. au. act Mar. 3, 1909. **Rs.** by Maj. Kutz, June 9, 1909, and July 11, 1911 (unfav.) (H. D. 693, 62d, 2d), **12,** 1267.

Part (r), WW-2 Columbia River (upper), Wash.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Description of, **93,** 3382.
1893, small signs of decrease, **93,** 3382.

ENGINEERS.

Chief of Engineers. **R., 89,** 364; **90,** 329; **91,** 406; **92,** 381; **93,** 439; **94,** 409; **95,** 449.

In charge:
Maj. W. A. Jones, 1888–90. **R., 90,** 3065, 3069.
Maj. T. H. Handbury, 1890–91. **R., 90,** 3066.
Capt. T. W. Symons, 1891–95. **R., 91,** 3223; **92,** 2716; **93,** 3378; **94,** 2593; **95,** 3393.

Assistants:
J. C. Ensign. **R., 90,** 3067.
J. G. Holcombe. **R., 91,** 3230; **92,** 2718.
Wm. Cuthbert. **R., 93,** 3391.

OPERATIONS.

1890-91. Rock removal begun at Priest and Cabinet Rapids; 15 ringbolts and 6 buoys placed at Priest Rapids, **91,** 3230.
1891-92. 12,199 c. y. r. blasted and removed at Cabinet Rapids, 1,894 c. y. r. removed at Rock Isld. Rapids, **92,** 2717.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 3069.
Description of, international boundary line to mouth of Okanogan R., **93,** 3381.
Volume of water; current velocities; slopes; numerous falls, rapids, and dangerous rs., **93,** 3384.
Some of obstr. can not be passed or made passable by any system of regulating, **93,** 3384.
List of obstr., **93,** 3384.
Table of distances, **93,** 3397.
List of bench marks, memorandum of falls and levels at l. w. stage, and rates of flow of water in most rapid places, upper Columbia R., **93,** 3398, 3399.

PLANS. (See Projects.)

By Maj. Jones, 1890, opening to navigation reach of R. incl. Priest, Cabinet, and Rock Isld. Rapids, by means of auxiliary water power; est., $138,000; with steam plant, est., $151,000, **90,** 3074, 3075.

PROJECTS. (See Plans.)

By Capt. Symons, 1890, Rock Isld., Cabinet, and Priest Rapids, removal of r. and putting in at all locations where they would be convenient iron posts and ringbolts to which ascending boats could make fast their lines and wind themselves up over the rapids with their steam capstans; est., $550,000, **91,** 3224–3225; **92,** 2716.
In 1893 Capt. Symons est. $18,025,000 to imp. the R., international boundary line to mouth of Okanogan R., **93,** 3390.

SURVEYS.

Sur. bet. Wallula and British line au. act Aug. 11, 1888; made, 1889, by Maj. Handbury, **90,** 3066.
Sur. from head of Rock Isld. Rapids to international boundary line, made, 1891, by Capt. Symons, **91,** 3232.
Sur. of Columbia R., international boundary line to Rock Isld. Rapids, au. act Sept. 19, 1890; **R.** by Capt. Symons, 1893, covering such a sur. to mouth of Okanogan R. only (see Projects), **93,** 3381.

Maps. **92,** 124, 125, 126, 127, 128, 129.

Part (s), WW-2 Columbia River, Rock Island Rapids to Foster Creek Rapids, Wash.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

This portion of the R. is a waterway of considerable importance in connection with the transcontinental RR. line known as the Great Northern, **95,** 3534.

ENGINEERS.

Chief of Engineers. **R., 95,** 450, 460; **96,** 413; **97,** 517.

In charge:
Capt. T. W. Symons, 1895. **R., 95,** 3395, 3534.
Capt. H. Taylor, 1896–97. **R., 96,** 3380; **97,** 3455.

Assistants:
C. F. B. Haskell. **R., 95,** 3537.
P. G. Eastwick. **R., 95,** 3397.

OPERATIONS.

1895-96. 4,055 c. y. r. removed, **95,** 3398.
1896-97. Boom to aid in lining up constr., **96,** 3381.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3395, 3534.
This part of the R. is 80 m. l., and flows through a d. canyon having an average fall of 2.2′ per m. In 1895 the difficulties in the way of navigation were swift currents, known and unknown rs., and rapids, **95,** 3395.
List of bench marks estab., table showing distances of prominent places from the international boundary, from mouth of Columbia R., and elsewhere, and list of obstr. in the R., **95,** 3542, 3543.

PROJECTS.

By Capt. Symons, 1895, removal of obstr. rs. at Rocky Reach, Methow Rapids, and where found necessary; and for proper apparatus for lining up of boats where necessary, **95,** 3396.
In 1895 Capt. Symons est. $19,987 to imp. this part of the R., **95,** 3537.

SURVEYS.

Sur. Rock Isld. Rapids to Okanogan R. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3534.
List of bench marks, **95,** 3542.

Maps. **95,** 3542.

Part (t), WW-2 Columbia River, between Wenatchee and Bridgeport, Wash.

APPROPRIATIONS. (See p. 1619.)

ENGINEERS.

Chief of Engineers. **R., 07,** 798; **08,** 846; **09,** 888; **10,** 991; **11,** 1048; **12,** 1258.

In charge:
Maj. H. M. Chittenden, 1907–08. **R., 07,** 2226; **08,** 2305.
Maj. C. W. Kutz, 1909–11. **R., 09,** 2261; **10,** 2433; **11,** 2640.
Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2862.

Assistant. Eugene Ricksecker. **R., 08,** 2305.

OPERATIONS.

1907–08. 18,277 c. y. r. removed at Methow Rapids, **08,** 2305.
1908–09. 5,500 s. f. drilled at Chelan Rock., **09,** 2261.
1909–10. Chelan Rock broken up by blasting, but not removed owing to h. w., **10,** 2433.
1910–11. 15,080 c. y. dr. from chan. at Eutiat Rapids; rs. removed by blasting; obstr. removed at Rocky Reach, **11,** 2640.
1911–12. 44,982 c. y. removed at Eutiat Rapids, **12,** 2862.

PHYSICAL CHARACTERISTICS.

Stretch of R. bet. Wenatchee and Bridgeport, Wash., about 80 m. in l.; chan. occupied by swift currents, rs., and reefs, **07,** 798.
Variation in water surface about 20′, **09,** 888.
Completed chan. is 3,000′ l., 150′ w., and 5′ d., **12,** 2862.

PROJECT.

Act Mar. 2, 1907, au. imp. bet. Wenatchee and Bridgeport by removal of rs. and bowlders, and constr. of dikes and wing dams; est., $42,000 (H. D. 440, 59th, 2d), **07,** 798.

SURVEY.

Sur. au. act Mar. 3, 1905, of Columbia R. bet. Wenatchee and Bridgeport, Wash.; **R.** by 1st Lt. F. A. Pope, Nov. 16, 1905; est., $42,000 (H. D. 440, 59th, 2d), **07,** 801.

Part (u), WW-2 Columbia River, between Bridgeport and Kettle Falls, Wash.

APPROPRIATIONS. (See p. 1619.)

COMMERCE.

Proposed imp. intended to provide an outlet for traffic from territory not "now" reached by RR. will materially reduce cost of transportation, **10,** 992.

ENGINEERS.

Chief of Engineers. **R., 07,** 801; **10,** 992; **11,** 1049; **12,** 1259.

In charge:
Maj. H. M. Chittenden, **07,** 780.
Maj. C. W. Kutz, 1910–11. **R., 10,** 2434; **11,** 2640.
Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2863.

Assistant. H. J. M. Baker, **R., 11,** 2641.

OPERATIONS.

1910–11. 3 rs. removed at Foster Creek Rapids, **11,** 2641.
1911–12. Str. *Yakima* received from State, repaired; 1,670 c. y. r. removed at various localities, **12,** 2863.

PHYSICAL CHARACTERISTICS.

R. 162 m. l. at this sec., navigable at certain stages; chief obstr. are rapids caused by immense bowlders and ledges of solid r., **10,** 992.

PRIVATE WORK.

Washington turned over a stern-wheel SS. for use on this work, **11,** 2640.

PROJECT.

Act June 25, 1910, au. removal of rs. and bowlders to 7′; est., $100,000 (H. D. 440, 59th, 2d), **10,** 992.

SURVEYS.

Pre. ex. au. act Mar. 3, 1905, Wenatchee to Kettle Falls, Wash. **R.** by Maj. John Millis, June 26, 1905; sur. recom. but not made (H. D. 440, 59th, 2d), **07,** 801.
R. of sur. of Columbia R. bet. Bridgeport and Kettle Falls, in response to resol. of Committee on Rivers and Harbors of H. of R. (H. D. 16, 60th, 2d), **10,** 992.
Ex. of Grand or Rickey Rapids by dept. au.; est., for imp., $48,000, **11,** 2641.

Part (v), WW-2 Columbia River, Clarks Fork.

ENGINEERS.

Chief of Engineers. **R., 91,** 409.

In charge. Capt. T. W. Symons. **R., 91,** 3250.

Assistant. Wm. Cuthbert. **R., 91,** 3254.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3250.

SURVEYS.

Ex., international boundary line to mouth of Big Blackfoot R., au. act Sept. 19, 1890; made, 1891, by Capt. Symons (**R.** unfav.), **91,** 3250.

WW-3(a) YOUNGS, LEWIS AND CLARK, AND SKIPANON RIVERS, OREG.

ENGINEERS.

Chief of Engineers. **R., 81,** 332; **82,** 324.

In charge. Capt. C. F. Powell. **R., 82,** 2714.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 2714.

PLANS.

By Capt. Powell, 1881, to extend navigation on Youngs, and Lewis and Clark Rs., to give 6′ at l. w. to the head of tide, and to remove snags in the Skipanon; est., $20,500, **82,** 2715, 2716.

SURVEY.

Au. act Mar. 3, 1881; made, 1882, by Capt. Powell, **82,** 2714.

WW-4(a) YOUNGS BAY CHANNEL, OREG.

ENGINEERS.

Chief of Engineers. **R., 91,** 420, 3376.

In charge. Maj. T. H. Handbury, 1891. **R., 91,** 3377.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3377.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Maj. Handbury (**R.** unfav.), **91,** 3377.

WW-5 LEWIS AND CLARK RIVER, OREG.

ENGINEERS.

Chief of Engineers. **R., 91,** 421.

In charge. Maj. T. H. Handbury, 1890–91. **R., 91,** 3383, 3384.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3383.

PLANS.

By Maj. Handbury, 1891, removing sand bars, snags, and logs; est., $1,200, **91,** 3385.

SURVEY.

Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Handbury, **91,** 3385.

WW-6(a) YOUNGS AND KLASKUINE (KLASKANINE) RIVERS, OREG.

APPROPRIATIONS.

1890, $1,600, **91,** 3372.

ENGINEERS.

Chief of Engineers. **R., 89,** 358; **90,** 324; **91,** 419; **92,** 393; **93,** 456; **94,** 418; **95,** 466; **96,** 405.

In charge:
Capt. W. Young, 1889. **R., 90,** 2989, 2991.
Maj. T. H. Handbury, 1891–93. **R., 91,** 3371; **92,** 2839; **93,** 3527.
Maj. J. C. Post, 1894–95. **R., 94,** 2663; **95,** 3595.
Capt. W. L. Fisk, 1895. **R., 96,** 3283.

Assistant. J. S. Polhemus. **R., 90,** 2992.

OPERATIONS.

1890-91. 61 snags and logs cleared from chan., **91,** 3372.

PHYSICAL CHARACTERISTICS.

Description of, **90,** 2992.

PLANS.

By Capt. Young, 1889, removal of snags, logs, and similar obstr. from Youngs and Klaskanine Rs.; est., $1,650, **90,** 2993.

SURVEY.

Sur. au. act Aug. 11, 1888; made, 1889, by Capt. Young (see Plans), **90,** 2992.

WW-20 CLATSKANIE RIVER, OREG.

APPROPRIATIONS.

1899, $13,000, **99,** 3247.
1910, 5,200, **10,** 2411.
1912, 1,000, **12,** 2831.

Total, 19,200 (less $324.53 reverted to surplus fund, $18,875.47, **12,** 2831).

COMMERCE.

Description of, **95,** 3597; **98,** 3050.
Value in 1893 est. at $500,000, **95,** 3598.
1901, 51,967 t.; 1906, 10,000 t.; 1911, 38,942 t., **12,** 1222.
Stream extensively used for logging purposes; there are fine forests of fir, hemlock, spruce, and cedar along its banks; R. rates lower than RR., **12,** 1222.

CONTRACTS.

1901. Robert Wakefield, dr., 14¢ c. y., **01,** 637, 3571.

ENGINEERS.

Chief of Engineers. R., 95, 467; **98,** 510; **99,** 595; **00,** 672; **01,** 637, 640; **02,** 558; **03,** 616; **04,** 681; **05,** 687; **06,** 760, 765; **07,** 775; **08,** 825; **09,** 865; **10,** 961, 968; **11,** 1019: **12,** 1221.

In charge:
Maj. J. C. Post, 1895. **R., 95,** 3596.
Maj. W. L. Fisk, 1898–99. **R., 98,** 3049; **99,** 3247.
Capt. W. C. Langfitt, 1899.
Capt. W. W. Harts, 1899–1900. **R., 00,** 4363.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3571; **02,** 2403; (Maj.) **03,** 2318; **04,** 3554; **05,** 2492.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2017; **07,** 2203; **08,** 2274.
Maj. J. F. McIndoe, 1909–. **R., 09,** 2239; **10,** 2411; **11,** 2616; **12,** 2831.

Assistant. Capt. Arthur Williams, **11,** 1007.

LEGAL PROCEEDINGS.

Negotiations to acquire title to necessary land, **00,** 4363; acquired through Dept. of Justice, **01,** 3571.
Deeds executed by city of Clatskanie turning over to U. S. SS. chan. dr. by city, in accordance with permit granted them, 1904, **05,** 2492.
Chan. dr. in 1910 by the Columbia Agricultural Co., deeded to U. S., 1910, **11,** 2616.

OPERATIONS.

1901–02. 55,864 c. y. removed, completing proj. of 1899, **02,** 558, 2403.
1907–08. Chan. snagged bet. Clatskanie and mouth and 5,200 c. y. removed from shoal below Clatskanie, **08,** 2274.
1910–11. 27,261 c. y. dr. from Clatskanie to RR. br., to 6′ at l. w.; bulkhead constr. at Chinaman Bend; 31 snags removed from chan., **11,** 2616.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3597.
R. rises in the Nehalem Mts. and enters Columbia R. 70 m. below city of Portland. The principal obstr. up to Clatskanie City, 1895, were the abrupt bends in the chan. and the varying d. of from 2 to 6′ at l. w. The distance from mouth to Clatskanie is 3 m., and w. to there about 50 to 60′. **95,** 3597.
Dr., 1901–02, increased d. 2′ and shortened distance to Clatskanie about 4,500′, **02,** 2403.
Chan. excavated by city of Clatskanie across bend at Beaver Slough effects a saving of 2 m., **05,** 2492.
Backwater of Columbia R. during freshet times raises R. to max. h. of about 10′, **11,** 1019.
Slight shoaling near head of navigation, **12,** 2831.
6′ draft at l. w. can be carried, **12,** 1222.

PRIVATE WORK. (See Legal proceedings.)

SS. chan. excavated across bend in Beaver Slough by city of Clatskanie; completed chan. to become property of U. S., **05,** 2492.
Cut dr. across sharp bend in R. near mouth by Columbia Agricultural Co., under provision that chan. should be 6′ x 40′ x 1,000′ m. l. w.; land and chan. to be deeded to the U. S., **09,** 2239; completed, **10,** 2411; Columbia Agricultural Co. dr. chan. from mouth to below RR. br.; **11,** 2616.

PROJECTS.

By Capt. Fisk, 1897, cutting short chan. across a bend immediately below Manzanillo and another through the bend above this point to the first bend below the town of Clatskanie, and dr. immediately below the latter point; est., $13,000, **98,** 3049; **99,** 3247.
Est., 1900, R. could be kept in good navigable condition with $1,500 an., **00,** 4363.
Act June 25, 1910, au. dr. chan. 6′ x 40′, Clatskanie to RR. br., and for mainten. of same: est., $4,200, and $1,000 an. for mainten. (H. D. 633, 61st, 2d), **10,** 961.
Act July 25, 1912, au. combined dr. and snag boat, cost $55,000 for use in connection with imp. of Cowlitz, Lewis, and Clatskanie Rs. (H. D. 28, 62d, 1st), **12,** 1223, 1228.

SURVEYS.

Ex., mouth to Clatskanie, au. act Aug. 17, 1894, made, 1895, by Maj. Post (**R.** fav.), **95,** 3596.
Sur. of same locality au. act June 3, 1896, made, 1897, by Capt. Fisk (**R.** fav.; see Projects), **98,** 3049.
Ex. au. act Mar. 3, 1905, made, 1905, by Maj. Langfitt (**R.** unfav.) (H. D. 134, 59th, 1st), **06,** 765.
Au. act Mar. 3, 1909, made, 1909, by Maj. McIndoe; est., $4,200, and $1,000 an. for mainten. (H. D. 633 61st, 2d), **10,** 968.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1222.

WW-26 SCAPPOOSE BAY AND CREEK, OREG.

COMMERCE.

Extensive traffic in lumber. (See Physical characteristics), **98,** 3044.

ENGINEERS.

Chief of Engineers. R., 98, 509.

In charge. Maj. W. L. Fisk, 1896–98. **R., 98,** 3043.

PHYSICAL CHARACTERISTICS.

Description of. Locality open to light-draft R. SS., 1898. B. a mouth of one of lesser tributaries of the Columbia R. in nw. Oregon. **98,** 3043.

SURVEYS.

Ex. of B. from mouth to and incl. the lower part of the creek au. act June 3, 1899; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 3043.

WW-30 WILLAMETTE RIVER.

NOTE.—Imp. of this waterway bound up, in some measure, with imp. of the Columbia, into which it flows.

Part.	Title.	Period.	Appropriations.
a	Willamette R. below Portland	See p. 1616 of this Index.	
b	Willamette R. above Portland; Yamhill, and Long Tom Rs	1870–1912	$780,500.00
c	Willamette R., Clackamas Rapids, Ross Isld., and Corvallis City	1890–1892	
d	Willamette R., Willamette Falls	1909–1912	300,000.00
e	Willamette R. above Oregon City	1892–1893	
	Total (See also p. 1616 et seq. of this Index)		1,080,500.00

Part (a), WW-30 Willamette River and Columbia River—See p. 1616.

Part (b), WW-30 Willamette River above Portland, and Yamhill and Long Tom Rivers, Oreg.

(See pp. 1647 and 1648 of this Index.)

APPROPRIATIONS.

1871,	$16,000, **71,** 97.
1873,	3,000, **73,** 107.
1874,	7,500, **74,** 117.
1875,	[1] 25,000, **75,** 168, ii, 765; **76,** ii, 658.
1876,	20,000, **76,** 115, ii, 660; **77,** 123.
1878,	20,000, **78,** 138, 1330.
1879,	12,000, **79,** 181, 1834.
1880,	[2] 12,000, **80,** 2277.
1881,	[2] 15,000, **81,** 2555.
1882,	[2] 5,000, **82,** 2658.
1884,	10,000, **84,** 2227.
1886,	10,000, **86,** 1941.
1888,	29,000, **88,** 2188.
1890,	11,000, **90,** 3063.
1892,	[2] 30,000, **92,** 2837.
1894,	[2] 23,000, **95,** 3593.
1896,	[2] 40,000, **96,** 3283.
1897,	[2] 160,000, **97,** 3431.
1900,	5,000, **01,** 3554.
1902,	68,000, **02,** 2389.
1904,	12,000, **04,** 3527.
1905,	50,000, **05,** 2472.
1907,	60,000, **07,** 2187.
1909	20,000, **09,** 2228.
	5,000, **10,** 2399.
1910,	60,000, **10,** 2399.
1911,	20,000, **11,** 2602.
1912,	32,000, **12,** 2813.
Total,	780,500

COMMERCE.

Rapid increase of, **75,** ii, 770; **77,** 1035.

Benefit of imp. to, **79,** 1833.

Obstr. to navigation from br. at Portland, **81,** 2553; **82,** 2656.

List of vessels on the Willamette route, **84,** 2229.

Description of traffic through Willamette Falls Canal, 1899. C. through this region in the future would probably be great, **00,** 4373, 4379.

In Willamette R. above Portland in 1900, 182,458 t. and 47,324 passengers, **01,** 632; in 1904, 332,130 t. and 65,947 passengers, **05,** 2473; in 1907, 412,846 t. and 41,998 passengers, **08,** 618; in 1911, 875,740 t., and 25,282 passengers carried by 26 R. steamers, **12,** 2814.

Farm products raised on rich lands adjacent to R. and logs and timber from near-by forests make up the C., **08,** 618.

Albany one of the principal shipping points for grain, hops, and produce, **04,** 3566.

CONTRACTS.

1872. J. Paquet, wing dams, **72,** 985.

1875. Peter & F. X. Paquet, wing dams and removal of r., **76,** ii, 658.

1877. Peter & F. X. Paquet, wing dams and r. removal, **77,** 1036. Grant & Stone, wing dams, **77,** 1036; **78,** 1330.

1878. J. Paquet, removal of r., **79,** 1834.

1881. J. Paquet, r. removal, $7.40 c. y., **81,** 2553, 2556.

1896. Honnes & Nelson, snag boat, $4,850, **97,** 3432.

1898. Normille & Fastabend and McGregor, lock and dam constr., Yamhill R., earth excavation, r. excavation, piles, lumber, concrete, st., brush, $59,918, **98,** 3028.

1903. B. C. Miles, 2,500 c. y. r. delivered on bank of Willamette R., $2.25 c. y., **03,** 2260.

1904. Featherstone Foundry & Machine Co., dr. machinery for 1 dr., $12,850; Joseph Supple, constr. and delivering boat (hull and house for dr.), $6,350, **04,** 3528.

1905. Joseph Supple, reconstr. snag boat, $9,200, **06,** 2004.

1908. Joseph Paquet, constr. fish ladder, $1,325, **09,** 2228.

DOCUMENTS. (Not published in reports.)

Maj. Williamson's **R.** of Dec. 12, 1870, **71,** 901.

ENGINEERS.

Chief of Engineers. R., 70, 32, 84; **71,** 97; **72,** 96; **73,** 107; **74,** 117; **75,** 125; **76,** 115; **77,** 122; **78,** 137; **79,** 181; **80,** 238; **81,** 326; **82,** 319; **83,** 332; **84,** 336; **85,** 369; **86,** 358; **87,** 331; **88,** 305; **89,** 363; **90,** 328; **91,** 417; **92,** 391; **93,** 455; **94,** 417; **95,** 465, 468; **96,** 404, 406; **97,** 506; **98,** 504, 505, 510; **99,** 591, 599; **00,** 667, 675; **01,** 631; **02,** 552; **03,** 609; **04,** 672, 686; **05,** 678; **06,** 752; **07,** 768; **08,** 818; **09,** 856; **10,** 951; **11,** 1007, 1026; **12,** 1206.

Boards:

Board convened, Portland, Oreg., Sept. 18, 1899, under S. O. No. 34, dated June 19, 1899, to consider and report upon advisability of acquiring canal and locks at Willamette Falls. **R., 00,** 4374. (Maj. W. H. Heuer, Capts. W. C. Langfitt and W. W. Harts.)

Pre. ex. opposite Albany. **R., 04,** 3567. (See Surveys.)

[1] Called $7,500, **75,** 125, ii, 770.

[2] Willamette and Yamhill Rs.

Pre. ex. bet. Portland and Oregon City. **R., 04,** 3561. (See Surveys.)

Report of board relative to imp. of canal and locks at Willamette Falls would not injure operations of mfg. enterprises (H. D. 99, 58th, 3d). (Maj. John Millis, Capt. W. C. Langfitt, and 1st Lt. R. P. Johnston), **05,** 2497.

B.E.R.H. concurs in recom. of local officer, but reduce an. est. of $60,000 to $40,000, to be applied as conditions of R. indicate to be most advisable, **11,** 1026. (See H. D. 13, 62d, 1st.)

In charge:

Maj. R. S. Williamson, 1870–71; **70,** 84. **R., 71,** 905.

Maj. H. M. Robert, 1871–73. **R., 71,** 901; **72,** 984; **73,** 1119; **74,** ii, 363.

Maj. N. Michler, 1873–75. **R., 74,** ii, 357; **75,** ii, 760; **76,** ii, 634.

Maj. J. M. Wilson, 1875–78. **R., 76,** ii, 654, 661; **77,** 1026; **78,** 1325; **79,** 1788.

Maj. G. L. Gillespie, 1878–81. **R., 79,** 1831; **80,** 2275; **81,** 2553.

Capt. C. F. Powell, 1881–84. **R., 82,** 2654; **83,** 2038; **84,** 2226.

Maj. W. A. Jones, 1884–90. **R., 85,** 2424; **86,** 1940; **87,** 2517, 2518; **88,** 2187; **89,** 2576, 2579.

Maj. T. H. Handbury, 1890–93. **R., 90,** 3061; **91,** 3368; **92,** 2835; **93,** 3522.

Maj. J. C. Post, 1894–95. **R., 94,** 2659; **95,** 3591.

Capt. W. L. Fisk, 1896–99. **R., 96,** 3281, 3309; **97,** 3429; (Maj.) **98,** 3025, 3051; **99,** 3234.

Capt. W. C. Langfitt, 1899.

Capt. W. W. Harts, 1899–1900. **R., 00,** 4347, 4368, 4374.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3550; **02,** 2388; (Maj.) **03,** 2257; **04,** 3526, 3559, 3565; **05,** 2469.

Lt. Col. S. W. Roessler, 1906–09. **R., 06,** 2001; **07,** 2185; **08,** 2259; **09,** 2225.

Maj. J. F. McIndoe, 1910–. **R., 10,** 2397; **11,** 2599; **12,** 2811.

Assistants:

Lt. W. H. Heuer. **R., 70,** 905.

R. A. Habersham, **75,** ii, 768; **76,** ii, 634; **78,** 1329. **R., 79,** 1834; **80,** 2278; **81,** 2556; **82,** 2659.

J. H. Cunningham. **R., 96,** 3314.

D. B. Ogden. **R., 98,** 3029.

ESTIMATES. (See Estimates and Projects.)

By Lt. Heuer, imp. of R. by wing dams, etc., $16,000, **71,** 909.

By Maj. Wilson, cut-off and wing dams, $39,600, **76,** ii, 656. Cut-off and wing dams, r. removal, and repairs, $80,000, **77,** 1035; **78,** 1329.

By Maj. Gillespie, an. dr. and repairs, $17,500, **79,** 1833.

LEGAL PROCEEDINGS.

U. S. atty. for Oregon of opinion, in relation to the Willamette Falls Water Power Co.'s rights, that private ownership below ordinary h. w. and all water rights are held subject to the rights of U. S. for benefit of navigation, **00,** 4377, 4407.

U. S. atty. of opinion that U. S. has absolute right to entire flow of waters of this R. Congress could legally au. constr. of locks and other structures at Willamette Falls, bet. h. and l. w. mark, and riparian owners would have no remedy as against the U. S. for any injury sustained (H. D. 99, 58th, 3d), **05,** 2503.

LEGISLATION.

Acts of State of Oregon relating to the constr. of canal and locks at Willamette Falls, **00,** 4412.

Act June 13, 1902, au. the Sec. of War to ascertain through B.E., or otherwise, and report to the House whether acquisition of "present" canal and locks at Willamette Falls, or constr. of new canal and locks by U. S. would, by withdrawing waters from said R., injure operations of the mfg. enterprises now in operation or contemplated; also to ascertain through Dept. of Justice or otherwise, whether the Portland General Electric Light Co., by virtue of their ownership of certain real property at Willamette Falls, has a legal right and title, as against the U. S., for continued use of waters of Willamette Falls in the Willamette R. for use of mfg. enterprises located on their property, whether such water is needed for navigation or not, what method would be necessary for U. S. to acquire title to such water for purposes of navigation and the measure of damage it must pay to such company, **04,** 674.

OBSTRUCTIONS. (See Commerce.)

Willamette R. is more or less obstr. by snags, **02,** 553.

List of obtsr. bet. Portland and Oregon City, **04,** 3560.

OPERATIONS.

1852. 450 l. f. wing dams built, **76,** ii, 657.

1871–72. 39 snags removed; scraper and snag boat built, **72,** 985.

1872–73. 2,000 l. f. wing dams built and 222 snags removed, **73,** 1119.

1873–74. 360 l. f. wing dams built and 471 snags removed by blasting, **74,** 117, ii, 358, 363.

1874–75. 900 snags removed and overhanging trees cut, **75,** 125, ii, 760.

1875–76. 1,530 l. f. wing dams built; 12¼ c. y. r. and 707 snags removed, **76,** 115, ii, 635, 658.

1876–77. New snag boat and 4,732 l. f. wing dams built; 71½ c. y. r. and 901 snags removed; **77,** 122, 1033, 1034.

1877–78. 100 overhanging trees cut, 3,840 l. f. wing dams built, and 1,031 snags removed, **78,** 137, 1326, 1327.

1878–79. Snag boat repaired; 282 c. y. r. and 753 snags removed, **79,** 1831, 1832.

1879–80. 586 snags removed, 700 l. f. temporary wing dams built, and scraping on 6 bars, **80,** 2275, 2278, 2288.

1880–81. 1,021 snags removed, 600 l. f. wing dams built, scraping on bars, and 497 c. y. r. removed by blasting on Rock Isld. Rapids, **81,** 326, 2553, 2557.

1881–82. 524 snags removed; scraping on bars, **82,** 2655, 2659.

1882–83. 913 snags removed, scraping on bars, and bank protection placed, **83,** 2038.

1883–84. 43 snags removed, **84,** 2226.

1884–85. 1,332 snags removed, **85,** 2425.

1885–86. 1,192 snags removed and 200 l. f. wing dams built, **86,** 1940.

1886–87. 100 l. f. wing dams built and 396 snags removed, **87,** 2517.

1888–89. 2,364 l. f. of pile dike built; 1,676 l. f. of bank revetted; 6,720 c. y. of bank excavated and 810 piles driven; 825 snags removed, **89,** 2578.

1889–90. Snagging operations continued, **90,** 3062.

1890–91. 35 snags and 20 overhanging trees removed, **91,** 3368.

1891–92. 577 snags removed, **92,** 2836.

1892–93. About 1,300 logs and other obstr. removed, and dams aggregating 635 l. f. in l. built, **93,** 3523.

1893–94. Over 1,500 snags and other obstr. removed, and dikes aggregating 1,162 l. f. in l. built, **94,** 2660.

1894–95. 4,300 l. f. revet. work constr., and over 1,000 snags, etc., removed, **95,** 3592.

1895–96. Nearly 1,000 snags, etc., removed, **96,** 3282.

1896–97. New snag boat purchased, over 1,000 snags, etc., removed, and over 800 l. f. dikes constr. and repaired, **97,** 3430–3431.

1897–98. Over 1,200 snags, etc., removed, **98,** 3030; and 8,378 l. f. dams constr., **98,** 3031.

1898–99. Over 4,000 snags, etc., removed; 6,530 l. f. dams constr. (photographs), **99,** 3235.

1899–00. Over 3,000 snags, etc., removed; 1,707 c. y. hardpan blasted and scraped from the chan.; 4,783 l. f. dams constr., **00,** 4348.

1900–01. Repairs to dams, constr. temporary wing dams, 254 snags and trees removed, and 100 c. y. hardpan blasted from Yamhill and Willamette Rs.; lock and dam in Yamhill R. completed and placed under operation and care, **01,** 3550. Lock officially opened to navigation Sept. 24, 1900, **01,** 3552.

1901–02. Snagging and drift removal was done near Corvallis and a number of troublesome snags and overhanging trees removed by blasting and

cutting from Yamhill R. bet. Dayton and McMinnville, **02,** 2388.

1902–03. Repairs to dams and dikes and to Corvallis revet.; new dams constr. at Candiani Bar, Five Islds., and at the head of Lamberts Slough; 2,026 snags removed, **03,** 2258–2259. Gravel bar at mouth of Yamhill R. scraped and snags and trees removed from chan. bet. mouth and McMinnville, **03,** 2259.

1903–04. Sec. of bank revet. near Independence completed; repairs made to dams heretofore constr.; and gravel bars in mouth of Yamhill R. scraped with teams, **04,** 3526.

1904–05. Repairs made to existing dams; work begun on unfinished portion of Independence revet.; snagging and dr. in Willamette R.; 862 snags removed by snag boat *Mathloma,* and 22,581 c. y. dr. by dipper dr. *No. 2;* pile-driver plant repaired, and cut 800′ l. to l. w. d. of 4′ dr. through shoal at mouth of Yamhill R., **05,** 2470–2471.

1905–06. 33,494 c. y. dr. bet. Salem and Portland in Willamette R., blasting and snagging done, extension of Independence revet. completed, dams at various points repaired, and dr. done at mouth of Yamhill R., **06,** 2002–2003.

1906–07. 36,159 c. y. gravel dr. from various points in upper Willamette R., 1,175 snags and trees removed from R. by snag boat *Mathloma* as far up as Corvallis and Harrisburg, and 65 c. y. r. removed from chan.; pile driver with repair crew constr. temporary dams at head of Clackamas Rapids and at Carey Bend, and repaired and extended existing dams at various points; repairs to Independence revet. begun, **07,** 2186.

1907–08. 29,472 c. y. dr. from shoal gravel bars and 2,475 c. y. gravel removed by shovel and team; 877 snags removed by snag boat *Mathloma* and 19 removed by blasting; 651 trees cut from bank; 5,743 c. y. gravel dr. at Wheatland revet. and on various bars; existing dams extended and repaired; work on constr. of revet. at Independence in progress, **08,** 2260.

1908–09. Snag boat *Mathloma* dr. 38,405 c. y. gravel on the various bars in Willamette R., and removed 730 snags and trees; 130 c. y. r. placed in Independence revet., **09,** 2227. 39,174 c. y. gravel removed by dipper dr. *No. 2,* completing cuts through several bars; pile driver and repair crew made repairs to revet. at Wheatland and Independence, **09,** 2226–2227. 148 snags and overhanging trees removed from banks of Yamhill R., and fish ladder built under contract, **09,** 2227–2228.

1909–10. 43,058 c. y. gravel removed from shoals and bars by dr. *Mathloma,* also 26 snags; 18,087 c. y. dr. from various shoals and bars by U. S. dr. *No. 2;* floating pile driver and crew repaired dams and revet. at Wheatland and Independence, driving piles, placing fascines and st., and repairing pavements; 177 snags removed by hired labor and rowboats, **10,** 2398–2399.

1910–11. Work on Willamette R. carried on bet. Peoria and mouth of Clackamas R., 119 m.; combined dr. and snag boat *Mathloma* removed 100,316 c. y. from chan. and 1,302 snags from chan. and banks; 43,433 c. y. dr. from bars by dipper dr. *Champoeg;* revet. and spur dike at Independence repaired and Wheatland Dam repaired and reconstr.; work begun on dam at Carey Bend and 530 snags removed from R. and bank; bar at mouth of Yamhill R. scraped, **11,** 2599, 2600–2601. 900 c. y. removed from bar at head of Clackamas Rapids by hired labor and plant, **11,** 2602.

1911–12. Work was carried on in Willamette and Yamhill Rs. bet. Peoria and Portland, 130 m.; combined dr. and snag boat *Mathloma* removed 53,966 c. y. gravel from chan. at various places; 394 snags and 919 overhanging trees removed from Willamette R. and 21 snags and 270 overhanging trees from Yamhill R.; 6,754 c. y. dr. from various bars by dr. *Champoeg;* floating pile driver and crew completed repairs to Wheatland Dam and to Carey Bend Dam; boat party removed 43 snags and 26 overhanging trees bet. Corvallis and Peoria, **12,** 2811.

PHYSICAL CHARACTERISTICS.

Described, **71,** 906; **75,** ii, 760; **76,** ii, 654, 661; **89,** 2579; **96,** 3310.

Stages of water on upper R., **80,** 2279; **81,** 2550.

Description of bars, **80,** 2281.

Threatened cut-off at Corvallis, **87,** 2518.

R. flows mostly bet. banks which cave in after freshets, carrying in stumps, etc., **96,** 3310.

List of towns on the upper Willamette, **96,** 3319.

Description of, opposite Salem. The R. deflects to the left about 50° just in front of Salem, **98,** 3052.

Description of, in vicinity of Willamette Falls, **00,** 4374.

Physical features of R., small volume of water, constant movement of gravel bed makes impracticable attainment of permanent and stable chan. outlined in approv. proj., **01,** 3553.

Freshets in Willamette R., **02,** 2388.

At Albany of recent years there has been more or less scour, creating apprehension among residents that R. may ultimately cut a new chan. for itself, leaving the town inland, **04,** 3568.

R. bank is caving rapidly below Independence revet., **07,** 2187.

Variation of level of w. surfaces on the Willamette at Salem from extreme summer l. w. to winter h. w. 23′, and on Yamhill below lock and dam 35′, **08,** 818.

Winter freshets caused damage and undermining at Independence revet., **09,** 2226.

Lower dam at Matheneys Bar was carried away by freshet, R. returning to old chan., **09,** 2226.

Erosion of R. banks, **10,** 952.

PLANS. (See Estimates and Projects.)

By Maj. Wilson, system of dams, **77,** 1035.

By Maj. Jones, protection of R. bank at Corvallis from a cut-off; est., $14,000, **87,** 2519.

PRIVATE (CORPORATE) WORK.

Wing dams built by the People's Transportation Co., **71,** 906. Canal and locks around the Falls of the Willamette built by a company aided by the State at a cost of $600,000, **72,** 985; **75,** ii. 768.

Works of the Willamette Transportation Co. at Oregon City, **80,** 2281.

Description of canal and locks owned by the Portland General Electric Co., owning also the water power of Willamette Falls and the land on both banks of the R. in the immediate vicinity. Histories of the companies using the falls for power, **00,** 4372–4408.

92,458 c. y. excavated from Portland H. by Portland Commission, **03,** 2258.

Pacific Bridge Co., Star Sand Co., Columbia Digger Co., and Nickum & Kelly, operating under permits granted by Sec. of War, have done considerable amount of dr. in Willamette R., in vicinity of Ross Isld., removing 126,000 c. y. during year, **09,** 2228.

Private parties removed from Willamette R. bet. Portland and Milwaukee, 243,124 c. y. in 1911, **11,** 2602, and 276,085 in 1912, **12,** 2813.

PROJECTS. (See Estimates and Plans.)

By Maj. Williamson, wing dams, bulkheads, etc., **71,** 909.

By Maj. Robert, removal of snags from chan., **71,** 901.

By Maj. Michler, constr. of wing dams, the narrowing, d., and rendering the chan. more uniform; also the removal of such ledges of r. and bowlders as may be found in the chan., **75,** ii, 764.

By Maj. Wilson, constr. of 6,000′ of cut-off dams and 8,000′ of wing dams; also removal of Bissels and Doves Rocks, **78,** 1329.

Proj. for imp. of upper Willamette R. bet. Portland and Corvallis, 114 m., adopted 1870, and consisted in removal of snags and imp. of chan. at rapids by scraping, removal of wreck, bowlders, and gravel, and the constr. of wing dams, **71,** 905; **80,** 2284. From 1871 to 1877 $71,500 app., **78,** 1329.

In 1878 proj. submitted for constr. of cut-off and wing dams above Corvallis, constr. of new snag boat, and imp. of rapids at Bissels and Doves Rocks; est., $80,000, **78,** 1329.

In 1886 an aggregate of $155,500 having been app., $29,000 would be required to complete proj., **86,** 1941.

In 1889 Maj. Jones proposed imp. of reach bet. Portland and Oregon City by constr. of riprap dike 6,000′ l. to protect Willamette from débris brought down by Clackamas R., and excavation of chan. with l. w. d. of 8′ and a w. of 150′; est., $60,000, **89,** 2581, 2582.

By Capt. Fisk, 1896, imp. of R. from Portland to Eugene by removal of obstr. and building of controlling works with view to obtaining 2′ to 12′ in various sections of the R.; est., $131,697, **96,** 404, 3281.

Summary of different est. of cost of locks and dam at Willamette Falls, **00,** 4379. Summary of different est. of value of works at 1899, **00,** 4381.

BE., 1899, could not recom. acceptance of offer of Portland General Electric Co. to sell its interest in Willamette Falls canal and locks for $1,200,000, believing that $456,000 should be max. sum asked for. Board recom. if water rights of the company could not be purchased that U. S. should undertake to build new works; est., $450,000. **00,** 4381.

Act June 13, 1902, au. constr. of dr. for use on this imp., and app. $500 for Long Tom R., **02,** 553.

In 1904 it was recom. that Long Tom R. be dropped as unworthy of further imp., **04,** 3526.

Revised proj., by Maj. Langfitt, for imp. Willamette R., with view to obtaining, by dr. with aux. dam and revet. constr., and by snagging, a l. w. d. of 2½′ to 3½′, Corvallis to Oswego, and a l. w. d. of 12′ thence to Portland; est., $213,500, **04,** 3529–3531.

SURVEYS.

Au. act July 11, 1870, **70,** 32, 84; made by Lt. Heuer, **71,** 97. **R., 71,** 906.

Ex. by Maj. Robert, 1871, **72,** 984.

By Maj. Michler, 1876, **76,** ii, 634.

Ex. and sur. by Maj. Wilson, 1877–78, **77,** 1026; **78,** 1326, 1328.

Misc. surs., **93,** 3523.

Sur. of R., Portland to Eugene, au. act Aug. 17, 1894; made, 1896, by Capt. Fisk (see Projects), **96,** 3309.

Sur. of R. opposite Salem with view to constr. revet. for chan. mainten., au. act June 3, 1896; made, 1897, by Maj. Fisk (**R.** unfav.), **98,** 3051.

Ex. of canal and locks at Willamette Falls, with view to their condemnation and purchase, au. act Mar. 3, 1899; made, 1899, by Maj. Fisk (sur. recom). Sur. ordered and BE. appointed (**R.** fav. to purchase if reasonable price would be accepted, or to constr. of new works otherwise). **00,** 4368.

Pre. ex. au. act June 13, 1902, bet. Portland and Oregon City. **R.,** by Maj. Langfitt, Aug. 14, 1902, and May 1, 1903; est., $5,100 (H. D. 504, 58th, 2d) **04,** 686, 3559–3560. BERH concurs in views of local officer, **04,** 3561.

Pre. ex. au. act June 13, 1902, opposite Albany, Oreg., with view to ascertaining whether a diversion of said stream at that point would result in injury to navigation. **R.** by Maj. Langfitt, July 23, 1902, and Apr. 13, 1903: est., $27,000 (H. D. 476, 58th, 2d), **04,** 3564. BERH. concurs in recom. of Maj. Langfitt, **04,** 3565.

Pre. ex. au. act Mar. 3, 1909. **R.** by Maj. McIndoe, Jan. 19 and Dec. 3, 1910. No specific proj. recom. Est. $40,000, to be applied to snagging, dr. and permanent works, as is considered most advisable (H. D. 13, 62d, 1st), **11,** 1026.

Pre. ex. and sur. au. act June 25, 1910, bet. Portland and Oregon City. **R.** by Maj. McIndoe, Oct. 28, 1910, and May 17, 1911: est., $24,000, and $2,500 an. for mainten. (H. D. 438, 62d, 2d), **12,** 1231.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1208.

Maps (H. D. 438, 62d, 2d):

Of the upper Willamette. **77,** 1035; **78,** 1328. **98,** 3030; **99,** 3238; **03,** 2260.

Photographs. **99,** 3238; **00,** 4350; Yamhill R. lock and dam, **02,** 2391.

Part (c), WW-30 Willamette River, Oreg. (Clackamas Rapids, Ross Island, and Corvallis City).

ENGINEERS.

Chief of Engineers. **R., 91,** 421; **92,** 393.

In charge. Maj. T. H. Handbury, 1892. **R., 92,** 2840, 2842, 2844, 2847.

PHYSICAL CHARACTERISTICS.

Description of R. at Ross Isld. and Clackamas Rapids, **92,** 2842, 2844.

PLANS.

By Maj. Handbury, 1891, chan. 14′ x 100′ at l. w. at Ross Isld. by dr., closing chutes, and works of contraction; imp. at Clackamas Rapids by removal of old dam at head of rapids and constr. of 6,800 l. f. of dike for contraction and direction of current; imp. at Corvallis by removal of snags and similar obstr.; est., $138,900, **92,** 394.

SURVEY.

Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Handbury (see Plans), **92,** 2842, 2844, 2847.

Part (d), WW-30 Willamette River at Willamette Falls, Oreg.

APPROPRIATION.

1910, $300,000, **10,** 2401.

COMMERCE.

C. through canal and locks at Oregon City, 1909, 12,411 t. grain, flour, gen. mdse., etc., 291,000 linear ft. of piling, 1,169,477 ft. b. m. of lumber and logs, 10,937 passengers, etc., **10,** 2402.

With free locks and consequent reduction in both rail and water rates of 50¢ per t., the indirect savings to producers would amount to thousands of dollars an., **12,** 1213.

ENGINEERS.

Chief of Engineers. **R., 10,** 954, 968; **11,** 1011, 1026; **12,** 1211, 1231.

In charge. Maj. J. F. McIndoe, 1910–. **R., 10,** 2401; **11,** 2604; **12,** 2815.

LEGISLATION.

Oregon passed an act, Feb., 1909, app. $300,000, provided U. S. app. like sum on or before Mar. 1, 1912, toward purchase of locks, or purchase of necessary land and constr. new canal and locks, **10,** 955. $200,000 deposited by Tr., State of Oregon, to credit of Tr. U. S., and the balance of $100,000 will be incl. in State tax levy for 1913, **12,** 1212.

OPERATIONS.

1910–11. Work begun by a field party making sur. and obtaining data for use in compiling report; work completed, **11,** 2604.

1911–12. Report of result of negotiations for sale of right of way on 2 tentative routes on e. side of R. submitted Dec. 4, 1911, and supple. report forwarded Dec. 6, 1911. Latter report recom. present locks on w. side be acquired by condemnation instead of constr. a new canal and locks on e. side of

R., **12,** 2815. Field work during year consisted in making surs. to obtain data necessary for preparation of plans and ests. for future work, **12,** 2816.

PHYSICAL CHARACTERISTICS.

Falls form an obstr. to navigation which could be overcome only by some method of artificial imp. Willamette Canal & Locks Co., incorporated State of Oregon, for purpose of constr. a canal and locks on w. side of falls. Canal and locks completed, 1873, at a cost of $450,000, and are "now" owned and operated by Portland Railway Light & Power Co. Canal basin above locks 1,250′ l., while the canal and locks consist of flight of 4 locks each 40′ x 210′, and having lift of 10′ each. Concrete dam. constr. along crest of Rocky Reef, and land is ideal for power sites, **12,** 1211.

PROJECTS.

Act June 25, 1910, app. $300,000 for purchase of existing locks, or for purchase of necessary lands and constr. of new canal and locks, in discretion of Sec. of War.: Provided further, that, except for acquisition of lands and right of way and for surs., etc., no part of these funds to be expend. until State of Oregon shall app. like amount for same purpose, **10,** 955.

Sept. 2, 1911, Sec. of War. approv. recom. of Chief of Engineers that constr. of new canal on e. side of R. be undertaken, and that necessary antecedent work, incl. preparation of plans, acquisition of lands and rights of way needed, etc., be proceeded with. Addl. report made Feb. 10, 1912, that U. S. offer present owners the sum of $375,000 for locks, canal, and right of way on w. side. This recom. approv. by Sec. of War Feb. 15, 1912. Offer duly made and accepted; transfer papers in course of preparation by owners, the Portland Railway Light & Power Co.; abstract of title forwarded to U. S. atty. for ex., **12,** 1212, 2815–2816.

General plan of imp. to be recom. is to obtain d. of 6′ over lower sill of locks and in the upper basin (the available l. w. d. now being about 2′), and to constr. a concrete wall dividing upper basin from factories which use the water for power purposes. Extent and cost of imp. to depend upon action of Congress on special **R.** of Feb. 23, 1910, **12,** 1212.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1909, of Falls of the Willamette at Oregon City, **10,** 968; **11,** 1026; **12,** 1231.

Cong. docs., etc., relating to ex., surs., plans, etc., **12,** 1213.

Part (e), WW-30 Willamette River, Oreg. (Above Oregon City.)

COMMERCE.

Description of, **93,** 3530.
Tonnage, 1892, 70,872 t.
Imp. of R. above Oregon City recom., **93,** 3530.

ENGINEERS.

Chief of Engineers. **R., 93,** 457.

In charge. Maj. T. H. Handbury, 1893. **R., 93,** 3529.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3529.

Rises in Cascade Mts. and empties into Columbia R. 98 m. from Pacific Ocean. For 20 m. from its mouth is navigated by ocean-going boats, and for about 175 m., at certain seasons, by R. craft.

At extreme h. w. it discharges approx. 400,000 c. f. per second.

Oregon City on right bank, 25 m. above mouth. Near it the stream has perpendicular fall of about 40′, which is overcome by a series of 4 locks built by State of Oregon about 1873, **93,** 3529.

PRIVATE WORK. (See Physical characteristics.)

SURVEYS.

Ex. of R. above Oregon City au. act July 13, 1892; made by Maj. Handbury in that year (**R.** fav.), **93,** 3529.

WW-32 TUALITIN RIVER, OREG.

ENGINEERS.

Chief of Engineers. **R., 89,** 357; **95,** 467; **98,** 511.

In charge:
Capt. W. Young, 1888. **R., 89,** 2525.
Maj. J. C. Post, 1895. **R., 95,** 3598.
Maj. W. L. Fisk, 1898. **R., 98,** 3053.

OBSTRUCTIONS. (See Physical characteristics.)

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2525; **95,** 3599; **98,** 3054.

Rises in Coast Range of mts. and empties into Willamette R. about 14 m. above Portland.

Subject to freshets which flood surrounding country. In 1895 chan. obstr. by snags, log jams, rapids, and private dams, and also by 14 brs. which crossed it at various points with single spans.

Dairy Fork enters on n. bank near Hillsboro, and extends back for about 13 m. to Louisignant Lake, a dry plain at the time the sur. of 1897 made, **95,** 3599; **98,** 3054.

PLANS.

In 1888 Capt. Young considered cost of imp. R. greatly in excess of benefits to be conferred upon its C., **89,** 2526.

SURVEYS.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Young (**R.** unfav.; see Plans), **89,** 2525.

Ex. to Hillsboro and the head of navigation au. act Aug. 17, 1894; made, 1895, by Maj. Post (**R.** unfav.), **95,** 3598.

Sur. of R. from Tualitin up to Gaston, and of Dairy Fork to Louisignant Lake, au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 3053.

WW-33 YAMHILL RIVER, OREG.

Part.	Title.	Period.	Appropriation.
a	Yamhill and Willamette Rs.	1873–1900	See WW-30, Part b.
b	Yamhill R.—Operating and Care	1901–1912	$40,644.49
	Total (to which might be added money spent on Yamhill and Willamette Rs. combined—See p. 1642 of this Index).	.....	40,644.49

Part (a), WW-33 Yamhill River, Oreg.

COMMERCE.

Important, **75,** ii, 792, 794.

ENGINEERS.

Chief of Engineers. R., 73, 108; **75,** 125; **91,** 421; **93,** 455, 457; **94,** 417; **95,** 465, 467; **96,** 404; **97,** 506; **98,** 504; **99,** 591; **00,** 667.

In charge:

Maj. H. M. Robert, 1873. **R., 74,** ii, 364.
Maj. N. Michler, 1873–75. **R., 74,** ii, 364; **75,** ii, 792.
Maj. T. H. Handbury, 1890–93. **R., 91,** 3381, 3382; **93,** 3522, 3531.
Maj. J. C. Post, 1894–95. **R., 94,** 2661; **95,** 3591, 3602.
Capt. W. L. Fisk, 1896–99. **R., 96,** 3281; **97,** 3429; (Maj.) **98,** 3025; **99,** 3234.
Capt. W. C. Langfitt, 1899.
Capt. W. W. Harts, 1899–. **R., 00,** 4347.

Assistants:

G. F. Cramer, **75,** ii, 792.
D. B. Ogden. **R., 98,** 3029.

OPERATIONS.

1892–93. Over 1,200 snags, etc., removed, **93,** 3524.
1893–94. Over 300 snags, etc., removed. **94,** 2661.
1894–95. Over 150 snags, etc., removed, **95,** 3592.
1895–96. 1215 snags, etc., removed, **96,** 3282.
1896–97. Some snagging done, **97,** 3431.
1897–98. Constr. of lock and dam at Lafayette commenced, **98,** 3026.
1898–99. 1,673 c. y. dr. from mouth of R.; cofferdam completed, lock pit pumped out; bank movement checked by piles; excavation for lock pit completed, pile driving for foundation completed; laying of concrete begun, **99,** 3236.
1899–00. Concrete laying completed (total concrete in sill and foundations, 7,618 c. y.); lock gates, etc., placed in position; keeper's house built; timber revet. constr.; dam constr. in progress (photographs), **00,** 4349.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 792, 794, 795; **91,** 3381; **93,** 3532; **95,** 3602.
Table of distances and slope of R., **75,** ii, 793.
R. begins to be navigable at McMinnville, county seat of Yamhill County, Oreg., distant 17 m. from mouth of R., **93,** 3532.
Mouth to McMinnville, it is a narrow, tortuous stream. Chan. is sometimes completely closed by the banks sliding in after being loosened by heavy freshets. **95,** 3602–3605.
Table of the fall of various secs. of the R., **95,** 3603.
Results of works of imp. beneficial, **93,** 3532.
Heavy rains interfering with lock constr., **99,** 3237; **00,** 4349.

PLANS.

By Maj. Michler, 1875, dr. and removing r. and snags, constr. of locks and dams at navigable ends, similar to work at Willamette; est., $222,500, **75,** ii, 796, 798.
By Maj. Handbury, 1891, removal of logs and similar obstr.; est., $3,000, **91,** 3383.
By Maj. Post, 1896, lock and dam at Lafayette, and removal of logs and all other obstr. to provide draft of 3½′ throughout year from mouth to McMinnville; est., $69,000, **95,** 3604; **96,** 3281.

SURVEYS.

Ex. au., 1873, **73,** 108; made by Maj. Robert, **74,** ii, 364.
By Maj. Michler, 1875, **75,** 125, ii, 792.
Sur. au. act Sept. 19, 1890; made, 1891, by Maj. Handbury, **91,** 3382.
Ex., mouth to McMinnville, au. act July 13, 1892, with view to obtaining slack-water navigation by lock and dam; unfav. **R.** by Maj. Handbury, 1892, **93,** 3531.
Sur. up to McMinnville with view to imp. of R. by lock and dam or otherwise au. act Aug. 17, 1894. **R.** by Maj. Post, 1895 (see Projects), **95,** 3602.

Maps. **95,** 3604; **99,** 3238.
Photographs. **99,** 3238; **00,** 4350.

Part (b), WW-33 Yamhill River, Oreg.

APPROPRIATIONS.[1]

1901,	$2,313.40,	**01,** 3557.
1902,	22,479.27,	**02,** 2392.
1903,	4,067.33,	**03,** 2263.
1904,	1,256.21,	**04,** 3533.
1905,	1,274.13,	**05,** 2474.
1906,	1,801.63,	**06,** 2005.
1907,	1,656.14,	**07,** 2189.
1908,	$1,687.10,	**08,** 2262.
1909,	1,188.66,	**09,** 2230.
1910,	1,025.89,	**10,** 2400.
1911,	999.20,	**11,** 2603.
1912,	895.53,	**12,** 2814.
Total,	40,644.49	

[1] Expend. under permanent indefinite app. provided by act July 5, 1884, as amended by act Mar. 3, 1909, for operating and keeping in repair canals and other public works.

COMMERCE.

Traffic through lock and dam, 1900, 1,742 t. and 2,010 passengers, **01,** 3557.

Practical suspension of traffic since 1902 due to fact that Oregon City Trans. Co. had taken its boats for use on Willamette R. and abandoned McMinnville route on account of uncertainty of lock operations during winter, **04,** 675.

1912, 386.6 t. and 327 passengers, **12,** 2815.

In Sept., 1911, boat carrying freight and pssengers placed on run bet. Portland and McMinnville. Although this service was discontinued in Oct., it is first time in several years that regular use has been made of the locks. SS. traffic practically abanponed since 1902, **12,** 1211.

ENGINEERS.

Chief of Engineers. R., 01, 632; **02,** 554; **03,** 612; **04,** 675; **05,** 680; **06,** 754; **07,** 770; **08,** 819; **09,** 858; **10,** 954; **11,** 1010; **12,** 1211.

Boards. BERH. **R.** on ex. with view to prolonging season of navigation, **04,** 3569. (See Surveys.)

In charge:

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3555; **02,** 2390; (Maj.) **03,** 2261; **04,** 3532; **05,** 2475.

Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2004; **07,** 2188; **08,** 2262.

Maj. J. F. McIndoe, 1909–. **R., 09,** 2229; **10,** 2400; **11,** 2603; **12,** 2814.

OPERATIONS.

1900-01. Lock opened to navigation Sept. 24, 1900. Crew employed during winter to check scour of banks and make repairs as stage of R. and materials at hand would permit, **01,** 3556.

1901-02. Repairs of damage caused to slopes and revet. practically completed, **02,** 2390. A windmill and storage tank erected near lockmaster's dwelling, **02,** 2391.

1902-03. Minor repairs made to timbering to prevent leakage, and addl. st. placed along face of dam; grounds and slopes, e. side of lock, graded and sowed, **03,** 2261–2262.

1903-04. General repairs made; gates, operating gear and lock building were painted, and gravel walkways were laid in grounds in lieu of wood to overcome flotation at h. w., **04,** 3532.

1904-05. Lock, dam, adjacent grounds and general property have been kept in repair, **05,** 2474.

1905-06. Damage caused by h. w. to paving below dam repaired, **06,** 2005.

1906-07. Lock, dam, and adjacent grounds kept in repair; parcel of land bet. dwelling house and lock grounds purchased, fenced in and partly cleared, **07,** 2188.

1907-08. Grouting 1,000′ pavement below dam, and dam and adjacent ground repaired, **08,** 2262.

1908-09. Lock, grounds, and machinery kept in repair, and fish ladder built over dam, **09,** 2229.

1909-10. Lock, dam, and U. S. ground and property kept in repair, **10,** 2400.

1910-11. Lock, dam, grounds, etc., kept in repair, **11,** 2603.

1911-12. Lock and dam, kept in repair, and grounds policed, **12,** 2814.

(Lock and dam opened to navigation entire year except during freshets.)

PHYSICAL CHARACTERISTICS.

Yamhill Lock situated on Yamhill R. near Lafayette, Oreg., about 8 m. above its junction with the Willamette and some 10 m. below town of McMinnville, the head of SS. navigation, **01,** 3555, 3556.

Freshets, damaging parts of work, **01,** 3555, 3556.

Scour of banks, **01,** 3556.

High water, **05,** 2474; **07,** 2188; **08,** 2262.

SURVEYS.

Pre. ex. with view to prolonging season of navigation, au. act June 13, 1902. **R.** by Maj. Langfitt, Mar. 17 and Sept. 18, 1903; est., $28,560 (H. D. 78, 58th, 2d), **04,** 686, 3569. BERH. concurs in recom. of DO., **04,** 3573, 3575.

Maps (photographs), **02,** 2391.

WW-36 LONG TOM RIVER, OREG.

(See p. 1642 this Index).

APPROPRIATIONS.

1899,	[1] $3,000.	
1902,	[2] 500,	**02,** 552.
Total,	3,500	

COMMERCE.

Description of. Limited, but would probably be increased if stream were imp., **98,** 3047. Shipment of about 300 t. grain made 1899–1900, the first shipment by R. in 20 years, **00,** 4346.

ENGINEERS.

Chief of Engineers. R., 98, 509; **99,** 590; **00,** 666; **01,** 630; **02,** 551.

In charge:

Maj. W. L. Fisk, 1896–99. **R., 98,** 3045; **99,** 3233.

Capt. W. C. Langfitt, 1899; **00,** 4345.

Capt. W. W. Harts, 1900–01. **R., 00,** 4346.

Capt. W. C. Langfitt, 1901–. **R., 01,** 3549; **02,** 2387.

OPERATIONS.

1899-00. Nearly 1,500 s. y. brush and 1,000 snags, etc., removed, **00,** 4346.

PHYSICAL CHARACTERISTICS.

Description of. Stream a tributary of the Willamette, 80 m. s. of Portland; 122 m. distant by R. **98,** 3045.

PROJECTS.

By Maj. Fisk, 1898. Removing overhanging trees from banks and snags from the chan., from the mouth up to Monroe, about 10 m., to secure navigable chan. on h. w. stages during the rainy seasons, **99,** 3233.

Capt. Langfitt recom., 1901, that all further work be done in connection with Willamette and Yamhill Rs., **01,** 3550.

SURVEY.

Ex., mouth to Monroe, au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** fav.), **98,** 3045.

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[1] Trans. from app. for Willamette R. above Portland, **99,** 3234. See WW-30, p. 1642.

[2] Allotted from app. imp. Willamette and Yamhill Rs. See WW-30, p. 1642.

WW-38 SANTIAM RIVER, OREG.

COMMERCE.

Limited, 1898, and carried by the RRs., **98,** 3048.

ENGINEERS.

Chief of Engineers. **R., 98,** 510.

In charge. Maj. W. L. Fisk, 1896–98. **R., 98,** 3047.

OBSTRUCTIONS.

Navigation up the stream obstr, at Jefferson by 2 drawless brs., **98,** 3048.

PHYSICAL CHARACTERISTICS.

Description of. Tributary to the Willamette, about 95 m. above Portland, and not navigable for several months in the year, **98,** 3048.

SURVEYS.

Ex., Jefferson to Willamette R., au. act June 3, 1896; made, 1897, by Capt. Fisk (**R.** unfav.), **98,** 3047.

WW-40 CLACKAMAS RIVER, OREG.

ENGINEERS.

Chief of Engineers. **R., 89,** 357.

In charge. Capt. W. Young. **R., 89,** 2523.

PHYSICAL CHARACTERISTICS.

Description of, **89,** 2524.

SURVEY.

Ex. au. act Aug. 11, 1888; made, 1888, by Capt. Young (**R.** unfav.), **89,** 2523.

WW-41(a) COLUMBIA RIVER, OREG. AND WASH. (Tributaries below mouth of Willamette River.) (Dredging plant.)

ENGINEERS.

Chief of Engineers. **R., 01,** 640.

In charge. Capt. W. C. Langfitt, 1901–02. **R., 01,** 3575; **02,** 2407.

PHYSICAL CHARACTERISTICS.

Details concerning streams on which proposed dr. is to be used, **01,** 3575.

PROJECT.

Constr. of dr. to be used on Lewis and Cowlitz Rs. Wash., and Clatskanie R., Oreg.; est, $40,000, **01,** 3576.

WW-44 LEWIS RIVER, WASH.

APPROPRIATIONS.

1899,	$10,000,	**99,** 3248.
1902,	*4,750,	**03,** 2320.
1905,	*5,600,	**05,** 2495.
1907,	*2,500,	**07,** 2207.
1910,	*2,500,	**10,** 2414.
1911,	*2,500,	**11,** 2620.
1912,	*2,500,	**12,** 2836.
Total,	30,350	

COMMERCE.

Description of, **95,** 3601; **97,** 3471, 3475.

In 1892, 10,000 t. of freight and 14,000 passengers. There were large lumber shipments also, **93,** 3535.

In 1893, valued at $119,000, **95,** 3601.

In 1897, important and growing, **97,** 3471.

Large, 1900, in proportion to cost of an. mainten., **00,** 4365.

R. only means of transportation, except from town of Woodland, **07,** 778; but R. traffic preferred because of rates, **12,** 1228.

Beneficial effect on rates from Woodland, **08,** 828.

Small boats make regular trips above Woodland to Runyon, **09,** 868.

In 1911, 55,000± t., **12,** 2837. R. transport uncertain at times, and some freight is carried by teams, **12,** 1228.

CONTRACT.

1899. Cascade Construction Co., dr. 6,246 c. y., 25¢ c. y., **00,** 4364.

ENGINEERS.

Chief of Engineers. **R., 84,** 342; **85,** 372; **93,** 458; **95,** 467; **97,** 523; **99,** 596; **00,** 673; **01,** 638; **02,** 560; **03,** 618; **04,** 683; **05,** 689; **06,** 763; **07,** 777; **08,** 827; **09,** 867; **10,** 964; **11,** 1022, 1056; **12,** 1226.

In charge:

Capt. C. F. Powell. **R., 84,** 2293.
Maj. W. A. Jones. **R., 85,** 2444.
Maj. T. H. Handbury, 1893. **R., 93,** 3533.
Maj. J. C. Post, 1895. **R., 95,** 3600.
Capt. H. Taylor, 1897. **R., 97,** 3469, 3473.
Maj. Fisk, 1899. **R., 99,** 3248.
Capt. W. C. Langfitt, 1900; **00,** 4345.
Capt. W. W. Harts (temporary charge), 1900. **R., 00,** 4364.

* Allotments.

Capt. W. C. Langfitt, 1901–05. **R., 01,** 3572; **02,** 2406; (Maj.) **03,** 2320; **04,** 3557; **05,** 2495.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2019; **07,** 2206; **08,** 2277.
Maj. J. F. McIndoe, 1909–. **R., 09,** 2241; **10,** 2413; **11,** 2619; **12,** 2835.

Assistants:
Lt. H. Taylor. **R., 93,** 3535.
P. G. Eastwick. **R., 97,** 3476.

OPERATIONS.

1899-00. 6,246 c. y. dr.; 5 brush and r. dams built; work in progress at the Cowley Bar Dike, the principal work, **00,** 4364, 4365.
1900-01. Dike at Cowleys Bar completed, **01,** 3572.
1902-03. 12,960 c. y. dr. and 1,299 snags removed, **03,** 2320.
1903-04. 3 days' dr., **04,** 3557.
1906-07. 324 snags removed; 143 snags and trees cut from banks, **07,** 2206.
1907-08. Snags removed, **08,** 2277.
1908-09. 132 snags removed; 169 snags and trees cut from bank, **09,** 2241.
1909-10. 88 snags removed; 103 snags and trees cut from banks, **10,** 2413.
1910-11. 29,925 c. y. dr., and 131 snags and other obstr. removed, **11,** 2619.
1911-12. 296 snags and other obstr. removed by U. S. boat and hired labor, **12,** 2835–36.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3534; **95,** 3601; **10,** 964.
R. empties into the Columbia R. 14 m. below mouth of the Willamette R. Etna is at the mouth of Cedar Creek, and is about 12 m. from mouth of Speliah Creek. Above and below the town there is a succession of bars and pools, the number diminishing downward, **93,** 3534. Lacenter is situated on the East Fork, 7 m. by water from the Columbia R. The average rise and fall of the tide at this place is 14″, **95,** 3601.
Rises in Cascade Range; 3¾ m. from mouth there is separation into 2 branches, North Fork, 85± m. l., and South Fork, 36± m. l., **12,** 1226.
Duration of water elevations in 1896 at the forks and at Lacenter, **97,** 3477.
Freshets carrying considerable sediment damaging works, **00,** 4364.
Max. draft to forks 4′, on East Fork 2½′, and on North Fork, 1′, **11,** 1023.
Winter freshets vary from 15 to 20′ in height, except near mouth, where water spreads over large area, **11,** 1023.

PLANS.

In 1883 Capt. Powell considered a part of the R. worthy of minor imp., but that work not a public necessity, **84,** 2293.
In 1884 Maj. Jones considered the R. worthy of imp. at an. cost of $1,000 for the removal of snags, **85,** 2444.

PRIVATE WORK.

Considerable work done by private parties and by county au. in protecting high banks at various localities along main R. and North Fork as far as Woodland, **11,** 2619.

PROJECTS.

By Capt. Taylor, 1897, 6′ chan. in the main R. to the forks, and a 4′ chan. thence to Lacenter on the East Fork, by training dikes, closing dikes, and supple. dr.; est., $20,460, **97,** 3475; **99,** 3248.
It was est., 1900, that $500 would be required an. for mainten., **00,** 4365.
Act June 13, 1902, combined apps. for Cowlitz and Lewis Rs., and extended Lewis R. proj. to incl. work on North Fork, **02,** 2406.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Powell (see Plans), **84,** 2293.
Ex. au. act July 5, 1884; made by Maj. Jones (see Plans), **85,** 2444.
Ex. from its mouth to Speliah Creek, au. act July 13, 1892; made by Maj. Handbury, 1892 (**R.** fav. for limited imp.), **93,** 3533.
Ex. from Lacenter to its mouth for d. the chan. and imp. navigation, au. act Aug. 17, 1894; made, 1895, by Maj. Post. (**R.** fav.), **95,** 3600.
Ex. of the North Fork to Etna, au. act June 3, 1896; **R.** (fav.) submitted, 1896, by Capt. Taylor, **97,** 3469.
Sur. from the Columbia R. to Lacenter, au. act June 3, 1896; made, 1897, by Capt. Taylor (see Projects), **97,** 3473.
By Capt. Langfitt, 1901–02, **02,** 2406.
Pre. ex. with plan and est. of cost of imp. of Lewis R., incl. North Fork and East Fork to La Center, Wash., au. act March 3, 1909. **R.,** Maj. McIndoe, Feb. 2 and Sept. 8, 1910; est., $61,500, and $6,000 an. mainten., **10,** 968 (H. D. 28, 62d, 1st); **11,** 1056.
Cong. docs., etc., relating to exs., surs., plans, etc., **11,** 1022; **12,** 1226.

Maps. **03,** 2320; **04,** 3557.

WW-49 COWLITZ RIVER, WASH.

APPROPRIATIONS.

1880,	$2,000,	**81,** 2601.
1881,	1,000,	**81,** 2601.
1882,	1,000,	**82,** 2685.
1884,	2,000,	**84,** 2273.
1886,	2,000,	**86,** 1952.
1888,	3,000,	**88,** 2190.
1890,	8,000,	**90,** 3064.
1892,	3,000,	**92,** 2838.
1894,	3,000,	**95,** 3595.
1896,	3,000,	**96,** 3385.
1899,	3,000,	**99,** 3249.
1902,	*4,750,	**03,** 2319.
1905,	*4,400,	**05,** 2494.
1907,	*12,500,	**07,** 2205.
1910,	*31,600,	**10,** 2413.
1912,	3,000,	**12,** 2835.
Total,	87,250,	**12,** 2835.

COMMERCE.

Important, **81,** 2600.
Large, 1900, compared with cost of an. mainten., **00,** 4366.
Description of, **06,** 762; **11,** 1021.
R. great factor in regulation of RR. rates to contiguous points, **08,** 827.
Tonnage, 1911, 293,620 t., **12,** 2835.

CONTRACTS.

1884. J. Kellogg & Co., constr. of 300′ of wing dam, **85,** 2439.
1907. Burcham & Byrnes Constr. & Contract. Co., st., $2.60 per c. y., **08,** 2276.

ENGINEERS.

Chief of Engineers. **R., 80,** 241, 242; **81,** 331; **82,** 323; **83,** 336; **84,** 339; **85,** 371; **86,** 359; **87,** 333; **88,** 306; **89,** 364; **90,** 329; **91,** 418; **92,** 392; **93,** 456; **94,** 417; **95,** 466; **96,** 415; **97,** 520; **98,** 508; **99,** 597; **00,** 674; **01,** 639; **02,** 559; **03,** 617; **04,** 682; **05,** 688; **06,** 761; **07,** 776; **08,** 826, 830; **09,** 866, 871; **10,** 962, 968; **11,** 1020; **12,** 1223.

In charge:
Maj. G. L. Gillespie, 1879–82. **R., 80,** 2331; **81,** 2600.

* Allotment.

Capt. C. F. Powell, 1882–85. **R., 82,** 2684; **83,** 2073; **84,** 2272.
Maj. W. A. Jones, 1885–90. **R., 85,** 2439; **86,** 1952; **87,** 2524; **88,** 2190; **89,** 2589.
Maj. T. H. Handbury, 1890–93. **R., 90,** 3063; **91,** 3370; **92,** 2837; **93,** 3526.
Maj. J. C. Post, 1894–95. **R., 94,** 2662; **95,** 3594.
Capt. H. Taylor, 1896–97. **R., 96,** 3385; **97,** 3463.
Maj. W. L. Fisk, 1898–99. **R., 98,** 3041; **99,** 597.
Capt. W. C. Langfitt, 1899.
Capt. W. W. Harts, 1899. **R., 00,** 4366.
Capt. W. C. Langfitt, 1901–05. **R., 01,** 3573; **02,** 2404; (Maj.) **03,** 2319; **04,** 3555; **05,** 2493.
Lt. Col. S. W. Roessler, 1906–08. **R., 06,** 2018; **07,** 2204; **08,** 2275.
Maj. J. F. McIndoe, 1909–. **R., 09,** 2240; **10,** 2412; **11,** 2618; **12,** 2832.

Assistant. R. A. Habersham. **R., 80,** 2232; **81,** 2601.

OPERATIONS.

1880–81. 40 m. of R. cleared by removal of snags and trees, **81,** 2600.
1881–82. 304 snags and trees removed, **82,** 2684.
1882–83. 483 logs, snags, and trees removed, **83,** 2073.
1884–85. 300 l. f. wing dam built by contract, **85,** 2439.
1886–87. 190 l. f. wing dams built; 315 snags removed, **87,** 2525.
1888–89. 281 snags, 9 log jams, r. and gravel cleared from the chan.; 250 l. f. of wing dams built, **89,** 2590.
1890–91. 1,200 c. y. of gravel and 156 logs, snags, and trees removed from chan. bet. mouth and Toledo, **91,** 3370.
1891–92. 50 snags cleared from chan., and 400 l. f. of wing dam built at Toutle R. Bar, **92,** 2838.
1892–93. 1,094 l. f. wing dams built, and about 150 snags, etc., removed, **93,** 3526.
1893–94. Over 100 snags, etc., removed, **94,** 2662.
1894–95. Over 100 snags, etc., removed, a large r. removed, and 2,000 l. f. bank revet. built, **95,** 3594.
1895–96. About 500 snags, etc., removed, and bank revet. repaired, **96,** 3386.
1896–97. About 150 snags, etc., removed, and bank revet. repaired, **97,** 3463, 3464.
1897–98. Snagging done, and a small wing dam built, **98,** 3041.
1899–00. Closing dam opposite Toledo built, and one under constr. below Toledo; R. thoroughly snagged for 20 m., **00,** 4366.
1903–04. 12,181 c. y. dr., many snags removed, 849 l. f. dikes constr., and 40 snags blown out, **04,** 3556.
1905–06. 15,000 c. y. dr., **06,** 2018.
1906–07. 62 snags removed and 10 snags and trees cut from banks, **07,** 2205.
1907–08. Logs and snags removed, several bars dr. to 3′ to 5′, 1,150 l. f. revet. built at Castlerock to prevent cut-off, **08,** 2275.
1908–09. 34 snags and one large r. removed, **09,** 2240.
1909–10. 24 snags removed and driftwood jams cleared from chan., **10,** 2412.
1910–11. 24 snags blasted and overhanging brush cleared, 1½ c. y. bucket purchased, and 8″ centrifugal sand-dr. plant installed, **11,** 2618.
1911–12. 85,202 c. y. dr. from bars; 83 snags removed from chans.; js. repaired at Keegans Bar; dr. boat sank, afterwards raised and repaired, **12,** 2832, 2834.

PHYSICAL CHARACTERISTICS.

Results of works of imp., **93,** 3526; **98,** 3041.
Chans. changed by freshetsin 1896 and 1897, **97,** 3464; **98,** 3041.
H. stages damaging works, **00,** 4366.
Variation of d. on account of freshets, 22′, **12,** 1224.
New chan. made by freshets below Castlerock, **07,** 2205.
R. rises in Cascade Range, flows s. for 60 m., w. for 40 m., and empties into Columbia 64 m. above its mouth and about 45 m. below Portland, **12,** 1223.

PRIVATE WORK.

Cowlitz Bridge Co. and the Hurley, Mason Co. removed 2,386 and 2,616 c. y., resp., from chan., **11,** 2618.
2,300 c. y. gravel and 1,100 c. y. sand removed by private parties; citizens of Kelso and vicinity constr. 4 js., **12,** 2833.

PROJECTS.

By Maj. Gillespie, 1879, mouth to Cowlitz Landing, removing snags and scraping bars; est., $5,000 for first year, with an an. expend. thereafter of $2,000, **80,** 2331; **81,** 2600; **86,** 1952; **91,** 3371; **00,** 4366.
App. combined by act of 1892 with those for Lewis R., Wash., **02,** 560.
Act 1907 au. building revet. below Castlerock, **07,** 2205.
By Maj. McIndoe, 1908, plan for imp.; est., $22,000, and $4,000 an. for mainten. (H. D. 1167, 60th, 2d), **09,** 871; act June 25, 1910, au. chan. 4′ d., mouth to Ostrander, and 2½′ thence to Castlerock, by dr., **10,** 962.
By Maj. Cavanaugh, 1909, plan for imp. bet. Castlerock and head of navigation; est., $9,600, and $2,000 an. mainten., **10,** 968; act June 25, 1910, au. chan. 2½′ x 40′ (H. D. 404, 61st, 2d), **10,** 963.

SURVEYS.

Au. act Mar. 3, 1879; made by Maj. Gillespie, 1879, **80,** 2331.
Minor surs., **97,** 3464; **00,** 4366.
Ex. and sur. up to Castlerock au. act Mar. 2, 1907; made, 1908, by Maj. Roessler and Maj. McIndoe, resp., (H. D. 1167, 60th, 2d), **09,** 871.
From Castlerock to head of navigation, au. act Mar. 3, 1909; made, 1909, by Maj. Cavanaugh (H. D. 404, 61st, 2d), **10,** 968.
A stadia and hydrographic sur. from Toledo to Castlerock begun, **12,** 2833.

Maps. (H. D. 1167, 60th, 2d.)

WW-67 GRAYS RIVER, WASH.

APPROPRIATIONS.

1907,	$2,500, **07,** 2207.
1910,	500, **10,** 2415.
1911,	500, **11,** 2621.
Total,	3,500

COMMERCE.

Principally towing of logs, **07,** 779; **12,** 1229.
Not believed that imp. will have any tendency to reduce freight rates, **09,** 870.
1911, 136,000± t; 6,000 pass.; other than logs, etc., 2,500± t., **12,** 2838.

ENGINEERS.

Chief of Engineers. R., 91, 421; **07,** 779; **08,** 829; **09,** 869; **10,** 966; **11,** 1024; **12,** 1229.

BOARDS. (See Projects.)

In charge:
Maj. T. H. Handbury, 1890. **R., 91,** 3385.
Lt. Col. S. W. Roessler, 1907–08. **R., 07,** 2207; **08,** 2278.
Maj. J. F. McIndoe, 1908–. **R., 09,** 2242; **10,** 2415; **11,** 2621; **12,** 2837.
Maj. J. B. Cavanaugh, **10,** 951.

Capt. Arthur Williams, **10,** 951.
Maj. Jay J. Morrow, **10,** 951.

Assistant. Capt. Arthur Williams, **09,** 856; **10,** 951; **11,** 1007.

OPERATIONS.

1907-08. 51 snags and trees removed from chan.; 295 trees cut from banks, **08,** 2278.
1908-09. 195 snags removed; 2,000 c. y. gravel and sand removed from bars by scraping, **09,** 870, 2242.
1911-12. 197 snags and trees removed, **12,** 2837.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3386.
Work interfered with by storms and freshets, **08,** 2278.
Shoaling and depositing of logs and snags during freshets, **10,** 2415.
Work accomplished is of material benefit to navigation, **12,** 2837.

R. rises in Coast Range, flows sw. 30 m., empties into estuary of Columbia R. known as Grays B., nearly opposite Astoria; passes through dense forests before reaching lowlands; l., 8 m.; proj. part narrow, tortuous, obstr. by snags, etc.; town of Grays R. 8 m. above mouth, **12,** 1229.

PLANS.

By Maj. Handbury, 1891, removal of obstr., snags, logs, etc.; est., $2,500, **91,** 3387.

PROJECTS.

By BERH., 1906, removal of logs, stumps, and overhanging trees and clearing chan. up to present head of navigation at Walkers Landing (R. and H. D. 1, 59th, 2d). Proj. au. act Mar. 2, 1907, which app. $2,500, **07,** 779.

SURVEYS.

Ex. and sur. au. act Sept. 19, 1890; made, 1891, by Maj. Handbury, **91,** 3386.

WW-68(a) DEEP RIVER, WASH. (including Skamokawa and Crooked Rivers).

ENGINEERS.

Chief of Engineers. R., 91, 420.

In charge. Maj. T. H. Handbury, 1890. **R., 91,** 3378.

PHYSICAL CHARACTERISTICS.

Details, **91,** 3378.

SURVEY.

Ex. au. act Sept. 19, 1890; made by Maj. Handbury (**R.** unfav.), **91,** 3378.

WW-68(b) ALAMICUT (Deep) RIVER, WASH.

ENGINEERS.

Chief of Engineers. R., 10, 968.

In charge. Maj. J. F. McIndoe, 1910. **10,** 951.

SURVEY.

Ex. au act Mar. 3, 1909, to main chan. of Columbia R. **R.,** Maj. McIndoe, Aug. 16, 1909 (H. D. 302, 61st, 2d) (unfav.), **10,** 968.

WW-69 BAKERS AND WILLAPA (Shoalwater) BAYS, WASH. (canal between).

COMMERCE.

Necessities of C., **82,** 2727.

ENGINEERS.

Chief of Engineers. R., 81, 332; **82,** 324.

In charge. Capt. C. F. Powell, 1882. **R., 82,** 2724.

Assistant. R. A. Habersham. **R., 82,** 2725.

PHYSICAL CHARACTERISTICS.

Description of, Bakers and Shoalwater Bs., **82,** 2724.

PLANS.

By Capt. Powell, 1881, water communication via Johnsons and Holmans Lakes and Tarlet Slough, the canal part to be 40′ w. at bottom; est., $512,520, **82,** 2725, 2727.

SURVEYS.

Previous surs., **82,** 2725.
Au. act Mar. 3, 1881; made, 1881, by Capt. Powell, **82,** 2724.

WW-71(a) ILWACO HARBOR, WASH.

ENGINEERS.

Chief of Engineers. R., 06, 765.

In charge. Maj. W. C. Langfitt, **06,** 752.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, for d. chan. near H., and near Sand Isld., to 8′. **R.,** Maj. Langfitt, Mar. 3 and Nov. 24, 1905; est., $39,000, and $13,000 an. mainten. **R.** fav. imp. as a military necessity but not as a measure of R. and H. imp. (H. D. 318, 59th, 1st), **06,** 765.

Maps. (H. D. 318, 59th, 1st.)

RIVER AND HARBOR WORKS—PACIFIC COAST.

XX.—SEATTLE, WASH., DISTRICT.

XX.—SEATTLE, WASH., DISTRICT.

In charge of U. S. Engineer Office,
Seattle, Wash.

XX 1 Pacific Ocean.
XX 2 Willapa Bay (Shoalwater), Wash. (1)
XX 3 Nasel R., Wash. (2)
XX 4 Rocky Nemah R., Wash. (2)
XX 5 Nemah R., Wash. (2)
XX 6 Williams Cr., Wash. (2)
XX 7 Palix R., Wash. (2)
XX 8 Stuart Slough, Wash. (2)
XX 9 Willapa R., Wash. (2)
XX 10 South Fork of Willapa R., Wash. (9)
XX 11 Wilson Cr., Wash. (9)
XX 12 North R., Wash. (2)
XX 13 Grays H., Wash. (1)
XX 14 Elk R., Wash. (13)
XX 15 Johns R., Wash. (13)
XX 16 Chehalis R., Wash. (13)
XX 17 Satsop R., Wash. (13)
XX 18 East Branch, Satsop R., Wash. (17)
XX 19 Wynooche R., Wash. (13)
XX 20 Wishkah R., Wash. (13)
XX 21 East Hoquiam R., Wash. (22)
XX 22 Hoquiam R., Wash. (13)
XX 23 Humptulips R., Wash. (13)
XX 24 Grays H. to Cape Flattery, Wash. (1)
XX 25 Copalis R., Wash. (1)
XX 26 Moclips R., Wash. (1)
XX 27 Wreck Cr., Wash. (1)
XX 28 Quiniault R., Wash. (1)
XX 29 Queets R., Wash. (1)
XX 30 Hoh R., Wash. (1)
XX 31 Goodman Cr., Wash. (1)
XX 32 Quillayute R., Wash. (1)
XX 33 Bogachiel R., Wash. (32)
XX 34 Calower R., Wash. (33)
XX 35 Sol Duc R., Wash. (32)
XX 36 Dicky R., Wash. (1)
XX 37 Ozette R., Wash. (1)
XX 38 Suez R., Wash. (1)
XX 39 Cape Flattery to Port Townsend (Straits of Juan Fuca), Wash. (1)
XX 40 Sekiu R., Wash. (39)
XX 41 Hoko R., Wash. (39)
XX 42 Pysht R., Wash. (39)
XX 43 Elwha R., Wash. (39)
XX 44 Little R., Wash. (43)
XX 45 Dungeness R., Wash. (39)
XX 46 Chimikim R., Wash. (39)
XX 47 Hood Canal, Wash. (39)
XX 48 Quilcene R., Wash. (47)
XX 49 Docewallips R., Wash. (47)
XX 50 Duckabush R., Wash. (47)
XX 51 Waketichie R., Wash. (47)
XX 52 Hamahama R., Wash. (47)
XX 53 Eagle Cr., Wash. (47)
XX 54 Lilliwaup R., Wash. (47)
XX 55 Skokomish R., Wash. (47)
XX 56 Union R., Wash. (47)
XX 57 Big Mission Cr., Wash. (47)
XX 58 Mission Cr., Wash. (47)
XX 59 Tahuyah R., Wash. (47)
XX 60 Dry Cr., Wash. (47)
XX 61 Dewatto R., Wash. (47)
XX 62 Puget Sound, Wash.
XX 63 Olympia and Des Chutes R., Wash. (62)
XX 64 Nisqually R., Wash. (62)
XX 65 Steillacoom, Wash. (62)
XX 66 Steillacoom Cr., Wash. (65)
XX 67 Tacoma H., Wash. (62)
XX 68 Puyallup R., Wash. (67)
XX 69 Stuck R., Wash. (68)
XX 70 White R., Wash. (69)
XX 71 Hylebos Cr., Wash. (67)
XX 72 Seattle H., Wash. (62)
XX 73 Duwamish R., Wash. (72)
XX 74 White R., Wash. (73)
XX 75 Green R., Wash. (74)
XX 76 Black R., Wash. (73)
XX 77 Cedar R., Wash. (73)
XX 78 Sammamish R., Wash. (72)
XX 79 Everett H., Wash. (62)
XX 80 Snohomish R., Wash. (79)
XX 81 Snoqualmie R., Wash. (80)
XX 82 Skykomish R., Wash. (80)
XX 83 Pilchuck R., Wash. (80)
XX 84 Ebey Slough, Wash. (80)
XX 85 Steamboat Slough, Wash. (80)
XX 86 Stanwood H., Wash. (62)
XX 87 Hat Slough, Wash. (86)
XX 88 South Pass, Wash. (86)
XX 89 Stilaguamish R., Wash. (86)
XX 90 West Pass, Wash. (86)
XX 91 Skagit B., Wash. (62)
XX 92 Skagit R., Wash. (91)
XX 93 Sauk R., Wash. (92)
XX 94 Cascade R., Wash. (92)
XX 95 Baker R., Wash. (92)
XX 96 North Fork of Skagit R., Wash. (92)
XX 97 Old Main R., Wash. (92)
XX 98 La Conner, Wash. (62)
XX 99 Swinomish Slough, Wash. (98)
XX 100 Samish B., Wash. (39)
XX 101 Samish R., Wash. (100)
XX 102 North Fork of Samish R., Wash. (100)
XX 103 Bellingham B., Wash. (39)

XX 104 Whatcom Cr., Wash. (103)
XX 105 Nooksack R., Wash. (103)
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XX 106 COLUMBIA RIVER
(above Snake R., Wash. See p. 1616.)

XX 107 Spokane R., Idaho and Wash. (106
XX 108 St. Joe R., Idaho. (107)
XX 109 Coeur de Alene R., Idaho. (107)
XX 110 Pend O'Reille R., Idaho and Wash. (106) (See WW-2)
XX 111 Clarks Fork, Mont. and Idaho. (110) (See WW-2)
XX 112 Kootenai R., Mont. and Idaho (106)
XX 113 Kettle R., Wash. (106)
XX 114 San Poil R., Wash. (106)
XX 115 Nespilem R., Wash. (106)
XX 116 Okanogan R., Wash. (106)
XX 117 Methow R., Wash. (106)
XX 118 Stehekin R., Wash. (106)
XX 119 Wenatchee R., Wash. (106)
XX 120 Yakima R., Wash. (106)
XX 121 Natches R., Wash. (120)
List now proceeds to—

ALASKAN WATERS.

XX 122 Gulf of Alaska, Alaska. (1)
XX 123 Stikine R., Alaska. (122)
XX 124 Taku R., Alaska. (122)
XX 125 Alsek R., Alaska. (122)
XX 126 Copper R., Alaska. (122)
XX 127 Bremner R., Alaska. (126)
XX 128 Chitina R., Alaska. (126)
XX 129 Tebay R., Alaska. (128)
XX 130 Klu R., Alaska. (128)
XX 131 Tana R., Alaska. (128)
XX 132 Young R., Alaska. (128)
XX 133 Nizina R., Alaska. (128)
XX 134 Lakina R., Alaska. (128)
XX 135 Kusk R., Alaska. (128)
XX 136 Kotsina R., Alaska. (126)
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War Department.

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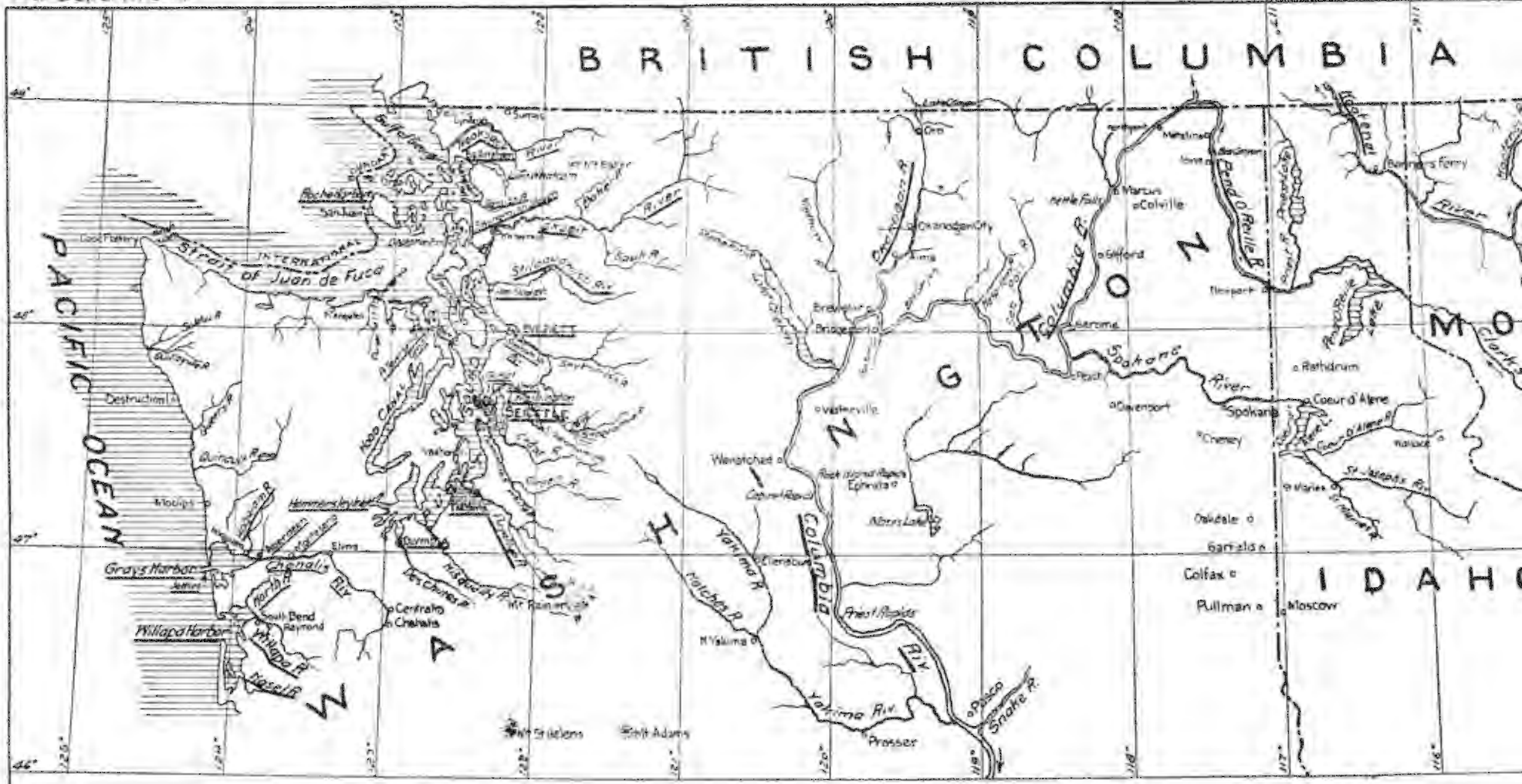

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Seattle, Wash

1912.

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IN TWO SHEETS

Corps of Engineers, U.S. Army

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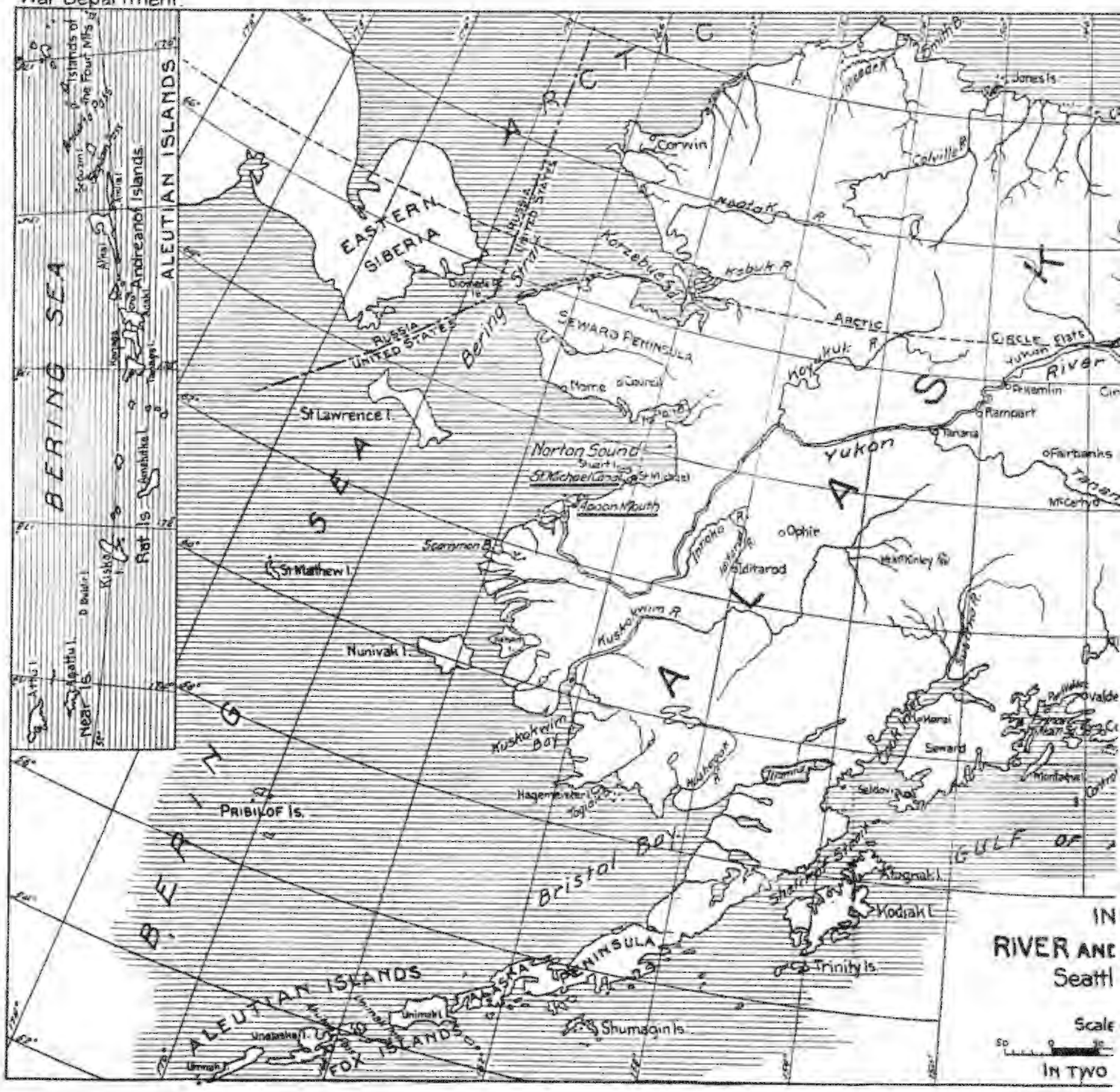
War Department



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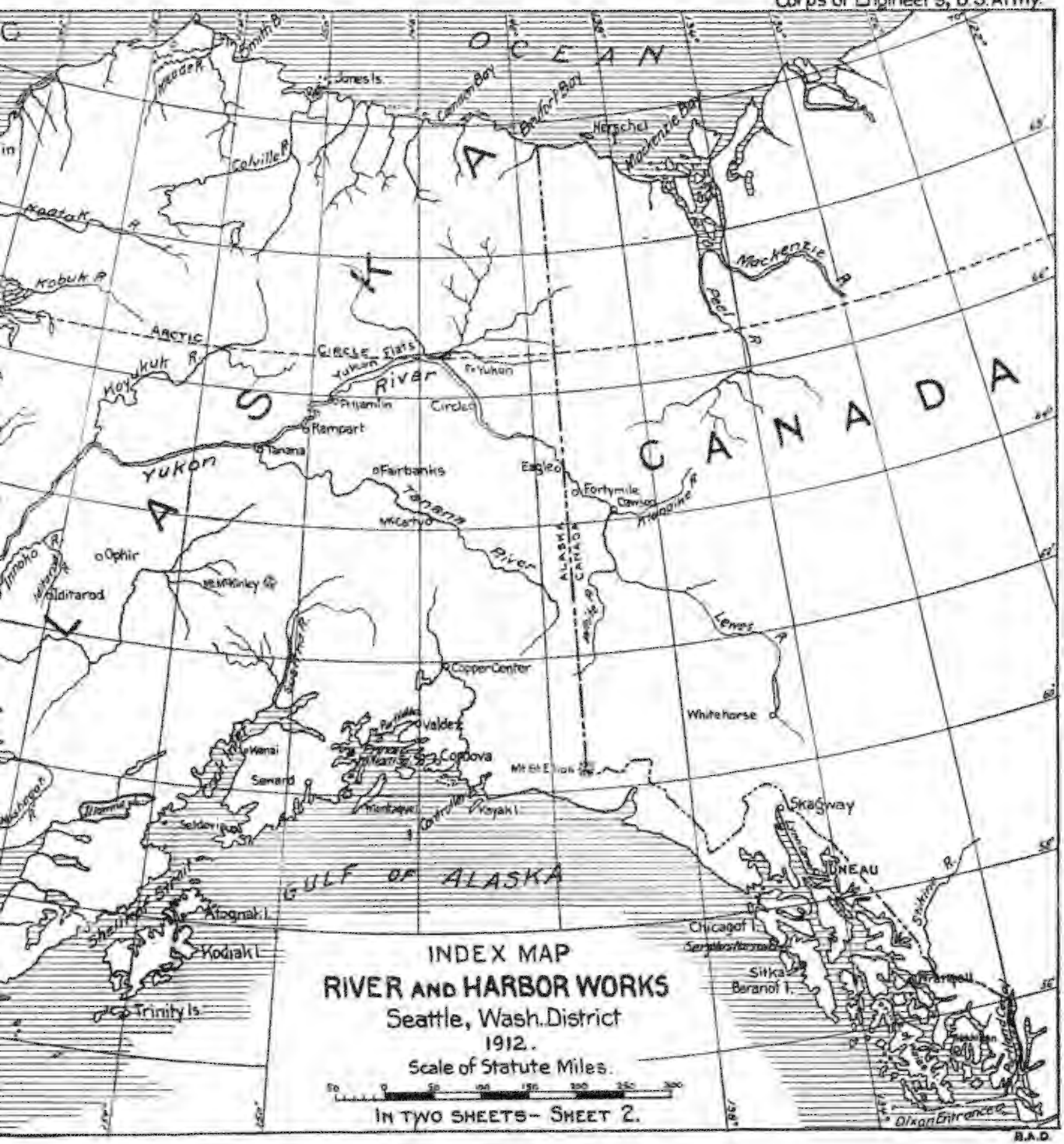

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XX-2(a) WILLAPA BAY (Shoalwater Bay) TO COLUMBIA RIVER, OREG.

COMMERCE.
Important, **76,** ii, 674.

ENGINEERS.
Chief of Engineers. R., 76, 116.

In charge:
Maj. N. Michler. **R., 76,** ii, 644.
Maj. J. M. Wilson. **R., 76,** ii, 672.

PHYSICAL CHARACTERISTICS.
Described, **76,** ii, 644, 672.

PLANS.
By Maj. Michler, 1875, canal to connect Shoalwater B. with Columbia R., 11′ x 65′, with lock at each end for boats to pass at ordinary high tides; est., $529,279; at lowest l. w., $854,116, **76,** ii, 644.
By Maj. Wilson, 1875, canal for passage of SS. drawing 10′ at ordinary high tide; canal 24,544′ l., with locks at each end; and dr. chan. in Columbia R. and Shoalwater B.; est., $768,185, **76,** ii, 673, 674.

SURVEY.
By Maj. Michler, 1875, **76,** 116, ii, 644.

XX-3 NASEL RIVER, WASH.

APPROPRIATION.
1892, $1,500, **93,** 3400.

ENGINEERS.
Chief of Engineers. R., 91, 411; **93,** 411.

In charge. Capt. T. W. Symons, 1890–93. **R., 91,** 3294, 3296; **93,** 3399.

Assistants:
R. A. Habersham. **R., 91,** 3295.
A. J. McMillan. **R., 91,** 3296.
P. G. Eastwick. **R., 93,** 3400.

OPERATIONS.
1892–93. R. cleared of snags obstr. navigation, **93,** 3400.

PHYSICAL CHARACTERISTICS.
Description of, **91,** 3296.

PROJECT.
By Capt. Symons, 1891, imp. navigation by removal of snags and r.; est., $1,500, **91,** 3296.

SURVEY.
Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **91,** 3296.
Maps. **91,** 3296.

XX-9 WILLAPA (Shoalwater) RIVER AND HARBOR, WASH.

APPROPRIATIONS.

1892,	$18,000,	**93,** 3404.
1894,	13,350,	**95,** 3400.
1899,	5,000,	**99,** 3260.
1907,	25,000,	**07,** 2210.
1910,	50,000,	**10,** 2418.
1911,	50,000,	**11,** 2626.
1912,	75,000,	**12,** 2842.
Total,	236,350	

COMMERCE.
Description of, **98,** 3089.
Principal business of H. in 1897, lumber, oysters, and fish, **98,** 3089.
Description of, with **R.** by E. L. Carpenter, jr. engr., **05,** 2507.
1911, 743,681 t.; 769 SS. and 29 sailing vessels entered the H. during 1911, **12,** 2843.

CONTRACTS.
1892. J. E. Howard, dike constr.—piles, 10¢ l. f.; lumber, $11.75 M f.; complete bolts, 17¢ each; spikes and wire, 3½¢ lb.; brush, $2.45 cord; st., 56¢ short t. ($4,922.49). D. D. Clarke, dr., $3 c. y. ($10,500), **93,** 3403.
1894. Rudder & Kelley, removal of log jam ($2,175), **95,** 3401.
1895. C. O. Rude, dr., $2.74 c. y. ($2,192). Dickinson & Co., dike constr.—piles, 8½¢ c. y.;

lumber, $11 M f.; complete bolts, 18¢ each; spikes and wire, 3½¢ lb.; brush, $2.35 cord; and st., 60¢ t. ($2,447.50), **95,** 3401.

1908. North American Dredging Co., dr., 26¢ c. y., **08,** 2282.

1911. Puget Sound Bridge & Dredging Co., dr. 1,104,552 c. y., and constr. dikes (prices given), **12,** 2842.

ENGINEERS.

Chief of Engineers. **R., 85,** 369; **91,** 409; **93,** 441; **94,** 409; **95,** 451; **96,** 406; **97,** 508; **98,** 511, 523; **99,** 599; **00,** 676; **01,** 641; **02,** 562; **03,** 620; **04,** 686; **05,** 692; **06,** 766, 787; **07,** 780; **08,** 830; **09,** 871; **10,** 968, 998; **11,** 1026; **12,** 1231.

In charge:
Capt. C. W. Powell, 1884–85. **R., 85,** 2420.
Capt. T. W. Symons, 1890–95. **R., 91,** 3266, 3268; **93,** 3402; **94,** 2595; **95,** 3399.
Capt. H. Taylor, 1896–1900. **R., 96,** 3325; **97,** 3434; **98,** 3058, 3088; **99,** 3259; **00,** 4463.
Maj. John Millis, 1901–05. **R., 01,** 3577; **02,** 2409; **03,** 2323; **04,** 3582; **05,** 2505.
Maj. H. M. Chittenden, 1905–08. **R., 06,** 2021; **07,** 2209; **08,** 2281.
Maj. C. W. Kutz, 1908–11. **R., 09,** 2245; **10,** 2417; **11,** 2625.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2841.

Assistants:
R. A. Habersham. **R., 91,** 3267.
A. J. McMillan. **R., 91,** 3271.
J. M. Clapp. **R., 93,** 3404; **96,** 3327.
J. Zugg. **R., 93,** 3406; **95,** 3402; **96,** 3330; **00,** 4465.
Lt. M. L. Walker, **01,** 641.
E. L. Carpenter. **R., 05,** 2507.
Lt. F. A. Pope, **06,** 765; **07,** 780; **11,** 1026; **12,** 1231.
1st Lt. J. H. Earle, **09,** 871; **10,** 968; **11,** 1026.
Capt. Arthur Williams, **11,** 1026; **12,** 1231.

OPERATIONS.

1892–93. Dike at Mailboat Slough completed, and about 1,900 c. y. dr., **93,** 3403.

1893–94. About 1,300 c. y. dr., **94,** 2596.

1894–95. Dr. in progress and also constr. and repair of dikes, **95,** 3402.

1895–96. Work of previous year completed, **96,** 3326.

1896–97. Minor repairs made, **97,** 3434.

1899–00. Chan. through North R. jam cleared; dikes in Willapa R. repaired and refilled, **00,** 4464.

1900–01. Chan. through log jam in North R. thoroughly cleared and w. to 100′, **01,** 3577.

1901–02. General ex. of dikes near South Bend made, **02,** 2409.

1902–03. Mailboat Slough Dike repaired and refilled, and Louderback Slough Dike partly removed, **03,** 2324.

1903–04. 51 snags and stumps removed from Nasel R., **04,** 3582.

1904–05. Inspection of works, **05,** 2506.

1907–08. 83,400 c. y. dr., **08,** 2282.

1911–12. 476,918 c. y. dr., **12,** 2842.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 2420; **91,** 3267, 3270; **93,** 3401; **98,** 3089.

R. empties into Pacific through Willapa H., about 25 m. n. of Columbia R. Near its mouth it is joined by the North R., which flows at right angles into it. Mailboat Slough is a small cut-off chan. in H. **98,** 3089.

PLANS. (See Projects.)

Capt. Powell, 1884, est. $1,500 as cost of clearing lower R. of snags and similar obstr., but did not consider such an imp. a "present" necessity, **85,** 2422.

After sur. of Willapa R., 1890, Capt. Symons proposed imp. of Willapa R. by d. shoals to secure min. d. of 8′ at m. l. w. up to Willapa City; est., $31,350, **91,** 3267, 3269.

PROJECTS. (See Plans.)

By Capt. Symons, 1892, closing Mailboat Slough by dike of piles, brush, and st., and removal of bad shoal in R. just below Willapa City by dr.; est., $31,350, **93,** 3402.

By Capt. Symons, 1894, cutting chan. through log jam in North R., **95,** 3400.

In 1897 Capt. Taylor est. $80,000 to further imp. H., **98,** 3090.

Acts 1894 and 1899 au. use of a portion of funds for this R. to clear chan. through jam in North R., **99,** 3260.

Act June 13, 1902, au. use of balance of available funds to be expend. in repair and mainten. of existing work and imp. North and Nasel Rs., **03,** 2323.

Act Mar. 2, 1907, au. dr. chan. 12′ x 150′ through shoal bet. South Bend and Raymond; est., $25,000 (H. D. 477, 59th, 1st), **07,** 780.

Act June 25, 1910, au. proj. for 18′, local interests to pay one-half cost of certain work at Raymond; conditions complied with (H. D. 524, 61st, 2d), **11,** 1026, 2626.

SURVEYS.

Au. act of July 5, 1884; made, 1884, by Capt. Powell (**R.** unfav.) (see Plans), **85,** 2420.

Ex. of Shoalwater B. made, 1890, by Capt. Symons (**R.** unfav.), **91,** 3267.

Sur. of Willapa R. au. act of Sept. 19, 1890; made, 1891, by Capt. Symons (**R.** fav.) (see Plans), **91,** 3268.

Sur. of mouth of R. and Mailboat Slough au. act June 3, 1896; made by Capt. Taylor, 1897 (**R.** fav.) (see Projects), **98,** 3088.

Pre. ex. and sur. au. act Mar. 3, 1905, South Bend to Raymond, with view to 12′ and 18′, resp. **R.** by Maj. Millis, June 23, 1905, and Jan. 18, 1906; est. for 12′ chan., $25,000 (H. D. 477, 59th, 1st), **06,** 787.

Pre. ex. and sur. au. act Mar. 3, 1909, to and through Raymond. **R.** by Maj. Kutz, Apr. 19 and Oct. 25, 1909; plan at est. cost of $218,132.20 submitted, provided local interests contribute one-half of cost of dr. at city of Raymond ($5,500.24) (H. D. 524, 61st, 2d), **10,** 998.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1232.

Maps. (H. D. 477, 59th, 1st; H. D. 524, 61st, 2d.) **91,** 3268; **96,** 3332; **03,** 2324; **08,** 2282.

XX-12 NORTH RIVER, WASH.

COMMERCE.

Description of, **95,** 3485.

In 1895 est. 4,000,000,000′ of merchantable timber adjacent to the stream, **95,** 3485; **97,** 3472.

ENGINEERS.

Chief of Engineers. **R., 91,** 409; **95,** 458; **97,** 523.

In charge:
Capt. T. W. Symons, 1890–95. **R., 91,** 3263, 3264; **95,** 3485.
Capt. H. Taylor, 1897. **R., 97,** 3472.

Assistants:
A. J. McMillan. **R., 91,** 3266.
J. M. Clapp. **R., 95,** 3486.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3485.

Tributary of Willapa H., rising in the Coast Range. Has narrow bottoms on itself and tributary streams. Flows through a hilly country. In 1897 navigation was impeded by several riffles and other obstr., **95,** 3485.

SURVEYS.

Au. act Sept. 19, 1890; made, 1891, by Capt. Symons (**R.** unfav.), **91,** 3265.

Ex. from mouth to Willapa B. upward for 25 m. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** fav.), **95,** 3485.

Ex. au. act June 3, 1896; **R.** (fav.) submitted, 1896, by Capt. Taylor, **97,** 3472.

Maps. **91,** 3265; **95,** 3488.

XX-13 GRAYS HARBOR, WASH.

Part.	Title.	Period.	Appropriations.
a	Grays H. and Bar Entrance	1881–1912	$2,660,000
b	Grays H. and Chehalis R.	1890–1912	399,500
	Total		3,059,500

Part (a), XX-13 Grays Harbor and Bar Entrance, Wash.

APPROPRIATIONS.

1896,	$20,000,	**96,** 3334.
1897,	350,000,	**97,** 3436.
1899,	285,000,	**99,** 3262.
1900,	50,000,	**00,** 4470.
1901,	138,225,	**01,** 3580.
1902,	156,775,	**02,** 2412.
1905,	30,000,	**05,** 2509.
1907,	200,000,	**07,** 2212.
1908,	300,000,	**08,** 2286.
1909,	100,000,	**09,** 2249.
1910,	75,000,	**10,** 2420.
1911,	300,000,	**11,** 2628.
1912,	655,000,	**12,** 2844.

Total, 2,660,000 (incl. misc., $2,660,087.25, **12,** 2844).

COMMERCE.

Large and increasing; principally lumber exporting, **05,** 694, 2510.

1898, 169,000± t.; 1903, 459,000± t.; 1908, 828,000± t.; 1911, 710,800± t., **12,** 1237.

So far as known, U. S. imp. has not caused any reduction in rates, **12,** 1237.

CONTRACTS.

1897. Hale & Kern Contract Co., j. constr. (piles, 11¢ l. f.; lumber, $11 M f.; steel rails, $40; ironwork, 4¢ lb.; brush, $1.20 c. y.; st., $1.10 t.), $769,870, **98,** 3061.

1907. Daniel Kern, 46 dump cars, $400 each, **08,** 2286. Grays Harbor Constr. Co., constr. of wharf and trestle, **08,** 2286.

1908. Independent Asphalt Paving Co. and Northwestern Contract Co., r., $1.55 t., **08,** 2286. R. J. Stoner, piling and brush fascines, prices given, **08,** 2286; **09,** 2248.

1909. R. J. Stoner, brush fascines, 1,800 cords, $3.50 cord, **09,** 2248. Doty Lumber & Shingle Co., piles, 9¢ l. f., **09,** 2249.

1910. C. W. Green, fir piling, 17½¢ l. f.; R. J. Stoner, 2,500 cords brush fascines, $4 cord, **11,** 2627.

1911. Hercules Sandstone Co., 375,000 t. st., $1.61 t., aver. price; Ela & Kinnear, 2,500 cords brush fascines, $3.67 cord; Little Rock Lumber Co., 77,725 l. f. fir piling, 15½¢ l. f.; A. A. Tibbetts, grillage poles, 3,000 poles 20′ long, 34¢ pole, **11,** 2628.

1912. H. C. Minkler, 500 cords brush fascines, $3.84 cord; E. B. Hamilton, 14,700 l. f. piling, prices given; C. W. Green, 500 grillage poles, 25¢ each, **12,** 2845.

ENGINEERS.

Chief of Engineers. **R., 81,** 332; **82,** 324; **95,** 459; **96,** 407; **97,** 509; **98,** 512; **99,** 600; **00,** 678; **01,** 642; **02,** 563; **03,** 621; **04,** 687; **05,** 693; **06,** 767; **07,** 781; **08,** 831; **09,** 873; **10,** 970; **11,** 1029; **12,** 1234.

Boards:

Convened, Portland, Oreg., Sept. 11, 1903, by S. O. No. 20, at request of R. and H. Com. of H. of R., to consider advisability of continuing the imp. or modifying plans. **Rs.,** Nov. 7, 1903, and Jan. 28, 1904 (H. D. 576, 58th, 2d) (see Projects) (Lt. Col. W. H. Heuer, Maj. John Millis, Maj. W. C. Langfitt), **04,** 688, 3586, 3597.

BERH. reviewed **R.** of above board, Feb. 15, 1904 (H. D. 576, 58th, 2d) (see Projects), **04,** 688, 3589.

In charge:

Capt. C. F. Powell, 1881–82. **R., 82,** 2722.

Capt. T. W. Symons, 1895. **R., 95,** 3517.

Capt. H. Taylor, 1896–1901. **R., 96,** 3333; **97,** 3436; **98,** 3059; **99,** 3261; **00,** 4468; **01,** 3578.

Maj. John Millis, 1901–05. **R., 02,** 2410; **03,** 2325; **04,** 3583; **05,** 2508.

1st Lt. F. A. Pope, **06,** 766.

Maj. H. M. Chittenden, 1906–09. **R., 06,** 2022; (Lt. Col.) **07,** 2211; **08,** 2283.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2246; **10,** 2418; **11,** 2626.

Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2843.

Assistants:

R. Q. Habersham. **R.,** 2723.

J. M. Clapp. **R., 98,** 3063; **99,** 3263; **00,** 4471; **08,** 2283.

E. L. Carpenter. **R., 05,** 2510; **06,** 2023.

Capt. F. A. Pope, **06,** 766; **07,** 780; **11,** 1026; **12,** 1231.

1st Lt. J. H. Earle, **09,** 871; **10,** 968; **11,** 1026.

Capt. Arthur Williams, **11,** 1026; **12,** 1231.

OPERATIONS.

1897–98. J. constr. begun, **98,** 3060.

1898–99. J. trestle completed to 5,152′ outside the h. w. line; foundation built to 4,320′; enrockment completed to above h. w. l. for 3,520′ (maps), **99,** 3261.

1899–00. J. trestle advanced 2,584′; foundation completed for 3,336′; enrockment completed to level of ordinary h. w. for addl. distance of 3,680′ (maps), (photographs), **00,** 4468.

1900–01. J. trestle advanced 3,232′, completed foundation 3,200′, completed enrockment 1,992′, **01,** 3579.

1901–02. Trestle advanced 2,096′, foundation 2,240′, enrockment 3,648′, **02,** 2411.

1902–03. Trestle advanced 720′, foundation 724′, enrockment 880′; total enrockment completed about 13,784′; work discontinued due to exhaustion of app., **03,** 2325.

1907–08. Work started on n. j., 2,624 l. f. under constr., **08,** 2283–2285.

1908–09. N. j. trestle and mattress completed to proj. l. of 10,000′, 67,467 t. st. placed, **09,** 874, 2247.

1909–10. 62,283 t. st. placed in n. j.; 69,302 c. y. dr. by U. S. plant, **10,** 2418–2419.

1910–11. Extending n. j., 2,784′ trestle constr., 2,656 l. f. mattress foundations placed, 56,615 t. st. placed, **11,** 2626–2627.

1911–12. N. j. trestle and plant repaired; 2,752′ trestle constr.; 163,608 t. st. placed in j.; mattress foundation placed for 2,880′, **12,** 2843–2844.

PHYSICAL CHARACTERISTICS.

Description of, **82,** 2723; **95,** 3517; **98,** 3063.

Entrance to H. from the Pacific Ocean is about 45 m. n. of the Columbia R. H. is about 17 m. l. and

about 14 m. broad from n. to s. A few of the tributaries entering the H. are the Satsop, Chehalis, Wynooche Rs., **95,** 3517. Through the H. throat is a d. chan. and bet. this and the open sea is a bar convex to the sea and connected with sand spits on the 2 sides of the H. throat. The chans. across this bar in 1895 were variable and shifting, **96,** 3333.

Littoral current, description of, **95,** 3520.

Table showing differences bet. Grays H. and other Hs. of the U. S. where js. had been or were being constr. in 1895, **95,** 3531.

Imp. condition of the bar, 1899, **99,** 3265; **00,** 4470.

Tides and currents, **99,** 3265.

Scouring effect of j., **01,** 3579; **02,** 2411.

Damage to works, **02,** 2411; **03,** 2325; **04,** 3583; **05,** 2508; **06,** 2022; **10,** 2419.

Condition of works, d. of w., etc., **02,** 2411; **03,** 622; **04,** 3584; **05,** 2508; **06,** 2023; **07,** 2211; **08,** 2284; **09,** 2247; **10,** 2419.

Spruce and fir piles attacked by teredo; hemlock piles sound, **10,** 2419.

Winter storms, 1912, did considerable damage to j. trestle, **12,** 1236, 2843–2844.

Shoaling, outer bar; controlling d. at outer bar, 17′, m. l. w., **12,** 1236, 2843–2844.

PRIVATE WORK.

Land for approach and operating plant donated to U. S. by local interests, **12,** 1235.

PROJECTS.

In 1895 Capt. Symons est. $2,363,309 to constr 2 js. for the imp. of the H., **95,** 3533.

By Capt. Symons, 1895, for a single j. of rubblest. built above h. t. l. to extend out to sea from a point on the s. side of the H. throat for about 3½ m., to concentrate the ebb and flood waters upon the bar to obtain 24′ across the bar; est., $1,000,000, **96,** 3333.

B E., convened, 1903, under S. O. No. 20, proposed 24′ across bar by extending s. j. to l. orig. contemplated (18,200′) at cost of $557,360.10, by constr. a n. j., and protecting n. shore at cost of $508,000; total, $1,065,360.10. Approx. est. for building n. j. as far out as s. j. of $2,334,818, also presented. Proj. reviewed by BERH.; of opinion that cost involved by proposed j. proj. too great, and that desired results could be obtained at a much reduced cost by dr., **04,** 688, 3586, 3589, 3597.

Proj. enlarged, act Mar. 2, 1907; au. j. on n. side of H. throat, extending out to sea 9,000′ from ocean h. w. line; est., $600,000 (R. and H. Com. D. 2, 59th, 2d), **07,** 782.

Act June 25, 1910, further extended proj. by providing for extension of n. j. 7,000′, thus bringing end of j. opposite existing end of s. j., to be built up to height of mid tide with a w. at crest of 8′; est., $1,030,000, in accordance with plan of BERH. (R. and H. Com. D. 29, 61st, 2d), **10,** 971.

SURVEYS.

Ex. au. act Mar. 3, 1881; made, by Capt. Powell (**R.** fav.), **82,** 2722.

List of surs. made of the H., **95,** 3520.

Sur. of the H., its bar and entrance, for imp. of the chans. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3517.

Sur. of the bar, by Capt. Taylor, 1898, **98,** 3060.

By Maj. Millis, 1901, **01,** 3579; 1902, **02,** 2326; 1904, **05,** 2508.

By Maj. Kutz, 1909, **09,** 2247; 1910, **10,** 2419; 1911, **11,** 2627.

By Maj. Cavanaugh, 1912, **12,** 2844.

Minor surs., **98,** 3060; **00,** 4470, 4475.

(See Boards and Projects.)

Pre. sur. for location of n. j., **07,** 782, 2211.

Minor sur. made shows a narrow chan. 19′ d., m. l. w., ne. of best chan., **12,** 2844.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1235.

Maps. **95,** 3532; **98,** 3064; **99,** 3266; **02,** 2412; **03,** 2326; **08,** 2286; **09,** 2248; **10,** 2420; **12,** 2844.

Part (b), XX Grays Harbor and Chehalis River, Wash.

APPROPRIATIONS.

1892,	$50,000,	**93,** 3408.
1895,	25,000,	**95,** 3405.
1902,	50,000,	**02,** 2413.
1905,	30,000,	**05,** 2512.
1907,	177,000,	**07,** 2213.
1909,	* 25,000,	**09,** 2250.
1910,	32,500,	**10,** 2422.
1911,	[1] 10,000,	**11,** 2629.
Total,	399,500 (incl. misc., $389,530.05,	**12,** 2847).

COMMERCE.

12,000 t. lumber, fish, machinery, etc., 1906, **07,** 2213.

Waterway extensively used for floating saw logs, **07,** 784.

Diagram of relations of app., tonnage, and valuation, **11,** 2630.

1,300,000 t., mostly lumber, 1911, **12,** 1239.

CONTRACTS.

1892. J. E. Howard, dike constr.: Piles, 8¢ l. f.; lumber, $10 M f.; bolts, 18¢ each; spikes and wire, 3 and 2.9¢ lb.; brush, $2.45 cord; st., 59¢ t.; sand bags, 8¢ each; edgings, slabs, etc., $2 cord ($44,086.50), **93,** 3409.

1894. Dickinson & Co., dike constr.—piles, 8½¢ l. f.; lumber, $11 M f.; bolts, 18¢ each; spikes and wire, 3¢ lb.; brush, $2.49 cord; st., 62¢ t.; edgings, etc., $2 cord ($13,213.10), **95,** 3406.

1903. Puget Sound Bridge & Dredging Co., dr., 13.8¢ c. y., and supple. agreement, **04,** 3602–3603.

1904. Creech Bros., repairs to dikes. **04,** 3604. J. W. Hall, snagging, $30 per day, **04,** 3602.

1907. North American Dredging Co., dr., 1,250,000 c. y., 15½¢ c. y., **08,** 2287, 2289.

1911. Puget Sound Bridge & Dredging Co., dr. 94,350 c. y., 18¢ c. y., **12,** 2847.

ENGINEERS.

Chief of Engineers. **R., 91,** 411; **93,** 442; **94,** 410; **95,** 452; **96,** 408; **02,** 564; **03,** 623; **04,** 689; **05,** 695; **06,** 769, 787; **07,** 783; **08,** 833; **09,** 875, 893; **10,** 973; **11,** 1031; **12,** 1237.

In charge:

Capt. T. W. Symons, 1890–95. **R., 91,** 3297; **93,** 3408; **94,** 2597; **95,** 3405.

Capt. H. Taylor, 1896. **R., 96,** 3334.

Maj. John Millis, 1902–05. **R., 02,** 2413; **03,** 2327; **04,** 3601; **05,** 2511.

Capt. F. A. Pope, **06,** 766.

Maj. H. M. Chittenden, 1906–08. **R., 06,** 2024; **07,** 2212; **08,** 2287.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2250; **10,** 2421; **11,** 2629.

Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2846.

Assistants:

R. A. Habersham. **R., 91,** 3298.

A. J. McMillan. **R., 91,** 3302.

J. M. Clapp. **R., 93,** 3411; **94,** 2599; **95,** 3408; **96,** 3337; **08,** 2287.

E. L. Carpenter. **R., 04,** 3602; **05,** 2511; **06,** 2024.

Capt. F. A. Pope, **06,** 766; **07,** 780; **11,** 1026.

1st Lt. J. H. Earle, **10,** 968; **11,** 1026.

Capt. A. Williams, **11,** 1026.

* Allotment.

[1] For imp. Chehalis R., Wash.

OPERATIONS.

1892–93. 7,500 l. f. dike built, **93,** 3410.
1893–94. About 10,000 l. f. dike built, **94,** 2598.
1894–95. About 15,000 l. f. dike built, **95,** 3411.
1895–96. Repairs made to dikes, **96,** 3335.
1902–03. Sur. for location of proposed chans.; 81 snags and a large amount of débris removed from Chehalis R., **03,** 2327.
1903–04. 165,727 c. y. dr. from chans.; 31 snags removed from Chehalis R.; repairs to Cow Pt. Dike completed; middle chan. dike repaired, **04,** 3602, 3603.
1904–05. Repairs to Cow Pt. and middle chan. dikes completed; 61,897 c. y. dr. during year; 26 snags removed from Chehalis R., **05,** 2511.
1905–06. Snagging continued in Chehalis R., **06,** 2024.
1906–07. Snagging continued in Chehalis R., **07,** 2213.
1907–08. 900,000 c. y. dr.; snagging carried on in Chehalis R., **08,** 834, 2288.
1908–09. 300,000 c. y. dr., **09,** 876, 2250.
1909–10. Dr. with U. S. dr. *Oregon* resulted in removal of 413,100 c. y.; snagging done in Chehalis R., 179 snags and trees removed, **10,** 2421.
1910–11. 133,852 c. y. dr., w. chan. to 200'; 64,000 c. y. dr. in Chehalis R.; snagging in Chehalis R., **11,** 2629.
1911–12. Chan. in inner H. below Hoquiam redr., 94,350 c. y. removed, **12,** 2846.

PHYSICAL CHARACTERISTICS.

Description, bar and H., **91,** 3298.

Grays H. in sw. part of Washington, 48 m. n. of the mouth of the Columbia R. Total l. from e. to w., 17 m.; greatest breadth, n. to s., 14 m., **12,** 1237.

The Chehalis R. the principal tributary of Grays H. In 1893, on account of the division of the waters of the H. into several chans., troublesome shoals existed at the head of the B. **93,** 3408.

Draft, inner H., 1903, 8'; Chehalis R., 4', at l. w., **03,** 624.

Chan. through Cow Pt. completed, affording 15' throughout, **04,** 690.

Deterioration of chan. due to débris, **06,** 770.

North chan. used by all ocean-going vessels; s. chan. little used, **08,** 833.

Shoals in n. chan.; ruling d., 1908, m. l. w., 8', **08,** 833.

Chan. 18' x 175'; d. in Chehalis R., 7½', **09,** 2250.

Chan. w. 200', as projected: total l. of chan. below Cosmopolis covered by dr., 9,000', **11,** 2629.

Deterioration of chan., Chehalis R., **12,** 2846.

PROJECTS. (See Plans.)

By Capt. Symons, 1891, removal of shoals from R. to 16' at half tide, by dr. and closing side sloughs and chans., for building dikes to close a s. chan. leaving a passageway 8' x 1 000', and to wholly close a middle chan. to compel more of the ebb and flood waters to flow through a n. chan. and scour away existing bars: est., $150,000, **93,** 3408.

Act June 13, 1902, combines Grays H. (inner portion bet. Aberdeen and entrance) and Chehalis R., Wash., **02,** 564.

Proj. contemplates snagging and clearing obstr. in Chehalis R., repairs to dikes, excavation of chan. 15' x 100' through shoals near Aberdeen and Hoquiam, **03,** 624.

Act Mar. 2, 1907, au. chan. 18' x 200', m. l. w., Cosmopolis to d. w. below Hoquiam, and removing snags from Chehalis R.; est., $187,500 (H. D. 507, 59th, 1st), **06,** 2024; increased to $262,500, **08,** 834.

For Chehalis R., au. act June 25, 1910, chan. 6', m. l. w., Cosmopolis to Montesano, and constr. of dikes to concentrate currents over certain shoals; est., $50,000 (H. D. 1125, 60th, 2d), **10,** 973.

SURVEYS.

Sur., H. and bar, au. act Sept. 19, 1890; made 1890, by Capt. Symons (**R.** unfav.), **91,** 3300.

Sur. made, 1894, by Capt. Symons, **94,** 2598.

Pre. ex. and sur. au. act Mar. 3, 1905, Grays H. (inner portion) and Chehalis R. to Montesano, Wash. **R.,** Maj. Millis, 1905 and 1906; est., Grays H., $187,500, with $3,000 an. mainten.; to secure 18' supple. imp. of Chehalis R. "not worthy" (H. D. 507, 59th, 1st), **06,** 787.

Pre. ex. and sur., Chehalis R. up to Montesano, Wash., for removal of bars, au. act Mar. 2, 1907. **R.,** Lt. Col. Chittenden, Mar. 31, 1908; est., $50,000 (H. D. 1125. 60th, 2d), **08,** 850; **09,** 893.

Cong. docs., etc., relating to exs., surs , plans, etc., **12,** 1238.

Maps. (H. D. 507, 59th, 1st; H. D. 1125, 60th, 2d.) **91,** 3302; **94,** 2602; **02,** 2413; **03,** 2326; **05,** 2512; **08,** 2288; **10,** 2420.

XX-13(c) GRAYS HARBOR TO PUGET SOUND, WASH. (Ship channel connecting.)

ENGINEERS.

Chief of Engineers. R., 08, 850.

In charge. Maj. H. M. Chittenden, **08,** 830.

SURVEY.

Pre. ex. for a ship chan. connecting Puget Sound and Grays H., Wash., au. act Mar. 2, 1907. **R.,** Maj. Chittenden, 1907 (unfav.) (H. D. 70, 60th, 1st), **08,** 850.

XX-16 CHEHALIS RIVER, WASH.

APPROPRIATIONS.[1]

1882,	$3,000,	**82,** 2686.
1884,	2,500,	**84,** 2276.
1886,	2,500,	**86,** 2010.
1888,	2,000,	**88,** 2175.
1890,	3,000,	**90,** 2986.
1896,	3,000,	**96,** 3343.
1899,	3,000,	**99,** 3266.
Total,	19,000[1]	

COMMERCE.

Important, **75,** ii, 800.

CONTRACTS.

1889. T. S. Tew, hire of boat and snagging outfit, $31.67 per day, **89,** 2560.

ENGINEERS.

Chief of Engineers. R., 75, 125; **80,** 332; **81,** 323; **82,** 323; **83,** 337; **84,** 340; **85,** 367; **86,** 364;

[1] Unexpend. balance of $1,581.76 trans. to app. for imp. Grays H. and Chehalis R., **02,** 2413.

87, 328; **88,** 302; **89,** 360; **90,** 323; **91,** 407; **92,** 382; **93,** 442; **94,** 411; **95,** 452; **96,** 409; **97,** 510; **98,** 514; **99,** 602; **00,** 680; **01,** 644; **02,** 565.

In charge:
Maj. N. Michler, 1874. **R., 75,** ii, 799.
Capt. C. F. Powell, 1881–88. **R., 82,** 2686, 2687; **83,** 2075; **84,** 2276; **85,** 2405; **86,** 2009; **87,** 2489.
Maj. T. H. Handbury, 1888–90. **R., 88,** 2174; **89,** 2550.
Capt. T. W. Symons, 1890–95. **R., 90,** 2984; **91,** 3236; **92,** 2726; **93,** 3414; **94,** 2604; **95,** 3413.
Capt. H. Taylor, 1896–1900. **R., 96,** 3343; **97,** 3437; **98,** 3064; **99,** 3266; **00,** 4476.
Maj. John Millis, 1901–02. **R., 01,** 3580; **02,** 2413.

Assistants:
G. W. Cradlebaugh, **75,** ii, 799.
R. A. Habersham. **R., 82,** 2688.
J. M. Clapp. **R., 95,** 3414.

OPERATIONS.

1883–84. 1,611 logs, snags, and pieces of driftwood removed, **84,** 2277.
1884–85. 1,711 logs, snags, and pieces of driftwood cut and removed, **85,** 2405.
1886–87. 293 logs and snags removed, **87,** 2489.
1887–88. 353 snags and 129 overhanging trees removed, **88,** 2175.
1888–89. 60 snags and 5 overhanging trees removed, **89,** 2560.
1889–90. 56 snags cleared from the chan., **90,** 2985.
1890–91. 60 snags and 51 stumps removed from chan. bet. Montesano and Grays H., **91,** 3237.
1891–92. 8 snags cleared from the chan., **92,** 2727.
1893–98. Small amount of snagging done, **94,** 2606; **95,** 3414; **97,** 3437; **98,** 3065.
1899–00. Nearly 500 snags removed, **00,** 4476.
1900–01. 91 snags removed below Montesano, **01,** 3580.

PHYSICAL CHARACTERISTICS.
General, **75,** ii, 799.
Obstr., raft at Chehalis Indian Reservation, **75,** ii, 799, 800.
Description of R. and its obstr., **82,** 2687, 2690.
From the nature of the country through which the R. runs it is liable to be obstr. by snags after every freshet, **97,** 3437.

PLANS. (See Projects.)
By Maj. Michler, removal of rafts near Chehalis Indian Reservation, est., $32,500, **75,** ii, 800.

PROJECTS.
By Capt. Powell, 1882, removal of snags, logs, drift and similar obstr., Claquato to mouth, 70 m., giving navigable chan. of 3′ two-thirds of the year, est., an. cost, $5,000, **82,** 2687, 2688.
Act June 13, 1902, combined imp. with that of "Grays H., inner portion, bet. Aberdeen and entrance," **02,** 2413.

SURVEYS.
By G. W. Cradlebaugh, 1874–75, **75,** ii, 799.
Au. act Mar. 3, 1881; made, 1882, by Capt. Powell, **82,** 2686.
Ex. made, 1893, by Capt. Symons, **93,** 3414.
Maps. **02,** 2412.

XX-22 HOQUIAM RIVER, WASH.

APPROPRIATIONS.
1912, $12,000, **12,** 2848.

COMMERCE.
Consists mainly of floating and towage of saw logs and shipment of lumber products from mills, **12,** 1240.
In 1911, 75,000,000′ logs rafted and towed from boom works, **12,** 1240.

ENGINEERS.
Chief of Engineers. **R., 12,** 1240, 1267.

In charge. Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2848.

PHYSICAL CHARACTERISTICS.
Depth approx. 20′; logs floated on main R. and branches during freshet seasons for from 2 to 6 m., **12,** 1240.

PROJECTS.
Act July 25, 1912, au. chan. through 4 shoals 18′ x 100′, m. l. w. (H. D. 268, 62d, 2d), **12,** 1240.

SURVEYS.
Pre. ex. and sur. au. act June 25, 1910. **R.,** Capt. Williams and Maj. Kutz, 1910, and 1911, resp.; est., $12,325, and $1,000 an. mainten. (H. D. 268, 62d, 2d), **12,** 1267.
Maps. (H. D. 268, 62d, 2d.)

XX-23 HUMPTULIPS RIVER, WASH.

ENGINEERS.
Chief of Engineers. **R., 84,** 342.

In charge. Capt. C. F. Powell. **R., 84,** 2294.

PHYSICAL CHARACTERISTICS.
R. described, **84,** 2295.

SURVEY.
Ex. au. act Aug. 2, 1882; made by Capt. Powell (**R.** unfav.), **84,** 2294.

XX-32 QUILLAYUTE HARBOR AND RIVER, WASH.

COMMERCE.
Description of, **95,** 3454; **98,** 3092.
Small, 1895, but it was thought that if a change were made in the entrance a great impetus would be given to the C., **95,** 3454.

ENGINEERS.
Chief of Engineers. **R., 95,** 457; **98,** 524.

In charge:
Capt. T. W. Symons, 1894–95. **R., 95,** 3452.
Capt. H. Taylor, 1896–98. **R., 98,** 3090.

Assistant. Lt. F. R. Shunk. **R., 95,** 3454.

PHYSICAL CHARACTERISTICS.
Description of, **95,** 3453; **98,** 3091.
H. in probably the most inaccessible region of the U. S.; is in nw. portion of Washington, con-

necting with Pacific Ocean about 35 m. to s. of Cape Flattery; separated from the centers of population on Puget Sound by the extremely rocky and unexplored Olympic Mts.; is about 5 m. l., with tidal flow of 2½ m. The nontidal part of the R. is obstr. by rapids, and, together with its tributaries, the latter for 20 to 30 m. is navigable only by canoes, **95,** 3453.

PROJECTS.

In 1897 Capt. Taylor est. $20,000 to make imp. by reopening the old mouth, **98,** 3092, 3093.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** fav.), **95,** 3452.

Sur. au. act June 3, 1896; made, 1897, by Capt. Taylor (see Projects), **98,** 3090.

XX-39(a) JUAN DE FUCA, STRAITS OF, WASH. (Removal of Duncan Rock.)

ENGINEERS.

Chief of Engineers. **R., 04,** 703.

Boards. BERH. concurs in DO. opinion that benefit to C. incommensurate with cost, **04,** 3629.

In charge. Maj. John Millis, 1904. **R., 04,** 3627.

PHYSICAL DATA.

Duncan Rock, and adjoining ones, in track of all in and out bound vessels; great menace to shipping, **04,** 3623.

SURVEYS.

Pre. ex. of Duncan Rock, Straits of Juan de Fuca, for removal of same, au. act June 13, 1902. **R.,** Maj. Millis, July 22, 1902 (unfav.) (H. D. 212, 58th, 2d), **04,** 703, 3626.

XX-39(b) NEAH BAY, WASH.

COMMERCE.

Description of, **98,** 3083; **00,** 4506.

Large and growing. Constr. of H. of refuge recom., **98,** 3082. During the 2 years preceding 1899, there was a very marked increase, **00,** 4506.

List of wrecks occurring in the vicinity, **98,** 3086.

ENGINEERS.

Chief of Engineers. **R., 98,** 523; **00,** 692; **12,** 1267.

In charge:

Capt. H. Taylor, 1898–1900. **R., 98,** 3082; **00,** 4502, 4504.

Maj. C. W. Kutz, **12,** 1231.

Assistants:

Capt. F. A. Pope, **12,** 1231.

Capt. A. Williams, **12,** 1231.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 3083; **00,** 4505.

B. at the outer end of the Straits of Fuca through which passes all the deep-sea shipping arriving at and departing from Puget Sound and British Columbia ports, **98,** 3083.

Rainfall at the entrance very great, **98,** 3084.

Description of anchorage in the vicinity of this part of the coast, **98,** 3085.

PROJECTS.

Capt. Taylor est., 1899, it would cost, for 2 break'rs to form a H. of refuge, $1,111,907.50. The DE. est. cost for more extensive works at $1,873,154, **00,** 4510.

SURVEYS.

Ex. for H. of refuge au. act June 3, 1896; made, 1897, by Capt. Taylor (**R.** fav.), **98,** 3082.

Ex. and sur. au. act Mar. 3, 1899; made by Capt. Taylor, 1899 (**R.** fav.; see Projects), **00,** 4502.

Pre. ex. au. act June 25, 1910, of H. of refuge at Neah B., or at such other points in the vicinity thereof as would best subserve the interests of C. and navigation; made, 1910, under direction of Maj. Kutz, by Capt. A. Williams and Lt. J. H. Earle (H. not deemed immediately advisable) (H. D. 472, 62d, 2d), **12,** 1267.

XX-39(c) CLALLAM BAY, WASH.

COMMERCE.

Description of: Straits of Fuca is the passage through which all the C. of Puget Sound and the Gulf of Georgia connects with the Pacific Ocean, **95,** 3457.

ENGINEERS.

Chief of Engineers. **R., 95,** 457.

In charge. Capt. T. W. Symons, 1895. **R., 95,** 3456.

PHYSICAL CHARACTERISTICS.

Description of: A shallow indentation on the s. shore of the Straits of Juan de Fuca, 24 m. to the e. of Cape Flattery, well sheltered from the s., e., and w., but open to the n., **95,** 3457.

Rainfall very great; fog prevails for 3 months in the year, **95,** 3459.

Currents run through the strait with great velocity. Anchorage ground fair. List of wrecks that occurred in the 20 years previous to 1895 in the vicinity. **95,** 3460.

SURVEY.

Ex. with view to H. of refuge au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** unfav.), **95,** 3456.

XX-46(a) PORT TOWNSEND BAY, PUGET SOUND, TO OAK BAY, WASH. (Ship channel.)

ENGINEERS.

Chief of Engineers. R., 91, 409, 3260; **12,** 1267.

In charge:
Capt. T. W. Symons, 1890. **R., 91,** 3260.
Maj. C. W. Kutz, **12,** 1231.

Assistant. A. J. McMillan. **R., 91,** 3262.

PHYSICAL CHARACTERISTICS.

Description of, **91,** 3260.

SURVEY.

Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Symons (**R.** unfav.), **91,** 3260.

Pre. ex. and sur. au. act June 25, 1910, of ship canal bet. Port Townsend B., Puget Sound, and Oak H., Wash. **R.** on ex. by Capt. Arthur Williams, Nov. 5, 1910, and on surs. by Maj. J. B. Cavanaugh, Dec. 9, 1911; est., $62,500 for first constr. (H. D. 625, 62d, 2d), **12,** 1267.

XX-48(a) DABOB BAY, WASH.

ENGINEERS.

Chief of Engineers. R., 11, 1056.

In charge. Maj. C. W. Kutz, **11,** 1026.

Assistants:
Capt. F. A. Pope, **11,** 1026.
Capt. Arthur Williams, **11,** 1026.
1st Lt. J. H. Earle, **11,** 1026.

SURVEY.

Pre. ex. au. act June 25, 1910; **R.,** Maj. Kutz, Oct. 28, 1910 (unfav.) (H. D. 4, 62d, 1st), **11,** 1056.

XX-62(a) PUGET SOUND AND ITS TRIBUTARIES (Skagit, Stilaguamish, Nooksack, Snohomish, and Snoqualmie Rivers), WASH.

APPROPRIATIONS.

1880,	[1] $2,500,	**82,** 2686.
1882,	20,000,	**82,** 2685.
1884,	10,000,	**84,** 2275.
1886,	10,000,	**86,** 2008.
1888,	15,000,	**88,** 2176.
1890,	12,000,	**90,** 2987.
1892,	15,000,	**92,** 2730.
1894,	14,000,	**95,** 3443.
1896,	75,000,	**96,** 3345.
1899,	20,000,	**99,** 3268.
1902,	35,000,	**02,** 2415.
1904,	12,000,	**04,** 3606.
1905,	20,000,	**05,** 2515.
1905,	* 4,500,	**07,** 2215.
1907,	75,000,	**07,** 2215.
1909,	* 25,000,	**09,** 2252.
1910,	100,000,	**10,** 2423.
1911,	20,000,	**11,** 2631.
1912,	25,000,	**12,** 2849.

Total, 510,000 (incl. misc., $514,445.45, **12,** 2849).

COMMERCE.

Amount to be influenced by imp., **84,** 2275.
Water traffic on sound, large and rapidly growing, **02,** 566.
Large increase in lumber business, **03,** 2329.
Description of C. and limits of navigation in tributaries, **03,** 625; **04,** 692; **12,** 1241.
Importance of, at Roche H., **06,** 2026–2028.
Regulations to govern floating of logs prescribed by Sec. of War, **10,** 2423.

CONTRACTS.

1883. Cashen, McKay & Co., wooden hull snagboat constr., **83,** 2075.

1896. Reed & Shephard, rebuilding snag boat, $8,124.05, **97,** 3441.

1903. Morrison Bros., removing log jam in Nooksak R., **04,** 3606.

1907. Puget Sound Bridge & Dredging Co., removing r. at entrance to Roche H., $23,460, **08,** 2290–2291.

1910. C. E. Lund, constr. of mattress sill and shore protection, prices given, **11,** 2630.

ENGINEERS.

Chief of Engineers. R., 80, 242; **81,** 332; **82,** 323; **83,** 336; **84,** 340; **85,** 367; **86,** 364; **87,** 329; **88,** 303; **89,** 361; **90,** 323; **91,** 408, 410; **92,** 383; **93,** 444; **94,** 412; **95,** 456; **96,** 409; **97,** 511; **98,** 514; **99,** 603; **00,** 681; **01,** 645; **02,** 565; **03,** 625; **04,** 691; **05,** 696; **06,** 770, 787; **07,** 785; **08,** 835; **09,** 876; **10,** 974; **11,** 1033; **12,** 1241.

In charge:
Maj. G. L. Gillespie, 1880–82. **R., 81,** 2608, 2611, 2614.
Capt. C. F. Powell, 1882–87. **R., 82,** 2686; **83,** 1998; **84,** 2274; **85,** 2403; **86,** 2007; **87,** 2490.
Maj. T. H. Handbury, 1888–90. **R., 88,** 2176; **89,** 2561, 2564.
Capt. T. W. Symons, 1890–95. **R., 90,** 2986; **91,** 3238, 3271; **92,** 2729; **93,** 3425; **94,** 2619; **95,** 3442.
Capt. H. Taylor, 1896–1900. **R., 96,** 3344; **97,** 3438; **98,** 3066; **99,** 3267; **00,** 4477.
Maj. John Millis, 1900–05. **R., 01,** 3581; **02,** 2414; **03,** 2328; **04,** 3604; **05,** 2514.
1st Lt. F. A. Pope, **06,** 766.
Maj. H. M. Chittenden, 1906–08. **R., 06,** 2026; **07,** 2214; **08,** 2290.
Maj. C. W. Kutz, 1908–11. **R., 09,** 2251; **10,** 2422; **11,** 2630.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2848.

Assistants:
R. A. Habersham. **R., 81,** 2610, 2613, 2615.
E. H. Jefferson. **R., 89,** 2562; **90,** 2988; **91,** 3243, 3273; **92,** 2731; **93,** 3427; **94,** 2621; **95,** 3445; **96,** 3347; **97,** 3441; **98,** 3068; **99,** 3269; **00,** 4479; **05,** 2514.
D. W. McMorris. **R., 04,** 3605.
F. A. Siegel. **R., 06,** 2029.

[1] For Skagit R. alone.

* Allotment.

LEGAL PROCEEDINGS.

Owners of fish trap obstr. navigation indicted by grand jury, **02,** 2414.

OPERATIONS.

1883-87. 105 snags removed from Snohomish R., **84,** 2274.

1884-85. 1,202 snags, logs, etc., removed from Stilaquamish and Skagit Rs; extensive log jam below Nooksack Crossing removed; **85,** 2403.

1886-87. 847 snags and 97 trees removed from lower Snohomish and Nooksack Rs., **87,** 2490.

1887-88. 708 snags cleared from Snohomish and Snoqualmie Rs., **88,** 2176.

1888-89. 1,527 snags and 449 trees removed from Skagit, Nooksack, and Snohomish Rs., **89,** 2561.

1890-91. 769 snags and 44 leaning trees cleared from Snohomish, Stilaquamish, and Skagit Rs., **91,** 3244.

1891-92. 1,175 snags and 144 leaning trees cleared from Snohomish, Stilaquamish, Skagit, and Nooksack Rs., **92,** 2731.

1892-93. About 2,000 snags and other obtsr. removed, **93,** 3426.

1893-94. About 1,500 snags and other obstr. removed, **94,** 2620.

1894-95. Over 1,000 snags and other obstr. removed, **95,** 3443.

1895-96. A wreck and about 1,200 snags, etc., removed, **96,** 3345.

1896-97. Over 2,000 snags, etc., removed, **97,** 3439.

1897-98. About 10,000 snags, etc., removed, **98,** 3066.

1898-99. Snag boat repaired; nearly 6,000 snags, etc., removed, **99,** 3267.

1899-00. 4,726 snags and drift disposed of; 1,153 trees chopped; 468 c. y. earth handled, **00,** 4478.

1900-01. 4,235 snags removed, 246 trees cut, wreck removed, and small amount of earthwork done, **01,** 3581.

1901-02. 4,050 snags and 594 overhanging trees removed, **02,** 2414.

1902-03. 2,728 snags and 414 trees removed, **03,** 2329.

1903-04. 3,183 snags and 313 trees removed, and log jam removed from mouth of Nooksak R., **04,** 3604–05.

1904-05. 3,169 snags and 422 trees removed, **05,** 2514.

1905-06. 2,405 snags and 37 trees removed, **06,** 2029.

1906-07. 2,777 snags and other obstr. removed, **07,** 2214.

1907-08. 2,803 snags, etc., removed, and r. at Roche H. removed under contract, **08,** 2290.

1908-09. 4,737 snags, etc., removed, **09,** 2251.

1909-10. Snag boat repaired and addl. machinery installed, 14,700 c. y. dr. by snag boat, snags removed, and mattress sills built in Stilaquamish and Skagit Rs., **10,** 2422–23.

1910-11. Snagging; 30,704 c. y. dr., **11,** 2630.

1911-12. 2,518 snags and 516 piles removed, 22,000 c. y. dr., and dikes repaired, **12,** 2848.

PHYSICAL CHARACTERISTICS.

Description of, **81,** 2613; **90,** 2988; **91,** 3273; **96,** 3346.

Streams which flow into Puget Sound have their origin in the mountains. Upper parts are in nature of torrents; lower parts flow through flat, heavily wooded country, and out into the sound through deltas, bringing to mouth accumulations of snags, etc., and other obstr. to navigation, **97,** 3440.

Skagit R., 1900, by removal of snags, safe to navigate at night, **99,** 3267.

Limits of navigation in tributary streams, **03,** 625; **04,** 692; **12,** 1241.

Description of, at Roche H., **06,** 2026–28.

Severe freshets in 1909, **10,** 2423.

All streams are affected by the tidal variations in Puget Sound, which are large and extremely irregular, **05,** 698.

PLANS.

After ex. of Nooksack, Skagit, and Snohomish Rs. in 1890, Capt. Symons reported that the "present" or prospective demands of C. did not justify a further expend. for imp., **91,** 3272.

PRIVATE WORK. (See Projects.)

Work on the Nooksack Jam done byc ontractor's party under local citizens' committee, **85,** 2404; **86,** 2007.

PROJECTS. (See Plans.)

By Maj. Gillespie, 1881, constr. of snag boat and mainten. of same for 1 year; est., $25,000, **81,** 2682. Increased $5,000 in 1882, **82,** 2686; and $10,000 in 1884, **84,** 2275. Est. for completion, 1886, $29,000, **86,** 2008; **92,** 2729.

By Capt. Taylor, 1896–97, imp., by a cut-off, of one particularly bad bend in Skagit R., **97,** 3439.

Act June 13, 1902, au. expend. of $15,000 for removing log jam in Nooksack R., or cutting new chan. around jam, **02,** 566–567.

Act Mar. 3, 1905, au. removal of Star Rock, Bellingham B., and of r. obstr. at entrance of Roche H., **05,** 2514.

Maj. Chittenden recom., 1906, removal of Star Rock be not undertaken at "present" time; est cost of work, about $100,000, can be spent to better advantage in dr.; recom. removal of r. at Roche H. at est. cost of $30,000; also recom. constr. of dr. at est. cost of $100,000, **06,** 2026–2029.

Act Mar. 2, 1907, au. removal of r. in Roche H. at cost not to exceed $30,000, and app. $100,000 for dr. for joint use of Oregon and Washington districts, **07,** 786. (See Oregon and Washington, coast of.)

SURVEYS.

Au. act June 14, 1880; made, 1880, by Maj. Gillespie, **81,** 2611.

Ex. of Stilaguamish R. au. act June 14, 1880; made, 1880, by Maj. Gillespie, **81,** 2608.

Ex. of Nooksack R. au. act June 14, 1880; made, 1880, by Maj. Gillespie, **81,** 2611.

Ex. of Snohomish R. au. act June 14, 1880; made, 1880, by Maj. Gillespie, **81,** 2614.

Ex. of Nooksack, Skagit, and Snohomish Rs. made, 1890, by Capt. Symons (**R.** unfav.; see Plans), **91,** 3271.

Misc. surs. made, 1896–97, by Capt. Taylor, **97,** 3440.

Pre. ex. and sur. of Duwamish R., au. act Mar. 3, 1905. **R.** by local Engineer officer, Apr. 24 and Dec. 9, 1905 (H. D. 590, 59th, 1st) (not advisable to imp. to greater extent than contemplated by "present" proj.), **06,** 787.

Pre. ex. and sur. of Stilaguamish R., au. act June 25, 1910. **R.** by Capt. Williams, Oct. 27, 1910 (H. D. 19, 62d, 1st) (no further work recom. until closure of Hat Slough is observed for some time), **11,** 1056.

Pre. ex. and sur. au. act Feb. 27, 1911, of Duwamish R., **12,** 1268.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1241.

Maps. **02,** 2414; **03,** 2328, 2329; **04,** 3605.

XX-62(b) PUGET SOUND, WASH. (Waterway to connect with Lakes Union, Sammamish, and Washington.)

APPROPRIATIONS.

1890,	$10,000,	**92,** 2762.
1894,	25,000,	**95,** 3424.
1896,	150,000,	**96,** 3355.
1902,	160,000,	**02,** 2419.
1905,	125,000,	**05,** 2543.
1907,	10,000,	**07,** 2222.
1909,	*5,000,	**09,** 2258.
1910,	155,000,	**10,** 2429.
1911,	150,000,	**11,** 2635.
1912,	500,000,	**12,** 2855.

Total, 1,290,000 (incl. misc., less app. of 1890, $1,280,131.10, **12,** 2855).

COMMERCE.

Shipping of Puget Sound, **92,** 2767.
C. interests of Seattle, Wash., **92,** 2786.
Description of, **01,** 647.
C. of Ballard benefited by work done, **03,** 630; **06,** 778.
Advantages to C. of proposed imp. discussed, **03,** 2349.
Naval advantages, **03,** 2348.
Regulations governing logging operations formulated, **07,** 2221.
Diagram showing relation bet. app. and amount and value of freight, **11,** 2635.

CONTRACTS.

1901. Puget Sound Bridge & Dredging Co., dr. chan. at lower end of Salmon B., 26.7¢ c. y., **01,** 3586; **02,** 2417. Henningsen & Fortiner, excavat. 10,780 c. y., 29¢ c. y., **01,** 3586.
1902. Smyth & Howard, excavat. 140,416 c. y., 27¢ c. y., **02,** 2417.
1903. Puget Sound Bridge & Dredging Co., dr. 281,847 c. y., at 48.2¢ c. y., **03,** 2333.
1905. Puget Sound Bridge & Dredging Co., dr. 340,000 c. y., 35.9¢ c. y., p. m., **06,** 2036–2037.
1911. Puget Sound Bridge & Dredging Co., constr. cofferdam, excavating and dr., prices given, **12,** 2855. C. Geske & Co., constr. of wharf and bunkers, prices given, **12,** 2855.

ENGINEERS.

Chief of Engineers. **R., 91,** 412; **92,** 385; **95,** 453; **96,** 411; **97,** 513; **98,** 516; **99,** 606; **00,** 684; **01,** 646; **02,** 568, 2419; **03,** 629, 2340; **04,** 695; **05,** 701; **06,** 776; **07,** 791; **08,** 840, 850; **09,** 882; **10,** 981; **11,** 1040; **12,** 1248.

Boards:
Convened, Portland, Oreg., Dec. 15, 1891, act of Sept. 19, 1890, to select and sur. most feasible location and to est. cost of constr. of ship canal to connect Lakes Union, Washington, and Sammamish with Puget Sound. **R., 92,** 2762. (Col. Mendell, Maj. Handbury, and Capt. Symons.)
Board appointed by Sec. of War Mar., 1898, to consider and report upon most feasible route for waterway, with special reference to terminal point at s. end, **98,** 3073. (Capts. W. L. Fisk and H. Taylor and Lt. C. L. Potter.)
Board au. act June 13, 1902, convened, Seattle, Wash., Aug. 4, 1902, to consider and report on feasibility and advisability of constr. a waterway connecting Puget Sound with Lakes Union and Washington, with necessary locks and dams, of sufficient w. and d. to accommodate largest commercial and naval vessels. Jan. 6, 1903 (S. D. 127, 57th, 2d), board concludes that constr. of such a canal feasible but not advisable at "present" time. Est. most advantageous route (through Shilshole B.), $7,422,000. Route via Elliott B. feasible, but cost and difficulties almost prohibitive. 2 proposals of Seattle & Lake Washington Waterway Co., for constr. of canal at cost of $8,304,121 and $10,679,747, resp., according to route selected, also considered. (Lt. Col. Heuer, Capt. Langfitt, and 1st Lt. Johnston), **03,** 2340–2357.

In charge:
Capt. T. W. Symons, 1895. **R., 95,** 3422.
Capt. H. Taylor, 1896–1900. **R., 96,** 3351; **97,** 3445; **98,** 3072; **99,** 3271; **00,** 4483.
Maj. John Millis, 1900–05. **R., 01,** 3583; **02,** 2417–2420; **03,** 2332; **04,** 3611; **05,** 2541.
1st Lt. F. A. Pope, **06,** 766.
Maj. H. M. Chittenden, 1906–08. **R., 06,** 2036; **07,** 2221; **08,** 2298.
Maj. C. W. Kutz, 1908–11. **R., 09,** 2257; **10,** 2428; **11,** 2635.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2853.

Assistants:
P. G. Eastwick. **R., 92,** 2772.
E. Ricksecker. **R., 95,** 3424; **96,** 3363.
John Zug. **R., 04,** 3612.
Thomas Irving. **R., 05,** 2541, 2544.
J. M. Clapp. **R., 06,** 2036.

LEGAL PROCEEDINGS.

Effort made by Kings County to secure right of way free to U. S., **99,** 3272; title to entire right of way secured, **00,** 4484.
To compel county commissioners to act as board of equalization in matters of assessment to raise funds for canal work, **09,** 883; **10,** 983.

LEGISLATION.

Analysis of act by Washington State Legislature, 1893, providing for excavating waterways by private contract, **03,** 2353.
Act Feb. 8, 1901, Washington State Legislature au. U. S. to constr. waterway through State lands, and releasing U. S. from liability to damages to State, **06,** 777.
As result of movement started by communities interested, for constr. of canal with local funds, Congress, June 11, 1906, au. James A. Moore to constr. canal along U. S. right of way, **06,** 778. Modified by act Mar. 2, 1907, to commute work required under previous act to excavation alone of a canal with bottom w. of 75′ and l. w. d. of 25′. Same act directed sur. and est. of cost of canal with single lock, and report as to what contributions toward constr. would be made by local interests, **07,** 793.
Washington State legislature Mar. 13, 1907, created local assessment district with view to raising net sum of $1,000,000 by taxation to assist in building canal, **07,** 793.
Attempts made by State legislature to remedy defects in King Co. bond issue, which was declared invalid by Supreme Court of State, **07,** 793; **08,** 841; **09,** 883.

OBSTRUCTIONS.

Notice from Sec. of War requiring removal of existing brs. on canal, **07,** 793.

OPERATIONS.

1900–01. Test borings made, observations in progress for compiling physical data, surs. made, and clearing of right of way, etc., **01,** 3584–3585.
1901–02. 219,056 c. y. dr. below lower lock site, 85,660 c. y. dr. from cut bet. Salmon B. and Lake Union, surs. and observations made, and clearing right of way, etc., **02,** 2417–2418.
1902–03. 128,473, c. y. dr. on 1st sec. ower cut, work in progress on 2d sec., 32,217 c. y. excated bet. Salmon B. and Lake Union, ad surs. and observations made, **03,** 2332–2333.
1903–04. 162,333 c. y. dr., completing 10′ chan. to wharves at Ballard, outlet gates of Lake Union repaired and enlarged, discharge capacity of the "Portage" imp., and outlet of Lake Washington into Black R. cleared out, **04,** 696, 3611–3613.
1904–05. Repairs and mainten., **05,** 2541.
1905–06. 218,974 c. y. dr. in Ballard H., **06,** 2036.

* Allotment.

1906–07. Dr. in Ballard H. completed, making total of 340,000 c. y. removed, **07,** 2221.

1907–08. Mainten. and surs., and H. lines estab. for Lake Union, **08,** 2298.

1908–10. Mainten., **09,** 2257; **10,** 2428.

1910–11. Borings made at lock site, plans and specifications in preparation, excavation of canal above lock in progress, using funds provided by local interests, **11,** 2635.

1911–12. 48,850 c. y. dr. for temporary chan. around lock, cofferdam 98% completed, 243,539 c. y. excavated from lock pit, contracts made on behalf of State of Washington and King Co. for excavation of 3 secs. of canal above lock, **12,** 2853-2854.

PHYSICAL CHARACTERISTICS.

Description of lakes and of possible routes, **92,** 2764, 2765.

Physical data, **92,** 2772, 2773.

Rainfall, 1878 to 1890, **92,** 2778.

Description of, **93,** 3422; **95,** 3357; **96,** 3363.

Lake Washington situated e. of Seattle and from 2 to 6 m. from Puget Sound. About 19 m. l., and has w. of 2 m.

Lake Union n. of Seattle, bet. Lake Washington and Puget Sound, with area of about 1½ sq. m., connected artificially with Lake Washington.

From Lake Union there is small stream flowing to head of Salmon B., distant from Lake Union about 1 m., and from head of Salmon B. to d.w. in Puget Sound there is distance of about 3 m. **93,** 3422.

Elevations, areas, d., etc., dimensions, **95,** 3427; **96,** 3363.

Results of test borings, and of water level and discharge observations, **01,** 3584.

Description of, **01,** 646, 647; **03,** 2343–2344.

Teredo unusually destructive in Puget Sound, **01,** 647.

Condition of works and d. of water, **03,** 630; **04,** 696, 697; **05,** 702, 703; **07,** 792, 793.

Dam at Lake Union broke, 1903, due to work of muskrats, **04,** 3611.

PRIVATE WORK.

County commissioners, 1896–97, had Smiths Cove route sur. and gave the results to the U. S., **97,** 3446.

Small amount of work done by Seattle & Lake Washington Waterway Co. on Elliott B. route (see Legislation), **03,** 2354.

James A. Moore au. by Congress, 1906, to constr. canal along U. S. right of way (see Legislation), **06,** 778; **07,** 793.

King Co., 1906, voted bond issue of $500,000 to assist in constr. of canal, **07,** 793.

State to raise funds by taxation, to be expend. under direction of DO. (see Legislation), **07,** 793.

State app. $250,000 in 1909 to be expend. in constr. of canal under direction of DO., **09,** 883.

Excavation of canal above lock, **12,** 1250, 2853–2854.

PROJECTS.

BE., 1891, canal 2,600′ l., 80′ w. at bottom and 158′ w. at water line, and 26′ d. through portage bet. Union B. in Lake Washington and Lake Union, with masonry lock 50′ x 400′, 26′ d. over sill, and with lift of about 7½′; dr. chans. to connect this canal with d.w. in Lake Washington and across Lake Union, and constr. canal 6,700′ l., 80′ w. at bottom and 158′ w. at water line, and 26′ d., connecting Lake Union along its outlet with head of Salmon B. From head of Salmon B. to Puget Sound 2 routes considered by board, one by way of Salmon B. and Shilshole B., with lock near sound 16′ x 50′ x 400′ over sill at low tide, the other by way of Smiths Cove, and a canal 80′ w. at bottom, 158′ w. at water line, and 26′ d., to be constr. across neck of land bet. head of Salmon B. and Smiths Cove, with lock near sound similar to that proj. for Shilshole B. Constr. of basin and chan. through shoals contemplated. Est. of proposed canal bet. Lake Washington and Puget Sound by 2 routes, not incl. damages for lands submerged, as follows: Smiths Cove route, $3,500,000; Shilshole B. route, $2,900,000. Board reported in favor of Smiths Cove route on grounds that entrance would be in H. of Seattle and less exposed to bombardment in time of war. **92,** 2770, 2771.

Shilshole route adopted on recom. of Board of 1898, by Sec. of War, **98,** 3072.

BE. of 1898, drawing back outer lock about 2,000′ from location recom. by board of 1890, as above, **98,** 3073.

App. made up to 1899 were with the proviso that the entire right of way should be obtained without cost to the U. S., **99,** 3271.

Detailed est. of cost with locks 86′ x 720′, with 35′ d. over sills, with corresponding increase in canal section, submitted by Maj. Millis in special **R.,** Jan. 10, 1902 (H. D. 335, 57th, 1st). Total l. of waterway to be about 41,500′, or 7.86 m. Est., $6,155,839, **02,** 2420.

Act June 13, 1902, app. $160,000 for continuing imp., but confines work to securing l. w. chan. 10′ d. from Shilshole B. through Salmon B. to wharves at Ballard; also provides for BE. to reex. whole question of ship canal, incl. proposals from private company to constr. canal (see Boards of Engineers), **02,** 570.

Expend. of $6,000 au. by Chief of Engineers, 1903, for imp. drainage of Lake Washington, **04,** 3611.

Brief history of proj.. **07,** 791, 793.

Act June 25, 1910, au. continuing imp. by adopting plan which contemplates constr. of a double lock at entrance to Salmon B., and an unbroken channelway through Salmon B. and Lakes Union and Washington; est., $3,554,932 (H. D. 953, 60th, 1st), work to be done by U. S. being constr. of lock and accessory works at est. cost of $2,500,000; excavation above the lock to be done by local enterprise, and U. S. to be secured against liability or claims for damage on account of grant to James A. Moore (see Private work), or on account of necessary changes in existing water levels, **10,** 982.

SURVEYS.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **92,** 2773.

Sur. for waterway to connect Puget Sound at Salmon B. with Lakes Union and Washington, and submission of est. of cost of its constr. au. by congressional resol. Apr. 18, 1896; sur. made, 1895, by Capt. Symons, **96,** 3355. Capt. Fisk submitted est., 1896 (see Projects), **96,** 3372.

R. by BERH., 1905, in pursuance of resol. by R. and H. Com. requiring consideration of waterway, incl. modification of plan, which shall contemplate but one lock. Est. cost of modified plan would be $1,665,406.43; an. mainten., $50,000. In the opinion of board, however, it would not be advisable to constr. this waterway. (R. and H. Com. D. 18, 61st, 2d.)

Sur. of waterway au. act Mar. 2, 1907. **R.** by Maj. Chittenden, Dec. 2, 1907; est., $2,500,000 (H. D. 953, 60th, 1st), **08,** 850.

Maps. **01,** 3586; **02,** 2418; **03,** 2332; **05,** 2544; **06,** 2036; **11,** 2635.

XX-62(c) HAMMERSLEY INLET, PUGET SOUND, WASH.

APPROPRIATION.

1910, $9,000, **10,** 2426.

COMMERCE.

In 1909, 248,000 t. lumber and logs; 7,600 t. merchandise, **10,** 979; 1911, 189,388 t.; effect of imp. to prevent delays waiting for h. t.; rates not noticeably affected, **12,** 1245.

CONTRACTS.

1910. Tacoma Dredging Co., dr., 17,940 c. y., 48¢ c. y., **11,** 2633.

ENGINEERS.

Chief of Engineers. **R., 10,** 979, 998; **11,** 1037; **12,** 1245.

In charge:
Maj. C. W. Kutz, 1910. **R., 10,** 2426; **11,** 2633.
J. B. Cavanaugh, 1912–. **R., 12,** 2851.

OPERATIONS.

1910-11. Work in progress at Cape Horn Bar; about 5% of entire work completed, **11,** 2633.
1911-12. 17,940 c. y. dr., securing proj. dimensions, **12,** 2851.

PHYSICAL CHARACTERISTICS.

Description of locality; swift tidal currents, **11,** 1037.

Mouth of inlet 10 m. n. of Olympia; mouth to Shelton, 7 m.; narrow, **12,** 1245.

PROJECTS.

Au. act June 25, 1910, removal of materials near entrance, at Cape Horn Bar, and at No. 3 Bar, for chan. 9′ x 150′ d., m. l. w.; est., $9,000 (H. D. 213, 61st, 2d), **10,** 979. Proj. completed, **12,** 2851.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909; **Rs.,** Maj. Kutz, May 3 and Oct. 22, 1909; est., $9,000 (H. D. 213, 61st, 2d), **10,** 998.
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1245.
Maps. (H. D. 213, 61st, 2d.)

XX-62(d) PUGET SOUND, WASH. (Channel to connect Hoods Canal with North Bay.)

COMMERCE.

Description of, **95,** 3468.
In 1895 the probable benefits to be derived from a constr. of the waterway appeared entirely incommensurate with the probable enormous cost of the work, **95,** 3468.

ENGINEERS.

Chief of Engineers. **R., 95,** 457.

In charge. Capt. T. W. Symons, 1895. **R., 95,** 3466.

Assistant. E. Ricksecker. **R., 95,** 3469.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3467.

North B. comes close to Hoods Canal on the e. or greater arm of a portion of Puget Sound s. of Port Townsend. The w. or lesser arm of the sound is known as Hoods Canal, about 97 m. l., and shaped like a fishhook. The head of Hoods Canal and North B. come within about 2 m. of each other. **95,** 3467.

SURVEY.

Ex. with view to constr. of canal to connect the 2 bodies of water at the most practicable place, and of sufficient d. to be navigable for all classes of vessels, au. act Aug. 17, 1894; made by Capt. Symons, 1894 (**R.** unfav.), **95,** 3466.

XX-62(e) PUGET SOUND, WASH. (Inspection of Fish traps.)

APPROPRIATIONS.

1904,	$4,000,	**04,** 3626.
1905,	9,000,	**05,** 2560.
1906,	6,000,	**06,** 2047.
1907,	6,000,	**07,** 2218.
1908,	6,000,	**08,** 2294.
1909,	4,000,	**09,** 2254.
Total,	35,000	

CONTRACTS.

1907. James W. Hall, launch for inspection purposes, **08,** 2294.

ENGINEERS.

Chief of Engineers. **R., 04,** 703; **05,** 709; **06,** 786; **07,** 787; **08,** 837; **09,** 879; **10,** 977.

In charge:
Maj. John Millis, 1904–05. **R., 04,** 3625; **05,** 2560.
Maj. H. M. Chittenden, 1906–08. **R., 06,** 2047; **07,** 2217; **08,** 2293.
Maj. C. W. Kutz, 1909–10. **R., 09,** 2253; **10,** 2424.

LEGISLATION.

Revised form of permit for traps, **05,** 2560.
Revised regulations for lights and fog bells to be maintained on traps, **05,** 2560.

OPERATIONS.

1903-04. The SS. *Marian* constantly engaged in inspection of traps to check locations, and at night to see that they are properly lighted, **04,** 3625.
1904-10. Inspection of traps continued, **05,** 2561; **06,** 2047; **07,** 2217; **08,** 2293; **09,** 2253; **10,** 2424.

PROJECTS.

The fishing industry having grown to great proportions, traps have been constr. in navigable waters without regard for laws relative to such obstructures. After the loss of the SS. *Clallam* and about 50 lives, public sentiment aroused to such an extent as to necessitate U. S. interference; in future all such structures must be built by au. of U. S., and State license, and be regularly inspected, **04,** 3625.

XX-63 OLYMPIA HARBOR, WASH.

APPROPRIATIONS.

1892,	$35,000,	**93,** 3416.
1894,	40,000,	**95,** 3418.
1896,	32,000,	**96,** 3349.
1899,	15,000,	**99,** 3270.
1902,	$25,000,	**02,** 2416.
1910,	15,000,	**10,** 2425.
1911,	43,000,	**11,** 2632.
Total,	205,000	

COMMERCE.

Importance of the place due to its being the capital of the State, and the only C. carried 1897 was local C. bet. it and other places on Puget Sound, **97,** 3444.

In 1897 the interests involved not important enough to warrant imp. of Deschutes R. at the H., **98,** 3095.

Description of, **03,** 627; **04,** 693.

Further imp. required on account of growth of C., **04,** 3608.

1911, 48,275 t., **12,** 1244.

CONTRACTS.

1892. Geiger & Zabriskie, dr. and bulkhead constr., 13¢ c. y. ($17,920), **93,** 3416.

1894. Bowers Dredging Co., dr., 16¢ c. y ($32,000), **95,** 3417.

1896. New York Dredging Co., dr., 12⅞¢ c. y. ($19,312.50), **97,** 3444.

1899. Puget Sound Dredging Co., dr., 100,199 c. y., at 13⅞¢, **00,** 4482.

1903. Puget Sound Bridge & Dredging Co., dr. 46,952, c. y., 29.9¢ c. y., **03,** 2331.

1910. Puget Sound Bridge & Dredging Co., dr., 200,000 c. y., 10.8¢ c. y., **11,** 2632.

1912. Puget Sound Bridge & Dredging Co., dr. 168,000 c. y., 14¢ c. y.; James W. Hall, constr. launch, **12,** 2850.

ENGINEERS.

Chief of Engineers. R., 85, 369; **91,** 411; **92,** 384; **93,** 443; **94,** 411; **95,** 453; **96,** 410; **97,** 512; **98,** 516, 524; **99,** 605; **00,** 683; **01,** 645; **02,** 567; **03,** 626; **04,** 693; **05,** 698; **06,** 773, 787; **07,** 788; **08,** 838; **09,** 879; **10,** 977; **11,** 1035; **12,** 1243.

Boards. Further consideration of ex. and sur. given by BERH., in compliance with a resol. of Com. on R. and H. of House of Rep. **R.** pub. R. and H. Com. D. 5, 61st, 2d, **10,** 978.

In charge:

Capt. C. F. Powell. **R., 85,** 2413.

Lt. E. Burr. **R., 85,** 2415.

Capt. T. W. Symons, 1891–95. **R., 92,** 2733, 2736; **93,** 3415; **94,** 2606; **95,** 3416.

Capt. H. Taylor, 1896–1900. **R., 96,** 3349; **97,** 3443; **98,** 3070, 3094; **99,** 3270; **00,** 4481.

Maj. John Millis, 1901–05. **R., 01,** 3582; **02,** 2416; **03,** 2330; **04,** 3607; **05,** 2521.

1st Lt. F. A. Pope, **06,** 766.

Maj. H. M. Chittenden, 1906–08. **R., 06,** 2031; **07,** 2218; **08,** 2294.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2254; **10,** 2425; **11,** 2631.

Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2850.

Assistants:

P. G. Eastwick. **R., 85,** 2414.

A. J. McMillan. **R., 92,** 2735.

B. W. De Courcy. **R., 92,** 2740.

J. R. Savage. **R., 93,** 3417; **94,** 2608; **95,** 3418.

J. Zug. **R., 98,** 3097; **00,** 4482.

Lt. M. L. Walker, **01,** 641.

Eugene Ricksecker. **R., 04,** 3608; **05,** 2522.

Lt. F. A. Pope, **06,** 766; (Capt.) **11,** 1026; **12,** 1231.

1st Lt. J. H. Earle, **09,** 871; **11,** 1026.

Capt. Arthur Williams, **11,** 1026; **12,** 1231.

OPERATIONS.

1892-93. Dr. in progress, **93,** 3415.

1893-94. In connection with the previous year, 237,805 c. y. dr., **94,** 2607.

1894-95. 224,071 c. y. dr., **95,** 3417.

1896-97. 192,485 c. y. dr., **97,** 3443.

1899-00. 100,199 c. y. dr. (maps), **00,** 4481.

1903-04. 46,952 c. y. dr.; proj. completed, **04,** 3608.

1910-11. 200,211 c. y. dr., **11,** 1036.

1911-12. 150,936 c. y. dr., **12,** 2850.

PHYSICAL CHARACTERISTICS.

Description of, **85,** 2414; **92,** 2735.

Olympia situated at the head of Budd Inlet, **93,** 3415.

Deschutes R. rises in foothills of Cascade Mts., and empties into upper or s. end of Budd Inlet at Tumwater, where it meets tide water. Olympia located on Budd Inlet about 2 m. n. of Tumwater, and the part of Budd Inlet in vicinity of city is known as Olympia H. R. unnavigable above 3 falls, having an aggregate height of 84′, situated at Tumwater, just before it meets tide water, **98,** 3095.

Condition of works and d. of water, **11,** 2632; **12,** 1244.

PLANS.

By Lt. Burr, 1885, chan. by dr., aided by j. from Capitol Pt. 8′ d. at l. w.; est., $147,950, **85,** 2416.

PROJECTS.

By Capt. Symons, 1891, dr. chan. 12′ x 250′ at mean of the lower low waters, from vicinity of Fourth St. Br. to d. w. in Budd Inlet; est., $275,000, **93,** 3415.

In 1897 Capt. Taylor est. $264,000 or $1,000,000 by one of two plans to imp. Deschutes R. at H., **98,** 3095, 3096.

Proj. modified act June 25, 1910, to obtain chan. 12′ d., m. l. w., on w. side of H., with turning-basin at its inner end 400′ x 800′; est., $58,000, with $1,160 an. mainten., subject to certain conditions as to cooperation on part of local interests (R. and H. Com. D. 5, 61st, 2d), **10,** 977.

SURVEYS.

Au. act July 5, 1884; made by Lt. Burr, **85,** 2415.

Sur. au. act Sept. 19, 1890; made, 1891, by Capt. Symons, **92,** 2736.

Sur. of Deschutes R. at its entrance into Olympia H. au. act June 3, 1896; made, 1897, by Capt. Taylor, (H. D. 104, 55th, 2d), **98,** 3094.

Pre. ex. and sur. au. act Mar. 3, 1905. **R.** by Maj. Millis and Lt. Pope, June 24 and Nov. 18, 1905; locality not deemed worthy at the "present" time of imp. beyond that contemplated by existing proj. (H. D. 405, 59th, 1st), **06,** 787.

Maps. **94,** 2610; **95,** 3420; **00,** 4482; **02,** 2416; **03,** 2330.

XX-67 TACOMA HARBOR, WASH.

APPROPRIATIONS.

City waterway:

1902,	$75,000,	**02,** 2417.
1903,	100,000,	**03,** 2332.
Total,	175,000	

Puyallup waterway:

1905,	$40,000,	**05,** 2530.
1906,	160,000,	**06,** 2035.
1909,	40,000,	**09,** 2256.
Total,	240,000	

COMMERCE.

Very extensive; rapidly growing, **01,** 3597.

Letters of Tacoma (Wash.) Chamber of Commerce and Board of Trade, **04,** 3647.

C. to be benefited by this imp. of large and extremely varied character, **04,** 694.

1904, 1,584,624 t., **05,** 2531; 1911, 854,799 t., "incomplete" **12,** 1248.

Remarks as to C. prosperity, etc., **05,** 2538.

Imp. of City Waterway stimulated C., particularly along portion s. of 14th St., **06,** 2033.

Grain export very important item, in which Tacoma exceeds all other Puget Sound ports, **07,** 790.

Diagram showing cash app. and cash valuation of freight, with total freight 1880 to 1911, **11,** 2634.

CONTRACTS.

1903. Raymond A. Perry, dr. 2,100,000 c. y., 6.44¢ c. y., **03,** 2331.

1907. A. W. Tweeden & Co., dr. in Puyallup Waterway, 1,811,599 c. y., 8¢ c. y., building necessary bulkheads and filling (cost of bulkheading and filling borne by private interests), **08,** 2295; **09,** 2256.

ENGINEERS.

Chief of Engineers. R., 01, 655; **02,** 568; **03,** 627; **04,** 694, 704; **05,** 699; **06,** 774; **07,** 789; **08,** 839; **09,** 880; **10,** 979, 999; **11,** 1038; **12,** 1246.

In charge:

Capt. H. Taylor, 1901. **R., 01,** 3594, 3596.

Maj. John Millis, 1902–05. **R., 02,** 2417; **03,** 2331; **04,** 3609, 3629, 3634; **05,** 2527.

Maj. H. M. Chittenden, 1906–09. **R., 06,** 2033; **07,** 2219; **08,** 2295.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2255; **10,** 2427; **11,** 2633.

Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2852.

Assistant. Eugene Ricksecker. **R., 05,** 2528; **06,** 2033; **08,** 2296.

LEGAL PROCEEDINGS.

Contract bet. Washington and R. B. Lehman for land excavation in H., **01,** 3599.

Pre. action to secure compliance with law in matter of Lehman contract and of depositing material, had been taken at close of past year; views invited from interested persons relative to application of available funds, **02,** 568.

Negotiations in progress, 1906, bet. local au. and owners of property adjacent to the Puyallup Waterway to secure compliance with conditions of app. act. Bonds prepared for each owner guaranteeing that bulkhead constr. and similar work would be done to satisfaction of U. S. Engr. Dept., **06,** 2034. Conditions under act of 1905 complied with, **07,** 2219.

OPERATIONS.

1902–03. 7,400 c. y. dr. from City Waterway, **03,** 2331.

1903–04. 944,000 c. y. dr. from City Waterway, **04,** 3609.

1904–05. 1,155,608 c. y. excavated from City Waterway chan., completing same according to proj., **05,** 700.

1905–06. Policing H. to prevent encroachments, enforcing laws relative to refuse disposal and obstr., and their removal, and ex. of proposed br. sites, brs., etc., **06,** 2033.

1906–07. Preparations made for dr. in Puyallup Waterway, **07,** 2219.

1907–08. Contractors built electric suction dr. and 80,000 c. y. dr.; considerable bulkhead work done, **08,** 2296.

1908–09. 890,000 c. y. dr. from Puyallup Waterway, 855,000 c. y. of which was placed behind bulkhead; 75% bulkhead work done, **09,** 2255, 2256.

1909–10. 956,599 c. y. dr. from Puyallup Waterway; contract terminated by limitation. Work on bulkheads, **10,** 2427.

PHYSICAL CHARACTERISTICS.

City Waterway completed; d. and w. obtained, **05,** 700.

In fall of 1909, Puyallup R. and its tributaries, during severe floods, brought down quantities of material and deposited it in dr. chan. in Puyallup Waterway, practically obliterating excavation under proj., **10,** 2427.

Extreme tidal variation, 18′; mean variation 14.5′, **10,** 979.

Filling since beginning of work, **12,** 1247.

Estab. that chan. would be seriously impaired by every freshet, as dr. chan. acts as a catch basin of vast quantities of material eroded and carried down by rapid currents, **12,** 1247.

Owing to severe floods Nov., 1906, White R. was turned bodily into Puyallup R., and the latter R. had to carry double the former normal flow, and as both Rs. are heavy silt carriers, the effect of this change was highly detrimental to work in Puyallup Waterway, **12,** 1247.

PRIVATE WORK.

The Northern Pacific Ry. Co. paid contractor 3¢ c. y. for depositing dr. material on its tide lands, **03,** 2331; **04,** 3609.

Under arrangements bet. contractor and owners of adjacent lands, 1,155,608 c. y. removed from City Waterway deposited as filling, **05,** 700.

PROJECTS.

Act June 13, 1902, au. contracts might be entered into by the Sec. of War for materials and work necessary for prosecution of proj., not to exceed in aggregate $100,000, excl. of $75,000 app. by above act. No part of app. to be expend. until release from liability for damages should be obtained, arising from a contract bet. State of Washington and R. B. Lehman, and right obtained, free of charge, to deposit material dr. from said chan. upon adjacent lands. Work to be so conducted as not to damage ps. or foundations of brs. crossing said waterway, or the wharves adjacent thereto (H. D. 76, 56th, 2d), **02,** 568.

Act June 13, 1902, au. dr. in City Waterway from d. w. in Commencement B. to 11th St. to 25′, from 11th St. to 14th St. to 18′, and from 14th St. to s. end of waterway to 15′, extreme l. w., **03,** 628.

Act Mar. 3, 1905, contemplates dr. chan. 500′ x 3,650′ l. from n. end of Puyallup Waterway, to 28′, extreme l. w.; est., $240,000 (H. D. 520, 58th, 2d); provided that U. S. should be under no expense in connection with the constr. of bulkheads, groins, or fillings, the cost and charges to be furnished upon demand of U. S. engineer in charge, design and location to be subject to his supervision, and all necessary filling to be made in accordance with plans and specifications furnished by said engineer; that no expend. to be made under this app. until provision satisfactory to Sec. of War be made for permanent mainten. of said proj. when completed, without expense to U. S., **05,** 700; conditions of act complied with and submitted to Sec. of War, **06,** 775.

Puyallup Waterway considered unworthy of further imp. by U. S. unless R. be first diverted or proj. otherwise modified (H. D. 418, 61st, 2d), **11,** 2633.

SURVEYS.

Pre. ex. and sur. au. act June 6, 1900. **R.** by Capt. Taylor, June 22 and Nov. 13, 1900; est., $444,000 (H. D. 76, 56th, 2d), **01,** 655, 3593.

Pre. ex. and sur. au. act June 13, 1902, of Puyallup and other waterways, not already sur., Tacoma H. **R.** by Maj. Millis, July 2, 1902, and Dec. 31, 1903; est., $477,000 (H. D. 520, 58th, 2d), BERH. does not deem it advisable for U. S. to undertake imp. (H. D. 520, 58th, 2d), **04,** 704, 3629, 3632.

R. by BERH., 1905, requested by R. and H. Com.; board submits est. $240,000 for chan. 28′ x 500′ x 3,650′ (R. and H. D. 37, 61st, 2d).

Pre. ex. and sur. au. act Mar. 3, 1909, with view to extending Puyallup Waterway 5,000′ or less. **R.** by Maj. Kutz, May 20, 1909, and Jan. 29, 1910 (H. D. 832, 61st, 2d), (**R.** unfav.), **10,** 999.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1247.

Maps. **02,** 2417; **03,** 2331; **05,** 2540; (photographs) **09,** 2256.

XX-68 PUYALLUP RIVER, WASH.

COMMERCE.

Important, **76,** ii, 641, 669, 670, 671.

ENGINEERS.

Chief of Engineers. **R., 76,** 116; **85,** 369; **91,** 409, 3255; **98,** 524; **08,** 850; **09,** 893.

In charge:
Maj. N. Michler, 1876. **R., 76,** ii, 641.
Maj. J. M. Wilson, 1876. **R., 76,** ii, 668.
Capt. C. F. Powell, 1884. **R., 85,** 2417.
Capt. T. W. Symons, 1890. **R., 91,** 3255.
Capt. H. Taylor, 1896–98. **R., 98,** 3098.
Maj. H. M. Chittenden, **08,** 830; (Lt. Col.) **09,** 871.

Assistants:
R. A. Habersham. **R., 76,** ii, 642.
J. A. McMillan. **R., 91,** 3257.

PHYSICAL CHARACTERISTICS.

Description of R., **76,** ii, 642, 643, 669, 670; **85,** 2417; **98,** 3098.
Description of coal fields, **76,** ii, 643.
Table of distances and levels, **76,** ii, 643.
Description of, **98,** 3098.
Stream is about 50 m. l.; empties into Puget Sound near Tacoma, Wash. During freshets overflows its banks, **98,** 3098.

PLANS. (See Projects.)

By Maj. Wilson, 1876, removing obstr. from Tacoma to Moore's farm, $14\frac{1}{12}$ m., to $2\frac{1}{2}'$ l. w., by dams and scraping on bars; also to close e. chans. below agency; est., $11,836, **76,** ii, 670, 671. Upper section of R. from coal mines to Moore's farm can only be imp. by locks and dams, or by a canal for the entire distance; such expend. not justified, **76,** ii, 671.
Capt. Powell, 1884, reports R. worthy of imp. to extent of snagging operations as far upstream as county br.; est. (an.), $3,000, **85,** 2419.

PROJECTS. (See Plans.)

By Capt. Taylor, 1898, est. $570,486 to d. waterway, **98,** 3100.

SURVEYS.

1876. Ex. and sur. by R. A. Habersham, from coal mines to mouth, **76,** 116, ii, 641, 668.
Ex. au. act July 5, 1884; made, 1884, by Capt. Powell (see Projects), **85,** 2417.
Ex. au. act Sept. 19, 1890; made, 1890, by Capt. Symons (**R.** unfav.), **91,** 3256.
Sur. of mouth au. act June 3, 1896; made, 1898, by Capt. Taylor (**R.** unfav.; see Projects), **98,** 3098.
Pre. ex. and sur. au. act Mar. 2, 1907, with view to straightening chan. and securing suitable d., to city of Puyallup. **R.** by Lt. Col. Chittenden, Apr. 26, 1907, Apr. 4 and Aug. 31, 1908 (H. D. 1107, 60th, 2d) (unfav.), **08,** 850; **09,** 893.
Maps. (H. D. 1107, 60th, 2d.)

XX-72 SEATTLE HARBOR, WASH.

ENGINEERS.

Chief of Engineers. **R., 12,** 1268.

In charge:
Maj. C. W. Kutz, **12,** 1231.
Maj. J. B. Cavanaugh, **12,** 1231.

Assistants:
Capt. F. A. Pope, **12,** 1231.
Capt. Arthur Williams, **12,** 1231.

SURVEY.

Pre. ex. and sur. au. act Feb. 27, 1911, of east and west waterways, Seattle H., with view to mainten. by U. S. (**R.** not yet submitted), **12,** 1268.

XX-73 DUWAMISH AND BLACK RIVERS, WASH.

COMMERCE. (See Physical characteristics.)

ENGINEERS.

Chief of Engineers. **R., 84,** 342; **91,** 409; **98,** 525.

In charge:
Capt. C. F. Powell, 1884. **R., 84,** 2296.
Capt. T. W. Symons, 1891. **R., 91,** 3257.
Capt. H. Taylor, 1896–98. **R., 98,** 3103.

Assistants:
A. J. McMillan. **R., 91,** 3259.
R. H. Ober. **R., 98,** 3106.

PHYSICAL CHARACTERISTICS.

Description of, **84,** 2296; **91,** 3258; **98,** 3104.
City of Seattle situated about 2 m. from mouth of R., which is about 16 m. l. and is formed by junction of the Black and White Rs. In 1898 no navigation on any part, **98,** 3104.

SURVEYS.

Ex. au. act Aug. 2, 1882; made by Capt. Powell (**R.** fav., but work not a public necessity), **84,** 2296.
Ex. of Black and Duwamish Rs. au. act Sept. 19, 1890; made, 1890 by Capt. Symons (**R.** unfav.), **91,** 3258.
Sur. of R. and its tributaries au. act June 3, 1896; made, 1898, by Capt. Taylor (**R.** unfav.), **98,** 3103.

XX-78(a) SAMMAMISH RIVER, WASH.

ENGINEERS.

Chief of Engineers. **R., 12,** 1268.

In charge:
Maj. C. W. Kutz, **12,** 1231.
Maj. J. B. Cavanaugh, **12,** 1231.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910 (**R.** to come), **12,** 1268.

XX-78(b) EDMONDS HARBOR, WASH.

ENGINEERS.

Chief of Engineers. **R., 12,** 1268.

In charge. Maj. C. W. Kutz, **12,** 1231.

SURVEY.

Pre. ex. and sur. act Feb. 27, 1911 (**R.** to come), **12,** 1268.

XX-79 EVERETT HARBOR, WASH.

APPROPRIATIONS.

1894,	$10,000,	**95,** 3433.
1896,	20,000,	**96,** 3375.
1899,	50,000,	**99,** 3273.
1900,	135,000,	**00,** 4486.
1901,	90,000,	**01,** 3588.
1902,	117,000,	**02,** 2427.
Total,	422,000	

COMMERCE.

Description of, **93,** 3467; **97,** 3448.

H. accessible to vessels of deepest draft. Water traffic varied in character, **04,** 698.

Report relative to, **05,** 2547.

Chan. and H. dr. had not been utilized (1907–08) for C. purposes, **08,** 843.

U. S. imp. has not caused any reduction in freight rates, **09,** 885.

Tonnage, 1898, 55,000; 1903, 79,000; 1908, 168,000, **10,** 985.

CONTRACTS.

1895. Everett Terminal Co., bulkhead constr.—piles, 5¢ l. f.; lumber, $7.30 M f.; spikes, 3¢ lb.; brush, $1.25 cord ($3,760), **95,** 3432.

1896. Savage & Scofield, dike constr.—st., 82¢ t.; piles, 5¢ l. f.; lumber, $7.50 M f.; spikes, 3¢ lb.; brush, $1.30 cord ($11,074). New York Dredging Co., dr., 32,143 c. y., at 14¢ c. y., **97,** 3449.

1899. Seattle Dredging Co., 2,350,000 c. y. dr., at 9¢; piles, $2,240; lumber, $910; fascines, $7,500; st., $1,805, **00,** 4486.

ENGINEERS.

Chief of Engineers. **R., 93,** 446; **94,** 2623; **95,** 454; **96,** 412; **97,** 515; **98,** 518; **99,** 608; **00,** 3273; **01,** 648; **02,** 570; **03,** 631; **04,** 697; **05,** 703; **06,** 779, 786; **07,** 794; **08,** 842; **09,** 884; **10,** 984.

In charge:

Capt. T. W. Symons, 1893–95. **R., 93,** 3464; **94,** 2623; **95,** 3430.

Capt. H. Taylor, 1986–1900. **R., 96,** 3373; **97,** 3447; **98,** 3075; **99,** 3273; **00,** 4485.

Maj. John Millis, 1901–05. **R., 01,** 3587; **02,** 2426; **03,** 2334; **04,** 3615; **05,** 2546.

Maj. H. M. Chittenden, 1906–08. **R., 06,** 2038; **07,** 2223; **08,** 2300.

Maj. C. W. Kutz, 1909–10. **R., 09,** 2259 **10,** 2429.

Assistants:

Lt. M. L. Walker, **01,** 641.

John Zug, jun. engr., **02,** 2426; **03,** 2335; **04,** 3615.

J. M. Clapp. **R., 05,** 2547.

1st Lt. F. A. Pope, **06,** 766; **07,** 780.

1st Lt. J. H. Earle, **09,** 871; **10,** 968.

OPERATIONS.

1895–96. A dike 7,980′ l. built, **96,** 3374.

1896–97. The dike extended 6,465′ farther, and 32,143 c. y. dr. to make a chan. 6′ x 50′, m. l. w., for 2,885′, **97,** 3448.

1900–01. 8,182′ of bulkhead constr. and repairs done; dr. extended over 4,900′ of H. basin and chan.; quantities dr., material placed, and cost given, **01,** 3587.

1901–02. Work suspended, funds being exhausted; chan. dr. 100 to 200′ x 18,348′; 904′ of bulkhead constr.; quantities given; 797 snags removed, **02,** 2426.

1902–03. H. basin enlarged and bulkheads raised and strengthened; 816,627 c. y. dr.; 3,772 l. f. piling driven; 140,131 f. b. m. lumber and 12,393 t. st. placed, **03,** 2335.

1903–04. Chan. 26′ x 400′ dr. n. from d. w. inside of H., work completed; statement of work done during year; 45,197 c. y. dr.; 2,298 f. b. m. lumber and 268 t. st. placed, **04,** 3615.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3465; **94,** 2624; **02,** 571.

In 1892 Everett was 1 year old, at mouth of Snohomish R.; water frontage about 9½ m.; only a small proportion of which could be reached at all stages of the tide by ocean-going craft, **93,** 3465.

Marked filling in several places since dr. was suspended, **02,** 2426.

Average settlement of dike does not exceed 4″; bulkhead a marked benefit as break'r, **04,** 3615.

Max. draft carried, 1905, 26′ at l. w.; tidal variation (approx.), 15′, **05,** 704.

Chan. leading n. from basin dr. to 6′ l. w. for 6,000′, **10,** 985.

PROJECTS.

In 1894 Capt. Symons est. $372,000 to imp. H., **94,** 2626, by excavating a H. basin, by dr. a chan. from thence through the tide flats and the Old R. mouth to the fresh water of the Snohomish R., and by protecting and maintaining this H. and chan. by a bulkhead bet. them and the open sound; adopted, **95,** 3431.

In 1895, by Capt. Symons, bulkhead from lower end of Smiths Isld., for such l. as the prices bid would permit, **95,** 3431.

Est., $422,000, the total au. by act Mar. 3, 1899, **01,** 649. Est. cost of changes in bulkhead constr. au. Apr., 1901, $354,339, **01,** 3587, 3588.

Sec. of War advised chamber of commerce that no change of plan could be made, **01,** 3588. Some modifications of proj. desirable, **01,** 3588.

Proj. modified by joint resol. of Congress Apr. 23, 1902, au. Sec. of War, in his discretion, to abandon dr. and imp. of Old R. and apply balance to w. or d. H. basin and chan. through tide flats, **02,** 571.

SURVEYS.

Ex., incl. mouth of Snohomish R., au. act July 13, 892; made by Capt. Symons (**R.** unfav.), **93,** 3464.

Sur. and est. of the cost of dr. the bar at Everett to constr. fresh-water H. there with the greatest water d. practicable was called for by resol. of Cong. June 20, 1894. **R.** by Capt. Symons (see Projects), 1894, **94,** 2623.

Pre. ex., for extension of the dike and dr. area, au. act Mar. 3, 1905 (**R.** unfav.) (H. D. 70, 59th, 1st), **06,** 786.

Maps. **95,** 3434; **01,** 3588; **02,** 2426; **04,** 3616.

XX-80 SNOHOMISH RIVER, WASH.

APPROPRIATIONS.

1905, [1] $6,500, **05,** 2549.
1910, [2] 25,000, **10,** 2430.
1911, [2] 75,000, **11,** 2636.
1912, [2] 75,000, **12,** 2858.

Total, 181,500

COMMERCE.

Description of, **93,** 3463.
Growing, **93,** 3463.
1911, 910,855 t., **12,** 2858.

CONTRACTS.

1911. J. M. Clapp, constr. and repair of dikes (prices given); Tacoma Dredging Co., dr., 520,700 c. y., 11½¢ c. y., **12,** 2859.

ENGINEERS.

Chief of Engineers. R., 75, 125; **93,** 446; **04,** 704; **05,** 705; **06,** 780; **09,** 893; **10,** 985; **11,** 1042; **12,** 1251.

Boards. BERH. approv. Maj. Millis's plan for imp. at cost of $6,500, **04,** 3654.

In charge:
Maj. N. Michler, 1874. **R., 75,** ii, 798.
Capt. T. W. Symons, 1893. **R., 93,** 3462.
Maj. John Millis, 1904–05. **R., 04,** 3653; **05,** 2548.
Maj. H. M. Chittenden, 1905–06. **R., 06,** 2039.
Maj. C. W. Kutz, 1910–11. **R., 10,** 2430; **11,** 2636.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2857.

Assistants:
Lt. F. A. Pope, **06,** 766; **11,** 1026; **12,** 1231.
1st Lt. J. H. Earle, **10,** 968; **11,** 1026.
Capt. Arthur Williams, **11,** 1026; **12,** 1231.

OPERATIONS.

1905–06. Dike 1,008′ l. constr. and 4,444 c. y. dr. by hired labor, **06,** 780, 781.
1911–12. 8,305 l. f. new dike constr., 8,820 l. f. old dike repaired, and 222,283 c. y. dr., **12,** 2857.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 798; **93,** 3463.
R. formed by union of Skykomish and Snoqualmie Rs., about 20 m. l., flows into Possession Sound, one of the divisions of Puget Sound. In its lower course it has formed a delta with 4 separate chans., 3 of which are below the town of Lowell. One of these latter chans., known as Old Chan., in 1892 was much obstr. by snags, etc. Lowell is part of city of Everett, and is situated about 9 m. from mouth of the R., **93,** 3463.

PLAN.

By Maj. Michler, removal of snags from the R. at Clarks Bend; est., $2,000, **75,** ii, 799.

PROJECTS.

Act Mar. 3, 1905, au. constr. of single pile brush and st. dike to rectify chan. at Stretches Riffle, and maintain 4′ to 5′ at low stages (H. D. 163, 58th, 2d), **05,** 705.
Act June 25, 1910, au. training dike across bar at outlet of Old R. Chan. to connect with existing dike in Everett H., and to dr. chan. 8′ x 75′, m. l. w., Everett H. to mouth of Steamboat Slough; est., $280,000 (H. D. 1108, 60th, 2d), **10,** 986.

SURVEYS.

By Maj. N. Michler, 1874–75. **R., 75,** ii, 798.
Ex. of R., mouth to Lowell, au. act July 13, 1892; made by Capt. Symons (**R.** fav. to limited imp.), **93,** 3462.
Pre. ex. au. act June 13, 1902, to provide chan. of sufficient d. to accommodate steam vessels. **R.** by Maj. Millis, Sept. 18 and Nov. 26, 1902, and Jan. 29, 1903; est., $6,500 (H. D. 163, 58th, 2d), **04,** 704, 3652.
Pre. ex. and sur. au. act Mar. 2, 1907, mouth to Lowell. **R.** by Maj. Chittenden, Apr. 19, 1907, and Mar. 31, 1908; est., $280,000 (H. D. 1108, 60th, 2d), **09,** 893.
Maps. (H. D. 1108, 60th, 2d.)

XX-92 SKAGIT RIVER, WASH.

APPROPRIATIONS.

1910, $100,000, **10,** 2431.
1912, 15,000, **12,** 2860.

Total, 115,000

COMMERCE.

Obstr.; jams and snags in the R., **75,** ii, 792.
1900–1910, increased nearly 70,000 t., **12,** 1254.

CONTRACTS.

1910. International Dredging Co., constr. and repair of dikes and sills (prices given), **11,** 2637.

ENGINEERS.

Chief of Engineers. R., 75, 125; **98,** 525; **09,** 893; **10,** 987; **11,** 1044; **12,** 1253, 1267.

In charge:
Maj. N. Michler, 1874. **R., 75,** ii, 791.
Capt. H. Taylor, 1898. **R., 98,** 3112.
Lt. Col. H. M. Chittenden, **09,** 871.
Maj. C. W. Kutz, 1910–11. **R., 10,** 2430; **11,** 2637.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2859.

Assistants:
Capt. F. A. Pope, **12,** 1231.
Capt. Arthur Williams, **12,** 1231.

OPERATIONS.

1910–11. Mattress sill and closing dikes constr.; training dike built for 8,100′, **11,** 2637.
1911–12. Training dike, 10,450′ l., completed, **12,** 1254.

PHYSICAL CHARACTERISTICS.

Description of, **75,** ii, 791; **98,** 3113.
Tides, **75,** ii, 792.
Largest R. in w. Washington, rising in Cascade Mts., and flowing over international boundary line, down into Skagit B., into which it enters by 2 forks, **98,** 3113. Chief obstr. to navigation is accumulations of snags, **98,** 1114.
Sedro about 28 m. from mouth, **98,** 3112.

PLANS.

By Maj. Michler, removal of snags and jams from R. chan., and protection of banks from abrasion; est., $15,000, **75,** ii, 792.

PROJECTS.

Act June 25, 1910, au. constr. of training dike, from mouth of South Fork, across flats to d. w. in Saratoga Passage; and closing chans. at delta of R.; est., $100,000, **10,** 987.

[1] For imp. at Stretches Riffle.

[2] For imp. at Old R. and Everett H.

SURVEYS.

By Maj. Michler, 1874–75. **R., 75,** ii, 791.

Sur. of R. from mouth to Sedro au. act June 3, 1896; made by Capt. Taylor, 1897 (**R.** unfav.), **98,** 3112.

Pre. ex. and sur. au. act Mar. 2, 1907, of R. up to Sedro Wooley. **R.** by Maj. Chittenden, Apr. 15, 1907, and Mar. 31, 1908, on ex. and sur., and by Maj. Kutz, Nov. 3, 1908, on sur.; est., $100,000 (H. D. 1188, 60th, 2d), **09,** 893.

Pre. ex. and sur. au. act June 25, 1910, Sedro Wooley to Baker. **R.** by Capt. Williams on ex., Nov. 5, 1910, and by Maj. Cavanaugh on sur., Feb. 29, 1912 (H. D. 909, 62d, 2d) (unfav.), **12,** 1267.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1254.

Maps. (H. D. 1188, 60th, 2d; H. D. 909, 62d, 2d.)

XX-99 SWINOMISH SLOUGH, WASH.

APPROPRIATIONS.

1892,	$25,000,	**93,** 3420.
1894,	25,000,	**95,** 3437.
1896,	25,000,	**96,** 3378.
1899,	20,000,	**99,** 3274.
1902,	30,000,	**02,** 2428.
1905,	5,000,	**05,** 2551.
1907,	75,000,	**07,** 2224.
1909,	10,000,	**09,** 2260.
1910,	10,000,	**10,** 2432.
Total,	225,000	

COMMERCE.

In 1911, 53,247 t., **12,** 1256.

CONTRACTS.

1892. Geiger and Zabriskie, dr., 16¢ c. y.; dike constr.; piling, 11¢ l. f.; wattling, 5¢ s. f. ($18,265), **93,** 3420.

1894. Bowers Dredging Co., dr., 16¢ c. y. ($17,600). King & Marrinan, dike constr., 8½¢ f. ($2,380), **95,** 3436.

1896. D. Rutherford, dike constr.; piles, 7¢ l. f.; lumber, $10.50 M f.; spikes and wire, 3½¢ lb.; brush, $1.74 cord; st., 55¢ t. ($11,372). New York Dredging Co., dr., 20¢ c. y. ($8,000), **97,** 3452.

1899. Rutherford & Mullen, constr. and repair, ing pile, brush, and st. dikes, $13,859.39, **00,** 4488.

1908. Puget Sound Bridge & Dredging Co., dr. 238,539 c. y., 18.9¢ c. y., **08,** 2303.

1910. American Pile Driving Co., dike constr. (unit prices given), **10,** 2432.

ENGINEERS.

Chief of Engineers. R., 91, 411; **92,** 384; **93,** 443; **94,** 412; **95,** 455; **96,** 413; **97,** 416; **98,** 519; **99,** 609; **00,** 687; **01,** 651; **02,** 572; **03,** 632; **04,** 698; **05,** 705; **06,** 781; **07,** 796; **08,** 843; **09,** 885; **10,** 988, 998; **11,** 1045; **12,** 1255.

In charge:

Capt. T. W. Symons, 1890–95. **R., 92,** 2752, 2753; **93,** 3419; **94,** 2611; **95,** 3435.

Capt. H. Taylor, 1896–1900. **R., 96,** 3377; **97,** 3450; **98,** 3076; **99,** 3274; **00,** 4487.

Maj. John Millis, 1901–05. **R., 01,** 3589; **02,** 2428; **03,** 2336; **04,** 3617; **05,** 2549.

Maj. H. M. Chittenden, 1905–08. **R., 06,** 2040; **07,** 2224; **08,** 2301.

Maj. C. W. Kutz, 1908–11. **R., 09,** 2259; **10,** 2431; **11,** 2638.

Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2860.

Assistants:

J. R. Savage. **R., 92,** 2759; **93,** 3421; **94,** 2613.

E. L. Carpenter. **R., 95,** 3437; **97,** 3452.

Lt. M. L. Walker, **01,** 641.

Thos. H. Huddlestone, **R., 04,** 3617, 3618; **05,** 2549; **06,** 2040.

Lt. F. A. Pope, **06,** 766; **07,** 780; **12,** 1231.

1st Lt. J. H. Earle, **09,** 871.

Capt. Arthur Williams, **12,** 1231.

OPERATIONS.

1893–94. 6,180 l. f. dike built and 86,585 c. y. dr., **94,** 2612.

1894–95. 95,953 c. y. dr. and dike built bet. Goat and Ilka Islds., **95,** 3437.

1896–97. Skagit B. Dike repaired, 2,745 l. f. new dike repaired, and 36,017 c. y. dr., **97,** 3450, 3451.

1897–98. 796 l. f. spur dike built, **98,** 3076.

1899–00. Over 1,350 l. f. dikes repaired and strengthened; 630 l. f. dike built, **00,** 4487.

1901–02. Repairs to dikes and removal of drift and logs, **02,** 2428.

1902–03. General repairs to dike extending from Gallaghers Pt. to McGlinns Isld., **03,** 2336.

1903–04. 854 c. y. r. deposited in inner dike, **04,** 3617.

1904–05. 13,837.75 c. y. r. deposited in inner and outer dikes, **05,** 2549.

1905–06. 6,165 c. y. r. placed in outer dike, **06,** 2040.

1907–08. 480,000 c. y. dr. and dike extension in progress, **08,** 2301.

1908–09. 1,518 c. y. st. placed in Goat Isld. Dike, **09,** 2259.

1909–10. Dike 1,500′ l. opposite La Conner built, and 5,500 c. y. dr. bet. La Conner and Goat Isld., **10,** 2431.

PHYSICAL CHARACTERISTICS.

Description of, **92,** 2756.

Slough is tidal and connects Saratoga Passage and Skagit B. on the s. with Padilla B. on the n. It is an important water highway, furnishing the most e., shortest, and safest route for smaller class of SS. bet. n. and s. waters of Puget Sound, **93,** 3419. It passes through what is probably the most fertile and productive portion of Washington, and upon it is situated the town of La Conner, the county seat of Skagit County, **93,** 3421.

PROJECTS.

By Capt. Symons, 1891, dr. chan. 4′ x 100′ from d. w. in Saratoga Passage across Skagit Flats, through shoas of slough proper, and across flats of Padilla B. to d. w., and building pile-wattled dikes in Skagit and Padilla Bs. to direct the ebb and flood waters through dr. chans.; est., $122,000, **92,** 2756; **93,** 3420.

SURVEYS.

Au. act of Sept. 19, 1890; made, 1891, by Capt. Symons, **92,** 2753.

Misc. surs. made, 1894–95, by Capt. Symons, **95,** 3437.

Sur. of chan. La Conner to Saratoga Passage made by Capt. Taylor, 1896, **96,** 3379.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.** by Maj. Kutz, May 26 and Nov. 6, 1909, and Feb. 14, 1910, presenting plan with view to keeping open the 4′ chan. bet. Saratoga Passage and La Conner; est., $10,000 (H. D. 796, 61st, 2d), **10,** 998.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1255.

Maps. **94,** 2614; **96,** 3378; **00,** 4488; **02,** 2428; **03,** 2336; **08,** 2304.

XX-100(a) ANACORTES HARBOR, WASH.

ENGINEERS.

Chief of Engineers. **R., 06,** 787.

In charge. Maj. John Millis, 1905–. **06,** 765.

SURVEY.

Ex. au. act Mar. 3, 1905; made, 1905; **R.,** Maj. Millis, June 22, 1905 (unfav.), (H. D. 160, 59th, 1st), **06,** 787.

XX-103 BELLINGHAM BAY AND HARBOR, WASH. (including New Whatcom Harbor, Fairhaven).

APPROPRIATIONS.

1902,	$25,000,	**02,** 2429.
1905,	35,000,	**05,** 2552.
1910,	15,000,	**10,** 2433.
1911,	25,000,	**11,** 2639.
1912,	52,250,	**12,** 2861.
Total,	152,250 ($152,251.75, C. E. R., **12,** 2861).	

COMMERCE.

Description of, **95,** 3473; **97,** 3479; **11,** 1047.

87,000 t. 1902; value, about $2,800,000, **03,** 634. Increase, **05,** 2553; value, $7,000,000, at 1907, **09,** 887; $8,000,000 at 1909, **12,** 1258.

Work has not yet produced any material effect on rates, **10,** 990.

Traffic, 1911, 240,000+ t., **12,** 2862.

CONTRACTS.

1903. Seattle Bridge Co., dr. 160,000 c. y., 13¢ c. y., **04,** 3619, 3621.

1905. North American Dredging Co., dr. 200,000 c. y., 14.74¢ c. y., **06,** 2043.

1912. Puget Sound Bridge & Dredging Co., dr. 615,000 c. y., 14.4¢ c. y., **12,** 2861.

ENGINEERS.

Chief of Engineers. **R., 95,** 457; **97,** 523; **01,** 645; **02,** 573; **03,** 634; **04,** 700; **05,** 707; **06,** 782; **07,** 797; **08,** 845; **09,** 887, 893; **10,** 989; **11,** 1046; **12,** 1256.

In charge:

Capt. T. W. Symons, 1895. **R., 95,** 3472.

Capt. H. Taylor, 1897. **R., 97,** 3478.

Maj. John Millis, 1901–05. **R., 01,** 3581; **02,** 2429; **03,** 2337; **04,** 3619; **05,** 2552.

Maj. H. M. Chittenden, 1906–08. **R., 06,** 2043; **07,** 2225; **08,** 2304.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2260; **10,** 2432; **11,** 2639.

Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2861.

Assistants:

J. M. Clapp. **R., 97,** 3480.

D. W. McMorris. **R., 04,** 3619.

F. S. Greely. **R., 05,** 2553; **06,** 2043.

Capt. Arthur Williams, 1910–11. **10,** 968; **11,** 1026; **12,** 1231.

1st Lt. J. H. Earle, 1911. 1910–11. **10,** 968; **11,** 1026.

Capt. Francis A. Hope, 1911. **11,** 1026; **12,** 1231.

LEGAL PROCEEDINGS.

Action taken by Dept. of Justice to compel removal of log jam, **01,** 3581.

OPERATIONS.

1903–04. About 160,000 c. y. dr. (see Private work), **04,** 3619.

1905–06. 200,000 c. y. dr., **06,** 2043.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3472; **11,** 1046.

B. is part of Puget Sound, reaching to 15 m. of the international boundary. It is about 10 m. l. from n. to s. and about 5 m. w. Distinguished from most of the Sound Hs. in that it is shallow enough to afford an anchorage. Starr Rock is situated in path of the C. bet. 2 cities[1] on the B. **95,** 3472, 3473.

New Whatcom, one of the cities referred to above, is at n. end of B., and is largest city on Puget Sound n. of Seattle, **97,** 3479.

Max. draft available, 12′; range of tide, 12±′, **12,** 1258.

PRIVATE WORK.

Over 112,000 c. y. dr., without cost to U. S., for filling land of private parties, **04,** 3620; **05,** 2552.

Conditions relative to cooperation by local interests complied with, **12,** 2861.

PROJECTS.

In 1897 Capt. Taylor est. $80,000 to make imp. at Whatcom Creek, **97,** 3480.

Act June 13, 1902, au. dr. Whatcom Creek Waterway to 12′ at m. lower l. w. and 200′ w. from d. w. as far as the RR. br., and to its full w. inside this br.; est., $80,000, but act prohibited expend. until mill refuse and sawdust deposits be stopped. Refuse depositing stopped, 1903, **03,** 634.

R. and H. act June 25, 1910, au. dr. outer portion to 26′ and inner portion to 18′ l. w., in accordance with plan (H. D. 1161, 60th, 2d); est., $92,250, **10,** 990; **12,** 1257; the U. S. to be at no expense for bulkheads, etc., of dumps.

Act Aug. 24, 1912, placed work under con. contract, **12,** 1258.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** fav. only to Starr Rock removal), **95,** 3472.

Sur. of B. from d. w. to mouth of Whatcom Creek au. act June 3, 1896; made, 1897, by Capt. Taylor (**R.** fav.; see Projects), **97,** 3478.

Au. by R. and H. act Mar. 2, 1907; made by Maj. Chittenden; est., $92,250 (H. D. 1161, 60th, 2d), **09,** 893.

Cong. docs., etc., referring to surs., exs., plans, etc., **02,** 573; **03,** 634; **11,** 1047; **12,** 1257.

Maps. (H. D. 1161, 60th, 2d.) **02,** 2429; **03,** 2337; **05,** 2552; **06,** 2043.

XX-105(a) NOOKSACK RIVER, WASH.

COMMERCE.

Description of, important and growing, **93,** 3470.

ENGINEERS.

Chief of Engineers. **R., 93,** 446; **95,** 459; **10,** 998.

In charge:

Capt. T. W. Symons, 1893–95. **R., 93,** 3468; **95,** 3511.

Maj. C. W. Kutz, **10,** 968.

Assistant. B. Ogden. **R., 95,** 3513.

[1] See title, **04,** 3620.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3468; **95,** 3511.

R. rises in the Cascade Mts. and empties into Bellingham B. In its upper course it is a mountain torrent, but for the last 25 m. it is a narrow, tortuous stream, bringing down earth which it deposits in Bellingham B., **93,** 3468.

PROJECTS.

In 1895 Capt. Symons est. $25,000 by either of 2 plans to imp. mouth of R., **95,** 3513.

SURVEYS.

Ex. with view to removal of obstr. and straightening chan. to prevent jams and the filling of Bellingham B. with earth, au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** fav.), **93,** 3468.

Sur. au. act Aug. 17, 1894; made, 1895, by Capt. Symons (see Projects), **95,** 3511.

Pre. ex. au. act Mar. 3, 1909, of R. to Lynden, Wash. **R.** by Maj. Kutz, Apr. 27, 1909 (H. D. 414, 61st, 2d) (unfav.), **10,** 998.

XX-105(b) BLAINE HARBOR, WASH.

ENGINEERS.

Chief of Engineers. R., 08, 849.

In charge. Maj. H. M. Chittenden, 1908. **08,** 830.

SURVEY.

Pre. ex. au. act Mar. 2, 1907; **R.** by Maj. Chittenden, Apr. 11, 1907, unfav. (H. D. 69, 60th, 1st) **08,** 849.

XX-106 COLUMBIA RIVER, ABOVE SNAKE RIVER.

(See p. 1616)

XX-107 SPOKANE RIVER, IDAHO.

COMMERCE.

Description of, **93,** 3459. Restricted by condition of R., **93,** 3460.

ENGINEERS.

Chief of Engineers. R., 93, 446.

In charge. Capt. T. W. Symons, 1892–93. **R., 3,** 3458.

PHYSICAL CHARACTERISTICS.

Description of. About 150 m. l., flows into Columbia R., and is outlet of Lake Coeur d'Alene, which receives drainage of about 100 m. of mts. of same name. Post Falls is situated about 8 m. from lake. **93,** 3459.

SURVEY.

Ex. of R. from Post Falls to Lake Coeur d'Alene au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** fav.), **93,** 3458.

XX-108(a) COEUR D'ALENE LAKE AND RIVER, AND ST. JOSEPHS RIVER, IDAHO.

ENGINEERS.

Chief of Engineers. R., 85, 372.

In charge. Maj. W. A. Jones. **R., 85,** 2442.

PLANS.

In 1884 Maj. Jones recom. spending $3,000, **85,** 2443. Imp. not recom. by the Chief of Engineers, **85,** 372.

SURVEY. (See Plans.)

Ex. au. act July 5, 1884; made by Maj. Jones, **85,** 2442.

XX-110(a) PEND O'REILLE RIVER, IDAHO AND WASH.

APPROPRIATIONS.

1899,	$10,000,	**99,** 3276.
1902,	[1] 7,500,	**02,** 2431.
1905,	[1] 10,000,	**05,** 2554.
1907,	[1] 15,000,	**07,** 2228.
Total,	42,500	

COMMERCE.

Description of, **98,** 3128.

Decrease in R. traffic due to constr. of RR., **10,** 2434.

Existing traffic does not warrant further imp., **11,** 2643.

[1] From combined opp. for Pend O'Reille and Okanogan Rivers.

CONTRACTS.

1908. C. E. Beckman, dr. 32,000 c. y., 50¢ c. y., **09,** 2263; annulled, **10,** 2435.

ENGINEERS.

Chief of Engineers. **R., 98,** 526; **99,** 612, 614; **00,** 690; **01,** 653; **02,** 574; **03,** 635; **04,** 701; **05,** 708; **06,** 785; **07,** 799; **08,** 848; **09,** 890; **10,** 993; **11,** 1051; **12,** 1262.

In charge:
Capt. H. Taylor, 1898–1900. **R., 98,** 3124; **99,** 3276; **00,** 4494.
Maj. John Millis, 1900–05. **R., 01,** 3591; **02,** 2430; **03,** 2338; **04,** 3622; **05,** 2553.
1st Lt. F. A. Pope, **06,** 766.
Maj. H. M. Chittenden, 1906–08. **R., 06,** 2045; **07,** 2228; **08,** 2306.
Maj. C. W. Kutz, 1908–11. **R., 09,** 2262; **10,** 2434; **11,** 2643.
Maj. J. B. Cavanaugh, 1911–. **R., 12,** 2864.

Assistants:
E. Ricksecker. **R., 00,** 4495.
Lt. M. L. Walker, **01,** 641.
Lt. F. A. Pope, **06,** 766; (Capt.) **07,** 780; **11,** 1026; **12,** 1231.
1st Lt. J. H. Earle, **09,** 871; **11,** 1026.
Capt. Arthur Williams, **11,** 1026; **12,** 1231.
John Zug. **R., 04,** 3622.
C. E. Hansen. **R., 05,** 2557; **06,** 2045.

OPERATIONS.

1899–00. 7,950 c. y. r. removed (maps), **00,** 4494.
1903–04. 4,000 c. y. r. removed, **04,** 3622.
1905–06. 1,325 c. y. r. removed, **06,** 2045.
1908–09. Chans. dr.; 6,958 c. y. material removed, **09,** 2262.
1909–10. 5,892 c. y. material removed, **10,** 2434.

PHYSICAL CHARACTERISTICS.

Description of, **98,** 3125.
R. a continuation of the Clark Fork of the Columbia; and the e. and w. arm of the lake, from which it flows, appears to be only a spreading out of R. Clark Fork is name given to that part above lake. **98,** 3125. Pend O'reille about 125 m. l., flows through rocky country into the Columbia. There are but 2 towns on the R. Metalline lies below Box Canyon, and is hedged in on all sides by rocky and precipitous mts. Most serious obstr. are at Box Canyon, narrow gorge 3,600′ l., into which the R. passes over large rs. **98,** 3126, 3128.

PROJECT.

By Capt. Taylor, 1897, removing submerged r. and blowing off projecting rocky points in vicinity of Box Canyon; est., $30,000, **98,** 3130; **99,** 3276.
Modified proj., 1907, provides for dr. to 6′ at l. w. through bars bet. Newport and Box Canyon, **09,** 890.

SURVEY.

Sur. of R. from source at Lake Pend O'reille, Idaho, to Metalline, Wash., au. act June 3, 1896; made, 1897, by Capt. Taylor, **98,** 3124. (See Projects.)
Pre. ex., bet. Newport and Metalline, au. act Mar. 3, 1909. **R.** by Maj. Kutz, May 1, 1909 (H. D. 410, 61st, 2d) (unfav.), **10,** 998.
Maps. (Photographs), **98,** 3130; **00,** 4500.

XX-110(b) FLATHEAD RIVER AND PEND O'REILLE RIVER, MONT.

APPROPRIATION.

1896, $10,000, **96,** 3391.

COMMERCE.

Description of. On account of the difficulties in the way of making a C. water highway down the R., the stream, 1895, not thought worthy of imp. by U. S.; one portion, bet. Demersville and the lake, thought worthy of imp. to the extent of the removal of snags. **95,** 3481.
Ample d. for existing C., **02,** 576.

ENGINEERS.

Chief of Engineers. **R., 95,** 458; **96,** 417; **97,** 522; **98,** 522; **99,** 614; **00,** 692; **01,** 655; **02,** 576; **10,** 998.

In charge:
Capt. T. W. Symons, 1895. **R., 95,** 3480.
Capt. H. Taylor, 1896–1900. **R., 96,** 3390; **97,** 3468; **98,** 3081; **99,** 3280; **00,** 4501.
Maj. John Millis, 1900–02. **R., 01,** 3592; **02,** 2432.
Maj. C. W. Kutz, **10,** 968.

Assistant. Lt. M. L. Walker, **01,** 641.

OPERATIONS.

1897–98. 846 snags removed, **98,** 3081.
1898–99. Over 1,000 snags, etc., removed, **99,** 3280.
1900–01. About 280 snags and a large jam of driftwood removed, **01,** 3592.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3480.
The name "Flathead" applies to the R. above Flathead Lake and below the lake to a point where it unites with the Missoula, from which point it becomes the Clark Fork of the Columbia, or Pend O'reille R., **95,** 3480.
Columbia Falls, a very small town a little below where the North, Middle, and South Forks unite, **95,** 3481.
A portion of the R. passes through a rocky canyon in which there are 4 groups of falls, making a total fall of 220′, passage of which must be provided for at a great cost in order to give continuous navigation of the R., **95,** 3482.

PROJECTS.

By Capt. Symons, 1895, removal of snags, Demersville and Flathead Lake; uncertain cost, **95,** 3483; **96,** 3390.
Maj. Millis recom. no further **R.** be submitted, **02,** 2432.

SURVEYS.

Ex. from Columbia Falls, Mont., to mouth at Flathead Lake, and from outlet on the s. at Flathead Lake to the Clark Fork, Columbia R., au. act Aug. 17, 1894; made, 1895, by Capt. Symons (**R.** fav. to limited imp.; see Projects), **95,** 3480.
Pre. ex. from mouth and by Kalispel Slough to Kalispel, for 4′, au. act Mar. 3, 1909; made by Maj. Kutz; **R.,** 1909 (unfav.) (H. D. 407, 61st, 2d), **10,** 998.

XX-110(c) POLSON BAY, FLATHEAD LAKE, MONT.

APPROPRIATIONS.

1910, $6,000, **10,** 2436.

COMMERCE.

In 1911, about 72,466 t. in Flathead Lake, **12,** 2865.

ENGINEERS.

Chief of Engineers. **R., 10,** 995, 998; **11,** 1053; **12,** 1263.

In charge:
Maj. C. W. Kutz, 1910–11. **R., 10,** 2436; **11,** 2644.
Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2864.

OPERATIONS.

1910–11. Approx. 1,000 c. y. mud and 1,800 bowlders removed by hired plant and labor; work completed, **11,** 2644.

PHYSICAL CHARACTERISTICS.

Name given to extreme s. end of Flathead Lake; it is applied to that sec. of lake shore in front of town of Polson, lying at outlet of lake. It is in the Flathead Indian Reservation; very small white population, **10,** 995.

Flathead Lake subject to great fluctuations in level, for reason that R. outlet passes through narrow gorge, which prevents rapid discharge of flood water, **10,** 995.

PROJECTS.

Act June 25, 1910, au. removal of bowlders and other obstr. which obstr. approach to landing wharves, and obtaining chan. 6′ x 100′, l. w., with turning-basin near wharves; est., $6,000 (H. D. 645, 61st, 2d), **10,** 996.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909, with view to dr. chan. and providing H. on e. side Flathead Lake. **R.** by Maj. Kutz, May 19 and Oct. 23, 1909; est, $6,000 (H. D. 645, 61st, 2d), **10,** 998.

XX-112 KOOTENAI RIVER, IDAHO AND MONT.

APPROPRIATIONS.

1896,	$5,000,	**96,** 3390.
1897,	5,000,	**97,** 3080.
Total,	10,000	

COMMERCE.

Description of, **93,** 3457; **95,** 3490.

In 1892 indications it would increase rapidly, **93,** 3456.

In 1895 traffic from Jennings to the international boundary line of considerable importance, **97,** 3483.

ENGINEERS.

Chief of Engineers. **R., 93,** 446; **95,** 458, 459; **96,** 417; **97,** 521, 523; **98,** 521; **99,** 612, 613; **00,** 691; **01,** 654, 655; **02,** 575.

In charge:
Capt. T. W. Symons, 1893–95. **R., 93,** 3456; **95,** 3489, 3515.
Capt. H. Taylor, 1896–1901. **R., 96,** 3390; **97,** 3467, 3482; **98,** 3078, 3079; **99,** 3276, 3277; **00,** 4500; **01,** 3603.
Maj. John Millis, 1901–02. **R., 01,** 3591; **02,** 2431.

Assistants:
J. M. Clapp. **R., 99,** 3278.
Lt. M. L. Walker, **01,** 641.

OPERATIONS.

1896–97. About 160 snags and obstr. removed, **97,** 3467.

1897–98. About 400 snags removed, **98,** 3078; points which produced damming effect above Jennings Cut-off, and 1,859 c. y. r. removed, **98,** 3080.

1898–99. Nearly 300 c. y. r. removed, completing proj. for R. above Jennings (maps), **99,** 3277.

PHYSICAL CHARACTERISTICS.

Description of, **93,** 3457; **95,** 3490; **97,** 3482.

R. rises in British Columbia, flows through Montana and Idaho into Kootenai Lake, thence into the Columbia R., of which it is one of the main branches. Fry, about 60 m. from boundary line, is the head of navigation of the lower R. The country through which it passes one of the richest in minerals in the world. For about 3 months in the year it freezes up, **93,** 3457.

Above Jennings navigation is impeded by rs. in the chan., **97,** 3482. Jennings is a small town situated where the R. turns from its s. course from British Columbia to the w., **95,** 3490.

Location, and details, **01,** 654, 3603.

PROJECTS.

In 1895 Capt. Symons est. $5,000 to imp. the R. bet. Bonners Ferry and the international boundary line, **95,** 3515; by the removal of snags and other obstr.; the proj. adopted, **96,** 3390.

In 1897 Capt. Taylor est. $5,000 to imp. the R. above Jennings, **97,** 3483; by breaking up and removing rs., and by cutting off points which produced damming effects, so as to reduce the velocity of the current and thereby enable boats to navigate with greater ease and less danger; adopted, **98,** 3079.

SURVEYS.

Ex., Fry to the international boundary line, au. act July 13, 1892; made, 1892, by Capt. Symons (**R.** fav.), **93,** 3456.

Ex., Jennings, Mont., to international boundary line, au. by Chief of Engineers, 1895; made, 1895, by Capt. Symons (**R.** fav.), **95,** 3489.

Sur., Bonners Ferry and the international boundary line, au. act Aug. 17, 1894; made, 1894, by Capt. Symons (see Projects), **95,** 3515.

Sur. for removal of snags above Jennings, au. act June 3, 1896; made, 1897, by Capt. Taylor (see Projects), **97,** 3482.

Pre. ex. au. act June 6, 1900, Jennings, Mont., to international boundary line. **R.,** Capt. Taylor, June 21, 1900 (unfav.) (H. D. 98, 56th, 2d), **01,** 655, 3603.

Maps. **99,** 3278.

XX-116 OKANOGAN RIVER, WASH.

APPROPRIATIONS.

1899,	$15,000,	**99,** 3275.
1902,	[1] 15,000,	**02,** 2430.
1905,	[1] 5,000,	**05,** 2554.
1907,	[1] 5,000,	**07,** 2227.
Total,	40,000	

COMMERCE.

Description of, **95,** 3456; **98,** 3122.

Development of country seriously retarded by absence or difficulty of transportation. Chief resources of the country, mining and agriculture, **95,** 3476.

Effect on rates, **05,** 708; **12,** 1261.

Existing C. does not warrant further imp. or mainten., **11,** 2643.

1911, 1,529 t., **12,** 1261.

ENGINEERS.

Chief of Engineers. R., 95, 457; **98,** 526; **99,** 611; **00,** 689; **01,** 652; **02,** 574; **03,** 635; **04,** 701; **05,** 708; **06,** 783; **07,** 798; **08,** 847; **09,** 889; **10,** 992; **11,** 1050; **12,** 1260.

In charge:

Capt. T. W. Symons, 1895. **R., 95,** 3475.

Capt. H. Taylor, 1898–1900. **R., 98,** 3121; **99,** 3275; **00,** 4489.

Maj. John Millis, 1901–05. **R., 01,** 3590; **02,** 2429; **03,** 2338; **04,** 3622; **05,** 2553.

1st Lt. F. A. Pope, **06,** 766.

Maj. H. M. Chittenden, 1906–08. **R., 06,** 2044; **07,** 2227; **08,** 2306.

Maj. C. W. Kutz, 1909–11. **R., 09,** 2262; **10,** 2434; **11,** 2643.

Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2863.

Assistants:

Lt. F. R. Shunk. **R., 95,** 3477.

P. G. Eastwick. **R., 00,** 4490.

Lt. M. L. Walker, **01,** 641.

Lt. F. A. Pope, **06,** 766; (Capt.) **07,** 780; **11,** 1026; **12,** 1231.

C. E. Hanson. **R., 05,** 2555; **06,** 2044; **07,** 2227.

1st Lt. J. H. Earle, **09,** 871; **11,** 1026.

Capt. Arthur Williams, **11,** 1026; **12,** 1231.

OPERATIONS.

1899-00. Plant constr.; 51 large rs. blasted; 3,907 bowlders removed; 675 l. f. wing dam built, **00,** 4489.

1900-01. 1,145 bowlders removed and wing dam built; r. removed by blasting, **01,** 3590.

1902-03. 730 t. bowlders removed, 522 l. f. wing dam built, and 266 l. f. riprap placed, **03,** 2338.

1903-04. Work of removing rs. and bowlders and wing dam constr. continued, **04,** 701, 3622.

1904-05. Cables laid to assist vessels over rapids, **05,** 2554.

1905-06. Bowlders removed, chan. dr., wing dams repaired and strengthened, etc., **06,** 2045.

1906-07. Bowlders removed, wing dams constr. and cables laid, **07,** 2227.

PHYSICAL CHARACTERISTICS.

Description of, **95,** 3475; **98,** 3121; **01,** 652.

R. rises in British Columbia, 190 m. l., empties into the Columbia, and in its upper course is a succession of lakes, which act as reservoirs to prevent excessive floods and to regulate flow. Navigation obstr. at several points by reefs. **95,** 3475–3476.

PROJECTS.

By Capt. Taylor, 1897, r. removal, constr. wing dams, and snagging; est., $30,000, **98,** 3124; **99,** 3275.

SURVEYS.

Ex. au. act Aug. 17, 1894; made, 1894, by Capt. Symons (**R.** fav.), **95,** 3475.

Sur. au. act June 3, 1896; made by Capt. Taylor, 1897 (**R.** fav.) (see Projects), **98,** 3121.

Pre. ex. au. act Mar. 3, 1909, to determine whether further imp. should be made. **R.** by Maj. Kutz, May 20, 1909 (H. D. 359, 61st, 2d) (unfav.), **10,** 998.

Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1261.

XX-122(a) DRY STRAITS, ALASKA.

ENGINEERS.

Chief of Engineers. R., 08, 851.

In charge. Maj. H. M. Chittenden, **08,** 830.

SURVEY.

Pre. ex. au. act Mar. 2, 1907. **R.,** Maj. Chittenden, June 3, 1907, (unfav.) (H. D. 556, 60th, 1st), **08,** 851.

XX-122(b) WRANGELL NARROWS, ALASKA.

COMMERCE.

Northbound business, 87,401 t., value, $9,362,482; southbound business, 37,280 t., value, $19,002,500, **04,** 3669.

ENGINEERS.

Chief of Engineers. R., 04, 704.

In charge. Maj. John Millis, 1904. **R., 04,** 3656.

Assistant. D. W. McMorris. **R., 04,** 3662.

PHYSICAL CHARACTERISTICS.

Details; narrow passage 21 m. l. on regular route taken by vessels running to se. Alaska points. L. w. d., 10′±; tide range, 21′±. Distance from Seattle to Skagway, of which Wrangell Narrows is a part, 1,020 m. Wrangell Narrows only part deficient in d. Shoals in narrows a menace to life and property, **04,** 3660, 3157.

Details of sur., giving levels, bench marks, soundings, etc., **04,** 3662.

SURVEYS.

Pre. ex. and sur. au. act June 23, 1902, with view to providing a safe and adequate chan. **R.** by Maj. Millis, July 21, 1902, and Sept. 22, 1903; est., $1,600,000 (H. D. 39, 58th, 2d) for chan. 20′ x 200′ x 3 m. (length to be 300′), **04,** 704. BERH. concurs in fav. recom. of district engineer officer, **04,** 3659, 3661.

[1] From combined app. for Okanogan and Pend O'reille Rs.

XX-122(c) PORTLAND CHANNEL (Canal), ALASKA.

APPROPRIATION.

June 3, 1896, $5,000, **97,** 524.

COMMERCE.

Settlements, **97,** 3489.
Resources of the region, **97,** 3490.
The only industries hunting, trapping, and the smoking of some salmon, principally by Indians, **97,** 3492.

ENGINEERS.

Chief of Engineers. **R., 97,** 524.

In charge. Capt. D. D. Gaillard. **R., 97,** 3487.

OPERATIONS.

1896-97. 4 storehouses erected, **97,** 3492.

PHYSICAL CHARACTERISTICS.

Canal forms a part of the boundary line bet. British Columbia and se. Alaska. For about 25 m. up the average w. is 3½ m.; for 71 m. farther it has a w. averaging about 1½ m. The banks are steep and rocky, and the entire chan. is bordered by mts. and glaciers. Described as a beautiful sheet of water, with a least mid-chan. d. of 312′, remarkably easy to navigate, and d. of water so great that there are but few safe anchorages possible. **97,** 3487.

SURVEY.

Sur. au. act June 3, 1896. Pre. ex. by Capt. Gaillard in 1896–97. **R., 97,** 3487.

XX-125(a) KATALLA BAY, ALASKA.

ENGINEERS.

Chief of Engineers. **R., 08,** 851.

In charge. Capt. C. B. Pillsbury, **08,** 850.

SURVEY.

Pre. ex. au. act Mar. 2, 1907, of Katalla B. and adjacent Bs. **R.,** Capt. Pillsbury, Jan. 17, 1908 (unfav.) (H. D. 907, 60th, 1st), **08,** 851.

XX-170 KUSKOKWIM RIVER, ALASKA.

ENGINEERS.

Chief of Engineers. **R., 12,** 1268.

In charge. Maj. J. B. Cavanaugh, **12,** 1231.

SURVEY.

Pre. ex. and sur. of entrance to R., through Kuskokwim B., au. act Feb. 27, 1911 (**R.** to come), **12,** 1268.

XX-188 YUKON RIVER, ALASKA.[1]

APPROPRIATION.

1912, $130,000, **12,** 2867.

COMMERCE.

In 1911, 33,669 t., **12,** 2867.

ENGINEERS.

Chief of Engineers. **R., 71,** 103; **12,** 1266, 1268.

In charge:
Capt. C. W. Raymond, 1871. **R.,** Ex. Doc. 12, 42d, 1st.[1]
Maj. C. W. Kutz, **12,** 1231.
Maj. J. B. Cavanaugh, 1912. **R., 12,** 2867.

PROJECTS.

Act July 25, 1912, au. excavation of chan. 6′ x 200′ at bends: est., $130,000 (H. D. 556, 62d, 2d) (see Survey, 1911), **12,** 1266.

SURVEY.

See Engineers.[1]
Pre. ex. and sur. au. act Feb. 27, 1911, of Apoon mouth of Yukon R., from Pastol B. to mouth of Kotlik R. **R.** by Maj. Kutz July 10, and by Maj. Cavanaugh Dec. 8, 1911; est., $130,000 (H. D. 556, 62d, 2d), **12,** 1267, 1268.
Maps. (H. D. 556, 62d, 2d.)

[1] (" The final **R.** of Capt. C. W. Raymond, Corps of Engineers, who was temporarily assigned to duty in the military division of the Pacific for the purpose of making (an exploration of the Yukon), was transmitted to Congress April 15, 1871. * * *
" Capt. Raymond accomplished, in a highly creditable manner, the duties intrusted to him in this hazardous expedition.")

XX-239 ST. MICHAEL CANAL, ALASKA.

APPROPRIATIONS.

1907, $98,000, **07,** 2232.
1908, 150,000, **08,** 2309.
1910, 143,000, **10,** 2436.

Total, 391,000 (incl. misc., $391,026.55, **12,** 2865).

COMMERCE.

In 1905, 25,855 t., **07,** 802.
Increasing, **12,** 2866.

CONTRACTS.

1907. North American Dredging Co., excavating 162,000 c. y., $1.45 c. y., **08,** 2310.
1910. Puget Sound Bridge & Dredging Co., excavating 130,000 c. y., 90¢ c. y., **10,** 2437.

ENGINEERS.

Chief of Engineers. R., 06, 787; **07,** 801, 802; **08,** 850; **09,** 891; **10,** 996; **11,** 1054; **12,** 1264.

In charge:
Capt. G. B. Pillsbury, 1907–08. **R., 07,** 2231; **08,** 2309.
Maj. C. W. Kutz, 1909–11. **R., 09,** 2264; **10,** 2436; **11,** 2645.
Maj. J. B. Cavanaugh, 1912–. **R., 12,** 2865.

OPERATIONS.

1908–09. 41,905 c. y. dr. over about 0.6 m. of chan., **09,** 2264.
1909–10. 120,692 c. y. dr. over 9,650′ of chan. to required d. and w., **10,** 2436.
1910–11. 97,860 c. y. dr., **11,** 2645.
1911–12. 133,515 c. y. dr.; chan. of proj. dimensions secured, **12,** 2856.

PHYSICAL CHARACTERISTICS.

Canal is a chan. running from St. Michael B. to point on Norton Sound, about 38 m. from Apoon mouth of Yukon R. E. entrance obstr. by shoals and sharp bends, **07,** 801.

PROJECTS.

Act. Mar. 2, 1907, au. securing chan. in the South Branch 6′ x 100′ at entrance to canal, and a cut of same dimensions across first bends (H. D. 389, 59th, 2d), **07,** 801.

To carry out orig. proj. would require neary double amount est.; accordingly act June 25, 1910, modified proj. to provide a reasonably good chan. without expensive cut-offs; est., $143,000 (H. D. 416), 61st, 2d), **10,** 997.

SURVEYS.

Pre. ex. and sur. au. act Mar. 3, 1905, with view to straightening and imp. canal, **06,** 787. **R.** by Capt. Pillsbury, 1905 and 1906; est., $248,000 (H. D. 389, 59th, 2d), **07,** 802.

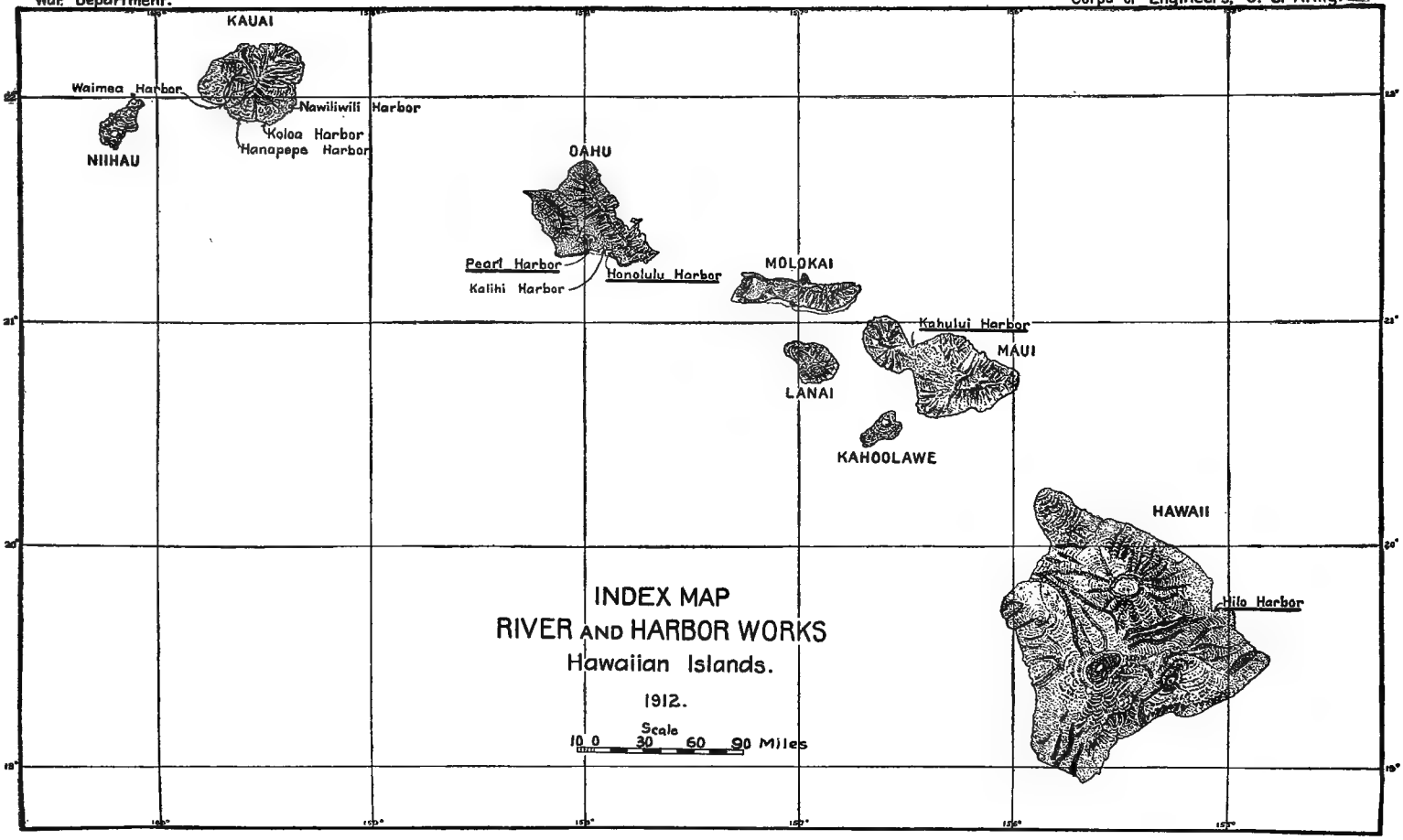
Cong. docs., etc., relating to exs., surs., plans, etc., **12,** 1265.

Maps. (H. D. 389, 59th, 2d; H. D. 416, 61st, 2d.)

RIVER AND HARBOR WORKS.

INSULAR OR OVERSEA.

YY.—PORTO RICO, HAWAII, AND THE PHILIPPINES.


War Department.
Corps of Engineers, U. S. Army.
KAUAI
Waimea Harbor
Nawiliwili Harbor
Koloa Harbor
Hanapepe Harbor
NIIHAU
OAHU
Pearl Harbor
Kalihi Harbor
Honolulu Harbor
MOLOKAI
Kahului Harbor
MAUI
LANAI
KAHOOLAWE
HAWAII
Hilo Harbor
INDEX MAP
RIVER AND HARBOR WORKS
Hawaiian Islands.
1912.
Scale
10 0 30 60 90 Miles

YY.—INSULAR RIVERS AND HARBORS.[1]

[Embracing works in Porto Rico (in charge of U. S. Engineer Office, Army Building, N. Y.), works in the Hawaiian Islands (in charge of U. S. Engineer Office, Honolulu, Hawaii), and work in the Philippines.]

YY.—PORTO RICO, HAWAII, AND THE PHILIPPINES.

PORTO RICO.

YY 1 Atlantic Ocean.
YY 2 San Juan H. (1)
YY 3 Piedras R. (2)
YY 4 Loiza R. (1)
YY 5 Eajardo R. (1)
YY 6 Naguabo R. (1)
YY 7 Guamani R. (1)
YY 8 Jobos H. (1)
YY 9 Satinas R. (1)
YY 10 Rincon B. (1)
YY 11 Coamo R. (1)
YY 12 Jacaguas R. (1)
YY 13 Ponce H. (1)
YY 14 Portugese R. (13)
YY 15 Guayanilla H. (1)
YY 16 Guanica H. (1)
YY 17 Boqueron R. (1)
YY 18 Port Real. (1)
YY 19 Guanajibo R. (1)
YY 20 Mayaguez H. (1)
YY 21 Anasco R. (1)
YY 22 Culebrinas R. (1)
YY 23 Cardos R. (1)
YY 24 Guajataca R. (1)
YY 25 Camuy R. (1)
YY 26 Arecibo R. (1)
YY 27 De la Platta R. (1)
YY 28 Rayamon R. (1)

HAWAIIAN ISLANDS, PACIFIC OCEAN.

YY 29 Kauai Isld.
YY 30 Hanalei. (29)
YY 31 Hanamaula Ldg. (29)
YY 32 Nawiliwili Ldg. (29)
YY 33 Lihue. (29)
YY 34 Koloa. (29)
YY 35 Lawai B. (29)
YY 36 Waimea. (29)

YY 37 Niihau Isld.
YY 38 Cooks Anchorage. (37)

YY 39 Oahu Isld.
YY 40 Kahuku H. (39)
YY 41 Waikane H. (39)
YY 42 Kaneohe H. (39)
YY 43 Waimanalo H. (39)
YY 44 Diamond H. (39)
YY 45 Honolulu H. (39)
YY 46 Pearl R. (39)
YY 47 Waianae H. (39)
YY 48 Waialua H. (39)
YY 49 Haleiwa H. (31)
YY 50 Molokai Isld.
YY 51 Kalaupapa H. (50)
YY 52 Halawa H. (50)
YY 53 Pailolo Chan. (50)
YY 54 Kaunakakai Ldg. (50)

YY 55 Lanai Isld.
YY 56 Auau Chan. (50) (55)
YY 57 Manele B. (55)

YY 58 Maui Isld.
YY 59 Honakohau H. (58)
YY 60 Kahului H. (58)
YY 61 Hamoa H. (58)
YY 62 Alenuihaha Chan. (58)
YY 63 Alalakeiki Chan. (58)

YY 64 Kahoolawe Isld.
YY 65 Makena H. (58)
YY 66 Maalaea B. (58)
YY 67 Kealaikahiki Chan. (74) (55)
YY 68 Lahaina H. (58)

[1] The waterways and points listed under this head should be used merely as landmarks, serving to show the relative position of the places reported on. The numbers after each waterway refer sometimes in this group to the island to which the waterway belongs.

YY 69 Hawaii Isld.
YY 70 Mahukona H. (69)
YY 71 Kohala H. (69)
YY 72 Kukaiau Ldg. (69)
YY 73 Hilo H. (69)
YY 74 Waiakea Ldg. (69)
YY 75 Kalapana H. (69)
YY 76 Keanhou Ldg. (69)
YY 77 Punaluu Ldg. (69)
YY 78 Kaalualu H. (69)
YY 79 Okoe Ldg. (69)
YY 80 Hoopuloa H. (69)
YY 81 Hookena H. (69)
YY 82 Napoopoo H. (69)
YY 83 Kailua. (69)
YY 84 Kiholo B. (69)
YY 85 Kawaihea. (69)

YY 86 THE PHILIPPINES.

YY 87 Luzon Isld.
YY 88 Cagayan R. (87)
YY 89 Digollorin B. (87)
YY 90 Dielasac B. (87)
YY 91 Baler B. (87)
YY 92 Dingalan B. (87)
YY 93 Lamon B. (87)
YY 94 San Miguel B. (87)
YY 95 San Bernardino Straits. (87)
YY 96 Sorsogon. (87)
YY 97 Ragay Gulf. (87)
YY 98 Tayabas B. (87)
YY 99 Verde Passage. (87)
YY 100 Manila B. (87)
YY 101 Subic B. (87)
YY 102 Iba. (87)
YY 103 Dasol B. (87)
YY 104 Lingayen. (87)
YY 105 San Fernando. (87)
YY 106 Abra R. (87)
YY 107 Loaag. (87)

YY 108 Mindoro Isld.

YY 109 Masbate Isld.

YY 110 Samar Isld.
YY 111 Palapag. (110)
YY 112 Lanan. (110)
YY 113 Guiuan. (110)

YY 114 Leyte Isld.
YY 115 Tacloban. (114)
YY 116 Maasin. (114)
YY 117 Hilongos. (114)
YY 118 Ormoc. (114)
YY 119 Leyte. (114)

YY 120 Cebu Isld.
YY 121 Cebu. (120)
YY 122 Argao (120)
YY 123 Oslob (120)
YY 124 Tanon Strait (120) (126)
YY 125 Dumanjug (120)

YY 126 Negros Isld.
YY 127 Cadiz (126)
YY 128 Tanon Strait (120) (126)
YY 129 Dumaguete (126)
YY 130 Tolong (126)
YY 131 Sipalay R. (126)
YY 132 Ilog (126)
YY 133 Guimara Strait (126)
YY 134 Bacolod (126)

YY 135 Panay Isld.
YY 136 Capiz (135)
YY 137 Manapla (135)
YY 138 Iloilo (135)
YY 139 San Jose (135)

YY 140 Palawan Isld.
YY 141 Tay Tay B. (140)
YY 142 Islas Verdes B. (140)
YY 143 Honda B. (140)
YY 144 Puerto Princesa (140)
YY 145 San Antonio B. (140)
YY 146 Coral B. (140)
YY 147 Balabac (140)
YY 148 San Pablo B. (140)
YY 149 Imuruan B. (140)

YY 150 Bohol Isld.
YY 151 Tagbilaran (150)

YY 152 Mindanao Isld.
YY 153 Surigao (152)
YY 154 Port Canay (152)
YY 155 Lianga B. (152)
YY 156 Bislig B. (152)
YY 157 Mayo B. (152)
YY 158 Pujada B. (152)
YY 159 Gulf of Davao (152)
YY 160 Sarangani B. (152)
YY 161 Tuna B. (152)
YY 162 Cotabata, and Mindanao R. (152)
YY 163 Malabang (152)
YY 164 Illana B. (152)
YY 165 Tucuran (152)
YY 166 Dumanquilas B. (152)
YY 167 Sibugay B. (152)
YY 168 Basilan Straits (152)
YY 169 Zamboanga (152)
YY 170 Sipuco B. (152)
YY 171 Sicogon B. (152)
YY 172 Sindangan B. (152)
YY 173 Dapitan (152)
YY 174 Iligan B. (152)
YY 175 Misamis (152)
YY 176 Higan (152)
YY 177 Macajalar B. (152)
YY 178 Cagayan (152)
YY 179 Butuan B. (152)
YY 180 Agusan R. (179)

YY 181 Sulu Archipelago.
YY 182 Jolo (181)

YY-2 SAN JUAN HARBOR, PORTO RICO.

APPROPRIATIONS.

1907,	$157,500,	**07,** 2239.
1908,	220,000,	**08,** 2320.
1909,	300,000,	**09,** 2274.
1910,	100,000,	**10,** 2444.
Total,	777,500	

CONTRACTS.

1907. Standard Dredging Co., removing soft material, 19¢ c. y.; and coral r., $6.80 c. y., **08,** 2320.
1909. Standard Dredging Co. (supple.), removing soft material, 14¢ c. y.; and coral r., $6.50 c. y., **09,** 2274.

ENGINEERS.

Chief of Engineers. R., 06, 790; **07,** 806; **08,** 855; **09,** 897; **10,** 1004; **11,** 1061; **12,** 1274.

In charge:
Maj. C. A. F. Flagler, **06,** 790.
Maj. C. L. Potter, 1907–10. **R., 07,** 2239; **08,** 2319; **09,** 2273; **10,** 2443.
Col. S. W. Roessler, 1911–. **R., 11,** 2655; **12,** 2877.

OPERATIONS.

1907–08. 497,266 c. y. soft material and 1,057 c. y. r. dr., **08,** 2320.
1908–09. 1,025,322 c. y. soft material and 8,048 c. y. coral r. dr., **09,** 2273.
1909–10. 224,129 c. y. soft material and 20,177 c. y. coral r. dr., **10,** 2443.
1910–11. 104,024 c. y. soft material and 23,185 c. y. coral r. dr., completing proj., **11,** 2655.

PRIVATE WORK.

Some dr. done by the Spanish Govt., **07,** 806.

PROJECTS.

Act Mar. 2, 1907, au. proj. for chan. 600′ w. from d. w. to a point opposite Morro Pt., 500′ w. from there to La Puntilla, both to be 30′ d., and to be w. where they make the turn around these points; and dr. e. of La Puntilla H. areas amounting to 398,600 sq. y. to 30′, and 70,200 sq. y. to 24′; est., $757,500 (H. D. 914, 59th, 1st), **07,** 806.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, with view to sufficient anchorage grounds, and depths, resp., of 24′ and 30′ in chans. reaching thereto. **R.** by Maj. Flagler, 1905 and 1906. Plan for imp. by providing a chan. entrance of 30′; est., $850,000 (H. D. 914, 59th, 1st), **06,** 791.
Pre. ex. and sur. au. act Feb. 27, 1911. **R.** to come, **12,** 1275.
Maps. (H. D. 914, 59th, 1st.)

YY-5(a) GREAT HARBOR, CULEBRA ISLAND, P. R.

ENGINEERS.

Chief of Engineers. R., 06, 791; **07,** 807.

In charge. Maj. C A. F. Flagler, **06,** 790; **07,** 807.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905, for sufficient entrance, or entrances, thereto. **R.,** Capt. Flagler, 1905 (unfav.) (H. D. 180 59th, 2d), **06,** 791; **07,** 807.

YY-13 PONCE HARBOR, P. R.

ENGINEERS.

Chief of Engineers. R., 06, 791; **07,** 807.

In charge. Maj. C. A. F. Flagler, **06,** 790; **07,** 807.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1905. **R.** by Maj. Flagler, June 6, 1906 (H. D. 267, 59th, 2d) (unfav.), **06,** 791; **07,** 807.

YY-20 MAYAGUEZ HARBOR, P. R.

ENGINEERS.

Chief of Engineers. R., 06, 790; **07,** 806.

In charge. Maj. C. A. F. Flagler, **06,** 790.

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.,** Maj. Flagler, June 16, 1906 (H. D. 268, 59th, 2d) (unfav.), **06,** 791; **07,** 807.

YY-26 ARECIBO HARBOR, P. R.

ENGINEERS.

Chief of Engineers. R., 10, 1006.

In charge. Maj. Chas. L. Potter, 1910–. **10,** 1004.

SURVEY.

Ex. au. act Mar. 3, 1909; Maj. Potter's **R.,** June 2, 1909, unfav. (H. D. 406, 61st, 2d), **10,** 1006.

YY-26(b) PALMAS ALTAS HARBOR, P. R.

ENGINEERS.

Chief of Engineers. **R., 12,** 1275.

In charge. Col. S. W. Roessler, **12,** 1274.

SURVEY.

Pre. ex. au. June 25, 1910. **R.** by Col. Roessler, Nov. 3, 1910 (H. D. 568, 62d, 2d), (unfav.), **12,** 1275.

YY-29 KAUAI, ISLAND OF, HAWAII.

ENGINEERS.

Chief of Engineers. **R., 12,** 1273.

In charge:
Capt. A. B. Putnam, **12,** 1268.
Maj. W. P. Wooten, **12,** 1268.

SURVEY.

Pre. ex. and sur. au. act June 25, 1910, of Hs. of Isld. of Kauai, Hawaii, for best location for a port. **R.,** Maj. Winslow and Capt. Wooten, 1910 and 1911, resp. (H. D. 609, 62d, 2d). Plan for imp. of Nawiliwili H.; est., $1,086,000, and $10,000 an. mainten., **12,** 1274.
Maps. (H. D. 609, 62d, 2d.)

YY-35(a) HANAPEPE BAY, ISLAND OF KAUAI, HAWAII.

ENGINEERS.

Chief of Engineers. **R., 10,** 1004.

In charge. Maj. E. E. Winslow, **10,** 999.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Maj. Winslow, 1909 and 1910; locality unworthy of imp.; more desirable port for a H. to be selected (H. D. 833, 61st, 2d), **10,** 1004.
Maps. (H. D. 833, 61st, 2d.)

YY-45 HONOLULU HARBOR, HAWAII.

APPROPRIATIONS.

1905,	$200,000,	**05,** 2566.
1906,	200,000,	**06,** 2050.
1907,	200,000,	**07,** 2234.
1908,	200,000,	**08,** 2314.
1909,	*25,000,	**09,** 2268.
1910,	150,000,	**10,** 2440.
Total,	975,000	(incl. misc., $975,016.50, **12,** 2870).

COMMERCE.

Foreign, amounts to over 300,000 t.; local about 237,727 t.; passing through port, bet. San Francisco and the Orient and Australia, valued at $45,000,000. Will be directly benefited by imp.; may result in larger ships calling at port, **05,** 712.
Diagram of tonnage, values, and app., **11,** 2649.
In 1911, foreign, 802,311 t.; local ports 362,398 t., total, 1,164,709 t., **12,** 1269.
Vessels able, 1912, to enter and leave H. with their full load draft, **12,** 1269.
Wharves not sufficient to accommodate C. **12,** 1270.

CONTRACTS.

1905. San Francisco Bridge Co., dr., prices listed, **06,** 2050.
1907. Hawaiian Dredging Co., dr., 97¢ c. y., p. m., **08,** 2314.
1910. Hawaiian Dredging Co., dr., 77¢ c. y., p. m., **11,** 2648.
1911. Standard American Dredging Co., redr., 34¾¢ c. y. (reduced to 30¢ c. y.), **11,** 2648; **12,** 2870.

ENGINEERS.

Chief of Engineers. **R., 05,** 711; **06,** 787; **07,** 803; **08,** 852; **09,** 894; **10,** 999; **11,** 1056; **12,** 1268.

In charge:
Lt. J. R. Slattery, 1905–06. **R., 05,** 2564; **06,** 2049.
Capt. C. W. Otwell, 1907–08. **R., 07,** 2233; **08,** 2314.
Maj. E. E. Winslow, 1909–10. **R., 09,** 2267; **10,** 2439.
Capt. A. B. Putnam, 1911. **R., 11,** 2647.
Maj. W. P. Wooten, 1912–. **R., 12,** 2869.

OPERATIONS.

1905-06. Entrance chan. dr. to 35′ x 400′, and H. proper to 35′ x 800′, **06,** 2050.
1906-07. Dr. in sections A and B completed; 58,755 c. y. removed from section C and deposited on Quarantine Isld., **07,** 2233.
1907-08. 221,016 c. y. dr., practically completing removal of lighthouse point, **08,** 2314.
1908-09. 208,106 c. y. dr., **09,** 2268.
1909-10. Repairs to gauges, minor sur., **10,** 2439.
1910-11. 110,897 c. y. removed from n. end of H., 60,000 c. y. of which placed on Oahu RR. property and 50,897 c. y. on Quarantine Isld., **11,** 2647.
1911-12. 41,166 c. y. dr. from n. end of H., and 99,500 c. y. from entrance chan., completing contracts, **12,** 2869.

* Allotment for maintenance.

PHYSICAL CHARACTERISTICS.

Shoaling, **10,** 1000; bottom soft, and maneuvering of vessels causes shoaling, **12,** 1269.

H. on s. coast of Oahu, 9± m. e. of Pearl H.; 33′–35′ d.; area of H., 184.5 acres, **12,** 1268, 1269.

PRIVATE WORK.

Entrance chan., through a coral reef, and H. proper, dr. from time to time by the monarchial, republican, and Territorial govts. prior to 1904, **12,** 1268.

PROJECTS.

Act Mar. 2, 1907, au. entrance chan. 35′ x 400′, m.l.w. easing curve at junction of entrance chan. by cutting off lighthouse point, and enlarging H. proper to 35′ x 1,200′ m.l.w.; est., $1,628,894.60; new front range light, est. $30,000 (see Surveys), **05,** 711, 2564, 2566; **07,** 803; **12,** 1269.

SURVEYS.

Sur. au. act Mar. 3, 1905. **R.,** Capt. Slattery, Oct. 23, 1906; est., $1,628,894.60 (H. D. 332, 59th, 2d) (see Projects), **07,** 806.

Maps. (H. D. 332, 59th, 2d.) **06,** 2050; **11,** 2648.

YY-45(b) HONOLULU, HAWAII. (Reclamation of Quarantine Island.)

APPROPRIATION.

1906, $20,000, **06,** 2052.

CONTRACT.

1906. San Francisco Bridge Co., reclamation work, 10¢ c. y., **06,** 2052.

ENGINEERS.

Chief of Engineers. R., 06, 789; **07,** 804; **08,** 853; **09,** 895.

In charge:

Capt. J. R. Slattery, 1906. **R., 06,** 2052.

Capt. C. W. Otwell, 1907–08. **R., 07,** 2236; **08,** 2316.

Maj. E. E. Winslow, 1909. **R., 09,** 2270.

OPERATIONS.

1905–06. 142,596 c. y. deposited on isld., **06,** 2052.

1906–07. 158,214 c. y. deposited; work with hoisting engine and scraper begun, **07,** 2236.

1907–08. 9,784 c. y. placed on isld., **08,** 2316.

PHYSICAL CHARACTERISTICS.

Quarantine Isld. a low, swampy isld. on the reef, opposite Honolulu. Except for land around buildings, raised by quarantine authorities, isld. is submerged at high water, **06,** 789.

Sur., 1906, shows considerable portion of isld. below grade, and large cracks appearing, due to drying out of materials, **07,** 804.

PROJECTS.

Consists in reclaiming low and swampy portions lying within concrete sea wall, by pumping material dr. from Honolulu H.; est., $20,000; au. Feb. 27, 1906, **06,** 789. Bringing low places to grade by filling in by means of hoisting engine and scraper, au. June 17, 1907, **07,** 804.

YY-46(a) PEARL HARBOR, HAWAII.

APPROPRIATION.

Mar. 3, 1899, $100,000, **99,** 41.

COMMERCE.

No C. On H. border are very large sugar plantations, the products from which could be shipped direct by sea. Greatest advantage from imp. will be in furnishing safe, deep, and commodious H. for U. S. naval vessels, **03,** 593.

CONTRACT.

1901. Clark & Henry, dr. chan. through Pearl H. Bar, 44½¢ c. y., **02,** 2362.

ENGINEERS.

Chief of Engineers. R., 01, 612; **02,** 534; **03,** 592; **04,** 650; **05,** 710; **08,** 852; **09,** 893.

In charge:

Lt. Col. W. H. Heuer, 1901–04. **R., 01,** 3433; **02,** 2361; **03,** 2201; **04,** 3423.

Lt. J. R. Slattery, 1905. **R., 05,** 2563.

Capt. C. W. Otwell, 1908. **R., 08,** 2313.

Maj. E. E. Winslow, 1909. **R., 09,** 2267.

OPERATIONS.

1901–02. Less than 20,000 c. y. dr.; dr. proving nadequate for the work, **02,** 2361.

1902–03. Chan. bar dr. to 30′ x 200′; 186,077 c. y. dr., **03,** 2201.

1903–04. Dr. completed Aug., 1903; 200,625 c. y., principally coral sand, removed; proj. completed, **04,** 3423.

PHYSICAL CHARACTERISTICS.

Pearl H. on isld. of Oahu, 8 m. w. of city of Honolulu, safe and commodius, but entrance obstr. by bar 1,900′ through, having only 10′ at l. w., **01,** 612.

Suction dr. wrecked during gale, **03,** 2201.

Chan. crooked, and the turns so sharp that navigation is not safe for vessels of large size, **05,** 2563.

PROJECTS.

Approv. Dec. 5, 1900, provides for dr. chan. through bar to 30′ at l. w., and as wide as funds would permit, **01,** 3433.

SURVEYS.

Sur. au. act June 4, 1897; made by Navy Dept., **99,** 41.

Work turned over to the Corps of Engineers, **00,** 43.

YY-60 KAHULUI HARBOR, MAUI, HAWAII.

APPROPRIATIONS.

1910, $150,000, **10,** 2442.
1911, 150,000, **11,** 2652.
1912, 100,000, **12,** 2875.

Total, 400,000 (incl. misc., $400,001.50, **12,** 2875).

COMMERCE.

Foreign, 1910, about 119,000 t.; local, 21,000 t., **10,** 1003; foreign, 1912, 170,533 t.; local, 26,866 t., **12,** 1273.

Extension of break'r has made a wonderful imp. in loading vessels, **12,** 1273.

CONTRACTS.

1910. Kahului RR. Co., break'r constr., 73,000 t. st., $1.85 t., **11,** 2652.

1911. Hawaiian Dredging Co. (Ltd.), dr. (241,000 c. y.), 56¢ c. y., **12,** 2875.

ENGINEERS.

Chief of Engineers. R., 10, 1002, 1004; **11,** 1060; **12,** 1272.

In charge:
Maj. E. E. Winslow, 1910. **R., 10,** 2442.
Capt. A. B. Putnam, 1911. **R., 11,** 2652.
Maj. W. P. Wooten, 1912–. **R., 12,** 2875.

LEGISLATION.

The proj. au. June 25, 1910, provides: The Kahului RR. Co. cede to U. S., free, all rights in existing break'r; that agreement bet. company and territorial govt. relative to wharf and wharf shed be extended to provide for st. of proper w. giving access to wharf, **10,** 1003; complied with, **12,** 1273.

OPERATIONS.

1910–11. 5,549 t. r. placed in strengthening 360 l. f. old break'r, **11,** 2652.

1911–12. Break'r extended 806.5′, 69,451 t. r. placed, completing contract; 52,000 c. y. dr., **12,** 2875.

PHYSICAL DATA.

Isld. of Maui 2d in size of Hawaiian Island; Kahului H. 110 m. e. se. of Honolulu, **12,** 1272.

PRIVATE WORK.

The Kahului RR. Co. had imp. this H. by break'r 1,800′ l., **10,** 1003.

PROJECTS.

Act June 25, 1910, au. extending existing break'r to American Girl Rock, dr. to 35′ area in e. part of H., and dr. to 35′ area in w. part of H. all at est. of $375,000 (H. D. 593, 61st, 2d), **10,** 1003.

SURVEY.

Pre. ex. and sur. au. act Mar. 3, 1909. **R.,** Maj. Winslow, June 4 and Nov. 18, 1909; est., $375,000 (H. D. 593, 61st, 2d), **10,** 1004.

Map. (H. D. 593, 61st, 2d.) **11,** 2652.

YY 3 HILO HARBOR, HAWAII.

APPROPRIATIONS.

1907, $200,000, **07,** 2237.
1908, 100,000, **08,** 2317.
1909, 100,000, **09,** 2270.
1910, 200,000, **10,** 2441.
1911 250,000, **11,** 2650.
1912 { 76,000 / 100,000 } **12,** 287

Total, 1,026,000 (incl. misc., $1,026,004, **12,** 2873).

COMMERCE.

In 1906 valued at $6,623,454, **07,** 805; 1911, 308,381 t., **12,** 1271.

CONTRACTS.

1908. Delbert E. Metzger, break'r constr., $2.485 t. for st. in place, **08,** 2317.

1910. Lord-Young Eng. Co. (Ltd.), break'r substr., $1.84 t. for st. in place (100,000 t.), **11,** 2651.

1912. The Breakwater Co., break'r superstr., $2.17 t. for st. in place (208,000 t.), **12,** 2873.

ENGINEERS.

Chief of Engineers. R., 07, 805, 806; **08,** 854; **09,** 895; **10,** 1001; **11,** 1058; **12,** 1270, 1274.

In charge:
Capt. C. W. Otwell, 1907–09. **R., 07,** 2236; **08,** 2317; **09,** 2270.
Maj. E. E. Winslow, 1910. **R., 10,** 2441.
Capt. A. B. Putnam, 1911. **R., 11,** 2650.
Maj. W. P. Wooten, 1912–. **R., 12,** 2873.

OPERATIONS.

1908–09. 31,507 t. st. placed. building 766′ of break'r, **09,** 2270.

1909–10. 69,618 t. st. placed, building 1,229′ of break'r, **10,** 2441.

1910–11. 47,075 t. st. placed, completing 2,528′ of break'r; 315′ substr. built using 9,294 t. st., **11,** 2650.

1911–12. 88,283 t. st. placed, completing substr.: work on superstr. commenced, **12,** 2873.

PHYSICAL CHARACTERISTICS.

Hilo B. is on e. side of Hawaii, the latter being largest and most s. of group of Hawaiian Islands. Hilo B. is 200 m. se. from Honolulu, **12,** 1270.

Choppy sea caused by winds makes it unsafe for ships to lie at wharves, and renders loading and unloading difficult, **07,** 805.

Entrance to Kuhio B. blocked by shoals, **12,** 1270. Details, **12,** 1270.

PRIVATE WORK.

Territorial govt. contemplates building wharf close to break'r; will accommodate vessels drawing 35′, m. l. w., **12,** 1271.

PROJECTS.

Act Mar. 2, 1907, au. proj. for constr. rubble break'r 10,170′ l. along Blonde Reef from a point on shore 6,000′ ± e. of Cocoanut Isld.; eliminating of 3d or shore arm of break'r and extension of middle arm of break'r to shore which are in plan of 1905–06 (see Surveys); est., $1,700,000 (H. D. 407, 59th, 2d), **07,** 805; **12,** 1271.

No expend. to be made unless benefits accruing therefrom warrant same, **07,** 805.

Act July 25, 1912, au. modification of proj., i. e., to dr. entrance to Kuhio B. to 35′ (est., $76,000), and continuation of break'r along approv. lines so far as can be done without increasing orig. est., **12,** 1271.

SURVEYS.

Ex. and sur. au. act Mar. 3, 1905, for break'r along Blonde Reef to Cocoanut Isld. **R.,** Capt. Slattery, Sept. 12, 1905, and Oct. 27, 1906 (see Projects) (H. D. 407, 59th, 2d), **06,** 790; **07,** 806.

Resur. au. act Feb. 27, 1911, to determine whether modification could be made to increase C. facilities without further increase in cost. **R.** and plan by Maj. Wooten, Dec. 16, 1911 (H. D. 417, 62d, 2d), **12,** 1274.

Maps. (H. D. 407, 59th, 2d; H. D. 417, 62d, 2d.) **08,** 2316; **11,** 2650.

YY-85(b) WELLES HARBOR, MIDWAY ISLAND.

ENGINEERS.

Chief of Engineers. R., 06, 790.

In charge. 1st Lt. J. R. Slattery, **06,** 787.

SURVEY.

Pre. ex. au. act Mar. 3, 1905. **R.** by 1st Lt. Slattery, Aug. 22, 1905 (H. D. 152, 59th, 1st), (unfav.), **06,** 790.

YY-100(a) MANILA HARBOR, AND PASIG RIVER, PHILIPPINE ISLANDS.

(Continuation of this and other Philippine Island work not reported in Reports of Chief of Engineers.)

APPROPRIATIONS. (See Projects.)

1902, $1,000,000, **02,** 608.
1903, 1,000,000, **03,** 670.

COMMERCE.

1900, about 1,000,000 t. an.; 1903, 1,400,000 t., **03,** 671. Large C. on upper Pasig in barges, cascos, etc., **03,** 2912.

CONTRACTS.

1902. Atlantic, Gulf & Pacific Co.; total, $2,150,000, **02,** 608, 3055.

Purchase of plant for working on Pasig R., partly from Bucyrus Co., Milwaukee, Wis., **02,** 3057.

ENGINEERS.

Chief of Engineers. R., 02, 606; **03,** 670.

In charge:
Maj. C. B. Sears, **02,** 606.
Lt. Col. C. E. L. B. Davis. **R., 02,** 5050; **03** 2910.

OBSTRUCTIONS.

Br. of Spain, 6,000′ above mouth of Pasig, with its st. arches and clearance of but 16′, serious obstacle to navigation, limiting wharf front for seagoing craft to area below it.

3 other brs. above it, **03,** 2912.

Work of imp. interfered with by passing craft; no prohibitive laws with penalties; interference apparently from malice or inefficiency, **02,** 3056.

OPERATIONS.

1902. Contractors began gathering plant, erecting warehouses, etc.; quarries opened; 1,093′ bulkhead built; 18,131 t. st. deposited; 472,804 c. y. dr. by U. S., **02,** 608. Shops of the port works used by various depts.; repair of sea walls, betterment of grounds, etc., **02,** 3057.

1903. In the H., bulkhead built to total of 4,189′, protected by 102,954 t. riprap. In break'r, 93,832 t. had been placed; 1,550,233 c. y. dr. and deposited behind bulkhead; 416 t. r. placed e. break'r. In the Pasig, 696,264 c.y .dr.at mouth; additions made to plant; old wall at entrance to canal removed to 12′, **03,** 2912.

PROJECTS.

Previous to U. S. occupation, Spain had begun imp. of Manila H. Prior to 1898 had begun constr. of w. break'r, extending from mouth of Pasig R. 7,000′, of which 2,210′ had been completed. An e. break'r 600′ had also been built.

Act 22 of the U. S. Philippine Commission, Oct. 15,1900, au. use of insular funds, continuous app., not to exceed, with extensions, a total of $4,029,000 (U. S. cur.), **02,** 608; **03,** 670.

The work at 1902 contemplated building of a timber and st. bulkhead from the canal entrance near the mouth of the Pasig to intersection of s. j., the latter to be prolonged with riprap foundation and masonry superstr.; dr. out of H. basin behind the break'r to 30′; filling in with dr. material behind bulkhead to 10′ above l. w.; completion and extension of existing break'r; deepening of canal; dr. of bar at mouth of Pasig, and of the latter as far as the br. of Spain, to 18′, m. l. w.; and the dr. of the upper Pasig to give 6′ l. w. navigation, **02,** 609; **03,** 2912.

FINDING LIST

U. S. RIVERS AND HARBORS

1693

ALPHABETICAL FINDING LIST.

Rivers, Creeks, Canals, Harbors, and Other Waterways of the United States.

NOTE.

This list is an alphabetical arrangement of the names of the waterways of the United States, as found in Part I of this index.

Each name is followed by (a) the district letter, (b) the district number of the waterway, and (c) the page number of this index whereon further information concerning the waterway is found.

This finding list does not contain references to special points embraced by a waterway, except in a few instances; as, for example, the instances of the Ohio, Missouri, Mississippi, and the Columbia. The abstracts concerning these waterways have their own indexes, and in this finding list the page reference is to the page of this index whereon the special index contains the waterway or waterway point name listed herein. A star (*) follows the page reference in all these cases.

Part I of this index has, as far as practicable, preserved the different spellings of waterway names. For example, on page 131 of this index three different spellings are given of "Potonowut." These different names are listed herein.

The different names or titles given waterways have also been preserved. On page 318 of this index "Smyrna River" is listed also as "Duck Creek," and this waterway is found under both titles in this list.

Compound Words.—Compound words are listed according to the initial of the first or prefix word. For example, Bay Pompadour is listed in the B's. The more generally used prefixes are Bay, Big, Bogue, Broad, East, Fort, Lake, Little, Lower, Middle, New, North, Old, Saint, San, South, Upper, West, White.

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